population exposed to risk in the different regions—for example, in the region of East and West Ridings 56.3% of the population live in the large towns, while in the South-west Region the percentage is only 25.4. A more general picture of the amount of sickness experienced can, however, be obtained from the new claims to sickness benefit under the National Insurance Act. These claims, expressed as a percentage of the claims in week 35, are shown in Table III.

The week of the maximum and the order of occurrence agree with the distribution of the maximum deaths in Table II. The largest rises between week 35 and the week of the maximum were in the regions of the South-west, 700%, and the North-west, 612%, while the lowest were Wales, 459%, and the East and West Ridings, 463%. Table III is based on the population of working ages and excludes married women who elected not to be insured in their own right. The most important omission is the child population, which was severely attacked by influenza. An indirect estimate of the severity of the influenza epidemic in the whole population can be obtained from the notifications of acute pneumonia; Table I shows that there is a correlation between influenza mortality and pneumonia mortality and incidence. The notifications of acute pneumonia per million population are shown in Table IV.

TABLE IV.—Notifications of Acute Pneumonia in England and Wales, 1957. Rates Per Million

Week	Date	North	East and West Ridings	North-west	North Midlands	Midlands	East	London and South-east	South	South-west	Wales	Total
35	Aug. 31 ..	4	9	4	4	6	2	3	2	3	3	4
36	Sept. 7 ..	5	11	6	4	5	5	2	4	2	5	7
37	" 14 ..	7	21	12	7	4	5	4	2	5	7	17
38	" 21 ..	24	44	30	14	14	9	4	2	6	17	16
39	" 28 ..	38	94	50	31	23	13	10	9	12	41	31
40	Oct. 5 ..	70	88	67	43	39	45	17	12	22	33	42
41	" 12 ..	88	76	63	54	66	51	27	28	44	41	51
42	" 19 ..	53	59	46	59	61	59	42	45	64	41	51
43	" 26 ..	44	37	24	45	52	66	43	39	58	31	43
44	Nov. 2 ..	11	24	16	20	30	72	38	31	51	38	32
45	" 9 ..	9	13	11	16	13	40	18	18	20	11	17
46	" 16 ..	10	16	11	7	12	28	14	12	18	13	14
47	" 23 ..	12	18	9	10	12	19	8	8	13	11	11
48	" 30 ..	11	19	9	5	9	16	8	19	14	9	11
49	Dec. 7 ..	19	22	11	16	11	23	12	14	16	9	15

The peak incidence was reached earlier in the three northern regions than in the remainder of the country. The largest maxima were 94 per million in East and West Ridings and 88 in the Northern Region, and the lowest were 41 in Wales and 43 in London and the South-east. The somewhat different picture given by Table IV from that of Table III may be due to differences in severity of the attacks between regions.

From the above comparisons it seems that London and the South-east Region had a relatively light attack and the East, South, and Wales also had a more favourable experience than the remainder of the country. The South-west Region, with very high values for new claims to sickness, number of notifications of acute pneumonia, and mortality in the large towns, was the exception to the north/south distribution of incidence.

In proportion to its population, Northern Ireland was doing three times as much as Great Britain in the field of medical welfare, said Dr. J. OLIVER, of the Northern Ireland Ministry of Health and Local Government, at a meeting in Belfast last week. There were 2,000 more hospital beds in Northern Ireland than ten years ago and four completely new hospitals were under construction, which was something without parallel in the rest of the United Kingdom. The number of medical specialists in Belfast had increased 60% since 1948, and in the rest of Northern Ireland by 200%. Infant mortality had fallen from 106 per 1,000 live births in 1913 to 29 in 1956.

SUDDEN DEATH DUE TO FULMINATING INFLUENZA

BY

D. BRUCE NEILSON, M.B., Ch.B.

Clinical Laboratories, Victoria Infirmary, Glasgow

It has been stated in both the lay and the medical press that the Asian influenza epidemic was mild in nature. Certainly the reports by Lim *et al.* (1957) and Guthrie *et al.* (1957) of the epidemics in Singapore and Kuwait recorded only two deaths; and Smith *et al.* (1957) stated that in Malaya deaths were few, and the mortality was certainly low among the cases from several general practices reported in the *Journal* of November 2, 1957 (p. 1057). In Britain, however, a considerable number of deaths attributed to influenza were notified. For example, in the six-weeks period ending October 19 2,083 deaths were reported from England and Wales. Although a major factor in many of these was probably underlying pulmonary or cardiovascular disease, nevertheless a certain percentage must have been due primarily to pulmonary complications of influenza, particularly to staphylococcal and pneumococcal pneumonia. It is pertinent to note that 8,338 cases of acute pneumonia were notified from England and Wales in October, 1957. This represents a weekly average of 2,084 as against 275 in October, 1956.

