CLAIM NO: FL-2020-000018

IN THE HIGH COURT OF JUSTICE
BUSINESS AND PROPERTY COURTS
COMMERCIAL COURT (QBD)
FINANCIAL LIST
FINANCIAL MARKETS TEST CASE SCHEME

BETWEEN

THE FINANCIAL CONDUCT AUTHORITY

Claimant

-and-

(1) ARCH INSURANCE (UK) LIMITED

(2) ARGENTA SYNDICATE MANAGEMENT LIMITED

(3) ECCLESIASTICAL INSURANCE OFFICE PLC

(4) HISCOX INSURANCE COMPANY LIMITED

(5) QBE UK LIMITED

(6) MS AMLIN UNDERWRITING LIMITED

(7) ROYAL & SUN ALLIANCE INSURANCE PLC

(8) ZURICH INSURANCE PLC

Defendants

AGREED FACTS – DOCUMENT 7

THE PANDEMICS OF 1957-1958 & 1968-1969

[Page numbers referred to in this document are references to the page numbers of the appended source documents unless otherwise specified.]

1. Three influenza pandemics occurred during the Twentieth Century: the "Spanish Flu" pandemic (caused by an A(H1N1) virus) in 1918-1919, the 1957-1958 "Asian Flu" pandemic (caused by an A(H2N2) virus), and the "Hong Kong Flu" pandemic in 1968-1969 (caused by an A(H3N2) virus).[1]

2. The UK Government's Coronavirus action plan published on 3 March 2020 states that:

    a. With regard to the 1957-1958 Pandemic:

        i. The estimated attributable excess mortality worldwide was between 1 and 4 million; and

        ii. The estimated attributable excess mortality in the UK was 33,000 (with the most affected age group being children)[2]; and

    b. With regard to the 1968-1969 Pandemic:

        i. The estimated attributable excess mortality worldwide was between 1 and 4 million; and

        ii. The estimated attributable excess mortality in the UK was 80,000 (all age groups being affected).[3]

3. Although measures were taken on a local level including at least some school closures,[4] the UK Government did not, in response to either the 1957-1958 pandemic or the 1968-1969 pandemic

    a. Impose general closures on either businesses or their premises;

    b. Confine citizens to their homes unless they were able to show reasonable excuse or impose any other mandatory restrictions on freedom of movement; or

    c. Require the general closure of schools or universities.

4. In 1960 the Ministry of Health published a 56-page Report on *"The influenza epidemic in England and Wales 1957-58"*[5], intended as a *"distillate of a large volume of information assembled by the Department on the epidemic"*.[6] The report notes that *"[t]he consensus of opinion was that the illness was, in general, mild"*[7] and makes no references to restrictions on trade or freedom of movement in response to the pandemic and only states that *"[i]n a number of instances small schools were temporarily closed for want of pupils or staff but in general schools remained opened*

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[1] See WHO Europe website, Past Pandemic: https://www.euro.who.int/en/health-topics/communicable-diseases/influenza/pandemic-influenza/past-pandemics **[p. 1]**.

[2] *History lessons: the Asian Flu pandemic*, Claire Jackson, British Journal of General Practice, August 2009. The article by Jackson suggests that the core group of sufferers were between 5-39 years and 49% were 5-14 years **[pp. 2-3 at p. 2]**.

[3] At para 3.1: https://www.gov.uk/government/publications/coronavirus-action-plan/coronavirus-action-plan-a-guide-to-what-you-can-expect-across-the-uk#what-we-know-about-the-virus-and-the-diseases-it-causes. **[pp. 4-31 at p. 10]**. The publication of the plan is in the proposed Agreed Facts (item 14 page 12) but when one turns to the page identified there one only finds the webpage advertising the publication of the plan not the plan itself.

[4] See paragraphs 6 and 7 below.

[5] Reports on Public Health and Medical Subjects No 100. 1960: London HMSO **[pp. 32-107]**.

[6] Ibid **[pp. 32-107 at p. 34]**.

[7] Ibid **[pp. 32-107 at p. 53]**.

throughout the epidemic".[8] In its final section (*"Control of Influenza"*), the Report's authors stated: *"…the idea of control of influenza may seem rather to be the expression of a hope than of a practical issue. But there are grounds for restrained optimism."*[9] They outlined a potential strategy to combat any new influenza virus in the future, namely *"to delay by all reasonable measures available the spread of infection for as long as possible so as to give time for the preparations of vaccines effective in its control"*. This envisaged, preparing the appropriate vaccine, immunising priority groups, isolating patients with the disease at home and *"the issue to contacts of advice regarding their personal conduct aimed at delaying the spread of infection"*.[10] As noted this strategy aimed to delay the spread of the virus until a vaccine could be developed and in the case of the 1957-1958 pandemic, the report specifies that 22 days after the notification of the strain of virus to the World Health Organization ("**WHO**") (which was not itself until over two months after the virus had first been isolated) subcultures of the virus were sent out to vaccine manufacturers in the UK and vaccine trials were completed in late July 1957 (1 inoculation) and late August 1957 (2 inoculations).[11]

5. These pandemics were discussed in Parliament. For example, on 8 July 1957 there was an oral question on the UK Government's approach to the 1957-1958 pandemic in the House of Lords[12] and the costs to meet this pandemic (amongst other matters) were discussed in the House of Commons on 17 March 1958.[13] As to the 1968-1969 pandemic, in written answers concerning the influenza epidemic dated 19 January 1970, the Secretary of State for Social Services, Richard Crossman MP, answered a written question from a Mr Wall as to whether he would make a statement on the epidemic of influenza and measures taken to combat its spread. He stated in response that it was the government's belief that, aside from vaccination, there were *"no practical means of preventing the spread of influenza in the general community*. *Influenza vaccine is available, but I have been advised by the Joint Committee on Vaccination and Immunisation that a decision to make its use routine could not be expected to make a significant contribution to the control of outbreaks."*[14] There was also further discussion in Parliament on the 1968-1969 pandemic including, for example, written answers in the House of Lords on 25 October 1968[15] and in the House of Commons on 2 December 1968.[16]

6. An article in the British Journal of General Practice in August 2009 commented on the response to the 1957-1958 pandemic from those responsible for public health. It outlines that following *"almost daily reports in the press"* in the previous weeks, by July 1957 there were *"a number of localized outbreaks"* and by August the virus *"was hitting communities and closing schools across the North West"* prompting *"a broadcast… advising the public not to visit the doctor if they felt the flu coming on but to stay at home and take aspirin"*. The article also mentions that there was a meeting of the Ministry of Health *"to devise a national procedure to cope with a large scale epidemic"* where it was instead decided *"that local Medical Officers of Health (MOH) would be responsible for devising their own schemes"*, although The Times later reported that *"emergency epidemic plans"* had been put into operation. This lead to localised approaches to addressing the

[8] Ibid **[pp. 32-107 at p. 74]**.
[9] Ibid **[pp. 32-107 at p. 89]**.
[10] Ibid **[pp. 32-107 at p. 90]**.
[11] Ibid **[pp. 32-107 at p. 89-90]**.
[12] See Hansard Vol. 204, from col. 807 [**pp. 108-113 at p.108**].
[13] See Hansard Vol. 584, from col. 1003 [**pp. 114-149**].
[14] See Hansard Vol.794, from col.30 **[pp. 150-152]**.
[15] See Hansard Vol. 296, from col. 1605 [**pp. 153-154**].
[16] See Hansard Vol. 774, from col. 221 [**pp. 155-157**].

outbreak, and the author suggests that *"in some areas officers ordered complete closure of schools while in others only assemblies and physical training were banned."*[17]

7. An article in the Lancet dated 25 May 2020 by Mark Honigsbaum (a medical historian of infectious disease and lecturer at City University) stated with regard to the 1957-1958 pandemic that there were *"few hysterical tabloid newspaper headlines and no calls for social distancing. Instead the news cycle was dominated by the Soviet Union's launch of Sputnik and the aftermath of the fire at the Windscale nuclear reactor in the UK"*.[18] With regard to the 1968-1969 pandemic, this article stated that *"while at the height of the outbreak in December, 1968, The New York Times described the pandemic as 'one of the worst in the nation's history', there were few school closures and businesses, for the most, continued to operate as normal"*.[19] The author also commented on the *"relative unconcern about two of the largest influenza pandemics of the 20th Century"* describing it as *"a marked contrast and, to some critics, a rebuke to today's response to COVID-19 and the heightened responses to outbreaks of other novel pathogens, such as avian and swine influenza."*[20]He states that although *"[n]ot everyone was happy with the UK Government's passivity"* the *"only real strategy considered by health authorities in the UK…was vaccination, but the vaccinations arrived too late in both 1957 and 1968 influenza pandemics to make any difference."*[21] In qualification the article went on to note that *"[i]t is questionable whether deaths attributed to COVID-19 are comparable to those recorded during previous influenza pandemics, given that between March and early May, 2020, alone the UK Office for National Statistics recorded 55 000 excess deaths compared with the same period last year. Furthermore, it will not be possible to obtain an accurate accounting of the total excess deaths due to COVID-19 in 2020 before 2021 at the earliest and by then, assuming a vaccine is not deployed in the meantime, many thousands more people will most likely have died from COVID-19"*.[22]

8. Since the 1957-1958 and 1968-1969 pandemics, the UK Government has considered the risk of further influenza outbreaks. In 2017 the Cabinet Office published the National Risk Register of Civil Emergencies. This document said its purpose was to inform the public about some events which could cause widespread damage and would require some form of Government response and give advice and guidance on how the public can prepare for them. This document identified an influenza pandemic as such a risk, outlining the consequences as including *"up to 50% of the UK population experiencing symptoms, potentially leading to between 20,000 and 750,000 fatalities and high levels of absence from work"*. It also referred to the risk of some other *"emerging infectious diseases"* with *"several thousand people experiencing symptoms, potentially leading to up to 100 fatalities."* [23]

9. This set of agreed facts focuses on the 1957-1958 and 1968-69 pandemics so far as they impacted the UK. It will be noted that, as well as the three pandemics listed in paragraph 1 above, in the last 100 years one other pandemic (Swine Flu in 2009 to 2010) and several epidemics/pandemic threats have affected other countries, in particular:

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[17] *History lessons: the Asian Flu pandemic*, Claire Jackson, British Journal of General Practice, August 2009 **[pp. 2-3 at p. 3]**.

[18] *The art of medicine Revisiting the 1957 and 1968 influenza pandemics,* Mark Honigsbaum, The Lancet, June 2020 **[pp.158-160 at p. 158]**.

[19] Ibid **[pp.158-160 at p. 158]**.

[20] Ibid **[pp.158-160 at p. 158]**.

[21] Ibid **[pp.158-160 at p.160]**.

[22] Ibid **[pp.158-160 at p. 159-160]**.

[23] National Risk Register of Civil Emergencies (2017 Edition) **[pp. 161-231 at p. 194]**. For analysis by the insurance industry see Lloyd's Report, Pandemic: Potential insurance impacts, May 2008 **[pp. 232-258].**

a. The Serious Acute Respiratory Syndrome ("**SARS**") outbreak in 2002 to 2003, which emerged in China and with estimated attributable excess mortality worldwide of 774 and the most affected age group being middle age adults.[24] SARS was described by the WHO as a viral respiratory illness caused by the SARS-CoV coronavirus. No specific treatment was available and the focus was on prevention, including surveillance and early detection, proper hygiene and avoiding direct contact with infected bodily fluids.[25] The Swine Flu outbreak in 2009 to 2010, which emerged in Mexico and with estimated attributable excess mortality worldwide of 18,000 (457 of which in the UK) and the most affected age group being children, young adults and pregnant women.[26]

b. The Middle East Respiratory Syndrome ("**MERS**") outbreak 2012, which emerged in the Middle East and with estimated attributable excess mortality worldwide of 861 and the most affected age group being the elderly.[27] MERS was described by the WHO as a viral respiratory disease caused by the MERS coronavirus. No antiviral treatment or vaccine was available. Preventing MERS relied on avoiding unpasteurized or uncooked animal products, practicing safe hygiene habits in health care settings and around dromedary camels (which were implicated in the spread of the disease), community education and awareness training for health workers, as well as implementing effective control measures.[28]

c. There were Ebola virus outbreaks in 1976 (in what are now South Sudan and the Democratic Republic of Congo) and 2014–2016 (in Sierra Leone, Liberia and Guinea) and one is ongoing in the Democratic Republic of the Congo. The 2014-2016 outbreak was the largest and most complex Ebola outbreak ever, with over 28,000 cases and more than 11,000 deaths. The Ebola virus was described by the WHO as being a severe viral illness with a fatality rate varying between 25% and 90% in previous outbreaks. It was noted that in addition to the direct health impact, the outbreak and associated fears and stigma caused severe damage and disruption to local economies and daily life.[29]

d. The Zika virus which on 1 February 2016 was declared by the WHO to constitute a Public Health Emergency of International Concern (PHEIC). As of February 2018, 86 countries and territories around the world have reported transmission of Zika virus infection, of which 27 areas have ongoing transmission with new introduction or reintroduction reported since 2015. The Zika virus disease (ZIKV) was described by the WHO as a disease caused by a virus which is transmitted primarily by *Aedes* mosquitoes. There is no vaccine to prevent Zika virus infection, nor is specific anti-viral treatment currently available. Protection against mosquito bites during the day and early evening is a key measure to prevent Zika virus infection.[30]

10. There are been a range of different responses from local and national governments to the pandemics and epidemics. In particular, attention is drawn to the following:

a. During the Spanish Flu pandemic several US cities took measures to control the spread of the virus, including closing theatres, dance halls, banning public gatherings, staggering

[24] UK Government Coronavirus action plan **[pp. 4-31 at p. 11]**.
[25] WHO - Severe acute respiratory syndrome **[pp. 259-260]**.
[26] UK Government Coronavirus action plan [**pp. 4-31 at p. 10-11**].
[27] Ibid **[pp. 4-31 at p. 11]**.
[28] WHO – Middle East respiratory syndrome **[pp. 261-263]**.
[29] WHO – Ebola **[pp. 264-266]**.
[30] WHO – Zika **[pp. 267-269]**.

business hours to reduce congestion in stores and on transit systems and effecting community-wide business closures.[31]

b. The most stringent measures in relation to the SARS outbreak were adopted in Beijing, where on 26 April 2003, all sites of public entertainment (theaters, bars, libraries, and indoor sports facilities) were closed. By the time these places began opening again during the second week in June, 3,500 public places had been closed. Restaurants were never ordered to close, although patronage was much reduced during the height of the outbreak.[32]

c. After it emerged in the country in 2009, Mexico adopted stringent measures to control the spread of Swine Flu. On 24 April 2009 all schools, museums and other cultural venues were shut down in Mexico City,[33] and on 30 April 2009 the Mexican government shut down government offices and businesses not essential to the economy and ordered people to stay indoors for five days.[34]

[31] Public health interventions and epidemic intensity during the 1918 influenza pandemic, Richard Hatchett, PNAS May 1, 2007 104 (18) 7582-7587 **[pp. 270-275 at p. 271]**.
[32] Evaluation of Control Measures Implemented in the Severe Acute Respiratory Syndrome Outbreak in Beijing, 2003, Xinghuo Pang, AMA. 2003;290(24):3215-3221 **[pp. 276-282 at p. 280]**.
[33] Fighting Deadly Flu, Mexico Shuts Schools, The New York Times, 24 April 2009 **[pp. 283-288]**.
[34] Swine flu: Mexico braces for unprecedented lockdown, The Guardian, 30 April 2009 **[pp. 289-293]**.

English (https://www.euro.who.int/en/health-topics/communicable-diseases/influenza/pandemic-influenza/past-pandemics)

Past pandemics

2009 pandemic

The first influenza pandemic of the 21st century occurred in 2009–2010 and was caused by an influenza A(H1N1) virus. It was the first pandemic for which many Member States had developed comprehensive pandemic plans describing the public health measures to be taken, aimed at reducing illness and fatalities. For the first time, pandemic vaccine was developed, produced and deployed in multiple countries during the first year of the pandemic.
While most cases of pandemic H1N1 were mild, globally it is estimated that the 2009 pandemic caused between 100 000–400 000 deaths in the first year alone. Children and young adults were disproportionately affected in comparison to seasonal influenza, which causes severe disease mainly in the elderly, persons with chronic conditions and pregnant women.

Pandemics of the 20th century

Three influenza pandemics occurred at intervals of several decades during the 20th century, the most severe of which was the so-called "Spanish Flu" (caused by an A(H1N1) virus), estimated to have caused 20–50 million deaths in 1918–1919. Milder pandemics occurred subsequently in 1957–1958 (the "Asian Flu" caused by an A(H2N2) virus) and in 1968 (the "Hong Kong Flu" caused by an A(H3N2) virus), which were estimated to have caused 1–4 million deaths each.

Continuous learning

With each pandemic, researchers, public health experts and international organizations have gained a better understanding of the complexity and dynamics of influenza pandemics. With the improvement of surveillance and reporting systems, more data and characteristics of viruses can be documented than was possible a decade ago.

Researchers and public health experts are continuously learning more about the influenza virus, vaccines and response measures, and this knowledge is used to improve capacities related to both seasonal and pandemic influenza. Much of the knowledge acquired may also be applied to other areas of disease surveillance or to respond to other health threats.

Evaluation of the response to pandemic (H1N1) 2009 in the European Region (https://www.euro.who.int/en/health-topics/communicable-diseases/influenza/pandemic-influenza/past-pandemics/pandemic-h1n1-2009/evaluation-of-the-response-to-pandemic-h1n1-2009-in-the-european-region)

History lessons: the Asian Flu pandemic

'Although we have had 30 years to prepare for what should be done in the event of an influenza pandemic, I think we have all been rushing around trying to improvise investigations with insufficient time to do it properly. We can only hope that people will have taken advantage of their opportunities and at the end it may be possible to construct an adequate explanation of what happened.'[1]

So wrote J Corbett McDonald of the Public Health Laboratory Service, to Ian Watson, Director of the College of General Practitioners' Epidemic Observation Unit in the autumn of 1957. He was referring to that year's Asian flu pandemic. In the event, neither the Unit nor the PHLS undertook any large scale research projects during the outbreak and later studies were limited. The Unit's retrospective investigation had a response from 42 practices, of which only 29 provided useable data. Could or should more have been done? By 1957, unlike 1918, there was a global network of laboratories linked to the World Influenza Research Centre in London, which aimed to create a clearing house for research and tracking the virus.

In 1957 it had all seemed initially quiet on the UK influenza front. Dr McDonald's quarterly report (November 1956—March 1957) mentioned a 'remarkably low level of respiratory illness so far this winter.' However, a *Times* newspaper comment (17 April) that 'an influenza epidemic has affected thousands of Hong Kong residents' heralded the start of rapid movement across the East with 100 000 cases in Taiwan by mid-May and over a million in India by June. Five months after the Hong Kong outbreak it was reckoned to have traversed the globe. As an entirely new strain there was no immunity in the populace and the first vaccines were not distributed until August in the US and October in the UK, and then on an extremely limited basis.

The first cases in the UK were in late June, with a serious outbreak in the general population occurring in August. From mid-September onwards the virus spread from the North, West, and Wales to the South, East, and Scotland. One GP recalled 'we were amazed at the extraordinary infectivity of the disease, overawed by the suddenness of its outset and surprised at the protean nature of its symptomatology.'[2] It peaked the week ending 17 October with 600 deaths reported in major towns in England and Wales. There was some evidence of a limited return in the winter.

By early 1958 it was estimated that 'not less than 9 million people in Great Britain had ... Asian influenza during the 1957 epidemic. Of these, more than 5.5 million were attended by their doctors. About 14 000 people died of the immediate effects of their attack.'[3] Not only was £10 000 000 spent on sickness benefit, but also with factories, offices and mines closed the economy was hit: 'Setback in Production — "Recession through Influenza"' *(Manchester Guardian*, 29 November).

Despite Watson's early prediction that 'in the end, and in spite of the scare stuff in the lay press, we will have our epidemic of influenza, of a type not very different from what we know already, with complications in the usual age groups,'[4] the core group of main sufferers was aged 5–39 years with 49% between 5–14 years. In London, 110 000 children were off school suspected of having influenza. With adults there was usually a connection to children; for example, parents, teachers, doctors, or a closed group such as the armed forces and football teams. As the *Manchester Guardian* put it: 'Fit Go Down with Flu' (20th August). There was also a rise in influenzal deaths in January 1958 of an older age group but it was not clear how much of this was the usual seasonal deaths attributed to influenza as opposed to Asian flu.[5]

SYMPTOMS AND TREATMENT

Patients were often able to pinpoint the start of Asian flu to the very minute with wobbly legs and a chill followed by prostration, sore throats, running nose, and coughs; together with achy limbs (adults), head (children), and a high fever following. Young children, particularly boys, suffered nose bleeds. Edgar Hope-Simpson observed that the illness had two or three phases, the second being 2–14 days after the first and of a more severe nature.

Symptoms were mostly mild and patients usually recovered after a period in bed with simple antipyretic measures. There were complications in 3% of cases with 0.3% mortality. Pneumonia and bronchitis accounted for 50% of these, the rest being cerebro- and cardiovascular disease brought on by the flu. The incidence of known post-influenzal pneumonia rose during the pandemic — the percentage of deaths from this in the Midlands was 4% in the week ending 14 September, but by 19 October it was 22%.

John Fry treated 15% of his list and suspected that another 10% had not bothered to consult him. This assumption was questioned however, considering that a signed certificate was needed for sickness benefit.[6] Watson, himself, noted few complications in the patients he saw, but did mention depression that required treatment in 3 out of 10 women aged 20–25 years. Arthur Watts, (author of *Psychiatry in General Practice*) found that, in contrast, 'the depression usually associated with influenza was absent.'[7]

There was a lack of uniformity in treatment, some GPs prescribed antibiotics to all uncomplicated cases; one doctor in Salford used 100 000 units penicillin intramuscularly, while others only used antibiotics for serious cases. It was later noted however, that 'indiscriminate use of antibiotics' was not beneficial.[5]

Hospital wards were closed when nurses and doctors fell ill. Robin Pinsent was a GP who succumbed. Watson was intrigued;neither he nor his assistant had developed any antibodies despite daily exposure for 4 weeks:

'Whether ... I will eventually develop a detectable antibody in my serum is the very point ... Until I get the answer to this, I, at any rate will not accept any doses of vaccine because I believe that even this may upset the delicate symbiotic balance which I appear to have struck up with the virus at present.

What happens if I cease to be in daily contact with fresh doses of the virus? It may be that at that stage a dose of the vaccine may be useful if I have not yet developed any detectable antibodies in the blood.'[8]

Watson ran a retrospective study which, based upon 66 responses found a 35% rate of GP infection, 8% had no clinical symptoms but tested positive. Those without families were slightly more likely to have a subclinical infection.[3]

PANDEMIC GUIDANCE AND ADVICE

Six weeks before the virus struck in the UK there were almost daily reports in the press despite the advice of the World Health Organization that it was unlikely to strike until the winter.

'The public seems under the impression that nothing can be done to prevent the calamity that is threatened by the advance of influenza in the Far East. On the contrary there is a great deal that the Government can do; by acting at once they may save hundreds and thousands of lives', argued a Dr Kitching to the *BMJ*.[9] The government, he said, should organise a locum system to cover sick doctors, mobilise reserves of health visitors and nurses, and lastly arrange a reprieve from 'the chore' of signing certificates.

Watson read Kitching's letter and wondered whether the College should circulate something to all members, perhaps in a newsletter:

'I feel that we must go very carefully and only underline what is really needed from our own point of view. The Ministry and Colindale are no doubt on their toes in this matter. I think that we must be very sure of the need for any extra pre-epidemic publication before we rush into print.'[4]

By July there had been a number of localised outbreaks, and the Minister of Health was asked to issue a statement to allay fears, having declined to do so a month earlier. He replied that it was unnecessary as the flu was not spreading in the UK. However, in August when Asian flu was hitting communities and closing schools across the North West, a broadcast went out advising the public not to visit the doctor if they felt the flu coming on but to stay at home and take aspirin. Watson, hearing this 'deprecated the Ministry's encouraging self-diagnosis and prescribing drugs.'[10] He asked the College Council to take a stand and condemn it but they did not think it appropriate to get involved, although their representative raised Watson's point, without success, at the next GMSC meeting in September. The GMSC Chairman reported that he had recently attended a Ministry meeting, to devise a national procedure to cope with a large scale epidemic. It had, however, been decided that such a scheme would not be workable and that local Medical Officers of Health (MOH) would be responsible for devising their own schemes 'they would know almost as soon as the GPs that there was an epidemic.'[11] Watson, not appeased wrote to the *BMJ* reiterating his point and deploring that the broadcast had not specified an appropriate dose, method of taking, or allergic reactions to aspirin.'[12]

Was a clear message being given to the public as to what to expect and to do in the event of illness? Was there a leadership role for medical organisations such as the BMA or the College that was not taken up? The broadcast did not seem to dispel public concern. Is it reasonable to expect that it would do so? By late September, the *BMJ* correspondence column was full of complaints:

'It is time the BMA took urgent steps to counteract the … exaggerated publicity in the press … There have been no cases in this neighbourhood; patients have already started sending urgently on most inadequate grounds. One woman in the best of health had obeyed instructions given her in a woman's magazine'.[13]

Another called for an announcement that the influenza was highly contagious but quite harmless without evidence of serious complications. This drew the ire of Dr Agnes Wilkinson, as many doctors were flat-out caring for their flu patients; it was deemed dangerous to describe influenza as harmless and to advocate complacency in patients.

How effective was allowing outbreak management plans to be delegated to local MOH? The *Times* (28 September) reported that 'emergency epidemic plans' had been put into operation, which was denied; all that had been sent out were the usual reminders to be vigilant for epidemics over the winter. The actual policy of having local action plans drew criticisms of inconsistencies of practice. In some areas officers ordered complete closure of schools while in others only assemblies and physical training were banned. Was there any central mechanism to ensure that MOH reports were reviewed and the most effective measures identified and disseminated?

Are we able to learn anything from 1957 as we deal with H1N1? Will our guidance be examined for lessons in the future? It is already being collected for just this purpose. On 13 May 2009 the College received an email from the British Library asking if they could archive the section of the RCGP website devoted to H1N1 and pandemic planning. 'The swine flu outbreak is of international interest and the British Library believes it has a responsibility to archive relevant materials for the benefit of current and future researchers.'

Claire Jackson

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Coronavirus: action plan

A guide to what you can expect across the UK

Published 3 March 2020

Department of Health & Social Care

Department of Health
An Roinn Sláinte
Männystrie O Poustie
www.health-ni.gov.uk

Scottish Government
Riaghaltas na h-Alba
gov.scot

Llywodraeth Cymru
Welsh Government

Contents

1. Introduction

1.1 The current novel coronavirus (COVID-19) outbreak, which began in December 2019, presents a significant challenge for the entire world. The UK Government and the Devolved Administrations, including the health and social care systems, have planned extensively over the years for an event like this, and the UK is therefore well prepared to respond in a way that offers substantial protection to the public.

1.2 Of course, this is a new virus, and new technology and the increasing connectivity of our world mean that our plans need to be kept up to date, to reflect that illnesses – and news and information about them – travel much more quickly today than even ten years ago.

1.3 Recognising the respective roles and responsibilities of the UK Government and Devolved Administrations, this document sets out what the UK as a whole has already done - and plans to do further - to tackle the current coronavirus outbreak, based on our wealth of experience dealing with other infectious diseases and our influenza pandemic preparedness work. The exact response to COVID-19 will be tailored to the nature, scale and location of the threat in the UK, as our understanding of this develops.

1.4 This document sets out:

- what we know about the virus and the disease it causes
- how we have planned for an infectious disease outbreak, such as the current coronavirus outbreak
- the actions we have taken so far in response to the current coronavirus outbreak
- what we are planning to do next, depending upon the course the current coronavirus outbreak takes.
- the role the public can play in supporting this response, now and in the future.

2. What we know about the virus and the diseases it causes

2.1 Coronaviruses are a family of viruses common across the world in animals and humans; certain types cause illnesses in people. For example, some coronaviruses cause the common cold; others cause diseases which are much more severe such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS), both of which often lead to pneumonia.

2.2 COVID-19 is the illness seen in people infected with a new strain of coronavirus not previously seen in humans. On 31st December 2019, Chinese authorities notified the World Health Organisation (WHO) of an outbreak of pneumonia in Wuhan City, which was later classified as a new disease: COVID-19.

2.3 On 30th January 2020, WHO declared the outbreak of COVID-19 a "Public Health Emergency of International Concern" (PHEIC).

2.4 Based on current evidence, the main symptoms of COVID-19 are a cough, a high temperature and, in severe cases, shortness of breath.

2.5 As it is a new virus, the lack of immunity in the population (and the absence as yet of an effective vaccine) means that COVID-19 has the potential to spread extensively. The current data seem to show that we are all susceptible to catching this disease, and thus it also more likely than not that the UK will be significantly affected. Among those who become infected, some will exhibit no symptoms[1]. Early data suggest that of those who develop an illness, the great majority[2] will have a mild-to-moderate, but self-limiting illness – similar to seasonal flu[3].

2.6 It is, however, also clear that a minority of people who get COVID-19 will develop complications severe enough to require hospital care[4], most often pneumonia. In a small proportion of these, the illness may be severe enough to lead to death[5]. So far the data we have suggest that the risk of severe disease and death increases amongst elderly people and in people with underlying health risk conditions (in the same way as for seasonal flu)[6] [7]. Illness is less common and usually less severe in younger adults[8]. Children can be infected[9] and can have a severe illness[10], but based on current data overall illness seems rarer in people under 20 years of age. So far, there has been no obvious sign that pregnant women are more likely to be seriously affected[11] [12].

2.7 Given that the data are still emerging, we are uncertain of the impact of an outbreak on business. In a stretching scenario, it is possible that up to one fifth of

employees may be absent from work during peak weeks. This may vary for individual businesses.

2.8 We do not yet have entirely complete data on this disease. But as we learn more about the virus, its effects and its behaviour (for example, the timing and extent of the peak of an outbreak, its precise impact on individuals), we will be able to revise estimates of its potential spread, severity and impact[13]. We will then review, and (where necessary) adapt this plan accordingly.

2.9 Work is in hand to contain the spread of the virus. This includes extensive guidance provided to individuals returning from areas where there are cases being reported, and encouraging self-isolation as the primary means to contain the spread of the disease. Given that there is currently neither a vaccine against COVID-19 nor any specific, proven, antiviral medication[14] [15], most treatment will therefore be towards managing symptoms and providing support to patients with complications. The majority of people with COVID-19 have recovered without the need for any specific treatment, as is the case for the common cold or seasonal flu - and we expect that the vast majority of cases will best be managed at home, again as with seasonal colds and flu.

3. How the UK prepares for infectious disease outbreaks

3.1 The table below shows the impact of some of the major respiratory virus pandemics and epidemics in the last 100 years.

Major respiratory virus outbreaks

Area of emergence	Estimated case fatality ratio*	Estimated attributable excess mortality worldwide	Estimated attributable excess mortality in the UK	Age groups most affected
Spanish Flu 1918 – 1919 Severe influenza pandemic				
Unclear	≥ 2%	20 – 50 million	200,000	Young adults, elderly and young children
Asian Flu 1957 – 1958 Moderate influenza pandemic				
Southern China	0.1 – 0.2%	1 – 4 million	33,000	Children
Hong Kong Flu 1968 – 1969 Moderate influenza pandemic				
Southern China	0.2 – 0.4%	1 – 4 million	80,000	All age groups
Swine Flu 2009 – 2010 Very mild influenza pandemic				

Area of emergence	Estimated case fatality ratio*	Estimated attributable excess mortality worldwide	Estimated attributable excess mortality in the UK	Age groups most affected
Mexico	<0.025%	18,000	457	Children, young adults and pregnant women
Middle East Respiratory Syndrome 2012 Continuing coronavirus pandemic threat				
Middle East	>30%	861	0	Elderly (60+)
Serious Acute Respiratory Syndrome 2002 - 2003 Severe coronavirus pandemic 'near-miss'				
China	<10%	774	0	Middle aged adults (45 - 65)
Seasonal flu epidemic 1989 - 1990 Severe influenza seasonal epidemic				
UK	Data not available	Not applicable	26,000 excess deaths in England & Wales	Elderly 75+

* the proportion of people who became ill with symptoms and subsequently died

3.2 The UK is well prepared for disease outbreaks, having responded to a wide range of infectious disease outbreaks in the recent past, and having undertaken significant preparedness work for an influenza pandemic for well over one decade (eg. our existing plan 'flu plans[16]). Our plans have been regularly tested and updated locally and nationally to ensure they are fit for purpose. This experience

provides the basis for an effective response to COVID-19, which can be tailored as more specific information emerges about the virus.

3.3 These plans ensure the UK is equipped to deliver a coordinated multi agency response to minimise wider societal impact that could arise from a significant outbreak. An effective response also requires the active participation of a well-informed public and all service providers.

3.4 Planning draws on the idea of a “reasonable worst case (RWC)” scenario. This is not a forecast of what is most likely to happen, but will ensure we are ready to respond to a range of scenarios.

Planning Principles

3.5 In preparing for, and responding to, a serious disease outbreak, the UK and the Devolved Administrations aim to:

- undertake dynamic risk assessments of potential health and other impacts, using the best available scientific advice and evidence to inform decision making
- minimise the potential health impact by slowing spread in the UK and overseas, and reducing infection, illness and death
- minimise the potential impact on society and the UK and global economy, including key public services
- maintain trust and confidence amongst the organisations and people who provide key public services, and those who use them
- ensure dignified treatment of all affected, including those who die
- be active global players - working with the World Health Organization (WHO), the Global Health Security Initiative (GHSI), the European Centre for Disease Prevention and Control (ECDC), and neighbouring countries, in supporting international efforts to detect the emergence of a pandemic and early assessment of the virus by sharing scientific information
- ensure that the agencies responsible for tackling the outbreak are properly resourced to do so, that they have the people, equipment and medicines they need, and that any necessary changes to legislation are taken forward as quickly as possible

- be guided by the evidence, and regularly review research and development needs, in collaboration with research partners, to enhance our pandemic preparedness and response.

3.6 The UK Government and the Devolved Administrations have been planning an initial response based on information available at the time, in a context of uncertainty, that can be scaled up and down in response to new information to ensure a flexible and proportionate response.

3.7 The fundamental objectives are to deploy phased actions to Contain, Delay, and Mitigate any outbreak, using Research to inform policy development.

3.8 The different phases, types and scale of actions depends upon how the course of the outbreak unfolds over time. We monitor local, national and international data continuously to model what might happen next, over the immediate and longer terms.

3.9 The overall phases of our plan to respond to COVID-19 are:

- **Contain**: detect early cases, follow up close contacts, and prevent the disease taking hold in this country for as long as is reasonably possible

- **Delay**: slow the spread in this country, if it does take hold, lowering the peak impact and pushing it away from the winter season

- **Research**: better understand the virus and the actions that will lessen its effect on the UK population; innovate responses including diagnostics, drugs and vaccines; use the evidence to inform the development of the most effective models of care

- **Mitigate**: provide the best care possible for people who become ill, support hospitals to maintain essential services and ensure ongoing support for people ill in the community to minimise the overall impact of the disease on society, public services and on the economy.

4. Our response to the current coronavirus outbreak

Current planning

4.1 There is similarity between COVID-19 and influenza (both are respiratory infections), but also some important differences. Consequently, contingency plans developed for pandemic influenza[17], and lessons learned from previous outbreaks, provide a useful starting point for the development of an effective response plan to COVID-19. That plan has been adapted, however, to take account of differences between the two diseases. Annex A sets out the structure for the UK's response to a disease outbreak.

4.2 Our response to COVID-19 is guided by the international situation, the advice of organisations such as the WHO, surveillance, data modelling based on the best available evidence and the recommendations of our expert bodies (Annex B). The Scientific Advisory Group for Emergencies (SAGE) provides expert medical scientific advice. The four UK governments' Chief Medical Officers (CMOs) continue to advise the health and social care systems across the UK, and government agencies in all parts of the UK involved in responding to this outbreak.

4.3 System wide response plans for pandemic influenza, focused on the continuity of public and critical services and the stability of the economy, have been adapted for COVID-19, based on the best available scientific evidence and advice. For the latest information on the current situation please refer to: www.gov.uk/guidance/wuhan-novel-coronavirus-information-for-the-public.

4.4 The nature and scale of the response depends on the course of the disease, which cannot be predicted accurately at this point. As our understanding of the disease increases and its impact becomes clearer, we will issue further detailed advice about what to expect if/when further measures become necessary.

The phased response - what we have done so far

4.5 As there are already cases in the UK, the current emphasis is on the Contain and Research phases, but planning for Delay and Mitigation is already in train.

The Contain phase - actions to date

4.6 Across the whole of the UK, public health agencies and authorities, the NHS, and Health and Social Care NI (HSCNI) have established plans and procedures to detect and isolate the first cases of COVID-19 as they emerge in the UK. Each nation's public health agencies have worked with Border Force, port operators and carriers to enhance port health measures. PHE teams are on site at appropriate international ports, and health advice and information has been widely cascaded, as part of our public communications plan, with appropriate arrangements also put in place in the Devolved Administrations (given that some aspects relating to the arrival of aircraft and shipping are devolved).

4.7 Border Force and the Foreign and Commonwealth Office (FCO) have assisted the repatriation of British nationals and their dependents from affected areas overseas. Where foreign nationals in the UK have been unable to return to affected areas, the Home Office have provided support enabling them to remain in the UK.

4.8 New regulations introduced in England under public health legislation provide new powers for medical professionals, public health professionals and the police to allow them to detain and direct individuals in quarantined areas at risk or suspected of having the virus. In Scotland Health Boards have powers to place restrictions on the activities of individuals who are known to have the disease, or have been exposed to the disease, and to prohibit them from entering or remaining in any place. Boards may also apply for court orders for quarantine and medical examination. In Wales, local authorities have powers to apply for an order to be made by the Justice of the Peace to isolate, detain or require individuals to undergo medical examination. Similar powers are available to the Public Health Agency in Northern Ireland. Welsh Ministers also have powers to make regulations equivalent to those now in place in England if the level of risk increases.

4.9 As part of the port health measures, direct flights arriving into the UK from countries within the UK's CMOs' case definition are required to provide a declaration (General Aircraft Declaration) to airport authorities stating that all their passengers are well, 60 minutes prior to landing. Similarly, The Maritime Health Declaration Form is required for all vessels arriving from any foreign port. For Scotland parallel measures are in place.

4.10 The health and social care systems and public health authorities in all parts of the UK have cascaded information widely to all health professionals on steps to take if they identify patients who may have COVID-19.

4.11 The NHS/HSCNI have well rehearsed plans that have enabled the provision of excellent care for all patients affected by this disease. The initial confirmed

patients are being cared for by specialist units with expertise in handling such cases, using tried and tested infection control procedures to prevent further spread of the virus. When necessary, the provision of care may move from specialist units into general facilities in hospitals

4.12 The NHS/HSCNI have expert teams in every ambulance service and a number of specialist hospital units with highly trained staff and equipment ready to receive and care for patients – these provide coverage across the whole of the UK. If the current outbreak takes a greater hold, we will use those lessons about effective treatment methods and apply them throughout our health services, across all hospital sites and into community settings.

4.13 Once a case has been detected, our public health agencies use tried and tested procedures for rapid tracing, monitoring and isolation of close contacts, with the aim of preventing further spread.

4.14 The UK maintains strategic stockpiles of the most important medicines and protective equipment for healthcare staff who may come into contact with patients with the virus. These stocks are being monitored daily, with additional stock being ordered where necessary.

4.15 We have provided UK residents and travellers with the latest information to make sure they know what to do if they experience symptoms and worked with NHS 111, NHS Direct Wales and NHS 24 in Scotland, to ensure people with symptoms are given appropriate advice. Public health advice has been widely publicised and is regularly updated at www.gov.uk/guidance/wuhan-novel-coronavirus-information-for-the-public

4.16 FCO Travel Advice gives British nationals advice on what they need to know before deciding whether to travel and what to do if they are affected by an outbreak of COVID-19 while travelling. Our Travel Advice and consular assistance also help to contain the spread of COVID-19 to the UK.

4.17 Advice has been provided to first responders, employers, the justice system (including prison and probation services), educational settings, and the adult social care sector. The Department for Education provides advice about educational settings in England, which can be found on PHE's website. A DfE helpline is being set up to manage the flow of increasing queries, from providers and from parents of pupils.

4.18 Equivalent guidance for educational settings in Scotland can be found on the Health Protection Scotland website. This guidance provides links to further advice via NHS Inform and contact details for local Health Protection Teams. Scottish local authorities can also provide advice and support to education settings in their

areas, working closely with local Health Protection Teams and local and regional resilience partnerships.

4.19 In Wales, guidance for educational settings is provided on the Welsh Government website which also provides links to further public health advice - https://gov.wales/guidance-educational-settings-about-covid-19.

4.20 Department for International Trade teams around the globe continue to support British companies facing disruption due to the Coronavirus. The Department's officials across the globe are already working with UK businesses on the ground to relay public health advice and FCO travel advice, and provide practical and concrete support to firms, including engaging with local government and suppliers, and working with business associations to disseminate latest information on UK consular and visa services, and accessing existing UK Export Finance facilities.

4.21 All NHS and HSCNI emergency and urgent care facilities are working to establish coronavirus assessment services to lessen impacts on Emergency Departments and other clinical settings. This enables them to identify, isolate and contain cases, separate from other patients and the public, and in a way scalable to cope with expanding need. Specifically tailored and effective services responding to this outbreak have protected GPs, ambulance and hospital services for other patients.

4.22 The safety and security of British Nationals overseas will always be our top priority. Our initial focus has been helping those Britons who have found themselves at the greatest risk of exposure to the virus. Our crisis response team in the FCO has been working around the clock with our Embassies throughout the world to provide them with the care they need and reduce the risk of importation of Coronavirus into the UK. This includes the use of quarantine and self-isolation measures for those returning from at risk areas.

The Delay phase - actions to date

4.23 Many of the actions involved in the Contain phase also act to help Delay the onset of an epidemic if it becomes inevitable. These include case finding and isolation of early cases.

4.24 Many of the actions that people can take themselves - especially washing hands more; and the catch it, bin it, kill it strategy for those with coughs and sneezes - also help in delaying the peak of the infection.

4.25 Our experts are considering what other actions will be most effective in slowing the spread of the virus in the UK, as more information about it emerges. Some of these will have social costs where the benefit of doing them to Delay the peak will

need to be considered against the social impact. The best possible scientific advice and other experts will inform any decision on what will be most effective.

4.26 Delaying the spread of the disease requires all of us to follow the advice set out below. The benefits of doing so are that if the peak of the outbreak can be delayed until the warmer months, we can reduce significantly the risk of overlapping with seasonal flu and other challenges (societal or medical) that the colder months bring. The Delay phase also buys time for the testing of drugs and initial development of vaccines and/or improved therapies or tests to help reduce the impact of the disease. There is therefore a strong dependency between the different elements of our approach.

The Research phase - actions to date

4.27 The UK Government is liaising with the National Institute for Health Research (NIHR), UK Research and Innovation (UKRI) including the Medical Research Council (MRC) and other funders such as the Wellcome Trust to support and co-ordinate research during the COVID-19 outbreak.

4.28 Our Public Health Agencies are supporting the rapid development of specific tests for this coronavirus, in partnership with WHO and a global network of laboratories. This has been rolled out to NHS/HSCNI laboratories across the UK to enable faster confirmation of positive diagnoses.

4.29 The UK Government has already pledged £20 million to the Coalition for Epidemic Preparedness Innovations (CEPI) to develop new vaccines to combat the world's deadliest diseases, including vaccines for COVID-19, as quickly as possible, and is actively considering further investment.

4.30 The UK Government has also additionally announced £20 million for COVID-19 research via a joint rapid research call between UKRI and, through DHSC, the National Institute for Health Research (NIHR). This asks for proposals for projects to develop vaccines, therapeutics, and diagnostics; or to address the epidemiology, spread or underpinning knowledge of COVID-19.

4.31 Our health and social care departments across the UK are seeking to build on the relationships they have with institutions involved in Health Protection Research. A number of these are involved in research in relation to the COVID-19 epidemic.

4.32 This includes one on Emergency Preparedness and Response led by King's College London. It brings together experts on how to conduct important research that includes research on how to respond to infectious disease outbreaks such as COVID-19.

4.33 The UK is a world leader in the field of outbreak modelling and data analytics. The NIHR HPRU in Modelling Methodology led by Imperial College London has developed novel analytical and computational tools which exploit novel data streams on infectious diseases such as COVID-19. This group and other leading academic groups have developed tools to prepare for infectious disease outbreaks, which include real time infectious disease models, allowing policy decisions to be made using the best possible data and are actively modelling questions of relevance to dealing with the COVID–19 outbreak.

The role the public can play in supporting this response

4.34 Everyone can help support the UK's response by:

- following public health authorities' advice, for example on hand washing
- reducing the impact and spread of misinformation by relying on information from trusted sources, such as that on www.nhs.uk/, www.nhsinform.scot, www.publichealth.hscni.net, https://gov.wales/coronavirus-covid-19 and www.gov.uk/
- checking and following the latest FCO travel advice when travelling and planning to travel
- ensuring you and your family's vaccinations are up to date as this will help reduce the pressure on the NHS/HSCNI through reducing vaccine-preventable diseases
- checking on elderly or vulnerable family, friends and neighbours
- using NHS 111 (or NHS 24 in Scotland or NHS Direct Wales) (including online, where possible), pharmacies and GPs responsibly, and go to the hospital only when you really need to. This is further explained on the NHS website - www.nhs.uk/using-the-nhs/nhs-services/urgent-and-emergency-care/when-to-go-to-ae/ and http://www.choosewellwales.org.uk/home
- being understanding of the pressures the health and social care systems may be under, and receptive to changes that may be needed to the provision of care to you and your family.
- accepting that the advice for managing COVID-19 for most people will be self-isolation at home and simple over the counter medicines
- checking for new advice as the situation changes.

The phased response - what we will do next

4.35 In the event of the outbreak worsening, or a severe prolonged pandemic, the response will escalate, and the focus will move from Contain to Delay, through to Mitigate. During this phase the pressures on services and wider society may start to become significant and clearly noticeable.

4.36 The decision to step up the response from Contain to Delay and then Mitigate will be taken on advice from the UK's Chief Medical Officers, taking in to account the degree of sustained transmission and evident failure of measures in other countries to reduce spread.

4.37 To ensure that the health and social care system is prepared to respond to all eventualities, at all phases of a potential future pandemic, the NHS/HSCNI and local authorities have plans in place to ensure people receive the essential care and support services they need - and sometimes this might mean that other services are reduced temporarily. Plans are flexible to respond to different types of pandemics - ranging from a mild pandemic with a low impact on services (for example the 2009 H1N1 pandemic), through to a severe prolonged pandemic as experienced in 1918 ("Spanish Flu").

4.38 Similarly, potential pandemics are one of a wide range of risks that the owners and operators of our most essential services and systems plan for. The UK Government and Devolved Administrations are currently working with our critical national infrastructure partners to ensure that these plans are appropriate for COVID-19, and that we minimise any impacts that could disrupt the daily services on which the UK depends.

4.39 The Ministry of Defence has put in place plans to ensure the delivery of its key operations in the UK and overseas. There are also well practised arrangements for Defence to provide support to Civil Authorities if requested.

4.40 The UK Government will also step up the central co-ordination of its overall response using its proven crisis management mechanisms: COBR would meet as often as needed, bringing in system leaders to co-ordinate vital public services; and there will be more communication with Parliament, the media and the public. Ministers from across government will be designated to lead for their department on handling the outbreak; with senior officials and system leaders working intensively alongside them. The respective crisis management mechanisms across the Devolved Administrations have also been stood up and will operate in very similar terms to that of COBR within their own nations, and all four co-ordination centres are linked up on UK-wide planning and delivery of the response to Covid-19.

4.41 There will be regular meetings between the UK Government, and NHS/HSCNI and public health leaders, chaired alternately by the Secretary of State for Health and Social Care and his Permanent Secretary, to discuss the most recent advice from scientific experts and those delivering key services, and to decide next steps.

The Delay phase - next steps

4.42 If the disease becomes established in the UK, we will need to consider further measures to reduce the rate and extent of its spread. Based on experience with previous outbreaks, it may be that widespread exposure in the UK is inevitable; but slowing it down would still nonetheless be beneficial. For example, health services are less busy in the summer months when flu and other winter bugs are not driving GP consultations and hospital admissions. In the 2009 ‘swine flu’ pandemic school holidays significantly slowed transmission of the virus.

4.43 We will increase publicity about the need for good hygiene measures (hand washing, and catch it, bin it, kill it) and further promote the need for people with symptoms to stay at home for the full duration of their illness.

4.44 Other action will be considered to help achieve a Delay in the spread of the disease. We will aim to minimise the social and economic impact, subject to keeping people safe. Such judgements will be informed based on the best available and most up to date scientific evidence, and take into account the trade-offs involved.

4.45 Action that would be considered could include population distancing strategies (such as school closures, encouraging greater home working, reducing the number of large scale gatherings) to slow the spread of the disease throughout the population, whilst ensuring the country’s ability to continue to run as normally as possible. The UK governments' education departments' planning assumptions include the possibility of having to close educational settings in order to reduce the spread of infection.

4.46 We would consider such measures in order to protect vulnerable individuals with underlying illnesses and thus at greater more at risk of becoming seriously affected by the disease. The effectiveness of these actions will need to be balanced against their impact on society.

The Research phase - next steps

4.47 It is possible that an outbreak or pandemic of COVID-19 could occur in multiple waves (it is not known yet if the disease will have a seasonal pattern, like flu) and therefore, depending upon what the emerging evidence starts to tell us, it may be

necessary to ensure readiness for a future wave of activity. The intention is to gather evidence about effective interventions in order to inform decision-making going forward. The UK Government will keep emerging research needs under close review and progress research activities set out above.

The Mitigate phase - next steps

4.48 As and when the disease moves into different phases, for example if transmission of the virus becomes established in the UK population, the nature and scale of the response will change. The chief focus will be to provide essential services, helping those most at risk to access the right treatment. This means that:

- there will be further publicity of advice to individuals about protecting themselves and others
- treatment and the requirement for medicines and other clinical countermeasures might start to increase, with the need to draw down on existing stockpiles of the most important medicines, medical devices and clinical consumables
- health and social care services will work together to support early discharge from hospital, and to look after people in their own homes
- emergency services, including the police and fire and rescue services will enact business continuity plans to ensure they are able to maintain a level of service that fulfils their critical functions. For example, with a significant loss of officers and staff, the police would concentrate on responding to serious crimes and maintaining public order
- for businesses facing short term cash flow issues (for example, as the result of subdued demand), an effective mitigation already exists in HMRC's Time To Pay system. This is offered on a case by case basis if a firm or individual contacts HMRC about falling behind on their tax
- as NHS/HSCNI staff also start to become affected, and more seriously ill patients require admission, clinicians may recommend a significantly different approach to admissions. Some non-urgent care may be delayed to prioritise and triage service delivery. Staff rostering changes may be necessary, including calling leavers and retirees back to duty
- there could well be an increase in deaths arising from the outbreak, particularly amongst vulnerable and elderly groups. The UK Government and Devolved Administrations will provide advice for local authorities on dealing with this challenge

- there will be less emphasis on large scale preventative measures such as intensive contact tracing. As the disease becomes established, these measures may lose their effectiveness and resources would be more effectively used elsewhere.

4.49 Everyone will face increased pressures at work, as well as potentially their own personal illness or caring responsibilities. Supporting staff welfare will be critical to supporting an extended response.

4.50 We will implement a distribution strategy for the UK's stockpiles of key medicines and equipment (e.g. protective clothing). This will cover the NHS/HSCNI, and extend to social care and other sectors as appropriate.

4.51 We will consider legislative options, if necessary, to help systems and services work more effectively in tackling the outbreak.

4.52 The UK's health and social care systems will start to implement their business continuity plans, which cover:

- continuing to minimise the risk of infection to patients and those receiving care
- further identification of vulnerable persons to be supported
- arrangements for the continuation of essential services, to maintain normal business for as many people as possible for as long as possible
- plans to reduce the impact of absentees during the pandemic
- systems to lessen the impact of disruption to society and the supply chain.

4.53 The UK remains in a high state of readiness to respond robustly to any disease outbreak, and our track record of success means that we can offer a high degree of assurance that we will be able to maximise the effectiveness of our health and care systems, and in doing so also respond effectively to the outbreak.

4.54 As and when we discover more about the disease and what, if any, impact its course has on the UK, we will provide further updates on how our plans are being adapted to respond to specific, changing circumstances.

4.55 The UK Government is advising businesses to build their own resilience by reviewing their business continuity plans and following the advice for employers available on GOV.UK - www.gov.uk/government/publications/guidance-to-employers-and-businesses-about-covid-19

4.56 Businesses should also ensure that they keep up to date with the situation as it changes, at: www.gov.uk/coronavirus.

Annex A - responsibilities for pandemic preparedness and response

National responsibilities

The Department of Health and Social Care (DHSC) is the lead UK Government Department with responsibility for responding to the risk posed by a future pandemic.

The four UK CMOs provide public health advice to the whole system and government throughout the UK. The Scientific Advisory Group for Emergencies (SAGE) is responsible for ensuring that a single source of coordinated scientific advice is provided to decision makers in COBR.

The NHS works in partnership with Local Resilience Forums on pandemic preparedness and response delivery in healthcare systems in England and Wales. Public Health England provides specialist technical expertise to support both planning and delivery arrangements in England, working closely with public health agencies in Wales, Scotland and Northern Ireland. These organisations have developed plans for coordinating the response at a national level and supporting local responders through their regional structures. The tri-partite partnership of DHSC, PHE and NHS England provides strategic oversight and direction for the health and adult social care response to an influenza pandemic, with Department for Education (DfE) leading on the children's social care response. In Devolved Administrations, there are similar arrangements for multi-agency working with strategic oversight provided by the appropriate departments. These arrangements are supported by national co-ordination structures.

PHE and their equivalent in the Devolved Administrations lead the provision of expert advice on health protection issues and actively contributes to the planning and delivery of a multi-agency response. PHE provides health protection services, expertise and advice, delivering specialist public health services to UK national and local government (in England), the NHS/HSCNI and the public, working in partnership to protect the public against infectious diseases. There are comparable public health expert advisory support arrangements in each of the other three UK countries.

Local/Regional responsibilities

In England and Wales, local organisations (working jointly through the Local Resilience Forums and Local Health Resilience Partnerships in England, and NHS emergency planning structures in Wales) have the primary responsibility for planning for and responding to any major emergency, including a pandemic. Similar arrangements exist in

Scotland working through Regional Resilience and Local Resilience Partnerships. In Northern Ireland, Emergency Preparedness Groups coordinate emergency planning at the local level.

Multi-agency working

Multi-agency working at both a national and local level ensures joint planning between all organisations. A coordinated approach to ensure best use of resources to achieve the best outcome for the local area.

NHS England and NHS Improvement and partners have published a series of quick guides to assist multi-agency working and support local health and care systems manage increasing demand on their services. The series of guides can be found at www.nhs.uk/quickguides. Integration Authorities in Scotland have access to a range of government advice on priorities for multi-agency working, which supports existing local plans to optimise care pathways.

Social care is provided by a diverse range of local authority, private and third sector bodies. It is important that the role of social care provision in all sectors is central to contingency planning. Social care providers should remain in contact with local commissioners and resilience partners, review their business continuity plans and continue to practice proper infection control and good respiratory hygiene practice.

Other key public services

The Ministry of Justice's HM Courts & Tribunal Service have well established plans to deliver key services to protect the public and maintain confidence in the justice system. Similar plans are in place in the Devolved Administrations.

Annex B - expert advice and guidance

The UK Government and the Devolved Administrations have ensured that all of our actions are based on the best possible evidence, and are guided by the four UK CMOs.

The UK health departments preparations and response are developed with expert advice, ensuring that staff, patients and the wider public can be confident that our plans are developed and implemented using the best available evidence. These groups include:

- the Scientific Advisory Group for Emergencies (SAGE) – Chaired by the Government Chief Scientific Adviser and co-chaired by the CMO for England - provides scientific and technical advice to support government decision makers during emergencies, ensuring that timely and coordinated scientific advice is made available to decision makers to support UK cross-government decisions in the UK Cabinet Office Briefing Room

- the New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG) is an expert committee of DHSC and advises the CMOs and, through the CMOs, ministers, DHSC and other Government departments, and the Devolved Administrations. It provides scientific risk assessment and mitigation advice on the threat posed by new and emerging respiratory virus threats and on options for their management

- the Advisory Committee on Dangerous Pathogens (ACDP) - provides independent scientific advice to the Health and Safety Executive, to Ministers in DHSC and DEFRA, and to their counterparts in Scotland, Wales and Northern Ireland on all aspects of hazards and risks to workers and others from exposure to pathogens

- the Scientific Pandemic Influenza Group on Modelling (SPI-M) - gives expert advice to the Department of Health and Social Care and wider UK government and the Devolved Administrations on scientific matters relating to the UK's response to an influenza pandemic (or other emerging human infectious disease threats). The advice is based on infectious disease modelling and epidemiology

- the Joint Committee on Vaccination and Immunisation (JCVI) advises UK health departments on immunisation

- FCO Travel Advice is informed by PHE and DHSC advice and gives British nationals advice on what they need to know before deciding whether to travel and what to do if they are affected by an outbreak of COVID-19 while travelling.

The actions we are taking to tackle the COVID-19 outbreak are being informed by the advice of these committees.

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The Influenza Epidemic

in England and Wales

1957-1958

LONDON

HER MAJESTY'S STATIONERY OFFICE

1960

PREFACE

The report which follows is a distillate of a large volume of information assembled by the Department concerning the epidemic of influenza which occurred in England and Wales between June, 1957 and April, 1958. It was part of the world-wide pandemic which is thought to have originated in China where the causal virus was first identified in February, 1957. From China it reached Hong Kong in the second half of April, Singapore in May, and thereafter spread rapidly.

An interesting feature of the pandemic was the way in which its course could be charted, thanks to the pre-existing arrangements made by the World Health Organization for the study of influenza throughout the world. Another was the rapidity with which it appeared to spread in the tropical regions of Asia and Africa and its relative slowness in Northern Europe and the British Isles.

Information collected from many countries was published by the World Health Organization in 1959. The present Report is concerned essentially with events in England and Wales and does not attempt to consider in detail the international aspects of the subject or the part played by the World Influenza Centre, London, in technical investigations and advice.

It is fortunate that the clinical manifestations in this pandemic were generally milder than those of the pandemic of 1918–19 which was responsible for an excess mortality of 200,000, of which 150,000 deaths were ascribed to influenza. Nevertheless, it is thought that in 1957 alone the recent epidemic was responsible in England and Wales for some 30,000 deaths of which 6,716 were ascribed to influenza itself.

The brunt of the outbreak seemed to fall primarily on schoolchildren and young adults in whom recovery was usually rapid.

The effect of antibiotics in the treatment of uncomplicated attacks of influenza was negligible. There was no evidence that their use was of the slightest value in preventing complications from developing.

A hopeful feature of the report is the prospect given of control by the beneficial effects of vaccination with an appropriate vaccine. The importance of this for the maintenance of essential services, education and industrial output does not need to be emphasised.

The original material was assembled by Dr. C. Grant Nicol of this Department, who also made the first draft of the report. Thereafter, a small departmental Editorial Committee gave it its final form.

JOHN A. CHARLES.

Ministry of Health,
London,
1959.

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I

INTRODUCTORY

The outbreak of Asian influenza which first reached this country in June, 1957 was widespread but for the most part mild for an influenza epidemic. It has been considered worthy of special report mainly because the causal strain of the influenza virus was an entirely new variant of the A strain and also because world-wide arrangements for laboratory investigation and exchange of intelligence made possible for the first time a well-informed and accurate observation of the spread of pandemic influenza, together with a reasoned forecast of the paths of spread.

It may be of interest to review briefly the several stages by which knowledge of influenza has been advanced through study of earlier world-wide outbreaks.

The pandemics of 1889–90

The winter of 1889–90 saw the return of influenza in epidemic form to this country after an absence of 43 years. This was the first epidemic of influenza of any considerable magnitude in the British Isles since the establishment of a central health authority, and a most comprehensive inquiry was undertaken by the medical staff of the Local Government Board. A Report, prepared by Dr. H. F. Parsons, described in some detail the epidemiology and clinical manifestations of the disease, both in the British Isles and throughout the world. In great measure Dr. Parsons' report was a detailed recording of demonstrable paths of spread of the infection, with the purpose of showing that the pandemic had advanced at a rate and in a manner entirely consistent with its dissemination by human agency. He thus refuted the widely held and firmly entrenched beliefs that influenza was derived from emanations from the soil (miasmata) and was subsequently spread to great distances by prevailing winds to infect simultaneously a whole district, county or province. Equally current and equally firmly refuted was the view that influenza in man was preceded by and derived from an epidemic disease of horses termed " horse influenza ".

In his foreword to Parsons' Report, Sir George Buchanan, then Medical Officer to the Board, commented that " the matter which most exercised the public mind was the source of influenza. The universal desire in every country appears to have been to accuse another country of generating the epidemic, accusing by preference the more distant ones ". Of these, Russia and China were generally held to have originated the epidemic. In point of fact the pandemic of 1889–90 first appeared in three widely separated parts of the world at the same time. In May, 1889, influenza of a severe type was prevalent in Greenland, as well as being reported in Athabasca in north-west Canada; at the same time the disease appeared in Bokhara, Central Asia. Subsequently influenza spread over the whole of the known world, the epidemic appearing in this country towards the end of 1889, but the main incidence being in the opening months of 1890.

Having offered all reasonable proof that the pandemic had spread westward to Europe from Bokhara by human agency along the regular and ordinary paths of travel, Dr. Parsons, like numerous other careful observers, expressed the firm belief that influenza was caused by a specific germ, that it was a highly communicable disease with a short incubation period, that susceptibility was general and immunity after attack doubtful, and that the many slight or unrecognised cases contributed materially to the spread of the disease.

Influenza appeared again in this country later in 1890 and was prevalent in epidemic form in the spring of 1891, to be followed in the winter of 1891–92 by a third epidemic. These later outbreaks in this and other countries were the subject of a further but shorter report by Dr. Parsons and the occasion of systematic bacteriological studies by Dr. Klein, F.R.S., to determine if possible the causal germ of influenza. These investigations led Klein to agree with the conclusions of Pfeiffer and Kitasato* that the organism first described by them and now known as *Haemophilus influenzae* was the causative bacillus.

1892–1918

Influenza has remained with us as a frequent cause of winter concern since the pandemic of 1889–90. In 1895, 1900, 1908 and 1915 there occurred outbreaks of considerable magnitude, but that of 1918–19 far surpassed anything previously recorded.

The pandemic of 1918–19

Not since the plague of Justinian's reign and the Black Death of the 14th century had there been so great a scourge. Within a few months the pandemic destroyed more human lives than did the European war in five years, carrying off upwards of 200,000 persons in England and Wales alone of whom 150,000 were certified as having died of influenza. Everywhere the disease bore hardest on healthy young adults, tending to spare those at the extremes of life. The official record of this outbreak given in the Report on the Pandemic of Influenza 1918–19, written by the medical staff of the newly formed Ministry of Health in collaboration with others distinguished in their own special fields, supplemented that† published in 1920 by the General Register Office.

Once again it was apparent that no country was prepared to accept responsibility as the place of origin of the pandemic, and as in former years each sought to lay the blame elsewhere.

The writers of the Ministry's record were at particular pains to show that the pandemics of 1918–19 and of 1889–90 had been preceded by localised outbreaks of influenza in this country as also by outbreaks of infectious diseases of the central nervous system, and that disturbances of the public health had been recorded as preceding all known epidemics of influenza. By reasoned argument, which need not be re-stated here, it was contended " that we might have explosions of influenza even if Russia or Spain did not exist and the British frontiers were hermetically sealed."

Possible viral cause of influenza

Equally with its source, the cause and possible prevention of epidemic influenza was the occasion of both speculation and scientific inquiry. In the

* *Deutsche Med. Woch.* 1892, 2.

† Report on the Mortality from Influenza in England and Wales during the epidemic of 1918–19. 1920, London. His Majesty's Stationery Office.

Ministry's report of the events of 1918–19 Sir Frederick Andrewes provided an appreciation of what was then known of the microbiology of influenza, and examined the claims of Pfeiffer's bacillus and the evidence in favour of a viral cause. He concluded that the position of *Haem. influenzae* as the primary cause of the disease " had been in no way strengthened " despite its established place as a cause of secondary infections of an abnormal fatality, while " the evidence for a filter passing virus as the primary cause of the disease is suggestive but at present a final verdict cannot be given." In the absence of precise knowledge of the cause of influenza, no true advance could be made to provide a specific vaccine, and as would be expected, equivocal reports were received of the efficacy of the anti-influenzal vaccines then available, which were derived from *Haem. influenzae* and pneumococci.

Experimental evidence of a viral cause of influenza

Of the prospect for the future, the authors of the Ministry's Report wrote " the problem of influenza is still unsolved, its solution will be one of the great events in the history of medicine ". In the 40 years that have elapsed since the events of 1918–19 we have come some part of the way at least towards this solution.

In 1933 Smith, C. H. Andrewes and Laidlaw experimentally transmitted influenza from human sources to ferrets by nasal instillation of bacteria-free filtered throat washings derived from patients in the early stages of influenza. They showed that the disease could be passed serially in ferrets, that recovery of the experimental animal was followed by immunity and that both serum from convalescent ferrets and convalescent human beings neutralised the ferret virus.

With one strain of the causative agent of the disease now available for laboratory study, identification of further members in the group of influenza viruses followed and recognition of the serological reactions to which the several strains give rise in infected persons placed diagnosis on a firm aetiological basis.

In 1935 the influenza virus was successfully cultivated in the fertile hen's egg by Wilson Smith. Further developments and application of egg cultivation were subsequently made both in Australia and the United States of America. The discovery that the virus could be grown in this way meant that investigation of its properties could be conducted on a very much greater scale than was possible when ferrets were the only means of laboratory propagation. It also meant that different viruses and strains of virus could be identified with reasonable ease and accuracy. Moreover, it enabled the establishment throughout the world of influenza reference laboratories linked to the World Influenza Centre in London and to other major study centres where detailed laboratory investigations can be undertaken and arrangements made for the collection and exchange of epidemiological information.

The whole subject of influenza has long been beset with difficulties in making clear-cut distinction between true influenza and the many other influenza-like illnesses. Since these occur in one form or another in England and Wales every winter, it is understandable that in reports of earlier influenza pandemics antecedent localised outbreaks of illness clinically indistinguishable from that subsequently seen in epidemic form were often mentioned. While certain of

the older observers were convinced of the unity of a pandemic influenza and its trans-continental spread, others maintained that the seeds of a world-wide outbreak were already present in every country, and that they needed only breakdown of sanitary conditions to become epidemic.

While at this distance of time it is not possible to re-examine the validity of the reasons which so frequently led former observers to doubt the unity of epidemic influenza, there is clear evidence of the homogeneity of the 1957–58 influenza pandemic and, in areas where there was opportunity for investigation, equally definite proof that certain antecedent local outbreaks were not of influenzal causation (Holland and McDonald).

II

INVASION AND SPREAD

The arrangements operative for the study of influenza at international level provided exact data about the 1957 pandemic from the outset. The virus was first identified by Drs. F. F. Tang and C. M. Chu in China in February though the first official reports to give warning of its spread came later from Hong Kong and Singapore. A widespread outbreak developed in Hong Kong during the second half of April, 1957 and reached Singapore in May. Laboratory investigations showed that these outbreaks were associated with a new antigenic form of influenza virus A, which later became known as Virus A 2. Strains of this variant isolated in Hong Kong, in Singapore and Malaya and in Japan were found to be closely related to each other but widely different from any previously isolated virus A strain. Human serological studies in several parts of the world led to the complementary conclusion that antibodies to the new variant were absent from most members of the population prior to exposure to the virus.

Predicted spread

The establishment of these facts at a time when outbreaks of influenza were still confined to a few Asian countries was of cardinal importance in forecasting the subsequent trend of events. The likelihood that the new virus would spread in a presumably susceptible world population and so give rise to extensive epidemics was predicted even at that stage. Many countries were thus enabled to plan measures for combating influenza well in advance of the appearance of the first cases. What could not be estimated so certainly was the precise rate at which the infection would travel, this being dependent on many random elements and also, possibly, on aetiological factors which were still not understood.

Peoples of the temperate zones have become accustomed to regard influenza as a disease essentially of the winter months. This seasonal incidence was observed, for instance, in England and Wales whenever influenza was epidemic throughout the years since 1918, but in 1957 spread occurred without apparent relation to climate or season and the disease affected north-western Europe during late summer and early autumn.

Introduction of the virus into this country

The first cases of influenza of Asian origin to be recognised in this country were among persons recently arrived from the Far East by air. The earliest isolations of the Asian virus were in specimens, taken in London on 17th June, 1957, from Pakistani naval ratings. At this date influenza had extended westward on a large scale as far as India and Pakistan. Travellers by air who had acquired the infection in these regions developed symptoms either during the journey or within 48 hours of arrival.

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So long as the pandemic was limited to the Far East the likelihood of introduction of infection by sea-borne traffic remained small. Outbreaks among passengers and crews of inward-bound liners were reported during the first half of June but these had subsided by the time the vessels reached European ports. As the epidemic in Asia continued to spread westward, the length of the sea voyage to Europe from the nearest affected regions progressively diminished. In consequence there was an increased likelihood that ships in which influenza was occurring would reach this country before the outbreak aboard had come to an end and that persons would disembark while still in an infectious state. The earliest recorded instance of this mode of introduction followed the arrival of a liner at Southampton on 26th June, 1957.

Individual cases and groups of cases continued to arrive by sea and air throughout July. During the early part of August extensive outbreaks began to develop in certain parts of Europe and the sources of infection reaching the British Isles were then augmented by travellers from the Continent.

Localised outbreaks

The period mid-June to mid-August was characterised in this country by the development of numerous localised outbreaks of influenza. The first of these to attract attention followed the arrival by air on 13th June of a party of Pakistani naval ratings who were accommodated aboard a vessel lying at Tilbury dock in the Port of London. On 10th June one of the party had developed an acute respiratory illness, and on 12th June eleven more were taken ill. Influenza virus A 2 was isolated from three of these patients. While at Tilbury some members of the party were in contact with the crews of two other ships which sailed for Liverpool on 18th June. Almost at once cases of influenza began to occur among the crews of both ships.

At the same time serological evidence of infection was found in specimens taken from a Pakistani welfare officer who had visited these seamen at Tilbury and in three members of his family. Contemporarily with the isolation of virus A 2 from the three Pakistani naval ratings already mentioned the virus was found in a specimen from a patient newly arrived by air from Rangoon.

Sea-borne importation

Sea-borne importation followed close on that by air. Virus was isolated from infectious patients who arrived at Southampton by troopship on 26th June and serological evidence of recent infection was found in upwards of thirty convalescent patients returned from the Far East.

During July and August virus was isolated or serological evidence of infection found in a gradually increasing number of persons from widely separated parts of the eastern world and the southern hemisphere who entered this country by air and by ports at points around the coast. Their places of departure included Aden, New Zealand, South Africa, Lagos, Kuwait, Bahrein, Bombay, Moscow, Finland and Tokyo. Some were passengers on liners, others Lascar or Pakistani crews. Outbreaks occurred among Scouts from all parts of the world coming to this country to attend a jamboree which was to be held in the Birmingham area.

Towns in this country from which newly arrived cases of influenza were reported included Tilbury (mentioned above), Liverpool (both in crews infected

at Tilbury and in those coming directly from overseas), Avonmouth, Sunderland, Jarrow, Winchester (from a naval ship) and Manchester. Influenza was also reported in persons resident in this country dealing with aircraft from abroad—an engineer at Prestwich and in one of the staff servicing Australian aircraft, at Reading.

During the same months cases of influenza were reported from all three Services. The Royal Army Medical Corps detected them in troops returned from the Far East and from the Middle East and in military hospitals in the Chester and Worcester areas; the Royal Air Force in servicemen stationed at Bridgnorth, Louth, Grantham, the Swindon area (infected in Cyprus) and West Kirby, Cheshire; and the Royal Navy in a convalescent patient (mentioned above under Winchester). About the same time outbreaks were reported at United States Air Force stations in Lancashire and Middlesex.

Occurrence in the resident population

Interspersed with continuing reports of influenza in those arriving from abroad and their associates, the first intelligence was received of influenza in the general population. At this time outbreaks were confined to small groups and closed communities such as National Coal Board trainees in the Nottingham area, a professional football team in Sheffield, a docker and his family in Tilbury, a mental deficiency hospital in the Midlands, a girls' school in the Bath area (the first cases being in children arrived from Rotterdam), scouts encamped at Lyme Regis, children in a large holiday camp at Skegness and those at a holiday home in Conway. At this stage, too, every case could be traced with reasonable certainty to its source of infection.

In the week ended 24th August the first reports were received suggesting invasion of the population in general. In Colne Municipal Borough half of the school children were ill, the first cases occurring one week after reassembly. Teachers and parents were also affected. In Nottingham 40 of 70 workers were absent ill from a factory. In the following week the isolation of the Asian variant from a young patient in Colne confirmed the diagnosis. One quarter of the children at three schools in Orrell, near Wigan, were now absent with influenza. In the West Riding of Yorkshire outbreaks were reported among steel workers in Sheffield and the Pakistani community in Bradford.

It would be profitless to follow the subsequent spread of influenza in similar detail. Once established in the community, the epidemic spread from its now numerous foci to involve in turn Lancashire and Yorkshire, the counties to the north and North Wales. The Midlands and the South Western area of England were widely affected by early September, closely followed from mid-September onwards by London, Surrey, Hampshire, Sussex and Kent, Essex and East Anglia. By this time the occurrence of the epidemic throughout the country was also demonstrable through the returns of first sickness claims received by the Ministry of Pensions and National Insurance. The following table shows this very clearly and confirms the evidence obtained by the laboratories. The table gives estimates of the start of the epidemic in each standard region, and the date when it reached its peak.

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Standard Region	*Date of Commencement Week ending*	*Date of Peak Week ending*
Northern	27th August	1st October
East and West Riding	27th August	24th September
North Western	27th August	1st October
North Midland	27th August	8th October
Midland	27th August	8th October
Eastern	10th September	15th October
London and Middlesex...	3rd September	15th October
Remainder of London and South Eastern ...	10th September	15th October
Southern	10th September	15th October
South Western	10th September	15th October
Wales	3rd September	1st October

The dates of commencement of the epidemic shown in the table are necessarily approximate and are almost certainly somewhat later than the appearance of the first cases in the regions concerned. The rapid rise in incidence took place on the whole about two weeks after the dates mentioned above. It is clear from these data that epidemic spread from the numerous foci began in the north of England. Shortly afterwards it occurred in the south. This is in agreement with virological evidence.

The epidemic in Wales

In Wales the epidemic followed much the same type of spread as it did in England but the incidence was probably lower. The disease was first manifested in small groups of children, several of them in camps. It then involved the rest of the population as well as a number of closed and semi-closed communities. The same heavy incidence was noted in school children. The greatest incidence throughout Wales came at the end of September and by 20th October the epidemic was subsiding rapidly or had ended. From all places involved there was laboratory confirmation of the diagnosis.

The Table on page 9 analysing the experience of one practice may be regarded as representative of the incidence of influenza in industrial Wales.

A noteworthy feature throughout was the slowness of the spread of the infection in the British Isles as compared with the speed with which it involved the Far East and some tropical countries.

Influenza in a general practice in Barry, Glamorgan, between 26th August, 1957 and 5th January, 1958
(Lennox, Caddick and Keble Williams, Personal communication)

Week commencing	New Influenza Cases		Age Groups															
	Number of new cases		Under 1 year		1–4 years		5–9 years		10–14 years		15–24 years		25–44 years		45–64 years		65 years and over	
	Male	Female	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
25. 8.57	2	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—
1. 9.57	3	6	—	—	—	—	1	1	—	—	—	—	2	4	—	1	—	—
8. 9.57	4	4	—	—	—	—	—	1	1	—	1	1	1	1	1	1	—	—
15. 9.57	87	83	1	—	13	9	12	12	25	24	20	22	11	10	5	4	—	2
22. 9.57	246	239	3	2	31	27	51	41	64	52	58	44	20	51	12	17	7	5
29. 9.57*	215	263	2	2	31	38	57	69	37	44	44	43	33	51	11	15	—	1
6.10.57	192	224	—	4	29	33	56	43	24	27	24	34	37	48	—	—	1	6
13.10.57	77	105	1	2	9	14	14	15	6	5	14	28	20	25	12	16	1	—
20.10.57	43	37	—	1	11	5	3	9	3	3	7	4	13	9	5	5	1	1
27.10.57	14	12	—	—	2	1	2	2	—	—	1	3	6	3	2	2	1	1
3.11.57	15	14	—	—	—	2	4	1	—	1	2	—	7	7	2	2	—	1
10.11.57	8	12	—	—	—	—	1	2	1	2	2	2	4	3	—	2	—	1
17.11.57	10	3	1	—	—	—	—	1	—	—	—	2	4	—	5	—	—	—
24.11.57	3	2	—	—	—	—	1	1	—	—	—	—	1	1	2	—	—	—
1.12.57	3	1	—	—	—	—	—	1	—	—	—	—	3	—	—	—	—	—
8.12.57	3	9	—	—	—	—	—	1	—	—	—	1	1	2	2	4	—	—
15.12.57	1	2	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—
22.12.57	3	8	—	—	1	1	—	1	—	—	—	2	2	3	—	1	—	—
29.12.57	4	5	—	—	1	—	—	—	—	—	1	1	2	2	—	2	—	—
Totals ...	933	1,029 (1,962)	8	11	128	131	201	201	161	158	175	189	218	220	60	72	11	18
Number in Practice	3,767	4,233	112	101	379	357	443	437	437	373	475	581	1,099	1,312	699	768	123	304
Attack rate per cent. of patients at risk	24·5		7·1	11	33·8	36·7	45·4	46·0	36·8	42·4	36·8	32·5	19·9	16·8	8·7	9·4	9·0	5·9

* During this week one partner was absent from illness and the records are known to be incomplete.

III

ESTIMATES OF INCIDENCE; INCUBATION PERIOD; AGE AND SEX DISTRIBUTION

Influenza is not a notifiable disease and there is consequently no formal record of its incidence which can only be estimated from such other data as may be available. A further factor militating against accuracy of ascertainment is that diagnosis must in the main rest upon clinical findings which cannot with certainty distinguish true viral influenza from other similar respiratory diseases. This complication did not occur to a serious extent in the first and main phase of the epidemic which took place in the Autumn of 1957, a season when other febrile respiratory illness is uncommon in this country. But in the early part of 1958 the outbreak carried over into the season of prevalence of respiratory illness with the result that it was impossible to judge to what degree the epidemic A2 strain of influenza was operative though virological studies revealed that it was still present.

An estimate has been made of the total number of cases of influenza occasioned by the epidemic in that part of the population gainfully employed and eligible for sickness benefit, based on the number of new claims to sickness benefit compared with the average in the corresponding period during the preceding 5 years. From 21st August, the week in which this increase, presumably due to influenza, was first perceived, until the end of 1957, there was an excess of some two million claims in an insured population of some 17½ million in the country.

Within the same age group (15–64 years) there are a further 12½ million uninsured persons. Conceding that these were affected to a like extent, 1½ million cases of influenza would have occurred in this group.

Scrutiny of reports from medical officers of health in all parts of the country suggests that nearly half of the school population was at some time during the epidemic absent from school because of influenza. With some 7 million children of school age, this represents a further 3½ million cases.

The incidence of influenza was relatively light in those under 5 years of age, about 3,300,000 in number and those over 64 years roughly 5,300,000 in number, but from information available from a number of sources it appears reasonable to estimate that a further half million cases occurred in these two groups.

In all, then, from consideration of all information available, there were almost certainly at least 7½ million persons in England and Wales who suffered some incapacity from influenza during the course of the epidemic.

The Epidemic Observation Unit of the College of General Practitioners made an analysis of information supplied by practitioners which suggested that some nine million persons in Great Britain had an attack of influenza, of whom more than five and a half million were attended by their doctors. This estimate refers to Scotland and Northern Ireland as well as England and Wales so that there appears to be reasonably close agreement between this and other estimates.

Incubation Period

The incubation period was 48–72 hours.

Age Distribution

The subject of age distribution has been mentioned in a number of investigations (Woodall, *et al.* Holland, *et al.*). In general it may be said that during 1957 the disease affected principally those aged between 5 and 39 years of age. Woodall's statistics show that one third of males and a similar proportion of females in this age group were attacked. The highest attack rate, 49 per cent., was shown by the age group 5–14 years. This is displayed in the following table.

Clinical attack rates by age and sex (Woodall, Rowson and McDonald)

Age—Years	Males		Females		Persons	
	At risk	Percentage attacked	At risk	Percentage attacked	At risk	Percentage attacked
0–4	115	*36*	92	*25*	207	*31*
5–14	194	*51*	172	*48*	366	*49*
15–39	323	*25*	352	*28*	675	*27*
40–59	192	*21*	169	*29*	361	*25*
60 and over ...	55	*15*	68	*10*	123	*12*
All ages	879	*31*	853	*30*	1,732	*31*

This pattern of age incidence receives confirmation from Holland *et al.* who note that in the Royal Air Force the attack rate for acute respiratory disease during the epidemic was higher in recruit and boys' units than in permanent operational stations where personnel were older and more static.

It was thought that during the first four months of 1958 the elderly suffered more than younger members of the community but there are no statistics available to confirm this impression. In fact, Holland's investigations showed that in the post-epidemic period high sickness rates continued in the primary recruit units of the Royal Air Force but not in any other type of unit.

Sex distribution

There was no significant difference between the sexes so far as the incidence of influenza was concerned.

IV

MORBIDITY AND MORTALITY

It is difficult by an examination of vital statistics to be certain of the exact effect of a genuine epidemic of virus influenza due to a specific strain such as that described in this Report. Nevertheless, estimates of mortality sufficient for most purposes can be made, based on a study of death rates from all causes and from three specific causes of death which are most sensitive to the effect of an influenza epidemic; namely influenza, pneumonia and bronchitis.

As far as morbidity is concerned, a study of the number of new claims for sickness benefit (all diagnoses) made under the National Insurance Act, 1946, provides an indication of the effect of a widespread epidemic on the insured population. Since these figures are restricted to the insured, the effect of the epidemic on the uninsured, on children and on old people cannot be measured by this means.

The notification of acute primary pneumonia is compulsory in England and Wales although it is known to be very incomplete. Despite this there was a distinct upward swing in pneumonia notifications at the height of the epidemic.

A special aspect of influenza morbidity could be studied in 1957 for the first time. It was the number of cases discharged from hospital in England and Wales with a diagnosis of influenza and was based on a 10 per cent. sample of discharges from about 80 per cent. of hospitals in England and Wales.

The 1957 epidemic compared with previous years

Table A* shows the number of deaths from all causes and from influenza, pneumonia and bronchitis by quarters from the third (September) quarter of 1950 to the second (June) quarter of 1958.

Deaths from all causes were higher in the September and December quarters of 1957 than in the same period in previous years back to 1950. There were, during this period in 1957, a total of 262,191 deaths. The average number of deaths for the years 1950–56 for the same quarters was 228,760. The difference between these figures (33,431) produces a measure, albeit a very rough one of the toll in deaths taken by the influenza epidemic of 1957.

Although there was probably a continuation of the epidemic into the early part of 1958 the number of deaths during the first quarter of that year was less than in many previous years.

Out of the excess of about 30,000 deaths about half were reported as due to influenza, bronchitis and pneumonia and much of the remainder to the increased number of deaths from cerebro- and cardio-vascular disease which usually accompany an influenza epidemic. It should be remembered that the winter of 1956–57 was a very mild one and that the death rate for the first quarter of 1957 was much lower than in recent years. There would probably remain therefore a group of people who would have succumbed to a normal English

* The lettered tables are those in the Appendix pp. 60–72

winter. These people will be among those who are most prone to die in the presence of a relatively mild infection, or even with the onset of the colder weather. It is possible therefore that the figure of 30,000 is somewhat inflated as a result of the preceding mild winter, but it is impossible to estimate the extent of this.

The September quarter is usually the quarter with the least number of deaths from influenza, pneumonia and bronchitis. As far as the last two diseases were concerned the number of deaths in this quarter in 1957 was still fewer than in the other three quarters of the year although it was much higher than in the same period in previous years. However, the figure of 998 deaths assigned to influenza in the September quarter of 1957 was at least ten times more than in any previous year since 1950, when there were 102 deaths. This was followed in the December quarter by 5,230 deaths assigned to influenza, compared with 254 in the same quarter of 1956. There were 8,719 deaths from pneumonia which was more than in any similar quarter in the period 1950–1956 and approximately the same as is usual in the first quarters. Deaths from bronchitis in the last quarter of 1957 also showed a large increase although the number did not reach that usually observed in the first quarter of the year.

Deaths from influenza, pneumonia and bronchitis in the first two quarters of 1958 would not by themselves have given rise to comment. The experience of 1958 was similar to that of 1955 and 1956 and much more favourable than in 1951 and 1953.

Table B shows the number of new claims to sickness benefit by quarters from 1950–1958. Both the last two quarters of 1957 showed more claims than in any corresponding quarter in previous years. The figure for the December quarter, 3,542,900, was over half a million greater than in any quarter. The previous highest figure was for the first quarter of 1951 when there were 2,967,300 new claims.

Subtracting the average number of new claims for the last two quarters of the year (for 1950–56) from the figures for 1957 gives a figure of 2,418,000. It would thus appear that during this period over 2 million out of an insured population of about 17½ million suffered from the effects of influenza in a form severe enough to cause absence from work.

Table C gives the corrected notifications of pneumonia for the period July, 1950 to June, 1958. The figures are in line with those discussed above with the September quarter slightly higher and the December quarter much higher than in corresponding quarters of previous years. The first two quarters of 1958 showed that notifications were below the average for the previous seven years.

The evidence for a secondary wave in January, 1958, is not clear and it is very difficult to make any distinct separation from the seasonal rise in illness which takes place about that time. That influenza deaths were still occurring then is undoubted, and their secondary rise is evident. In the early weeks of almost every year deaths from bronchitis and pneumonia increase, and with this rise there is a simultaneous increase in deaths *attributed* to influenza but which may not have been *caused* by the epidemic virus or, indeed, by any influenza virus. Whether the rise in influenza deaths that occurred in January, 1958, was a secondary rise in response to an increase in bronchitis or pneumonia, or whether it was a genuine second wave of truly epidemic nature which contributed to the rise in bronchitis and pneumonia is something that cannot be determined by vital statistics alone.

New claims to sickness benefit July, 1957–June, 1958, are given in Table D.

Original notifications of pneumonia are shown in Table E by week and Standard Region. The pattern is similar to that shown in Table D but the rise in each region seems to have taken place about a week or a fortnight after the rise in new claims. While this may have been due to a slight delay in onset it is more probably due to the relative crudity of this method of measuring influenza morbidity.

Table F shows the number of deaths in the 160 great towns in England and Wales by week from all causes, and from influenza, pneumonia and bronchitis. Calculated figures for England and Wales deaths are also shown from July to December, 1957, and actual figures from January to June, 1958.

The weekly number of deaths from all causes is too crude a factor to allow many conclusions concerning the epidemic to be drawn from a study of it. Much more reliable are the numbers of deaths assigned to influenza, pneumonia and bronchitis and particularly the first.

The first sign of a rise in the number of deaths occurred in the week ended 7th September, 1957, when eight deaths from influenza were reported in the great towns. The number then rose rapidly reaching 592 and 607 in the weeks ended 12th and 19th October respectively. The fall was almost equally rapid, reaching 70 in the week ended 23rd November, but it was then halted. There was a small secondary rise in January, 1958, with a maximum of 155 in the week ended 11th January (315 in England and Wales). A steady fall again commenced, until by May and June the figures had reached about 13 deaths per week in England and Wales.

Deaths from pneumonia and bronchitis showed the same rise in September 1957, from weekly figures of about 140 and 130 respectively in August (great towns) to peaks of 572 and 502 in October. Although a fall in the weekly number of deaths from these two diseases did take place, it soon became merged with the seasonal rise, and the maximum number of deaths occurred in the week ended 4th January when there were 752 deaths from pneumonia and 905 from bronchitis in the great towns and 1,233 and 1,421 respectively in England and Wales. After February, as with influenza the weekly number of deaths began to fall off, reaching their minimum in June.

The distribution of deaths by age, sex and month of occurrence for all causes, and influenza, pneumonia and bronchitis is shown in Table G.

The peak that occurred in the deaths from all causes can be seen, but it is much more clearly shown in deaths from influenza. There were comparatively few deaths in the younger age groups, although a peak is noticeable for deaths in September and October in the 4 weeks—1 year age group. The death rate for influenza rose with increasing age as is shown in the table below.

Death Rates per million per annum from Influenza (Persons) 1957–58

	1957						1958					
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
0– ...	3·7	3·7	162·8	284·6	68·9	59·9	85·0	28·9	9·8	16·8	3·3	3·4
5– ...	—	1·7	178·7	220·3	16·2	12·2	22·6	3·9	1·7	3·6	—	—
15– ...	—	4·4	194·1	329·7	22·6	41·5	15·2	19·3	10·9	15·7	—	—
25– ...	—	3·8	138·4	263·4	43·6	38·4	49·3	28·9	19·3	6·0	3·9	3·0
45– ...	3·0	4·0	368·7	1,082·7	258·3	201·6	263·1	154·4	66·3	38·4	11·0	6·2
65– ...	19·7	26·2	833·9	3,223·0	745·8	731·1	980·4	418·8	235·3	107·7	52·3	13·5
75 and over	19·6	45·8	844·6	5,470·6	1,871·6	1,849·7	2,640·5	1,355·1	849·7	405·4	85·0	60·8
All ages...	3·4	7·1	296·7	925·0	224·1	206·9	277·5	140·8	77·5	40·2	11·7	6·2

One point concerning the September–October peak is worthy of comment. Although in all age groups the maximum number of deaths from influenza occurred in October, the ratio of deaths in September to deaths in October falls with increasing age. This is shown in the table below.

	Age Group						
	0–	5–	15–	25–	45–	65–	75 and over
Number of deaths:							
1. September, 1957 ...	42	99	86	143	354	246	125
2. October, 1957 ...	76	126	151	281	1,074	983	837
Ratio of Line 1 to Line 2	0·55	0·79	0·57	0·51	0·32	0·25	0·15

This may mean that the first wave of the epidemic involved the younger people, only affecting the older people later. Alternatively, the epidemic might have affected young and old simultaneously but while the young person recovers quickly, the older is more liable to complications which do not bring about death until later. The underlying cause in such cases is quite properly reported as influenza. The rise in the number of deaths which occurred in January, 1958, was limited to the upper age groups.

The death rates per million per annum for pneumonia and bronchitis are shown in the table below.

Death Rate per million per annum from Pneumonia (Persons) 1957–58

	1957						1958					
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June
0– ...	303·4	314·6	465·1	561·8	546·5	1,003·7	970·6	956·7	800·7	616·2	346·4	255·9
5– ...	14·0	8·7	74·0	64·7	23·5	26·2	22·6	13·5	38·3	19·8	15·7	9·0
15– ...	21·8	15·3	65·5	67·7	18·1	32·8	34·8	36·1	19·6	29·2	15·2	9·0
25– ...	20·6	15·0	84·2	103·1	42·6	88·1	78·3	62·1	41·5	45·0	24·2	32·0
45– ...	144·2	114·9	385·4	658·3	345·8	666·3	675·7	465·6	421·7	339·2	168·7	136·9
65– ...	645·9	718·0	1,345·8	2,691·8	1,755·9	3,134·4	3,192·8	2,324·9	2,098·0	1,888·9	1,019·6	771·0
75 and over	3,437·9	3,359·5	4,560·8	7,790·8	6,702·7	11,869·3	12,836·6	10,572·5	9,601·3	8,351·4	4,712·4	4,033·8
All ages	258·8	251·4	465·7	785·0	554·9	1,002·9	1,049·6	828·6	743·9	640·8	351·9	289·9

Death Rate per million per annum from Bronchitis (Persons) 1957–58

	1957						1958					
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June
0– ...	71·2	59·9	69·8	104·9	116·3	209·7	245·1	216·6	166·7	114·5	98·0	30·3
5– ...	—	7·0	18·1	17·5	1·8	5·2	10·4	3·9	8·7	5·4	3·5	7·2
15– ...	2·2	8·7	6·8	13·1	4·5	10·9	8·7	19·3	4·3	6·7	6·5	2·2
25– ...	15·0	18·7	25·2	43·1	29·0	60·9	65·7	41·8	42·5	37·0	19·3	14·0
45– ...	244·0	224·8	464·6	839·7	701·0	1,509·1	1,644·6	1,086·7	901·6	675·3	342·4	320·5
65– ...	1,114·8	1,163·9	1,637·3	3,554·1	2,715·3	5,803·3	6,251·6	4,454·9	3,673·2	2,976·4	1,598·0	1,340·1
75 and over	2,385·6	2,235·3	3,114·9	6,333·3	5,945·9	12,817·0	13,882·4	10,963·8	9,065·4	7,310·8	3,960·8	3,168·9
All ages	257·7	252·8	392·0	780·3	654·8	1,404·6	1,521·3	1,108·1	916·5	726·5	389·2	324·7

The picture for pneumonia is similar to that for influenza in September and October, but is confused by the normally occurring pneumonia deaths. The winter rise in deaths from pneumonia was probably slightly complicated by the recurrence of the influenza epidemic on a smaller scale, and as a result the number of deaths in the older age group rose above the peak reached in October.

There was an outbreak of pneumonia among infants in the winter of 1957–58 which is shown in this table. It was not thought to be related to influenza. There was no evidence of any simultaneous rise in influenza and bronchitis deaths in the same age group.

The September–October peak is present in deaths from bronchitis but was restricted to persons of 45 and over, and was not very marked. The number of deaths in January, 1958, assigned to bronchitis in the older age group was about twice as great as in October of the previous year.

Up to the age of 45, deaths from influenza occurred in approximately equal numbers among males and females but above that age male deaths predominated, the sex ratio falling again among those aged 75 and over. For pneumonia and bronchitis male deaths predominate throughout except for deaths from pneumonia among persons aged 75 and over. This is the normal pattern for deaths from these two diseases.

Corrected notifications of pneumonia by sex and age and quarter are shown in Table H. With the exception of the 0–5 age group notifications were most numerous in the December quarter.

The effect of the Epidemic on 1957 Death rates

The table below shows the death rate per 1,000 living in 1957 and the percentage changes in the rate compared with 1956.

Age Group	Death rate per 1,000 living, 1957		Percentage changes in death rate in 1957 compared with 1956	
	Male	Female	Male	Female
1–	1·04	0·90	+ 6·1	+ 8·4
5–	0·48	0·34	+ 4·3	+ 3·0
10–	0·44	0·30	+ 7·3	+11·1
15–	0·91	0·45	+15·2	+25·0
20–	1·15	0·54	+ 7·5	+ 1·9
25–	1·19	0·86	− 1·7	− 1·2
35–	2·50	1·92	+ 0·4	+ 1·1
45–	7·51	4·56	+ 0·8	+ 0·9
55–	22·3	11·2	+ 0·9	—
65–	54·0	30·9	− 0·4	− 2·8
75–	119·9	84·2	− 6·0	− 6·6
85 and over	226·8	199·2	−11·5	−10·6

Data in a table such as this are compounded from many factors and childhood infectious diseases were responsible for some of the increase in the death rates at the younger ages. Nevertheless with the single exception of the 25–34 year age group, increases occurred in the death rates at all ages up to 54. Much of this was due to influenza. The large percentage increases which occurred among adolescents and young adults were due to there being so few deaths normally in these age groups that even a small absolute increase in the death rate produced a large relative increase. At the older ages, despite the fact that the epidemic caused more deaths among the old, it was not severe enough to overcome the mitigating effect of the mild winter in the early part of the year.

Fatality Ratio

It is virtually impossible to estimate the fatality of the influenza epidemic because of the absence of comprehensive morbidity figures for all age groups. That the disease was relatively mild, though widespread, is certain, but to say more than this is difficult. Estimates have ranged from 13 to 35 deaths per 10,000. Despite this comparatively low ratio of deaths to cases, indicative of the general mildness of the disease, the total incidence of cases during the epidemic was so high that many thousands of deaths resulted.

Morbidity in Hospital

The table below shows the estimated number of admissions to and deaths in hospital with influenza, pneumonia and bronchitis in England and Wales during the last six months of 1957.

	July	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Estimated Number of Admissions	5,670	5,796	16,834	28,186	13,432	16,216
Estimated Number of Deaths (by date of admission) ...	1,096	1,197	2,129	3,755	2,407	3,339
Fatality Rate per cent. ...	19	21	13	13	18	21

As with all other data there was a very noticeable rise in admissions in September and October, 1957. During these two months it would appear that hospitals in the National Health Service admitted something between 25,000 and 30,000 more cases of acute respiratory infection than would be expected at that time of year.

The hospital fatality rate fell during the epidemic. There were probably two reasons for this. Firstly, during the epidemic more young patients with a lower fatality rate would have been admitted, and secondly, even among the older patients there were more admissions of those with a good prognosis.

The effect of the epidemic on the hospital service can be judged from the following table, which shows the estimated number of admissions with influenza, pneumonia and bronchitis and the number of other immediate admissions and admissions from the waiting list.

	Estimated Number: Thousands					
	July	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Admissions with Influenza, Pneumonia and Bronchitis...	6	6	17	28	13	16
Other Immediate	125	122	114	118	118	116
All Immediate	131	128	131	146	131	132
Waiting List Cases	136	111	114	109	127	100
All Admissions...	267	239	245	255	258	232

This table shows that influenza, pneumonia and bronchitis accounted for nearly all excess admissions during the epidemic in contradistinction to the deaths of which only half were assigned to respiratory conditions. As might have been expected, the increase in immediate admissions produced a fall in the admission of cases from the waiting lists. This fall was made good to some extent in November.

V

CLINICAL STUDIES

In an outbreak of the magnitude and relative mildness of the influenza of 1957–58, the most truly representative portrayal of the clinical features of the epidemic must come from doctors in general medical practice for they attended the great majority of cases. Hospitals on the other hand received only the most seriously ill, either from the disease itself or on account of complications. In describing the clinical features of the epidemic a more balanced presentation will therefore result if a description of the disease as met with in general practice is given and followed by an account of its salient features as seen in patients admitted to hospital.

INFLUENZA IN GENERAL MEDICAL PRACTICE

Detailed reports have been published by several observers of the impact of influenza on individual medical practices (Fry; Woodall, Rowson and McDonald). The Epidemic Observation Unit of the College of General Practitioners has published an analysis of information contributed by members and associates in 42 practices caring for some 150,000 patients in different parts of the British Isles. In the East Midlands division of England Dr. G. V. Davies of this Department carried out an informal inquiry of all general medical practitioners in that area and received 190 replies in respect of approximately one million persons on practitioners' lists. In Salford, the Medical Officer of Health carried out a similar inquiry of practitioners participating in the influenza-spotting scheme in that County Borough.

The consensus of opinion was that the illness was, in general, mild. The onset was often sudden but by no means invariably so. Fever, cough and headache were predominant symptoms, with sore throat, nasal symptoms, aches and pains and shivering the next most frequent complaints. In children under school age drowsiness, general malaise, vomiting and epistaxis were frequently noted, while delirium was particularly observed in school children. Slight cyanosis in men over 50 was reported by Burn in Salford (Burn, J. L., personal communication) though this sign did not carry the grave prognostic significance of such an appearance in the pandemic of 1918–19. Many minor variations in clinical pattern were recorded not only by different observers but even by the same observer at different places. The duration of the febrile stage of the illness was usually three to five days. There was a variable period of convalescence. Post-influenzal debility was neither particularly frequent nor severe. In a small proportion of patients a recurrence of symptoms was experienced about two to three weeks after the first onset.

The following table from Woodall's paper illustrates the frequency of the main symptoms seen in patients of different ages in a general practice:

Clinical features of 187 illnesses in serologically confirmed family outbreaks

Age-group	0–4 years (24 cases)	5–14 years (71 cases)	15–39 years (70 cases)	40+ years (22 cases)	Total (187 cases)
	per cent.	per cent.	per cent.	per cent.	per cent.
Onset					
Gradual	50	48	61	55	54
Sudden	50	52	39	45	46
Symptons					
Cough	84	83	93	82	87
Headache... ...	8	65	92	82	70
Sneezing	75	63	67	73	67
Nasal symptoms...	62	62	71	59	65
Sore throat ...	17	56	73	55	57
Sweating	37	46	61	68	48
Shivers	8	41	59	59	46
Aches and pains...	12	17	73	59	42
Malaise	33	7	17	18	15
Prostration ...	17	13	26	9	14
Drowsy	54	11	0	0	11
Delirium	4	21	3	5	10
Nose bleeds ...	17	8	9	0	9
Faint and giddy ...	0	4	10	14	7
Hoarseness ...	8	1	6	9	5
Vomiting	29	23	11	9	18
Abdominal pain ...	0	10	9	0	7
Diarrhoea ...	8	4	1	0	3
Complications					
Pneumonia ...	4	3	1	9	3
Otitis media ...	4	3	0	0	2
Most frequent initial symptoms.	Cough, Drowsy	Headache, Sore throat	Headache, Sore throat	Sore throat, Headache	Headache, Sore throat
Most troublesome symptoms ...	Cough, Drowsy	Headache, Sore throat, Cough	Headache, Prostration	Headache	Headache, Cough
Days fever (median)	3	2	3	3	3
Days in bed (median)	2	3	3	3	3

The writers of the paper comment " Some of the age differences in symptomatology can probably be attributed to the young being less able to describe their troubles; thus it is not surprising that sore throat, headache, and aches and pains were infrequent in those under 5 years of age, whereas malaise was relatively prominent. Other differences, however, may be more real—for example the greater frequency of drowsiness, vomiting, diarrhoea, and nose bleeds in the young, or delirium in children of school age, and of aches and pains and faintness or giddiness in adult life."

Of unusual interest was the experience of Breen and his partners in Bradford where the epidemic occurred in two overlapping phases, the first confined to the local Pakistani community and the second affecting all nationalities.

In the first phase, which lasted from 6th July until 26th August, the first patient suffering from influenza was seen on 5th July, having arrived in this country by air from Pakistan 24 hours previously.

Infection spread rapidly, in part because of the custom of visiting the sick in large numbers and in part by reason of the greatly overcrowded unventilated homes.

The second phase in the general population of the practice began on 15th August to end on 18th October, reaching its maximum between 12th and 28th September, during which time as many as 100 cases of influenza were seen daily. As it happened, the first twelve cases were in West Indian textile workers, but all races were affected.

Severe headache, pains in the limbs, fever and, later, profuse sweating were common to patients in both phases, but certain differences were observed:— in the first, no complaint was made of sore throat, neck pain or stiffness, or vomiting; all ages were affected, but with few complications and little residual weakness.

In the second phase, almost all complained of sore throat; neck pain, even mild meningismus was frequently met. Vomiting was not unusual in children. The main incidence of the disease was in those under 40, complications were more frequent and subsequent lassitude marked.

Infection conferred immunity, so that relatively few Pakistanis were affected during the second phase. It was noted that the type of illness became more severe as the epidemic advanced, and thus the differences observed during the two phases may have been essentially temporal and only incidentally racial.

Treatment of uncomplicated cases

In an epidemic fortunately relatively free of complications, treatment of the uncomplicated case was primarily rest in bed with its attendant isolation and simple antipyretic measures to which patients in general responded extremely well. Many patients made do with simple homely treatment and never sought medical advice, others were convalescent when they first came under medical notice—and then principally for certification of incapacity rather than for active treatment.

In passing, it may be mentioned that isolation at home in bed enables an influenza patient to avoid his neighbours' bacterial flora quite as much as it protects the community from the patient's influenza.

Antibiotics

There was considerable difference of opinion about the use, as in the choice, of antibiotics in uncomplicated influenza. While some physicians prescribed antibiotics in all cases as a routine safeguard against secondary infection others restricted this prophylaxis to the very young, the aged and those with pre-existing chest disease; others again withheld chemotherapy until there was some specific indication.

Of 930 patients treated by Fry, none received chemoprophylaxis, and antibiotics were found necessary in only 24 patients with complications. Of these, " 20 received penicillin intramuscularly and 4 oxytetracycline orally. No patient required admission to hospital and no patient died from the direct or indirect effects of influenza."

Burn reported similarly from Salford, where one practitioner treated 497 cases of influenza by rest and a simple antipyretic and in only six patients was antibiotic therapy required. In the same area, another practitioner gave all of several hundred patients with influenza " at least 100,000 units penicillin intramuscularly. This latter treatment was given by many practitioners to

patients with signs of respiratory distress, the injections being given daily for five days." The evidence provided by these and many similar reports from all parts of the country confirms the view that the indiscriminate use of antibiotics in the treatment of influenza is in no way beneficial. While these remedies should certainly be given when indicated their unnecessary use must be deprecated.

Complications

Not every patient made an uninterrupted recovery. In two practices for which the recorded incidence of complications has been published (Fry; Woodall *et al.*) pneumonia occurred in 3 per cent. of cases of influenza and otitis media in 2 per cent. and 1 per cent. respectively. While many of the 190 replies received by Davies agreed with these findings one or two practitioners reported that influenza had been a serious illness with frequent complications.

Fatality

The most comprehensive study of fatality from influenza as seen in general practice is that made by the College of General Practitioners. For 29 practices information was available of the numbers of patients attended for influenza and of deaths directly ascribed to the disease, and for a further 13 practices the number of deaths from influenza was known, but not the total treated for this disease. A total of 29 deaths from influenza occurred in the 29 practices, a fatality ratio of 2·3 per thousand cases attended.

INFLUENZA IN HOSPITAL PRACTICE

General

There is remarkably little published work on influenza as met in hospital practice in England and Wales during the Autumn of 1957. In fact, the only comprehensive account has been given by Bashore and his collaborators. They describe the clinical features of the disease as seen in 1,264 influenza patients admitted to an Air Force hospital in the United Kingdom between 11th August and 21st December, 1957.

These patients were not strictly comparable with those admitted to civil hospitals insomuch as they formed part of a younger age group in a better pre-existing state of health than the general population. Moreover, any patient suffering clinically from influenza was admitted whereas civil hospitals took only patients who were seriously ill. The sex ratio of the Air Force patients was also different, 82 per cent. were adult males, 7·4 per cent. adult females and 10 per cent. were children. The ages of the adults ranged between 14 and 45 years with an average of 23·3 years. The child patients ranged in age from 4 months to 13 years.

All patients were given a comprehensive clinical, laboratory and X-ray examination on admission to special isolation wards.

The most common symptoms at the time of admission are shewn in Fig. 1. The term malaise includes myalgias which varied from generalized aching to low back pain.

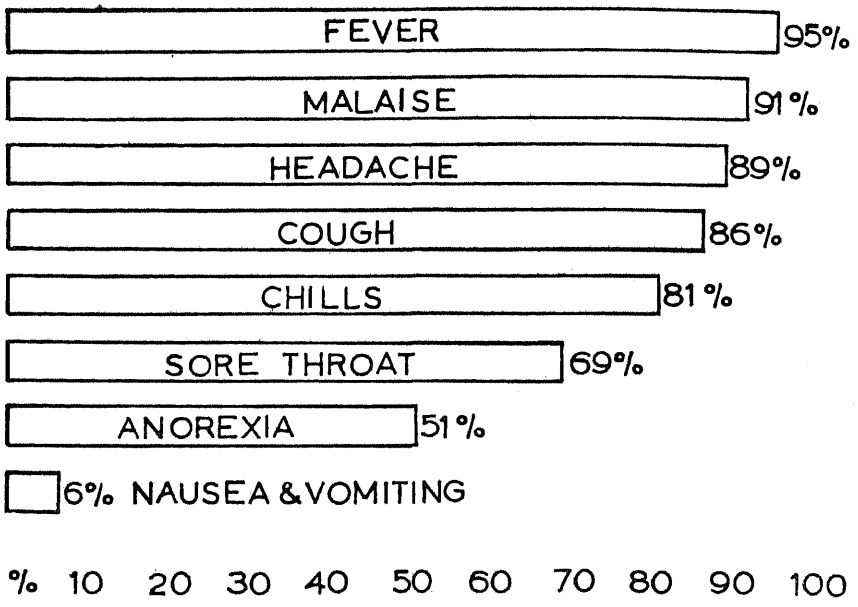

FIG. 1. Frequency of specific symptoms in 1,264 cases of Asian Influenza. (Bashore *et al*, 1958)

Complications occurred in six per cent. of cases. Pneumonia was the most common and most severe amounting to 4·3 per cent. Also noteworthy were sinusitis and otitis media, each 0·6 per cent., and pharyngitis and tonsillitis 0·5 per cent. The frequency of pneumonia in adult females was high and 10 of the 14 adult female patients showing this complication were pregnant.

As in previous epidemics the outstanding causes of admission to the civil hospitals were respiratory complications. The national " Hospital Inpatient Enquiry " analysis of a ten per cent. sample of patients reveals that between 25,000 and 30,000 additional cases of acute respiratory infection were admitted to hospitals of England and Wales during September and October, 1957.

Pressure on Hospitals

The demand for hospital accommodation appears to have been heavy in the north. During September and October, 1957, in the area covered by the Liverpool Regional Hospital Board the number of discharges from departments of general medicine was 5,191, an increase of 27 per cent. compared with an average of 4,087 for the same two months during the years 1953–56 inclusive. The total discharges from the departments of general medicine during the months of September and October for the years 1953–1957 were as follows:

1953	*1954*	*1955*	*1956*	*1957*
3,933	4,214	3,870	4,331	5.191

Pressure on hospitals may also be gauged from the following figures for Liverpool and London. The first series are the figures for total admissions through the Emergency Bed Bureau, Liverpool, during the months of September and October of the years indicated.

1953	*1954*	*1955*	*1956*	*1957*
1,781	1,710	1,671	1,654	2,808

In London the Emergency Bed Service dealt with the following number of patients suffering from acute respiratory disease in the period 23rd September to 5th November which corresponds with the Liverpool period of epidemic incidence as follows:

1954	*1955*	*1956*	*1957*
734	924	1,015	2,477

Complications

Pneumonia

Of respiratory complications pneumonia was the most frequent. Its course and outcome were greatly influenced by the presence or absence of secondary staphylococcal infection and the presence of pre-existing disease.

The general pattern of influenzal pneumonia in the recent epidemic was fairly uniform throughout England and Wales as a whole. The onset resembled that of influenza in general. Within 24 hours pneumonic or other serious symptoms were observed in one third of patients. Deterioration was much more rapid in the young than in the elderly; in one large series, 56 per cent. of those patients under 5 years of age were gravely ill within the day compared with 16 per cent. of those over 64 (P.H.L.S. Series).

Severe dyspnoea was usual; cyanosis occurred in about one third of cases and haemoptysis occasionally. In fatal cases deterioration was rapid after the onset of pneumonia. In one series of 477 deaths (P.H.L.S.) no fewer than 86 occurred before admission to hospital, two thirds within 48 hours of admission and the majority within 7 days of the onset of the illness.

Staphylococcal infection

The presence of the staphylococcus rendered the prognosis grave. This was noted early in the epidemic and continued throughout. It was the subject of comment by several observers. Of the published reports, that by Oswald and his colleagues in London may be quoted as representative of general experience. The accompanying table compares fatality in relation to age and sex in a series of 155 staphylococcal and 145 non-staphylococcal pneumonias studied

Fatality in Relation to Age and Sex

	Total	Age (Years)				Sex	
		0–14	15–34	35–54	55–	Male	Female
Staphylococcal pneumonia	Cases ... 155	10	74	28	43	98	57
	Deaths ... 44	3	19	8	14	25	19
	Percentage ... *28*	*30*	*26*	*29*	*33*	*26*	*33*
Non-staphylococcal pneumonia	Cases ... 145	10	38	35	62	86	59
	Deaths ... 18	—	1	1	16	11	7
	Percentage ... *12*	—	*3*	*3*	*26*	*13*	*12*

in the ten London undergraduate teaching hospitals, certain other hospitals in London and further cases in the three Services. This table demonstrates clearly the greater fatality of staphylococcal pneumonia at all ages.

In those who survived, staphylococcal influenzal pneumonia was also a more severe illness. In Oswald's series of 121 who recovered from this complication 37 had an illness regarded as " severe ", 65 were " moderately ill " and

in only 19 was the course of the disease " mild ". By comparison, among 127 who recovered from other forms of influenzal pneumonia, the illness was severe in only 16, in 69 it was moderate and in 42 mild.

With staphylococcal pneumonia the median duration of symptoms before admission was five days and in other pneumonias four; the length of stay in hospital 26 days as against 16; and the median duration of fever in survivors was eight compared with four days or, after allowing for previous duration of illness at home, two weeks compared with eight days.

As may be seen from the following table X-ray investigation showed the much greater extent of lung tissue involved in staphylococcal pneumonia. In 37 per cent. of cases in this group three or more zones were involved, but in non-staphylococcal pneumonia only 19 per cent.

Result of X-Ray examination at Height of Disease

	Total		Number of Zones involved				Abscess	No Radiograph taken
			1	2	3	4 or more		
Staphylococcal pneumonia	Number ...	155	27	44	27	30	21	27
	Deaths ...	44	2	4	4	11	—	23
	Percentage ...	*28*	*7*	*9*	*15*	*37*	—	*85*
Non-staphylococcal pneumonia	Number ...	145	65	38	16	12	2	14
	Deaths ...	18	—	4	3	6	—	5
	Percentage ...	*12*	—	*11*	*19*	*50*	—	*36*

In a series of 13 cases of influenzal broncho-pneumonia reported by Morgan and Pickup from the West Riding of Yorkshire there were 5 deaths. Post-mortem examinations were made in two cases. In both, solid haemorrhagic patches were found in the lungs, measuring up to 6 cm. across, and trachea and bronchi contained bloodstained purulent frothy material. *Staph. aureus* was found in one of these cases. This series illustrates also the varying severity of influenza in adjoining areas—of the 13 children admitted to hospital with influenzal broncho-pneumonia, twelve were from the Pontefract and one from the Wakefield district. In both localities the incidence of influenza was much the same, but severe cases were much more frequent in the Pontefract area.

Lung abscess

In 41 adults admitted to a group of hospitals in Bromley, Farnborough and Beckenham, Kent, during October, 1957 with pneumonic complications of influenza, Angeloni and Scott report 15 in whom *Staph. aureus* was cultured from the sputum, six of the strains being penicillin-resistant. Of the 41 patients, 8 developed lung abscesses—ranging from a solitary lesion at the apex of the right lower lobe to multiple cavities spread throughout both lungs. All these patients with lung abscess recovered more or less completely. In six of the eight *Staph. aureus* was cultured from the sputum, in one a beta-haemolytic streptococcus was obtained, the remaining case yielded no pathogen. Of the six with staphylococcal lung abscess, 3 harboured strains which were resistant to penicillin though sensitive to other antibiotics.

In Oswald's series of patients in London, lung abscess was found by X-ray in 25 patients, 21 of those with staphylococcal pneumonia (14 per cent.) and 4 with other forms of pneumonia (2 per cent.). The true incidence may well have been higher, the authors comment, because consolidation often obliterated the ring shadows of abscesses, as was evident on comparing radiographs with post-mortem findings. Abscesses were frequently not demonstrable until late in the course of the disease when pneumonia had resolved, and patients had recovered except for excessive purulent sputum. With antibiotic treatment most pyogenic abscesses cleared rapidly—by the end of the short period of observation possible 13 had resolved entirely, 5 had become hairline cysts, 2 continued as thin walled cavities and one remained a rather thick walled cavity at the end of two months, and all four of the abscesses in which pyococci were not detected resolved with treatment.

Lung abscess was also reported in 4 of 46 influenza deaths studied by Giles and Shuttleworth and in 18 per cent. of 219 deaths investigated by the Public Health Laboratory Service.

Pre-existing disease. The adverse effect of pre-existing illness was commented upon, both in reports currently received by the Department from many sources and in accounts later published in medical journals.

Chronic bronchitis was present in 84 of 379 patients studied by Oswald and his colleagues in London, in 56 of 125 reported by Walker and in 13 of 41 seen by Angeloni and Scott in Bromley.

Mortality was high in these patients—of Oswald's series 25 died (30 per cent.) and of the Bromley series 6 died (46 per cent.) all of whom had suffered from long-standing pulmonary disease.

Chronic heart disease was an equally serious handicap. Of 379 patients in Oswald's series, ischaemic heart disease was present in 11 (with 6 deaths) and hypertensive heart disease in 6 of whom 2 died.

Eight had rheumatic heart disease (6 mitral stenosis and 2 aortic incompetence) of whom 4 died.

Diabetics, too, fared badly—of 9 in Oswald's series, 6 died, 4 of whom were admitted in coma.

Late pregnancy, while a physiological condition and not a disease, adversely affected the course of influenzal pneumonia in 7 of the same series—2 died (one had mitral stenosis in addition), 4 were delivered at the height of their illness and all were gravely ill.

Fulminating influenza

In a number of cases the disease took the acute course well described as "fulminant", the cardinal features being the short duration of illness and the severe toxaemia.

In the series reported by Oswald *et al* there were 132 patients with fulminating influenza, the symptoms being prostration (55 per cent.), cyanosis (80 per cent.), pallor (12 per cent.), mental disturbance (48 per cent.), excessive dyspnoea (62 per cent.) and blood-stained sputum (36 per cent.). Staphylococcal pneumonia complicated 71 (54 per cent.) of cases, and there were 76 (58 per cent.) deaths. In the management of fulminating influenza these authors stressed the imperative need for immediate treatment to combat collapse. So far as this is due to adrenal damage (for which there was some post-mortem evidence) or

impairment, substitution therapy appeared to them a logical measure to counter circulatory collapse associated with toxaemia. Accordingly, some 27 patients in this series received steroid therapy, 100 mg. hydrocortisone intravenously followed by 50 mg. 6- or 12-hourly. Of these, 17 died, 8 within hours of admission. The survivors among those given hydrocortisone were those with a reasonably free airway whose pneumonia responded quickly to antibiotics.

Obstructed airway

Obstruction of the airway occurred in a certain number of cases in all reported series. In that of Oswald *et al*, there were 9 such cases. In six, tracheo-bronchial intubation was performed to establish an effective airway and allow the aspiration of inflammatory products. Of the six, three survived. In retrospect these authors considered this procedure might well have been more widely adopted and undertaken earlier. The same authors reported that bronchoscopy, while simpler and allowing aspiration of the larger bronchi under direct vision, was less well tolerated and therefore reserved for acute emergencies. Of three thus treated, all survived.

Other respiratory complications

Pleural effusion or empyema was present in a proportion of cases—in 5 of 219 of the Public Health Laboratory Service series, one of 13 in Morgan and Pickup's series, six of 224 non-staphylococcal pneumonias and 18 of 155 staphylococcal pneumonias in Oswald's cases. In four of these last the effusion was purulent, one being associated with ruptured lung abscess and pyo-pneumothorax. All recovered, in the main uneventfully. Three of the empyemata required aspiration followed by penicillin instillation. Aspiration followed by pleural decortication was required in the fourth.

Cardiovascular complications

Acute myocarditis due to toxaemia was considered to have been the immediate cause of death in a few cases of fulminating influenza.

In two cases of fatal staphylococcal pneumonia cited by Oswald, the post-mortem findings in one showed a dilated heart and pale soft myocardium of clay-like consistency with subendocardial haemorrhages throughout the left ventricle, and in the other a dilated heart with soft white clay-like myocardium and a few small abscesses in the wall of the left ventricle.

Emboli

Embolic spread outside the thorax was seen only with pyogenic infection. Four cases were recorded by Oswald; one of cerebral infarction and meningitis, another which developed emboli of toes and fingers and acute arthritis of the knee, and a third with a septic infarct of the foot which required incision.

Adrenal haemorrhage

The rapid deterioration almost from the beginning which was observed in so many fatal cases may in certain instances have been due to adrenal haemorrhage.

Eight such cases were recorded in 219 fatalities analysed by McDonald of which five were aged four years or under and two were between five and 14 years old.

Central nervous system

Mental changes were noted in influenzal pneumonia by many observers, ranging from confusion and delirium to coma.

Neurological complications were observed in a small proportion of those admitted to hospital. Flewett and Hoult described 18 such cases in the Birmingham area. In six, all fatal, there was a history of convulsions or of clinical encephalitis at the height of an attack of influenza. Asian-type virus was found in the lungs in five cases and in the brain in one. In this last case the authors emphasised the possibility of contamination of the brain in the post-mortem room. In reporting the association of influenza with the cerebral symptoms and post-mortem findings Flewett and Hoult observed that the changes seen could have been caused by anoxia accompanying severe pneumonia and were not necessarily a specific result of viral activity. On balance, the authors preferred the term " encephalopathy " to encephalitis.

In four non-fatal cases so-called encephalitis followed an attack of influenza, and in a further two patients (one of whom died) an ascending motor and sensory disturbance of the Guillain-Barre type succeeded an influenzal attack.

In all 18 of these cases there was serological evidence of infection with the Asian strain of influenza virus, but again the authors point out the high degree of probability of any hospital patient presenting such evidence of influenzal infection at that stage of the epidemic. There were a further six cases of sequelae referable to lesions of the central nervous system following an influenza-like illness, but with no laboratory confirmation of the influenzal element of the illness. This group the authors describe as " misleading cases ", illustrating the many diagnostic pitfalls that beset the whole subject of post-influenzal encephalitis.

McConkey and Daws reported from Cardiff four cases of severe neurological disorder following an illness resembling influenza. In three the symptoms were those of encephalitis while in the fourth (the only one in which there was a pleocytosis in the cerebrospinal fluid) the illness resembled lymphocytic choriomeningitis. In all four patients there was serological evidence of recent infection with influenza A/Asian, and in the fourth case the antibody titres for influenza C and for mumps were also raised. The first two patients in this series were brother and sister; another sister had headache and drowsiness four or five days after influenza but recovered without treatment. The parents and one other child had influenza also. Complement fixation and haemagglutination inhibition tests on parents and the child with the transient neurological illness supported the diagnosis of influenza. These four patients recovered.

Dubowitz reported two cases of encephalitis in two school children from Caterham. In one the cerebral symptoms arose two weeks after a severe cold; during her stay in hospital this girl's complement fixation titre showed no further rise from 1:64 in serum taken four days after admission. In the second patient cerebral symptoms occurred 3–4 days after the onset of an influenzal illness; this boy's C.F. titre showed a fourfold rise during the next two weeks. Both patients recovered.

Goodbody and McGill described three cases (two fatal) of typical acute haemorrhagic leucoencephalitis seen by them during the 1957–58 epidemic and three other cases seen by them since 1953. Five occurred during epidemics of influenza, and all had a history of an influenzal illness. In some, encephalitis began during a relapse after apparent recovery. Bronchitis or bronchopneumonia was present in all cases. In the three fatal cases the microscopic appearances of the brain were those of a haemorrhagic encephalitis confined to the white

matter. Histologically, the changes found included necrosis of vessels, perivascular oedema, leucocytic exudation, haemorrhage and demyelinisation, these changes, in the opinion of the authors, not being caused by simple anoxia and venous congestion. Symptoms typical of viral encephalitis were observed in several of Oswald's cases of which four were reported in some detail. In two which recovered the clinical features were those of meningeal irritation, and of two fatal cases which came to autopsy cerebral venous congestion was found in one and staphylococcal pneumonia with lung abscess, septic cerebral infarction and meningitis in the other. No microscopic evidence of haemorrhage or encephalitis was found in the first case. Thus, excluding the death from septic emboli, there were three cases in which " there was firm clinical evidence of encephalitis but pathological proof was lacking."

It seems, therefore, that a number of cases of acute haemorrhagic leucoencephalitis corresponding to that originally described by Hurst were observed during 1957–58. This condition is not rare and is usually preceded by an upper respiratory infection, not necessarily influenzal.

The cases of the sort reported in 1957–58 do not appear to indicate some special neurotropic effect of the Asian variant. Other studies undertaken by Flewett and Hoult afforded no support to the belief that the Asian variant was neurotropic or capable of becoming so. It is more reasonable to regard encephalitis as one of the possible sequelae of upper respiratory infection whether or not it is caused by influenza virus.

Minor disorders of the nervous system observed included transient peripheral neuritis and post-influenzal depression.

VI

LABORATORY DIAGNOSIS

ARRANGEMENTS FOR THE LABORATORY INVESTIGATION OF INFLUENZA-LIKE ILLNESSES

The Public Health Laboratory Service

At the time of Parsons' report, bacteriology was in its infancy, and when Newman described the influenza pandemic that accompanied and succeeded the closing stage of the first world war, virology stood very much in the position occupied by bacteriology in 1890, namely that it appeared probable that research in the field of virus diseases would be at least as illuminating and rewarding as had been the study of diseases of bacterial causation. During the past quarter of a century a great extension of our knowledge of the influenza viruses has occurred and laboratory facilities available for the routine examination of specimens and for reference purposes at national and international level have correspondingly increased.

Furthermore, isolation by cultural methods of the causal virus from the patient's secretions provides direct proof of the diagnosis of influenza.

In addition, two serological techniques are in common use in the diagnosis of influenza, the haemagglutination-inhibition test and the complement-fixation test.

In 1941, MacClelland and Hare, and Hirst, independently showed that influenza virus agglutinates red cells. At the same time Hirst described a technique for measuring the degree of agglutination, this method being later modified by Burnet and Clarke (1942).

The complement-fixation test, carried out on paired sera and extensively used by the Public Health Laboratory Service, is the outcome of the original work of Fairbrother and Hoyle (1937) on the group specific " soluble " antigenic component of the influenza virus and its property of fixing complement.

The establishment and development of the Public Health Laboratory Service, foreshadowed by the Emergency Public Health Laboratory Service of the second world war, has provided a network of laboratories covering the whole country, together with reference laboratories at the Service's central laboratory at Colindale and at other regional centres. Originally built up as a bacteriological service, it now deals, in addition, with virology. Thirty-four of these laboratories undertake serological tests for influenza A, B and C, the adenoviruses, Q fever, psittacosis, and atypical pneumonia and 20 of these centres cater for the isolation of influenza virus. All laboratories are in a position to offer advice on the collection and transport of specimens, and have facilities for their reception. In the presence of an outbreak of acute respiratory disease in his area the medical officer of health can thus seek the help and advice of his local Public Health Laboratory. Medical officers of hospitals, schools, factories, the Services, and other bodies make similar use of the Service. The medical officer of health can also consult on matters of this sort with the medical staff of the Ministry of Health.

Serological Tests

Serological diagnosis depends on the demonstration of an increase in the titre of complement-fixing or of haemagglutinin-inhibiting antibody during the course of the illness. Complement-fixing antibody begins to appear at 10–15 days and reaches a maximum titre some 15–30 days after the onset of illness.

Serological tests can be carried out rapidly and at little cost though 2 or 3 weeks must elapse between the taking of the first specimen by the clinician and the receipt of a report from the laboratory. For serological tests two samples of serum are required, one taken in the acute stage and one 10–14 days or more from the onset of illness. Because it may be necessary to examine for more than one serum antibody it is customary to send 5–10 ml of blood.

Virus Isolation

Isolation of influenza virus is made from pharyngeal washings or, more conveniently, from throat swabs taken at the onset of illness, or from the lungs in fatal cases. The virus soon becomes inactive at temperatures above 4°C. so that specimens must reach the laboratory quickly. Whenever possible, material for virus isolation is sent packed in ice or " dry " ice (CO_2 snow), or Thermos jars. In the laboratory isolation is effected by inoculation of the developing hen's egg. A result is available in 5 to 10 days, depending on the number of passages required.

It will be apparent that laboratory aids to the diagnosis of influenza will not be of immediate help in the diagnosis of acute respiratory diseases. The practitioner must, therefore, continue to rely on his clinical acumen. On the other hand virological studies of selected cases proved of the utmost value in confirming the epidemiological evidence that a new type of influenza A virus had been introduced by a series of importations from the Far East and elsewhere and subsequently disseminated throughout the country. The places from which such infection was imported, the groups of persons concerned, and their mode of travel to this country, have already been described, as have the earlier stages of spread of influenza from these numerous separate foci so long as the paths remained traceable.

During 1957, a sufficient number of specimens were submitted to the laboratories for the isolation of respiratory viruses to make it reasonably certain that there was no influenza due to the Asian strain present in this country before mid-June, 1957.

Total Isolation of Virus A2

Commencing with the first reported isolations of the Virus A2 strain from specimens taken in London on 17th June, the new type was isolated from 635 specimens during 1957 and from 214 specimens during 1958, up to the end of June (being the period covered by this report), in all, 849 isolations.

Serological evidence of A infections

Serological evidence of infection with influenza A2 virus during the same period was found chiefly by the complement-fixation test in 3,660 specimens during the second half of 1957, and in 1,000 specimens during the first half of 1958, in all, in 4,660 specimens. A proportion of the sera were further examined to determine the type of A virus responsible, and where this was done the infection was invariably due to the A2 strain.

Other strains of influenza virus and of adenovirus

In the first quarter of 1957, that is well before the onset of the epidemic, a small number of strains of Virus A of the " Dutch 56 " Type were isolated and during that year virological evidence of a few cases being due to Virus B and Virus C was obtained. Adenoviruses were also identified in connection with some outbreaks of acute respiratory disease occurring at that time.

The virological investigations which the Public Health Laboratory Service made possible over the greater part of the country, together with other observations, gave a good picture of the spread of the epidemic. The large scale on which these examinations were undertaken was made possible by advance information of the approach of the pandemic to this country and detailed anticipatory planning.

Bacteriological studies

Extensive bacteriological studies were made on material submitted from patients suffering from proven Asian influenza and from other influenza-like illnesses. The rapidity with which bacteriological results can be made available meant that many of these examinations were done with a view to immediate diagnosis of the primary disease. Others were made to determine the presence and nature of secondary bacterial invaders, and the amenability of these to antibiotic therapy. Examinations other than those made for reasons of diagnosis or guidance in therapy formed part of a detailed study to determine, if possible, matters which have long been in debate, for instance, the true role of *Haemophilus influenzae* in the causation of influenza, the place of other bacteria as secondary invaders, the possibility that certain bacteria or even particular strains of certain bacteria were associated with graver complications. In many cases these formed companion studies to the virological investigations. A combined study of the virological and bacteriological findings in deaths from Asian influenza made by hospital pathologists and the Public Health Laboratory Service throughout the country gave valuable results.

VII

POST-MORTEM BACTERIOLOGY AND MORBID ANATOMY OF THE EPIDEMIC

The full report by the Public Health Laboratory Service (1958) has been published of the collective study of 477 fatal cases of influenza undertaken by over one hundred hospital and 24 public health laboratory pathologists, the detailed analysis of individual reports being carried out at the Central Public Health Laboratory, Colindale, London.

This was the first occasion on which an investigation of such magnitude had been made. Covering as it did all parts of England and Wales it can be accepted as fairly representative geographically but less so from the point of view of age distribution.

Bacteriology at Post-mortem

It will be convenient to consider first the results of the bacteriological studies. In almost all cases these were made on specimens taken post mortem. The bacterial flora of lung or sputum was examined in 467 cases. The influenza virus was sought for in 310 of these cases and was isolated from 195 of them.

The results of the investigation are summarised in the table below:

Bacterial Flora of Lung or Sputum

Bacterial Flora	All Cases		Cases from which Influenza Virus was isolated	
	Number	Percentage of Total	Number	Percentage of Total
Staph. aureus alone	217	*46·6*	97	*50·3*
Staph. aureus + non-pathogenic bacteria	34	*7·3*	15	*7·8*
Staph. aureus + haemolytic streptococci	15	*3·2*	6	*3·1*
Staph. aureus + haemolytic streptococci + pneumococci	1	*0·2*	0	—
Staph. aureus + H. influenzae... ...	15	*3·2*	7	*3·6*
Staph. aureus + H. influenzae+ pneumococci	1	*0·2*	0	—
Staph. aureus + pneumococci	4	*0·9*	1	*0·5*
Staph. aureus + pneumococci + H. influenzae + haemolytic streptococci	1	*0·2*	0	—
Total with Staph. aureus	288	*61·8*	126	*65·3*
H. influenzae alone	7	*1·5*	5	*2·6*
H. influenzae + non-pathogenic bacteria	3	*0·6*	1	*0·5*
H. influenzae + pneumococci	1	*0·2*	0	—
Haemolytic streptococci (group A, C, or G) alone	3	*0·6*	0	—
Haemolytic streptococci + H. influenzae	2	*0·4*	1	*0·5*
Haemolytic streptococci + non-pathogenic bacteria	1	*0·2*	1	*0·5*
Pneumococci alone	16	*3·4*	11	*5·7*
Pneumococci + non-pathogenic bacteria	4	*0·9*	1	*0·5*
Total with other pathogenic bacteria ...	37	*7·9*	20	*10·3*
Non-pathogenic bacteria only	101	*21·6*	32	*16·5*
Sterile	41	*8·8*	15	*7·8*
Total non-pathogenic bacteria or sterile	142	*30·4*	47	*24·3*
Total Number examined bacteriologically	467		193	

Of the total number of specimens 8·8 per cent. were bacteriologically sterile and 21·6 per cent. contained non-pathogenic bacteria only. The proportions were similar in specimens from which influenza virus was isolated. Those in which there was no evidence of secondary pathogenic infection were not evenly distributed among the age groups but were drawn disproportionately from the extremes of life, or from those in the active years (15–44) with some pre-existent chronic disease. Thus, of 10 patients with rheumatic heart disease, nine were aged between 15 and 44 years, and seven yielded no bacterial pathogens in lung or sputum.