Roberts (1957) described nine cases of fatal fulminating influenza in a Glasgow hospital; a further three cases seen over a 10-day period are reported here. The devastatingly sudden and unexpected manner in which death occurred in all three cases, reminiscent of the 1918-20 epidemic, justifies placing them on record; in no case was there clinical evidence of severe illness, much less impending death. In Cases 1 and 2 the patients died at home and were examined at the instance of the Procurator Fiscal, Glasgow, and the third patient died in hospital.

Case 1

A man aged 22 was found dead in bed at home early one morning approximately four hours after returning from a dance. On the day before his death he had felt slightly unwell and complained of pain in his neck. (This was found at necropsy to be due to a small furuncle on the lower jaw.) There was no relevant past history.

Post-mortem Appearances.—The body was that of a muscular, normally developed young man. The larynx, trachea, and main bronchi were intensely congested and contained some frothy blood-stained fluid. Numerous small petechial haemorrhages were evident on the pleural surfaces of the lungs, which were practically airless, grossly congested, and oedematous throughout; blood-stained frothy fluid exuded freely from the cut surface. All five lobes were an intense crimson, and both lower lobes were consolidated and so friable as to disintegrate on light finger-pressure. There was no free fluid in the pleural sacs. The heart showed no obvious abnormality apart from petechial haemorrhages over the pericardial surface. The abdominal viscera, particularly stomach and kidneys, were grossly congested. The gastric veins were greatly engorged, and appeared as though injected with indian ink. The kidneys were uniformly dark red, almost purplish. The brain was congested and oedematous.

Case 2

A man of 36 had no past history of serious illness. Three weeks before his death he had an attack of "flu" which was not severe enough to necessitate a visit by his

doctor. A few days later he was back at work apparently completely recovered. On the morning of his death he was at business as usual and made no complaint. That afternoon, however, he developed pain and tightness in the chest and vomited several times. This attack passed off in a few hours but recurred early in the evening shortly after a meal. He went to the bathroom, where he was sick, and almost immediately afterwards, while still standing over the basin, he became rigid and dropped dead.

Post-mortem Appearances.—The body was that of a well-nourished, normally developed man. The internal appearances were strikingly similar to those of Case 1. The tracheobronchial tree was markedly congested and both lungs were haemorrhagic; the lower lobes were consolidated. Again the gastric veins were very congested and prominent, and the kidneys were dark red in colour.

Case 3

This patient, a man aged 30, attended a chest clinic on November 8, 1957. He complained of slight breathlessness on exertion, of three months' duration. There was no history of a recent acute pulmonary episode. Examination revealed signs of bronchitis with bronchospasm; an x-ray film of the chest was reported on as showing "a residual segmentary consolidation of the mid-basal segment of the right lower lobe." He was accordingly admitted to Mearns-kirk Hospital, Glasgow.

On the morning of November 9 he was examined by a physician, who found no signs in his chest, and a further x-ray film revealed no alteration in his condition. He remained well all day and was afebrile. At 9.55 p.m. he was seen by the house-physician, to whom he stated that he "felt fine." A few minutes later he arose from bed, went to a sink and vomited a large amount of blood; almost immediately afterwards he collapsed and died. During his brief stay in hospital he received two injections of a combination of procaine penicillin and streptomycin sulphate.