It would appear therefore that in infants, the aged and the infirm influenza virus was of itself sufficient to cause death.

At other ages some additional bacterial infection was usually found in fatal cases. Of all such pathogenic bacteria, *Staphylococcus aureus* was by far the most common. In the 467 deaths studied, it was found in 288. Moreover, it was the sole pathogenic bacterium in 251 cases. Excluding the 142 cases where no bacterial pathogen was detected, staphylococci were isolated from 88 per cent. of the remainder, their growth being frequently recorded as abundant.

Of other pathogenic bacteria, none was exclusively associated with influenza deaths. *Haemophilus influenzae* was found alone in seven and with other bacteria in 23 cases; pneumococci were present in 28 and haemolytic streptococci in 23.

The proportion of deaths associated with and probably attributable to staphylococcal infection varied with age. Staphylococci were found in 49 per cent. of specimens from fatalities under five years of age, in 88 per cent. of fatal cases in school children and in 73 per cent. of those in younger adults. After the age of 44, the proportion of cases shewing staphylococci fell; to 49 per cent. for older adults and to 31 per cent. for those over 64.

Morbid anatomy

Records of the findings at necropsy were available in 219 cases.

Post-Mortem Findings in Relation to Virus Isolation

Post-mortem Lesions	Cases with Specified Lesion as Percentage of all Examined	
	All Patients	Patients Yielding Influenza Virus
Pneumonia	85	85
Tracheobronchitis	53	63
Haemorrhage in lung or haemorrhagic pneumonia ...	31	36
Haemorrhage in adrenal	4	4
Haemorrhage elsewhere	6	4
Abscess in lung	18	13
Abscess elsewhere	9	0
Pleural effusion	5	7
Pericarditis	3	2
Rheumatic heart disease	5	2
Other chronic heart disease	3	4
Chronic bronchitis or bronchiectasis	6	3
Number examined	219	89

Death was due to pneumonia in 85 per cent. Tracheal or tracheobronchial lesions, often purulent, were present in more than half, in one third the pulmonary lesions were haemorrhagic and obvious abscess was noted in nearly one-fifth (18 per cent.). Other observers have commented on the capacity of the influenza virus for attacking and eroding respiratory mucous membrane, thus paving the way for secondary bacterial invasion.

Adrenal haemorrhage was noted in eight fatal cases—five of these patients were under four years of age and two were of school age.

Ten fatal cases had rheumatic heart disease (all mitral lesions) nine being in the age group 15–44 years. Other chronic cardiovascular disease was found in seven of the patients who died.

Chronic bronchitis or bronchiectasis was present at necropsy in 14 cases.

Twelve of 103 fatal cases in females aged 15–44 were pregnant which is about double the expected proportion in women in this age group. This reinforces the observation of Bashore and others that influenza can be a dangerous complication of pregnancy.

Influenza virus was isolated in 89 of the 219 fatal cases. The post mortem findings were similar to those of the whole series, and the appearances at necropsy were remarkably alike in all fatal cases irrespective of the bacteriological findings. Pneumonia was common in all bacteriological groups, but less so in those without pathogenic bacteria (67 per cent.) than in those with (86 per cent.), while, as might be expected, lung abscess was rarely found except in the presence of staphylococcal infection. The only further association noted between lesion and pathogen was in eight cases of adrenal haemorrhage—in three, infection with *Haem. influenzae* was found.

To summarize, the principal cause of death was pneumonia, and the pathogens mainly responsible were the staphylococcus and to a lesser extent the influenza virus itself.

The table below from Oswald, *et al* (1958) shows the principal pathogenic bacteria isolated from sputum. The authors express doubt whether *H. influenzae* should be regarded as a pathogen in the present context. In the non-staphylococcal group almost half yielded no pathogens, and a further 21 per cent. either had no sputum or examination was not performed. In the remainder the pneumococcus and *H. influenzae* occurred with equal frequency (16 and 17 per cent. respectively).

Principal Pathogenic Bacteria in Sputum (Oswald et al)

	Cases	Organisms*						Not Tested
		Staph. aureus	*Str. pneumoniae*	*Strep. pyogenes*	*H. influenzae*	*Kleb. friedlanderi*	Non-pathogens	
Staphylococcal pneumonia...	155	151	7	—	6	—	—	4
Non-staphylococcal pneumonia ...	145	—	24	2	23	2	74	30

* More than one organism was cultured from several cases in both series. Of the four cases in the first series in which the sputum was not tested the diagnosis was made in one from a blood culture and in three at necropsy.

The number of patients treated with the various antibacterial drugs is shown in the next table.

Number of Patients treated with Various Drugs

	Number of Patients Treated	
	Non-staphylococcal	Staphylococcal
Sulphonamides	16	12
Penicillin	108	118
Tetracycline	47	76
Chloramphenicol	13	25
Streptomycin	20	37
Erythromycin	2	39
Novobiocin	—	3

In the staphylococcal infections, penicillin (76 per cent.) and the tetracyclines (49 per cent.) were the drugs of first choice, but erythromycin, streptomycin and chloramphenicol were widely used as well; many received more than one antibiotic—only 28 per cent. were given a single drug.

In non-staphylococcal infections, 60 per cent. had only one antibacterial drug. Again, penicillin (74 per cent.) or the tetracyclines (32 per cent.) were the first choice, and were usually sufficient in illnesses which were mild or moderate. Other remedies were reserved for severer infections.

The final table of antibiotic sensitivities of staphylococci isolated shows the reason for the wide range and frequent change of drugs employed, and affords some measure of the risk to the influenzal patient of acquiring a secondary and often an antibiotic-resistant staphylococcal infection.

The proportion (49 per cent.) of penicillin-resistant strains found in those presumed infected outside hospital is greater than that reported by the Public Health Laboratory Service (approximately 35 per cent.). In those with possible or probable hospital infections, resistance to the more commonly used antibiotics was frequently met and presented a therapeutic problem. In all groups, resistance to the less widely used erythromycin and chloramphenicol was, by comparison, infrequent.

Sensitivities of Staphylococci Isolated from Patients with Staphylococcal Pneumonia following Influenza

	(*a*) Isolated within 4 days of Admission			(*b*) Isolated more than 4 days after Admission		(*c*) Influenza Contracted in Hospital		Per cent. Resistant (*b* + *c*)
	Number	Resistant	Per cent.	Number	Resistant	Number	Resistant	
Sulphonamides ...	34	15	44	5	4	1	0	67
Penicillin ...	113	55	49	18	16	9	9	93
Streptomycin ...	89	11	12	17	9	7	6	62
Tetracycline ...	94	21	22	18	12	9	8	74
Chloramphenicol	96	6	6	16	1	7	1	9
Erythromycin ...	60	4	7	17	1	8	0	4

VIII

INFLUENZA IN SPECIAL GROUPS

A. Influenza in the Royal Air Force

A study of the incidence of influenza in this Service was made by Holland, McDonald and Wilson between May, 1957 and the end of April, 1958. Three and a half months of this lengthy period of observation were to pass before the first authentic case of influenza A Asian occurred, during which time a miscellany of small outbreaks and sporadic cases of upper respiratory infections came to notice and were the subject of biological investigations. Without this, these incidents might well have passed for influenza, in which circumstances it might have been argued that the seeds of the epidemic had been here in the country the whole time. Two of the compilers of the report on the 1918–19 pandemic reached precisely this conclusion from similar observations of an accumulating number of small outbreaks of influenza-like illnesses which preceded that pandemic. Parsons in his earlier report mentions one localized outbreak in the north Midlands which preceded the pandemic of eighty years ago but stood by his opinion that the major epidemic was of foreign origin. Others of the older observers have recorded disturbances in the public health, some akin to a subsequent generalized outbreak and some not remotely resembling it. The purport of their comments was that disordered public health engendered epidemics. It is refreshing to find that at last this matter has been examined scientifically. In nine small outbreaks of acute respiratory disease at Royal Air Force stations between May and August, 1957 Holland, and his co-workers failed to find evidence of an influenzal cause; one outbreak was due to adenovirus type 3 and in eight no aetiological agent was discovered. There were, in addition, at recruit stations sporadic cases of Sendai virus infection, influenza C and psittacosis.

The first case of influenza A2 at Royal Air Force Stations in this country was detected on 15th August at a large recruit centre situated at West Kirby, Cheshire, which was the first unit to experience a large outbreak. The extent, date and duration of this outbreak and those at two other similar centres are shown in fig. 2.

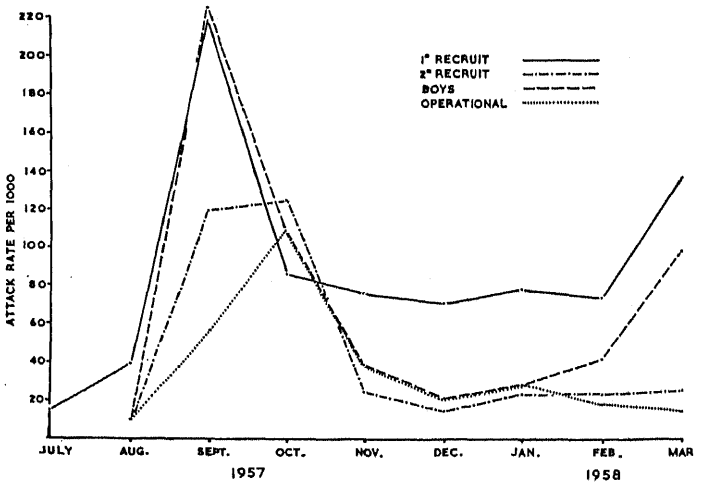

FIG. 2.—Acute respiratory disease attack rates in different types of station. (Holland, *et al.*)

West Kirby and Wilmslow, both in the county of Cheshire, had severe outbreaks in August and September. The record for the former ends with the closure of that centre in November. Bridgnorth, Shropshire, had a less severe outbreak in September and a second and more extensive outbreak late in November.

The epidemic affected primary recruit units and boys' units at much the same time.

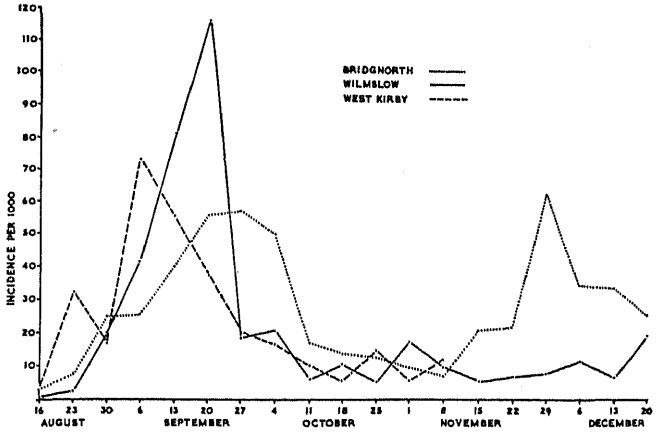

FIG. 3.—Incidence of acute respiratory disease at recruit camps, 1957. (Holland, *et al.*)

Secondary recruit units were involved a week later, and operational units two weeks later still. At operational stations there is more permanence of personnel than at recruit units, where there is constant change, and the average age is higher. After the main influenza outbreak had subsided in the operational stations no further outbreak occurred, although individual cases of influenza A arose. This was not so in the primary recruit units in which a high rate of respiratory illness continued until Easter. Not all of this was influenza: between December and the end of April 285 paired sera were examined, of which 54 showed a fourfold or greater rise in influenza A2 titre. During the same period 35 strains of the A2 variety were isolated, 28 from recruits and 7 from other stations. With few exceptions, the confirmed cases of influenza encountered in the first four months of 1958 were in patients who stated they had not been ill during the autumn epidemic.

The main weight of the epidemic fell in September and October, as is shown in the table below. (The column " estimated number of cases of influenza, 1957 " is derived from the total of acute respiratory illnesses less those that might be expected in a non-influenza year).

Number of cases of influenza in the R.A.F., August-December, 1957

Month	Total number admitted or sick at home with respiratory disease, 1957	Corrected number of cases of respiratory disease, 1956	Estimated number of cases of influenza in 1957	Incidence
				per cent.
August	1,526	830	696	*0·4*
September	12,093	1,180	10,913	*7·2*
October	17,042	1,320	15,722	*10·1*
November	5,981	1,620	4,361	*2·9*
December...	3,478	1,590	1,888	*1·3*

In all, some 22 per cent. of the Royal Air Force in this country fell sick with influenza.

The regional distribution of influenza was much as in the civilian population, the rates in London and South-eastern England being again noticeably lower than elsewhere.

Special study was made of influenza incidence in relation to type of station. The higher attack rate in recruit and boys' units has already been mentioned. At three operational stations attack rates were analysed in relation to immediate environment, comparing indoor with outdoor, small work place with large, ample with less commodious sleeping quarters and like observations. No association was found between these factors and the incidence of acute respiratory disease.

The only clearly discernible factor was the age of the patient. The incidence of acute respiratory disease fell with age: at 16–21 the attack rate was 36 per cent., at 22 to 30 it was 30 per cent. and at 31 and over, 19 per cent.

The opportunity was also taken at West Kirby to study the relationship between infection and clinical illness. Serological studies made on 387 patients admitted with acute respiratory disease showed that an influenza antibody titre of 1 in 8 or more was presumptive evidence of infection.

Sera from 121 of 128 airmen in a particular intake were examined after the peak of the epidemic had passed and before the men left the station. During the epidemic twenty-seven of the group had been in hospital with an acute respiratory disease of whom twenty showed a fourfold or greater rise in antibody titre to influenza A.

Of the 94 not admitted, from whom single sera were obtained, 38 had a titre of 1/8 or more, strongly suggestive of influenzal infection.

It would appear therefore that 48 per cent. of this intake became infected during their stay at this station, although only a third of those infected were ill enough to be admitted to hospital.

B. Influenza in schools

Of the total population nearly one-seventh attends day schools, forming a semi-closed community assembled in class by day, but otherwise dispersed. School children were caught up in the momentum of the epidemic and their experience was similar to that of the general population. In some instances the illness appeared in the community before the school opened, in others re-assembly seemed to have preceded the spread of infection in the community at large; in others again, and this was the more usual course of events, the two sections of the population were affected indiscriminately at about the same time.

There were variations in time of occurrence, incidence and severity in different parts of the country. Divergences were observed even between one school and another in the same locality, both in overall incidence and in the age-groups showing the highest attack rates.

It is not possible to state with any exactitude how many cases occurred, but as an estimate an overall attack rate of 50 per cent. would be not unjustified. Incidence among schoolchildren was usually measured by the number of absentees. For the most part, school attendance at the beginning of the Michaelmas term was better than average and in the region of 90–95 per cent. No other infectious disease was prevalent during the term and it is reasonable to ascribe to influenza any further fall in attendance. The estimates which follow are based on this assumption.

Day schools are open on five days a week during term. In 1957 most primary and secondary schools assembled in the first or second week of September after the summer holiday though there were certain exceptions, notably in East Lancashire and neighbouring parts of Yorkshire, where the summer holiday was taken in two parts.

In the northern half of England and Wales the peak of the epidemic was reached in most areas at the end of the third week in September. The day of highest absence from school was, in a number of instances, Friday, 20th September. Between one and three weeks' lag was observed before the epidemic developed in the southern half of the country, where in many places the maximum incidence was not until mid-October.

With its brief incubation period and short duration of illness, influenza developed swiftly in the schools. Even in those schools which were severely disorganised attendance returned to normal within four weeks of the appearance of the first cases. Most of the children affected suffered an illness lasting no more than three or four days and the majority were back at school within a week.

Within the ten-year span of the school age-group the attack rate varied with age. In general, those children upwards of 11 years attending secondary schools were attacked in the greatest numbers, and were usually the first to be affected, although in some areas the outbreak appeared first in entrants.

In the closed communities of residential schools a high attack rate was the rule, frequently reaching 90 per cent. and often affecting the whole school within a fortnight.

In a number of instances small schools were temporarily closed for want of pupils or staff but in general schools remained opened throughout the epidemic. In a few areas they were closed for a short period when absences exceeded 20 per cent., or some other agreed figure, but the effect of this procedure on the course of the epidemic is difficult to determine.

C. Influenza in the Insured Population

Through the courtesy of the Ministry of Pensions and National Insurance the information from which this section is derived was made available to this Ministry from week to week during the course of the epidemic.

Past experience has shown that sudden increases in first claims to sickness benefit are almost invariably due to influenza. So much is this so that arrangements are made whereby local insurance offices notify the Medical Officer of Health when the number of new claims for sickness benefit during the winter months exceeds by a set ratio the average weekly number received over the previous nine months from April to December. Though this scrutiny of claims usually takes place only in the winter it may be instituted at any time and on this occasion, in anticipation of an epidemic, it was begun in August. The yardstick was the average intake of claims in the period April to December, 1956.

Approximately 17½ million of the 29 million persons aged 15 and under 65 years of age are insured under the National Insurance Act and are entitled to sickness benefit. Though this large group of insured persons excludes, *inter alia*, children, old persons and most married women, who are not entitled to benefit, the behaviour of influenza in the insured population corresponds closely with its behaviour in the population as a whole. Consequently, the

number of persons claiming sickness benefit when influenza is present constitutes a rough index of the occurrence and prevalence of influenza in the general population. In Chapter 2 use has been made of this in tracing the sequence of events leading to epidemic occurrence.

Applications for sickness benefit began to rise during the week ended 27th August, 1957. Succeeding weeks saw an acceleration in the rate of rise of new claims until the peak of 471,000 was reached during the week ended 8th October. Thereafter the fall was rapid to begin with. The situation is shown graphically in the following chart. (It will be noted that this and other charts relate to Great Britain as a whole).

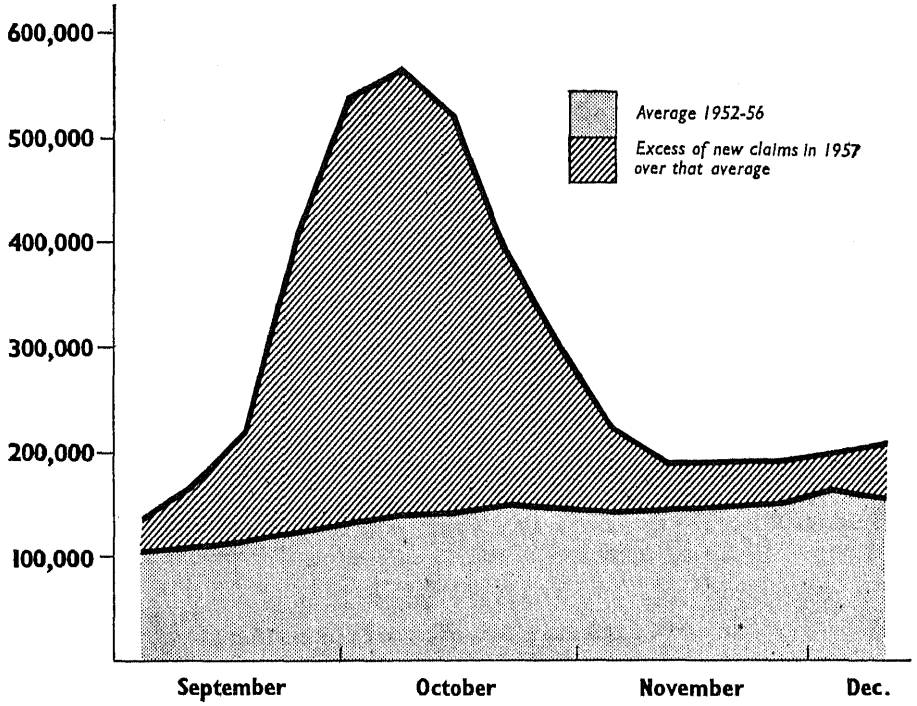

FIG. 4.—Number of new claims received in each week in the period 28th August to 10th December, 1957. (Ministry of Pensions and National Insurance).

In terms of claimants, there was in England and Wales between 21st August and 31st December, 1957, a total of some 4·5 million claims, being some 2 million in excess of the average for the preceding five years, the majority of which arose before the end of October. It is estimated by the Ministry concerned that one person in eight of those insured may have been incapacitated by influenza.

The approximate numbers drawing benefit at any one time can be estimated from the numbers of first medical certificates received in the course of a week from those falling sick, together with the numbers of intermediate certificates (from those still sick) and an allowance for the long-term sick not needing weekly certificates. The number of persons drawing benefit each week estimated on this basis is shown in Fig. 5 below, together with the excess intake of claims. The relationship between these weekly figures suggests that the majority of influenza claims lasted between one and two weeks.

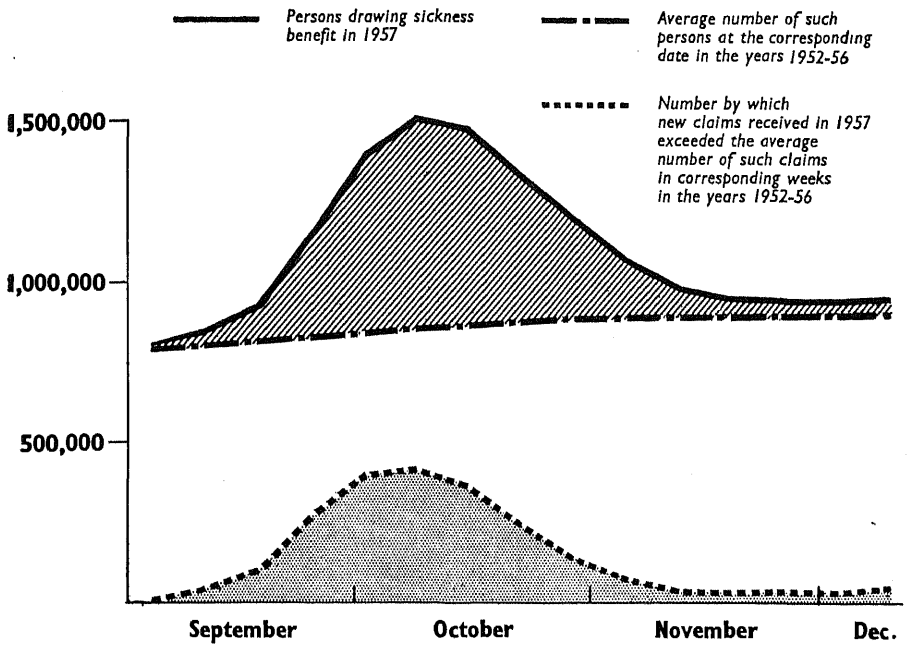

FIG. 5.—Increase in the number of persons drawing benefit compared with increase in the numbers making new claims, 28th August—10th December, 1957. Ministry of Pensions and National Insurance.

Fig. 6 shows the distribution of claims from the first sign of the epidemic to the end of the year compared with the average intake, the regions being arranged in descending order of average intake of claims.

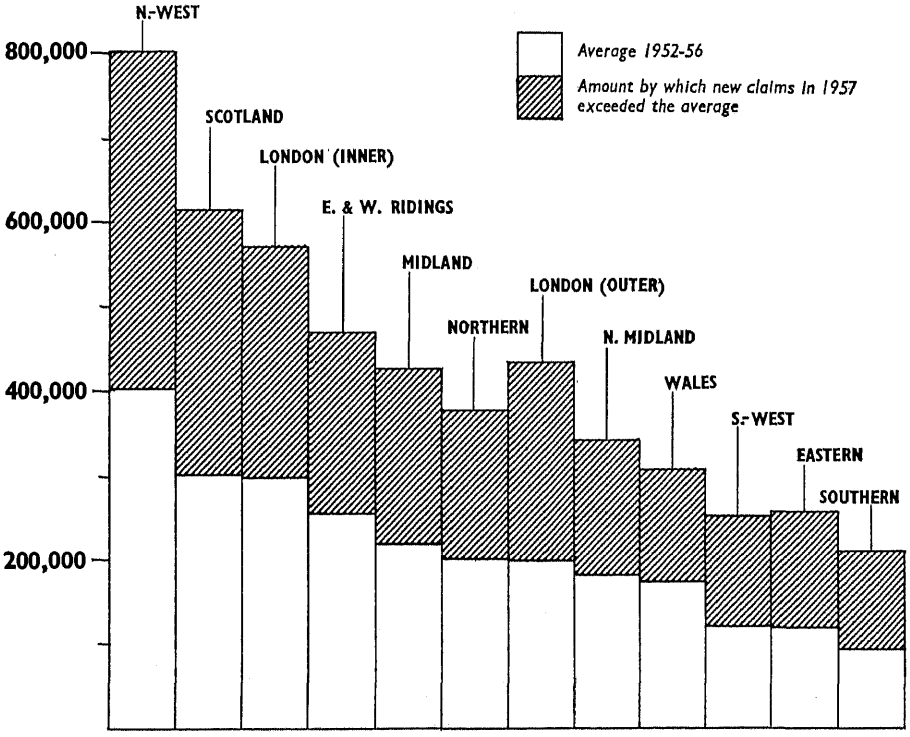

FIG 6.—Intake of new claims in each region between 21st August and 31st December, 1957. (Ministry of Pensions and National Insurance).

Commenting on this, the Ministry of Pensions and National Insurance remarks that the epidemic came first in the north of England but lasted longer in the home counties and the eastern region. The largest number of new claims was received in the heavily populated areas of North West England, but it was the South that experienced the greatest proportionate excess; outer London, the eastern, southern and south-west regions were especially heavily affected, but except in the south-west pressure was spread over a longer time.

Effect on Industry

With an eighth of the insured population incapacitated at some time during the period of the epidemic, it is of some interest to examine the effect on industry. In reports to this Department, many medical officers of health made reference to this matter, but more often than not it was a local undertaking which had been severely affected. A recital of only the more notable items would thus give a misleading impression. More representative are the studies made in one large city as a whole by Semple at Liverpool and, for one industry, coal mining, in the South West.

Professor Semple and his colleagues found that among 12,500 employed in three large enterprises (the corporation's transport system, a football pool promoter's office and a large factory) the percentage absent rose from 8·2 on 16th September to 14·9 on 28th of that month, remaining around this level until 12th October and declining to 8·2 once more on 22nd October. The period covered by the observations corresponded to that of the worst of the outbreak, which begun in Liverpool early in September and subsided by the end of October. Of the groups studied, those in the transport department were mainly men, the second mainly women and the third included both men and women.

The table following (published by permission of the Ministry of Fuel and Power) clearly shows the effect of influenza on capacity for work. The area covered includes South Wales, the Forest of Dean and the Bristol and Somerset coalfield.

From these analyses, and from the appreciation of the general position in local industry included by so many medical officers of health in their reports and the special references made to undertakings severely affected, it may be said that the industrial services and daily life of the country were maintained, and well maintained, despite the incursion made by the epidemic. So far as this was measurable it appears to have caused the absence at different stages and places of, in general, one-eighth of those engaged in industry, with even higher rates in some sorely tried establishments.

D. Influenza and the Family

In the course of their review of influenza in a general practice of just over 2,000 patients, Woodall, Rowson and McDonald noted that the highest attack rate was in children aged 5 to 14 years. This observation led to the investigation of the possibility of families with children attending school suffering more than those which had not. Scrutiny of the data revealed that this was so; the epidemic in this particular practice being almost confined to schoolchildren and their families.

Secondary attack rates, defined as attack rates among the remainder of the family after exclusion of the first case, for all age groups under forty years were similar, ranging between 48 and 60 per cent.; over forty years the percentage

The trend of absence increase mainly due to the influenza epidemic over a six weeks period

Area	Percentage Absence—Week ending						Change over corresponding week in 1956						Average
	31st August	7th Sept.	14th Sept.	21st Sept.	28th Sept.	5th Oct.							
	1	2	3	4	5	6	1	2	3	4	5	6	
1	12·12	12·98	14·99	20·30	22·65	19·52	− 0·19	+ 1·01	+ 2·5	+ 8·12	+ 9·68	+ 6·35	4·58
2	12·56	12·84	15·93	20·81	22·72	18·91	+ 0·62	+ 0·78	+ 3·6	+ 7·81	+ 9·42	+ 6·33	4·76
3	13·68	15·23	15·73	18·48	26·28	25·63	+ 1·45	+ 2·58	+ 2·14	+ 5·11	+11·67	+11·85	5·80
4	15·30	16·43	16·94	21·75	26·43	25·14	+ 1·07	− 0·64	+ 0·97	+ 5·72	+10·21	+ 9·66	4·43
5	14·36	17·38	17·59	23·12	23·66	21·08	+ 1·36	+ 4·07	+ 3·71	+ 9·09	+ 8·53	+ 6·60	5·56
6	13·11	15·06	15·79	19·78	22·23	20·34	+ 0·65	+ 2·12	+ 2·62	+ 6·18	+ 8·05	+ 6·31	4·32
9	12·58	13·69	16·21	21·83	25·68	21·46	+ 0·84	+ 1·85	+ 3·2	+ 8·20	+11·5	+ 8·52	5·68
F/D	9·69	9·02	9·72	11·66	14·04	19·14	− 0·99	− 2·96	− 1·77	+ 0·83	+ 2·81	+ 8·05	
B/S	9·0	9·28	9·51	11·64	13·47	14·36	+ 0·23	− 0·32	− 0·13	+ 0·72	+ 2·58	+ 4·24	
Div.	13·30	14·74	15·91	20·39	23·65	21·56	+ 0·86	+ 1·65	+ 2·5	+ 6·74	+ 9·35	+ 7·85	

F/D = Forest of Dean Group. B/S = Bristol and Somerset Group.

attacked fell to 37 per cent. of persons of 40 years but under 50 years, and 19 per cent. of those of 50 years and over. The lower rates in the senior members of the family could be explained either by lower susceptibility or by less exposure to infection. The primary cases in family outbreaks were most frequently in schoolchildren aged 5–14 years and least frequently in children under five. The subsequent order of becoming ill also varied with age, those over 40 seldom being infected next, but most often being third or later. The authors consider that this suggests that older persons may have been less exposed to infection from the younger ones who introduced it to the family than were infants and young adults.

The serial intervals between dates of onset in family outbreaks showed a periodicity of about two days, which agrees with other estimates of the incubation period of the disease.

E. Effect of Influenza on General Practice

During the course of the epidemic inquiry as to its extent and character was made of general practitioners in all parts of the country. In the main, these inquiries were as to the symptoms and severity of illness, the persons most affected and the ability of practitioners to meet the heavy and continued demands on their services—rather than the numbers treated.

A selection of representative examples may be given:

In South Yorkshire a partnership with a list of about 14,000 patients saw 150 fresh cases of influenza a day at the worst of the outbreak, later falling to 50 a day. Elsewhere, in this area, of a practice list of 8,500 270 fell ill with influenza in one week, and in a practice of 7,000 influenza attacked 30 a day at the time of the report. Near by, two partners saw 375 cases of influenza in a fortnight of their list of 6,000.

In the Birmingham area a partnership with 6,000 patients stated that some 50 fresh cases of influenza were seen each day for two weeks.

In a south-eastern suburb of London one practitioner recorded his visits and consultations. Between 20th September and 4th October he paid 192 visits. 572 patients attended his surgery. It was not possible to record those who had influenza, but compared with the corresponding period of the previous year there were an extra 123 visits and 93 consultations which could reasonably be regarded as some measure of the outbreak.

In towns on the Hampshire-Surrey border one doctor estimated that some 40 per cent. of 3,000 patients was treated for influenza, another with 1,700 patients considered that 60 per cent. of patients came under attention, and a partnership with 10,000 patients stated that the epidemic lasted a month and during the worst period influenza accounted for 80–100 cases a day.

In rural Kent, at the time of his report a doctor with a list of 3,000 was seeing some 10 new cases of influenza a day.

These and the many similar reports from all parts of England show that for upwards of a month general practitioners were exceptionally busy.

In Wales an assessment of the situation in general practice was made, county by county, by the medical staff of the Welsh Board of Health. In the west, crowded surgeries and trebled visiting lists allowed little opportunity for routine re-visiting which was reserved for those seriously ill. It was estimated that the

number of patients seen was no more than half of those affected, for in many instances one of a family would attend asking advice for the treatment of several members of the household without requesting a visit. In rural areas many obtained advice by telephone, or relied on that given in broadcasts and in the press. No serious complications appear to have arisen from the inability of doctors to follow up cases in the customary way.

In the industrial parts of Glamorgan and Monmouth the main pressure was on the surgeries. In one partnership one doctor remained all day in the consulting room seeing ambulant patients while the other was engaged in continuous visiting. Again, re-visiting was selective.

In a practice in Barry with a list of 8,000 patients, total visits by three partners for respiratory conditions reached 580 during the week commencing (Monday), 30th September, 470 being new visits, compared with a weekly range during the year of 30–150 total visits and 60–140 new visits; visits for all conditions during the year varied between 160 and 330 weekly, but reached 606 during the same week.

Elsewhere, in the industrial parts of North Wales the position was similar to that in the South.

In rural counties generally the greatest cause of concern was the difficulty in securing a locum tenens when practitioners themselves fell ill. The conditions of urban practice allow one doctor to assist another during times of emergency or personal incapacity but in areas served by sparsely distributed practitioners working alone, such mutual support is not possible.

From the time when influenza became generally epidemic it was clear that practitioners would be under great pressure as long as the outbreak lasted and in late September an approach was made by the Ministry of Health to Medical Officers of local health authorities, to hospital authorities and to local medical committees inviting their joint consideration of ways of mobilising, conserving and reinforcing medical manpower. Among measures suggested were the establishment of a county or regional pool of locum tenentes, a direct approach to retired doctors known to be living in the area, the loan of junior hospital medical staff as part-time assistants and of local authority medical officers for evening and week-end duty. This last proved to be the most effective and in a number of parts of the country public health medical staff made valuable digressions into general practice.

INFLUENZA IN PRACTITIONERS

As the preceding paragraphs suggest, doctors were themselves no more immune to influenza than were their patients. A study of the incidence of the disease in practitioners has been published by the College of General Practitioners.

Of 66 doctors who took part in an inquiry undertaken by the Epidemic Observation Unit of the College, 19 had an attack of influenza during the epidemic. Fourteen were incapacitated for some time; 13 had been in daily contact with influenza for three to nine weeks before they fell ill.

Among 22 who did not have a clinical attack of influenza, 17 still showed a complement fixation titre of 1 in 8 or less at the end of the epidemic and 5 had titres of 1 in 16 or higher.

PRESCRIPTIONS ISSUED DURING THE EPIDEMIC

Consideration of the number of prescriptions issued during the epidemic throws little light on the question of the total number of persons treated by general practitioners. During the three months before the outbreak (June, July and August) 44¼ million prescriptions were dispensed and 51 million in the corresponding months of 1956. During September–December, 1957 the total was 76¾ million, with 74¼ million in the same months of 1956.

In September and October, the months of greatest prevalence of influenza, 3½ million more prescriptions were dispensed than in the corresponding two months of 1956. On the other hand, there was a fall by the like amount in November and an increase of 2½ million in December, in both of which months influenza was still markedly prevalent.

Study of the drugs prescribed suggests that in the main simple antipyretics and linctuses sufficed for treatment of the patient in his own home, with selective rather than general use of antibiotics.

After the main impetus of the outbreak had spent itself, there remained a raised level of influenza in the country, clearly identifiable by the laboratory but merging clinically with other forms of winter respiratory disease. Some saw in this continuance the beginnings in this country of the second wave reported in certain countries abroad, others regarded it as no more than the inevitable aftermath. Except in November there was in each month from September, 1957 to the end of April, 1958 a substantial increase in prescriptions dispensed compared with the corresponding month of the preceding year. During these months the continuance of the epidemic was clearly discernible even if largely unrecorded at the time.

In retrospect, then, the influenza epidemic of 1957–58 was for the practitioner a month or more of sustained extreme demand during the autumn followed by a winter of increased work to which influenza still made a substantial contribution.

ANCILLARY SERVICES OF LOCAL HEALTH AUTHORITIES

Home Nursing

Of the health services provided by counties and county boroughs, three were in especial demand during the autumn epidemic. Long established and well known by doctor and patient, the home nurse (still better known to many by the older name district nurse) both shared with the practitioner the treatment of the seriously ill in their homes and materially reduced the size of his visiting list by a judicious sifting of potential calls.

There are in England and Wales a little over 10,000 home nurses, of whom approximately one half practice also as midwives or health visitors. In 1957 some 25 million visits were made to a little over one million patients. Of these nearly 19 million visits were designated medical and were in respect of some 750 thousand patients.

In 1956 slightly fewer total visits were made to substantially the same number of patients, 16¾ million being medical visits to some 700,000 patients.

There were therefore some 50,000 added medical patients who occasioned little short of 2¼ million visits, and it may not be unreasonable to regard much of this increase as of influenzal origin.

Health visiting

The part played by health visitors is not so readily shown arithmetically. The number of visitors was much the same in 1957 as in 1956—around 6,300—and the average number of visits made by each remained constant at some 11,000 in the year. It was rather by a re-arrangement of their work and local deployment of their strength that health visitors found opportunity to assist.

Of the part played by home nurses and health visitors, the observations of one Medical Officer of Health (J. L. Burn, Salford, personal communication) may be regarded as representative—(both) " aided the practitioner greatly in reducing the number of calls and in selecting those requiring visiting ".

Home helps

When doctor and nurse have departed there must still remain someone in the home to care for the patient confined to bed. Where relatives cannot undertake this local authorities provide help in the home. Demands for this service have increased progressively and the total strength of some 3,000 whole-time and 38,750 part-time workers is permanently occupied. Again, comparison of one year with another does not necessarily show the effect of the epidemic, but the 258,469 cases attended in 1957 were 20,808 more than in 1956. Of these 71 per cent. were elderly or chronic sick.

F. Influenza and the Hospital Services

Influenza in Hospital Staff

Of those working in hospital nurses and those whose duties brought them into contact with infection were at greater risk and suffered more than those whose duties lay elsewhere.

Reports from two areas may be regarded as representative of what was happening generally.

That from Liverpool (Dr. Lloyd Hughes, Senior Administrative Medical Officer, personal communication) relates to nurses and covers the five weeks during which the epidemic was at its worst. In 15 larger hospitals providing 3,344 beds, there were absent on 23rd September 12·6 per cent. of nursing staff, and weekly during the succeeding four weeks 17·5, 19·4, 14·8 and 10·7 per cent. On 7th October nearly one nurse in five was ill—at one hospital two in five were away, at another nearly one third.

The reports from the Senior Administrative Medical Officer, North West Metropolitan Region cover the period from the week ended 28th September to that ended 23rd November and relate to all hospital staff among whom the cases of influenza were 531, 1,057, 1,428, 1,277, 946, 502, 283, 173 and 142 in the respective weeks.

As will be seen, the epidemic made most serious inroads on those themselves engaged in treating the gravely ill. As with the general medical service, those in less urgent need stood aside—admission from waiting lists was suspended where the position so dictated. Visiting of patients was similarly greatly curtailed or suspended for a time both to limit the introduction of infection from without and to reduce work within. By these simple and clear-cut (if somewhat drastic) measures the work of the hospitals was continued.

Emergency Bed Bureaux

It will be inferred from the foregoing that practitioners having occasion to send patients into hospital might find some difficulty, not so much in ultimately

securing admission as in arranging for a bed at the hospital of first choice. Much of this labour is now transferred from the practitioner to the bed bureau in London, Birmingham, Sheffield and Liverpool, from all of which detailed reports have been made available of the working of this service during the epidemic. That from the Emergency Bed Service, London (provided through the courtesy of the Secretary, Commander J. R. E. Langworthy) may be given as typical.

" The effect of the epidemic became noticeable in the latter part of September when requests for beds for patients with respiratory disease became considerably more numerous than is normal at this season, but it was not until October that the full effect of influenza was felt.

During that month 6,408 applications were received compared with the normal 4,000 of which 2,477 were on account of respiratory disease. The peak was during the second week of October, at which time requests for beds were of an order usually found only in January, the busiest month of the year. During the latter part of October applications fell quickly and by early November were once more at their customary level."

The accompanying graph demonstrates admissions (shown by age groups) effected by the London Emergency Bed Service throughout the autumn and winter of 1957–58. The duration, magnitude and ages affected are clearly apparent.

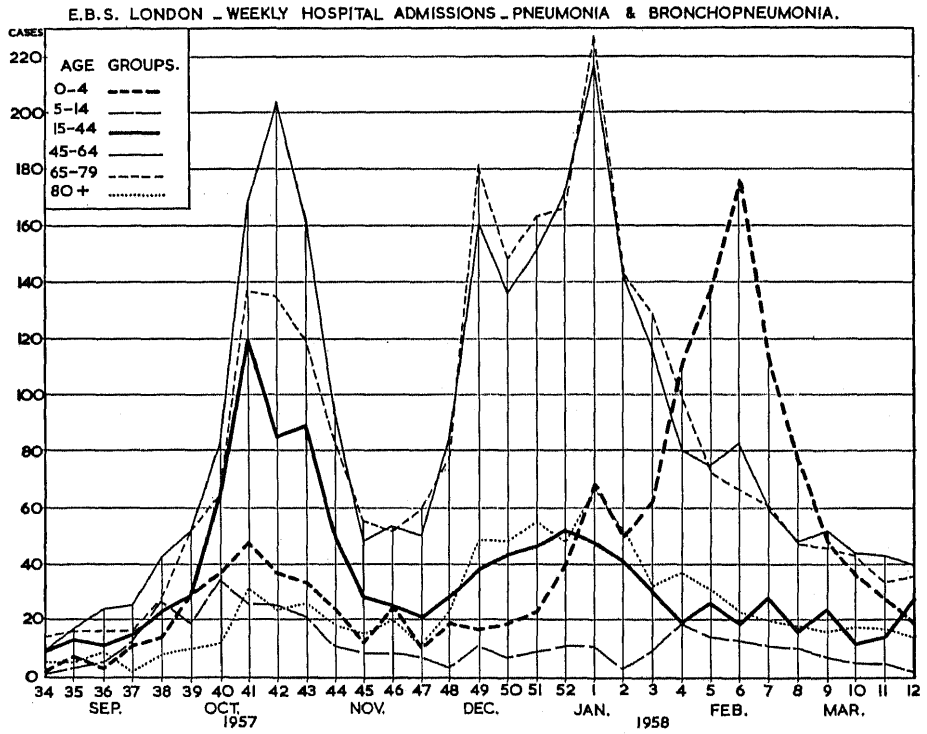

FIG. 7.

In general terms it can be said that the epidemic added notably to the normal work of the several health services but did not tax these beyond what all have long been accustomed to meet during each winter. The initial violent strain was followed by a somewhat higher demand than is usual in late autumn to merge with the inescapable winter rise in respiratory illnesses.

IX

VACCINATION AGAINST INFLUENZA A2 VIRUS

The early warning received of the impending arrival of the Asian strain in this country made it possible to attempt to provide a specific vaccine with some prospect of success.

The first requirement was a serological trial to establish the minimum antigenic potency needed for the vaccine to give an adequate antibody response. The second was to test the protective action of the vaccine by field trials.

Both the serological and the field trials were undertaken by the Medical Research Council's Committee on Influenza and Other Respiratory Virus Vaccines on whose "Fourth Progress Report" the notes which follow are based. The vaccines mentioned were prepared by Dr. F. Himmelweit of the Wright-Fleming Institute of Microbiology.

For the serological trial four saline vaccines were prepared from an egg-adapted line of the Asian strain A/Singapore/1/57, i.e. a vaccine of 20,000 haemagglutinating units (H.U.) per dose and three dilutions of this vaccine containing, respectively, about 14,000, 7,000 and 3,500 H.U. per dose.

In each vaccine the virus was adsorbed on to 10 mg. aluminium phosphate per dose of 1 ml. The vaccines were administered by deep subcutaneous inoculation into the upper arm.

Volunteers for the trial were obtained at the Royal Army Medical Corps Field Training Centre, Mytchett and from Royal Air Force stations at Lindholme, Finningley and Bawtry. These were divided into four sub-groups, each to receive one of the four vaccines. Specimens of serum were obtained from each volunteer prior to inoculation and three weeks later. The antibody responses are shown in the table below.

*Haemagglutination-inhibition Titres observed Three Weeks after Primary Inoculation with Asian Influenza Vaccine of Different Strengths**

Titre	Vaccine A 20,000 H.U. per Dose	Vaccine B 14,000 H.U. per Dose	Vaccine C 7,000 H.U. per Dose	Vaccine D 3,500 H.U. per Dose
10 or under	9	15	13	11
12·5–17·5...	9	8	6	6
20–50	13	3	6	8
60–120	3	2	4	—
Total	34	28	29	25
Geometric mean titre ...	14·9	7·6	9·8	7·2

* The H.I. titres prior to inoculation were in all cases less than 5.

It will be observed that the antibody responses were, in general, low, and it was accordingly decided to carry the trial a stage further and investigate the serological response to a second dose given three to four weeks after the first. This was done in all volunteers remaining in the sub-groups originally given full and one-third strength vaccines (A and C of the tables). Serological studies of further specimens taken about three weeks after the second dose showed a

marked rise in titre, the increase being much the same for both vaccines. The results of this further study are given in the table below.

Haemaglutination-inhibition Titres observed about Three Weeks after First and Second Doses of Asian Influenza Vaccines, the Second Dose given Three to Four Weeks after the First

Titre	Vaccine A 20,000 H.U. per Dose		Vaccine C 7,000 H.U. per Dose	
	After First Dose	After Second Dose	After First Dose	After Second Dose
Under 20	13	—	16	1
20–50	7	5	3	8
60–120	—	13	2	11
121–240	—	2	—	1
Total	20	20	21	21
Geometric mean titre ...	8·8	77·7	4·2	56·5

The purpose of the field trials was to study the relative protective effects of a single dose of about 20,000 H.U. (vaccine A), a single dose of about 7,000 H.U. (vaccine C) and two doses each of about 7,000 H.U. (vaccine C). In addition, a polyvalent vaccine from older strains of influenza virus A was used to find whether this would exert a protective effect. A vaccine of the influenza B type was used as a control.

Volunteers for these trials were forthcoming in public schools, teachers training colleges, a Royal Naval dockyard, the public services, a northern university and a pharmaceutical company in the midlands.

Field trials organised by the Committee in previous years had proved inconclusive because of a low incidence of influenza. During the 1957 trials the incidence of influenza was high, but the epidemic period was unusually early in the season and, in most of the groups under investigation, influenza began before the inoculations had been completed.

The results of the field trials of 1957 had therefore to be considered in relation to the interval between the inoculation of volunteers and the development of the epidemic in each area. For each of the public schools this information is shown separately in the note accompanying the Table on the following page.

RESULTS OF FIELD TRIALS

A. *Public Schools*

The vaccines used at the public schools were (1) An Asian type saline vaccine from the strain A/Singapore/1/57, with 20,000 H.U. per dose of 1 ml and 10 mg. of aluminium phosphate, to be given in one dose. (2) A polyvalent saline influenza A vaccine containing equal proportions of Swine PR.8 and FM.1 with 20,000 H.U. per dose of 1 ml and 10 mg. of aluminium phosphate, to be given in one dose. (3) An influenza B vaccine (1954) with 20,000 H.U. per dose of 1 ml and 10 mg. of aluminium phosphate, to be given in one dose.

Analysis of the results of the trials showed that, in the first eight days after inoculation, there was little difference between the influenza attack rates in the

Public Schools. Influenza Cases in Inoculated Boys According to the Length of Time Elapsing after Inoculation

Vaccine	School	Number of Boys Inoculated	Number of Cases Occurring			Cases Expressed as a Percentage of those Inoculated in Each Vaccine Group		
			Days after Inoculation			Days after Inoculation		
			1–8	9–15	16 and over	1–8	9–15	16 and over
						Per cent.	Per cent.	Per cent.
Asian	Canford School	75	2	7	—	2·7	9·3	—
	Epsom College	51	15	2	—	29·4	3·9	—
	Haileybury and I.S. College	139	23	10	2	16·5	7·2	1·4
	Marlborough College	97	51	10	—	52·6	10·3	—
	St. Lawrence College	42	4	4	3	9·5	9·5	7·1
	Trent College	64	36	—	—	56·3	—	—
	Total (excluding Trent College) ...	404	95	33	5	23·4	8·2	1·2
Polyvalent Virus A (Non-Asian)	Canford School	70	3	19	5	4·3	27·1	7·1
	Epsom College	62	16	17	1	25·8	27·4	1·6
	Haileybury and I.S. College	140	27	33	5	19·3	23·6	3·6
	Marlborough College	103	48	25	—	46·6	24·3	—
	St. Lawrence College	62	7	13	3	11·3	21·0	4·8
	Trent College	71	52	2	—	73·2	2·8	—
	Total (excluding Trent College) ...	437	101	107	14	23·1	24·5	3·2
Control Virus B	Canford School	73	4	23	4	5·5	31·5	5·5
	Epsom College	56	14	7	—	25·0	12·5	—
	Haileybury and I.S. College	143	18	43	5	12·6	30·1	3·5
	Marlborough College	100	55	21	—	55·0	21·0	—
	St. Lawrence College	57	3	12	7	5·3	21·1	12·3
	Trent College	62	43	—	—	69·4	—	—
	Total (excluding Trent College) ...	429	93	106	16	21·7	24·7	3·7

Canford School: Epidemic began 5th October, ended 19th October; whole school attack rate about 46 per cent. Inoculations 27th and 28th September with one or two boys a few days later.

Epsom College: Epidemic began 27th September, ended 13th October; whole school attack rate about 61 per cent. Inoculations 28th September.

Haileybury and I.S. College: Epidemic began about 21st September, ended about 16th October; whole school attack rate about 44 per cent. Inoculations 23rd, 24th, 26th and 27th September.

Marlborough: Epidemic began 22nd September, ended 4th October; whole school attack rate about 80 per cent. Inoculations 27th September.

St. Lawrence College (senior school): Epidemic began 1st October, ended 23rd October; whole school attack rate about 42 per cent. Inoculations mainly 29th September and 1st October, but some 13th October. Through a clerical error, not affecting the random allocation, rather fewer boys were given the Asian vaccine.

Trent College: Epidemic began 25th September, ended 6th October; whole school attack rate about 79 per cent. Inoculations 27th and 28th September. Excluded from the total, since the epidemic was over within the eight days after inoculations.

three vaccinated groups. In five of the schools a total of 309 boys inoculated with the Asian vaccine, 336 inoculated with the Asian vaccine, 336 inoculated with the polyvalent virus A vaccine and 336 inoculated with the virus B vaccine were not attacked by influenza within eight days of their inoculation. The subsequent attack rates in these groups were 12 per cent., 36 per cent. and 36 per cent. respectively. The protection given by the Asian vaccine (20,000 H.U. per dose) appeared to have been of the order of 67 per cent. There was no evidence to suggest that protection was conferred by the polyvalent virus A vaccine.

V] *Training Colleges*

The interpretation of the results at the teachers training colleges was subject to the same considerations as at the schools; the epidemic began a little before (or in one college a day after) the first inoculations were given.

Teachers Training Colleges, Influenza Cases in Inoculated Students in Five Centres according to the Length of Time Elapsing after Inoculation

Vaccine	Number of Students Inoculated	Number of Cases Occurring			Cases Expressed as a Percentage of those Inoculated in Each Vaccine Group		
		Days After Inoculation			Days After Inoculation		
		1–8	9–15	16 and over	1–8	9–15	16 and over
Asian	216	32	4	2	14·8	1·9	0·9
Control virus B ...	102	12	8	4	11·8	7·8	3·9

The vaccines used at the teachers training colleges were (1) An Asian type saline vaccine from the strain A/Singapore/1/57 with approximately 7,000 H.U. per dose of 1 ml and 10 mg. of aluminium phosphate, to be given in two such doses, the second to be given 28 days after the first. (2) The same as (1) but limited to one dose only. (3) An influenza B Vaccine as in A (3) above.

In some of the colleges the epidemic had passed before the second inoculations were due, in others these were given during the epidemic. In effect volunteers receiving two doses were in no better immunological position than those receiving a single dose and both sub-groups were accordingly considered as forming one group.

Subsequent to the eighth day the influenza attack rate in those given Asian-strain vaccine (7,000 H.U. approximately per dose) was 2·8 per cent. compared with 11·7 per cent. in the control group receiving virus B vaccine—an apparent protection of 75 per cent.

Miscellaneous centres

What has been said of the training colleges applies equally to the miscellaneous centres. The same vaccines were used and the overlap between inoculations and the occurrence of influenza made it impracticable to measure the effect of the second dose of Asian-strain vaccine (7,000 H.U. approximately per dose).

Consequently, all given this vaccine, whether in one or two doses, were regarded as forming a single group. The 1,308 volunteers observed at the " miscellaneous " centres included office, factory, dockyard and university resident staff, students at a university and members of an ambulance service—a diverse group, in the main adults living in their homes, drawn from a number of fields. In all these centres influenza was prevalent at some stage subsequent to the inoculations. In this group records were kept of absences from work both on account of influenza and from other respiratory infections.

The results of this trial

Miscellaneous Centres. Absences from Work Reported as due to (a) Influenza; (b) Other Respiratory Infections in Seven Centres according to the length of time elapsing after Inoculation

Vaccine	Number Inoculated	Number of Cases Occurring within Specified Intervals after Inoculation					
		1–8 Days		9–15 Days		16 Days and over	
		Number	Rate	Number	Rate	Number	Rate
				(*a*) Influenza			
			per cent.		per cent.		per cent.
Asian	861	10	1·2	9	1·0	42	4·9
Control virus B ...	447	2	0·4	4	0·9	46	10·3
				(*b*) Other Respiratory Infections			
			per cent.		per cent.		per cent.
Asian	861	9	1·0	5	0·6	41	4·8
Control virus B ...	447	2	0·4	2	0·4	27	6·0

indicated a 52 per cent. protection against influenza of those receiving the Asian-strain vaccine. The incidence of respiratory infections other than influenza was not significantly different between the two groups.

For the protection of priority groups the Ministry of Health arranged for the manufacture of an Asian-strain vaccine containing about 7,000 H.U. per dose. During October and November, 1957, the Wright Fleming Institute manufactured some 400,000 doses for distribution to hospitals through one of the pharmaceutical companies and another company prepared 200,000 doses. The whole of this supply was made available to the hospital service.

X

CONTROL OF INFLUENZA

From what has been written in this Report the idea of control of influenza may seem rather to be the expression of a hope than of a practical issue. But there are grounds for restrained optimism.

An important observation made by the Medical Research Council's Committee on the field trials which have just been reviewed in the preceding chapter was that relating to the protection provided by an A/Asian vaccine of suitable strength on young male volunteers. Eight days after vaccination, vaccinated groups showed significantly fewer cases of influenza than did control groups. This result was achieved while the epidemic was in progress, in spite of which a substantial degree of protection was attained, the protection ratios varying between 52 per cent. and 75 per cent. That vaccine may be used in the control of an outbreak already in progress is a new idea which is worthy of further consideration and investigation.

Further encouragement can be obtained by a study of the following chronological table of events relating to the spread of the A2/Asian virus in the first two phases of the pandemic.

Phase 1: Anticipation, 6th May, 1957 to 17th June, 1957

February	Drs. Tang and Chu, Peking, isolated the new variant
17th April	Report in the New York Times
6th May	First report to W.H.O. from Dr. Hale, Singapore
6th June	First report of importation to the United Kingdom

Vaccine Preliminaries

17th May	A2/Singapore/1/57 Virus reached the National Institute of Medical Research, London
24th May	Announcement of biological characters
28th May	Strains issued to manufacturers

Phase 2: Dissemination, 17th June, 1957 to 31st August, 1957

17th June	First proved outbreak in the United Kingdom 11/57 Pakistani naval ratings who arrived by air on 13th June
28th June	First proved indigenous case
July (early)	Outbreaks in troops and airmen
10th July	First outbreak in jamboree camps
15th July (onwards)...	Several indigenous cases known
1–14th August ...	27 outbreaks reported from certain groups
21st August	First outbreak—Sheffield
24th August ...	Widespread outbreak in Schools—Colne

Vaccine Trials

25th July	Results (serology) 3 weeks after 1 inoculation
26th August ...	Results (serology) after 2 inoculations

Significant points in this chronology are as follows: The new variant was isolated in China in February, 1957, but it was not until 6th May that the first report reached the World Health Organization from Singapore. There was thus a delay of over two months between the first isolation of the virus and its notification to the World Health Organization. Twenty-two days after the notification of the strain of virus to the World Health Organization subcultures of the virus were being sent out to vaccine manufacturers in the United Kingdom. Manufacturers had then a month to produce the first batches of vaccine in commercial quantity before the first indigenous cases were reported.

Had the new strain been made available to the World Health Organization as soon as it had been identified in February, two months would have been gained. In this country, had subsequent events followed the above chronological sequence or something very close to it, the new virus could have been issued to vaccine manufacturers early in April, nearly a month before the first importation into the United Kingdom and over six weeks before the appearance of indigenous cases there.

These observations point to the strategy which might be adopted under the threat of invasion by a new influenza virus; namely, in the early stages to delay by all the reasonable measures available the spread of the infection for as long as possible so as to give time for the preparation of vaccines effective in its control. This can only be feasible if the new strain makes its appearance in a distant country. This involves—

(*a*) obtaining as early warning as possible
(*b*) preparing the appropriate vaccine
(*c*) immunizing priority groups
(*d*) the isolation, usually at home, of patients suffering from the disease
(*e*) the issue to contacts of advice regarding their personal conduct aimed at delaying the spread of infection.

The priority groups for immunization comprise the key personnel of departments of security transport and health; hospital staffs and those engaged in essential occupations. Priority should also be given to those at special risk from complications, such as persons suffering from cardio-vascular disease, renal disease, disease of the lung and diabetes as well as to pregnant women who are known to be specially vulnerable to pulmonary complications.

As supplies of vaccine become more plentiful issue could be made on demand. In this country vaccine became available to patients under the National Health Service some months after the beginning of the epidemic and vaccine is still available as provision against future outbreaks due to the A/2 strain.

As a long-term policy there are the arrangements made by the World Health Organization for the continual surveillance of influenza throughout the world. A similar surveillance should be maintained in every country which has the means to carry it out, and so far as possible brought into the World Health Organization's programme.

The measures adopted in this country for the early reporting of winter epidemics may be put into action elsewhere. They are, briefly:

Arrangements made with selected general practitioners (influenza spotters) to report to the local Medical Officer of Health the first cases of influenza in their practice; arrangements made with local Registrars to draw the attention

of the appropriate Medical Officers of Health to excessive numbers of deaths ascribed to pneumonia, bronchitis or influenza and the arrangements whereby officers in charge of the local offices of the Ministry of Pensions and National Insurance inform Medical Officers of Health when the first claims for sickness show an increase of 30 per cent. above the figure for the preceding week or reach 250 per cent. of the average weekly number of new claims for the previous 35 weeks.

Under favourable circumstances there is thus the possibility of at least mitigating the disruptive effects of an influenza pandemic. This, in itself, would be a step forward in our control of the situation and augurs well for further progress directed at reducing the mortality from the disease.

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APPENDIX

TABLE A

Deaths from All Causes, Influenza, Pneumonia and Bronchitis by quarters (Persons)

England and Wales—July, 1950–June, 1958

Year and Quarter	All causes	Influenza	Pneumonia	Bronchitis
1950				
September	102,871	102	2,214	2,872
December	135,348	690	4,694	8,715
1951				
March	205,838	14,993	11,986	22,315
June	121,683	388	4,037	5,869
September	99,960	96	2,414	2,728
December	121,899	332	4,059	6,073
1952				
March	146,947	853	6,819	10,423
June	115,366	334	3,710	4,616
September	98,612	71	2,363	2,483
December	136,559	492	5,716	9,746
1953				
March	171,351	5,646	10,421	17,188
June	114,642	470	3,791	4,702
September	98,544	60	2,251	2,530
December	118,992	289	4,296	5,972
1954				
March	153,120	708	7,258	11,505
June	117,205	180	3,668	4,817
September	104,114	72	2,575	3,013
December	127,457	851	4,578	6,208
1955				
March	168,647	2,183	8,968	13,442
June	124,230	479	4,476	6,028
September	101,676	45	2,660	2,635
December	124,311	276	4,890	6,688
1956				
March	170,292	2,104	10,358	15,274
June	120,059	203	4,302	5,174
September	104,131	65	2,848	2,946
December	126,849	254	4,863	6,276
1957				
March	134,557	357	6,159	8,262
June	118,122	131	4,271	4,753
September	110,037	998	3,655	3,361
December	152,154	5,230	8,719	10,559
1958				
March	163,595	1,892	9,762	13,261
June	124,168	226	5,029	5,557

APPENDIX

TABLE B

New claims to sickness benefit under the National Insurance Act

England and Wales—July, 1950 to June, 1958

Quarter	New claims to Sickness Benefit	Quarter	New claims to Sickness Benefit
1950			
September	1,162,100		
December	1,548,600		
1951		1955	
March	2,967,300	March	2,470,900
June	1,312,300	June	1,437,700
September	1,127,700	September	1,230,300
December	1,384,700	December	1,603,700
1952		1956	
*March	1,911,600	*March	2,612,000
June	1,277,300	June	1,426,900
September	1,211,400	September	1,260,200
December	1,607,000	December	1,610,500
1953		1957	
March	2,522,600	*March	2,045,600
June	1,342,500	June	1,440,600
September	1,170,500	September	1,647,200
December	1,560,000	December	3,542,900
1954		1958	
March	2,077,100	March	2,271,500
June	1,350,600	June	1,525,300
September	1,179,400		
December	1,748,900		

* Includes last week of previous quarter.

APPENDIX

TABLE C

Corrected notifications of pneumonia by quarters

England and Wales—July, 1950 to June, 1958

Year	Quarter			
	March	June	September	December
1950	—	—	3,303	6,930
1951	26,387	6,896	3,404	6,538
1952	12,786	6,617	3,327	8,981
1953	19,923	6,859	3,110	7,306
1954	10,328	5,525	3,315	7,374
1955	13,193	6,612	2,631	5,463
1956	12,754	5,201	2,600	4,877
1957	8,215	4,784	4,622	15,074
1958	10,717	4,476	—	—

TABLE D

New Claims to Sickness Benefit under the National Insurance Act

England and Wales. Standard Regions. July, 1957 to June, 1958

Week ended	Standard Regions											
	England and Wales	Northern	East and West Ridings	North Western	North Midland	Midland	Eastern	London and South Eastern		Southern	South Western	Wales
								London and Middlesex	Remainder			
1957												
July 2nd...	93,900	8,100	10,700	16,200	7,400	9,400	5,200	11,800	8,400	4,400	5,100	7,300
„ 9th ...	94,700	8,100	10,900	15,000	7,500	9,300	5,600	12,300	9,200	4,600	5,400	6,700
„ 16th ...	88,500	7,900	10,200	14,300	7,100	8,400	5,100	11,400	8,000	4,400	5,100	6,700
„ 23rd ...	87,600	7,900	10,000	15,000	7,100	8,500	4,900	10,900	7,900	4,200	4,900	6,400
„ 30th ...	88,800	8,100	10,600	15,200	6,900	8,500	4,700	11,100	7,800	4,100	4,800	6,900
Aug. 6th†	65,900	6,500	7,200	12,200	4,900	5,000	3,400	8,500	6,000	3,100	3,600	5,600
„ 13th ...	90,400	8,500	10,000	16,800	6,600	6,900	5,000	11,900	8,400	4,200	5,200	6,900
„ 20th ...	94,700	8,500	10,700	16,500	7,500	9,500	5,000	11,600	8,300	4,200	5,200	7,500
„ 27th ...	103,700	9,400	13,100	18,100	8,600	10,500	5,400	12,200	8,800	4,500	5,200	7,800
Sept. 3rd ...	120,100	10,600	17,800	23,300	9,800	11,300	5,800	13,300	9,500	4,500	5,400	8,800
„ 10th ...	150,200	13,900	26,200	31,600	11,700	12,700	6,600	14,900	10,100	5,100	5,800	11,600
„ 17th ...	199,900	20,300	33,600	49,600	15,400	15,700	7,500	16,800	11,600	5,400	6,600	17,400
„ 24th ...	368,800	42,600	60,700	98,700	29,300	30,400	11,700	25,600	17,400	8,200	10,500	33,600
Oct. 1st ...	452,300	51,700	58,900	110,800	39,800	45,600	18,000	36,600	25,300	12,800	17,100	35,800
„ 8th ...	471,000	46,900	43,600	91,600	40,400	55,300	25,800	50,600	39,100	18,800	27,800	31,200
„ 15th ...	451,700	33,600	31,100	62,800	34,800	49,700	31,900	65,500	54,800	26,300	36,400	24,800
„ 22nd...	352,000	22,400	23,400	41,800	24,400	33,600	27,100	57,800	48,500	24,700	29,400	18,900
„ 29th ...	269,900	16,700	20,000	32,100	18,400	23,800	21,200	45,200	37,400	19,000	20,700	15,400
Nov. 5th ...	199,200	13,600	17,200	26,100	14,100	17,000	14,900	32,400	25,100	12,800	13,500	12,500
„ 12th ...	167,000	13,300	16,700	26,400	12,400	14,800	11,100	23,700	18,200	9,100	9,700	11,500
„ 19th ...	166,400	13,500	16,900	28,600	12,700	15,400	10,100	22,600	16,600	8,700	9,700	11,800
„ 26th ...	169,900	13,100	16,500	29,500	12,800	15,700	10,200	23,400	17,600	8,900	10,100	12,100
Dec. 3rd ...	178,000	12,800	16,300	28,500	13,100	16,300	11,300	27,100	20,200	9,600	10,600	12,100
„ 10th ...	189,100	12,300	16,800	28,900	13,500	16,900	12,400	31,800	23,400	10,400	11,100	11,600
„ 17th ...	166,500	11,500	14,400	25,500	12,200	14,700	11,500	26,700	20,000	9,500	9,800	10,800
„ 24th *	309,900	24,800	30,700	47,100	25,700	27,400	20,500	45,300	34,900	14,700	15,900	22,900

TABLE D—(*contd.*)

Week ended	Standard Regions											
	England and Wales	Northern	East and West Ridings	North Western	North Midland	Midland	Eastern	London and South Eastern		Southern	South Western	Wales
								London and Middlesex	Remainder			
1958												
Jan. 7th ...	271,100	18,700	27,000	38,700	22,000	24,600	18,200	44,100	31,300	13,900	14,900	17,700
„ 14th ...	230,000	19,500	24,500	35,400	18,600	20,500	15,400	34,400	24,200	11,200	12,300	14,000
„ 21st ...	200,300	17,000	21,900	32,500	17,100	18,600	12,900	27,600	19,900	9,300	10,900	12,600
„ 28th ...	205,100	19,100	22,600	35,000	17,300	18,700	12,400	25,500	19,600	9,500	11,300	14,200
Feb. 4th ...	194,800	17,800	21,800	32,200	17,400	18,600	11,700	24,300	18,400	9,200	10,500	12,900
„ 11th ...	187,200	17,000	21,100	32,300	16,200	17,700	11,100	23,100	17,600	8,600	9,800	12,600
„ 18th ...	181,100	16,800	21,000	32,000	15,300	17,500	10,300	21,700	16,300	8,200	9,500	12,600
„ 25th ...	159,300	14,300	17,800	28,200	12,600	15,900	9,100	19,700	14,600	7,100	8,500	11,400
Mar. 4th ...	172,200	15,600	21,100	31,300	14,500	16,800	9,800	20,700	15,200	7,200	8,300	11,600
„ 11th ...	151,600	13,900	17,100	27,000	12,000	14,900	8,400	19,000	13,900	6,500	7,700	11,000
„ 18th ...	159,200	15,400	17,500	28,100	12,200	15,600	8,800	19,800	14,400	6,900	8,600	12,000
„ 25th ...	159,600	14,400	17,000	28,500	12,100	15,700	8,800	20,400	15,000	7,000	8,600	12,000
April 1st ...	161,200	13,900	17,200	29,500	12,100	16,000	8,800	21,100	15,000	7,300	8,600	11,700
„ 8th†	96,400	9,100	12,100	16,800	7,700	10,200	4,900	10,800	8,100	3,700	4,800	8,200
„ 15th ...	152,200	13,700	15,700	27,200	11,100	14,500	8,600	19,800	14,300	6,900	8,300	12,100
„ 22nd...	142,900	12,800	15,300	24,600	10,700	14,400	8,000	18,500	13,500	6,400	7,900	10,800
„ 29th ...	135,600	11,900	14,400	22,800	10,500	13,700	7,700	17,800	12,700	6,100	7,500	10,300
May 6th ...	123,500	11,300	13,900	20,400	9,700	12,400	6,900	15,800	11,400	5,600	6,800	9,400
„ 13th ...	113,100	10,600	12,400	18,600	8,800	11,000	6,600	14,300	10,600	5,200	6,300	8,800
„ 20th ...	104,100	10,100	11,400	17,400	8,200	10,000	6,000	13,400	9,400	4,700	5,700	7,900
„ 27th†	85,000	8,500	10,100	14,700	6,900	7,800	4,600	9,900	7,200	3,700	4,400	7,100
June 3rd ...	105,700	10,200	11,700	17,000	8,200	9,800	6,100	13,000	9,500	5,000	6,000	9,200
„ 10th ...	106,500	9,600	11,800	18,100	8,500	10,800	6,000	12,800	9,300	4,800	6,100	8,800
„ 17th ...	99,700	9,000	11,800	16,500	7,900	10,000	5,500	12,100	8,900	4,600	5,400	8,100
„ 24th ...	99,400	9,100	11,700	16,100	8,300	9,900	5,700	11,800	8,700	4,600	5,400	8,100

* The local offices of the Ministry of Pensions and National Insurance were closed on 25th and 26th December. The figures are combined for the weeks ended 24th and 31st December, 1957.

† Bank Holidays.

APPENDIX

TABLE E

Original notifications of pneumonia by week

England and Wales and Standard Regions—July, 1957 to June, 1958

Week ended	England and Wales	Standard Regions									
		Northern	East and West Ridings	North Western	North Midland	Midland	Eastern	London and South Eastern	Southern	South Western	Wales
1957											
July 6th	266	20	41	40	23	30	20	43	17	15	17
„ 13th	197	9	52	21	14	25	9	36	5	15	11
„ 20th	156	14	26	15	16	20	11	29	8	10	7
„ 27th	172	13	22	25	15	29	7	26	5	20	10
August 3rd	167	10	21	18	15	17	10	30	9	17	20
„ 10th	179	11	33	33	19	16	11	31	7	8	10
„ 17th	223	14	48	24	20	25	10	50	10	11	11
„ 24th	176	22	39	23	12	22	4	33	10	8	3
„ 31st	184	13	39	26	15	29	4	35	6	8	9
September 7th... ...	206	16	46	37	13	22	12	30	11	6	13
„ 14th... ...	333	22	87	80	25	18	10	52	6	14	19
„ 21st	702	75	183	192	46	63	25	51	6	17	44
„ 28th... ...	1,367	120	389	326	108	103	27	125	25	37	107
October 5th	1,880	223	362	438	148	178	91	247	35	71	87
„ 12th	2,275	279	313	406	189	300	136	329	78	135	110
„ 19th	2,280	168	243	300	204	278	142	515	127	196	107
„ 26th	1,897	132	154	154	157	235	115	581	111	178	80
November 2nd ...	1,443	35	98	106	69	135	181	477	86	156	100
„ 9th... ...	742	28	55	72	55	61	92	235	52	63	29
„ 16th... ...	623	32	67	73	25	54	52	197	34	54	35
„ 23rd... ...	499	39	75	61	33	53	41	107	23	39	28
„ 30th... ...	486	35	79	56	19	42	31	105	53	42	24
December 7th... ...	649	59	90	72	55	49	51	159	40	50	24
„ 14th... ...	778	67	119	69	43	68	45	210	40	64	53
„ 21st	703	67	86	67	29	69	48	203	25	52	57
„ 28th... ...	755	69	120	87	49	80	47	188	23	45	47

TABLE E—(*contd.*)

Week ended	England and Wales	Standard Regions									
		Northern	East and West Ridings	North Western	North Midland	Midland	Eastern	London and South Eastern	Southern	South Western	Wales
1958											
January 4th	1,341	100	166	115	104	130	103	377	66	61	119
„ 11th	1,292	86	171	107	81	94	88	391	78	95	101
„ 18th	1,059	118	137	61	92	85	80	305	59	72	50
„ 25th	917	73	147	82	66	91	64	241	33	65	55
February 1st	909	78	138	78	92	88	74	203	36	75	47
„ 8th	1,023	60	156	80	103	131	63	283	46	64	37
„ 15th	882	63	133	86	75	87	70	191	56	65	56
„ 22nd	793	37	88	80	81	131	75	166	32	60	43
March 1st	773	62	129	80	63	102	44	166	31	60	36
„ 8th	690	47	108	84	53	65	79	134	46	35	39
„ 15th	537	47	65	47	29	68	39	115	20	71	36
„ 22nd	514	41	83	64	34	56	31	109	25	38	33
„ 29th	621	30	80	103	41	59	44	133	36	59	36
April 5th	534	36	85	59	46	50	30	126	30	47	25
„ 12th	585	39	79	60	51	62	45	145	25	41	38
„ 19th	556	51	97	52	45	46	39	113	29	40	44
„ 26th	507	62	66	41	47	49	27	115	26	42	32
May 3rd	425	51	66	39	22	57	24	92	10	40	24
„ 10th	304	23	42	36	22	28	27	78	9	18	21
„ 17th	243	25	37	34	15	22	18	42	11	21	18
„ 24th	255	16	43	28	15	33	14	63	12	15	16
„ 31st	238	22	32	29	16	22	21	49	13	19	15
June 7th	264	19	39	36	17	26	21	51	13	19	23
„ 14th	247	21	37	27	15	25	13	61	10	20	18
„ 21st	214	18	36	24	11	24	11	47	8	20	15
„ 28th	218	16	39	23	13	22	21	52	7	13	12

APPENDIX

TABLE F

Deaths from all causes, influenza, pneumonia and bronchitis by week

(*a*) *Great Towns—July*, 1957 *to March*, 1958
(*b*) *England and Wales—July*, 1957 *to June*, 1958

(England and Wales figures for July to December, 1957 are calculated)

Week ended	All causes		Influenza		Pneumonia		Bronchitis	
	Great Towns	England and Wales	Great Towns	England and Wales	Great Towns	England and Wales	Great Towns	England and Wales
1957								
July 6th	4,920	8,777	5	10	221	367	145	260
,, 13th	4,283	7,641	1	2	139	231	144	259
,, 20th	4,350	7,760	—	1	140	232	120	215
,, 27th	4,439	7,919	3	6	137	228	115	207
August 3rd	4,552	8,121	—	—	155	257	142	255
,, 10th	4,365	7,787	2	4	144	235	127	225
,, 17th	4,276	7,628	2	4	132	216	132	234
,, 24th	4,365	7,787	6	12	138	226	115	203
,, 31st	4,474	7,982	2	4	144	235	120	212
September 7th ...	4,689	8,365	8	16	177	244	128	212
,, 14th ...	4,692	8,371	47	91	245	337	158	261
,, 21st ...	5,211	9,296	121	235	273	376	188	311
,, 28th ...	5,410	9,652	282	549	418	576	276	456
October 5th	6,070	10,713	442	727	493	669	347	549
,, 12th	6,761	11,900	592	973	572	777	461	730
,, 19th	6,544	11,518	607	998	552	750	502	795
,, 26th	6,263	11,024	399	656	507	689	478	757
November 2nd ...	5,706	10,043	263	432	406	551	315	499
,, 9th ...	5,661	9,964	149	284	306	451	333	517
,, 16th ...	5,779	10,172	102	194	328	484	332	515
,, 23rd ...	5,947	10,468	70	133	353	521	309	480
,, 30th ...	6,248	10,997	84	161	338	499	464	721
December 7th ...	6,999	12,319	88	163	468	685	673	1,100
,, 14th ...	7,448	13,110	99	183	566	828	840	1,373
,, 21st ...	7,724	13,595	82	152	586	857	823	1,346
,, 28th ...	7,221	12,710	89	165	629	920	736	1,203
1958								
January 4th... ...	8,206	14,238	143	292	752	1,233	905	1,421
,, 11th... ...	8,129	14,375	155	315	678	1,177	871	1,398
,, 18th... ...	7,987	13,853	109	243	575	1,032	815	1,253
,, 25th... ...	7,702	13,402	107	217	581	992	798	1,239
February 1st ...	7,927	14,136	97	204	604	1,087	805	1,231
,, 8th ...	7,003	12,630	75	184	493	891	678	1,085
,, 15th ...	7,272	13,118	49	129	509	944	629	1,023
,, 22nd ...	6,294	11,523	38	101	430	819	494	834
March 1st	6,287	11,366	49	112	389	740	497	832
,, 8th	6,430	11,601	37	76	401	722	478	793
,, 15th	6,295	11,462	38	79	386	693	449	747
,, 22nd	6,558	12,019	28	69	382	706	452	807
,, 29th	7,082	12,777	29	72	443	838	489	846

TABLE F—(*contd.*)

Week ended	All causes		Influenza		Pneumonia		Bronchitis	
	Great Towns	England and Wales	Great Towns	England and Wales	Great Towns	England and Wales	Great Towns	England and Wales
April 5th	—	11,452	—	47	—	764	—	698
„ 12th	—	11,404	—	57	—	727	—	734
„ 19th	—	11,611	—	45	—	702	—	703
„ 26th	—	10,673	—	35	—	654	—	518
May 3rd	—	9,977	—	23	—	529	—	492
„ 10th	—	9,041	—	19	—	435	—	362
„ 17th	—	8,721	—	15	—	376	—	306
„ 24th	—	9,208	—	14	—	364	—	313
„ 31st	—	8,802	—	14	—	321	—	308
June 7th	—	8,837	—	7	—	348	—	302
„ 14th	—	8,640	—	9	—	328	—	285
„ 21st	—	8,558	—	8	—	342	—	299
„ 28th	—	8,370	—	11	—	314	—	272

APPENDIX

TABLE G

Deaths from all causes, influenza, pneumonia and bronchitis by age, sex, and month of occurrence

England and Wales—July, 1957 to June, 1958

Age		July	August	September	October	November	December	January	February	March	April	May	June
ALL CAUSES													
All ages	M.	18,024	18,095	20,222	25,946	23,480	30,691	32,001	24,853	27,201	23,523	20,223	17,465
	F.	16,844	16,908	18,761	23,480	21,511	27,964	29,427	23,679	25,842	23,208	19,371	16,916
0–4 weeks	M.	557	574	542	576	540	617	668	568	627	572	579	520
	F.	377	407	420	431	410	414	453	400	430	409	446	357
4 weeks–1 year ...	M.	156	175	182	201	220	317	345	303	299	251	186	134
	F.	135	147	141	167	183	256	282	285	217	186	131	116
1–	M.	103	87	105	165	110	136	158	121	125	122	98	92
	F.	86	68	104	108	87	114	124	86	88	101	68	56
5–	M.	154	156	178	200	98	115	125	95	122	141	143	110
	F.	87	72	151	168	71	83	99	74	89	92	71	61
15–	M.	305	247	270	320	235	262	225	158	204	206	209	146
	F.	108	114	166	197	92	131	125	115	107	110	85	85
25–	M.	844	913	957	1,153	925	1,194	1,096	912	942	892	916	733
	F.	660	661	831	915	721	806	857	678	691	700	685	584
45–	M.	5,257	5,043	5,995	7,574	6,477	8,312	8,571	6,701	7,128	6,268	5,647	4,887
	F.	3,270	3,280	3,725	4,536	3,928	4,760	4,773	3,938	4,275	3,877	3,683	3,171
65–	M.	4,962	5,053	5,723	7,728	6,722	8,844	9,251	6,868	7,492	6,614	5,534	4,854
	F.	4,166	4,196	4,804	6,157	5,472	6,910	7,295	5,597	6,258	5,644	4,734	4,207
75 and over	M.	5,686	5,847	6,270	8,029	8,153	10,894	11,562	9,127	10,262	8,457	6,911	5,989
	F.	7,955	7,963	8,419	10,801	10,547	14,490	15,419	12,506	13,687	12,089	9,488	8,279

TABLE G—(*contd.*)

Age		July	August	September	October	November	December	January	February	March	April	May	June
						INFLUENZA							
All ages	M.	12	9	564	1,937	446	359	534	247	153	80	23	10
	F.	1	18	531	1,591	381	430	529	240	144	69	22	13
0–4 weeks	M.	—	—	—	2	1	2	1	—	—	—	—	—
	F.	—	—	1	2	—	—	—	—	1	—	—	—
4 weeks–1 year ...	M.	1	—	9	15	3	5	4	4	1	2	—	—
	F.	—	1	5	15	4	2	9	3	—	1	—	1
1–	M.	—	—	17	25	6	3	8	1	—	2	—	—
	F.	—	—	10	17	4	4	4	—	1	—	1	—
5–	M.	—	—	42	54	5	4	6	—	1	2	—	—
	F.	—	1	57	72	4	3	7	2	—	—	—	—
15–	M.	—	—	40	70	5	7	5	4	4	3	—	—
	F.	—	2	46	81	5	12	2	4	1	4	—	—
25–	M.	—	3	58	133	25	17	31	17	7	5	2	2
	F.	—	1	85	148	20	24	20	10	13	1	2	1
45–	M.	3	2	222	693	155	105	161	86	49	27	10	3
	F.	—	2	132	381	93	95	101	53	17	10	1	3
65–	M.	5	3	131	579	132	112	159	63	38	17	7	3
	F.	1	5	115	404	88	111	141	53	34	15	9	1
75 and over	M.	3	1	45	366	114	104	159	72	53	22	4	2
	F.	—	6	80	471	163	179	245	115	77	38	9	7

TABLE G—(*contd.*)

Age		July	August	September	October	November	December	January	February	March	April	May	June
						PNEUMONIA							
All ages	M.	488	518	900	1,619	1,076	1,869	2,047	1,410	1,429	1,127	671	560
	F.	499	441	819	1,375	972	1,956	1,974	1,457	1,421	1,249	677	515
0–4 weeks	M.	—	—	—	—	—	—	—	—	—	—	—	—
	F.	—	—	—	—	—	—	—	—	—	—	—	—
4 weeks–1 year ...	M.	32	40	45	60	70	126	126	116	111	75	43	28
	F.	28	29	42	42	46	91	115	109	89	64	42	31
1–	M.	9	5	18	27	10	21	37	19	26	24	12	9
	F.	12	10	15	21	15	30	19	21	19	20	9	8
5–	M.	3	2	18	22	7	8	6	2	9	5	3	3
	F.	5	3	23	15	6	7	7	5	13	6	6	2
15–	M.	8	7	10	22	7	8	11	7	4	9	6	3
	F.	2	—	19	9	1	7	5	8	5	4	1	1
25–	M.	15	5	39	60	28	49	36	33	28	23	15	19
	F.	7	11	48	50	16	45	45	25	15	22	10	13
45–	M.	92	80	234	424	215	401	438	270	263	199	107	79
	F.	51	34	136	229	117	260	235	149	157	128	61	53
65–	M.	109	132	216	461	292	539	532	347	358	293	175	136
	F.	88	87	181	360	226	417	445	297	284	268	137	93
75 and over	M.	220	247	320	543	447	717	861	616	630	499	310	283
	F.	306	267	355	649	545	1,099	1,103	843	839	737	411	314

TABLE G—(*contd.*)

Age		July	August	September	October	November	December	January	February	March	April	May	June
BRONCHITIS													
All ages	M.	733	702	1,041	2,091	1,746	3,684	3,952	2,550	2,389	1,857	1,032	883
	F.	250	262	406	885	671	1,673	1,876	1,284	1,122	837	459	321
0–4 weeks	M.	—	—	1	1	1	2	—	3	2	1	—	—
	F.	1	—	—	1	2	1	1	3	—	1	1	—
4 weeks–1 year ...	M.	5	10	6	8	12	23	31	22	27	16	13	3
	F.	7	5	5	8	6	16	25	24	16	12	7	3
1–	M.	3	1	4	6	7	6	12	6	3	1	7	2
	F.	3	—	2	4	2	8	6	2	3	3	2	1
5–	M.	—	2	2	5	—	1	4	2	3	1	1	3
	F.	—	2	8	5	1	2	2	—	2	2	1	1
15–	M.	1	1	—	2	2	3	4	3	1	2	3	—
	F.	—	3	3	4	—	2	—	5	1	1	—	1
25–	M.	7	14	12	27	21	43	44	32	30	20	11	11
	F.	9	6	14	19	9	22	24	7	14	17	9	3
45–	M.	205	185	366	693	573	1,210	1,309	788	718	539	279	250
	F.	37	38	80	140	100	287	329	190	180	112	62	59
65–	M.	275	275	362	813	617	1,294	1,425	873	844	670	367	314
	F.	65	80	121	271	184	476	488	361	280	214	122	84
75 and over	M.	237	214	288	536	513	1,102	1,123	821	761	607	351	300
	F.	128	128	173	433	367	859	1,001	692	626	475	255	169

TABLE H

Corrected notifications of pneumonia by sex and age by quarters

England and Wales—July, 1957 to June, 1958

	Males				Females			
	Sept. Qtr., 1957	Dec. Qtr., 1957	March Qtr., 1958	June Qtr., 1958	Sept. Qtr., 1957	Dec. Qtr., 1957	March Qtr., 1958	June Qtr., 1958
All ages ...	2,610	8,201	5,846	2,508	2,012	6,873	4,871	1,968
0–	271	697	1,106	278	211	551	913	242
5–	339	742	516	295	296	708	450	231
15–	734	1,936	1,071	606	641	1,921	879	435
45–	811	2,993	1,836	779	480	1,878	1,253	481
65 and over ...	437	1,738	1,245	521	361	1,744	1,331	550
Unknown ...	18	95	72	29	23	71	45	29

(88451) Wt. 3548—9277 K16 3/60 D.L./HE/7.

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Asian Influenza

Share

08 July 1957

Volume 204

4.59 p.m.

VISCOUNT STANSGATE

rose to ask Her Majesty's Government when they will be prepared to make a comprehensive statement on the epidemic of Asian influenza and measures taken against it. The noble Viscount said; My Lords, my Question is a simple one: to ask Her Majesty's Government to make a comprehensive statement on the epidemic of Asian influenza and measures taken against it. It will be observed that this is a matter which does not touch the controversies that divide the two sides of the House except for one interesting point that for the first time we have heard from the Government Front Bench that "China" meant Formosa, which will certainly be a surprise, considering that the Government of China at Pekin has been recognised by Her Majesty's Government for many years. Apart from that, there is no point of political controversy at all.

Share

What I am asking is, what are Her Majesty's Government going to do? I hope I am not going to get the simple answer that they are taking precautions at the docks. No doubt that is part of the scheme of defence. But this is something much wider. Mr. Ritchie Calder's

article in the *New Statesman* was very informative. He said that any aircraft can now carry this infection and that it has turned up in the most surprising parts of the world. It has actually got to America, Australia and South Africa. Therefore I hope that we may have a comprehensive statement from the noble Earl.

The first question I ask is; what is the gravity of this outbreak? Having read the World Health Organisation bulletins which are issued on this matter, and *The Times* and other sources of information, I find that no one will say with certainty how fatal this disease is. That it is very widespread and very catching—there have been half-a-million cases in Hong Kong alone—is clear. Many noble Lords will remember the epidemic which followed the First World War, and which actually had a death roll of 15 million people in the world. This matter, therefore, certainly deserves very careful attention by the Government. The only thing in this connection that I have seen is a statement that we are preparing some form of prophylactic or antibiotic, or whatever it may be, and distributing it throughout the world.

We have, of course, an Influenza Research Branch of our own; it is at Mill Hill and Dr. Andrews is in charge. I believe there are others in other parts of the world but ours stands high. I am emphasising that this is not what we used to call a local government board job. That is why we have a world organisation to deal with it. I understand that forty-six public laboratories are to be supplied with this specially distilled—if that is the word—prophylactic remedy. Of course, the natural machine for all this work is the World Health Organisation. Of all the international organisations that have come into being since the Second World War, the World Health Organisation has perhaps been the most directly productive of happiness for mankind.

Now to come to the controversial point of my question. I asked, what we were doing about China. I must say that I was astounded at the reply—given, I think, by the noble Earl, Lord Gosford—to the effect that if they care to send any information about their influenza we shall be very glad to receive it. What an extraordinary statement to make! I asked him specifically in my question: "Is it a fact that this thing has been raging (raging is one of the words that has been used) in China?" He said: "I do not know, but if any information is sent to us it will be very carefully considered."

The Times on June 13 published a statement from Sir Macfarlane Burnet who is, I believe, a great expert. He has now gone to Geneva to the conference which is being held there. There have also been statements made in the *New Statesman* by two other eminent scientists. We know that the disease reached Hong Kong from somewhere, and we are told

that in the defence of world health the best we can do is to receive gratefully anything that comes in the post with the China postmark upon it. That really is not treating the subject as seriously as it deserves. Obviously, China should be, either temporarily or permanently, a member of the World Health Organisation. There are political difficulties but I am not raising that matter now. I am not asking the House to take any side on the question as to whether America or ourselves are right about recognition of Pekin. What I am saying is: Here is a machine; can you use it?

One of my Parliamentary Questions was: "Can a country be a member of the World Health Organisation without being a member of U.N.O.?" The answer given was, "Yes." Four or five countries were named by the noble Earl, Lord Gosford, who said that they are in the World Health Organisation but that, for political reasons, we could not have them in U.N.O. at the present time. If that is the case with regard to such countries as Viet Nam or Korea or somewhere else, why cannot it be the case with China? This is a serious question about the health of mankind. I hope that in the statement which is to be made on behalf of the Government there may be some encouraging word, some suggestion of improvisation of a way by which this scientific international machinery can be used for the protection of the health of mankind.

I put this specific question to the noble Earl, Lord Home: "Will you put China" (by "China" I am afraid I mean the same thing as the British Foreign Office mean by China)—" will you put Pekin or China on the list as well as the forty-six stations who are to receive these preparations?" I ask that question. I suggest that it was implied in my previous Question. But I asked it at about a quarter to three and I sincerely trust that now I may have an answer to it. Really, if we are to enlarge and glorify this House, Ministers must learn that they are there to answer questions. That is what is called Parliamentary government.

I would add this. People speak as if we are offering a favour or recognizing China by taking this; information from her. Certainly it is vital to us if we are to protect our own people And what about China herself? I say it is just as much our duty to protect the health of millions of Chinese as it is to protect the health of the rest of the world. What is the good of standing together, talking about "a Christian world", if we are going to leave 630 million people without assistance; if we are going to pass by on the other side? I inquired this morning how many fully qualified doctors there are in China. I was told, 20,000. And there are 630 million people. They are struggling, with success, to reconstruct their society and to build up the happiness of their people. So I ask the Government to tell us whether they will make available for China whatever they are making available in the international

sphere. They cannot do it singly; they must do it through their international organisation and they must, by some means, improvise a way in which the rupture or crack which has followed the dispute about recognition of Pekin is made good for the public weal.

5.8 p.m.

THE EARL OF ONSLOW

My Lords, the strain of virus which is causing the present epidemic of influenza in Asia and elsewhere has been identified. Laboratory tests have now confirmed that four persons who arrived in this country suffering from influenza had Asiatic influenza, or the Asiatic type of influenza, but there is no indication at present of any material spread of infection of this type of influenza in this country. A vaccine designed to protect against the particular strain of influenza is now being produced on a laboratory scale. It is being tested for efficacy and the results will be known shortly. I should like to point out that the disease is clinically mild and of short duration. It should not be assumed that vaccination would necessarily be an appropriate measure for general use. The noble Viscount added to his Question, if I may say so, by a rather long dissertation on China, which I think is slightly wide of the realm of the Ministry of Health.

Share

VISCOUNT STANSGATE

The question was not addressed to the Ministry of Health. It was addressed to the Government.

Share

THE EARL OF ONSLOW

Perhaps what I have to say will give the noble Viscount some comfort. The Pekin Government have not asked the World Health Organisation for any assistance. The World Health Organisation, by its structure, cannot voluntarily interfere in any country that has not asked it to do so, but I feel sure that it would consider any requests from Pekin, or any other country, should they be made.

Share

5.10 p.m.

VISCOUNT STANSGATE

My Lords, I am much obliged to the noble Earl for his courteous reply, which was international in the way I desired, but I would point out to him that only on May 10, at Geneva, the representative instructed by Her Majesty's Government—

Share

SEVERAL NOBLE LORDS

Order, Order!

Share

THE EARL OF ONSLOW

It is an Unstarred Question.

Share

VISCOUNT STANSGATE

Why are four noble Lords saying, "Order, Order!" all together? It is an Unstarred Question.

Share

SEVERAL NOBLE LORDS

Order, Order!

Share

VISCOUNT STANSGATE

Well, we will have the matter cleared up; we will have it cleared up privately. Surely an Unstarred Question gives the questioner the right to reply.

Share

SEVERAL NOBLE LORDS

No.

Share

VISCOUNT STANSGATE

If that is so, I bow to authority. I only wished to ask why the Government opposed collaboration with China, but I bow to the noble Lords, Lord Mersey, Lord Onslow, and others, who inform me that I am out of order. I certainly shall not transgress, but all the same I am not out of order.

House adjourned at twelve minutes past five o'clock.

National Health Service, England And Wales

17 March 1958

Volume 584

7.14 p.m.

The Minister of Health (Mr. Derek Walker-Smith)

The net amount of this Supplementary Estimate is £7,428,720, which is an increase of just over 1½ per cent. of the revised July Estimate of £477,876,365. This Supplementary Estimate is made up of excesses of £10 million, partially offset by savings of £2 million, mainly on hospital capital, general dental services and superannuation, and of £600,000 on appropriations in aid.

There are three main items in this excess exceeding £1 million apiece; that is to say, hospital revenue £5 million, pharmaceutical services £1,800,000 and grants to local health authorities £1,400,000. These items involve the convenient grouping of the various subheads which collectively compose them. I would add that the excess on hospital revenue of £5 million would have been £8 million but for the effect of a once-for-all saving of £3 million in the current year due to a change in the system of Exchequer advances to hospital authorities from a monthly to a weekly basis.

This increase for which I am asking the House today is accounted for largely by increases in prices and remuneration, for which no provision was made in the earlier Estimates. This price and remuneration increase is really part of the general point I made recently during the Second Reading debate on the National Health Service Contributions Bill. There is, of course, this year a special reason which contributes in part to the increase; that is to say, the effect of the Asian flu epidemic.

I should perhaps also add the general point that many items in the large National Health Service Vote relate to expenditure the course of which is inevitably difficult to predict. This Supplementary Estimate was prepared in January and submitted to the House early in February, and it represents the best estimate which could be made at that time. The latest expenditure returns suggest that at the end of the financial year there may conceivably be some net overall under-spending, but in view of the difficulties of predicting so much of the expenditure we cannot even now be sure how much this may amount to.

I will now say a word about the first of the main items, the hospital revenue item. The total of this in the July Estimate was £335 million, split as to £290 million for non-teaching hospitals and £45 million for teaching hospitials. Of this £335 million no less than £215½ million was for the salaries and wages of medical, nursing and other staff directly employed in hospitals. Other large items comprised in the total were: provisions at £40 million, drugs, dressings and appliances at £22¼ million, and fuel, power and light at £25¼ million.

The earlier Estimates were based on costs current at the time when they were settled, but the hospital authorities were told that additional amounts would be made available, if necessary, to meet increases in remuneration following from Whitley awards and to meet increases in the prices of goods and services taking effect during the year.

What the House is now being asked to do is to vote additional money solely to meet such increased costs. I will indicate the analysis of the make-up of the figure of £8 million. The Whitley awards amount to over one-half at £4¼ million. price increases to £3 million, rates to £300,000, and increased National Health Service and National Insurance contributions to £400,000. That total of £8 million is reduced by the once-for-all saving of £3 million to which I have referred already, making a net addition of £5 million.

Of the major increase, the Whitley awards, two awards account for about £3¼ million out of a total of £4¼ million. Those are respectively the award to nurses, amounting to £2½

million, and the introduction, with effect from 1st October last, of a shorter working week for ancillary staffs, costing £¾ million.

I come to the second main item, the pharmaceutical service, about which there has already been a good deal of discussion on the various stages of the National Health Service Contributions Bill, which is still before the House. On this item, the estimated increase of £1,770,000 is based on the latest assumption of an outturn of 216 million prescriptions, instead of an estimate of 237 million, at an average cost, however, of 5s. 10d. per prescription instead of an estimated average cost of just over 5s. 3d.

I should add that the expenditure on the pharmaceutical service is necessarily very unpredictable because, for example, of the effects of epidemics and of changes in prescribing practices due to the introduction of new drugs and so on; and for those reasons it is possible that the actual outturn may still be significantly different from that now assumed.

The general reason for the part of the Supplementary Estimate which relates to the pharmaceutical service is an increase in the average cost per prescription above that originally estimated, with a partial offset due to the falling off in the estimated number of prescriptions. Taking the average cost, the original estimate, as I have said, was just over 5s. 3d., but the increase in prescription charges to 1s. an item, with effect from December, 1956, had the effect of leading some doctors to prescribe larger quantities of drugs but at less frequent intervals. We would therefore expect an increase in the cost of prescribing and a reduction in the number of prescriptions, and that is exactly what has happened.

The average cost rose to just under 6s. 2½d. per prescription in August last, and in December, which is the last month for which figures are available, the figure was 6s. 1d.

Mrs. Lena Jeger (Holborn and St. Pancras, South)

Does not the right hon. and learned Gentleman agree that when doctors prescribe for longer periods in an effort to help their patients financially, there is more danger of waste and that it is more difficult to prescribe accurately over a longer period? Will he bear that problem in mind?

Mr. Walker-Smith

As I think the hon. Lady knows, the only circumstances in which I am encouraging general practioners to prescribe in larger quantities to last a longer time is in respect of chronic conditions, a subject in which the hon. Lady has displayed an especial interest in the House. I am not encouraging them to do it in ordinary cases, because, I agree with the hon. Lady, there are dangers of waste in that. That, no doubt, is one of the aspects of the matter to which Sir Henry Hinchliffe and his Committee are devoting their attention.

The 6s. 1d. figure is the figure which I gave to the House in the course of my speech on the Second Reading of the National Health Service Contributions Bill the other day. The Supplementary Estimate, which I am now commending to the House, assumes a figure of 5s. 10d. per prescription as the overall figure for the current financial year 1957–58.

I should add that another reason for the increase in the average cost is the availability of expensive new drugs which have come upon the scene and which were not previously available. Ever since the inception of the National Health Service, the number of prescriptions in any given financial year has tended to fluctuate. The Estimate for 1957–58 was based on a figure of 237 million which appeared to be the right figure in the context of that time. It now seems that the total number of prescriptions in this financial year will not exceed 216 million.

That is the figure which has been used in framing the present Supplementary Estimate. However, but for the influenza epidemic. the number of prescriptions might not have exceeded 204 million, instead of the 216 million which we now expect and the 237 million which was the basis of our Estimate. The reduction in that case would have been more than enough to offset the effect of the increased average cost of a prescription about which I have been speaking.

Having given that explanation of the reason for this part of the Supplementary Estimate, I must say that the Government are well aware of the problems of the mounting drug bill and, as the House knows, much action has already been taken in that regard. In addition, the question is currently under the review of an independent professional committee, the Hinchliffe Committee, to which I referred in answer to the hon. Lady's intervention a moment ago. I hope to receive an interim report from Sir Henry Hinchliffe fairly soon.

Finally, on the third main item of the Supplementary Estimate, the grants to local health authorities——

Share

Mr. Albert Roberts (Normanton)

It used to be said that the cost of prescriptions in non-industrial areas exceeded that in industrial areas. Can the Minister tell the House whether that is now the case?

Share

Mr. Walker-Smith

I do not know that it is, but it may be that I shall be able to form a more precise view in the course of our proceedings, in which case my hon. Friend the Parliamentary Secretary will be happy to communicate it to the House.

Local health authorities are at present entitled to a 50 per cent. Exchequer grant on their net expenditure on health services under Section 53 (1) of the National Health Service Act, 1946, as amended by Section 7 of the Local Government Act, 1948. There are ten main services involved, each with a separate subhead, and a further miscellaneous subhead. The amount of the Supplementary Estimate for the local health authorities is £1,400,000 in respect of all those services taken together. The Supplementary Estimate in respect of the services is necessary, because both the autumn revised Estimate of the net expenditure of local health authorities in the current financial year and the actual net expenditure in 1956–57 were higher than had originally been expected. As a result, the advances for the current year have to be increased by £1,079,000 and the balance due for 1956–57 by £323,000.

The House will appreciate that I cannot give the same detailed analysis in respect of local authority health services as for the other services, because local health authorities are not subject to detailed control. Broadly, however, the increases are due to three factors: first, wage and salary awards: secondly, rises in prices, and thirdly, staff increases and expansions of the services. Examples which I would quote in this connection are the salary increases to nurses, midwives and health visitors, wage increases for domestic helps, and, in

the mental health sphere, increased wages and prices, and the expansion of occupation centres for mental defectives.

With that explanation of the main items of which the Supplementary Estimate is made up, I hope that the House will agree that it is necessary—and, in the circumstances, even moderate—and will be prepared to vote it accordingly.

7.32 p.m.

Mr. A. Blenkinsop (Newcastle-upon-Tyne, East)

We all welcome the further information that the right hon. and learned Gentleman has given us in introducing this Supplementary Estimate, and at any rate, hon. Members on this side of the House also welcome a very large part of the increase. We would not wish to challenge the increases which have taken place in respect of hospital authorities, or the modest increases in respect of local authority health services, although it would be more appropriate to discuss those matters when the full Estimates are presented later on.

Although my hon. Friends may wish to raise certain points, I want to follow up some of the points which have been raised in connection with the pharmaceutical services. It would be useful to the House if more information and elucidation were given by the right hon. and learned Gentleman or the Parliamentary Secretary. Many of us feel that we are being asked to make a judgment about the Supplementary Estimate—especially in regard to the pharmaceutical services—on very inadequate information and evidence. I do not blame the right hon. and learned Gentleman exclusively; this situation has persisted for a long time. But it seems to me that if we are to decide whether or not we are getting reasonable value for our expenditure on the pharmaceutical services we ought to know far more about what is being done for the health of the nation in return.

All that we can do at present is to make some snap judgments from our own experience and the evidence that we have been able to gather, which may be misleading. A very considerable part of the pharmaceutical expenditure of the Health Executive Council in Newcastle is taken up by drugs used in the treatment of tuberculosis. The pharmaceutical expenditure for the last full financial year in the area was about £450,000, and on the best estimate that can be made, taking into account the number of patients under regular

treatment and the average cost per patient—which can amount to about £1 a week—there is an expenditure of between £50,000 and £100,000 on tuberculosis treatment alone in Newcastle. Whatever view we may take as to whether prices for drugs can be reduced, none of us doubts for a second that the expenditure is well worth while, both in reducing hospital attendance and enabling many people to carry on with treatment while at work.

Unfortunately, however, we know far too little about the rest of the matter. We have no estimate of the cost of the treatment for bronchitis, which is a very high figure in many industrial areas. We do not know to what extent the drug bill represents useful work in the treatment of children, although we know that great advances have been made and that hospital beds are becoming available in children's units. All this is encouraging, but we know extraordinarily little about the effectiveness of the use of these drugs, and we should know if we are to make a fair judgment.

The Guillebaud Committee called upon the Ministry to improve its investigation units and establish a statistics department. I know that the Ministry has taken some action along those lines, but we have not yet seen much evidence of its work. I was glad that the right hon. and learned Gentleman was able to say that he was hoping that further information would be coming forward for the public. The Guillebaud Committee said:

> “"we need to know more ... about the nature and causes of difference of morbidity in different Hospital Regions; about the changing patterns in the use of drugs in the National Health Service, and also about their cost; about the incidence of charges on particular sections of the community ..."”

I should be glad to know whether anything has been done on those lines.

Many general practitioners and probably the College of General Practitioners would be willing to help in collecting evidence about the value and efficacy of the treatments being carried out today. The only such investigation that I know of was carried out privately by a Mr. Martin who wrote a book called, "Social Aspects of Prescribing", an interesting book which, unfortunately, is rather out of date, since it relates to the position in 1951. Although the findings are of interest, we should like to have the views expressed brought more up to date.

One thing which the author says, which relates to the interjection of my hon. Friend the Member for Holborn and St. Pancras, South (Mrs. L. Jeger) a few moments ago, is:

> “"Expensive prescriptions occur most frequently in well-to-do areas."”

It is important for us to know whether that is still true. He also says that it is a

> “"sobering thought that the areas with the highest rates of morbidity as indicated by infant mortality are the ones with the cheapest prescriptions."”

These are important social factors.

Share

Sir Keith Joseph (Leeds, North-East)

The hon. Gentleman might also bring out the interesting point that often where prescription unit cost is cheapest the number of visits to the doctor are most frequent.

Share

Mr. Blenkinsop

I was going to refer to the relationship between the cost item and the frequency of visits.

We need a great deal more information in order to make effective judgment. There are some matters about which we have the right to inquire. One is the question of price. A good deal has been said about this already, and I do not wish to go over the ground which has already been covered in other debates. It is a striking fact that we have had this considerable rise in the cost per prescription which coincided with the introduction of the additional Health Service charge; although I agree that, as one might expect, there has been some reduction in the total number of prescriptions. That has not wiped out the effect of the larger quantities.

The right hon. and learned Gentleman made the point about the effect of the influenza epidemic, and the total number of prescriptions has for some time tended to vary, as we would expect. This must depend on the actual experience regarding health in the country over a period. One would expect variations. But this increase in the quantity prescribed is striking. Although, almost for the first time, the right hon. and learned Gentleman tried to

distinguish between the types of drugs which he wishes general practitioners to prescribe in larger quantities and those he does not, evidence from the medical profession shows that there is encouragement to increase the quantities prescribed and not purely in the limited scope to which the Minister referred. Even in that case one is doubtful whether this is a good practice, except, of course, as a means of saving the chronic sick and the elderly from having to pay extra charges. But the fact that they have to pay extra charges is the fault of the Government for imposing them. The answer is not necessarily to encourage the prescribing of larger quantities but to withdraw the charge.

No notice was taken by the right hon. and learned Gentleman and his predecessors of the recommendations of the Guillebaud Committee, which did not recommend any increase in charges for prescriptions. Hardly was the ink dry on that Report than the Government proposed an increase, with the ill effects which we have seen. We cannot emphasise too strongly not only the waste which attends the prescribing of large quantities, but the danger of so doing. I do not think there is a single pharmacist in the country who would not say the same.

We know from experience what happens. There are few houses in the country where it would be impossible to find a number of bottles of medicine or packets of pills of one sort or another which are used by different members of the family or passed over the garden wall to be used by other families. This practice makes nonsense of effective medical control of states of illness. It is a cause of danger as well as being a waste, and it would be a good thing to recommend that at the end of a treatment the medicine left over should be disposed of by pouring it down the drain or by getting rid of it in some other way as rapidly as possible. I ask the right hon. and learned Gentleman to look at this matter. In our anxiety about what has happened, we are supported by a good deal of medical evidence. Not only are we wasting money by providing larger bottles of medicine and bigger packets of pills, but danger is being caused.

Ministers of Health come and go rapidly, and sometimes one is sorry for the reason. I am not sure which Minister it was, but not so long ago one announced the conclusion of an agreement with manufacturers regarding the prices of drugs, particularly the proprietary medicines. It was a very complicated agreement. The last Report of the Public Accounts Committee gives us cause for anxiety. The right hon. and learned Gentleman himself

suggested that we should not get the economy we had originally hoped to secure through that agreement. Many of us believe that we shall have to look again at the question of prices. There is no doubt that doctors should know far more about prices even than they do now after the modest efforts of the Ministry and the prescribers' notes which have been sent out.

We have to reach the state where manufacturers are required to put prices on any material they issue. I had sent to me a large bundle of advertising matter which had been received by a doctor in a particular fortnight; and of that mass about one-third included prices and the other two-thirds did not. I consider that some action must be taken about this. It has been suggested that doctors should have a standard card index of drugs and prices. It would not matter about having detailed prices, because the doctors would not be doing the work of the pharmacists in making up the actual accounts, but they would have some evidence of the average cost of the treatment of a patient for a week. Every doctor should possess some such evidence. It is wrong that the Government should pay twice for the cost of advertising, but, in effect, that is what happens today. The Treasury makes its concession for tax purposes, and a very considerable concession it is, and then that cost is bound to come into the total figure of drugs that the Government have to meet for the Health Service. In a sense, the Government pay twice. There again, there must be a very serious further review. We cannot accent the present position in which advertising is in effect encouraged, even though a very large part of it is to the detriment rather than for the benefit of the National Health Service.

While I am dealing with prices, I would refer to one further factor. I do not expect the Minister to give me an answer immediately about it. Nobody has been able to do so yet, and I am not very hopeful of the right hon. and learned Gentleman's being able to do so, although he might be able to find something to tell us before the end of the debate. We know that a considerable proportion of the proprietary medicines supplied today originates from the United States. Very valuable many of them are, yet we have to face the fact that included in the cost that we pay are quite heavy additional charges for patents and royalties which we should not have to pay if the drugs were produced in this country.

Different suggestions are made about how much this cost amounts to; I do not pretend to know. I only know that a very substantial proportion of the drugs and proprietary medicines

commonly used comes from the United States, I do not mean that they are necessarily manufactured there. Very often they are manufactured under licence in this country. Nevertheless, those external charges are imposed before the medicines can be sold here. That is a matter that we are bound to take note of, because it may affect substantially the total drug bill.

The Government should step in to see whether we can get more favourable terms. We remember the situation about penicillin. Many of us feel that we could reach more satisfactory agreements if the Government could step into the negotiations on these matters. I will ask the Parliamentary Secretary to say a word on this matter when he replies.

We all agree that the cost of drugs is under the control of the doctor and of no one else. The Labour Government, when instituting the Health Service, and subsequent Governments, have said that we must guarantee to the doctor freedom to prescribe what he thought was necessary for his patients, but there have been, by agreement with the profession, arrangements that in certain fields, for example in the proprietaries, doctors would not prescribe if there was any equivalent in our pharmaceutical list. The doctor still retained the right in the last resort to prescribe that special form of drug if he thought it necessary for his patient, knowing that he might be asked to explain why. The doctor still insists, and I think rightly, on his right to prescribe what is necessary for his patient.

If that is so, we have to face the unhappy fact, of which we have had experience, that there has been a very great deal of excessive prescribing over the years, of some of the antibiotics for example, for minor conditions for which they were not necessary which has endangered their use for the more proper purposes. We are facing acute problems in relation to this matter today simply because of the many costly drugs which have been used for conditions for which they were not necessary, although they might have had dramatic effects.

If we say that the doctor should be given complete freedom to prescribe what he thinks fit, there is the corollary that the doctor, while he should receive training about prescribing, must have all the necessary information. We are very clever about saying what shall be put into a curriculum but not so clever in suggesting what shall be left out. The education of the doctor should help him to exercise his proper judgment.

How can that be done? We must consider whether the present set-up of the committee, which has done valuable work in the classification of drugs, is now adequate as a permanent

part of our Health Service system. One wonders whether it is not necessary to have some even more thorough check on new drugs coming on to the market before they are made fully available for general use. This matter will have to be discussed with the medical profession, but there have been suggestions that there should be a kind of testing before the drugs are made generally available. This is obviously another matter for the committee to consider. I hope that the medical profession will join in and help in this matter.

We must not look at these problems too much in isolated and separate compartments. The real hope of getting stabilisation and reduction in the drug bill will come from the doctor becoming far more of a health educator and leader of a team, which ought to include the health visitor and others, of people who realise that their main job is health education just as much as treatment. They will try to effect some change from the assumption that the bottle of medicine and the packet of pills are the essential corollary to a visit to the doctor.

If progress is to be made in this direction, there must be some reduction of prices such as is now under consideration. We want greater impetus to group practice and health-centre work to encourage the doctor to use a more independent judgment. It is said that many doctors say, in explanation, that they are pressed to prescribe particular drugs. They are afraid that if they do not give the prescriptions their patients will go down the street to another doctor. I must say that in that attitude there is not an awful lot of trust shown in the professional standard. If we are to get a better standard, we must move away from the isolation in which too many doctors still work. That will come if we encourage this wider development of the group practice.

Can we not here bring in more actively the Central Council of Health Education? I should have thought that the right hon. Gentleman the Chancellor of the Duchy of Lancaster would have encouraged that, because I believe that at one time before he came to this House he was very actively interested in it. In any case, there is a need for a really vigorous drive for public education in health, and the proper use of drugs. None of us doubts for one moment the value of drugs. What we very sincerely doubt, as my right hon. Friend the Member for Warrington (Dr. Summerskill) has said on many occasions, is the wisdom of the way in which they are being used at present. We ask the right hon. and learned Gentleman therefore to make some of the inquiries that we think important.

We think that the Ministry itself has a very real part to play here and that it must, as it were, break out of its confinement. I do not blame the Ministry, but it is true that it is too narrowly confined to the recovery side to tackle effectively the reasons, in a sense, for these high drugs bills. What is the Minister doing, for example, to get ahead more rapidly with the Clean Air Act? I believe that the more quickly he can get the clean air zones the less bronchitis we shall have and the lower, eventually, will be our bills for many of the drugs that are being continually poured out for such conditions.

In the same way, if the right hon. Gentleman could stir some of his laggard Ministerial colleagues who are denying us the opportunities to develop our sewerage schemes and to carry out house improvements, it might very well make a very real dent in our drug bill. We want to know what he is doing in all of these sectors—and I make no apology for, perhaps, widening the debate rather more than the right hon. and learned Gentleman may have expected, but if I had not been strictly in order I am sure that I would have been told.

I make a final suggestion which I am sure will appeal to the Minister. On this side, we have been worried—and I have asked Parliamentary Questions—about the developing costs of these tranquilliser drugs. Again, these drugs can be of undoubted value if properly controlled, but medical opinion is very much seized of the dangers of their general use, particularly if we are ever to use these drugs as widely as they are used in America. There are these anxieties and dangers, and if we do not help in some way to control the use of these drugs through education of the public, the bill may go on expanding more and more and we may still be without the real, effective ways of judging just how much of the drug bill is valuable and how much is not.

I said that I would make a final suggestion that the right hon. and learned Gentleman would welcome. We would, of course, secure a very considerable reduction in our bill for tranquillisers if we could only persuade the whole of Her Majesty's Ministers to resign at an early date and to give us the date. It would relieve the country very greatly and might even relieve many of Her Majesty's Ministers as well.

8.5 p.m.

Vice-Admiral John Hughes Ballet (Croydon, North-East)

It would be very difficult indeed to challenge any of the specific items in this Estimate, and I certainly do not intend to do so. On the other hand, the fact that we have this big Supplementary Estimate confronts Parliament with a problem of priorities that is becoming ever more acute, and a problem as to whether or not, as the hon. Member for Newcastle-upon-Tyne, East (Mr. Blenkinsop) said, we are really getting full value for the money being spent on the National Health Service. As he said when at the start of his speech, these are matters that could more appropriately be discussed when we come to the main Estimates, and I assure hon. Members present that I intend to follow that precept.

I want to refer to four ways that have been suggested from time to time by which the rising cost of the Health Service can be kept in check, and to ask my right hon. and learned Friend whether they are being carefully studied. More than six months have passed since the Select Committee on Estimates recommended that some sort of training on the finances of the National Health Service should be given to medical students. I believe that suggestion to be one of the greatest importance. It is something that must be done if we are to keep under any sort of financial control a Service which, after all, costs more than any single one of the fighting Services.

When hon. Members read the evidence given before the Committee they will observe that not all the doctors who appeared before us agreed with this proposal. There were some who said. "Oh, health is something for which there is no price too high to pay." To that, I would say only that any price is too high if one has not the money. I ask my right hon. and learned Friend to do what he can to implement that proposal.

Secondly, there is the question of closing some of the smaller hospitals when they become uneconomical. I understand that, from time to time, regional boards put forward proposals to close a hospital, in a group, perhaps, where they feel that the patients can be properly looked after in the remaining hospitals. Obviously, the savings resulting from such measures are real, the economy produced is a genuine one, and I should like to be reasurred that such proposals, when made, are not lightly set aside.

Thirdly, is my right hon. and learned Friend entirely satisfied that we are doing all we can to educate the public in preventive measures? I am not here talking of the use of drugs and so on, but of ordinary common-sense preventive measures. I ask him, in particular, because one of the reasons given for this Supplementary Estimate is the influenza epidemic Few things

were heralded so widely or for so long than was the arrival of that epidemic in this country. Its progress from the East across the world was followed almost from seaport to seaport until it arrived here. It is rather disappointing that it should, none-the-less, have taken such a toll.

While there may be a great deal of controversy, and a number of views on whether or not it is desirable to televise major operations, surely there can be no two opinions that any time that television can devote to a little homely advice about not going into crowded trains when one has a bad cold, about not going into places of entertainment when one feels that a fever is coming on, would be well spent. I suggest to the Minister that millions of pounds might be saved on the Estimates if people could be educated to use just a little common sense in looking after their own health.

Lastly, is my right hon. and learned Friend entirely happy that the general practitioner service is working as it should? After all, the expensive thing in the Health Service is the hospital service. Are we sure that as many cases as possible are treated by the general practitioners in the patients' own homes? I know that this is a very big question, and I am not asking for a reply tonight, but it is very much in my mind that one of the radical steps that could be taken to prevent Supplementary Estimates of this nature, and to keep down the cost of the Health Service, would be to try to ensure that as many people as possible were treated in their own homes, without having to go to hospital.

8.11 p.m.

Mr. Somerville Hastings (Barking)

I should like to refer to one point made by the hon. and gallant Member for Croydon, North-East (Vice-Admiral Hughes Hallett) in his interesting speech, and that is his suggestion about the closure of some small hospitals. I am in complete agreement with him, because small hospitals are not economic and, in many cases, are not efficient. I shall be glad when special hospitals are abolished and are fused for operational purposes with general purpose hospitals.

I should like to extend what he said. Not only do we want the closure of small hospitals and the fusion of hospitals, but we also want a greater fusion of hospital management

committees. In each case we have not only a management committee but also staff, including financial officers, engineers and supply officers, responsible for purchasing. In the regional hospital board to which I am attached there are two or three management committees with only three or four hospitals in each. Not only is that uneconomic but it tends to be inefficient, because when we have a group of hospitals it is very much better to centralise special departments in one of these hospitals and not to let every small hospital have a department with inpatient beds for every specialty.

The debate has been largely directed to the question of pharmaceutical products. I have no regret whatever that more is being spent on drugs, assuming that it is being well spent. The public insists on having medicines, and it is very much better that those medicines should be ordered by a doctor who understands what he is doing than be bought straight from a chemist. I do not think that this increase is such a disaster. It is fashionable to blame the drug houses for everything that has happened, but I believe that the cost of the standard drug has not risen within the last few years in anything like the same proportion as have many other things which we use.

It must be admitted, too, that the drug houses spend a good deal of money on research. I think that they could fuse their research departments usefully and that money could be saved in that direction, but I am convinced that money must be spent on research into pharmaceutical products and that we are getting benefit from it.

Perhaps these drug houses advertise too much. I have not seen a patient since 1945, when I returned to this honourable House, but I still receive samples—I will not say daily, but at frequent intervals—of different drugs from the various drug houses. To some extent that is regrettable, but it has another side to it, because a busy general practitioner who is seeing a large number of patients, many of them with the same disease, may lose interest in his work unless he is able to try out new methods of treatment. These new drugs which are coming out increase the general practitioner's interest and keenness and, therefore, the quality of his work.

Mr. Blenkinsop

I am interested in my hon. Friend's remarks, many of which I agree with, but I am sure that he agrees that the drug houses should state prices on their documents.

Share

Mr. Hastings

I agree entirely, and I also agree with my hon. Friend's suggestion that medical students ought to be taught to some extent the relative costs of the drugs which they propose to order.

Nevertheless, I believe that it is inevitable that we shall spend more money in the National Health Service on drugs. There are two reasons for this. First, although the maximum age to which people live is probably not increasing appreciably, there are many more people over the age of 70. When people reach old age they are more subject to disease and need more treatment. Moreover, the object of treatment is not necessarily in every case to cure. It may be to make the patient comfortable and to relieve symptoms. Because we have an ageing population it is inevitable that we shall need more medicine.

In addition, much more can be done with drugs today. When I was a student there were no drugs which would kill germs without first killing us. Now we have the large group of antibiotics. It is true that germs are beginning to get the better of them, because they are themselves becoming immune to many of our antibiotics, but we are reacting by discovering others. Among these drugs are the very valuable ones used for the treatment of tuberculosis which have been responsible to a large extent for the reduced mortality from this disease. For these reasons we shall use more drugs in the future, apart from the fact that research is constantly being carried out and new uses for drugs being found.

I agree that we should urge on doctors care in prescription and care not to use the proprietary drugs while others which are equally good are available. But I suggest to the right hon. and learned Gentleman that he should be a little careful about how doctors are approached on this question. One doctor whom I saw recently told me that he had had two visits from people from the Ministry urging him to reduce his drug bill, and he resented it very much indeed. I have asked other doctors about it, and they have told me that they have had visits on the same lines, but they rather liked it and did not resent it at all. There are those

two sides to the question. The important thing is that the approach by officers of the Ministry should be as tactful as possible in order to obtain the best results.

Share

8.21 p.m.

Mr. Reader Harris (Heston and Isleworth)

I have been most interested in the debate, though it is a subject on which I am no expert. I listened with great interest to the speech of the hon. Member for Newcastle-upon-Tyne, East (Mr. Blenkinsop), who certainly widened the debate and ranged over many subjects, even suggesting that more should be done to implement the Clean Air Act. If we are to widen the debate to that extent, there are many things we could suggest. I hope that we shall one day have a Government having the courage to pass a law making it compulsory for everyone to have a bath every day; that would do as much as anything——

Share

Mr. Deputy-Speaker

That is a little beyond this Supplementary Estimate. The hon. Member for Newcastle-upon-Tyne, East (Mr. Blenkinsop) went to the periphery of the bounds of order. I hope that the hon. Member for Heston and Isleworth (Mr. R. Harris) will not go further.

Share

Mr. Harris

I would try to keep within the bounds of order, Mr. Deputy-Speaker. I wish to raise the question of drugs and support what the hon. Member for Newcastle-upon-Tyne, East, said about the prices of some of them. This is a very important matter. A little time ago I wrote a letter to the Parliamentary Secretary to the Ministry of Health about the price of a drug called Terramycin. The answer which my hon. Friend very kindly gave me does not, I am afraid, entirely satisfy me. A pharmacist of my acquaintance drew my attention to this particular drug and sent me one of the actual cartons showing that it contained 100 tablets.

He told me that these hundred tablets cost £14 10s. This raises many questions, the first of which is this. What control is the Minister able to exert over the drug houses which produce drugs of this sort?

I am not in any way trying to comment on the use of any drugs which may be necessary for the saving of life, and I am certainly in no position to say whether there is any drug other than Terramycin which is as effective. But, if a drug like this is to be produced, 100 tablets of which cost about £14 10s., one wonders whether the Ministry is able to exercise any control over the size of carton in which they are distributed. The situation may well arise—it has, in fact, arisen, my pharmacist friend tells me—of a drug like this being prescribed and the chemist having to obtain it. A certain number of tablets may be used and the rest may remain on the chemist's shelf, and may, I am told, be there for a very long time without being used. In his reply to me, my hon. Friend the Parliamentary Secretary said that about twenty tablets would be the normal number in one prescription. Even that makes it a very expensive prescription, something in the region of £3, although my hon. Friend said that it would, in fact, cost 47s. 6d., this amount including chemist's dispensing fee and a sum to cover overhead expenses. However, one-fifth of £14 10s. is more than 47s. 6d.

Can the Minister control the size of the package in which the drug houses distribute these things? When one considers the terrific barrage of advertising which goes out, the matter assumes even greater importance. I do not say that this advertising is entirely wrong; obviously, there must be some advertising by drug houses, though I can name one particular American firm which reckons to circularise all the doctors in the country twice a week. It may be done only by postcard, but it seems quite fantastic that any firm should reckon to reach each doctor in the country twice a week by any form of circularisation.

Inevitably, with this tremendous pressure upon doctors, they will occasionally prescribe a drug which is, perhaps, a little more expensive or they may prescribe in a quantity slightly greater than is necessary. Obviously, doctors being hopelessly overworked in many places, there is always a tendency to prescribe for a little more than is necessary, perhaps in order to prevent a patient having to come back.

I have been informed that there is a tendency today for doctors to prescribe for larger amounts than in the past. For instance, a liquid medicine which used to be prescribed in

what were known as doctors' bottles, 6 oz. bottles, are very often prescribed now, according to my pharmacist friend, in 40 oz. bottles. Has the Ministry any control over things like that?

I hope that it will be possible to have the advice of well known and reputable British firms who exercise restraint in these matters. Their advice on how to control the activities of what are, usually, American firms with high pressure sales methods would be useful. I do not altogether condemn those methods. I have an American pharmaceutical company in my constituency, Parke Davies and Co., a very reputable company, which has progressed steadily and gradually over the years; but there are other firms which are bringing to this country the methods they use in the United States. One firm which I know in the United States has travellers on the road and reckons to get round to every doctor once a week. If there is to be that sort of personal visit once a week in this country, life will become intolerable for doctors.

Share

Colonel Tufton Beamish (Lewes)

I appreciate what my hon. Friend is saying, but does he realise that a great many doctors like these visits and that, if a doctor should say he does not want to be called on again, he will not be called upon?

Share

Mr. Harris

I am glad to hear that and to think that some notice is taken of what the doctors say in these matters; but, from what I know of some of the firms, I am not sure that they would be taken off the list quite so readily as that.

In the letter I received from the Parliamentary Secretary, he told me that information and advice on the use of these drugs has been made available to doctors in the British National Formulary and in the Prescribers' Notes. Do the Formulary and the Notes put the prices of these drugs against them? Perhaps they do; I do not know. If some assurance can be given by the Minister on this very important point, I should be very glad. I know that it would give some reassurance also to chemists, many of whom may be doing extremely well out of it but

who, nevertheless, are genuinely desirous of keeping the cost of the Health Service down as much as possible.

Share

8.29 p.m.

Mr. James Harrison (Nottingham, North)

My contribution to the debate takes the form of a very short question, but it is a question which ought to attract the serious notice of the Minister. If he can contribute towards an answer, I for one would be much obliged.

I wish to refer to the increased cost of our hospital services as a result of the universal treatment that is offered. Any person who is in these islands, or who comes to these islands especially for hospital treatment, can obtain treatment free under the National Health Service.

Can the Minister give us something rather more than the stock reply to this question? Whenever we raise this matter we are told of the administrative cost of making the service selective. We are told of the difficulty of limiting it to residents in this island and those people whose countries offer reciprocal services and give our citizens the privilege of free treatment in their hospitals.

Can the Minister tell us what schemes he and his officers have examined when they say that the administrative cost would exceed by far the amount saved by the exclusion of people whose countries do not offer similar facilities and who are non-resident in these islands? The premise of these arguments is usually that it would be a good thing if we could limit the services and thereby save considerable money, but that to do that we should have to introduce an administrative scheme of selectivity that would cost more than the amount which might be saved by its introduction.

I have never heard any of these schemes described. I wonder if the Minister would indicate some of the schemes that he has examined and tell us where the extra cost would fall if a scheme were adopted. That would help us to understand the position and to argue the question should it be raised in our constituencies.

Share

8.32 p.m.

Dr. Donald Johnson (Carlisle)

There are two points that I want to raise on this Supplementary Estimate. They are on the general lines that the debate has pursued. I wonder whether the Minister can say something about the general plan of expenditure on the development of mental hospitals.

I was very pleased to hear on my last visit to my constituency that, at last, our local mental hospital, The Garlands, is getting very much needed improvements. Nobody is more pleased about that than myself. On the other hand, looking at the other point of view, in answer to a Question that I asked the Minister a week or two ago about the development of psychiatric units in general hospitals, he told me that about 12 to 15 psychiatric units in general hospitals had been initiated over the last two or three years.

We all know that because of our restricted resources we cannot do everything. We cannot spend the money in every way that we would like. I think it is generally accepted now that the idea of psychiatric units attached to general hospitals and the beginning of small psychiatric units nearer to the community are more in line with modern thought.

I wonder, therefore, whether the Minister can tell us something about the policy of development and expenditure in this respect. Will the money be spent more on these older hospitals, or will he let them go to some extent, realising that they have had their day, and make a drive forward on a newer line? We all know how thought has changed very much in this respect over the last two or three years, and it is changing rapidly at present.

Three or four years ago it was the wish of many hon. Members to hear the Government bring forward a policy for building more and more mental hospitals. Now, many of us look forward to the day when the Minister can introduce a policy for the demolition of the older hospitals and the building of newer units more in line with modern thought. I do not expect my hon. Friend to develop this discussion in any great detail tonight, but can he give us some indication of his views about it when he replies to the debate?

Whether my right hon. and learned Friend is spending the money on the older hospitals or on the newer units, I urge that the money should be spent especially on admission wards and observation wards. I do not want to go into a discursion on admission procedures and that sort of thing, but the most distressing stories we hear from former mental hospitals patients,

such as ladies with nervous depression who may go as voluntary patients for treatment and who, because of lack of accommodation and lack of facilities, have to be put in a ward with chronic and deteriorated patients, so that whatever treatment was given, the surroundings in which they find themselves are apt to do them much more harm than good.

The second point which I want to discuss has already been mentioned—the intractable problem of drugs, a subject on which I made some comments in the debate ten days ago. As a former general practitioner, I am the first to maintain that doctors must always have the right to prescribe what they like. None the less, doctors are the same as other people, very susceptible to pressure by suggestion and pressure by advertising.

In discussions about advertising with representatives of drug companies and others, one has to admit that a measure of advertising is both legitimate and necessary, with a view to introducing doctors to new drugs, in the way about which we have heard. The visits of representatives from drug firms are among the better features of this advertising. When I was working in general practice, before becoming a Member of Parliament, three years ago, I always welcomed the visits of these gentlemen. I found them quite inoffensive and they never used high pressure methods. They were always reasonable and I welcomed their visits for discussion with a view to hearing about newer methods and drugs which had been developed.

However, one wonders whether some of the more florid forms of literature which come through the post are really necessary and whether they are not wasteful. My hon. Friend the Member for Heston and Isleworth (Mr. R. Harris) referred to an American firm which sent out a small brochure to doctors twice a week. He said that it might be a postcard. I can assure him that it was considerably more than a postcard. I know the firm, because I have received these things myself. Some of the brochures are tasteful and expensive half-tone publications. One wonders whether that sort of thing is necessary.

One wonders whether the kind of publication which I received only a couple of days ago through the post, and which I now show to the House, is really necessary. It has been most expensively prepared and contains many pages of coloured advertising of a number of new products. It was sent to me, although the last time I had occasion to practise was three years ago. Therefore, in my case, it is a complete waste of money. One cannot help thinking that expenditure of this kind is running to waste and obviously coming out of the money

which we vote in the House for the National Health Service. We give the drug firms fair play when we discuss these matters in the House and I think that they should get together in the national interest and arrive at some self-denying ordinance in advertising so as to ensure that this immense amount of money is not squandered on sending these highly-coloured and expensive publications to doctors.

There still remains the main question of what is to be done to tackle the mounting drug bill. Various suggestions have been made and the hon. Member for Newcastle-upon-Tyne, East (Mr. Blenkinsop) has said that by various methods doctors should be perpetually reminded of prices. He is more optimistic than I am about the economy-mindedness of my profession. I do not think that we can really remind people of prices effectively unless we have some sort of sanction over them to keep them up to scratch. Then, if we adopt a method involving sanctions we shall get into trouble straight away.

The hon. Member for Barking (Mr. Hastings) mentioned the possibility of visits from the Ministry's officers. Some doctors take those well. Others do not take them particularly well, and again we should run the risk of creating resentment and trouble among the doctors. A third suggestion is that we should teach doctors something about economy and prices and put that subject into an already overcrowded curriculum. It is no use putting these things into a medical student's curriculum, however, unless he knows that he will have an examination at the end. I question whether he would seriously suggest that before qualifying a medical student must undergo an examination on the prices of drugs. Unless there is an examination, any amount of trying to teach medical students about prices will be ineffective. I can assure the House from memories of my own student days that if there is no examination they will be elsewhere when the lectures take place.

I suggest, therefore, that the drug firms might get together and devise some self-denying ordinance on advertising expenditure. I would go a little further and suggest that the Minister might go into competition with the drug people in a little advertising on his own account, by drawing the attention of doctors to the cheaper, simpler pharmacopeia preparations which are identical with the proprietary medicines.

It is useless to do that, however, unless the Minister does it in an attractive and arresting way. I do not think that the average ministerial circular would compete very much with a publication such as the one which I now have in my hand. If the Minister will publish

attractive brochures and leaflets periodically to circularise among doctors, spending a little on typography and layout so as to to make the presentation attractive and easy to read, they might well yield him excellent dividends.

Share

8.45 p.m.

Dr. Horace King (Southampton, Itchen)

I wish to continue this debate for a few minutes only, in order to press a point about drugs. I agree with every word said by the hon. Member for Carlisle (Dr. D. Johnson). I think he stated a magnificent case temperately.

Obviously, we cannot prevent doctors from prescribing drugs that save life or preserve health, but my hon. Friend the Member for Barking (Mr. Hastings) was quite right in the tribute which he paid to all the modern discoverers of drugs, who get a little bit of money for what they have discovered, as compared with the manufacturers and exploiters of drugs, who get much more for the brain-child of some eminent scientist, or the advertisers, who probably get more than the manufacturing druggists for bringing these drugs to the notice of the medical profession. I do not think we can do very much about that. I do not think that we can build a shield round the medical profession to protect it from this barrage of publicity that the manufacturing druggists impose upon them.

I have always thought that the chemist himself had a claim. He has asked for a long time that he should be able to substitute the pharmaceutical equivalent for any prescription, but no doubt the medical profession would be up in arms if we gave that privilege to the practising chemist.

There is something which the Minister can do. It is now three or four years since the Select Committee on Estimates examined the National Health Service and pointed out, among other things, that there were manufacturing druggists or chemists who were getting their working capital back within four years, and who were making an average annual profit of about 25 per cent.—and this after all the apparatus of advertising, which has to be paid for ultimately by the National Health Service.

At that time, the Ministry was in consultation with the manufacturing chemists, and I would hope that by now we have narrowed the field of difference between the Minister and private enterprise in the drug manufacturing industry. No one denies that the labourer is worthy of his hire. Having visited the factories of the manufacturers of some of these American so-called ethical products, I can say that they are manufactured under ideal conditions. The doctors are satisfied because they know that the drugs they obtain from one of the reputable firms are all that they purport to be, and that they are manufactured under the best of conditions. All that is worthy of the hire of the labourer. What the Select Committee found three years ago was that the labourer was making an unreasonable charge for his labour, and I think we have a right to demand from the Minister that he should exercise some control on the profits made by these manufacturers.

At the same time, I would press upon the right hon. and learned Gentleman another point which has arisen casually and incidentally in the debate. It should be possible in time for British manufacturing chemists to take over the manufacture of products now made by the Americans. There was a time when, penicillin, having been invented in this country—Fleming was one of the greatest men of our century, and there are hundreds of thousands of people in the world today who owe their lives to him—it was manufactured in America, and we were paying a royalty year after year from the National Health Service to American druggists for a drug invented by a great Englishman.

Mr. E. G. Willis (Edinburgh, West)

A great Scotsman, surely?

Dr. King

I hope that the Minister will be able to tell us what steps he is taking to take over from the Americans the manufacture of British products.

8.50 p.m.

Mr. Raymond Gower (Barry)

I wish to make one comment on what was said about charging for the services administered for the benefit of people from abroad. I quite agree with the view that has been expressed that this is both desirable and needed, but I think it would be most difficult to do. I think, however, my right hon. Friend recognises that the number of questions addressed to us as hon. Members of this House, and indeed to him, indicate that among the general public there is a good deal of misunderstanding about this issue. It is the kind of thing that can easily arouse a hearty roar of approval at any meeting. I hope he will find it possible to get some more definite information about the difficulty and the cost than he has yet been able to give the House.

My only other point concerns Wales. The figures indicate that the miscalculation in respect of expenditure in Wales was proportionately rather more serious than in England. I wonder to what extent as regards teaching hospitals, if at all, this is due partly to the antiquated nature of the hospital in Cardiff, which involves a great deal of capital and revenue expenditure each year. The maintenance expenditure is necessarily heavy owing to the age of the building, which has given great service but obviously should now be replaced.

My right hon. and learned Friend will recall that one of his predecessors promised us in the relatively near future one of the new hospitals as a teaching hospital in South Wales, the first to be built since the war. I would like to know whether even the current expenditure on the maintenance of existing buildings, apart from other reasons, indicates that this matter should now receive his earnest attention. We need this hospital for other reasons also. Cardiff has established in respect of its population an enviable reputation, and a new teaching hospital would be a facility which would give greater opportunities to the large number of young people in South Wales who are entering the practice of medicine.

I hope my hon. Friend will find it possible to comment on this point when he replies to the debate.

8.53 p.m.

The Parliamentary Secretary to the Ministry of Health (Mr. Richard Thompson)

When my right hon. and learned Friend the Minister of Health opened the debate he made the case for the Supplementary Estimate in general terms, and I can best serve the House by dealing with some of the points of detail which have arisen during the debate. To a great extent it has turned on the question of drugs: how we can effectively control the size of the drug bill, and similar matters. I will answer a number of hon. Members at the same time by dealing with the question in some detail. First, I will outline the measures we take now to limit the size of the drug bill.

We try to encourage doctors to be economical and we keep them cost-conscious by means of letters from the Chief Medical Officer of the Ministry of Health, through comparative lists of prices supplied to them by the Ministry, through the British National Formulary, through Prescribers' Notes also issued by the Ministry, and through arrangements whereby a doctor can compare the cost of his prescribing with that of his colleagues.

There are also arrangements under which the Ministry's regional medical officers visit doctors, where necessary, to inquire into possible excessive prescribing. Eventually, reference may be made for formal investigation by the local medical committee, and the Minister has power, in appropriate cases, to direct that money be withheld. Of course, that is exceptional and only in the last resort.

My hon. and gallant Friend the Member for Croydon, North-East (Vice-Admiral Hughes Hallett) referred to the recommendations of the Select Committee on Estimates that the Minister should urge on medical schools that medical students should be required to satisfy examiners about their knowledge of the financial structure of the National Health Service and the costs of the treatment for which they may be responsible. That recommendation is under active consideration, and I can say that earlier approaches have been made by the Ministry's Chief Medical Officer to deans of medical schools on the subject of instruction on economic prescribing. This is an aspect of the cost of prescribing which no doubt will be brought under review by the Committee under the chairmanship of Sir Henry Hinchliffe.

The prices of proprietary preparations which were not, in the view of the Cohen Committee, therapeutically superior to the standard preparations are now regulated by a voluntary price regulation scheme which has been agreed for a trial period with the Association of British Pharmaceutical Industries. The latest figure for 1956 of the proportion of preparations in this category is 91 per cent., but I shall have a word or two more to say about that in a minute.

The question of giving advice to doctors is extremely thorny and "sticky." No one can reasonably expect a doctor, simply to oblige the Treasury, to utilise the methods of treatment appropriate to a generation ago. Naturally, he will wish to use the latest aids and devices known to science, and he would not be a proper doctor if he did not. Having said that, however, there is the other aspect that it is possible to over-prescribe, all with the very best intentions, as the hon. Member for Newcastle-upon-Tyne, East (Mr. Blenkinsop) said.

It is reasonable to assume that the aggregate effect of these measures has been to help to keep the costs of the drug bill below the level which they might otherwise have reached. We shall set considerable store by the Report of the independent professional committee under the chairmanship of Sir Henry Hinchliffe, which is looking into all this.

I said that I would say a word or two about manufacturers' prices. In 1953, we began a systematic investigation of manufacturers' prices and in 1955 we concluded that prices of standard drugs and preparations were reasonable. This conclusion was based on an examination of costs and profit margins which may be renewed from time to time. On proprietary preparations which, in the Cohen Committee's view, are not superior to the standard preparation, long and difficult negotiations with the Association of British Pharmaceutical Industry led to the Government's acceptance of three years' trial of a scheme under which manufacturers voluntarily accepted regulation of their prices.

This scheme began to come into operation on 17th June, 1957, and has so far been applied over nearly 70 per cent. of the total field, which covers 4,000 preparations produced by nearly 200 different manufacturers. Its application has so far resulted in 237 price reductions at a very substantial saving to the Exchequer. Naturally, this is a process which we want to see continue.

In view of the importance which hon. Members have attached to this question, I should say a word about the three main provisions for regulating prices. Under the first, the price in the United Kingdom shall not exceed that which the product commands in adequate volume in overseas markets in face of international competition. The second consideration, which applies when a drug is not exported in significant quantities, provides that if an identical non-proprietary standard drug is available in the United Kingdom the price of the proprietary shall not exceed the price of the standard drug. Thirdly, if it is impossible to apply either of these two provisions, a maximum price should be determined by using a detailed formula,

comprising an ingredient allowance based upon recognised trade prices and processing and packaging allowances according to a schedule covering different types of drugs. I should add that the scheme also provides, in special cases, that where a manufacturer prefers this course, a fair and reasonable price may be negotiated with the Health Departments.

We are also inquiring into prices of basic drugs, such as antibiotics and hormones, which are important basic ingredients used in both standard and proprietary preparations. Investigations in this field were necessarily held up whilst we were negotiating on proprietary preparations because of the close interaction between the two fields. They are now being resumed.

The hon. Member for Newcastle-upon-Tyne, East made a general plea for a more detailed breakdown of the drug bill and information as to the way in which various conditions were responding to the use of drugs. He probably had in mind such a condition as tubercular meningitis which, once uniformly fatal, is now curable. Indeed, the morbidity and mortality of adult tuberculosis has fallen dramatically over the past ten years because of effective drug treatment.

On the other hand, as at present organised—as the hon. Member well knows—it is difficult for us to isolate these items in the drug bill. I shall certainly bear in mind what he has said about this matter because, if it is possible for us to enlarge our knowledge by some such operation as he suggests, we will certainly consider doing so, but for the present I cannot say more than that we will give the matter consideration.

Mr. Blenkinsop

Will the hon. Gentleman follow up my suggestion that he might contact the College of General Practitioners to see what help it might give in any special inquiries into diseases such as bronchitis?

Mr. Thompson

We would certainly see whether its experience and knowledge could be of help to us in that respect.

The hon. Member went on to talk of the danger of prescribing large quantities. In all good temper, I must say that I take leave to doubt whether the removal of the prescription charge would make any difference to the formidable arrays of medicine which accumulate on family shelves. I do not think that it would make the slightest difference.

The hon. Member went on to ask what was the value of the royalty element on foreign drugs imported into this country in large quantities. As he surmised, that is a matter which I certainly cannot answer "off the cuff", if, indeed, it can be answered at all. It involves a complicated statistical exercise in trying to separate the drug royalty element from all the other royalty elements which we pay to foreign countries, but I shall look into the matter and see whether it is possible to get even an approximation of that kind of information.

The hon. Member referred to tranquillisers. We have no general power to control the marketing of a drug in relation to its efficacy or safety, but in their own interests manufacturers do not introduce drugs without a preliminary test and trials. The Health Service Act provides that a general practitioner shall prescribe proper and sufficient drugs and medicines. Our advice is that this gives no authority to exclude a class of drugs from supply under this service.

As regards the question of limitation to prescription, the dangerous drugs legislation applies to specified drugs of addictions, but there is not sufficient evidence on which the Home Office can bring tranquillisers under this kind of control. The Pharmaceutical Society has recommended chemists not to supply transquillisers without prescriptions and such a recommendation would command special weight.

Information about types of tranquillisers and the advice available as to their use and cost was given to National Health Service doctors in March, 1957, in an edition of Prescribers' Notes. For the future, my right hon. Friend the Home Secretary has asked the Poisons Board to consider the general question of the need for controlling the supply of drugs which may be harmful if taken in excess, but it was said that an early report could not be expected and it is likely that further control would require fresh legislation.

Arising out of the matters quoted by certain hon. Members about the misuse of a particular proprietary tranquilliser, the Department is consulting the Home Office about whether reference to the Poisons Board of bromvaletone and carbromal would be desirable in the light of such general information as is now available.

One matter referred to by the hon. Gentleman with which I have not dealt is the disparity in the prescribing returns as between industrial and other areas. There are unexplained differences in the cost of prescribing per person between apparently similar areas, which apply to industrial areas as well as others. There has been no fundamental change since the increase in the charge. It is true to say that prescribing is less expensive in rural than in industrial areas, but no such generalisation is true as between industrial and other urban areas. The figures are being studied by the Hinchliffe Committee.

Mr. Blenkinsop

Can the hon. Gentleman do anything about the idea of developing a special standard of price indications for general practitioners? That proposal is being aired at present.

Mr. Thompson

I will look into that.

My hon. and gallant Friend the Member for Croydon, North-East referred to several matters. I have dealt with the recommendation of the Select Committee on Estimates, but he referred to the question of economies arising from the closure of small hospitals and matters of that kind. I am glad to say that quite a number of small hospitals have been closed over recent years, 70 or 80 in England and Wales in the past five years.

The small hospitals are, however, providing an essential local service and they attract much local interest and support. It is not infrequently the case that while the economic and medical arguments for closing a small unit may be powerful, or indeed overwhelming, as soon as they are put into practice, an immense volume of local opposition develops and finds political support in this House. However, we are alive to any possibilities of economy and a

more rationalised system of working through the closing of small outlying units that are difficult to staff and otherwise inefficient.

My hon. and gallant Friend referred to the influenza epidemic. It was his view that as we knew that this epidemic was coming—its progress across the world was dramatic and well advertised—would it not have been practicable to take forestalling action rather than to deal with the cases when they actually arose? It would not have been practicable to inoculate 48 million people, which is roughly what we should have had to do, within the time available. We could not have made enough vaccine, and we could not have had enough doctors to give the necessary shots within the time. I cannot think it would have been justifiable to devote to it such a large percentage of our medical effort, although the alternative was that we had to accept epidemic when it came.

Share

Vice-Admiral Hughes Hallet

My point was not connected with vaccination or inoculation, but with the education of patients, telling them on television, and so forth, the simple rules by which one avoids getting this infection.

Share

Mr. Thompson

As a matter of fact, an effort was made in that direction and we received a number of angry calls from doctors who said that they objected to the Ministry of Health setting itself up as doctor and telling patients what steps they should take to meet a not very specifically defined complaint.

My hon. Friend the Member for Heston and Isleworth (Mr. R. Harris) had a question on the prices of drugs with which I hope I have dealt in my general reference to the subject earlier. In particular, he asked whether we could control the size of packages. My advice is that we cannot, more particularly in the case of American drugs.

Share

Mr. R. Harris

On the question of prices, I understand from my hon. Friend that there have been 237 price reductions. Is that out of the total of 4,000 possible, since he said that there were 4,000 drugs? What special steps are taken in the case of a drug like Terramycin, which is a monopoly? I was at a loss to understand what a trade association can do in getting restriction or reduction in prices.

Mr. Thompson

Inquiry into these prices is still going on. Although I mentioned the figure 237, which my hon. Friend correctly quoted, that is not the whole story. We have not stopped there. On the particular point about terramycin, I could not tell my hon. Friend whether there is any alternative supply. If the doctor chooses to prescribe this drug we cannot stand between him and his patient. I agree that if we can provide the means of a more economical source of supply, it would be very desirable indeed.

The hon. Member for Nottingham, North (Mr. J. Harrison) had a point about what he thought was the indiscriminate admission to hospital of patients of foreign origin not resident in this country, as the result of which beds were taken up and expense was devoted to the care of those patients. The hon. Member asked me, I think, what force lay in the argument that the administrative procedures necessary to stop this were so complicated that it was not worth while to do so.

I would make two replies to that. The first is that one of the administrative procedures is already at work, and, I think, functioning satisfactorily. The immigration officials at the ports have instructions to resist as far as possible, people coming here whom they are able to show, or whom they have reason to think have come here specifically for the purpose of going into hospital to have an operation. I am sure that the hon. Member will be pleased to know that.

The rest of the argument probably applies more particularly to the general practitioner service but is also relevant to the hospitals, to which the hon. Gentleman wished to confine it. I think that he will see—and this is the answer to my hon. Friend the Member for Barry (Mr. Gower), also—that if we are to erect a nationality bar to these people, someone has to do it

for us, and that, in practice, will be the doctor, who will have the duty of satisfying himself that various patients coming to his surgery are foreigners. We take the view that that is putting an additional, unsought and unwelcome duty on the doctor, and that, if it is performed efficiently, it will make the treatment of our own people more difficult than it is now.

Share

Mr. Gower

I certainly did not advance any argument that was at all contrary to what my hon. Friend has just said, but I did suggest that public opinion obviously demands a rather clearer answer on this subject than has yet been given.

Share

Mr. Thompson

Perhaps my references, and my hon. Friend's intervention, may enlighten public opinion. I hope so.

My hon. Friend the Member for Carlisle (Dr. D. Johnson) asked a number of questions about the future of psychiatric medicine—about which he has been asking Questions recently—which, I think, went a little outside of the scope of this debate. It is a fascinating subject but, with great respect, I would have thought that the proper time to raise it would be during a general debate on the Estimates which, no doubt, we shall have before long.

I know that hon. Members for Scotland are anxious to have a debate——

Share

Miss Margaret Herbison (Lanarkshire North)

Not now.

Share

Mr. Thompson

We seldom hear them admit defeat. However that may be, they must admit that I did my best to get them into the debate.

I have no intention of minimising an increase of even the 1½ per cent., which we are asking on our original Estimate of £477 million, but it has been shown by my right hon. and learned Friend that most of this arises from higher wages and salaries and increased prices. Consequently, the increase in real terms is smaller, although, of its nature, the Service is an expanding one, because we have an increasing population, old people are living longer, and drugs are getting more costly.

Clearly, the National Health Service will be a major beneficiary if the efforts of Her Majesty's Government to stabilise prices prove successful, and, although we need to look with the greatest care at such a great consumer of public money as is this Service, and not pass lightly any demand for additional provision that is made, I feel that we have made out the case for this Supplementary Estimate, and I hope that hon. Members may feel that the money can now be voted.

Question put and agreed to.

Fourth Resolution read a Second time.

Motion made, and Question proposed, That this House doth agree with the Committee in the said Resolution.

Influenza Epidemic

19 January 1970

Volume 794

88.

Mr. Wall

asked the Secretary of State for Social Services if he will make a statement on the epidemic of influenza and measures taken to combat its spread.

Mr. Crossman

A sharp increase in influenza was first reported from parts of Kent and south-east London in the week ended 13th December, 1969. During the second half of December outbreaks of considerable intensity occurred in all regions of England and Wales. These developed at first most rapidly in the South East and West Midland regions; the last regions to become heavily involved were the North West and East Anglia. Returns from general medical practitioners indicate that outbreaks in the South East, South West and North East regions reached a peak at the end of December.Requests for hospital accommodation for patients suffering from respiratory diseases rose steeply in the major cities, particularly in London and in Birmingham. Applications for hospital admission through the Emergency Bed Service for London reached a maximum in the last week of December.New

claims to sickness benefit in England, Wales and Scotland for the fortnight ended 6th January, 1970, which covered the Christmas holiday period, totalled 1,084,000 (provisional figure) which is higher than any two consecutive weeks since the influenza epidemic of the autumn of 1957 when 1,106,000 new claims to sickness benefit were recorded in the fortnight ended 8th October. New claims for the week ended 13th January totalled 635,000.Deaths assigned to influenza and influenzal pneumonia in England and Wales for the week ended 9th January 1970 totalled 2,850 (provisional figure), which represents a mortality rate from influenza greater than any experienced in a similar period since the winter of 1950–51. The deaths have occurred mainly in the older age groups, about 90 per cent. of them in persons aged 55 years or more. There have been corresponding rises in deaths assigned to pneumonia and bronchitis to many of which influenza virus infection may have contributed.There are no practical means of preventing the spread of influenza in the general community. Influenza vaccine is available but I have been advised by the Joint Committee on Vaccination and Immunisation that a decision to make its use routine could not be expected to make a significant contribution to the control of outbreaks. The decision whether or not vaccination is desirable for an individual patient must lie with his own medical practitioner. The Joint Committee's advice is that influenza vaccine may be indicated for the protection of persons suffering from certain chronic diseases in whom an attack of influenza might aggravate their disability or prove fatal, and might also be offered with advantage to children in residential establishments and to those. such as nurses and doctors, at special risk of infection because of their contact with patients. The Chief Medical Officer reminded doctors, including medical officers of health of local authorities responsible for ambulance services, of this advice early in November.

89.

Mr. Wyatt

asked the Secretary of State for Social Services on the basis of what evidence his Department issued statements on several occasions before the recent influenza epidemic to the effect that there was no influenza epidemic and that one was not expected.

Share

Mr. Crossman

The Department has not issued any statement to the effect that an epidemic of influenza was not expected. As soon as information became available of a sharp increase in parts of England and Wales the Department issued on 10th December 1969 a statement to this effect. Detailed influenza statements have been issued weekly since 12th December showing the rapidly rising trends which occurred in subsequent weeks.

Share

Mr. Wall

asked the Secretary of State for Social Services what special arrangements were made to provide influenza vaccine during the recent epidemic, particularly for those in specially vulnerable employment such as ambulance drivers.

Share

Mr. Crossman

I would refer the hon. Member to my reply to another Question from him today.

Share

"Hong Kong 'Flu"

25 October 1968

Volume 296

The EARL OF HARROWBY

asked Her Majesty's Government whether any steps can be taken to expedite the production of the preventative antibiotic for "Hong Kong 'flu", in view of the likelihood of this disease reaching this country later this year.

BARONESS SEROTA

Some infections with the new variant of influenza virus have already occurred and more can be expected.No antibiotic has been shown to be effective against influenza. Certain new anti-viral drugs are under investigation but are not yet proven.The new variant of influenza virus is already being incorporated into new vaccines now under active development by the pharmaceutical industry. Production has begun and substantial quantities will have become available by the end of the year, but the degree of effectiveness of any new vaccine cannot be known in advance of use.

Influenza Vaccine

02 December 1968

Volume 774

40.

Dr. John Dunwoody

asked the Secretary of State for Social Services what preparations he has made in view of the possibility of an influenza epidemic this winter.

56.

Mr. Kenneth Lewis

asked the Secretary of State for Social Services what steps he is taking to ensure that there is sufficient vaccine available for inoculation against the threatened epidemic of Asian flu.

Mr. Ennals

In reply to my hon. Friend the Member for Billericay (Mr. Moonman) on 22nd November, I described steps being taken to increase supplies of vaccine and to give priority to those for whom protection is medically desirable. My right hon. Friend's Chief Medical Officer has now

written to all family doctors on the subject, and wholesalers, as well as manufacturers, have been approached. My Department is also in touch with the pharmaceutical profession. We hope that, subject to the necessary testing and checking, substantial and increasing supplies of imported vaccine will start to become available to doctors before Christmas.—[Vol. 773, c. *349–50*.]

Share

70.

Mr. Garrett

asked the Secretary of State for Social Services what arrangements have been made to make available to Members of Parliament and House of Commons staff anti-flu vaccine.

Share

Mr. Ennals

None. I indicated in my answer of 22nd November the categories of persons for whom vaccination against influenza might be desirable and the arrangements that have been made to make vaccine available to them. My right hon. Friend would not feel justified in extending these arrangements to other categories.—[Vol. 773, *c. 349–50*.]

Share

Mr. Moonman

asked the Secretary of State for Social Services if he will take steps to enforce the priorities which he has established for the distribution of the Mao influenza vaccine.

Share

Mr. Ennals

My right hon. Friend has no reason to suppose that suppliers will not comply with the request he has made to them.

Share

Mr. Moonman

asked the Secretary of State for Social Services what estimate he has made of the number of doses of Mao influenza vaccine which will be needed to deal with the epidemic expected to break out in late December.

Share

Mr. Ennals

No estimate is possible since the extent to which influenza vaccine is used mainly depends on the clinical judgment of individual doctors. Routine use of the vaccine is not recommended.

Share

The art of medicine

Revisiting the 1957 and 1968 influenza pandemics

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The virus emerged in China in the winter of 1957 and spread rapidly worldwide via ships, aeroplanes, and trains. In April, it sparked a major epidemic in Hong Kong, where about 250 000 people were infected, and by June India had seen over a million cases. Shortly afterwards, it made landfall in the UK, and by September outbreaks were being reported in England, Wales, and Scotland. General practitioners were "amazed at the extraordinary infectivity of the disease" and the suddenness with which it attacked younger age groups. Yet, while some members of the College of General Practitioners called for the UK Government to issue a warning about the dangers presented by the virus and coordinate a national response, the ministry of health demurred. Instead, the virus was permitted to run its course.

The 1957 outbreak was not caused by a coronavirus—the first human coronavirus would not be discovered until 1965—but by an influenza virus. However, in 1957, no one could be sure that the virus that had been isolated in Hong Kong was a new pandemic strain or simply a descendant of the previous 1918–19 pandemic influenza virus.

The result was that as the UK's weekly death count mounted, peaking at about 600 in the week ending Oct 17, 1957, there were few hysterical tabloid newspaper headlines and no calls for social distancing. Instead, the news cycle was dominated by the Soviet Union's launch of Sputnik and the aftermath of the fire at the Windscale nuclear reactor in the UK.

Bridgeman Images

British navy sailors in bed because of influenza in a warehouse near Ipswich, UK, which was transformed into an infirmary for 850 sailors, Sept 19, 1957

By the time this influenza pandemic—known colloquially at the time as "Asian flu"—had concluded the following April, an estimated 20 000 people in the UK and 80 000 citizens in the USA were dead. Worldwide, the pandemic, sparked by a new H2N2 influenza subtype, would result in more than 1 million deaths.

The subsequent 1968 influenza pandemic—or "Hong Kong flu" or "Mao flu" as some western tabloids dubbed it—would have an even more dramatic impact, killing more than 30 000 individuals in the UK and 100 000 people in the USA, with half the deaths among individuals younger than 65 years—the reverse of COVID-19 deaths in the current pandemic. Yet, while at the height of the outbreak in December, 1968, *The New York Times* described the pandemic as "one of the worst in the nation's history", there were few school closures and businesses, for the most, continued to operate as normal.

The relative unconcern about two of the largest influenza pandemics of the 20th century—the *Encyclopaedia Britannica* estimates that the 1968 pandemic, due to an H3N2 influenza virus, was responsible for between 1 million to 4 million deaths globally—presents a marked contrast and, to some critics, a rebuke to today's response to COVID-19 and the heightened responses to outbreaks of other novel pathogens, such as avian and swine influenza. "When hysteria is rife, we might try some history", opined Simon Jenkins in an article in *The Guardian* titled "Why I'm taking the coronavirus hype with a pinch of salt". "The [1968] pandemic raged over three years, yet is largely forgotten today", commented *The Wall Street Journal*, "a testament to how societies are now approaching a similar crisis in a much different way".

The ultimate testament to the supposed stoicism of earlier generations, according to this line of thought, is the 1918–19 influenza pandemic, in which at least 50 million people worldwide perished, but which resulted in few public monuments and was largely "forgotten" by the collectivity of society.

But were people really more stoical in 1918, 1957, and 1968? Or were there other factors that might account for the dampened social and emotional responses to these pandemics? And what should historians make of functionalist and, arguably, selective readings of history that seek to draw moral lessons from the past?

To answer these questions it is necessary to understand the origins of the modern preoccupation with pandemics. Before

the mid-19th century, few medical commentators used the term pandemic. That only began to change in the 1890s with the arrival of bubonic plague from southern China—what became known as the Third Plague Pandemic—and the Russian influenza pandemic that broke out in St Petersburg in 1889 and which was seen to spread rapidly to Berlin, London, and New York through ship and rail connections.

However, perhaps the crucial factor was the way that Victorian epidemiology and the science of vital statistics made the pandemic form of influenza "visible" to physicians in the UK who had long been sceptical of influenza, then viewed by some as a suspect Italian term for the common cold.

Statistics had long been used in the insurance and annuity businesses, but it was only in the 1840s that William Farr, the chief statistician to the General Register Office in the UK, began to use statistics in a systematic way to measure variations in the health of populations and the occurrence of epidemics. One of the most powerful tools in Farr's kit was the "excess death rate", calculated by subtracting the number of deaths observed during an epidemic from the average during non-epidemic seasons.

In 1847–48, Farr had observed that influenza increased respiratory deaths in London by about 5000 compared with non-epidemic years. However, because of the difficulty of distinguishing influenza from other respiratory diseases, physicians had attributed just 1157 deaths to influenza and the remainder to asthma, bronchitis, and pneumonia.

To persuade doctors of their error, and convince them that influenza ought to be taken as seriously as cholera and other notifiable diseases, Farr tabulated excess respiratory deaths and made them a regular feature of the annual mortality tables. In this way, he thought, statistics would spur sanitary reform and "banish panic".

What Farr could not have foreseen is that by making the risks presented by influenza and other forms of respiratory disease more visible to the medical profession, his statistical innovations would have the opposite effect. This was partly because it now became possible to measure the intervals between the peaks in excess deaths from respiratory diseases and show that influenza pandemics occurred in waves, with the second and third waves frequently resulting in more severe disease, and more deaths, than the first. Forearmed with this knowledge, medical officers of health could alert populations to the pandemic threat ahead of time and issue advice on isolation and social distancing measures designed to reduce the peaks or, as we would say today, flatten the curve.

Another crucial factor was the media: thanks to the expansion of telegraphic communications and the growth of mass market newspapers in the late Victorian period, it now became possible to telegraph news of the spreading infection ahead of its arrival, hence *The Lancet*'s claim in 1890 that "dread" of the Russian influenza had been "started by telegraph".

Some critics of the UK Government's response to COVID-19 have levelled similar charges at today's tabloid press and at disease modellers whose initial forecast that, in the absence of suppressive measures, severe acute respiratory syndrome coronavirus 2 could result in the deaths of 500 000 people in the UK has been widely credited with persuading the UK Government to reverse course and institute a strict lockdown. But is it really necessary, they ask, to risk plunging the UK into an economic depression through lockdown measures designed to prevent a wave of mortality given that deaths attributed to COVID-19 are broadly in line with those seen in previous pandemic years? There was no panic in 1957 and 1968, runs this argument, so why the panic today?

It is questionable whether deaths attributed to COVID-19 are comparable to those recorded during previous influenza pandemics, given that between March and early May, 2020, alone the UK Office for National Statistics recorded 55 000 excess deaths compared with the same period last year. Furthermore, it will not be possible to obtain an accurate accounting of the total excess deaths due to COVID-19 in 2020 before 2021 at the earliest and by then, assuming a vaccine is not deployed in the meantime,

A typist in Manchester, UK, during the 1957 influenza pandemic

Nurse Nadyne Weber at Cleveland's Grace Hospital, USA, during the influenza pandemic, December, 1968

many thousands more people will most likely have died from COVID-19. However, critics of the UK Government's response are perhaps right to point to the role of epidemiology and statistical modelling in propagating fear.

Unlike today, in 1957 epidemiologists did not have the ability to track the emergence of a novel pathogen in China—indeed, the initial signal was missed by WHO, meaning that the first that influenza experts knew of the "Asian flu" pandemic was when *The New York Times* published the report about the outbreak in Hong Kong. In 1957, virologists did not understand the genetic mechanisms behind the emergence of new pandemic strains, hence the initial confusion as to whether this influenza virus was a variation of the H1N1 influenza virus of 1918.

More importantly, realising that influenza was usually associated with mild or inapparent infections and that quarantines were impractical, public health authorities in the USA and the UK made no effort to mitigate the spread of the infection by, for instance, introducing border checks or strict isolation measures. Nor did governments consider suppressing the basic reproduction number to buy time for hospitals and front-line health workers: as Hugh Pennington, then a young medical student at St Thomas' Hospital, London, UK, recalled in a recent article in the *London Review of Books*, this was because intensive care units were not yet established in 1957 and ventilator technology was rudimentary. Nor, when the second wave of the pandemic arrived in the autumn of 1957, were hospitals overwhelmed by patients. Similarly, a review of hospital admissions in Pittsburgh, Baltimore, and New York, USA, during the 1968 pandemic found that although patient numbers increased by 3%, hospitals coped with the influx. Indeed, the only real strategy considered by health authorities in the UK and the USA was vaccination, but the vaccines arrived too late in both the 1957 and 1968 influenza pandemics to make a difference.

Not everyone was happy with the UK Government's passivity, however. "The public seems under the impression that nothing can be done to prevent the calamity that is threatened by the advance of influenza in the Far East", argued Dr Kitching in a letter to the *BMJ* in June, 1957. "On the contrary there is a great deal that the Government can do; by acting at once they may save hundreds of thousands of lives."

But the ministry of health was not listening. Instead, fearing that the press would have a field day if it issued a prominent warning about the pandemic, it left it to local medical officers of health to decide on the most appropriate course of action. "The general assessment seems to be that eventually [the influenza] will affect up to 20 percent of the population", wrote the then junior health minister John Vaughan-Morgan. "This is a heaven-sent topic for the press during the 'silly season'".

Vaughan-Morgan was right to be concerned about the press's reaction. At the end of July, 1957, the *Daily Mail* issued a dire warning about a "new outbreak of Asian flu" when a 1-year-old girl fell ill in Fulham. *The Guardian* surrendered its cool editorial tone for a headline reading: "Crash Fight Against Asian 'Flu'".

However, such headlines were the exception and for the most part newspapers seem to have behaved responsibly during the pandemic. Publishers were also reluctant to be seen to be stoking public fears, a reflection perhaps of heightened anxieties due to the Cold War and the launch of Sputnik, as well as greater respect for medical experts and deference to authority.

Indeed, Charles Graves, the brother of the novelist Robert Graves, recalled how when news of the influenza outbreak reached his publisher, Icon, it put the publication of his book *Invasion by Virus* on hold, citing concerns about "frightening the public". The result was that it was not until 1968 that Icon finally agreed to release the title, having been reassured in the meantime that influenza in 1957 "was no real killer". In his book Graves compared the 1957 and 1968 pandemics to that of the 1918–19 influenza pandemic and asked "Could it happen again?" His answer was yes and that the UK had been lucky that the recent pandemics had been of a "mild type" of influenza. He closed by reassuring readers that history was unlikely to repeat itself before 1998, "by which time the medical profession will know a great deal more about immunisation that it did in 1918—or does now."

Graves was right on both counts, but wrong to think that better medical knowledge of vaccines and statistical modelling would reduce public anxiety about pandemics.

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http://www.markhonigsbaum.co.uk/

Mark Honigsbaum is a medical historian and author of *The Pandemic Century: A History of Global Contagion from the Spanish Flu to Covid 19* (published by W H Allen on June 4, 2020).

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Cabinet Office

National Risk Register Of Civil Emergencies

2017 edition

Cabinet Office
70 Whitehall
London SW1A 2AS

Published September 2017

This publication is available for download at www.official-documents.gov.uk, and can be viewed on our website at www.gov.uk.

This document is also available from Cabinet Office, 70 Whitehall, London SW1A 2AS

Foreword

The United Kingdom has an enviable reputation for resilience. In a rapidly changing world, we are at the forefront of embracing new opportunities and seeking innovative solutions to emerging problems. Our openness and integration of technological developments brings us huge benefits but also introduces risks and vulnerabilities. As such, resilience is crucial to protecting our people and businesses, and through them our society and economy.

Resilience does not come easily but the UK has long experience. Call it what you will, but whether through the fabled 'stiff upper lip', 'Blitz spirit' or just a stubborn determination, our resilience can be seen at the forefront of our handling of emergencies. Within Government, this is based on robust risk management and tried and tested emergency response and recovery arrangements. At the front lines of an emergency, it is based on the unparalleled dedication and selflessness of our emergency services. Throughout society it is based on the many volunteers and charities who provide so much, and most especially on the individual; on you. The risks in this document may seem beyond your control but your response to them is not. Being better prepared will make a huge difference even in the face of adversity.

The 2017 National Risk Register provides an overview of the key risks that have the potential to cause significant disruption in the UK. This document explains the types of emergencies that might occur, what the Government and partners are doing to mitigate them, and how you as individuals, families or small businesses can help to protect yourself.

We have made the National Risk Register more robust, informative and accessible than ever before. When compiling the document we have drawn on the support of Government Departments, Devolved Administrations, local resilience practitioners and many external partners, including universities and industry. It is only with that help that we are able to produce robust and credible assessments and prepare ourselves for the challenges we face.

It is an unfortunate fact of life that emergencies do happen. However our awareness, preparedness, readiness and response to those emergencies is very much in our own hands. I encourage you to consider that as you read this document.

Caroline Nokes MP

Minister for Government Resilience and Efficiency

CONTENTS

CHAPTER 1 - INTRODUCTION

Purpose

Emergencies are a fact of life throughout the world and can take many forms. In the UK, we are fortunate that our environment and climate are relatively calm and stable, but we still face some risks that could cause serious disruption to peoples' day to day lives.

Alongside emergency services and local authorities, the Government has an important role to play in identifying, assessing, preparing for and dealing with emergencies, from flooding and severe storms to industrial accidents or terrorist attacks.

In addition to everything the emergency services and other authorities do to manage risks, there are also sensible precautions that you can take to help protect yourself. These include being aware of risks and understanding what you can do individually, or as part of your business or community to prepare for them.

There are some events that could cause widespread damage and would require some form of Government response. The Government produces this document, the *National Risk Register of Civil Emergencies* (NRR) to give information to the public about these risks, alongside advice and guidance on how you can prepare for them.

The NRR is based on information from the *National Risk Assessment*, which is a classified assessment of risks that could happen in the UK over the next five years. Both products help the Government and local authorities to inform, plan and prepare.

Synopsis

Chapter 1 explains what risks are included and how the NRR works. Diagrams in Chapter 1 (referred to as 'Risk Matrices') compare a sample of emergencies based on how likely they are and the severity of their likely effects on society.

Chapter 2 describes how you might be affected by the consequences of an emergency (such as transport disruption or power loss), along with simple actions that will help protect and prepare you, your family and your business if they happen.

Chapter 3 goes into more detail about each of the risks and how the Government and others prepare for and manage them. These pages also contain further information and resources to help individuals, businesses and communities to plan for specific emergencies.

Chapter 4 briefly outlines the methodology used to identify, assess and prioritise risks.

Is this document online?

Yes. An online version of the NRR can be found here.[1]

Where else can I find information?

Other useful sources of information include:

- For risks that are **most relevant to your local area**, your Community Risk Register can be found here. These are available from local authorities and are published by Local Resilience Forums in England and Wales, and Regional Resilience Partnerships in Scotland. They provide a brief overview of significant risks based on local conditions, infrastructure and geography. Page 70 has more information on local arrangements.
- For guidance on the **consequences of emergencies for businesses**, please refer to the Business Resilience Planning Assumptions.
- For **resilience training and qualifications**, please refer to the Emergency Planning College website. The College helps train resilience planners from across the UK.
- For information specific to **your part of the UK**, please refer also to the resilience websites of Scotland, Wales or Northern Ireland. Sections of this document also include relevant links.

What is a civil emergency?

Emergencies can take many forms. Most emergencies will be dealt with by local authorities without the involvement of central Government. However, there are some events which, if they happened, would have a serious effect on the security of the UK, its people or the environment in which we live. These risks are considered to be 'civil emergency' risks and are defined further in the *Civil Contingencies Act 2004* (linked here).

Every two years the UK Government produces an assessment of the risks facing the UK that could cause a civil emergency. These risks are written in the form of scenarios or events, such as a severe storm or a disease outbreak. The seriousness of any risk depends on two things: (a) how likely it is that the risk will occur; and (b) the expected impacts were it to happen. Government considers both of these factors when assessing a risk scenario.

The NRR is not a list of every harmful event that might occur. The NRR only considers events where there is evidence to suggest that it could plausibly happen within the next five years and where the consequences of that event would cause a civil emergency.

The risk matrices

A risk matrix illustrates at a glance the relative effects and likelihood of different risks. The two matrices on pages 9 and 10 illustrate a selection of risks that could lead to a civil emergency: one for natural hazards, accidents, diseases and societal risks; the other for malicious attack risks (e.g. conducted by terrorists). Some risks on the matrices contain multiple individual scenarios, each of which would cause different kinds or levels of damage. These have been condensed into summarised categories. Icons on the matrices represent the overall likelihood or impact of that risk category.

[1] https://www.gov.uk/government/collections/national-risk-register-of-civil-emergencies

How have the risks changed?

The Government's assessment of risks is based on a continuous cycle of learning lessons from real events, drawing on new scientific or technical evidence and improving the way in which we calculate the likelihood and potential impacts (consequences) of risks. Each NRR therefore improves upon the last one and updates the Government's understanding of risks. Previous editions can be found here.

The Government's assessment of some of the risks in the 2017 NRR has changed since the previous NRR was published in 2015. In some cases the changes are the result of new or better modelling which improves Government's understanding of the risk scenarios. In other cases, amendments reflect the changing world in which we live. Some examples of changed risks are included below.

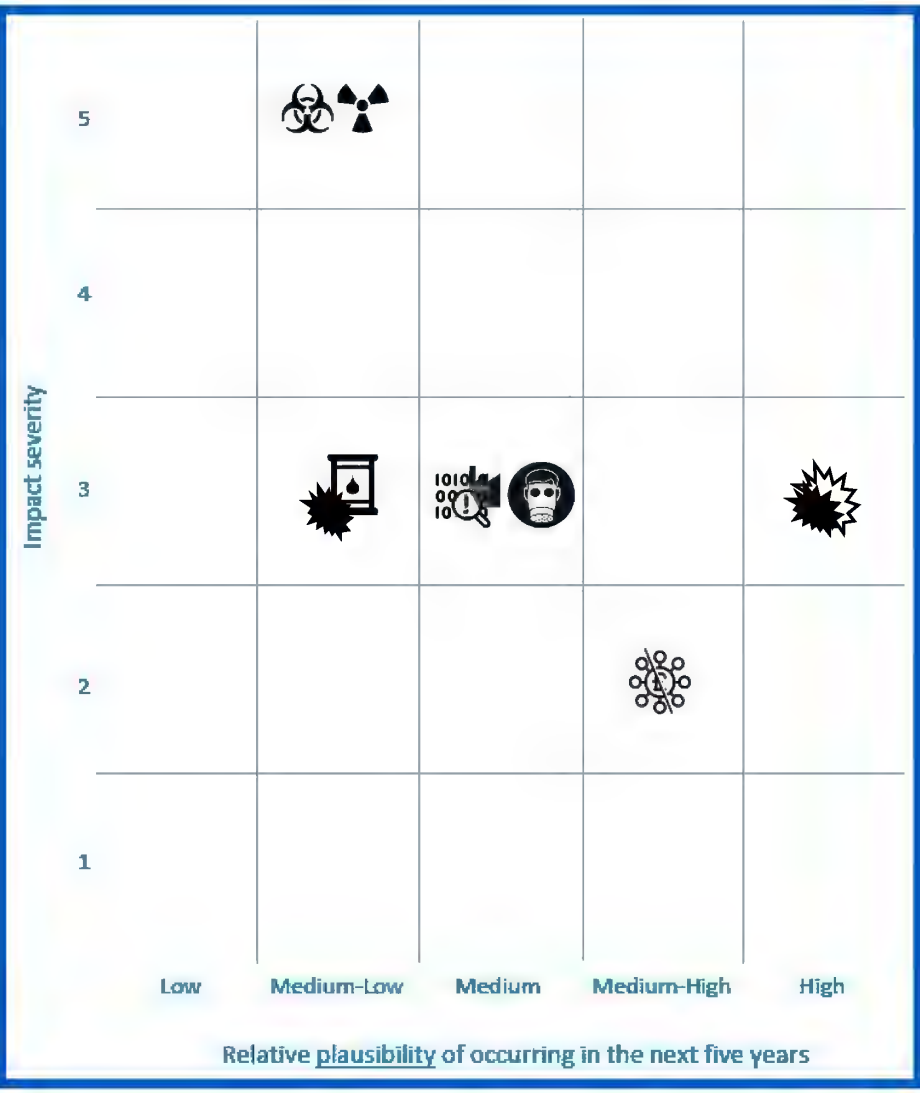
Long-term trends

This document covers very severe risks that could affect the UK within the next five years. In addition there are a variety of longer-term trends that are likely, over the coming decades, to change the overall risk landscape. These trends could make the risks we currently face more severe or more likely. In time they could also lead to the emergence of completely new risks.

[2] The 'Group of 7' and 'Group of 20' major advanced economies, respectively.
[3] Committee on Climate Change (2016): *UK Climate Change Risk Assessment 2017 - Synthesis Report*

Matrix A - Hazards, diseases, accidents, and societal risks

Matrix B - Malicious attack risks



CHAPTER 2 - BE PREPARED

This chapter will demonstrate the likely consequences in the event that emergencies like those explained in this document were to happen. It will then describe some simple actions that you might consider taking to better protect you, your family, your home and your business.

Temporary closures of **work, school** or **nursery**?

Roads, bridges or **public transport** being unavailable to use?

Physical damage or **flooding** to your home or business?

Having to **leave** your home or business to stay in **temporary accommodation?**

An **electricity blackout** or **loss of other utilities**, such as fuel, water or gas?

Having your personal information **stolen** or **corrupted** online?

A risk to you or **your family's health** from **extreme temperatures** or **disease?**

Being caught up in a **terrorist attack** involving **firearms?**

Being caught up in an environment **contaminated** by **hazardous materials?**

To protect yourself, your family and your business, you might consider...

Be Aware

Know your local risks; read your Community Risk Register

Consider signing up for **weather** and **flood alerts**

Be aware of your surroundings; report unattended packages or suspicious behaviour

Prepare

Keep up to date with **vaccinations**

Know where **key documents** and **medications** are so you can leave quickly

Consider the right **insurance** for your home and business, and **travel insurance** when abroad

Protect yourself online. Be Cyber Aware

Consider having **basic supplies** at home, like bottled water, a torch and batteries

Consider backup **childcare** and check what your **child's school** plans to do during emergencies

Respond

If you are caught up near gunfire; **Run. Hide. Tell.**

If instructed, or if you are unsure what to do; **Go in. Stay in. Tune in.**

In an emergency **dial 999**

CHAPTER 3 - RISKS

This chapter provides more detail about individual risks and some of the resources you can use to help you in the event of an emergency, including whilst you are abroad. For each risk, we have provided information about the likely consequences of that risk and the actions that Government takes to prepare for them. Further information to help individuals, businesses and communities to plan for emergencies is included at the bottom of each section, including helplines and hyperlinks to other websites.

XYZ — Hyperlink buttons can be clicked when online for more information.

Risks in foreign countries

This document is based on an assessment of risks happening within or affecting the UK. However, all of the risks detailed in the following pages could potentially affect you when travelling or living abroad, whether for work or leisure. Depending on the foreign country, you may experience different levels of response and/or assistance from local authorities. Some risks will also be more likely or more severe in certain countries.

Particularly severe incidents which could require a crisis response include:

- **civil or political unrest**, of such severity that the Foreign and Commonwealth Office may advise you to leave the country;
- events which cause **disruption and hardship to large numbers of British people**, such as volcanic ash, the collapse of travel companies and major airport shutdowns; and
- an incident in which **large numbers of British people are or could be killed or injured.** This includes conflict, terrorism, major transport incidents, major disease outbreaks and natural disasters such as earthquakes, hurricanes and tsunamis.

How does this affect me?

If you are British, a dual national or the immediate family of a British person, you are eligible to ask for consular assistance if you are affected by a crisis abroad. You are responsible for your own personal safety and should read and follow the advice provided by the UK Government and local authorities in the country you are visiting. In some circumstances, there will be limits to the assistance that the Government can provide, e.g. where it would involve sending staff into a situation where their safety could be at risk.

What you should do…

In all cases it is sensible to check the **Foreign and Commonwealth Office's travel advice**, sign up for updates by email alerts and ensure you have any necessary travel insurance before you go. If an incident does occur abroad, follow the advice or directives of local authorities in the first instance.

Twitter - Check the Foreign and Commonwealth Office travel feed

@FCOtravel

Further information online - hyperlinks below

British Nationals Abroad – FCO Guide	Travel advice and updates regarding your destination	General support and advice	Consider taking out travel insurance

NATURAL HAZARDS

Flooding

What's the risk?

There are three types of flooding considered within this document:[4]

- **coastal** (where high tides and storm surges combine to cause the sea to flood inland);
- **rivers and streams**, known as 'fluvial flooding' (where waterways overflow their banks into surrounding areas); and
- **surface water** (where rainfall overwhelms drainage systems).

All three forms could happen in different locations across the UK at the same time. Some flood risks are tied to specific geographic features such as coastline or flood plains, but surface water flooding can occur in a wide variety of locations including towns or cities far from the sea or rivers. Surface water flooding is also particularly difficult to forecast and can happen at very short notice. When flooding occurs, infrastructure (e.g. bridges) or flood defences can sometimes be overwhelmed with little, if any, notice, leading to additional disruption.

Consequences of flooding may include:

- **fatalities** and physical / psychological **casualties**;
- **evacuation** and long-term **shelter** of residents or employees;
- widespread **damage** to property and infrastructure;
- **disruption** to essential services, particularly transport and energy; and
- **environmental damage** or **contamination** (particularly by sewage).

Has this happened before?

Yes. The winter of 2015/2016 was the second wettest winter on record and a series of storms (including 'Desmond' and 'Eva') resulted in heavy and sustained rainfall. 17,600 UK properties were flooded and several bridges collapsed, disrupting access to and from local communities. 61,000 people lost power due to flooding in the Lancaster area. Economic damage was estimated to be about £1.6 billion.

What's being done about the risk?

Reducing vulnerability

- **Permanent defences** - the Government is investing £2.5 billion over six years (2015 to 2021) in England to build 1,500 new flood defence schemes, which will better protect more than 300,000 homes. Scotland is also investing £420 million over ten years (2017 to 2027), with 42 Flood Protection Schemes or engineering works scheduled to begin between 2016 and 2021 to improve protection for 10,000 homes. In Wales, £144 million will be invested in managing flood risk over five years (2016 to 2021).

[4] A fourth type also exists termed groundwater flooding. This happens when the level of water within the rock or soil that makes up the land surface (known as the water table) rises, such as due to persistent rainfall. More information is available here.

- **Temporary defences** - the Environment Agency has invested in 32 kilometres of temporary barriers which can be transported to protect places in particular need.
- **Resilient construction** - increasing numbers of new construction projects have flood resilience designed in from the outset.
- **Managing water flow** - the Government employs strategic use of dredging, reservoirs and barriers to reduce flood risks.
- **Using the local environment** - the Government is supporting investment in the use of natural flood measures such as tree planting to slow down the flow of water.

Better predictions

- Sophisticated **monitoring and forecasting** systems, (see Flood Forecasting Centres below), are used to anticipate flooding and provide early warning to areas likely to be affected.
- The National Flood Resilience Review has improved **the Government's** understanding of some of the worst plausible scenarios for coastal and river flooding.

Improved coordination

- The **Flood Risk Management Programme** aims to reduce the likelihood and effects of flooding in England. Similar activity is conducted by all devolved administrations.
- **Flood Forecasting Centres** are partnerships between the Met Office and the Environment Agency (in England, alongside close collaboration and financial support from Natural Resources Wales), and the Scottish Environment Protection Agency. These bring together expertise on flood monitoring, forecasting and warnings. The Department for Infrastructure in Northern Ireland also works closely with the Met Office in managing flood risks.
- Local Resilience Forums in England and Wales, Regional Resilience Partnerships in Scotland and Emergency Preparedness Groups in Northern Ireland **assess risks**, **develop contingency plans** and **review them.**

Storm Surges

Low atmospheric pressure **allows the sea's surface to** bulge upwards in what is **called a 'storm surge'. If** strong persistent onshore winds occur, these increase the height of the surge and generate waves that can damage the coastline. Surges can occur at any point on the tidal cycle; at low tide they rarely cause flooding but at high tide the resulting flooding can be significant.

What you should do...

The Met Office, Environment Agency, Scottish Environment Protection Agency, Natural Resources Wales and the Northern Ireland Department for Infrastructure, as well as local authorities around the UK all work hard to manage flood risks. You can take advantage of a variety of free, easy-to-use tools to help stay informed and protect yourself, your family, your property and your business.

Online - Flood Information Services - Live alerts by postcode in England / Wales, and Scotland

Telephone - Call the 24/7 Floodline - What to do before, during and after flooding

(England, Wales and Scotland)
0345 988 1188

(Northern Ireland)
0300 2000 100

Flooding on the Somerset Levels, England, 2 February 2014

Further information online - hyperlinks below

Sign up for flood alerts by phone, text or email	Health guidance and advice	Check your local flood risk	Flood defences and coastal change

Key flooding organisations by nation

England	Scotland	Wales	Northern Ireland

Severe weather

What's the risk?

The UK sits in the path of predominately westerly winds where low pressure weather systems, (and associated clouds and rain) frequently move eastwards or north-eastwards across the North Atlantic and then across the UK. This brings unsettled and windy weather, particularly in winter. Summers in the UK are usually cooler than those on the European continent whereas our winters are often much milder. However, experts anticipate that climate change will **alter the UK's weather, leading to** changes in patterns of rainfall and temperature. This has the potential to cause more frequent extreme weather events.

The Government assesses the risk from four main types of severe weather:

- **storms and gales** with damaging wind speeds and possible lightning;
- **low (sub-zero) temperatures and heavy snow** for prolonged periods;
- **heatwaves** with high temperatures lasting several weeks, harming peoples' health; and
- **drought** as a result of a lack of rainfall over several years, leading to water shortages.

Consequences of these events may include:

- **fatalities** and physical **casualties**, particularly among vulnerable groups (e.g. the elderly);
- some **evacuation** of residents or employees;
- **damage** to property and infrastructure, directly and via land instability (e.g. landslides);
- **disruption** to essential services, particularly transport, energy and communications;
- additional pressure on **healthcare**; and
- **environmental damage.**

Have these things happened before?

Yes. A storm on 16 October 1987 brought down 15 million trees in south-east England and caused **dozens of deaths. The 'Burns Day' storm on 25 January 1990 killed 47 people across the British Isles. The 'St Jude's Day' storm on 28 October 2013 caused four deaths** as a result of falling trees, severe disruption to transport and left more than 850,000 homes without electricity. The October storms caused significantly more damage to trees as they still held their leaves, making it easier for strong winds to damage or uproot them.

In February 2001, heavy snow and strong winds caused travel disruption for up to five days and brought down power lines across Northern Ireland. The most widespread and prolonged low temperatures and heavy snow in recent years occurred from December 2009 to January 2010. Daytime temperatures were mostly sub-zero across the UK. At night, temperatures in England, Wales and Northern Ireland regularly fell to -5°C to -10°C, while in Scotland (in the Highland glens) temperatures fell to -15°C or lower. Snowfall across the UK lasted for some time, allowing 20cm to 30cm of snow to build up, closing schools and making it very difficult to travel.

In August 1990, the UK experienced heatwave conditions with temperatures reaching what was then a record 37.1°C in Cheltenham, England. In August 2003 a UK heatwave lasted 10 days and resulted in over 2,000 deaths. Temperatures reached what was then a record 38.5°C in Faversham, England and 33°C in Anglesey, Wales. High temperature records are now being broken with increasing frequency.

Over the past 40 years or so England has experienced five long-duration droughts and two shorter periods of drought. Drought in the other UK nations is rare. During the 2010-12 drought, parts of south-east and eastern England recorded their lowest 18 month rainfall total in over 100 years. 20 million customers were given temporary hosepipe bans and the environment / agricultural sectors were disrupted. Drought has the longest advance warning times of the severe weather types.

What's being done about the risk?

Forecasting

- The **Met Office** provides 24/7 weather coverage and forecasting across the UK.
- The Environment Agency, Scottish Environment Protection Agency, Natural Resources Wales and the Northern Ireland Department for Infrastructure work hard to predict, monitor and provide early warning on severe weather. Links to information sources are at the bottom of the next page.

Publicly-available guidance

- **Warnings** - the Met Office uses a colour-coded system to show the likelihood and effects of expected severe weather.
- **High temperatures** - 'Heat-Health Watch' in England provides an alerting service between 1 June and 15 September each year, issuing tailored advice when temperatures are expected to rise significantly. Advice and guidance for each UK nation is available below.
- **Cold weather** - 'Cold Weather Alerts' in England provide a service between 1 November and 31 March each year, issuing alerts when the average temperature is forecast to fall below a certain level and/or for forecasted heavy snow or widespread ice. Advice and guidance for each UK nation is available below. Additional cold weather guidance for Wales is also available here.
- **Campaigns** - Government public information campaigns such as 'Get ready for winter' and 'Ready Scotland' give tailored advice, particularly for vulnerable people. The public health agencies in each UK nation may also employ bespoke campaigns during severe weather events.

Regulation, legislation and planning

- **Severe weather planning and response** - local and central Government work with infrastructure operators and emergency responders to develop response plans to deal with potential damage and restore utilities and travel routes as quickly as possible.
- **Drought planning** - water companies have a statutory duty to plan for drought. Plans include a range of actions to manage the supply and demand of water. The Environment Agency also has a drought response framework which sets out how the Agency works with Government, water companies and others to manage water resources during a drought in England. Natural Resources Wales maintains plans for dealing with droughts in Wales.
- **Emergency Drought Orders** - legislative orders can be issued to restrict water usage if required.

Heavy snow on Snowdon/Yr Wyddfa, Wales, 25 December 2010; seen from Carnedd y Cribau

What you should do…

Simple actions that can help keep you, your family and your business safe from severe weather are illustrated as part of the overall guidance in Chapter 2 and particularly within the links below.

Telephone – For more information via phone, call the 24/7 Met Office Weather Desk

Weather Desk (UK-wide)

0370 900 0100

Further information online - hyperlinks below

UK severe weather warnings	Severe weather warning impact tables	Community resilience	Driving in adverse weather

Heatwave advice

England	Scotland	Wales	Northern Ireland

Winter is coming… prepare yourself

United Kingdom	Scotland	Wales	Northern Ireland

Space weather

What's the risk?

Space weather is a collective term used to describe a series of phenomena originating from the Sun. There are three main types of space weather:

- **solar flares** which reach Earth within a few hours and can cause radio blackouts;
- **solar energetic particles** which travel somewhat slower and cause solar radiation storms, potentially harming astronauts if not forewarned; and
- **coronal mass ejections (CME)** which take up to four days to reach Earth and cause geomagnetic storms.

Consequences of these events may include:

- **electricity blackouts,** potentially causing **fatalities** and physical / psychological **casualties**;
- **loss / disruption** of Global Navigation Satellite Systems (e.g. GPS or Galileo);
- **disruption** to essential services, particularly air travel, energy and communications; and
- increases in **background radiation** doses high in the atmosphere and in space.

The Earth's core is largely molten iron and, as the Earth rotates, this creates a powerful magnetic field around our planet called the Magnetosphere. The Magnetosphere protects us from harmful radiation in the manner of a planetary shield. When solar flares, energetic particles or CMEs hit the Magnetosphere, this causes interference in the shield that disrupts technology, particularly electricity networks and services that rely on objects operating in space. Orbiting satellites are particularly vulnerable and can be damaged or temporarily disabled. Even if satellites continue to operate correctly, their signals may not reach the ground due to the effects of space weather.

Has this happened before?

Day-to-day space weather causes the *Aurora Borealis* ('the Northern Lights'), but much more severe events have occurred. The Carrington Event in 1859 is the largest space weather event on record. Telegraph systems were heavily disrupted and the *Aurora Borealis* was sighted as far south as Mexico, the Caribbean and Sub-Saharan Africa.

Other significant space weather events have been recorded since then. A Carrington-scale CME was measured by the Stereo-A satellite in July 2012. The path this took from the Sun narrowly missed the Earth. A smaller storm in 1989 tripped the equipment protection systems of the Hydro-Québec electricity network in Canada, resulting in a loss of power for nine hours across the province.

Another storm in 2003 caused the UK aviation sector to lose some GPS functions for a day. Records from solar storms in 1921 and 1960 describe widespread radio disruption and impacts on railway signalling and switching systems.

What's being done about the risk?

Pre-event

- **Understanding** - the Royal Academy of Engineering report on *Extreme Space Weather* (linked below) analysed potential impacts of space weather on the UK's infrastructure, and this is being used to inform measures to reduce the risk. The Department for Business, Energy and Industrial Strategy is also working with the electricity industry to understand exactly what might happen to the UK's electricity networks during space weather.
- **Strategy** - the Government's *Space Weather Preparedness Strategy* is linked below.
- **System hardening** - the relevant companies increasingly use better electronic shielding for satellites, new production regulations for electronic components and more resilient transformers in the electricity grid.

Forecasting

- **Forecasting by the UK** - the Met Office Space Weather Operations Centre provides a 24/7 forecasting service for a variety of space weather events.
- **Forecasting by partners** - the UK works closely with international partners to share information and knowledge.

Satellite Photography

The image to the right shows a coronal mass ejection (CME) leaving the Sun.

The Sun is the white circle in the middle of the image. The black disc obscures the Sun's brightest light to allow for the picture to be taken. The bright arc on the right is the CME.

The Earth is 100 times smaller than the white circle.

What you should do...

Relevant, harmful effects caused by a severe space weather event will be similar to those that happen if the UK electricity supply experiences a failure. Further information about this is covered on pages 40 to 43.

Further information online - hyperlinks below

Met Office – What is space weather?	Royal Academy of Engineering	Space weather public dialogue	Health protection guidance	Government Preparedness Strategy

Volcanic eruptions

What's the risk?

There are a range of volcanoes across Europe that could affect the UK, such as Santorini in the Aegean Sea and Vesuvius in Italy. However volcanoes in Iceland (such as Bárðarbunga and Eyjafjallajökull) are of most concern because they are close to the UK, erupt frequently and prevailing winds are more likely to blow ash and gas towards us.

Consequences of volcanic eruptions may include:

- **casualties** (from poor air quality);
- **disruption** to essential services, particularly transport;
- **economic damage** as disruption to air travel affects business and tourism; and
- **environmental contamination**, particularly to water and agriculture.

There are two distinct types of volcanic eruption. **'Explosive' eruptions happen when thick magma** reaches the surface of the volcano. This prevents gases from escaping, which build in pressure until they eventually explode, blasting magma and rock into the atmosphere in a cloud of ash, gas and other particles. Volcanic ash clouds can affect jet engines and therefore disrupt air travel. The second type, **'effusive' eruptions, happen when large quantities of** gases are able to escape freely. This can lead to long **periods of air pollution affecting crops and people's** health, particularly if they suffer from existing respiratory conditions.

Has this happened before?

Yes. In April 2010, a relatively small explosive eruption of Eyjafjallajökull in Iceland coincided with north-westerly winds, resulting in disruption to air travel across much of the UK and Northern Europe for six days. The 1783–84 Laki eruption from Grimsvötn in Iceland was an effusive eruption, releasing significant levels of sulphur dioxide, chlorine and fluorine over several months. This caused visible pollution across the UK and Northern Europe, mass crop failure and thousands of deaths.[5]

What's being done about the risk?

[5] Witham, C., Aspinall, W., Braban, C., Hall, J., Loughlin, S., Schmidt, A., Vieno, M., Bealey, B., Hort, M., Ilyinskaya, E., Kentisbeer, J., Roberts, E., Rowe,E., 2015, *'UK Hazards from a Large Icelandic Effusive Eruption'*, Effusive Eruption Modelling Project Final Report

Pre-event

- **Collaboration** - the International Airways Volcano Watch consists of nine Volcanic Ash Advisory Centres located around the world. These centres provide information on the movement and spread of volcanic ash. The London centre covers Iceland and the Jan Mayen Islands, working closely with the Icelandic Met Office.
- **Improving understanding and a new regulatory regime** - the aviation industry and regulators have improved their understanding of volcanic eruptions and how best to deal with them. Better data on how ash interacts with jet engines has enabled a new regulatory regime to be put in place since 2010. This allows airlines to fly in low ash concentrations and (in consultation with their airframe and engine manufacturers) to submit a safety case to the Civil Aviation Authority to fly safely in medium and high ash zones.
- **Test aircraft** - there is now a permanent and specially equipped civil contingency aircraft for atmospheric testing in UK airspace that can be ready within 48 hours.

Eyjafjallajökull, Iceland
17 April 2010

The ash in this image is at two different altitudes. A concentrated plume rises over a more diffuse cloud below. Volcanic ash reached between 16,000 and 24,000 feet, according to the Icelandic Met Office.

Image & caption content courtesy of the National Aeronautics and Space Administration (NASA).

What you should do…

The health effects of this risk are covered under poor air quality, which can be found on the next page. If you are planning to fly in Northern Europe and there is significant news media activity around volcanoes, you can find helpful information and guidance on the London Volcanic Ash Advisory Service, linked below. Specific information on potential air closures and further information can be found on the Civil Aviation Authority website, also below. Consult your travel provider for information on individual flights.

Further information online - hyperlinks below

Volcanic Ash Advisory Service	Icelandic Met Office	Global Volcanism Program	British Geological Survey	UK Civil Aviation Authority

Poor air quality

What's the risk?

Air quality has improved significantly over recent decades. However, more needs to be done to reduce air pollution to ensure a cleaner, healthier environment. Short-term surges in poor air quality occur primarily due to weather conditions preventing pollution from dispersing, such as low winds, or when a layer of warmer air traps colder air close to the ground (known as 'temperature inversion'). Air quality is also worsened by the ultraviolet light from sunshine, as it reacts with the air to generate ozone. Poor air quality is a risk to health, particularly for those with pre-existing heart and lung conditions, and especially among children and the elderly. Typical day to day air pollution is not within the scope of this risk.

Consequences of poor air quality may include:

- **fatalities** and physical **casualties**, principally by compounding pre-existing health conditions;
- **pressure on healthcare**, particularly hospital referrals and demands on ambulances;
- **economic damage**; and
- **environmental damage**

Has this happened before?

In 2006 the UK experienced two periods of extended hot weather with associated elevated ozone and harmful airborne particles. These occurred between 27 June and 7 July and between 13 and 23 July. In the first episode, the combination of heatwave conditions, poor air quality and associated exacerbation of mostly pre-existing conditions led to up to 540 deaths and up to 700 hospital admissions. The second episode led to up to 630 deaths and up to 830 hospital admissions due to the same combination of factors. In spring of 2015, two particle pollution episodes caused widespread poor air quality throughout the UK, with multiple areas measuring 'High' on the Daily Air Quality Index (which can be found here). Summer 2015 also contained two elevated ozone episodes.

What's being done about the risk?

Reducing likelihood

- **Reducing pollutants** - the Government regulates to control emissions and concentrations of harmful substances. In addition, the Government's revised air quality plan for tackling nitrogen dioxide (NO_2) emissions in urban areas can be found here.

Reducing the impact

- **Forecasting** - air quality forecasting is provided daily for the entire UK (linked below).
- **Health advice** - Defra provides health advice associated with each step of the Daily Air Quality Index (here), in consultation with the Committee on the Medical Effects of Air Pollution (explained here). Tweets (# below) are also issued during periods of elevated pollution.

What you should do…

Poor air quality can be a risk to anyone with respiratory conditions (such as asthma) or cardio-vascular conditions (such as heart trouble). If you think that you or a member of your family might be at risk, or if you or someone in your family has a history of experiencing particular problems with poor air quality, you should read the straightforward health advice on the Met Office and Department for Environment, Food and Rural Affairs websites (linked below). Those with pre-existing conditions should **follow your doctor's usual advice about exercising and managing your** condition, and take simple precautions like packing an extra inhaler.

You can check the daily pollution forecast (linked below) before you travel to get some advance warning of poor air quality. There are also telephone and Twitter services available.

Telephone - Air quality helpline (FREE)

United Kingdom

0800 556677

Twitter - Air quality feed

@Defraukair

Almaty, Kazakhstan

Dense accumulations of polluting aerosols at low altitude create an effect commonly known as **'smog'. Similar** effects occur in numerous cities worldwide.

Further information online - hyperlinks below

Daily pollution forecast	Met Office - Air pollution effects	Defra - Air quality plans	Where to find air pollution information

Public health organisations by nation

England	Scotland	Wales	Northern Ireland

Earthquakes

What's the risk?

Earthquakes in the UK are moderately frequent but rarely result in large amounts of damage. An earthquake of sufficient intensity (determined on the basis of the earthquake's local effect on people and the environment) to inflict severe damage is unlikely. Damage from UK earthquakes is likely to be greatest in historic buildings such as churches, monuments and Victorian or Edwardian terraced housing.

Consequences of an earthquake may include:

- fatalities and physical / psychological casualties;
- potential evacuation and shelter of affected individuals;
- damage to property and infrastructure, particularly to older buildings; and
- minor disruption to essential services such as water or electricity.

The majority of the Earth's interior is made up of semi-molten rock, called the mantle. Floating above the mantle is the crust, on which we live. The crust is subject to enormous pressure and the resulting stresses cause rocks to break along lines of weakness known as faults. The largest of these form the boundaries between different pieces of crust called tectonic plates. When stresses exceed the friction holding rocks on either side of a fault together, they slide or slip past each other, releasing energy in radiating waves that cause the ground to shake. This is called an earthquake.

Earthquake activity is greatest at the major fault lines, which are far away from the UK. However, the stresses exerted at the edges of a plate still affect the plate's interior, so earthquakes can occur anywhere. These are referred to as intraplate earthquakes and are less frequent and typically smaller than those at plate boundaries.

Has this happened before?

Yes. A large earthquake occurred in 1931 near Dogger Bank, 60 miles off the east coast of England. The intensity of the earthquake was low, with buildings in Hull suffering only minor damage as the epicentre was a long way away. The largest UK earthquake in terms of intensity occurred in 1884 in Colchester, Essex. Approximately 1,200 buildings required repairs to collapsed walls, chimneys and roofs. On 28 April 2007 a very shallow earthquake occurred near Folkestone, Kent, resulting in power outages, transport disruption and widespread superficial damage. Other high-intensity earthquakes have occurred in the Dover Straits (in 1382 and 2007), south Wales (in 1727, 1775, 1832, 1868 and

1903), the Midlands (in 1816, 1924 and 1957), and Inverness (in 1816, 1890, and 1901).[6]

What's being done about the risk?

Regulations

- **Sensitive structures** - certain critical buildings such as power stations, nuclear sites, and buildings under the *Control of Major Accident Hazard* regulations are subject to earthquake-resistant design requirements alongside other existing obligations.

Studies

- **Seismic hazard studies** - studies are sometimes carried out for non-sensitive infrastructure projects **(as opposed to those referenced under 'regulations')**, alongside a safety statement.
- **Research** - research is ongoing into the nature and driving forces of UK earthquake activity.

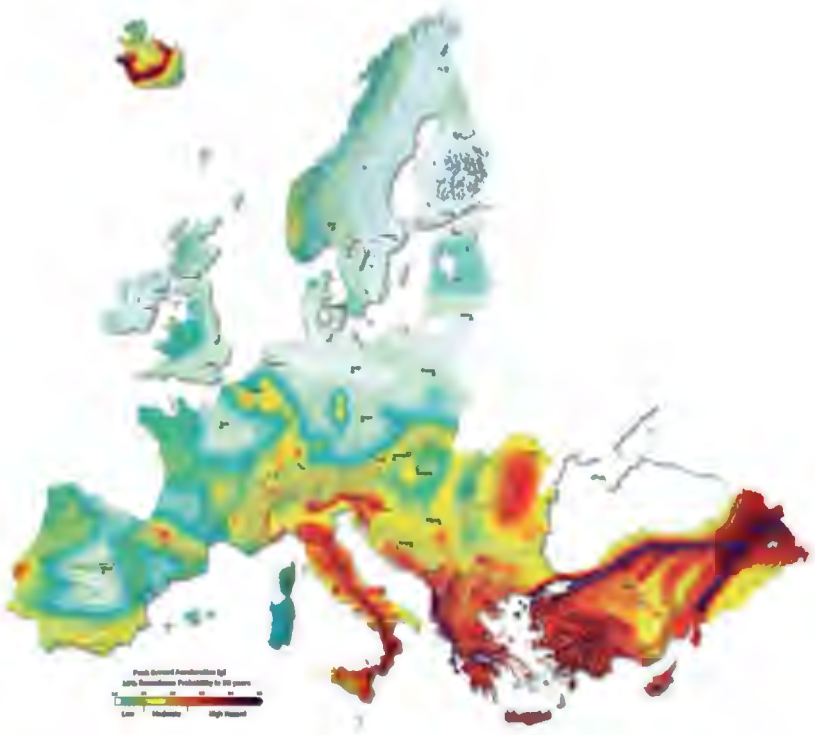
Forecasting

- Seismologists cannot currently predict when and where an earthquake will occur. However, some models of ground shaking can help plan for the effects and inform the design of buildings. Several such models and forecasts have been developed for the UK.

European seismic hazards

Blue to green shading represents areas of comparatively low hazard, yellow to orange shading represents areas of moderate hazard, and red to purple shading represents areas of high hazard.

Mapping courtesy of the Seismic Hazard Harmonisation in Europe project.[7]



Further information online - hyperlinks below

British Geological Survey	UK seismic hazard map	UK earthquakes in the last 50 days	Geo-hazard papers

[6] **Including those earthquakes that** rated above a 7 on the European macro-seismic scale.
[7] 10.12686/SED-00000001-SHARE, see also www.share-eu.org

Wildfires

What's the risk?

Wildfires can start for many reasons, including:

- **accidents** such as mishandled camp fires or barbecues;
- **human activity** such as use of weapons in military training areas;
- **malicious activity** such as fire-starting;
- **infrastructure incidents** such as sparks from electricity lines or rail transport; and
- **natural phenomena** such as lightning (although this is rare).

Hot, dry and windy weather are ideal conditions for wildfires to start and spread. Such weather tends to be relatively short-lived but is most likely to occur between March and May and between July and September. In years where there has been a significant drought the number of wildfires usually rises significantly. This risk is also affected by the availability and dryness of fuel (e.g. vegetation). Casualties from wildfires tend to be low but there are still psychological effects and other health consequences, such as breathing problems due to smoke or fume inhalation, which can particularly affect people with existing respiratory conditions. Disruption to services will depend on the location of the fire and whether it affects important infrastructure, but there is always a possibility of water contamination as ash and other burn residue dissolves into groundwater and reservoir supplies.

Consequences of wildfire may include:

- potential **fatalities** and physical / psychological **casualties;**
- potential **evacuation and shelter** of affected people;
- **damage** to property and infrastructure;
- minor **disruption** to essential services **(particularly Fire and Rescue Services' availability)**; and
- **environmental damage**, **air pollution** and potential **water contamination.**

Has this happened before?

Yes. In April and May 2011 numerous wildfires broke out across the UK after unusually hot and dry weather. The UK as a whole received only 52% of its usual rainfall for April 2011, and England and Wales received only 21%. Wildfires affected (amongst other areas): West Yorkshire, Lancashire, Dorset and Berkshire in England; the Brecon Beacons in Wales; County Down, Tyrone and Armagh in Northern Ireland; and the north-west Highlands in Scotland. The fires particularly affected the water quality in Northern Ireland reservoirs. Climate change is likely to lead to changes in the rainfall patterns that affect the UK. If we experience longer drier summers, this will increase the risk of drought and could lead to more frequent, larger wildfires.

What's being done about the risk?

Forecasting

- **Fire Severity Index** - the Met Office provides this information for England and Wales, thereby informing an assessment of the likelihood and potential severity of wildfires.

Division of responsibilities

- **Home Office** - is Lead Government Department for Wildfires. The Fire and Rescue Service and Local Resilience Forums or equivalent (operating on a multi-agency basis to plan and prepare for local incidents and large-scale emergencies) consider the wildfire risks in their areas. Management of the vegetation which fuels wildfires sits with a variety of other departments depending on sector and geography.
- **Wildfire Forums** - the England and Wales Wildfire Forum, and Scottish Wildfire Forum (including Northern Ireland), are partnerships between: fire and rescue services, land management regulators and private organisations, Government, administrations, and researchers. This improves assessment, prevention, preparedness, response, and recovery.
- **Devolution -** the devolved administrations are responsible for the Fire and Rescue Services in Scotland, Wales and Northern Ireland.
- **Arson reduction** - to address persistently high levels of deliberately-set wildfires in Wales, a Strategic Arson Reduction Board brings together fire services, police, Welsh Government, Natural Resources Wales and others to co-ordinate prevention and response activities.

What you should do…

The Fire and Rescue Services throughout the UK stand ready to protect you, your family, your home and your business against a wide range of different fires, while working hard to prevent fires from starting in the first place. Scottish Fire and Rescue Service has a helpful guide for protecting your home or business against the risk of wildfires (linked below). This applies equally well across the UK.

For land owners, the Forestry Commission's Practice Guide (linked below) can be used not only for forests and woodlands, but also high risk habitats such as grasslands, arable, mountain, moorland and heathlands. This guidance is also used for Defra's 'Countryside Stewardship' applications and certain forestry Environmental Impact Assessments. Legitimate fires started for agricultural land clearance purposes should be closely monitored at all times.

To report a fire, always call 999 and ask for the fire services.

Some fires are started maliciously. This is a crime and any related activity should be reported to the police or other appropriate local authority. If you would prefer not to call the police, you can also report fire-starting activities to Crimestoppers. Both allow you to remain anonymous.

Telephone - To report malicious fire-starting activity, call the police non-emergency number

(United Kingdom)

101

Telephone - Alternatively, you can also call Crimestoppers

(United Kingdom)

0800 555 111

Further information online - hyperlinks below

Fire services - wildfire guidance	Fire safety guidance	Wildfire knowledge exchange	Forestry Commission Practice Guide	Natural Hazards Partnership

DISEASES

Human diseases

What's the risk?

Human diseases take a variety of forms, some of which have the potential to cause a civil emergency due to the number of people they might affect in a short space of time. One such risk is an influenza ('flu') pandemic. Flu pandemics are natural events that happen when a unique flu virus evolves that few people (if any) are immune to. There are important differences between 'ordinary' seasonal flu of the kind that happens in winter, and pandemic flu. In a pandemic, the new virus will spread quickly and cause more serious illness in a large proportion of the population, due to the lack of immunity. There is a high probability of a flu pandemic occurring, but it is impossible to predict when, or exactly what it would be like.

Emerging infectious diseases could also cause large numbers of people to fall ill. These are diseases which have recently been recognised or where cases have increased over the last 20 years in a specific place or among a specific population (e.g. the Zika virus). The likelihood of an emerging infectious disease spreading within the UK is assessed to be lower than that of a flu pandemic.

Ways of catching these diseases can include:

- **respiratory** (airborne from one infected person to another);
- **vector-borne** (spread to humans via a third-party species, e.g. a mosquito);
- **blood-borne** (spread between humans via exposure to infected blood or blood products); and
- **food-borne** (spread by contaminated food/water).

It is difficult to forecast the spread and impact of a new flu strain or disease until it starts circulating. However, consequences may include:

- for **pandemic flu**:
    - up to 50% of the UK population experiencing symptoms, potentially leading to between 20,000 and 750,000 fatalities and high levels of absence from work.
- for **emerging infectious diseases**:
    - several thousand people experiencing symptoms, potentially leading to up to 100 fatalities.
- **disruption** to essential services, particularly health and education; and
- **economic disruption**, including disruption to business and tourism.

Has this happened before?

Yes. The most recent pandemic flu outbreak was an H1N1 strain ('Swine flu') in 2009 which caused at least 18,500 deaths worldwide. In 1918 another variant of the same H1N1 strain ('Spanish flu') killed over 50 million people globally. However, other flu strains exist with pandemic potential, such as H5N1 ('avian or bird flu'). This strain caused several hundred human deaths in South East Asia in 1996.

Over the past 25 years more than 30 new (or newly recognised) emerging infectious diseases have been identified around the world, such as Ebola, Zika and Middle East Respiratory Syndrome. The latter emerged recently in 2012 and poses a global health threat.

What's being done about the risk?

Pre-event

- **Planning** - the *UK Influenza Pandemic Preparedness Strategy* covers strategic planning, response and scientific evidence. Contingency plans exist for many emerging infectious diseases. The World Health Organisation collates global influenza preparedness plans here.
- **Coordination** - Government departments, devolved administrations, public health agencies and devolved NHS branches share plans and information.
- **International collaboration** - the UK Government collaborates with others to undertake work on prevention, detection and research. The World Health Organisation has an influenza programme which provides member states with strategic guidance, technical support and coordination of activities.

Response

- **Detection** - specialist epidemiology and microbiology capabilities exist within the UK to identify, characterise and respond to infectious diseases.
- **Antivirals** - the Government stockpiles enough antiviral medicines to help treat people showing symptoms during a flu pandemic. Antivirals can help treat flu symptoms but are not a cure.
- **Vaccines** - vaccines will be developed as soon as possible once new flu strains are identified. This will take at least four to six months after a pandemic begins.
- **Personal protective equipment** - emergency responders have personal protective equipment for severe pandemics and infectious diseases. There are also protocols in place for infection control both before and during an incident.

Metropolitan Cathedral, Mexico City, Mexico, 26 April 2009; during the swine flu epidemic

What you should do…

Emerging infectious diseases are closely monitored by public health agencies and international partners such as the World Health Organisation. Information will be provided on specific diseases as and when they emerge. If you are travelling abroad, consult the travel immunization guidance below and make sure your protections are up to date.

You can find a considerable amount of information and guidance online about the public health response to pandemic flu, including guidance aimed at specific organisations such as schools and higher education institutions, businesses, cleaning staff, and fire and rescue services.

For pandemic flu, good hygiene remains the most effective defence until a vaccine can be developed. Please note that antibiotics will not have any effect on flu, as it is a virus and antibiotics only kill bacteria.

Catch it, Bin it, Kill it

Flu germs can live on some surfaces for hours. If you have flu, you can protect others by carrying tissues with you and using them to catch your coughs and sneezes. Bin the tissue, and to kill the germs, wash your hands with soap and water or use a sanitiser gel. This is the best way to help slow the spread of flu.

Telephone – If you have concerns about symptoms, call the 24/7 NHS non-emergency numbers below. For emergencies continue to dial 999. A non-emergency British Sign Language (BSL) service is available here.

NHS (England and Scotland)
111

NHS (Wales)
0845 4647

Further information online - hyperlinks below

UK pandemic influenza strategy	Pandemic influenza evidence base	UK pandemic influenza guidance	UK infectious disease guidance	Foreign travel immunization guidance

Public health organisations by nation

England	Scotland	Wales	Northern Ireland

Animal diseases

What's the risk?

Animal diseases threaten the UK for two main reasons: firstly, because of the potential for some diseases to spread from animals to humans and cause illness or fatalities; and secondly, because they affect the animals on which we rely for food, trade, or to maintain the ecosystem.

Diseases which spread from animals to humans are called 'zoonotic diseases'. Examples include:

- **avian influenza** spread by migratory birds, movements of live poultry, poultry meat or contaminated vehicles / materials. Some strains can cause diseases in humans;
- **West Nile virus** spread by mosquitoes and via birds as intermediate hosts. It can cause encephalitis or meningitis in people (inflammations of the brain / brain lining and spinal cord) although 80% of those infected show no symptoms at all. It has never reached the UK; and
- **rabies** spread by bites / scratches from infected animals. It infects the nervous system and is usually fatal once clinical signs appear. Rabies is present at very low levels in some UK bat populations, but the risk to humans is very low.

Animal diseases which cannot spread to humans are termed 'non-zoonotic'. These harm the UK by affecting animals (particularly livestock) that agriculture or ecosystems rely on. Examples include:

- **foot and mouth** spread by direct and indirect contact and can be wind-borne;
- **swine fever** spread via movement of pigs or contaminated products. Classical swine fever has been recorded in the UK but African swine fever has not; and
- **bluetongue** spread between animals by midges. Severely affects sheep while cattle may show fewer clinical signs. Vaccination has eradicated Bluetongue virus from the UK but livestock remains susceptible to new strains.

Consequences of animal disease may include:

- human **fatalities** and physical / psychological **casualties;**
- **economic damage**, particularly to the livestock industry and via lost trade; and
- **disruption** to tourism and rural communities.

Has this happened before?

Yes. Low and highly pathogenic avian influenza has been recorded in poultry in the UK several times in the last 10 years, most recently in the winter of 2016/17, although with no human cases reported. Bluetongue was first recorded in the UK in 2007, although has since been eradicated from the UK. There was a devastating foot and mouth outbreak in 2001 which cost the UK around £8 billion; however, greatly improved response arrangements ensured that a subsequent 2007 outbreak caused much less damage (£15 million).

What's being done about the risk?

Pre-event

- **Monitoring** of disease outbreaks around the world, with horizon scanning and reporting on

latest trends.

- **Surveillance and alerts** in consultation with veterinary surgeons, industry, animal keepers and operational partners.

Response (using foot and mouth disease as an example)

- **Containment** - strict movement controls, including import controls where disease is detected in other countries, are applied to susceptible animals and animal products.
- **Eradication** - in the UK, susceptible animals on infected premises and in other places where risk of exposure is very high may be culled humanely to reduce the spread of disease.
- **Vaccination** - vaccines are available for some strains of disease and may be used to supplement the culling policy.

What you should do...

The early reporting of any suspicion of animal disease is vital. If you have concerns about the health of your animals, discuss them with your veterinary surgeon. If you suspect a notifiable disease (defined in the guidance links below) you should immediately report it to the Animal and Plant Health Agency. Further guidance specific to animal health monitoring and disease notification is linked below. You can also sign up to the Alerts Service (linked below) to keep up to date with the latest news. For zoonotic diseases (those that can spread to humans), please refer to the Human Diseases section on page 34.

Telephone – Animal and Plant Health Agency (APHA). For APHA in Scotland, contact your local Field Services Office.

APHA (England)
03000 200 301

APHA (Wales)
0300 303 8268

Telephone – If you have concerns about human symptoms, call the 24/7 NHS non-emergency numbers. For emergencies dial 999. A British Sign Language (BSL) service is available here.

NHS (England and Scotland)
111

NHS (Wales)
0845 4647

Further information online - hyperlinks below

Animal and Plant Health Agency	Animal and plant health policy	Animal diseases alerts service	International monitoring of animal disease	Notification duties of farmers

Public health organisations by nation

England	Scotland	Wales	Northern Ireland

MAJOR ACCIDENTS

Widespread electricity failure

What's the risk?

Instances of electricity failure (also referred to as power loss or blackout) can be caused by a number of things, such as severe weather (e.g. very strong winds, lightning and flooding) which damage the distribution network. Damage to the National Electricity Transmission System is much more rare but could cause significant electricity disruption and, in extreme cases, a widespread loss of power. These failures could be local (e.g. a metropolitan area), regional (e.g. the midlands) or national (e.g. across much of the UK).

An electricity failure across entire regions or the UK as a whole has not happened before. Were it to occur, impacts would be very severe, causing widespread disruption to many critical sectors and wider society in general. The National Grid has a recovery process called 'Black Start' to recover the network from a total or partial shutdown. Based on current plans, Black Start recovery could take up to five days with potential for some additional disruption beyond this timescale in the event of significant network damage.

Consequences of a national loss of power may include:

- **fatalities** and physical / psychological **casualties;**
- **disruption or loss** of essential services, particularly transport, food, water, fuel, gas, finance, communications (all types), and education;
- **disruption** to business (via lost working hours); and
- if blackouts are prolonged, also **potential disruption** to health care, emergency services and emerging public disorder.

Has this happened before?

No, a national blackout has never happened. A much less severe incident did occur between 22 and 28 December 2013 when, as a result of two severe winter storms and consequent damage to the distribution overhead line network, around 900,000 UK customers suffered a loss of electricity. 876,000 customers had power restored within 24 hours, however 16,000 experienced disruption for longer than 48 hours. Severe flooding in some areas has also led to instances of local power loss, such as in Lancaster during the 2015-16 floods.

What's being done about the risk?

Pre-event

- **Coordination** - the Department for Business, Energy & Industrial Strategy manages the central Government response to and recovery from electricity disruptions in England, Scotland and Wales. The Northern Ireland Department for the Economy works with Northern Ireland Electricity Networks Ltd to mitigate against and respond to power loss in Northern Ireland.

- **Planning** - the Department for Business, Energy & Industrial Strategy works closely with industry to develop comprehensive plans for handling a complete national outage and in collaboration with the devolved administrations regarding more localised outages.

What you should do…

If you experience a power cut, you can call '105' to report it and get further information. This is a free national service that covers England, Scotland and Wales. 105 is one of the ways you can contact your Distribution Network Operator, who is responsible for maintaining the power lines that bring electricity to your home and business. Both your Distribution Network Operator and the 105 number remain the same no matter who you choose to buy your electricity from.

The 105 website linked below also contains advice on how to prepare for a power cut along with simple steps to take if one occurs. In the (likely) event that you lose access to the Internet along with your power, general preparations such as those highlighted in Chapter 2 are also relevant.

Particularly large-scale electricity failures may prevent landline telephones and mobile phone transmitters from working (which will also affect mobile internet). Regardless of the situation, Government, the National Grid and Distribution Network Operators will be working to restore power as soon as possible.

Fire safety

Matches and candles in the home are useful if you lose electricity, but a torch and batteries would be much safer when handling objects in the dark.

Telephone - Call the free 105 service for more information on specific power cuts

PowerCut105 (England, Scotland and Wales)

105

Further information online - hyperlinks below

What to do in a power cut	Network and contacts advice	National emergency plan - gas & electricity	Responding to energy emergencies

System failures

What's the risk?

System failures is a broad category of risk and includes:

- **utilities failures** (including gas, localised electricity failure, fuel, water and sewerage);
- **financial failures** (such as with banking systems loss or other technical difficulties); and
- **telecommunications failures** (fixed and mobile telephony and broadband).

In many cases these incidents will only affect a specific place or be limited to customers of specific services or private companies. Many incidents will be dealt with locally, although some could have knock-on effects that cause problems for large numbers of people.

Widespread loss of electricity could potentially disrupt all other critical systems to a severe extent, resulting in greater consequences than more typical utilities failures. It is therefore listed separately on the matrix on page 9 and as an individual risk on page 40.

Consequences of system failures may include:

- some **fatalities** and physical / psychological **casualties;**
- **disruption** to essential services, particularly energy, water and/or sewerage, fuel, finance and telecommunications;
- **damage** to property and infrastructure; and
- **economic damage** (particularly to business).

Has this happened before?

Utilities - In April 2007, the failure of a major pumping component at a waste water treatment plant serving 800,000 customers in Edinburgh left thousands without access to clean water and caused 1,000 litres a second of partially diluted untreated sewage to be pumped into the Firth of Forth. A major accident at a gas-processing facility in September 1998 severely disrupted gas supplies to the state of Victoria in Australia. Households lost their gas for heating, cooking and hot water, as did hotels and restaurants, whilst industries that used gas had to close. Gas supplies were restored to major users 10 days later and to householders soon after.

Financial - In June 2012, 6.5 million customers of Royal Bank of Scotland (RBS), including NatWest and Ulster Bank of the RBS Group, were unable to carry out various transactions including cash withdrawals, phone and online banking and debit card payments due to a software update failure.

What's being done about the risk?

Energy

- **Private sector planning** - all network / transmission electricity and gas companies have plans and arrangements in place to deal with supply disruptions.

- **Government planning** - the *National Emergency Plan for Downstream Gas & Electricity* sets out arrangements between government, industry, regulator and other parties for safe and effective management of downstream gas and electricity supply emergencies.
- **Prioritisation** - the National Emergency Plan for Fuel sets out the Government's approach to maintaining continuity of fuel supplies in Great Britain. The plan is for use by government, the downstream oil supply industry and resilience planners for local services. It includes the possibility of prioritising fuel for emergency services and rationing fuel to retail customers using legislation under the Energy Act 1976.

Water and sewerage

- **Legislation** - *Security and Emergency Measures (Water and Sewerage Undertakers) Direction* 1998 and *Security and Emergency Measures (Scottish Water) Direction* 2002 place legal requirements on water companies in Great Britain to manage risks of failure.
- **Response measures** - all water companies can provide alternative water supplies to consumers, as well as command and control centres for more severe emergencies.

Telecommunications

- **Infrastructure investment** - investment, particularly by the large telecoms providers improves resilience to a variety of risks and reduces the likelihood of failure.
- **Coordination** - the Electronic Communications, Resilience and Response Group (EC-RRG) is industry-run, supported by the Department for Culture, Media and Sport and raises awareness of telecommunications resilience and best practice.
- **Planning** - extensive and well-practiced plans are in place for managing emergencies. The National Emergency Plan for Telecoms is owned by EC-RRG.
- **Response** - EC-RRG facilitates a response to major incidents through the National Emergency Alert for Telecommunications protocol.
- **Engagement** - business customers in particular are encouraged to discuss their needs with their provider to ensure they have adequate levels of resilience in place.

Finance

- **Coordination** - the Financial Authorities (e.g. regulatory bodies such as the Financial Conduct Authority) play a role in supervising, coordinating and driving change to improve the operational resilience of the finance sector.
- **Engagement** - the Financial Authorities test the sector's resilience to IT failures, and are working with the sector to review technology resilience arrangements at major retail firms.
- **Response** - the Financial Authorities coordinate their response to major operational disruption affecting the finance sector through the Authorities' Response Framework.

All sectors - response

- **Specialist training** for ambulance and fire service personnel (particularly for operating in high-risk environments).
- Promoting the **Joint Emergency Services Interoperability Principles** - improving the way our emergency services work together.

Further information online - hyperlinks below

Bank of England - financial sector continuity	Telecoms resilience guidance	National emergency plan - gas & electricity	Responding to energy emergencies

Major transport accidents

What's the risk?

Transport accidents occur across the UK on a daily basis, mainly on roads, and involving private vehicles. Well-practised plans exist to deal with these locally. This section focuses on rare but severe accidents that would require some form of national response.

Consequences of a major transport accident may include:

- **fatalities** and physical / psychological **casualties;**
- **disruption** to essential services, particularly transport;
- **disruption** to business and tourism;
- **damage** to property and infrastructure;
- possible **environmental contamination** (such as with fuels / cargoes); and
- possible **evacuation and shelter** of local residents or employees.

Has this happened before?

Thanks to modern safety regimes, large-scale transport accidents are very rare.

Air - There have been no major air accidents in the UK since the Kegworth incident in 1989, when a Boeing 737 crashed close to the M1 motorway, resulting in 47 fatalities. A helicopter crashed in Vauxhall, London on 13th January 2013, resulting in the deaths of the pilot and a passer-by struck by falling debris. A helicopter lost power and crashed in Glasgow on 29 November 2013, resulting in 10 fatalities. On 22 August 2015, a Hawker Hunter crashed onto the A27 road while participating in an aerial display, resulting in 11 fatalities among people on the ground.

Maritime - The *Herald of Free Enterprise* was the last major accident on a UK-flagged ship at sea; it capsized in March 1987 shortly after leaving Zeebrugge en route to Dover, resulting in 193 fatalities. On river routes, the collision between the *Marchioness* and the *Bowbelle* in August 1989 on the Thames resulted in 51 fatalities. The *Estonia* sank in the Baltic Sea in 1994, resulting in 852 fatalities, while the *Costa Concordia* capsized off the Italian coast in January 2012, resulting in 32 fatalities. Marine accidents such as the *MSC Napoli* in January 2007 and (to a much lesser extent) the *Hoegh Osaka* in January 2015 disrupted shipping in and around UK waters although neither involved major casualties thanks to the diligence of those responding.

Road - Even the largest road incidents would be highly unlikely to warrant a coordinated UK government or devolved administration response and would instead be managed by local authorities and the emergency services.

Rail - The Potters Bar derailment in May 2002 resulted in seven fatalities and over 70 injuries. The Grayrigg incident in February 2007 resulted in one fatality and 88 injuries. The first (and only) incident involving fatalities on a modern light railway occurred in Croydon, England in 2016, where

a tram derailed causing seven fatalities and 51 casualties.

What's being done about the risk?

Pre-event

- **Infrastructure improvements** - upgrades over recent years, alongside safety regimes, have led to substantial reductions in both the frequency and impacts of rail accidents. 2015/16 was the ninth consecutive year without any fatalities as a result of accidents on the mainline railway caused by trains or railway infrastructure.
- **Safety regimes and regulation** - there are different regimes for individual transport sectors.

Response

- **Planning** - all transport sector operators have plans that cover a range of possible incidents, including those most likely to create wider impacts. These plans include the diversion of routes where possible, based on safety and operational requirements.
- **Emergency services** - the response by emergency responders to transport accidents is covered by their existing arrangements for responding to other types of major incidents.

Train 1K77
10 April 2016

Damage to the cab of passenger train '1K77' after a collision with a moving tractor at Hockham Road crossing on a line between Harling Road and Thetford, England. The train was moving at 87mph and the resulting collision led to six people being injured, including the tractor driver and train driver. Fortunately there were no fatalities.

Note: taking the train is still statistically 22 times safer than travelling by car and over 1,200 times safer than travelling by motorcycle.

Further information online - hyperlinks below

Civil Aviation Authority	Rail Accident Investigation Branch	Marine Accident Investigation Branch	Air Accident Investigation Branch

Transport organisations by nation

United Kingdom	Scotland	Wales	Northern Ireland

Industrial and urban accidents

What's the risk?

Industrial and urban accidents can take a wide variety of forms and their impacts vary considerably in both scale and nature. In some cases these accidents will have very limited impacts beyond the immediate area and can be dealt with locally, although others can have cascading effects that will have a wider impact. This is a broad category of risk and includes:

- **fires and explosions** (affecting, e.g. residential buildings, power plants, refineries or oil rigs);
- **chemical and biological contamination** (such as oil spills or food contamination);
- **radiological contamination** (from nuclear accidents in the UK or abroad); and
- **dam breach** (leading to a sudden emptying of reservoirs and subsequent flooding).

Consequences may include:

- **fatalities** and physical / psychological **casualties;**
- **disruption** to essential services, particularly energy and transport;
- **damage** to property and infrastructure;
- **economic damage**;
- **environmental contamination** (such as with oil or radiation); and
- **evacuation and shelter** of affected individuals.

Has this happened before?

Fires - In December 2005 Europe's largest peacetime fire occurred at the Buncefield Oil Storage Terminal in Hemel Hempstead, England, resulting in a number of injuries. The surrounding area was temporarily evacuated and some local businesses experienced long-term disruption to operations. In October 2016 an explosion occurred at the BASF chemical company's Ludwigshafen HQ, Germany, resulting in three fatalities and 30 casualties. On 14 June 2017 a residential fire in Grenfell tower block in London, UK, spread beyond the originating apartment, resulting in at least 80 fatalities (investigation ongoing as of September 2017) and at least 70 injuries.

Chemical contamination - In 1976 an accident occurred at a chemical plant near Seveso, Italy, contaminating an area of more than 25km^2. More than 600 people had to be evacuated and up to 2,000 people were treated for dioxin poisoning. In 1996 the crude oil tanker *Sea Empress* grounded off south-west Wales, spilling approximately 72,000 tonnes of oil into the sea, damaging local environments and wildlife. In 2005 over 650 products were taken off the shelves in UK supermarkets due to concerns about contamination of food products with Sudan 1, a colouring agent banned in many countries, although it is still used in some parts of the global food industry. On 20 April 2010 an accident occurred at the *Deepwater Horizon* oil rig in the Gulf of Mexico, resulting in 11 immediate fatalities and almost five millions barrels of spilt oil.

Radiological contamination - Nuclear sites are designed, built and operated so that the chance of accidental releases of radiological material in the UK is extremely low. Historical accidents include Windscale (UK) in 1957, Three Mile Island (US) in 1979, Chernobyl (Ukraine) in 1986 and Fukushima (Japan) in 2011. Of these, Chernobyl and Fukushima were the most severe.

Dam breach and inundation - Dam breaches in the UK are rare; the last major breach was at the Cwm Eigiau dam in 1925, which caused 17 fatalities and widespread flooding. The Malpasset dam in southern France was breached on 2 December 1959. This created a wall of floodwater 40 metres high, moving at 70 kilometres per hour. It destroyed two small villages and, in 20 minutes, reached Fréjus, seven kilometres to the south, where it was still three metres high. The flood resulted in over 400 fatalities and widespread damage.

Buncefield oil storage terminal, Hemel Hempstead, England, 11 December 2005[8]

What's being done about the risk?

All sectors

- **Exercising** - emergency responders and infrastructure authorities practice response plans and using capabilities for simulated emergency scenarios.
- **Legislation** - *Control of Major Accident Hazard Regulations 2015* and *Control of Major Accident Hazard Regulations (Northern Ireland) 2000* are the laws under which major hazard sites are regulated and inspected to prevent and mitigate accidents involving dangerous substances. Some sectors / infrastructure types have specific regulations (e.g. pipelines).
- **Specialist training and equipment** - is provided to emergency responders, including those operating in high-risk and contaminated environments. Equipment requirements are reviewed in light of major incidents and adjusted where necessary.
- The UK Government promotes the **Joint Emergency Services Interoperability Principles,** which improve the way our emergency services work together.
- **Decontamination** - emergency responders and some industrial facilities are trained and equipped to decontaminate those affected by incidents. The Government Decontamination Service coordinates clean-up operations and elements of environmental recovery.

[8] Photography courtesy of Creative Commons; Robert Stainforth

- **Oversight** - the Health and Safety Executive (in England, Scotland and Wales) and Health and Safety Executive Northern Ireland work with public health agencies, industry and local authorities to reduce the risk from industrial accidents. The Maritime and Coastguard Agency has plans that include emergency responders and local authorities, with procedures for handling vessels involved in accidents and blowouts from offshore wells. The Department for Communities and Local Government (in England) and the Devolved Administrations (in Scotland, Wales and Northern Ireland) have oversight over local authorities' residential fire safety regulations.
- **Testing** - a vigorous testing regime is being conducted on relevant tower blocks around the UK as a result of the Grenfell fire. This includes specific testing on elements of the building materials, design and outer cladding. As of September 2017 this investigation is still ongoing.

National Firefighters' Memorial

Located on Carter Lane Gardens on the approach to St. Paul's Cathedral, the memorial commemorates those firefighters who lost their lives during the Second World War. It was rededicated in 2003 by HRH the Princess Royal to also honour all firefighters who have lost their lives in the line of duty.

1,192 names are inscribed into the pedestal.

Nuclear sites

- **Legislation and regulation** - Nuclear sites are covered by the *Radiation (Emergency Preparedness and Public Information) Regulations 2001*. The industry also has its own regulator in the Office for Nuclear Regulation.
- **Planning** - the UK Government maintains, updates and tests response plans for nuclear accidents, including those caused by nuclear accidents overseas.
- **Monitoring** - the UK Government regularly monitors radiation levels, including by ground sampling. A national radiation monitoring network and emergency response system analyses background radiation levels 24 hours a day, alerting government if abnormal levels are detected.
- **Identifying lessons** - following Japan's Fukushima nuclear incident in 2011, the UK Government assessed the upgraded safety and emergency response arrangements for nuclear sites in the UK and confirmed that they were satisfactory. Government regularly reviews lessons learned and aims for continuous improvement in our arrangements, including adopting international regulations arising out of new evidence.

Dam breaches

- **Regulation** - English, Scottish and Welsh reservoirs are regulated under the *Reservoirs Act 1975*, with additional regulation from the *Reservoirs (Scotland) Act 2011*.
- **Mapping** - organisations such as the Environment Agency (linked below) and Natural Resources Wales conduct extensive mapping of risk areas to support planners, reservoir personnel and responders in contingency planning and mitigation.

- **Public information** - the Environment Agency's 'What's in your backyard?' website enables users to view whether an address in England and Wales is in an indicated flood zone for a reservoir. A Scottish equivalent is also available here.

What you should do…

Know your building

- Familiarise yourself with the safety codes and emergency escape routes for the buildings in which you live or work. These could include fire escapes, emergency refuge areas or designated evacuation areas. Always follow instructions from the emergency services. The Fire and Rescue Services have helpful guidance on fire safety in the home, escaping from fires (also linked below), as well as specifically for shared or rented accommodation.

Know your area

- Check your local council's website for details of major industrial sites in your area. The Health and Safety Executive's 'Control of Major Accident Hazard (COMAH)' website also has information on nearby major industrial facilities.
- The Environment Agency's 'What's in your backyard?' website shows flood zones for reservoirs in England and Wales, and also provides a similar service for landfills and historic mine waste facilities. If you live in Scotland, you can find similar information on the 'What's in my area?' website.

Industrial accidents

- As with the guidance above, know what major industrial sites are in your local area. Make sure you are familiar with any advice they and your local authority provide.
- If you become aware of an incident at a local major industrial facility (e.g. a nuclear power plant, oil processing depot or chemical plant), **go indoors, stay indoors and tune in**. Close doors and windows to protect yourself from potential fumes or contaminants, and be prepared to evacuate if instructed to do so by emergency responders.
- If you suspect that the building you are in is at immediate risk of fire from a neighbouring facility, evacuate in the opposite direction of the incident.
- Follow the advice of the emergency services; responders have emergency plans in place for incidents in your area, and are trained and equipped to deal with industrial accidents.

Dam breaches

- Be aware of dams and reservoirs in your area, and familiarise yourself with any emergency advice issued by the facility managers and your local authority.
- A UK dam breach is highly unlikely. However, if a breach occurs you will be warned by the emergency services and may be asked to evacuate; always follow their instructions.

Further information online - hyperlinks below

Fire Escape Guidance	**What's** in your backyard?	Radioactive Incident Monitoring Network	Marine Pollution Contingency Plan
Control of Major Accident Hazards (COMAH)	Offshore oil and gas – Health & Safety Executive	Nuclear emergency planning guidance	Government Decontamination Service

SOCIETAL RISKS

Industrial action

What's the risk?

Industrial action **(or a 'strike')** is where a group of workers do not attend work as a means of protest. A trade union can only call for a strike if a majority of its members involved support it in an organised **vote called a 'ballot'.** There are legal restrictions around how long such strikes can last and in certain critical sectors (such as policing and for prison officers) striking is unlawful. Industrial action can lead to temporary closures, reduced services and disruption to organisations, customers and the general public. Services generally continue but at a reduced capacity.

Consequences of industrial action may include:

- **disruption** to essential services, particularly transport, health and education;
- **disruption** to business (via lost working hours);
- possible **public order** challenges (with associated pressure on policing); and
- **economic damage** (particularly for transport sector industrial action).

Has this happened before?

Yes, across a variety of sectors. In the twenty-first century, there have been strikes in both the public and private sector by; fuel tanker drivers, firefighters, teachers, health service staff, London Underground workers, government employees, and other groups of workers. The majority of recent industrial action and associated activity at picket lines has been peaceful.

What's being done about the risk?

Pre-event

- **Negotiation** - wherever possible the Government encourages negotiation and mediation, such as via the Advisory, Conciliation and Arbitration Service (ACAS), as a means of resolving industrial action both before and during a strike.
- **Monitoring** - the UK Government and devolved administrations work together closely to monitor impending strike action and resolve it where possible.
- **Legislation** - the *Trade Union Act 2016* provides additional protections to critical services.
- **Contingency planning** - the Civil Contingencies Act legally obliges some organisations such as the emergency services to plan for how to maintain services in the event of a strike. Other critical sectors such as fuel distribution also have comprehensive plans in place.

Response

- **Substitutions** - this involves staff from within or outside an organisation working adjusted rotas in order to cover for those on strike, e.g. medical consultants standing in for junior doctors, or the armed forces assisting with mitigating fuel supply distribution.

Further information online - hyperlinks below

What does the law say? | Taking part in industrial action | **Citizens' rights** | If your business faces industrial action

Widespread public disorder

What's the risk?

Public disorder can take many forms, including rioting, looting, vandalism, violence and arson. Disorder is unpredictable and peaceful protests can escalate quickly when small numbers of individuals are intent on provoking violence. Disorder can be influenced by a variety of factors, such as a breakdown in community and police relations, or other community tensions. Public disorder may be caused by long-standing grievances or as a spontaneous response to a single incident. Peaceful protests are not considered a form of public disorder.

Consequences of public disorder may include:

- physical / psychological **casualties;**
- **disruption** to critical services, particularly policing and health;
- **damage** to property and infrastructure;
- possible evacuation or **temporary shelter** requirements; and
- possible **economic damage.**

Has this happened before?

In recent decades serious disorder in the UK has been rare. On 6 August 2011 a protest in Tottenham escalated into widespread violent disorder. Over four days, disorder spread first in London and then to Manchester, Salford, the West Midlands and a number of other towns and cities across England. The disorder varied in character from area to area but included violence directed at police officers, damage to property and extensive looting. The G20 summits in 2009 and 2017 resulted in varying degrees of violent disorder, while the tuition fees protest in 2010 also involved some cases of criminal damage and use of improvised missiles against police.

What's being done about the risk?

Pre-event

- **Monitoring** - the police have a range of mechanisms in place that identify and assess known and emerging risks that could require a public order policing response.
- **Understanding triggers** - significant work has been carried out post-2011 to improve the Government's understanding of how public disorder can begin. This allows the police to identify risks and prepare in advance with plans to allocate and mobilise resources.

Response

- **Capabilities** - improvements have been made post-2011 in terms of mobilisation, tactics and training for police, ensuring they have the necessary capabilities to respond.
- **Coordination** - the National Police Coordination Centre supports forces in England and Wales and liaises with Police Scotland and Police Service Northern Ireland to ensure that mutual assistance is provided when required.

MALICIOUS ATTACKS

Malicious attacks: introduction

What's the threat to the UK?

The UK faces a serious and sustained threat from terrorism, including from international groups, domestic extremists and Northern Ireland-related groups. As of September 2017, the current UK threat level for international terrorism is 'severe'. This means an attack is highly likely. The level of threat in Northern Ireland from Northern Ireland-Related Terrorism (NIRT) is also 'severe', although in Great Britain (England, Wales and Scotland) the threat level from NIRT is lower.

The Joint Terrorism Analysis Centre explains all the threat levels and provides updates on the current assessments here.

Who are these potential attackers?

For the purposes of this document, 'terrorist' refers to any individual or group seeking to use violence as a means of inflicting terror for political reasons. This includes a wide variety of individuals and groups of varying ideologies and backgrounds.

Islamist extremists continue to pose the most significant terrorist threat to the UK and to UK interests and nationals abroad. Such groups include Daesh (also known as the so-called 'Islamic State', ISIL, and ISIS) in Iraq and Syria, Al Qa'ida (centred in Afghanistan and Pakistan), Al Shabaab (in Somalia), and Boko Haram (in Nigeria). Al Qa'ida and Daesh-affiliated groups can be found in the Middle East, South Asia, and North and West Africa, although Daesh has also expanded into South-East Asia and East Africa. These groups thrive in unstable environments where conflict and long-term societal problems have led to breakdowns in governance and law and order, providing a vacuum in which violent groups can base themselves, recruit, extort funding, and train. Numerous Islamist extremist groups want to conduct terrorist attacks against the western world, including the UK. The return of experienced fighters to the UK and Europe from Syria increases this threat. Online radicalisation of impressionable individuals is a serious problem and allows Islamist extremist groups to recruit from inside western and other countries. Individuals may become radicalised by international groups but choose to conduct attacks independently without external contact.

Northern Ireland-Related Terrorism is still a notable threat, with violent dissident republican groups intent on perpetrating attacks against (e.g.) the Police Service of Northern Ireland and prison officers.

Violent far-right extremism is relatively infrequent in the UK but does happen. Such individuals and groups generally seek to target specific individuals, minorities and politically-affiliated groups rather than the wider public.

What weapons and technologies could be employed?

Many of the networks and individuals who pose a terrorist threat seek to harm large numbers of people. Bladed weapons are cheap and easy to acquire. Firearms have strict regulations around ownership and sale but it is possible to acquire weapons illegally. Unsophisticated explosive devices can be made with household items. Vehicles can be used to drive into crowds. Some groups aspire to use non-conventional weapons such as chemical, biological or radiological substances, such as those employed by Daesh in Syria. Others aspire to attack infrastructure using both traditional methods and alternatives such as cyber attacks. In addition to being a mode of attack, cyber is commonly used as a means of recruitment, fund-raising and radicalisation, targeting isolated individuals online. Overall, any form of attack can potentially threaten life, property and community cohesion.

What's our strategy to respond?

The UK Government's counter-terrorism strategy, CONTEST (2011), is an integrated approach to counter-terrorism, based on four main elements. Each has a clear objective to reduce the risk to the UK from terrorism.

- **Prevent** (stopping people becoming terrorists or supporting terrorism in the first place)
- **Protect** (strengthening our defences against a terrorist attack)
- **Pursue** (stopping terrorist attacks, up to and including at the scene of attack)
- **Prepare** (where an attack cannot be stopped, mitigating its impacts)

Under CONTEST, comprehensive plans have been developed to protect: sites critical to national infrastructure; transport networks including planes and international rail; crowded places such as sports venues and shopping centres; and the UK's borders. Thousands of emergency responders, workers and key officials have been trained and equipped to deal with a terrorist incident, including those involving chemical, biological and radiological weapons. This ensures that our response to an attack is as effective, coordinated and immediate as possible.

The Government raises awareness among the responder community, local authorities and other organisations regarding the threat from terrorist groups in order to help them identify potential risks. For example, training is being given to NHS staff which helps them to identify individuals accessing healthcare services who might be vulnerable to radicalisation and refer them to appropriate organisations for support and protection. The National Domestic Extremism and Disorder Intelligence Unit continues to take the lead in setting the strategic national direction for domestic extremism intelligence and supports UK police forces in tackling these threats.

Telephone - Anti-Terrorist Hotline: "It's probably nothing, but..."

(United Kingdom)

0800 789 321

Further information online - hyperlinks below

MI5 - Security Service	Action Counters Terrorism	National Security Strategy 2015	What is CONTEST?	National Counter-Terrorism Security Office

Attacks on crowded places

What's the risk?

Crowded public places unfortunately remain an attractive target for terrorists, because they are generally easily accessible, tend to have less security and can be used to cause large scale injury and loss of life. Potential targets include pedestrian routes and other thoroughfares as well as sports arenas, retail outlets and entertainment spaces. Attacks could be carried out using a variety of weapons including blades, firearms, explosives, and vehicles deliberately used to harm people.

Consequences of an attack on a crowded place may include:

- **fatalities** and physical / psychological **casualties;**
- **damage** to property and infrastructure;
- **disruption** to essential services, particularly transport, health and education;
- **economic damage**, particularly via disruption to tourism; and
- **evacuation and shelter** of local residents or employees.

Has this happened before?

On 22 July 2011, a lone terrorist conducted a bomb attack in Oslo, Norway, resulting in eight fatalities and over 200 casualties. This was followed by an attack on an isolated youth camp, where the same terrorist killed 69 people and injured over 30 others. On 26 June 2015, a lone terrorist attacked a beach resort in Sousse, Tunisia, killing 38 people. On 13 November 2015 multiple groups of terrorists attacked restaurants, cafés, a sports stadium and a concert theatre in Paris, France, killing 130 and injuring several hundred. On 19 December 2016, a lone terrorist used a vehicle to attack a market in Berlin, Germany, killing 12 and injuring over 50. On 22 March 2017 a lone terrorist used a vehicle and knife to conduct an attack in London, UK, killing five and injuring over 50. On 22 May 2017, a lone terrorist detonated a suicide explosive device outside a concert venue in Manchester, UK, killing 22 and injuring over 100. On 3 June 2017, three terrorists used a vehicle and knives to kill eight people and injure 48 others in a marauding attack in London, UK. On 19 June 2017, a lone terrorist drove a van into pedestrians outside a mosque in London, UK, killing one and injuring ten.

What's being done about the risk?

Reducing vulnerability

- **Awareness-raising** - the Government provides a range of advice through Counter Terrorism Security Advisers, training and guidance documents to help businesses and other organisations understand the terrorist threat, improve protective security and preparedness, spot signs of suspicious activity and take other appropriate actions.
- **Physical protective security** - this includes barriers to prevent vehicles being used as a weapon, or to keep vehicle bombs further from buildings to mitigate the effects of the blast.

Limiting adversary capability

- **Explosive material limitations** - measures are in place to make it more difficult to source

ingredients needed to manufacture homemade bombs.
- **Stringent border security** - this makes it more difficult to smuggle weapons or dangerous substances into the UK.

Improving response

- **Major incident plans** - are regularly tested in exercises, where emergency responders practice using plans and response capabilities.
- **Armed response** - Government is now investing in additional armed policing capability.
- **Specialist training** - such as ambulance and fire service personnel operating in high-risk environments.
- The **Joint Emergency Services Interoperability Principles** have improved the way **the UK's** emergency services work together.

What you should do…

The Police Service and partners work very hard to keep us safe from threats. To support the public to protect themselves further, the **National Police Chiefs' Council has** produced a helpful YouTube video about how best to respond during a marauding terrorist attack, which can be found here.

Further information online - hyperlinks below

National Counter-Terrorism Security Office	Protecting Crowded Places – Guidance	Physical Security Advice	Protecting Against Terrorism

Attacks on transport systems

What's the risk?

Transport systems include (but are not limited to) railways, buses, passenger ferries, cargo vessels and aircraft. Attacks against such systems could take a variety of forms, including explosives and attackers wielding blades or firearms. In the UK, conventional terrorist attacks on land and air-based transport are more likely than against maritime (water) transport, although risks to maritime transport do exist, and are higher overseas. The likelihood of any of these things happening to any particular individual is still very low.

Consequences of an attack on a transport system may include:

- **fatalities** and physical / psychological **casualties;**
- **damage** to property and infrastructure;
- **disruption** to essential services, particularly transport;
- **disruption** to tourism;
- **disruption or interruption** of imports (particularly in the case of maritime incidents); and
- possible **evacuation and shelter** of local residents or employees.

Has this happened before?

Railways and subways - These forms of transport rely on the quick and easy movement of people on and off trains and as a result tend to have fewer physical security measures (such as metal detectors). On 7 July **2005, London's transport system was attacked with four explosions (three on underground** trains, one on a bus), resulting in 52 fatalities and over 750 casualties. Subsequent attacks were attempted (unsuccessfully) two weeks later. There was a failed gun attack on a high speed train to Paris in August 2015. On 22 March 2016, three coordinated suicide bombings occurred in Belgium: two at Brussels Airport in Zaventem; and one at Maalbeek metro station in central Brussels, resulting in 32 fatalities and over 300 casualties.

Air - Over the past 30 years there have been a number of attacks by terrorists against aircraft. These include: the 1988 bombing of a Pan Am flight over Lockerbie, Scotland, resulting in 270 fatalities; and the crashing of hijacked planes into the World Trade Center, the Pentagon and Pennsylvania, United States, in September 2001, resulting in 2,977 fatalities and over 6,000 casualties. Unsuccessful attacks include: a liquid bomb plot in 2006, attempting to circumvent security; a failed detonation in December 2009 on a flight from Amsterdam to Detroit; and explosives concealed in printer cartridges on cargo planes in October 2010. Attacks on airport infrastructure also occur, such as at Brussels Airport in March 2016, Istanbul Airport in June 2016 and Glasgow Airport in June 2007.

Maritime - To date, terrorists have not mounted an attack against ships or boats in the UK. However, attacks like those seen overseas (e.g. the suicide bomb attack on the *USS Cole* in Aden in 2000, the attack on the oil tanker *M. Star* in 2010 and recent attacks on shipping near Yemen and in the Bab-al-Mandeb Strait) cannot be ruled out in the UK.

What's being done about the risk?

A number of the mitigation measures described on pages 56 and 57 are also relevant to transport attacks as they: reduce the vulnerability of potential targets; limit the ability of attackers to make explosives or get hold of weaponry or other dangerous substances; and ensure responders are able to operate effectively. In addition, the activities below further reduce the risk to transport.

Railways and subways

- **Regulation and monitoring** - National Railways, London Underground, Docklands Light Railway and Glasgow Subway are all regulated and monitored by Department for Transport (DfT) who require these organisations to deliver a range of security measures. DfT also provide a range of best practice advice to the trams and bus and coach sector.
- **Channel Tunnel** - the Eurostar is subject to very stringent security screening requirements, similar to airport-style regimes. The tourist shuttle and freight are also subject to spot searches.
- **British Transport Police** - provide dedicated, specialised and tailored policing of the railway network. They work with industry and DfT on security.

Air

- **Screening** - of passengers, luggage and all staff working in restricted airport areas.
- **Separation** - physical barriers in airports are placed between incoming international passengers and all outbound travellers.
- **Vetting** - vetting involves undertaking background checks on staff in sensitive posts.
- **In-flight security and inspections** - in-flight security includes hardened and lockable cockpit doors. Regular inspections by the Civil Aviation Authority ensure compliance with security measures.
- **Overseas advice** - the Government gives guidance to UK airlines operating abroad regarding security measures.
- **Cargo** - the UK's cargo regime sets out security screening standards for all in-bound and out-bound cargo.

Maritime

- **Standards** - the Government sets security standards for UK ports and UK-flagged ships.
- **Inspections** - compliance is monitored / measured through inspections and reviews undertaken by Department for Transport and the Maritime & Coastguard Agency.
- **Sea marshals** - the UK and France have negotiated an agreement that allows armed French sea marshals to be deployed on French-flagged cross-Channel ferries travelling between France and the UK.
- **Engagement** - the Government works with other countries on improving port security measures.

What you should do…

The Police Service, the British Transport Police and many partners in the UK and abroad work very hard to keep us safe from threats. Attacks on transport are infrequent but the simple 'Run Hide Tell' guidance on page 57 is useful and relevant for many transport locations such as ships or airports, the video guidance for which can be found here.

To help prevent attacks from occurring, the public can also play an important role by reporting suspicious behaviour or unattended items to a member of staff or the police. You can contact the British Transport Police by texting 61016, or you can call the police non-emergency number on 101. If you see it, say it. It will be sorted.

Telephone - To report a crime or incident, call the numbers below. For emergencies dial 999.

(British Transport Police - United Kingdom)

0800 40 50 40, or text 61016

(Police non-emergency number - United Kingdom)

101

Further information online - hyperlinks below

British Transport Police	National Counter-Terrorism Security Office	Transport security newsfeed	National Strategy for Maritime Security

Attacks on infrastructure

What's the risk?

Critical national infrastructure is the buildings and other systems and networks needed to keep the UK running and provide the essential services that we rely on. These services could be essential to basic human needs, such as electricity for cooking or water for drinking, or they could be essential to keeping other infrastructure and the UK economy running, such as telecommunications. Deliberate attacks on infrastructure would cause many of the same problems as an industrial accident, technical failure or severe weather affecting services.

Attacks on infrastructure could be carried out by using explosives or other physical weapons, or by cyber means. Further information about the cyber risk can be found on page 63.

Consequences of an attack on critical infrastructure may include:

- **fatalities** and physical / psychological **casualties;**
- **damage** to property and infrastructure;
- **disruption** to essential services, particularly energy, transport and telecommunications;
- **economic damage** (particularly to business); and
- possible **evacuation and shelter** of local residents or employees.

Has this happened before?

Terrorists in the UK have previously attacked, or planned to attack, national infrastructure. Attempts were made to attack electricity substations in the 1990s. Bishopsgate, in the City of London, was attacked in 1993 and South Quay in London's Docklands in 1996. These attacks resulted in significant damage and disruption but relatively few casualties. Outside the UK, terrorists have carried out attacks against energy infrastructure (in Algeria and Yemen in 2007, 2008 and 2013) and against financial institutions and government buildings. The worst of these was against the World Trade Center, the Pentagon and Pennsylvania, United States, in 2001, resulting in 2,977 fatalities and over 6,000 casualties.

What's being done about the risk?

A number of the mitigation measures described on pages 56 and 57 are also relevant to infrastructure attacks as they: reduce the vulnerability of potential targets; limit the ability of attackers to make explosives or get hold of weaponry or other dangerous substances; and ensure responders are able to operate effectively. In addition, the activities below further reduce the risk to infrastructure.

Reducing vulnerability

- **Specialist advice** - the Centre for the Protection of National Infrastructure is the Government authority that provides protective security advice to businesses and organisations across the UK national infrastructure. They also provide integrated advice on physical and personnel

security, aimed at minimising risk and reducing our vulnerability to terrorism, espionage and other national security threats.

- More broadly, the UK has a comprehensive and well-established programme of work to protect our national infrastructure from terrorism and other security threats.

Common capabilities and responses

- The consequences of attacks on infrastructure and the plans to deal with them are frequently the same as they would be if an industrial accident happened at a critical national infrastructure site (see page 46). Developing plans that can be used in a range of situations is an efficient and effective means of ensuring we have the capabilities in place to deal with a variety of emergencies.

Physical protective security

Barriers such as these retractable bollards protect a variety of urban or industrial infrastructure sites from attacks employing vehicles. Use of architecture offers protection 24 hours a day, and can be cheaper and more sustainable than more active security measures, such as additional security personnel.

What you should do…

The Police Services and many partners in the UK and abroad work very hard to keep us safe from threats. Attacks on infrastructure are infrequent but the simple 'Run Hide Tell' guidance on page 57 is still useful and relevant if you find yourself caught in an incident. The National Police Chiefs' Council has a video explaining 'Run Hide Tell' which can be found here.

Similarly, the British Transport Police's 'See it, Say it, Sorted' guidance on page 60 is also relevant. There is no distinction between the need to alert security to the presence of suspicious activity, regardless of whether this is occurring in locations such as airports, train stations, utilities buildings or major offices. More information can be found here.

Further information online - hyperlinks below

CPNI	National Counter-Terrorism Security Office	Terrorist threat guidance	Bomb threat Police checklist

Cyber attacks

What's the risk?

Cyberspace is essential to our economy and society. While cyberspace supports open markets, sharing of information and access to knowledge, this very openness makes us more vulnerable to criminals, terrorists and foreign intelligence services seeking to steal our data, compromise our services or radicalise members of the public. Cyberspace is both a direct means of damaging our systems or extorting money, as well as a means through which hostile groups can recruit, fund-raise, inspire and manipulate.

One eighth of our Gross Domestic Product comes from the digital economy. UK digital industries grew two and a half times more quickly than the economy as a whole between 2003 and 2013 and we rely on cyber security to keep our digital economy safe. The UK also has the highest percentage of individual internet usage of any G7 economy.

The scale of our dependence on cyberspace means that our prosperity, key infrastructure, places of work and our homes can all be affected by cyber attacks. Vulnerabilities can take time to identify and exploited systems can be used to attack other systems and networks, making culprits difficult to identify.

Consequences of a cyber attack may include:

- possible **fatalities** and physical **casualties** (in the event of loss of critical services);
- **loss of availability**, by denying legitimate access to systems and information services;
- **loss of confidentiality**, through information being stolen or released;
- **loss of integrity**, where data is damaged or corrupted;
- possible **disruption** to critical services, such as energy or health;
- **economic damage**, particularly to business; and
- **reputational losses.**

Has this happened before?

Cyber attacks occur almost constantly. Accurate estimates are difficult to determine but economic losses as a result of cyber attacks are judged to be in the tens of billions of pounds. A cyber **attack on one of the UK's** major Internet Service Providers cost £60 million and the loss of 95,000 customers. 46% of all UK businesses (rising to 66% and 68% of medium and large firms respectively) identified at least one cyber security breach or attack in the last 12 months. Some firms are attacked much more than others; 13% of businesses are attacked daily. On average, there are 1,000 cyber security breaches a year for every UK business, distributed unevenly. The average business faces costs of £1,600 a year due to these breaches, falling only slightly to £1,400 a year even for micro and small businesses. Attacks can have global implications. On 12 May 2017, the WannaCry ransomware attack affected over 200,000 computers in 150 countries, including systems within 47 NHS Trusts, leading to significant disruption to patients.

What's being done about the risk?

Government

- **Strategy** - the *2015 National Security Strategy* described cyber as a 'top tier' threat, making it a Government priority to address the risk. As part of the 2015 Strategic Defence and Security Review, the Government committed to developing a comprehensive strategy to tackle the cyber risk whilst ensuring that we remain at the forefront of the digital world. In fulfilment of this commitment, the Government published the National Cyber Security Strategy 2016-2021 which is available in the links below. A local version for Scotland can also be found here.
- **Coordinated expertise** - the National Cyber Security Centre (NCSC) was established in 2016 as part of the Government Communications Headquarters (GCHQ) and brings together cyber expertise from a wide range of previously disparate cyber organisations. The Centre's main purpose is to reduce the cyber security risk to the UK, working with businesses and individuals to provide authoritative and coherent cyber security advice and cyber incident management, underpinned by world class research and innovation.
- **Investment** - the Government has committed to spend £1.9 billion over the next five years on ambitious policies to protect the UK in cyber space.
- **Personnel** - 250 new entry-level cyber security jobs have been created through the Tech Partnership. Government has also worked with employers to create apprenticeship frameworks in cyber security, such as GCHQ's 50 Fast Track Apprenticeship places.
- **DMARC** - Domain-based Message Authentication, Reporting and Conformance is an NCSC initiative which has helped UK Revenue and Customs to prevent eight million phishing emails from reaching its customers. It is being rolled out across Government.
- **Removing fraudulent websites** - in the last year the NCSC worked with UK Revenue and Customs and Internet Service Providers to remove 13,600 fraudulent websites that were infecting users and stealing information.
- **Detection** - the Department for Work and Pensions' Cyber Resilience Centre analyses events to identify security alerts that require further investigation or intervention.
- **Cyber essentials** - the Government is encouraging businesses and individuals to use Cyber Essentials to reduce the risk of a successful attack.[9] Nearly 70% of attacks in 2016 could have been prevented by using the Cyber Essentials scheme. A link is below.

Non-Government

- **Business and organisations** - organisations and company boards are responsible for cyber security risks and should ensure their networks are secure. The NCSC provides advice, guidance and free tools to businesses to support them. Training is key: only 22% of small firms had undertaken cyber security training in the past year, rising to 38% of medium size firms and 62% of large firms.
- **Citizen awareness** - members of the public are often targeted by a variety of cyber-attacks, such as scam emails and identity theft. Improving public awareness and resilience to attacks remains a Government priority. Cyber Aware (linked below) is a cross-government awareness and behavioural change campaign delivered by the Home Office in conjunction with the Department for Culture, Media and Sport, and the NCSC.

[9] 2016 Government Cyber Health Check and Cyber Security Breaches Survey

- **Education** - over 80,000 people are receiving cyber security training through the online course "Introduction to Cyber Security", funded by the National Cyber Security Programme in the Cabinet Office and developed by the Open University. Lessons in school are also being encouraged to grow future talent.

Collaboration

- **International** - the Government works in partnership with other countries and organisations including the G8, UN, NATO and the EU, to help shape norms of behaviour for cyberspace and promotes the UK as a leader in cyber technology and policy.

What you should do…

For members of the public, the **"Are you Cyber Aware?" link below** has helpful password security and software update guidance. These are quick and simple steps that will make your devices (like laptops, tablets, mobiles and home computers) much better protected against the vast majority of cyber attacks. Additional mobile phone guidance is available.

Business owners should read through **the "10 Steps to Cyber Security" guidance linked below,** as well as the Cyber Essentials and small business guidance. Even these relatively simple steps will dramatically reduce the threat of successful cyber attacks against you.

The NCSC website provides a wealth of information. NCSC also runs the Cyber-security Information Sharing Partnership (CiSP), designed to bring Government and businesses together to better understand cyber attacks.

Further information online - hyperlinks below

Are you Cyber Aware?	UK Cyber Essentials Scheme	*Businesses:* Cyber Essentials	*Businesses:* Small business guidance	*Organisations:* 10 Steps to Security
National Cyber Security Centre	UK Cyber Security Strategy	Cyber Security Strategy - Progress so far	Get Safe Online	Find out more about GCHQ

Chemical, biological, radiological and nuclear attacks

What's the risk?

The UK Government works hard to prevent terrorists from gaining the expertise and materials necessary to deliver attacks employing chemical, biological, radiological or nuclear (CBRN) materials. Such attacks have the potential to cause harm by contaminating people, animals, buildings, outdoor environments, water supplies and food. Their scale and impacts could vary widely depending on the materials involved and the way they are used. Extremists remain interested in CBRN materials, however alternative methods of attack such as employing firearms or conventional explosive devices remain far more likely.

Smaller-scale incidents could include targeted releases of chemical, biological or radiological materials in indoor or outdoor environments, or assassination. Larger-scale incidents could include the widespread use of biological agents or an improvised nuclear device; resulting in much greater numbers of casualties and widespread, long-term impacts of a magnitude above all other terrorist attacks. Larger-scale attacks of this type have never happened before but would be more challenging to respond to due to the nature of the potential health impacts and widespread environmental contamination. While the likelihood of terrorists successfully conducting a larger-scale CBRN attack in the UK is highly unlikely, it cannot be ruled out.

Consequences of CBRN attacks could vary heavily depending on methods and materials employed, but may include:

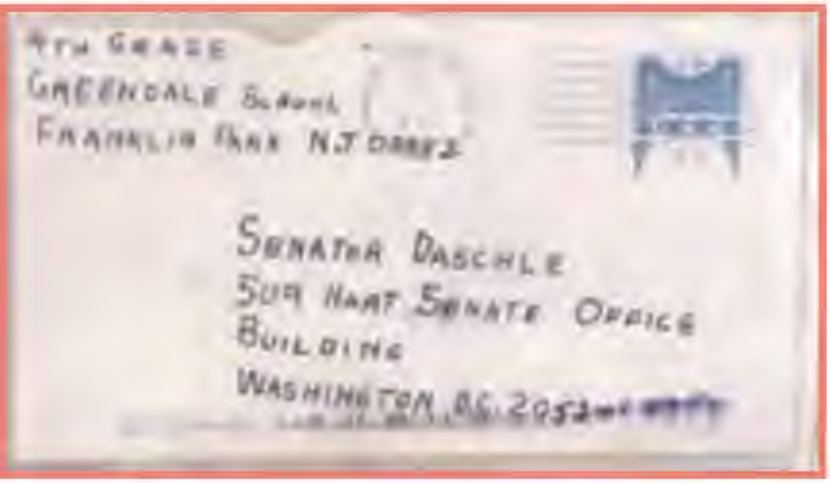
- **fatalities** and physical **casualties** (including contaminated people);
- psychological **casualties**;
- **damage** to property and infrastructure;
- **evacuation and shelter** of affected individuals;
- **disruption** to critical services, particularly transport but potentially across all sectors;
- **economic damage**, including disruption to business and tourism; and
- **environmental contamination**, including the natural and urban environment, animals, infrastructure, food and water.

Has this happened before?

There are relatively few examples of CBRN attacks outside of active warzones. These include: a chemical attack carried out by the terror group Aum Shinrikyo on the Tokyo underground system in 1995, resulting in 13 fatalities and at least 6,300 casualties; letters containing anthrax mailed to government buildings in the USA in 2001, resulting in five fatalities and 17 casualties; and Alexander Litvinenko's death on 23 November 2006 in London from poisoning by polonium (a radiological substance administered via a cup of tea as a means of assassination). In addition, there are isolated examples of production of ricin by both Islamist and far-right extremists, and criminal purchase of abrin by a lone individual. These latter examples did not result in fatalities.

Targeted biological attack
United States of America, 2001

Letter containing *Bacillus anthracis* (anthrax) spores sent to Democratic Senate Majority Leader, Tom Daschle.



What's being done about the risk?

Reducing vulnerability

- **Detection** - the Government is improving methods to detect and monitor CBRN materials, including the means by which terrorists may get hold of them.
- **Protecting emergency responders** - the Government issues protective equipment to specialists such as the Hazardous Area Response Teams in England, Wales and Northern Ireland and Special Operations Response Teams in Scotland.
- **Communications and public awareness** - the Government will ensure further guidance is available during incidents, and is increasing public access to information on what you can do during general emergencies to minimise the risk to you and your family (please refer to Chapter 2).

Limiting adversary capability

- **Material limitations** - tight restrictions on the supply of hazardous substances make it more difficult to get hold of CBRN-related materials or explosives for use in an attack.
- **Stringent border security** - security measures make it more difficult to smuggle weapons or dangerous substances into the UK.

Common capabilities and responses (via a comprehensive, nationwide programme)

- **Planning** - plans to deal with a CBRN incident are kept up to date and regularly tested in exercises.
- **Training** - emergency responders are trained in the immediate steps needed to save lives after a CBRN incident. General responders are supported by specialists across the emergency services trained to operate in hazardous environments.
- **Disposal** - if a device is identified pre-detonation, the police and armed forces possess explosive ordnance disposal capabilities suitable for rendering CBRN devices safe.
- **Medical countermeasures** - the Government maintains national stocks of medical treatments with arrangements in place for how these would be distributed in an emergency.
- **Evacuation and shelter** - local authorities can adapt existing plans for other large-scale incidents to support affected individuals.
- **Decontamination** - the emergency services are trained and equipped to decontaminate large numbers of people. The Government Decontamination Service has mechanisms in place for decontaminating buildings and environments.

- **Government continuity** - plans are in place to ensure effective civil government can continue throughout and after the incident.

Hazardous Area Response Team - training exercise, Welsh Ambulance Service, 2013

What you should do...

If you suspect a CBRN incident, you should inform the emergency services immediately by calling 999. Emergency responders receive specialist training for these types of incidents. They may arrive wearing specialist protective clothing.

The response to a CBRN incident will vary depending on the type of incident, however as is the case for other emergencies you should move away from the immediate source of danger and follow the instructions from the emergency services.

If emergency responders think you may have been exposed to a potentially harmful substance, you could be asked to remain near the scene at a safe location, remove your outer clothing and undergo some form of decontamination (e.g. showering).

For some situations, you may be advised to take shelter in the nearest building. You should then tune in to local and national news media and await further instructions.

Further information online - hyperlinks below

CBRN information	Securing hazardous materials	Government Decontamination Service	Protecting food and drink from contamination

CHAPTER 4 - METHODOLOGY

The risk matrix

The National Risk Assessment (NRA) is the classified Government version of the National Risk Register (NRR). A number of risks in the NRA have been grouped together into more generic categories for the purposes of producing the NRR. This is partly to bring thematic risks together and also due to the sensitivity of the NRA. The position of each category on our risk matrices on pages 9 and 10 is therefore an estimate based on the positions of all the different constituent risks from the NRA, taking care not to undervalue the most serious risks.

How are civil emergency risks identified?

This is done by consulting a wide variety of experts in government departments, devolved administrations and outside of Government in Agencies, academic institutions and industry. This includes the Government's Chief Scientific Adviser network as well as a number of specific groups coordinated by Cabinet Office who have expertise in particular issues such as cyber. Between them these experts can identify instances of possible major accidents, natural events (hazards and diseases) and malicious attacks (threats) that could plausibly happen and could cause significant harm and disruption in the UK in the next five years. Expert groups also help government departments to improve their understanding of the consequences of their risks, such as the effect on the mental wellbeing of the population.

What does this document cover?

Each of the risks in the NRA is described as a 'reasonable worst case scenario'. For a risk to be included in the NRA, they must:

- fulfil the definition of a civil emergency, as described on page 6. Note that long-term trends (such as climate change) increase the chance or severity of civil emergencies (e.g. floods), but do not constitute civil emergencies in themselves;
- have at least a 1 in 20,000 chance of occurring in the UK in the next five years, or in the case of malicious attacks; have a plausibility score of "1" or more (see section on plausibility below); and
- have an expected impact that reaches a minimum threshold (typically significant damage to human welfare in the UK).

How is the likelihood and plausibility of a civil emergency assessed?

Experts assign likelihood scores to each risk on a scale of one to five. For each step on this scale, the probability of an event happening in the next five years increases roughly tenfold. For some risks, data such as historical analysis and numeric modelling can be used to inform estimates of likelihood (especially for naturally and accidentally occurring hazards). Scientific expertise is also sought to

inform the development and review of risks. Where possible, a combination of this analysis and expert judgement is used to estimate the approximate likelihood of an event occurring.

The plausibility of terrorist attacks or other malicious incidents is assessed slightly differently. The willingness of individuals or groups to carry out attacks is balanced against an objective assessment of their capability – now and, as far as possible, over the next five years – and the vulnerability of their potential targets. The two scales are not directly comparable with one another; however, for the purposes of planning, a hazard or threat in the top right quadrant of either matrix would be given the same priority.

How are the impacts of civil emergencies assessed?

We base impacts on the following criteria:

- **fatalities** directly attributable to the incident;
- **casualties** resulting from the incident (including illness, injury and psychological trauma);
- **social disruption to people's daily lives** (such as disruption to transport, healthcare, education, telecommunications, etc.);
- **economic damage** (such as lost tourism or working hours); and
- **psychological impact** on the wider population (including widespread anxiety, loss of confidence in the Government or public outrage).

Each of the dimensions listed above is scored on a scale of 0 to 5 and these scores are then combined to provide a single overall impact score.

Local preparations for emergencies

Most incidents are best managed by local authorities, the affected industry and emergency responders. The Civil Contingencies Act provides a common framework for this activity, putting a duty on emergency planners and responders to identify and assess the risks of emergencies affecting the area in which they operate. The NRA helps this local tier in identifying potential risks and preparing plans for either preventing or mitigating the impact of incidents locally. This work is coordinated through Local Resilience Forums in England and Wales, Regional Resilience Partnerships in Scotland, and Emergency Preparedness Groups in Northern Ireland. These multi-agency partnerships are made up of representatives from local public services, including the emergency services, local authorities, the NHS and the environmental agencies. These local partners also draw on support by other organisations such as Highways England and public utility companies.

The UK Government's Civil Contingencies Secretariat in the Cabinet Office provides guidance on the planning and preparation work coordinated by local partners based on the NRA, as does the Scottish Government in respect of matters devolved to the Scottish Parliament. Many local communities also plan for emergencies and they will want to think about developing their own local risk register as part of their Community Emergency Plan.

Further information on local partners throughout the UK can be found by following this link.

National preparations for emergencies

For each risk of civil emergency, a lead Government department is identified and is responsible for the day-to-day policy oversight, coordination, support and overall management of the central Government response to an emergency. In Northern Ireland, Scotland and Wales, if the matter is devolved (e.g. as with Health), the devolved administration performs the lead Government department function.

For emergencies on a larger scale, the UK Government has developed:

- The Government's Concept of Operations, which sets out the flexible arrangements for coordinating the response to and recovery from emergencies within the UK.
- Contingency plans for responding to the highest priority risks identified in the NRA.
- A National Resilience Capabilities Programme, which aims to build a range of capabilities for emergencies.
- A Strategic National Framework on Community Resilience, which explores the role and resilience of individuals, businesses and communities.

Scotland, Wales and Northern Ireland all have their own resilience arrangements, broadly consistent with those outlined above and drawing on wider UK resources where appropriate. For more information please refer to the resilience websites of Scotland, Wales and Northern Ireland.

Civil Contingencies Secretariat
September 2017

Cabinet Office

LLOYD'S

PANDEMIC

POTENTIAL INSURANCE IMPACTS

LLOYD'S EMERGING RISKS TEAM REPORT

DISCLAIMER

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CONTENTS

EXECUTIVE SUMMARY

1. A PANDEMIC IS INEVITABLE With historic recurrence rates of 30-50 years it is prudent to assume that a pandemic will occur at some point in the future. The severity of such events is highly variable; some estimates suggest the most severe to date, in 1918, killed up to 100m. Many pandemics affect the old and young; but some (including the 1918 event) can, perversely, affect the most healthy.

2. 1918 MAY NOT BE A WORST CASE It is certainly true that the 1918 event was extreme relative to other pandemics in history. However many published "worst case" scenarios take 1918 as a base. There is a danger that we over optimise to this one scenario. There are other forms of pandemic than influenza, some have higher case mortality. Pandemic preparedness should consider a range of scenarios to ensure plans are appropriately flexible.

3. ECONOMIC IMPACTS MAY BE SIGNIFICANT A repeat of the 1918 event is expected to cause a global recession with estimated impacts ranging from 1% to 10% of global GDP. Most industries will be affected, some more than others. In particular, industries with significant face to face contact will be impacted significantly. Insurers investment assets may be affected depending on the mix held. Wider economic and social effects may lead to secondary forms of loss for insurers.

4. MANY INSURANCE LOSSES ARE POSSIBLE For some classes of business such as, life and health it is clear that the impact will be adverse. For other classes of business it is less clear but many forms of liability covers including general liability, D&O, Medical Malpractice as well as specific products offering business interruption and event cancellation could be triggered. Inner limits for Pandemic losses (vertical and sideways) may help to contain exposure.

5. SECONDARY IMPACTS MAY OCCUR Events causing significant global and societal turmoil can give rise to considerable secondary impacts. It is far from clear which of these, if any, would occur; but for resilience planning purposes it is worth considering them. For example the lawlessness experienced in New Orleans after Katrina could be repeated if police services are affected. Traditional claims such as fire loss may be exacerbated if fire emergency services have depleted efficiency and if tradesmen are in short supply.

PURPOSE

This report will consider the impacts a pandemic might have on the insurance industry. This is not a business continuity report and we mainly focus on scenarios that may lead to underwriting losses and adverse investment returns which drive profitability, rather than operational issues. This is not to understate the importance of such issues. Employees are an insurer's greatest asset and it is vital for insurers (as with other companies) to have robust and regularly tested pandemic preparedness plans; but there are many excellent papers on this subject already available.

A pandemic is certain to occur at some point in the future. They have happened regularly in the past. It is clear that life and health assurers will be adversely affected; but it is less clear how general insurers will fair; this report hopes to provoke some debate on this point.

We believe there are scenarios that could lead to loss in a large number of classes of business. These could arise from primary effects such as successful lawsuits leading to claims under liability policies. Claims could also come from secondary impacts to society, such as reductions in the availability of tradesmen in the short term, which lead to further losses. Some potentially affected policies may not have been written with such claims in mind and one possible response from the insurance industry is to clarify coverage intentions sooner rather than later. Contract certainty is to everyone's advantage.

We hope that insurers will consider the scenarios posed in this report and take action to measure and monitor exposure; consider capital implications and tighten terms and conditions, if necessary.

EMERGING RISKS TEAM

The Emerging Risks team is part of the Franchise Performance Directorate at Lloyd's. We define an emerging risk as an issue that is perceived to be potentially significant but which may not be fully understood or allowed for in insurance terms and conditions, pricing, reserving or capital setting. Our objective is to ensure that the Lloyd's market is aware of potentially significant emerging risks so that it can decide on an appropriate response to them.

The Lloyd's emerging risk team maintains a database of emerging risks which is updated regularly through consultation with the Lloyd's emerging risks Special Interests Group, which consists of experts within the Lloyd's market put together with help from the Lloyd's Market Association. The team also maintains strong links with the academic community, the wider business community and government. Contact with academics is often facilitated through the Lighthill Risk Network a not-for-profit organisation founded by Lloyd's, Benfield, Guy Carpenter and Catlin and open to subscribers from academia and within the financial services industry.

More details can be found at www.lloyds.com/emergingrisks.

DEFINITIONS

"Pandemic: An epidemic (a sudden outbreak) that becomes very widespread and affects a whole region, a continent, or the world."

Individuals may be infected by the pathogen responsible for the pandemic, but may not die from it. Indeed in many pandemics, thankfully, only a small fraction of those becoming ill actually die. This fraction is known as the "case mortality rate".

Not all pandemics are influenza related and this is discussed more in the "other forms of pandemic" section. However, due to particular concerns at present, the World Health Organization (WHO) has set out some specific guidance relating to influenza pandemics. They give three conditions for such a pandemic[1]: 1. a new influenza virus subtype emerges; 2. it infects humans, causing serious illness; and 3. it spreads easily and sustainably among humans.

The World Health Organization global influenza preparedness plan[2] defines the stages of pandemic influenza, outlines the role of WHO and makes recommendations for national measures before and during a pandemic . The phases are:

Interpandemic period:

Phase 1: No new influenza virus subtypes have been detected in humans.

Phase 2: No new influenza virus subtypes have been detected in humans, but an animal variant threatens human disease.

Pandemic alert period:

Phase 3: Human infection(s) with a new subtype but no (or rare) human-to-human spread.

Phase 4: Small cluster(s) with limited localized human-to-human transmission

Phase 5: Larger cluster(s) but human-to-human spread still localized.

Pandemic period:

Phase 6: Increased and sustained transmission in general population

[1] World Health Organisation, FAQs http://www.who.int/csr/disease/avian_influenza/avian_faqs/en/

[2] World Health Organisation, global influenza preparedness plan
http://www.who.int/csr/resources/publications/influenza/WHO_CDS_CSR_GIP_2005_5.pdf

FACTS AND STATS

A pandemic is inevitable. There have been a series of pandemics in history, since the 1600s these have had an average recurrence rate of 30-50 years. We are currently at Phase 3 of the WHO plan due to concerns of Avian Influenza H5N1.

The last influenza pandemic was in 1968[3]. AIDS is a pandemic that is occurring now. Pandemics vary in their impact from high hundreds of thousands to even hundreds of millions dead.

Severity and impact is very uncertain; some pandemics have affected the young and old; others have impacted those of working age.

The 1918 Influenza pandemic occurred just after the end of World War I and killed more people than the war itself. Estimates of the number of deaths vary considerably between 20 to 100 million. This event stands out by far as the worst influenza pandemic on record. It infected around 30% of the population and had a case mortality rate of up to 2.5%. Unusually, it most affected those aged between 20 and 40 (the young and old were affected, but no more than normal seasonal flu). One possible explanation of this is that the particular strain (H1N1) may have triggered an overreaction from the human immune system (known as a Cytokine storm), ironically this affects the most healthy. Recent research suggests that bacteria taking advantage of weakened immune systems and fluid on the lungs were a major cause of death in the 1918 pandemic; suggesting that antibiotics are a key feature in any line of defence.

THERE IS A CONTINUAL PROCESS OF MUTATION OF ANIMAL VIRUSES, SOME OF WHICH AFFECT HUMANS.

There is a continual process of mutation of animal viruses, some of which affect humans. For example the (non exhaustive) list below illustrates how often this happens. Clearly recently more effective monitoring has shown up the frequency of mutation which, we presume, was present in earlier years but not observed:

- 1918 Pandemic “Spanish flu” H1N1
- 1957-58 Pandemic "Asian flu" H2N2
- 1968-69 Pandemic "Hong Kong flu" H3N2
- 1977 new strain in humans “Russian flu” H1N1
- 1997 new strain in humans H5N1
- 1999 new strain in humans H9N2
- 2002 new strain in humans H7N2
- 2003 new strain in humans H7N7, H7N2, H9N2, SARS
- 2004 new strain in humans H7N3, H10N7

[3] though some argue an event in the 1970s was of sufficient size to be counted

At a conference hosted by Lloyd's and XL in 2008 Professor Lindsey Davies, the National Director of Pandemic Influenza Preparedness, noted several key features of an influenza pandemic from a UK perspective:

- Droplets produced when coughing or sneezing are the main route of spread (direct or indirect).
- Incubation period of 1-4 days.
- Adults are highly infectious for 4-5 days from the onset of symptoms; children for longer.
- Adults with uncomplicated flu may be absent from work for up to 10 days.
- One or more waves lasting about 15 weeks nationally (6-8 weeks locally).
- Waves may be weeks or months apart.
- Peak incidence during two weeks in the middle of the wave.
- Rapid spread across the country.
- If the pandemic starts elsewhere, it will probably reach the UK within 2-4 weeks.
- A probable maximum loss based on assumptions of: clinical attack rate 50%; maximum case fatality rate 2.5% of those with symptoms.

Regarding the last bullet, see the discussion later on whether 1918 is a worst case scenario.

Antivirals- Professor Davies also noted that the use of antivirals for prophylaxis as a prophylactic (i.e. a treatment designed to prevent disease) could reduce spread significantly but may have unwanted side effects. When used for the treatment of people who have flu, antivirals should reduce the incidence of complications, such as pneumonia, by up to 50%, may reduce the length of uncomplicated influenza by a day or so and may reduce infectiousness. Anti-virals purpose is to reduce the length of illness by around 10% not to prevent it. Once a virus has been diagnosed they can substantially reduce the risk of death; and will also (when combined with other common sense measures, like staying at home if sick) reduce the speed of spread of disease; buying time for vaccines to be developed.

UNTIL A VIRUS HAS EMERGED THERE ARE SO MANY UNKNOWNS WE PREPARE A VACCINE

Vaccines- until a virus has emerged there are so many unknowns we ***cannot*** prepare a vaccine. It then takes several months to isolate the virus and prepare a vaccine; which will therefore not be available to fight the first wave of pandemic. Many sources of advice stress that planning should not count on a vaccine immediately. Recent research by Chen et al[4] has shown that an alternative approach to vaccine production, based on extracting common "root" DNA from related viruses and producing antibodies from this, is both quicker than the traditional approach and provides protection against a wider range of virus mutations. However research into this promising approach is at an early stage.

[4] "A consensus–hemagglutinin-based DNA vaccine that protects mice against divergent H5N1 influenza viruses" Ming-Wei Chen et al 2008 http://www.pnas.org/content/105/36/13538.abstract

BETTER OFF TODAY?

Many have argued that historical pandemic impacts would be reduced if they were to recur today. Arguments in favour of this include:

- **Better drugs-** (antivirals, vaccines for second wave, fever reduction, antibiotics)
- **Coordinated response-** the WHO will coordinate a global response to the pandemic; the International Health Regulations (see regulations section) place legally binding responsibilities on nations. A recent success storey is that of SARS in 2002/3 (see case study later)
- **Influenza models-** have been developed by many stakeholders including within the insurance industry, these help to plan.
- **Better communication methods-** With so many forms of communication (television, radio, internet) the public can play an active role in combating the spread and health professionals are better and earlier informed.
- **Healthier population-** In the developed world the population is well nourished and healthy in many cases. (See below this is, of course, not the case everywhere)

THE PUBLIC CAN PLAY AN ACTIVE ROLE IN COMBATING THE SPREAD

However there are counter arguments that suggest the impact could be worse now than in the past:

- **Global networks-** Many businesses are now part of a global network of suppliers and clients. Goods and materials including food are transported globally, potentially carrying pathogens. The "just in time" model of many businesses may lead to shortages of some drugs or even food.
- **Global travel-** In 1918, the pandemic spread quickly around the world due to demobilisation of troops. The number of people travelling round the world today using air, rail, motor and sea travel surely far exceeds this and would quickly spread disease.
- **Larger population-** The global population is estimated at September 2008[5] to be 6.7bn, nearly 3.5 times its level in 1918. We can expect the numbers affected to be greater, just as a consequence of this larger pool of exposure, other things equal.
- **More concentration in cities-** For the first time in 2008 more people are living in cities than outside them. In 1918 people were more dispersed due to more rural economies. Pandemics can spread quickly within cities due to density of population and large numbers commuting.
- **Large pools of sick people-** The developing world has large numbers of sick people, including those with AIDS (and hence immune deficiency) these will not be well equipped to fight a pandemic.

THE "JUST IN TIME" MODEL OF MANY BUSINESSES MAY LEAD TO SHORTAGES OF SOME DRUGS OR

Of course a key factor on the impact of a pandemic is the strength of the pathogen itself: how easily it is spread, how infectious and what the case mortality rate is. The next pandemic could be stronger or weaker than past examples.

[5] US census bureau. World POPClock Projection http://www.census.gov/ipc/www/popclockworld.html

POTENTIAL PANDEMICS?

Much of the recent focus has been on influenza pandemic. This is for good reason because the H5N1 bird flu virus has already led to limited human to human transmissions and hence caused the WHO to move to level three of the pandemic plan. The WHO states that "*Experts at WHO and elsewhere believe that the world is now closer to another influenza pandemic than at any time since 1968*"

However, when planning for emerging risks it is important to consider alternative issues. There are many other pathogens that could give rise to a pandemic and have in the past. The following short discussion comments on a few examples, but this list does not attempt to be exhaustive.

Hendra virus - First identified in 1994 and mainly affects horses. Human cases have been observed which gives cause for concern. Australia is currently suffering a large outbreak but so far the virus has been contained within its boarders.

Nipah virus – This is biologically related to the Hendra, and was discovered in 1999. To date the only means of transmission appear to be close contact and fluids from affected animals; so does not easily transfer to humans. The WHO suggest Nipah transmission is easier than for Hendra but assess the risk as low at present. However a case mortality rate approaching 50% is high and therefore this virus has been classified as *biohazardous*.

Cholera - At one time Cholera was a major cause of death around the world. Current outbreaks are generally contained by good sanitation practices. The last Cholera pandemic took place over the 60s and 70s involving Italy, USSR and India, amongst others. Recently there has been an emergence of resistance to drugs typically due to misuse of antibiotics.

Small pox- Now thankfully eradicated, apart from some strains kept in laboratories around the world. Prior to its containment it killed hundreds of millions and had a case mortality rate of 30%. Some of the earliest recorded pandemics are believed by some to be small pox. Given its virulence there are concerns that small pox could pose a terrorist threat if the virus were to be accessed.

HIV/ AIDS- Has killed 25m people since 1981 which makes it one of the most destructive pandemics ever, and of course it is in current progress. Transmitted by bodily fluids it has not progressed as rapidly as initially feared in the developed world. In Africa, with two thirds of all HIV cases, the story is regrettably different. HIV's high genetic variability and regular mutations makes an effective vaccine difficult to develop.

Bubonic plague- believed by many to be responsible for the Black Death which killed 30%-60% of Europe's population in the 1300s. Transmitted by fleas it was able to progress rapidly around the world. It can now be treated by antibiotics and the disease is rarely seen in the developed world.

Tuberculosis (TB)- Is spread through the air and the WHO estimates that 1/3 of the world's population has been infected at some time, with a new infection occurring once a second. Few new infections develop into the full disease. TB is a major cause of death amongst AIDS sufferers. It is cautionary to note that the first effective antibiotic was only developed in 1946. Since the 1980s drug resistant strains have arisen requiring significantly more expensive and longer treatment, there are now cases of fully drug resistant strains which are effectively untreatable. Proper completion of antibacterial programs is vital to reduce the threat of such resistant strains. The use of medicines to suppress the immune system has been shown to increase TB risk.

TUBERCULOSIS: THERE ARE NOW CASES OF FULLY DRUG RESISTANT STRAINS WHICH ARE EFFECTIVELY UNTREATABLE

Lassa fever, **Rift Valley fever, Marburg virus, Ebola virus and Bolivian hemorrhagic fever**- are all dangerous diseases that require close contact to spread. They are contagious but symptoms appear quickly and the spread of disease can usually be prevented by quarantine. There is a concern that these diseases could mutate and become more easily transmitted. Ebola has the highest biosafety level and is considered a potential terrorist weapon.

MRSA and SARS: See case study.

CASE STUDY MRSA A GROWING CONCERN

"MRSA" = **M**ethicillin **R**esistant **S**taphlococcus **A**ureus

Methicillin – a type of antibiotic, typically not prescribed now, MRSA bugs are resistant to other antibiotics as well, but the name has stuck.

Resistant - these bacteria are resistant to many commonly prescribed forms of antibiotics, hence their danger.

Staphylococcus Areus (SA): A particular type of bacteria of which MRSA is a particular strain. 1 in 3 people carry the general SA bacterium. If they enter the body they can cause infection.

MRSA is causing concern, as it appears to be a growing epidemic in some regions. Initially found in hospitals (HA-MRSA), there are now several strains in the community (CA- MRSA). A study in 2006 (see below) showed that CA-MRSA is now the predominant cause of certain types of skin infections in the US.

HISTORY:

- Penicillin, which revolutionised traditional SA treatment, was only introduced in the 1940s.
- Methicillin a new antibiotic was developed in 1959 and for a time held new strains of SA at bay.
- HA-MRSA was first discovered in 1961, CA-MRSA strains became an issue in the 1990s
- It is believed that MRSA developed due to overuse of antibiotics and people not completing the full course.

WHAT EFFECTS?

- Most SA infections are skin related including boils and abscesses and similar but more serious conditions. However complications can arise leading to: blood poisoning, bone marrow, lung or heart infections, inflammation of brain and spinal chord.
- MRSA acts very fast; after 72 hours the bug can take hold of human tissue and become very resistant to treatment.
- MRSA is not more infectious than other SA bacteria; but it is harder and more costly to treat.
- In hospitals, patients with various risk factors are at greater risk than the general public. Such factors include: weakened immune systems and open wounds.
- Various groups appear at elevated risk: Community centres (e.g. schools), Hospitals and Prisons.
- Some reports suggest that MRSA is responsible for more deaths in the US than AIDS annually.
- Some new antibiotics like linezolid and platensimycin appear successful treatments.
- MRSA can be spread by person to person contact or via contaminated materials.
- Good hygiene standards are critical to stop spread: Employers have a duty to ensure these are upheld.
- Professor Gerald Pier from Harvard Medical School and his team may have developed a method which could be used to produce a vaccine within 2-3 years.

CA-MRSA

- CA-MRSA the community version of MRSA are currently uncommon in the UK but a leading cause of infection in the US.
- CA-MRSA is more virulent than HA-MRSA.
- CA- MRSA is susceptible to more antibiotics than HA-MRSA.
- It is not known why some people develop fatal CA-MRSA infections and others don't.

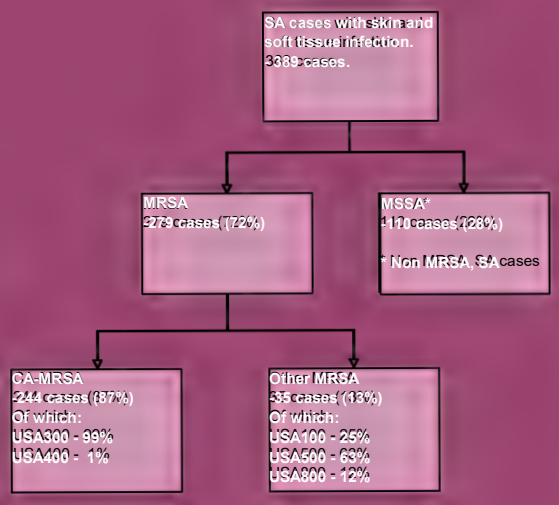
IMPORTANT ACTIONS

- Hospital staff wash hands carefully
- Isolate infected cases
- Staff and visitors should wear gloves and gowns
- Disinfect surfaces

KING ET AL

A paper "Emergence of Community Aquired MRSA US300 Clone as the predominant cause of skin and soft tissue infections" by King et al in 2006 noted that the CA-MRSA strain US300 was now the predominant cause of SA skin infections in their US study. They commented that *"Clinicians did not realise that community acquired MRSA emerged as the leading cause of community-onset skin .infection".*

- Their paper also noted that certain groups had higher or lower risk than average, in particular:
- Black race: Prevalance increased 53%
- Female: Prevalance increased 16%
- Patients in hospital in last 12 months: Prevalance decreased 20%



Source: Based on King et al figure 1

ACTION GROUPS AND LEGAL DAMAGES

Groups such as MRSA Action UK have been set up, founded by those deeply affected by MRSA. They are lobbying hard for safer standards in hospitals and arguably set the scene for legal cases. No Win No Fee legal firms have set up in UK to offer legal advice and take cases to court. They suggest that the list of damages that plaintiffs may be able to claim for include: pain and loss of amenity, loss of salary, private medical expenses and costs of care provided by family for example.

1918 – A WORST CASE?

Many of so called “worst case” scenarios in the pandemic literature are based on the 1918 influenza pandemic. The “Spanish” Flu in 1918 was certainly an extreme example of the effects of pandemic. Spread by troop movements it was arguably a prelude of how global trade can accelerate the rate of infection. However the case mortality rate was around 2.5% compared with the Black Death which had an equivalent rate of 50%.

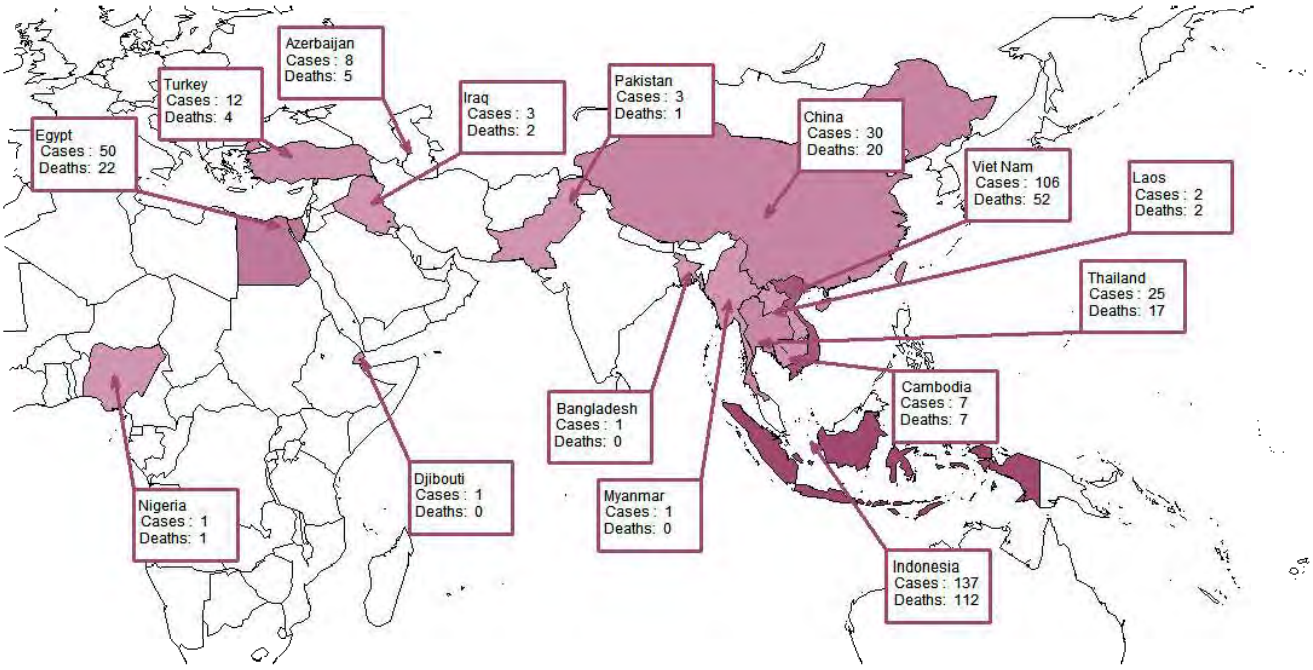
Based thankfully on a very few cases the current H5N1 virus has over a 60% case mortality rate. There is some reason to hope that if the H5N1 virus mutates to be easily transmissible to humans it will also weaken; but this is not certain. H5N1 already appears to be resistant to some of our key antiviral drugs.

WE SHOULD NOT OVER OPTIMISE OUR PANDEMIC PREPAREDNESS EITHER AS GOVERNMENTS OR BUSINESSES TO ONE PARTICULAR PATHOGEN

The previous sections have suggested that there a number of reasons to be concerned that a major pandemic could affect our globalised world more than in previous generations. We have also noted that many forms of pathogen exist beyond bird flu.

This section does not seek to scare monger; but it is important to consider alternatives. The key point is that we should not over optimise our pandemic preparedness either as governments or businesses to one particular pathogen. All stakeholders need to ensure that their plans are flexible and robust to a variety of scenarios.

CASES OF H5N1 GLOBALLY – TO SEPTEMBER 2008



CASE STUDY LESSONS FROM SARS

SOME ESTIMATES SUGGEST SARS CAUSED ECONOMIC LOSSES OF BETWEEN $30BN AND $150BN

SARS = SEVERE ACCUTE RESPIRATORY SYNDROME

- Caused a near-pandemic from November 2002 to July 2003.
- Over 8000 infections and a case mortality rate of nearly 10%.
- SARS was a wake up call; it was not predicted.
- Pandemics don't have to be avian influenza, other sources are possible. In this case SARS was a corona virus.
- Just six weeks after official reporting of the virus some 27 countries had experienced outbreaks of SARS.
- Economic effects did occur:
  - Some estimates suggest SARS caused economic losses of between $30bn and $150bn.
  - Face to face industries (including entertainment and air travel) were the most affected.
- Infectious diseases will travel quickly via international travel.
- There were weaknesses of public health infrastructure in some countries;
  - many hospitals did not have the ability to rapidly deploy skilled staff.
  - there was little consensus on how to quarantine infected people.
- SARS provided a real test and the world is better prepared now.
- Emerging infections can be contained with high-level government commitment, the role of the WHO was successful.
- Powerful diagnostic tests were developed; and are now helping to identify other respiratory diseases.
- Practices and health conditions in the developing world affect the developed world.
- Health care professionals discharged their responsibilities admirably.
- Modern methods of communication were critical; the use of email and other on-line resources enabled a much earlier warning that would otherwise have been possible.
- On-line health resources were a powerful aid to medics.

REGULATIONS

UK Department of Health, Campaign Poster.

See:
www.ukresilience.info
www.dh.gov.uk/pandemicflu
pandemicflu@dh.gsi.gov.uk

This section gives a few examples of regulations and guidance to illustrate the significant amount of information now available to businesses. This information sets the scene for what directors and their advisors can have reasonably foreseen in any legal case; and has relevance for consideration by those offering liability insurance.

- A Prudential Practice Guide from APRA sets out expectations on regulated businesses and calls for cross disciplinary action to deal with a pandemic if it arises. It suggests that a 30% infection rate is a reasonable WHO assumption.
- For those wishing to keep a track of diseases notified in UK, DEFRA have pages devoted to this subject.
- The International Health Regulations' are legally binding and form international law. They were enacted in 2005 and came into force in 2007. They give a new framework under which countries must detect, assess, notify and respond to public health threats. Assuming the regulations operate as hoped they will help to reduce the risk of a pandemic gaining hold.
- A variety of media have been used to help communities and businesses learn about pandemic planning. For example Planfirst is a series of WebCasts from the U.S. Department of Health and Human Services. They have covered topics such as workplace preparedness and, state and health care agency planning.
- The Whitehouse has issued a national strategy for pandemic influenza which covers how the US government will approach the pandemic threat. The strategy covers: Preparedness and Communication, Surveillance and Detection, and Response and Containment. It specifically considers an allocation of responsibilities between the Federal Government, States and Localities, Private sector, Individuals and International Partners.

ECONOMIC IMPACT AND INVESTMENT RISK

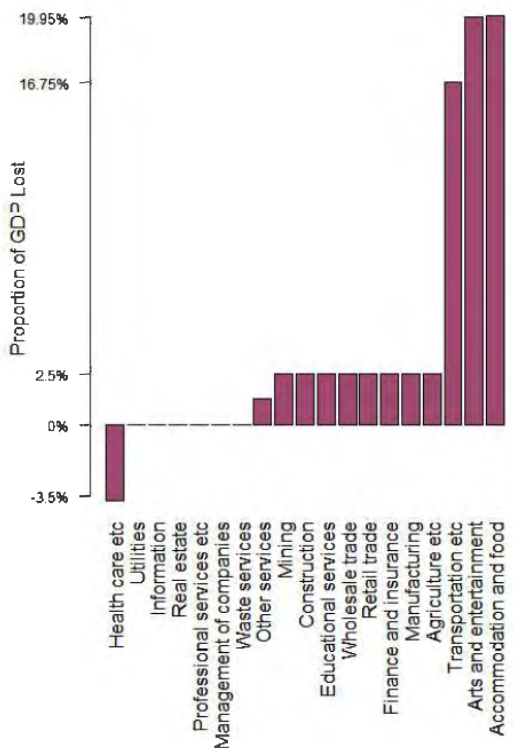
A repeat of the 1918 pandemic is expected by many to lead to a major global recession, estimates of the impact range from 1% to 10% reduction in global GDP. The impact will vary depending on country and within countries.

Most industries will be affected, typically adversely (see figure below). Those industries requiring a significant amount of face to face interaction are expected to be the most affected. These include: travel companies, airlines, restaurants/bars, hotels and the entertainment industry. The impact on local communities will somewhat depend on the mix of business activity.

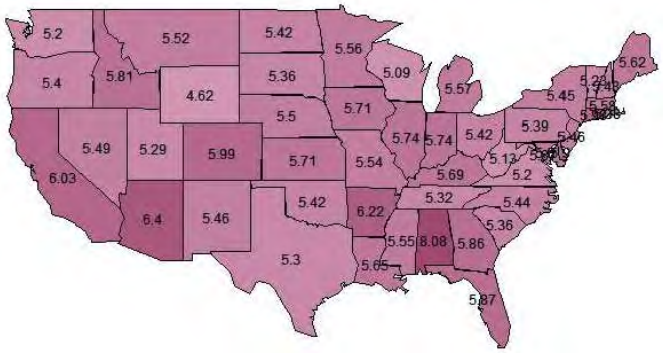
It is important to appreciate the magnitude of these impacts. A report

by the organisation Trust for Americas Health, notes that under the SARS outbreak which led to 774 deaths (compared to the millions anticipated from a major pandemic) there was a 66% reduction in travel arrivals to Hong Kong with cinemas in the region noting a 50% reduction in takings. It is estimated that the Asia Pacific Region lost some USD 40bn in this outbreak. They have built a model to estimate the impact of a major pandemic on the US economy, the figures below use data from their report.

Estimated GDP Lost in US by industry



Estimated GDP Lost in US by State (percent)



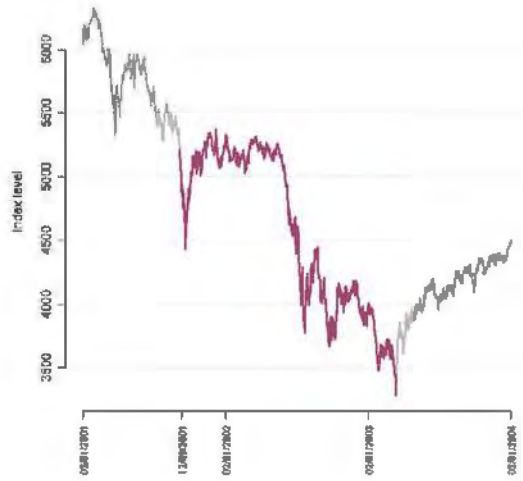
Insurers are major investors and a global recession is likely to impact the investments we hold. Many expect a “flight to quality” where investors switch from riskier assets to those perceived to be safer (typically government securities). Such securities will then increase in price and those holding them will see an appreciation in value. Conversely we can expect many sectors of the equity markets to be adversely affected.

A global pandemic will be a time of great insecurity and we witnessed in the years following the 9/11 attacks how large an impact a drop in confidence can have on the markets. The current financial crisis in 2008 gives us a stark reminder of the interconnected nature of the global economy and the financial services industry in particular.

Corporate bond spreads may widen, though risk free interest rates would fall if there was a flight to quality. Whether these opposing effects will cause an overall increase or decrease in the value of a diversified basket of corporate bonds is unclear. Liquidity may be effected which can affect short term claim paying ability.

A key issue is that past pandemics occurred at a time when global trade was significantly different than now. We do not know how the shockwave of a pandemic will impact supply chains. Many businesses operate a “just in time” model and stock only what they need for sales in the next period of trade. If supply chains are adversely affected we may see knock-on effects throughout the economy leading to shortages in some areas and backlogs in others. Hospitals are no different here and rarely stockpile drugs or supplies.

Impact of loss of confidence on stock markets (FTSE 100 INDEX) – after the 9/11 terrorist attacks and prelude to the 2nd gulf war.



INSURANCE IMPACT

When considering pandemic scenarios and the impact on our business we must have an image in mind. For a severe pandemic we have seen that a global recession would be a likely result; so many businesses will be struggling, food may be short in some areas if supply chains are affected. Society will not be operating as it ordinarily does. We saw in the aftermath of hurricane Katrina the breakdown of law and order, and the looting that followed. This was at a time when the majority of the US was not affected; in a pandemic it is possible that the entire planet will be suffering the effects simultaneously or in quick succession.

To offset this bleak view, we stress that emergency services have: planned ahead to secure their supply chains, stockpiled antivirals and expect to be able to offer a close to normal service. However, for the purposes of scenario planning it is appropriate to consider what might happen if these plans are not a successful as hoped. The purpose of scenario planning is precisely to consider outcomes that are ***not*** the most likely and to see how our businesses will fair if these events come to pass.

If a deep recession has been triggered, history tells us there will be a search for deep pockets and possibly an increase in fraudulent claims. Some will be looking to claim on any policy they believe could be valid and will be creative in their interpretation of the policy wording.

It is also important to note that whilst the impacts discussed below may not all be capital damaging issues on their own, taken together they will have a larger impact. This is an example of “tail dependency” that we witnessed with the terrorism attacks of 9/11; for very large scale events, things tend to go wrong at the same time. A global pandemic potentially affects every industry, every person and every country at the same time.

The following is a brief discussion of the potential impact on various classes of business:

Many classes of business
A global recession means, by definition, there will be a reduction in economically active stakeholders. Inevitably this will lead to a reduced demand for insurance, so premium income will be reduced yet many overheads will remain. Offsetting this we might expect a reduction in available capital to cause a hardening of premium rates.

Life/health
Although life and health insurance is not the focus of this paper it is clear that the impact on these businesses will be very significant. Research by various life insurers and reinsurers suggest that profitability will be damaged for several years but that capital is adequate to withstand this. The “natural hedge” against a rush of life assurance claims is that annuity payments may cease earlier than expected (due to premature death of the annuitant). This is not certain to work; in 1918 the pandemic affected those of working age and was little worse than a “normal” winter flu for the elderly; so such hedging should not be relied upon. Some reinsurers for the general insurance markets also offer life reinsurance; their balance sheet may be weakened at a time when P&C cedants are also looking to claim.

General Liability
Issues of liability are settled in the courts. However, insurers may be able to prevent unexpected claims by proactive consideration of pandemic scenarios.

Third parties rely on others to keep them from harm of personal injury. Certain key industries (though this list is far from exhaustive) such as

entertainment (e.g. pop concerts), hospitals, hotels, travel and universities involve a significant amount of close interaction between humans; a breeding ground for pandemics. These industries can be expected by third parties to have thought through the impact of pandemic fully and have robust and tested plans in place. Those that don't plan adequately and perform badly in a pandemic, putting others at risk, may face legal action. Clearly there will be considerable uncertainty during a pandemic; mistakes will be made and hindsight will show that certain planned actions were not appropriate. We hope that such errors will not cause liability provided they were the result of reasonable planning. However, those that have not planned, or whose plans are clearly deficient relative to their peers, may be at targets for shareholders, employees and other financial stakeholders.

A few scenarios worth discussing are:

- At the start of a pandemic wave, the organisers of a pop concert host a planned event despite several other events being cancelled claiming, in answer to questions from the press, that it is safe to do so. Later, attendees claim that they contracted the flu at the event; a legal case ensues and the organisers are found to have acted inappropriately. Will their liability policy be triggered?

- Several airlines (in accordance with their pandemic plans) have cancelled all flights to avoid people being in such close proximity for an extended period of time. A few airlines are keeping services going. Some travellers are known to be showing the signs of flu (sneezing, coughing etc), passengers complain but are reassured that they are safe. Several passengers go on to develop the flu and, suspecting that they caught it on the flight, start a campaign. A statistical review ensues and demonstrates that a higher than average proportion of people become infected and were also on flights in that period. A class action is taken against the airline.

- A catering company is responsible for the food for a particular global airline. It is discovered that the pandemic can be spread on packaging and after a review the global explosion of the pandemic is tracked back to a sick individual in the company whose health procedures were inadequate. Is the company responsible?
  If they are not already doing this, insurers could start to ask: whether companies have robust plans in place; how regularly they are tested; and what amount of budget is assigned to Business Continuity Planning. These simple indicators of exposure and risk management would illuminate the most ***at risk*** businesses and perhaps even encourage additional planning.

D&O

Following a similar line of argument as that discussed under the general liability section, one might conclude that any company that did not properly plan and was disproportionately financially impacted, when compared to their peers, may see their directors sued for loss of shareholder value.

There is very clear guidance on how business should prepare, as illustrated in the regulations section. Yet, speaking at the Lloyd's/ XL Pandemic event Robert Hall a managing consultant at Marsh noted that:

- Over three-quarters of companies have inadequate plans for coping with a flu pandemic.
- Around a third of businesses have no strategy at all, while 14% have only rudimentary contingency plans.
- Around a third of executives are unaware of how their companies intend to deal with the threat, only 22% are comfortable that they are prepared.

Employers Liability/ Workers compensation
We can expect a significant level of absence from work during a major pandemic. To avoid major economic impacts companies may well be urging their staff to return to work stressing that they are only thought to be contagious if they display symptoms of illness. If the company's plans are shown to be weak compared to their peers (for example if most companies close their canteens to avoid large gatherings of people but a few don't) might they have failed in their duty of care to their employees?

Certain employers appear to be a higher risk than others, in particular those employing health care workers. Under the SARS outbreak many patients who became ill were medical workers; particularly those working close to patients whose illness had not yet been diagnosed. Hospital staff and those of other health facilities are being asked to perform in extraordinary circumstances and can expect their employers to have taken particular care over their safety. For private medical facilities in particular, those employers whose plans are shown to be inadequate in an absolute sense, or relative to their peers, may be targets for legal action. Were enough masks bought? Do they work? Did they hold a high enough volume of antivirals? Were standards of cleanliness sufficient? These questions and others will be asked. Insurers can monitor risk levels by tracking exposure to these companies and asking what plans they have in place.

Medical Malpractice
Some have forecasted that around 30% of total hospital beds will be required to deal with serious flu cases. Yet hospitals already operate at 100% capacity, there are few, if any, spare beds. Who goes home, how do doctors decide? Were such decisions consistent across different medical centres? The example of MRSA has shown that in some circumstances hospitals spread disease and legal challenges follow.

Marine issues
Due to the discrete nature and isolated populations of large cruise ships certain scenarios may be possible, for example:

- If a ship has been at sea for longer than the incubation period of the illness and has no cases of pandemic sickness, it is likely to be free of the pandemic. If the ship then docks in a region known to have the pandemic and passengers become ill the action of docking might be deemed to be the cause of their illness. Should the captain have checked before docking? Were procedures faulty? It is possible that liability will arise in this scenario and typically cruise ship passengers are wealthy individuals so claims could be large.

- If a ship carrying those with the flu comes to port without informing the authorities in a region that is currently free of the illness, might they be deemed to be the cause of the illness in that region and liability be sought?

- It is conceivable that, with a large proportion of the workforce absent during the pandemic, safety standards will fall. Might this lead to an increase in general risk levels? Will all procedures be followed as thoroughly as usual? The existence of a thorough and tested plan may give some reassurance to insurers here.

Product Liability
If it could be established that a faulty air conditioning system exacerbated the spread of the pandemic through an office building, aircraft, (as has been argued in cases of legionnaires disease), this could lead to a class action against the manufacturer under a GL/Products policy.

Property, business interruption
For business interruption under property policies to be triggered there has to be an insured event. It is hard to see how the presence of a pandemic could constitute such an event; but, if history is any guide, there will be a search for deep pockets, particularly for extreme pandemics if the expected global recession occurs and particularly from the hardest hit industries. Contract certainty may be a useful defence here. However higher than average property damage may result from a pandemic in some scenarios and this is discussed in the secondary impacts section later.

Hotel/ hospitality Business Interruption
Some policies have specifically included business interruption cover for the hotel/hospitality industry. The cover is triggered if guests exhibit symptoms of disease. This may be a quantifiable insurance risk when the outbreak occurs in isolated cases and where global diversification will help to cap total portfolio losses. But in the case of a pandemic there is potential for significantly many, and perhaps even all policies, claiming simultaneously. We may also see multiple claims from the same policy if there are several waves of pandemic over the year of cover.

Event cancellation cover
Within the Lloyd's market Contingency Business Event Cancellation Cover excludes communicable diseases as a norm on all event cancellation business.

Travel Insurance
Under travel insurance policyholders can claims for lost deposits or other costs if they have to cancel a trip because either they or close family are ill. If illness strikes whilst abroad cover is provided to cover hotel costs and medical expenses until the policyholder is fit to travel or released from quarantine. The conditions for claims are presumably far more likely to be triggered during a pandemic and could give rise to many more claims than expected. Whilst such claims are unlikely to cause significant solvency problems for large diversified insurers it is possible that the profits from this line of business would take many years to climb back into the black.

Credit Insurance
For a large pandemic there may be a number of company insolvencies; particularly from the most affected industries. This might lead to payments from credit insurers. Those providing credit life or accident and health cover can also expect to see significant payouts.

Professional Indemnity
An architect, for example, could be sued under a PI policy if it was claimed that a particular feature of the building design contributed to the spread of the virus throughout the building. Should the Architect have been aware of the potential and tried to plan accordingly? Did they receive specific instructions from the client to take account of the pandemic? A possible defence could be State of Art i.e. the exposure was

not clearly established when then the advice was given and the steps taken were reasonable based on the level of knowledge available at that time. Clearly the likelihood of a successful defence using this argument depends on the level of knowledge which changes rapidly. Hence it is important to monitor emerging information.

Secondary Impacts

Terrorism/political risk
The political environment after a pandemic may be different to before. We can hope that a coordinated global response is formulated and the political environment is better rather than worse; but some scenarios may tell a different story. Scientists tell us that developing countries will be the worst affected. This will be for many reasons, but may include the fact that in the developed world: medical facilities are much better and governments may have bought all the available supplies of antivirals/vaccine. This may increase tensions globally particularly against a backdrop of other global trends such as water shortages and global warming. Insurers offering political risk cover are at risk if the political scene shifts; particularly as some construction projects agree premium terms over a multiple year deal.

Property damage
If emergency services are affected (again we stress they have taken reasonable steps to avoid this; but in scenario planning it pays to consider alternatives) then, due to a reduction in fire suppression capacity, fires may be more severe than otherwise and burst gas or water pipes may go unnoticed and remain unattended for longer due to a shortage of plumbers. As more people are at home than usual this may lead to lower residential risk as they will be present to avoid these risks; however in this case there will be less people at work and for the opposite reasons this may lead to higher commercial risk at a time when the fire services will be most stretched.

We typically see that the longer the delay between property damage and its eventual rectification the larger the claim. Lost tiles that are not replaced quickly can let water into a property and turn a small claim into a large one. Yet the supply of roofers and builders during a pandemic is likely to be reduced either by sickness or not wishing to go into others' homes. We may see, so called, "loss amplification", as this reduction in supply leads to an increase in prices, again causing the average claims cost to rise. This may not be a capital damaging event but will be an unwelcome drain on an insurer's resources.

Theft
It is not clear whether theft will increase. During the July 2005 bombings in London when police services were stretched we did not see a rise in crime; perhaps society will pull together. However, in New Orleans following hurricane Katrina (a much larger event) looting and a localised breakdown of civic order were witnessed. If supply chains fail and food is short; or if a recession causes high unemployment, it is conceivable that crime will rise. This may occur during a pandemic or in the months after the pandemic, as the economy recovers. Civil commotion exclusions may apply; but an increase in frequency caused by isolated crimes may not be covered by these.

Motor
As large volumes of people stay at home either because of sickness, caring for others or fear of travel we can expect the volume of traffic to fall. Offsetting this we can expect many people to avoid public transport and take to their cars. If on balance there is less traffic we can expect

accident frequency to fall. However accidents will still occur and conceivably bodily injury claims could be more severe if the number of paramedic staff is reduced or response times increased. Such increases in severity will tend to increase the average claims size. It is not clear which affect will dominate.

OPERATIONAL ISSUES

Lloyd's has detailed business continuity plans in place to manage the continuation of business activities for a variety of events as far as is practically possible. We were one of 70 organisations that took part in the Financial Services Authority's market-wide pandemic exercise in 2006 and we hold annual business continuity exercises for the market and the Corporation.

Media outlets are growing in number. Global communication is becoming ever more rapid. We can expect sensationalism from some sources. The level of media interest in a subject is not a guide to underlying risk levels; for example in 2005 the focus on bird flu was much higher than now, yet the WHO alert level has not changed over this period. Business Continuity Plans should consider media response in advance.

Insurers regularly calculate capital requirements allowing for a combination of many adverse outcomes from various risk types (investment market risk, insurance risk, credit risk, operational risk, liquidity risk and group risk). This will stand insurers in good stead as a pandemic is likely to impact several of these areas simultaneously.

Pandemic preparedness requires cooperation between stakeholders: Government, Business, Health centres and the community.

CONCLUSIONS

Pandemics are inevitable and have happened regularly in the past. They have been of variable impact, at worst leading to approaching 100 million deaths.

There are reasons to assume that the world would be better prepared than ever before to face a pandemic due to international cooperation and better health care. However, population growth, urbanisation and increased global mobility may lead to a more rapid and widespread disease.

The parameters of the 1918 event, which led to between 20 and 100 million deaths, is often used as a worst case scenario. Whilst this was an extreme event compared to past pandemics it is important to consider other scenarios and other pathogens, so society doesn't over optimise its response to one scenario.

Economic impacts are likely to occur and a pandemic as severe as 1918 may lead to a global recession with reductions of between 1% and 10% of GDP. These may impact the investment assets of insurers and will also impact the general business environment.

Many classes of business will be affected by a pandemic. Clear cut cases include life and health insurance. Other forms of cover including D&O, General Liability, Medical Malpractice and Event Cancellation policies may be affected depending on policy wordings and legal judgements.

General economic and societal affects may give rise to secondary forms of loss, particularly if there is a reduction in the efficiency of the emergency services. Those leading such essential national services are taking significant steps to plan for and avoid this; nevertheless as part of sensitivity planning insurers should consider scenarios where such plans are not 100% effective.

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The following were useful sources of information used when drafting this report. Links are shown for ease of use and were valid at the time of publishing the report:

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Robert Roos News Editor
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Severe acute respiratory syndrome

Face masks offer protection against SARS infection (Photo: Michel Depardieu/INSERM

SARS

Severe Acute Respiratory Syndrome (SARS) is a viral respiratory illness caused by the SARS-associated coronavirus (SARS-CoV). Considered the first emerging epidemic of the 21st century, SARS emerged in Asia in February 2003 and spread to more than two dozen countries in North America, South America, Europe, and Asia before being contained. At the end of the epidemic in June 2003, SARS-CoV had infected 8422 people and killed 916. In the Eastern Mediterranean region, only one case was reported, from Bahrain.

SARS is spread by close person-to-person contact, most readily by respiratory droplets. Symptoms of the disease include high fever, headache, an overall feeling of discomfort, and body aches, sometimes diarrhea, a dry cough (after 2-7 days) and

pneumonia. Severe cases often evolve rapidly to respiratory distress and require intensive care.

Although vaccines are being researched, there is currently no specific treatment for SARS. The focus lies on prevention, including surveillance and early detection, proper hygiene, and avoiding direct contact with infected bodily fluids.

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Middle East respiratory syndrome

Training workers in health facilities can help to reduce health care-associated outbreaks

Middle East respiratory syndrome (MERS) is an emerging viral respiratory disease caused by the MERS coronavirus, also called MERS-CoV, that was first identified in Saudi Arabia in 2012.

Symptoms of MERS range from none to mild or severe respiratory ailments, including fever, cough, shortness of breath and, on occasion, pneumonia and gastrointestinal symptoms, including diarrhoea. In a handful of patients, particularly those with chronic underlying health conditions, the virus may cause severe illness, leading to respiratory failure that requires mechanical ventilation and support in an intensive care unit. Some laboratory-confirmed cases of MERS-CoV infection are reported as

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asymptomatic, meaning that they do not have any clinical symptoms, yet they are positive for MERS following a laboratory test. Most of these asymptomatic cases have been detected following aggressive contact tracing of a laboratory-confirmed case.

In the Region, 12 countries (Bahrain, Egypt, Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and Yemen) have so far reported laboratory-confirmed cases of MERS. Amongst these countries, imported cases that were associated with travel were reported from Egypt, Lebanon, Tunisia and Yemen.

Current scientific evidence suggests that dromedary camels are a major reservoir host for MERS-CoV and an animal source of MERS infection in humans. However, the exact role of dromedaries in the transmission of the virus and the exact routes of transmission are unknown. Although no sustained human-to-human transmission has been documented, cases have been reported where there was some unprotected contact with infected persons, such as in a health care setting. Health care-associated outbreaks have occurred in several countries, with the largest seen in the Republic of Korea, Saudi Arabia and the United Arab Emirates.

Preventing MERS relies on avoiding unpasteurized or uncooked animal products, practicing safe hygiene habits in health care settings and around dromedaries, community education and awareness training for health workers, as well as implementing effective control measures. There is no specific antiviral treatment recommended for MERS-CoV infection and no vaccine currently available.

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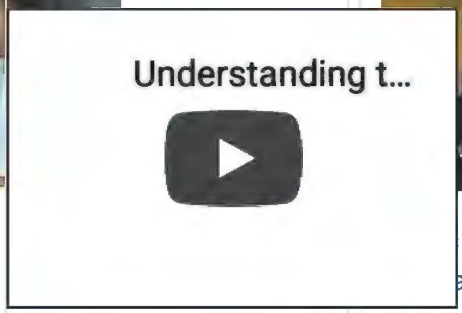

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Special supplement of Eastern Mediterranean Health Journal on novel coronavirus

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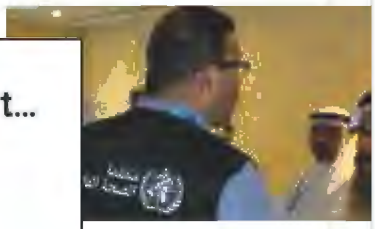

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Ebola

A member of a Rapid Response Team receives training on Ebola in Sudan (Photo: WHO).

Ebola virus disease (EVD) is a severe illness that is often fatal in humans if untreated. *Ebolavirus* is a genus of the virus family *Filoviridae*, which also includes the genera *Cuevavirus*, and *Marburgvirus*, and includes 5 species of Ebola: Zaire, Bundibugyo, Sudan, Reston and Taï Forest.

First symptoms are the sudden onset of fever fatigue, muscle pain, headache and sore throat. This is followed by vomiting, diarrhoea, rash, symptoms of impaired kidney and liver function, and in some cases, both internal and external bleeding (e.g. oozing from the gums, blood in the stools). Laboratory findings include low white blood cell and platelet counts and elevated liver enzymes.

The virus is transmitted to people from wild animals and spreads in the human population via direct contact with blood, secretions, organs or other bodily fluids of infected people, and with surfaces and materials (e.g. bedding, clothing) contaminated

with these fluids. Health-care workers have frequently been infected while treating patients with suspected or confirmed EVD, through close contact with patients when infection control precautions are not strictly practiced. Burial ceremonies that involve direct contact with the body of the deceased can also contribute to the transmission of Ebola. More surveillance data and research are needed on the risk of sexual transmission, and particularly on the prevalence of viable and transmissible virus in semen over time.

EVD on average kills half of those it infects, though fatality rates have varied from 25% to 90% in past outbreaks. The virus first appeared in 1976 in two simultaneous outbreaks in what is now South Sudan, and in the Democratic Republic of Congo, near the Ebola River from which the disease takes its name. The 2014–2016 outbreak in Sierra Leone, Liberia and Guinea, which was caused by the Zaire species, was the largest and most complex Ebola outbreak ever, with over 28,000 cases and more than 11,000 deaths. In addition to the direct health impact, the outbreak and associated fears and stigma caused severe damage and disruption to local economies and daily life. The same virus species re-emerged in the Democratic Republic of the Congo in 2017 and again in May and August of 2018.

To date, no EVD cases have been recorded in the Eastern Mediterranean Region. Between October 2014 and February 2015, 20 out of 22 countries in the Region conducted a rapid assessment of their preparedness and readiness measures for Ebola. Any gaps were addressed through a 90-day action plan addressing leadership and coordination, capacities at border crossings, surveillance and contact tracing, laboratory detection and diagnosis, case management and infection prevention and control, risk communication, and safe burials.

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Zika virus

WHO experts identify mosquito breeding sites to guide vector control efforts (Photo: WH

Zika virus (ZIKV) disease is caused by a virus which is transmitted primarily by *Aedes* mosquitoes. Most infections are either asymptomatic or cause a mild illness including low fever, skin rash, conjunctivitis, muscle and joint pain, malaise or headache. Zika virus infection during pregnancy can cause microcephaly and other congenital malformations in newborns, known as congenital Zika syndrome. In adults and children it can cause rare but severe neurologic complications induding Guillain-Barré syndrome.

On 1 February 2016, WHO declared that recently reported clusters of microcephaly and neurological disorders potentially associated with ZIKV constituted a Public Health Emergency of International Concern (PHEIC). As of February 2018, 86 countries and territories around the world have reported transmission of Zika virus

infection, of which 27 areas have ongoing transmission with new introduction or reintroduction reported since 2015.

As of August 2018, no cases of Zika have been recorded in the Eastern Mediterranean region. However, the *Aedes aegypti* mosquito is present in 8 countries in the Region (Djibouti, Egypt, Oman, Pakistan, Saudi Arabia, Somalia, Sudan and Yemen), so continued vigilance remains important.

There is no vaccine to prevent Zika virus infection, nor is specific anti-viral treatment currently available. Protection against mosquito bites during the day and early evening is a key measure to prevent Zika virus infection.

WHO is supporting countries to prevent and manage Zika and its complications according to the four main objectives outlined in the Zika Strategic Response Plan: detection, prevention, care and support, and research.

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Public health interventions and epidemic intensity during the 1918 influenza pandemic

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Edited by Burton H. Singer, Princeton University, Princeton, NJ, and approved February 14, 2007 (received for review December 9, 2006)

Nonpharmaceutical interventions (NPIs) intended to reduce infectious contacts between persons form an integral part of plans to mitigate the impact of the next influenza pandemic. Although the potential benefits of NPIs are supported by mathematical models, the historical evidence for the impact of such interventions in past pandemics has not been systematically examined. We obtained data on the timing of 19 classes of NPI in 17 U.S. cities during the 1918 pandemic and tested the hypothesis that early implementation of multiple interventions was associated with reduced disease transmission. Consistent with this hypothesis, cities in which multiple interventions were implemented at an early phase of the epidemic had peak death rates ≈50% lower than those that did not and had less-steep epidemic curves. Cities in which multiple interventions were implemented at an early phase of the epidemic also showed a trend toward lower cumulative excess mortality, but the difference was smaller (≈20%) and less statistically significant than that for peak death rates. This finding was not unexpected, given that few cities maintained NPIs longer than 6 weeks in 1918. Early implementation of certain interventions, including closure of schools, churches, and theaters, was associated with lower peak death rates, but no single intervention showed an association with improved aggregate outcomes for the 1918 phase of the pandemic. These findings support the hypothesis that rapid implementation of multiple NPIs can significantly reduce influenza transmission, but that viral spread will be renewed upon relaxation of such measures.

mitigation | nonpharmaceutical interventions | closures

Influenza pandemics have occurred periodically in human populations, with three pandemics in the 20th century. The 1918 influenza pandemic resulted in unprecedented mortality, with an estimated 500,000–675,000 deaths in the U.S. and 50–100 million deaths worldwide (1–3). The spread of H5N1 avian influenza has provoked public concern (4) and accelerated efforts to plan for the next pandemic. Because antiviral medications and effective vaccines may not be widely available at the beginning of a pandemic, many authorities have suggested using nonpharmaceutical interventions (NPIs; i.e., voluntary quarantine of infected households, closure of schools, bans on public gatherings, and other measures) to decrease disease transmission. This approach is supported by mathematical models, which suggest that multiple simultaneous NPIs applied early in an epidemic may significantly reduce disease transmission (5). A recent review, however, concluded that the evidence base for recommending such interventions is limited, consisting primarily of historical and contemporary observations, rather than controlled studies (6).

The intensity of the 1918 pandemic, whether assessed as total excess deaths, the rate of increase in the epidemic curve, or peak death rates, varied widely among U.S. cities. Cities also varied widely in their choice and timing of implementation of NPIs designed to reduce disease spread. Many cities closed schools, churches, theaters, dance halls, or other public accommodations; made influenza a notifiable disease; banned funerals or other public gatherings; or introduced isolation of sick persons. In some cases, these NPIs were put in place in the first days of epidemic spread in a city, whereas in other cases, they were introduced late or not at all (Table 1).

We noted that, in some cases, outcomes appear to have correlated with the quality and timing of the public health response. The contrast of mortality outcomes between Philadelphia and St. Louis is particularly striking (Fig. 1). The first cases of disease among civilians in Philadelphia were reported on September 17, 1918, but authorities downplayed their significance and allowed large public gatherings, notably a city-wide parade on September 28, 1918, to continue. School closures, bans on public gatherings, and other social distancing interventions were not implemented until October 3, when disease spread had already begun to overwhelm local medical and public health resources. In contrast, the first cases of disease among civilians in St. Louis were reported on October 5, and authorities moved rapidly to introduce a broad series of measures designed to promote social distancing, implementing these on October 7. The difference in response times between the two cities (≈14 days, when measured from the first reported cases) represents approximately three to five doubling times for an influenza epidemic. The costs of this delay appear to have been significant; by the time Philadelphia responded, it faced an epidemic considerably larger than the epidemic St. Louis faced. Philadelphia ultimately experienced a peak weekly excess pneumonia and influenza (P&I) death rate of 257/100,000 and a cumulative excess P&I death rate (CEPID) during the period September 8–December 28, 1918 (the study period) of 719/100,000. St. Louis, on the other hand, experienced a peak P&I death rate, while NPIs were in place, of 31/100,000 and had a CEPID during the study period of 347/100,000. Consistent with the predictions of modeling, the effect of the NPIs in St. Louis appear to have had a less-pronounced effect on CEPID than on peak death rates, and death rates were observed to climb after the NPIs were lifted in mid-November (7–9).

To investigate whether early implementation of individual interventions or of multiple measures reduces disease transmission during influenza pandemics, we analyzed the NPIs used in a collection of U.S. cities during the fall wave of the 1918 pandemic, identifying the NPIs used in each city as well as the timing of their implementation [details of individual city outcomes and interven-

Author contributions: R.J.H., C.E.M., and M.L. designed research; R.J.H., C.E.M., and M.L. performed research; M.L. analyzed data; and R.J.H. and M.L. wrote the paper.

The authors declare no conflict of interest.

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Freely available online through the PNAS open access option.

Abbreviations: P&I, pneumonia and influenza; CEPID, cumulative excess P&I deaths; NPI, nonpharmaceutical intervention; CFP, case-fatality proportion.

See Commentary on page 7313.

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This article contains supporting information online at www.pnas.org/cgi/content/full/0610941104/DC1.

Table 1. Summary of interventions and their timing across 17 cities

Intervention	Number of 17 cities implementing	Median (interquartile range) epidemic stage (CEPID) at time of implementation*
Making influenza a notifiable disease	15	5.6 (3.1, 25.9)
Emergency declarations	4	—
Isolation policies	14	15.7 (7.6, 30.8)
Quarantine of households where infection identified	5	—
School closures	14	30.8 (15.1, 96.3)
Church closures	15	29.9 (12.4, 130.6)
Theater closures	15	29.9 (10.3, 66.9)
Dance hall closures	11	44.7 (12.4, –)
Other closures	13	84.7 (29.9, 322.0)
Staggered business hours to reduce congestion in stores and on transit systems	8	—
Mask ordinances	2	—
Rules forbidding crowding on streetcars	6	—
Private funerals	11	92.1 (30.8, –)
Bans on door-to-door sales	1	—
Interventions designed to reduce transmission in the workplace	0	—
Protective sequestration of children	3	—
Bans on public gatherings	15	30.8 (12.4, 118.1)
No-crowding rules in locations other than transit systems	3	—
Community-wide business closures	1	—

*Shown only for interventions implemented in at least nine cities (>50%); 75th percentile not shown for interventions implemented in <13 cities.

tions are included in supporting information (SI) *Appendix*]. We then related this information to the observed outcomes of the peak weekly death rate and CEPID during the period September–December, 1918. Excess death rates were used as a proxy for case incidence because of the more accurate reporting of deaths than cases. We hypothesized that early implementation of multiple NPIs in an immunologically naïve population would slow the progression of the epidemic, resulting in a flatter epidemic curve, but that over time aggregate outcomes would approach those observed in cities not implementing such measures, until roughly comparable levels of herd immunity were achieved.

Results

Effect of Early Interventions on Epidemic Spread. We assessed the relationship between the timing of NPIs and three measures of epidemic outcome: (*i*) the peak weekly rate of excess P&I deaths per 100,000 population (peak death rate) during the study period; (*ii*) the "normalized" peak weekly excess P&I death rate (peak weekly death rate during the study period divided by the median weekly rate during the period); and (*iii*) the CEPID per 100,000 population during the study period. The stage of the epidemic at the time of each intervention was defined as the CEPID from the start of the study period until

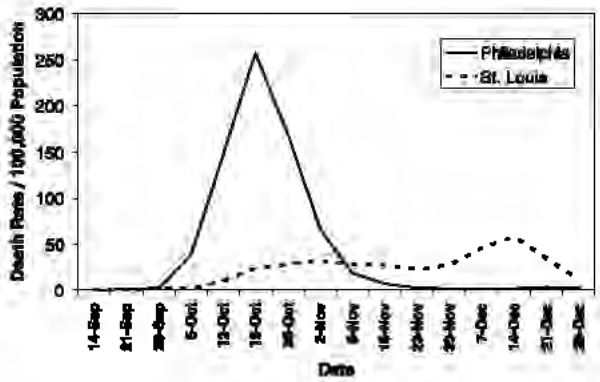

Fig. 1. Excess P&I mortality over 1913–1917 baseline in Philadelphia and St. Louis, September 8–December 28, 1918. Data are derived from ref. 10.

the date on which the intervention was announced. Thus, early interventions in a given city were those that were implemented when relatively few individuals had died, whereas later ones

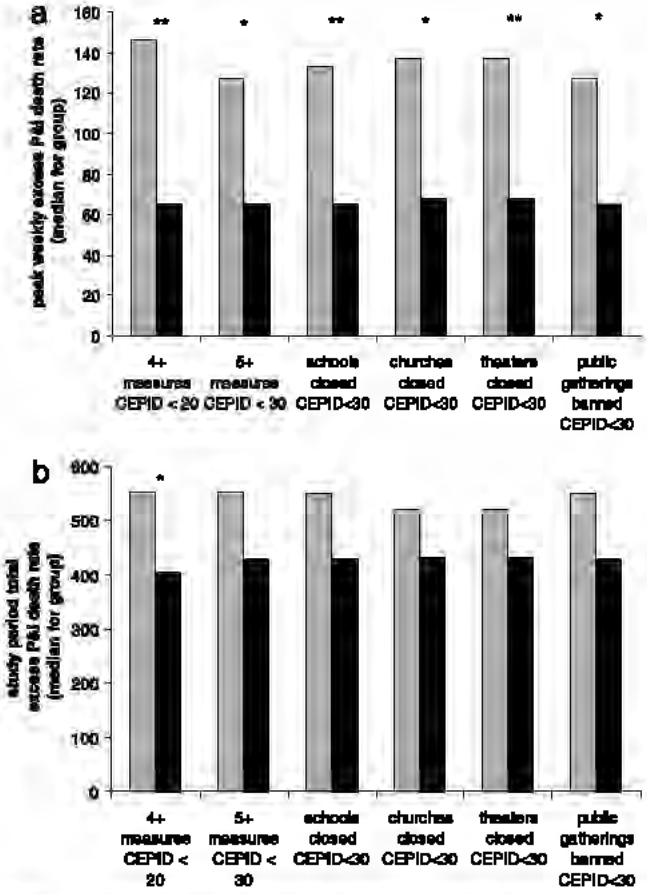

Fig. 2. Relationship of (a) peak weekly excess P&I death rate and (b) total excess P&I death rate during the study period to the timing of various NPIs. Cities were divided evenly into those intervening early (black bars) vs. late or not at all (gray bars), and the median outcome for the early and late groups was plotted. The first two groups of bars assess overall timing of intervention, comparing those cities that announced four or more NPIs before experiencing 20/100,000 CEPID with those with three or fewer and those that announced five or more NPIs before experiencing 30/100,000 CEPID with those with four or fewer. The remaining groups compare those cities that announced particular measures before experiencing 30/100,000 CEPID with those that did not. Significance by Mann–Whitney *U* test: *, $P < 0.05$; **, $P < 0.01$.

Table 2. Correlation between influenza epidemic outcomes and timing of interventions in 17 U.S. cities in 1918

Measure of interventions	Outcome: Excess weekly P&I deaths		
	Peak	Normalized peak	1918 total
Number of interventions before:			
10/100,000 CEPID	**−0.53, $P = 0.03$**	**−0.53, $P = 0.03$**	−0.31, $P = 0.22$
20/100,000 CEPID	**−0.68, $P = 0.002$**	**−0.64, $P = 0.005$**	**−0.52, $P = 0.03$**
30/100,000 CEPID	**−0.51, $P = 0.04$**	**−0.55, $P = 0.02$**	−0.29, $P = 0.27$
40/100,000 CEPID	−0.32, $P = 0.21$	−0.40, $P = 0.11$	−0.07, $P = 0.80$
CEPID at time of intervention:			
First	0.08, $P = 0.76$	0.004, $P = 0.87$	0.07, $P = 0.79$
Second	**0.54, $P = 0.02$**	0.47, $P = 0.06$	0.39, $P = 0.12$
Third	**0.54, $P = 0.02$**	**0.53, $P = 0.03$**	0.31, $P = 0.22$
Fourth	**0.66, $P = 0.004$**	**0.70, $P = 0.002$**	0.38, $P = 0.13$
Fifth	**0.55, $P = 0.02$**	**0.67, $P = 0.002$**	0.27, $P = 0.30$
Sixth	0.26, $P = 0.31$	0.44, $P = 0.08$	0.05, $P = 0.84$
CEPID at time of:			
Closing schools	**0.54, $P = 0.02$**	**0.63, $P = 0.007$**	0.25, $P = 0.34$
Closing theaters	**0.56, $P = 0.02$**	**0.72, $P = 0.001$**	0.17, $P = 0.52$
Closing churches	**0.56, $P = 0.02$**	**0.70, $P = 0.002$**	0.17, $P = 0.53$
Closing dance halls	0.03, $P = 0.90$	0.04, $P = 0.87$	0.15, $P = 0.57$
Other closures	0.33, $P = 0.19$	0.34, $P = 0.18$	0.24, $P = 0.35$
Making influenza notifiable	0.01, $P = 0.97$	−0.07, $P = 0.79$	0.11, $P = 0.67$
Bans on public gatherings	0.46, $P = 0.06$	**0.56, $P = 0.02$**	0.27, $P = 0.30$
Imposing case isolation	0.16, $P = 0.53$	0.14, $P = 0.59$	0.13, $P = 0.62$
Bans on public funerals	−0.09, $P = 0.75$	0.09, $P = 0.72$	−0.41, $P = 0.10$

Three measures of epidemic intensity. Peak weekly excess P&I death rate, normalized peak weekly excess P&I death rate (peak divided by median weekly rate during the study period), and 1918 study period total excess P&I death rate are related to number of interventions before reaching a specified CEPID, CEPID at time when specified numbers of interventions had been imposed, and CEPID at time when specific interventions had been imposed. Spearman rank correlations and associated P values are shown, with bold type for $P < 0.05$.

were those implemented after more excess P&I deaths had occurred.

In comparisons across cities (Fig. 2*a*, Table 2), we found that aggressive early intervention was significantly associated with a lower peak of excess mortality (Spearman $\rho = -0.49$ to -0.68, $P = 0.002$–0.047; see Table 2, *Number of interventions before*, for the number of NPIs before a given CEPID cutoff vs. peak mortality). Cities that implemented three or fewer NPIs before 20/100,000 CEPID had a median peak weekly death rate of 146/100,000, compared with 65/100,000 in those implementing four or more NPIs by that time (Fig. 2*a*, $P = 0.005$). The relationship was similar for normalized peak death rates and for a range of possible cutoffs (see Table 2, *CEPID at time of intervention*), although the relationship became weaker as later interventions were included. Cities with more early NPIs also had fewer total excess deaths during the study period (Fig. 2*b*, Table 2, *1918 total*), but this association was weaker: cities with three or fewer NPIs before CEPID = 20/100,000 experienced a median total excess death rate of 551/100,000, compared with a median rate of 405/100,000 in cities with four or more NPIs ($P = 0.03$).

The association of early intervention and lower peak death rates was also observed when cities were ranked according to the CEPID in each city at the time of the second, third, fourth, or fifth intervention (Table 2, *CEPID at time of intervention*). Similar relationships were again detected for the normalized peak death rate [Table 2, *CEPID at time of intervention/Normalized peak*]. Again, the relationship with total death rate was weaker and in this case not statistically significant.

Effects of Individual Interventions. To assess whether particular NPIs were associated with better outcomes, we calculated a Spearman rank correlation coefficient between outcome measures and the stage at which individual NPIs were implemented in each city (cities that never implemented a given intervention were ranked last in each analysis). Results are shown in Table 2, *CEPID at time of*. Early school, church, or theater closure was associated with lower peak excess death rates (Spearman $\rho = 0.54$–0.56, $P = 0.02$). Cities that made each of these interventions before they reached 30/100,000 CEPID had a median peak death rate of 65–68/100,000, compared with median peaks of 127–146/100,000 for cities that made these interventions later or not at all (Fig. 2*a*, $P = 0.005$–0.01). Announcements of school, church, and theater closures were linked in most cities, occurring within a span of ≤6 days in the majority, and this near simultaneity of implementation precludes multivariate analysis or strong inference about the relative importance of the individual NPIs. Early bans on public gatherings were also associated with lower peak excess death rates, but the statistical significance of this result depended on the test used [Table 2, *CEPID at time of*, and Fig. 2*a*]. Of the other NPIs considered (closure of dance halls, other closures, isolation of cases, bans on public funerals, and making influenza notifiable), none showed a statistically significant association between the stage of implementation and the peak or cumulative excess death rates (Table 2, *CEPID at time of*, and Fig. 2).

Other Predictors of Epidemic Severity. We assessed the correlation between peak mortality rate and each of the following variables: latitude, longitude, 1910 population density, 1920 population density, 1918 population size, and epidemic start week, defined as the first week in which excess P&I mortality exceeded 10/100,000. Of these variables, only longitude (Spearman $\rho = -0.61$, $P = 0.009$) and epidemic start week (Spearman $\rho = -0.55$, $P = 0.02$) were significantly associated with the peak weekly excess P&I mortality rate, and these two variables were strongly associated with one another (Spearman $\rho = 0.66$, $P = 0.004$), indicating that eastern U.S. cities were hit earlier in our data set. In addition, cities whose epidemics began later tended to intervene at an earlier stage of their

epidemics (Spearman $\rho = 0.77$, $P = 0.0003$), presumably because local officials in these cities observed the effects of the epidemic along the Eastern seaboard and resolved to act quickly.

In linear regressions of peak death rates vs. stage of the epidemic at the time of interventions (number of NPIs before CEPID = 20/100,000) and timing of epidemic onset, the association of peak with intervention stage was statistically significant and stronger than that with epidemic onset in univariate models (SI Table 3). If both predictors are used in a bivariate regression, the point estimate for interventions remains unchanged while the p value increases to 0.13; no independent effect of week of onset is seen in this bivariate model. Similar results are found for longitude (data not shown). Subject to the caveats of performing a linear regression on only 17 cities with such highly correlated explanatory variables, this finding suggests that the relationship between early intervention and lower peak death rates is explained by factors of geography or timing of epidemic onset only to the extent that these factors influenced the quality of the public health response.

Sensitivity Analyses. Similar results were obtained when the intervention date was defined as the date public health orders were promulgated (Table 2) or the last date a particular type of gathering was permitted (e.g., Sunday church service; SI Table 4). Results were identical or improved when 7- and 10-day lags in assessing CEPID were introduced to account for the lag between infection and death (SI Tables 5 and 6).

Relationship Between Interventions and Subsequent Waves. Although it was not the primary intent of this paper to analyze pandemic wave dynamics, it is possible to formulate descriptive observations from the data at hand (SI Table 7). In offering these observations, it is important to underscore that in some cities, information about the dates of relaxation of the interventions used was incomplete.

All cities showed some fluctuation in mortality rates after the main wave of the 1918 pandemic subsided. The peak weekly mortality rates observed in "second waves" in the cities we studied ranged from 13.60 to 79.69/100,000, as compared with 31.29–256.96/100,000 during the first wave. There was a statistically significant inverse correlation of the height of the first and second peaks (Spearman $\rho = -0.53$, $P = 0.03$), so that cities that had low peaks during the first wave were at greater risk of a large second wave. Cities that had lower peak mortality rates during the first wave also tended to experience their second waves after a shorter interval of time, ≈6–8 weeks after the first peak vs. 10–14 weeks for cities with higher peak mortality rates (Spearman $\rho = -0.84$, $P < 0.0001$). These patterns were also observed in cities that implemented NPIs sooner [as assessed by ranking the cities according to their CEPID at school closure (Spearman $\rho = 0.63$, $P = 0.006$) or CEPID at time of the fourth intervention (Spearman $\rho = 0.52$, $P = 0.03$)]. Finally, and this is perhaps the most important observation, no city in our analysis experienced a second wave while its main battery of NPIs was in place. Second waves occurred only after the relaxation of interventions.

Discussion

Comparisons across 17 U.S. cities show that the first peak in excess P&I death rates during the fall wave of the 1918 influenza pandemic was ≈50% lower in cities that implemented multiple NPIs to control disease spread early in their epidemics than in cities that made such interventions late or not at all. This finding suggests that such interventions may be capable of significantly reducing the rate of disease transmission so long as they remain in effect.

If NPIs were maintained indefinitely once they were put in place, one would expect that early interventions would be associated with a reduction in both the peak incidence (and therefore peak death rate) and also in the cumulative incidence or cumulative excess death rate. However, NPIs used in 1918 did not last indefinitely; rather, most of the NPIs in the study cities appear to have been relaxed within 2–8 weeks, whereas opportunities for reintroduction and transmission of the pandemic virus extended for many months. If highly effective NPIs are put in place early in the epidemic, and these result in a smaller epidemic, then a large proportion of the population will remain susceptible to the renewed spread of the virus once interventions are relaxed. In the absence of an effective method of otherwise inducing immunity in the uninfected population (i.e., a well matched vaccine), such an epidemic is likely to have two phases, with the first phase mitigated by NPIs and the second commencing after NPIs are relaxed. In our review of 17 cities, we observed that cities that implemented NPIs sooner had lower peak mortality rates during the first wave and were at greater risk of a large second wave. These cities also tended to experience their second waves after a shorter interval of time. As described above, no city in our analysis experienced a second wave while its main battery of NPIs was in place, and second waves occurred only after the relaxation of NPIs.

A mitigated two-phase epidemic may result in a cumulative burden of morbidity and mortality less than that observed in a single unchecked epidemic because of reduced epidemic overshoot (7–9). However, the relationship between the timing of transiently maintained NPIs and final outcomes will be complicated and not necessarily monotonic (10). Because our goal was to assess the evidence for an effect of NPIs on transmission, rather than to assess whether the particular NPIs in 1918 were sustained long enough to prevent epidemic spread altogether, we defined peak death rates *a priori* as the main outcome measure. Consistent with these expectations, the relationship between intervention timing and peak death rates was stronger and statistically more convincing than that with total death rates in 1918.

The most important limitation of our study is that we used observed weekly excess fatality rates as a proxy for weekly community morbidity rates, which are not available for the study period. We believe that untransformed excess mortality rates are the most reliable (and least assumption-laden) record of the effects of the pandemic, but it is important to note that case fatality proportions (CFP) in 1918 appear to have varied between populations [being higher, for example, among the Inuit than in the general United States population (1)], likely as a result of differing levels of general public health, and it is possible that they varied between cities in the United States for similar reasons. Varying patterns of bacterial colonization or other, unidentified factors could also have contributed to variation in CFP. Differences in CFP between the cities could introduce a systematic error into our results (because they would lead to higher total deaths at a given stage of the epidemic, and higher peaks, in the same subset of cities). Our use of a normalized peak death rate was designed to avoid this error. If our results were artifacts of city-to-city variation in CFP, then the associations found should become weaker after this normalization; in fact, each of the strongest associations was at least comparably strong after the normalization (Table 2, *Normalized peak*), suggesting that variation in CFP did not create the associations we found.

More generally, a possible explanation for our findings is that inherently small epidemics (i.e., epidemics with flatter and smaller overall mortality curves, because of variation in CFP or in other factors not considered in our analysis) could appear to be associated with earlier interventions as an artifact of how we defined "early." If this were the case, however, even ineffectual NPIs, considered individually, should correlate with lower peak mortality rates. In fact, NPIs that seem less likely to block transmission directly (e.g., making influenza a notifiable disease, closing dance halls, and bans on public funerals) had no such association. That several individual interventions were found not to be associated with lower peaks suggests this statistical artifact is not present.

Previous authors have noted that epidemics that started later tended to be milder and have speculated that this might be due to

attenuation of the causative virus (3). Although viral attenuation may explain changes in the CFP over the course of the pandemic period (which extended to approximately March 1920), this mechanism seems an unlikely explanation for the striking variability of outcomes during the 1918 fall wave, given the marked transmissibility of the lethal virus and the short intervals between the onset of epidemics in different cities. A potentially more plausible explanation is that public health and political authorities in cities that were struck later responded more quickly and aggressively because they had several weeks' notice of the severity of the pandemic. Subject to the caveats attendant on a linear regression in such a small data set, we found that the stage of the epidemic at the time of interventions predicted peak mortality better than timing of epidemic onset. This finding suggests that the association between early intervention and lower peak mortality may be explained in large part by the fact that later-hit cities responded more promptly. Similar results were obtained when longitude was included in the analysis along with or in place of time of epidemic onset. Although we do not know of any mechanistic hypothesis connecting longitude directly to epidemic severity, our analysis similarly suggests that longitude is not an important confounder of our results.

In a related vein, the analysis of second peaks adds credence to the inference that NPIs were responsible for the observed lower first peaks in cities that implemented NPIs promptly. If lower first peaks were attributable to some other mechanism (e.g., a less virulent virus, seasonal changes in transmission, etc.), it is difficult to explain why, upon relaxation of NPIs, these low-peak cities tended to have larger second peaks. On the other hand, if NPIs curtailed the first wave, leaving more susceptibles in the early-intervention cities, then one would expect a more severe second wave in these cities, as was observed. Altogether, we take these findings as evidence that NPIs were capable of reducing influenza transmission in 1918, but that their benefits (as one would expect) were limited to the time they remained in effect.

In sensitivity analyses, we found that associations between early intervention and better outcomes were strengthened when we timed interventions based on the cumulative excess deaths up to 7 or 10 days after the intervention, an effort to account for the delay expected from case incidence (which is affected by interventions) to mortality. In part, this strengthening likely is due to the fact that delayed death figures better reflect the true stage of the epidemic at time of intervention. However, use of a delay time in this fashion raises concerns about reverse causality. If a delay longer than the shortest time from infection to death is used (e.g., the median, rather than the minimum, time to death), then the number of deaths before intervention, the independent variable in our analysis, is affected by the intervention itself. To avoid such difficulties, we took as our primary analysis the simpler, more conservative approach of defining the stage of the epidemic based on the date of intervention, with no delay. This choice has the additional benefit that in future pandemics, the cumulative excess death rate at the time of an intervention is in principle knowable in nearly real time, whereas the delayed death rate cannot by definition be known at the time of an intervention.

The implications of our analysis should be interpreted with care. Our univariate analyses of the relationship between individual NPIs and outcomes are consistent with the hypothesis that social distancing through closure of particular institutions (schools, churches, and theaters) led to reduced transmission, but the similarities in timing of various NPIs within a given city make it very difficult to discriminate the relative contributions of individual interventions (Fig. 2). Similarly, it was not possible to evaluate the effects of NPIs that were undertaken only in a small number of cities, or that were generally implemented only late in the epidemic, if at all, such as mass transit interventions (rules forbidding crowding and introduction of staggered business hours to reduce crowding on mass transit) or mask ordinances. Whether these NPIs might have made a difference in particular cities where they were implemented early, such early implementation was not common enough to evaluate whether it was associated with better outcomes. A third consideration is that the historical record is not seamless, and it is possible that our source material did not capture the full range of interventions used or reflect the true timing of implementation of those it identifies. Finally, we note that causality may be complicated; the interventions used may themselves have produced the observed effects, or they could have worked by shaping perceptions about the epidemic and causing changes in unmeasured private behaviors. Despite these caveats about the details of interpretation, the relationships detected in our analyses strongly suggest that the aggressive implementation of NPIs resulted in flatter epidemic curves and a trend toward better overall outcomes in the fall of 1918.

To the extent that these results provide evidence that multiple NPIs can reduce influenza transmission and mitigate the impact of a pandemic, they should inform current efforts related to pandemic preparedness. In particular, our results underscore the need for prompt action by public health authorities. The strongest relationship between peak death rates and timing of NPIs was observed for the number of interventions in place before the CEPID exceeded 20/100,000. If we assume a 2% CFP, this approximately corresponds to interventions undertaken before the deaths caused by infections in 1% of the population in a given city had occurred. Given the rate of growth of the pandemic and the lag between infection and death, perhaps 3–6% of the population would have been infected at this time. This finding emphasizes the need for very rapid interventions to stem the spread of the disease. Communities that prepare to implement layered NPIs aggressively are likely to achieve better outcomes than communities that introduce such interventions reactively, and they may be better positioned to manage the disruption caused by the more stringent interventions, such as school closure.

Finally, an important practical issue that requires further study is the question of when such interventions can be relaxed. The implication of patterns observed in the timing and severity of second waves in 1918 seems clear, however. In the absence of an effective vaccine, cities that use NPIs to mitigate the impact of a pandemic remain vulnerable. In practice, and until emergency vaccine production capacity increases, this means that in the event of a severe pandemic, cities will likely need to maintain NPIs for longer than the 2–8 weeks that was the norm in 1918.

Methods

Historical Data. We defined our study period as September 8–December 28, 1918, encompassing the first 16 weeks for which excess P&I death rates were reported by ref. 11. Of the 45 cities reported in ref. 11, we eliminated those cities for which >4 weeks during the study period had missing or partial data (partial data included excess pneumonia deaths only or excess influenza deaths only). Of the remaining cities, we included in the final analysis those 17 cities for which we were able to obtain a complete account of public health responses during the study period from our research in period newspapers, public health reports, or municipal records; from consultations with current public health officials in the study cities; or from well documented secondary sources. We defined 19 categories of public health responses (NPIs, interventions, or measures) and scored the date on which a city implemented each of these interventions. Citations for the scoring of individual NPIs in each city are provided in *SI Appendix*.

Interventions. Cities were scored as implementing an intervention if available evidence suggested that a measure was implemented on a community-wide basis through policy actions. Cities attempting to influence public behavior through exhortation alone (e.g., a recommendation to "avoid crowds" without an explicit ban on their formation) were not scored as implementing an intervention.

Where possible, dates of implementation of NPIs were cross-checked against multiple sources.

Timing of NPIs was assessed relative to the epidemic in each city by defining the "stage" of an epidemic for a given intervention as the estimated CEPID from September 8, 1918, through the calendar date on which the intervention was announced. Linear interpolation was used for cumulative deaths when this date was between weekly reporting dates in ref. 11. In sensitivity analyses performed to account for the interval between infection (the true measure of transmission) and death (an outcome of infection), we also considered lags of 7 or 10 days in calculating the CEPID, that is, defining the stage of the epidemic at which an intervention was implemented as the CEPID 7 or 10 days after the date of intervention (the median time from infection to death in autopsy reports tabulated in ref. 12 was ≈10 days). In a separate sensitivity analysis, we defined the date of the intervention as the last day that a particular activity was possible, rather than the date on which it was banned. Thus, for example, if a ban on church services was announced on a day other than Sunday, the last activity date was defined as the preceding Sunday; likewise, if school closure was announced during a weekend, the last activity date was the preceding Friday.

The timing of a city's overall response was scored in two closely related ways. First, the number of NPIs (of a possible 19) announced by a city before the CEPID reached a particular threshold (e.g., 20/100,000) was quantified as "number of interventions before CEPID = 20/100,000." This threshold was varied from 10 to 40/100,000 to encompass the range in which there was substantial intercity variation. Second, the CEPID at the time of the first intervention imposed in a city, the second intervention, and so on up to the sixth intervention was calculated.

Outcomes. Epidemic outcomes were measured as (*i*) the first weekly peak excess death rate during the fall wave of the pandemic; (*ii*) normalized peak death rate: the ratio of *i* to the median weekly death rate for a given city during the study period; and (*iii*) cumulative excess deaths during the study period. Outcome *ii* was selected as a measure of the "peakedness" of the epidemic curve that would be insensitive to intercity differences in the CFR.

Data in SI Tables 8–11. Outcomes and CEPID at the time of each intervention are provided in SI Table 8. Dates of intervention intent used in the primary analysis are provided in SI Table 9, whereas last activity dates used in sensitivity analyses are provided in SI Table 10. Weekly excess P&I death rate data transcribed from ref. 10 are provided in SI Table 11. SI Tables 7–11 are in Excel format.

Analysis. To avoid issues of reverse causality and reduce some forms of confounding, the data were analyzed in a fashion similar to an "intention to treat" analysis: that is, NPIs were scored on the date they were announced, and the duration, effectiveness, or other features of the intervention were not considered in the analysis.

Associations between overall intervention timing and outcomes were assessed by Spearman rank correlation coefficients and associated P values calculated between the measures of overall response (number of interventions before CEPID = x or CEPID at the time of the xth intervention) and the three outcome measures. Univariate associations between the timing of particular NPIs and the outcomes were also assessed by Spearman rank correlation coefficients and associated P values. In these cases, multivariate analyses were not performed because of the small sample size and strong collinearity of many intervention timings.

Because of specific concerns that later-hit cities might have had milder epidemics for reasons other than interventions, we did perform linear regression of peak death rate on longitude and epidemic onset week, along with intervention timing (number of interventions before CEPID = 20/100,000) and eliminated model variables by backward selection.

For NPIs that showed significant or nearly significant overall correlations with outcomes, we divided cities as evenly as possible into early and late-intervening cities (eight in the early group and nine in the late or vice versa) and plotted the median outcome for each group. The round-numbered cutoff that created this division is shown in Fig. 2. Mann–Whitney U tests were used to assess statistical significance of differences in the distributions.

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ORIGINAL CONTRIBUTION

Evaluation of Control Measures Implemented in the Severe Acute Respiratory Syndrome Outbreak in Beijing, 2003

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Context Beijing, China, experienced the world's largest outbreak of severe acute respiratory syndrome (SARS) beginning in March 2003, with the outbreak resolving rapidly, within 6 weeks of its peak in late April. Little is known about the control measures implemented during this outbreak.

Objective To describe and evaluate the measures undertaken to control the SARS outbreak.

Design, Setting, and Participants Data were reviewed from standardized surveillance forms from SARS cases (2521 probable cases) and their close contacts observed in Beijing between March 5, 2003, and May 29, 2003. Procedures implemented by health authorities were investigated through review of official documents and discussions with public health officials.

Main Outcome Measures Timeline of major control measures; number of cases and quarantined close contacts and attack rates, with changes in infection control measures, management, and triage of suspected cases; and time lag between illness onset and hospitalization with information dissemination.

Results Health care worker training in use of personal protective equipment and management of patients with SARS and establishing fever clinics and designated SARS wards in hospitals predated the steepest decline in cases. During the outbreak, 30178 persons were quarantined. Among 2195 quarantined close contacts in 5 districts, the attack rate was 6.3% (95% confidence interval [CI], 5.3%-7.3%), with a range of 15.4% (95% CI, 11.5%-19.2%) among spouses to 0.36% (95% CI, 0%-0.77%) among work and school contacts. The attack rate among quarantined household members increased with age from 5.0% (95% CI, 0%-10.5%) in children younger than 10 years to 27.6% (95% CI, 18.2%-37.0%) in adults aged 60 to 69 years. Among almost 14 million people screened for fever at the airport, train stations, and roadside checkpoints, only 12 were found to have probable SARS. The national and municipal governments held 13 press conferences about SARS. The time lag between illness onset and hospitalization decreased from a median of 5 to 6 days on or before April 20, 2003, the day the outbreak was announced to the public, to 2 days after April 20 ($P<.001$).

Conclusions The rapid resolution of the SARS outbreak was multifactorial, involving improvements in management and triage in hospitals and communities of patients with suspected SARS and the dissemination of information to health care workers and the public.

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BEIJING, CHINA, EXPERIENCED THE largest outbreak of severe acute respiratory syndrome (SARS) in the world with a total of 2521 reported probable cases.[1-3] The outbreak began March 5, 2003, with the importation of several cases among travelers from other SARS-affected areas,[4-7] and soon accelerated as multiple SARS cases occurred in health care facilities, peaking in late April when more than 100 new patients with SARS were being hospitalized daily.[3,4] During the first week of May, the number of new cases dropped steeply and then declined steadily during the next few weeks, with the onset of the last probable case on May 29, 2003. The World Health Organization removed Beijing from its list of areas with recent local transmission and lifted its travel advisory on June 24, 2003.[8] The onset of the last case occurred only 6 weeks after the peak of the outbreak. In this report, we summarize

See also pp 3222, 3229, and 3251 and Patient Page.

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the control measures taken to rapidly repress the outbreak in Beijing and evaluate the effectiveness of some of these measures.

METHODS

Setting and Definitions

Beijing, capital of the People's Republic of China, has approximately 13.6 million people.[9] The municipal health system, which includes 466 nonmilitary hospitals and 85000 health care workers, is overseen by the Beijing Municipal Health Bureau, which reports to the China Ministry of Health (MOH). Disease reporting, epidemic investigations, and contact tracing are the responsibility of the section of the Beijing Municipal Health Bureau called the Beijing Center for Disease Prevention and Control (BCDC). Within the BCDC are 18 district Centers for Disease Prevention and Control (DCDC), which are affiliated with community health centers.

Probable and suspect SARS case definitions were disseminated by the MOH. Only probable cases were included in this study because all suspect cases were ultimately excluded or reclassified as probable based on review of an expert panel as part of the Beijing joint SARS leading group. The definition of a probable SARS case changed slightly during the course of the outbreak but always included clinical and epidemiological components. After May 3, 2003, probable cases were defined as meeting 1 of the 3 following categories: close contact with a patient with SARS and symptoms and signs of febrile respiratory illness and chest radiograph changes; visiting or residing in an area with recent local transmission of SARS and symptoms and signs of febrile respiratory illness and chest radiograph changes and lack of response to antibiotics; or visiting or residing in an area with recent local transmission of SARS and symptoms and signs of febrile respiratory illness and chest radiograph changes and normal or decreased white blood cell count.[4] Laboratory testing for coronavirus was not part of the case definition.

Beijing municipal government guidelines defined close contacts of patients with SARS as individuals who stayed in the same room as a patient with SARS at home, work, or school; who directly contacted a patient with SARS by visiting, caring for, transporting, or sharing an elevator; who were health care workers in contact with a patient with SARS without wearing full personal protective equipment (PPE); or who had other exposures to a patient with SARS deemed risky by public health personnel (ie, contact with bodily secretions) in a period from 3 to 14 days before the case's onset of symptoms (varied during different phases of outbreak) to the time of last contact.

Data Collection

Descriptive data of control measures were obtained through review of official documents and discussions with officials in the Beijing municipal health bureau and the BCDC. Data on the number of probable SARS cases were obtained from a standardized case report form issued by the MOH, which was required to be completed and sent to the DCDC by the physician who first diagnosed the SARS case. Public health personnel performed weekly onsite audits of hospitals to ensure complete reporting of all SARS cases. Because date of onset was missing for many cases, the reported date of hospitalization, which was missing in only 3.5% of cases, was used to create the epidemic curve.

Summaries of the number of fever clinic visits were compiled by the hospitals where the clinics were located and sent daily to both the DCDC and BCDC. The number of people placed in quarantine was tracked by the DCDC and reported daily to the BCDC.

Databases on close contacts from 5 districts (Changping, Chongwen, Dongcheng, Shijingshan, and Xicheng) with the most complete records were merged for the analysis of outcomes of quarantined close contacts. Information on close contacts of SARS cases was obtained from a standardized data collection form issued by the MOH. For each new SARS case, DCDC staff would interview the patient in the hospital about their potential close contacts. Staff from the DCDC or community health centers would find the close contacts, enforce quarantine, and complete the close contact data collection forms, which were maintained in a database at the DCDC. Close contacts who were already symptomatic when contacted were not included in the quarantine database. Although close contacts of suspect SARS cases were managed similarly to those of probable cases, they were excluded in our analysis.

Data Analysis

Databases at the BCDC and DCDCs were maintained in Microsoft Excel version 2002 (Microsoft Corporation, Redmond, Wash). Data analyses used SPSS version 11.0 (SPSS Inc, Chicago, Ill) and EPI Info version 6.02 (Centers for Disease Control and Prevention, Atlanta, Ga). The χ^2 test was used to compare proportions and the Kruskal-Wallis test to compare median values. The χ^2 test for trend was used to compare attack rates by age. The normal theory method for binomial parameters was used to calculate 95% confidence intervals around attack rates. $P<.05$ was considered significant.

RESULTS

Timeline of Outbreak and Control Measures

From March 5, 2003, to May 29, 2003, 2521 probable cases of SARS were reported in Beijing (FIGURE 1). It is unlikely that many patients hospitalized with SARS were not reported because reporting SARS cases was mandatory and weekly audits of hospitalized cases occurred. However, it is possible that some SARS cases were not counted before mid-April when the extent of the outbreak was fully recognized. Of the 2521 cases, 192 (7.6%) died.[2] The median (range) age of cases was 33 years (1-93 years), with less than 1% of cases in children younger than 10 years, and 51% of cases were men.[4] The outbreak peaked on April 25, when 173 probable SARS cases were hospitalized.

Emergency Infrastructure

On April 10, 3565 public health workers were mobilized to assist in the outbreak management. On April 17, the mayor of Beijing established the Beijing joint SARS leading group, which operated from an emergency command center in a downtown hotel. At that time, the Beijing government began purchasing emergency supplies both nationally and from abroad. Relevant local production facilities were directed to shift production toward SARS-related supplies. As of June 17, the following number of supplies had been distributed: 11 092 000 surgical masks, 758 000 gowns, 2 954 000 pairs of latex gloves, 621 000 shoe covers, 1 130 000 thermometers, and 302 tons of chemical disinfectant (peracetic acid). In addition, 76 new ambulances, 79 new radiograph machines, and 759 mechanical ventilators were acquired.

Medical Sector Interventions

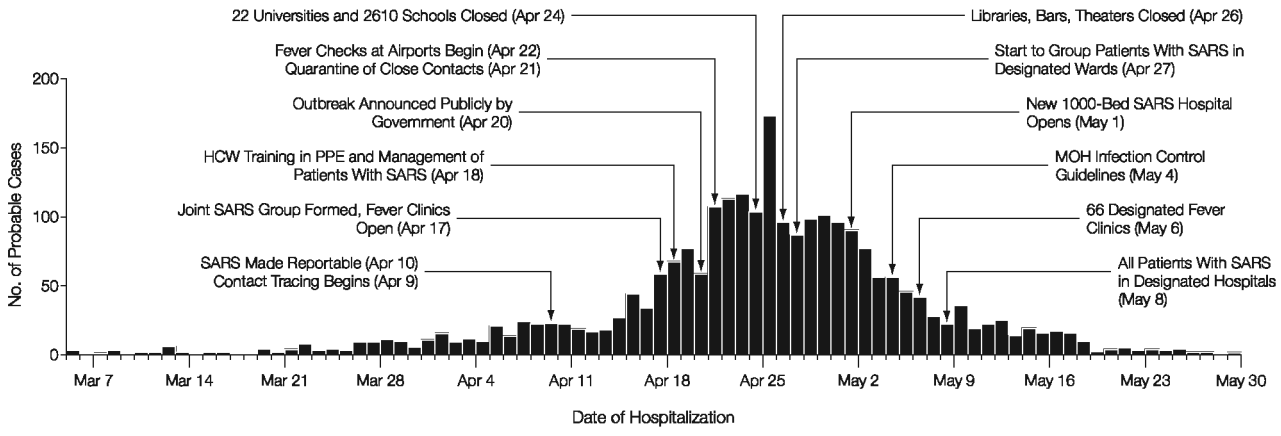
Of SARS cases, 407 (16%) occurred in health care workers. In 1 hospital, 88 health care workers were infected and 3 other hospitals had more than 20 health care workers infected. All 4 hospitals were closed by May 4. The spread of SARS virus among health care workers occurred more in the early part of the outbreak. Before April 25, the peak day of hospitalization, 55% of all health care worker cases had already been hospitalized compared with 45% of non–health care worker cases ($P<.001$). Beginning on April 18, 62 363 health care workers received training through in-person courses, videotapes, and printed materials in the management of patients with SARS, infection control, and the use of PPE. Two or 3 sets of gowns, gloves, and masks (N95 and/or 12-layer cotton) were required, the outer layer being removed and disposed of after contact with each patient with SARS. Goggles were also required.

On April 27, all patients with SARS started to be placed together on designated hospital wards. Hospitals also started to limit visitors at that time. By May 8, all previously and newly diagnosed patients with SARS were hospitalized in 16 hospitals designated exclusively for probable SARS cases and 30 hospitals for suspected SARS cases. Negative pressure rooms were not available in most Beijing hospitals. As recommended by Chinese authorities and the World Health Organization–Beijing Joint Expert Team, rooms in designated SARS hospitals were fitted with air extraction fans on windows or walls that blew air from the room to the outside, either directly or through air ducts. The primary direction of airflow was from the hospital into the room and then to the outside, with the goal of 20% more air leaving the room than entering it, and was assessed by observing the movement of smoke. A new 1000-bed SARS hospital was built in 7 days by the Beijing municipal government and completed on May 1, after which it treated 40% of Beijing's patients with probable SARS. No health care workers contracted SARS at this new hospital. After this hospital's completion, the designated SARS hospitals had a capacity of 6700 beds with 3400 (51%) occupied at the height of the outbreak.

Fever Clinics

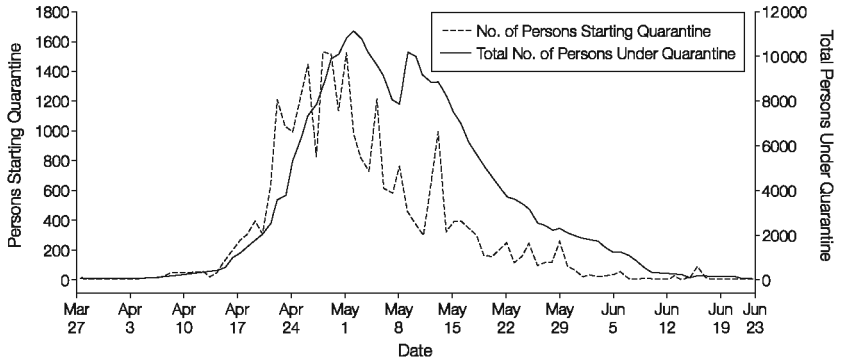
On April 17, 123 fever clinics were set up in all secondary and tertiary hospitals in Beijing. However, because some fever clinics were part of emergency departments or health centers where afebrile patients went for medical care, transmission of SARS was suspected to have occurred in some clinics. On May 6, the number of fever clinics decreased to 66, all of which were required to be separated from other patient care areas, staffed by trained personnel wearing full PPE, have individual examination rooms with outward-blowing extraction fans, and rooms for overnight medical observation. Fever clinic patients included patients with febrile respiratory or influenza-like illnesses sent from community physicians and quarantine sites, as well as self-referrals. All persons who vis-

Figure 1. Epidemic Curve for Beijing SARS Outbreak and Timeline of Major Control Measures From March 5 to May 29, 2003



SARS indicates severe acute respiratory syndrome; HCW, health care worker; PPE, personal protective equipment; MOH, China Ministry of Health.

Figure 2. Persons Quarantined for SARS in Beijing From March 27 to June 23, 2003



SARS indicates severe acute respiratory syndrome.

ited the fever clinics had a physical examination, white blood cell count, and chest radiograph.

Data became available on fever clinics after the establishment of the 66 designated clinics on May 6, 2003. Between May 7 and June 9, there were 65321 fever clinic visits, with an average of 1921 visits per day. During this time, 7457 (11%) visits resulted in overnight medical observation. From May 17, the first day information was available on outcome of fever clinic visits, to June 9, 47 probable cases were identified in the fever clinics, which were 0.1% of all visits but accounted for 84% of probable cases hospitalized during that period in Beijing.

Quarantine

The DCDC or community health centers were responsible for reaching all reported close contacts of patients hospitalized with SARS and issuing quarantine orders by telephone within 1 hour of notification about the case. If unable to reach the close contact, local police were notified to help find the individuals. Quarantine for close contacts was enforced for 14 days from the last contact with the patient according to national guidelines, which were based on data from the prior SARS outbreak in Guangdong Province that began in November 2002. The majority of close contacts were quarantined at home (60%) with the rest being quarantined at designated sites, which included hotels, universities, and construction work sites. Masks were not required to be worn by quarantined persons within the quarantine sites. Quarantined persons were unable to leave the site of quarantine, except for rare circumstances like funerals, during which they were required to wear masks. Community health workers and volunteers brought quarantined individuals food and other essential supplies, paid for mostly by the municipality. Only authorized public health or medical workers could enter the quarantined site and were required to wear full PPE. Community committees mobilized neighbors to support quarantined persons through gestures, such as giving flowers and comforting letters. When breaches in quarantine were observed, community members could call a SARS hotline to report the incident. The police could enforce quarantine if necessary according to national and municipal regulations; however, such action was not required during the outbreak. All quarantined persons were required to monitor their temperatures twice daily. A community health worker collected fever logs daily. Symptomatic persons were either sent to a fever clinic or evaluated by health care staff in mobile SARS evaluation vans.

By July 1, a total of 30178 persons (0.22% of the Beijing population) had been quarantined. The number of people in quarantine peaked on May 2 at more than 11000 people (FIGURE 2). Several instances of mass quarantine were instituted, including 4 hospitals (2643 people), 2 universities (517 students), and 7 construction sites (1434 workers).

In the 5 districts in which close contact data were further analyzed (total population 2.6 million [19% of Beijing's population]), there were 582 cases who reported 2195 close contacts, with a mean 3.8 contacts per case (range, 1-80). Of the 2195 contacts, 2120 (96.6%) were located, quarantined, and included in the database. Of the remaining 75, 38 were not quarantined, mostly because they were exposed before standardized criteria for quarantine were enforced, and 37 had incomplete records. However, these 75 cases were included in the analysis of close contacts because the relationship with the patient with SARS was often known by report of the case-patients, as was the clinical outcome through matching the names of the close contacts with the SARS case report forms. The overall attack rate for becoming a probable case among close contacts was 6.3% (range by district, 2.9%-9.7%). The attack rate was highest among spouses (15.4%), other household members (8.8%), and nonhousehold relatives (11.6%) (TABLE 1). The attack rate among work and school contacts was low (0.36%). Among spouses, other household members, and nonhousehold relatives (n=1162), the attack rate increased with the age of the close contact, from 5.0% in children younger than 10 years to 27.6% in adults aged 60 to 69 years (TABLE 2). The attack rate decreased from 22.0% among those quarantined during April 1 to April 15 to 1.1% during May 16 to May 31. A total of 42% of close contacts were put into quarantine on the same day and most (74%) were isolated within 2 days of the day of hospitalization of the related case. Among 206 close contacts whose last contact with a patient with SARS was before the patient's symptom onset, 4 (1.9%) developed SARS. For 2 persons, the

last reported contact was 1 day before the patient's onset of symptoms. For the other 2, the last contact was 5 days before the patient's symptom onset; however, both contacts occurred in a hospital where the patient was being treated for an illness before contracting SARS, so that the transmission of SARS might have been from other hospitalized patients with SARS.

Closing of Facilities

On April 26, all sites of public entertainment (theaters, bars, libraries, and indoor sports facilities) were closed. By the time these places began opening again during the second week in June, 3500 public places had been closed. Restaurants were never ordered to close, although patronage was much reduced during the height of the outbreak. Of the 68 universities in Beijing, 22 (32%) cancelled classes. All public elementary, middle, and high schools (n=2610) were closed on April 24, not reopening again in some cases until early July. In addition, universities, construction sites, and prisons stopped the entry of all visitors and many residential communities and business places screened visitors for fever at entry.

Transit Site Surveillance

In late April, fever checks were instituted at the Beijing airport, major train stations, and all 71 roads connecting Beijing to other areas. Infrared thermometers were used to screen passengers, followed up by axillary thermometers on those found to be febrile on screening. As of June 30, of almost 14 million people screened at these sites, only 12 probable cases of SARS were identified (TABLE 3).

Information Dissemination

The scope of the Beijing outbreak was announced in a press conference given by the executive vice-minister of health on April 20. Subsequently, the MOH participated in 4 press conferences about SARS and the Beijing municipal government had 9 press conferences. Many billboards, bus advertisements, and traditional red neighborhood banners educated and motivated the public to protect themselves and fight together to control SARS. Beijing television ran daily 2-hour educational programs about SARS. The BCDC started an informational 24-hour SARS hotline on April 8. At its peak, the hotline received 11 000 calls per day. In addition, the Beijing municipal health bureau conducted 6672 SARS seminars in the communities and distributed 8 280 000 copies of educational materials ranging from pamphlets to compact disks. The importance of information dissemination is suggested by the observation that the time lag between symptom onset and hospitalization decreased significantly during the outbreak from a median of 5 to 6 days before the outbreak was made public on April 20 to 2 days afterward (TABLE 4).

COMMENT

The SARS outbreak in Beijing was notable for its acceleration, magnitude, and rapid resolution. There are several likely reasons for the size of the out-

Table 1. Distribution of Relationship Between SARS Cases and Quarantined Close Contacts and Attack Rates for Probable SARS Among Close Contacts, 5 Districts in Beijing

Relationship to SARS Case	No. (%) of All Quarantined Contacts	Attack Rate, % (95% Confidence Interval)
Work or school	830 (37.8)	0.36 (0-0.77)
Household member (nonspouse)	635 (28.9)	8.8 (6.6-11.0)
Spouse	338 (15.4)	15.4 (11.5-19.2)
Nonhousehold relative	189 (8.6)	11.6 (7.1-16.2)
Friend	40 (1.8)	10.0 (0.70-19.3)
Health care worker*	30 (1.4)	0 (0-12)†
Other/unknown	133 (6.1)	0.75 (0-2.2)
Total	**2195 (100)**	6.3 (5.3-7.3)

Abbreviation: SARS, severe acute respiratory syndrome.
*Includes those exposed in small, community, nondesignated SARS hospitals or student clinics and not deemed to have been wearing complete personal protective equipment.
†Exact method used to calculate 95% confidence interval.

Table 2. Attack Rate for Probable SARS Among Quarantined Family Members by Age, 5 Districts in Beijing*

Age, y	Total No. in Quarantine	No. of Probable SARS Cases	Attack Rate, % (95% Confidence Interval)†
0-9	60	3	5.0 (0-10.5)
10-19	158	8	5.1 (1.6-8.5)
20-29	220	11	5.0 (2.1-7.9)
30-39	149	17	11.4 (6.3-16.5)
40-49	268	34	12.7 (8.7-16.7)
50-59	137	24	17.5 (11.2-23.9)
60-69	87	24	27.6 (18.2-37.0)
70-79	83	9	10.8 (4.2-17.5)
Total	**1162**	**130**	11.2 (9.4-13.0)

Abbreviation: SARS, severe acute respiratory syndrome.
*Quarantined family members included spouses, other household members, and nonhousehold relatives.
†$P<.001$ for increasing attack rate by age (χ^2 for trend).

Table 3. Summary of Screening for SARS at Points of Transit as of June 30, 2003, Beijing

Transit Site	No. of People Screened for Fever	No. (%) Febrile	No. (%) With Probable SARS
Airport			
International passengers	275 600	496 (0.2)	0
Domestic passengers	952 200	1449 (0.2)	10 (0.001)
Train stations	5 246 100	2575 (0.05)	2 (<0.001)
Roads	7 365 600	577 (0.008)	0

Abbreviation: SARS, severe acute respiratory syndrome.

Table 4. Lag Time Between Onset of Symptoms and Hospitalization of Probable SARS Cases, Beijing

Date of Onset, 2003	No. of SARS Cases	Lag Time, Median (Interquartile Range), d*
March 5 to April 9 (SARS becomes reportable)	146	6 (0-14)
April 10 to April 20 (SARS announced publicly)	476	5 (2-7)
April 21 to May 6 (designated fever clinics)	1046	2 (1-4)
May 7 to June 15	192	2 (1-3)

Abbreviation: SARS, severe acute respiratory syndrome.
*$P<.001$ comparing median times (Kruskal-Wallis test).

break: multiple imported cases, lack of knowledge about hospital spread, lack of awareness about proper PPE, delays in hospitalizing patients with symptoms, the population density of Beijing, and a failure to communicate the problem to hospitals and the public early enough. With these initial disadvantages, the prompt resolution of the Beijing outbreak was surprising and impressive. Beijing rapidly implemented multiple measures to control the SARS outbreak.

Similar to other SARS-affected areas, a large part of the Beijing outbreak occurred in hospitals.[10-13] This was particularly true early on as suggested by the number of health care workers infected. Part of the reason for the decrease in cases among health care workers was likely the emphasis on training and guidelines on infection control and use of PPE after April 18. The effectiveness of these interventions is highlighted by the fact that no health care workers contracted SARS at the new 1000-bed SARS hospital that opened May 1. In addition to health care workers, many patients without SARS and visitors to the hospital were likely infected by patients with SARS, as observed in other outbreaks.[10,12] The institution of improved triage, limitation of visitors, and designated SARS wards likely led to a decrease in such in-hospital exposures. The hospitals designated to SARS began to be established in late April and by May 8, all patients with SARS were hospitalized in such hospitals. Designated hospitals had the advantage of ensuring proper infection control practices, unidirectional airflow rooms, and proper patient triage and flow. However, the earlier decrease in hospital-based infections was likely because of control measures implemented in general hospitals, such as the use of PPE and grouping of patients with SARS on certain wards, because by May 8 the outbreak was already waning. In addition, the establishment of designated fever clinics identified the majority of new cases (84%) late in the outbreak. The earlier implementation of dedicated fever clinics, separated from general medical care areas, might have stemmed some of the transmission earlier in the outbreak.

Rigorous quarantine measures in Beijing were possible through both community-based and governmental involvement. Some categories of quarantined close contacts, such as family members, had much higher attack rates than others, such as school and workplace contacts. The high attack rate among family members might partially reflect contact with patients with SARS not just at home but at the hospital while visiting their ill relatives. Elderly close contacts had significantly higher attack rates than did children, although it is unclear if this is because of differences in the type of contact with the case, susceptibility to SARS, or the likelihood of developing symptoms after infection. The attack rate among quarantined persons was significantly higher in Beijing than in Taiwan, where among 50 139 quarantined close contacts the attack rate, even for family members of patients with SARS, was less than 1%.[14,15] The reasons for this difference might be because of differences in the case definitions of SARS, the higher incidence of SARS in Beijing, and the fact that only close contacts of probable SARS cases were included in our analysis, whereas in the Taiwan analysis contacts of both probable and suspected cases were included. Who should be quarantined during a SARS outbreak likely depends on several factors, such as resource availability, ability to mobilize public health personnel, and societal acceptability. Public health departments must weigh these factors in setting quarantine guidelines. For example, in smaller outbreaks or when resources are limited, public health authorities might consider active but nonquarantined surveillance in lower-risk settings, such as workplaces and schools, and among those whose contact with patients with SARS was only during the asymptomatic incubation phase.

In retrospect, several control measures undertaken by the Beijing municipality seemed to have less direct impact in resolving the outbreak; however, this was not known at the time of their implementation in the face of an accelerating outbreak of an unknown disease. The screening at points of transportation required a large amount of human and financial resources to maintain but identified very few cases of SARS. Such measures, however, might have prevented SARS cases indirectly by persuading symptomatic people to stay home. Moreover, these checkpoints assured the local as well as international community that proactive steps were being made toward controlling the outbreak. Second, the closing of the public schools for more than a month likely had a minimal effect on the prevention of SARS because of the low attack rate among schoolmates and the rarity of pediatric SARS in Beijing, as observed in other SARS-affected sites.[4,9,11,16,17] However, the closing of schools may have contributed to the widespread self-quarantine that occurred in Beijing in early May, when the streets were virtually empty.

Besides these specific control measures, a general increase in the awareness about SARS played an important role in controlling the outbreak. Early in the outbreak before information about the number of patients with SARS

in the city was disseminated, the outbreak amplified because of underrecognition and mismanagement of patients with SARS in both the hospitals and the community. The control of the outbreak followed improvements in communication and awareness among health care workers, public health personnel, and the general public, as suggested by the decrease in the time between illness onset and hospitalization as the outbreak progressed.

Our analysis had several limitations. Because of the simultaneous and overlapping implementation of multiple control measures, it was difficult to pinpoint which one or several interventions were the most effective. Evaluation of the control measures was further complicated by the lag of at least an incubation period between implementation and effect. Laboratory testing for SARS coronavirus infection was not widely available during the outbreak in Beijing and was not part of the SARS case definition; therefore, circulation of other agents causing febrile respiratory illness in 1 or more of the districts in which quarantine was evaluated might have led to SARS attack rates that were falsely elevated. The 5 districts selected to evaluate contact tracing and quarantine might not have been representative of all of Beijing. Three districts were urban and 2 suburban, which might have overrepresented urban Beijing because of the 18 districts in Beijing, 8 are urban and 10 suburban. Attack rates tended to be higher in urban districts because of the presence of more hospitals and a greater density of people.

The multiple control measures implemented in Beijing likely led to the rapid resolution of the SARS outbreak. Improvements in infection control practices, use of PPE, grouping of patients with SARS in the hospital, establishment of designated fever clinics, quarantine of high-risk close contacts, and improved public information and awareness of SARS likely played important roles in controlling the outbreak. Some interventions, in retrospect, such as quarantine of low-risk contacts and fever checks at transportation sites, seemed to have less direct impact in curbing the outbreak. The lessons learned from controlling this outbreak can hopefully serve to inform future responses to SARS, if it were to reemerge in Beijing or elsewhere.

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Study concept and design: Pang, Zhu, Xu, Guo, Z. Liu, Chin, Feikin.
Acquisition of data: Pang, Gong, D. Liu.
Analysis and interpretation of data: Pang, Xu, Gong, D. Liu, Feikin.
Drafting of the manuscript: Pang, Zhu, Xu, Feikin.
Critical revision of the manuscript for important intellectual content: Pang, Zhu, Guo, Gong, D. Liu, Z. Liu, Chin.
Statistical expertise: Xu, D. Liu.
Administrative, technical, or material support: Zhu, Guo, Z. Liu, Chin.
Study supervision: Zhu, Guo, Feikin.
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The New York Times

Fighting Deadly Flu, Mexico Shuts Schools

By Marc Lacey and Donald G. McNeil Jr.

April 24, 2009

MEXICO CITY — Mexican officials, scrambling to control a swine flu outbreak that has killed as many as 61 people and infected possibly hundreds more in recent weeks, closed museums and shuttered schools for millions of students in and around the capital on Friday, and urged people with flu symptoms to stay home from work.

"We're dealing with a new flu virus that constitutes a respiratory epidemic that so far is controllable," Mexico's health minister, José Ángel Córdova, told reporters after huddling with President Felipe Calderón and other top officials on Thursday night to come up with an action plan. He said the virus had mutated from pigs and had at some point been transmitted to humans.

The new strain contains gene sequences from North American and Eurasian swine flus, North American bird flu and North American human flu, said the Centers for Disease Control and Prevention. A similar virus has been found in the American Southwest, where officials have reported eight nonfatal cases.

Women waiting at a health center in Mexico City on Friday. Mexican officials said that in recent weeks there had been 1,004 possible cases of a new swine flu. Jorge Dan

Lopez/Reuters

Most of Mexico's dead were young, healthy adults, and none were over 60 or under 3 years old, the World Health Organization said. That alarms health officials because seasonal flus cause most of their deaths among infants and bedridden elderly people, but pandemic flus — like the 1918 Spanish flu, and the 1957 and 1968 pandemics — often strike young, healthy people the hardest.

Mexican officials promised a huge immunization campaign in the capital in the coming days, while urging people to avoid large gatherings and to refrain from shaking hands or greeting women with a kiss on the right cheek, as is common in Mexico.

Mexico City closed museums and other cultural venues, and advised people not to attend movies or public events. Seven million students, from kindergartners to college students, were kept from classes in Mexico City and the neighboring State of Mexico on Friday, in what news organizations called the first citywide closing of schools since a powerful earthquake in 1985.

Masked workers monitored visitors to Mexico City's General Hospital on Friday. Dario Lopez-Mills/Associated Press

Because of the situation, the World Health Organization planned to consider raising the world pandemic flu alert to 4 from 3. Such a high level of alert — meaning that sustained human-to-human transmission of a new virus has been detected — has not been reached

in recent years, even with the H5N1 avian flu circulating in Asia and Egypt, and would "really raise the hackles of everyone around the world," said Dr. Robert G. Webster, a flu virus expert at St. Jude Children's Research Hospital in Memphis.

Mexico's flu season is usually over by now, but health officials have noticed a significant spike in flu cases since mid-March. The W.H.O. said there had been 800 cases in Mexico in recent weeks, 60 of them fatal, of a flulike illness that appeared to be more serious than the regular seasonal flu. Mr. Córdova said Friday that there were 1,004 possible cases.

Still, only a small number have been confirmed as cases of the new H1N1 swine flu, according to Gregory Hartl, a W.H.O. spokesman. Mexican authorities confirmed 16 deaths from swine flu and said 45 others were under investigation, most of them in the Mexico City area. The C.D.C. said that eight nonfatal cases had been confirmed in the United States, and that it had sent teams to California and Texas to investigate.

People wearing surgical masks at the General Hospital in Mexico City on Friday. Dario Lopez-Mills/Associated Press

"We are worried," said Dr. Richard Besser, the acting head of the C.D.C. "We don't know if this will lead to the next pandemic, but we will be monitoring it and taking it seriously."

There is no point in trying to use containment measures in the United States, he said, because the swine flu virus has already appeared from San Antonio to San Diego, without any obvious connections among cases. Containment measures usually work only when a disease is confined to a small area, he said.

The C.D.C. refrained from warning people not to visit Mexico. Even so, the outbreak comes at an awful time for tourism officials, who have been struggling to counter the perception that violence has made Mexico unsafe for travelers. The outbreak was also causing alarm among Mexicans, many of whom rushed to buy masks or get checkups.

Health officials urged anyone with a fever, a cough, a sore throat, shortness of breath or muscle and joint pain to seek medical attention. Dario Lopez-Mills/Associated Press

"I hope it's not something grave," said Claudia Cruz, who took her 11-year-old son, Efrain, to a clinic on Friday after hearing the government warnings.

Health officials urged anyone with a fever, a cough, a sore throat, shortness of breath or muscle and joint pain to seek medical attention.

When a new virus emerges, it can sweep through the population, said Dr. Anne Moscona, a flu specialist at Cornell University's medical school. The Spanish flu is believed to have infected at least 25 percent of the United States population, but killed less than 3 percent of those infected.

The leading theory on why so many young, healthy people die in pandemics is the "cytokine storm," in which vigorous immune systems pour out antibodies to attack the new virus. That can inflame lung cells until they leak fluid, which can overwhelm the lungs, Dr. Moscona said.

But older people who have had the flu repeatedly in their lives may have some antibodies that provide cross-protection to the new strain, she said. And immune responses among the aged are not as vigorous.

Despite the alarm in recent years over the H5N1 avian flu, which is still circulating in China, Indonesia, Egypt and elsewhere, some flu experts argued that it would never cause a pandemic, because no H5 strain ever had. All previous pandemics have been caused by H1s, H2s or H3s.

Among the swine flu cases in the United States, none had had any contact with pigs; cases involving a father and daughter and two 16-year-old schoolmates convinced the authorities that the virus was being transmitted from person to person.

In Canada, hit by the SARS epidemic in 2003, health officials urged those who had recently traveled to Mexico and become ill to seek treatment immediately.

Marc Lacey reported from Mexico City, and Donald G. McNeil Jr. from New York. Ian Austen contributed reporting from Ottawa.

Swine flu

This article is more than 11 years old

Swine flu: Mexico braces for unprecedented lockdown

Mexican government orders businesses to close and citizens to stay indoors for five days in an effort to halt swine flu

Rory Carroll *and* Jo Tuckman *in Mexico City*

Thu 30 Apr 2009 15.52 BST

Mexico braced for an unprecedented nationwide lockdown after the government ordered most of the economy to shut and for people to stay indoors for five days.

The nation of 111 million people will grind to a halt tomorrow until 5 May in an effort to stifle the spread of swine flu which is on the brink of becoming a global pandemic.

"There is no safer place than your own home to avoid being infected with the flu virus," Felipe Calderón, Mexico's president, said in a television address on last night.

Shutting down government offices and businesses not essential to the economy was a painful but a vital step to preventing further infections, he said: "I know many of you have had to suspend your activities and may have seen your earnings fall but it is worth it if we can look after the health of our loved ones and protect Mexico from this evil."

Functions like transport, policing, supermarkets and hospitals will stay open but otherwise the country will largely come to a standstill. It is already operating on half-battery since earlier this week when schools, cinemas, restaurants, gyms and other services were closed or heavily restricted.

Celebrations for Dia del Nino, Day of the Child, have been cancelled today.

Such drastic measures were needed to break the reproductive cycle of a virus which has killed eight people out of 99 confirmed cases, health minister José Ángel

Córdova said last night.

The total number of deaths suspected to be related to swine flu in Mexico is now 179, although many of these died before proper samples were taken. The government is no longer giving the figure for the number of people hospitalised with pneumonia.

Mexico's economy, already hurting from recession and a bloody drug war, is set to scream. The economy probably shrunk by as much as 8% in the first three months of the year compared to the same period in 2008, according to the central bank.

Mexico's peso weakened sharply against other currencies after the government announced the new emergency measures.

Flu is costing the capital £59m a day, according to the mayor, Marcelo Ebrard, and unemployment could rocket if temporary lay-offs become permanent.

Tourism, worth 8% of Mexico's gross domestic, has evaporated. Several countries in the region have cut or restricted flights to and from Mexico and the EU could follow suit at the behest of France.

Cancun airport has been flooded by tourists trying to get out. The state of Quintana Roo, where Cancun is located, has yet to report cases but several tourists were found to be infected after returning home. Archaeological sites have been shut.

Surgical masks have now become so ubiquitous that even an important drug trafficker captured yesterday, Gregorio Sauceda Gamboa, alias El Caramuela, was pictured wearing one surrounded by heavily armed federal police wearing theirs. Masks are running out, prompting newspapers to publish diagrams and instructions to make homemade ones from cloth.

Last night's address was Calderón's first since the crisis broke. The president has been criticised for staying out of public view while his government battled the epidemic.

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