Post-mortem Appearances.—The body was that of a well-nourished, normally developed man. The larynx was injected. The trachea and main bronchi were markedly congested and were filled with frothy fresh blood. Both lungs were an intense crimson, and on section frothy blood-stained fluid escaped freely from the cut surfaces of the upper lobes. The lower lobes were consolidated and extremely friable, the left being more haemorrhagic in appearance than the right; blood exuded from their cut surfaces. There was no free fluid in the pleural sacs, where numerous dense adhesions were present over both lung bases. The stomach contained a considerable quantity of altered blood. The mucosa was congested and the gastric veins were extremely prominent. There was no obvious ulceration, and a source of haemorrhage could not be found. The liver and kidneys were much congested. The heart showed no abnormality and the adrenals appeared normal.

Histology and Bacteriology

Histological Features.—In all three cases the microscopical picture was essentially similar. The tracheae and main bronchi were intensely congested, the arterioles, venules, and capillaries being dilated and engorged. Slight submucosal oedema and round-cell infiltration were found. Most of the respiratory epithelium was intact and was covered in parts by a little fibrinous exudate. In a few areas superficial necrosis had occurred. The lungs showed widespread severe capillary congestion, and many of the alveoli were filled with albuminoid fluid. In the consolidated areas they were completely filled with blood and many of the alveolar walls had ruptured. The smaller bronchi and bronchioles contained some albuminoid fluid together with desquamated epithelial cells and a few red cells; in Case 3 abundant fresh blood was present. Examination of many sections of the lungs from all three cases failed to reveal any cellular reaction in the lung parenchyma; a few

lymphocytes and pigment-laden macrophages were the only cells present within the alveoli apart from erythrocytes. No organisms were found in sections stained with Gram's stain.

Bacteriological Examination.—Swabs were taken from the bronchi and lungs in each case. On direct examination of smears moderate numbers of Gram-positive cocci and diplococci were seen in the material examined from Cases 1 and 2, but in Case 3 Gram-negative bacilli were predominant. The scantiness of leucocytes was a noticeable feature in all cases. Cultures in the first two cases yielded a heavy growth of pneumococci and alpha-type streptococci which were sensitive to penicillin, erythromycin, streptomycin, tetracycline, and chloramphenicol. A few coagulase-positive staphylococci were grown after 48 hours' incubation, and these were sensitive to tetracycline but insensitive to penicillin, chloramphenicol, and streptomycin. In the third case a moderate growth of a coliform organism was obtained. This bacillus was sensitive to chloramphenicol, tetracycline, and erythromycin but resistant to penicillin and streptomycin. *Haemophilus influenzae* was not isolated in any case.

Discussion

Although no virological investigation was undertaken there can be little doubt that these cases are examples of fulminating influenza. The pathological changes conform to those observed during the 1918-20 pandemic and bear a striking resemblance to those reported by Roberts (1957). In my cases the most significant features are the paucity of clinical symptoms and signs, coupled with the dramatic suddenness of death, the age of the victims, and the negative bacteriological studies. All the patients described by Roberts initially had the usual "flu" symptoms—namely, fever, sore throat, and prostration. These were followed 24-48 hours later by a marked deterioration in their condition, as evidenced by cyanosis and severe dyspnoea, and culminated in death several hours later. On the other hand, in my cases no such signs of serious illness were manifest. One victim had been out dancing a few hours before his death and had felt only slightly "off colour" that day. Another experienced symptoms (pain and tightness in the chest with vomiting) for the short period of approximately six hours before he succumbed; he was ambulant and collapsed after vomiting. The third, who died in a similar fashion, had actually been talking to the house-physician a few minutes before he died. The doctor did not suspect that the patient was seriously ill, and examination of his chest, including x-ray earlier that day, had revealed nothing of note. This is astounding in view of the gross pathological changes seen at necropsy.

Coagulase-positive staphylococci have been incriminated in a number of influenzal deaths during this epidemic, including those reviewed by Roberts. In the present cases no cocci were seen in the tissue sections, and only a few colonies of the organisms could be grown after 48 hours' incubation; thus it would appear unlikely that the staphylococcus played any significant part in the disease process. It is also difficult to imagine a *Streptococcus viridans* causing such a fulminating infection, and it is probable that the coliform organism found in Case 3 was a post-mortem contaminant. The pneumococci present in the first two cases were not predominant on culture and did not evoke any inflammatory reaction.

It has been generally thought that the majority of deaths in an influenza epidemic uncomplicated by underlying disease were due to secondary invasion of the lung by pathogenic organisms and not primarily to the virus. Thus it was reasonably supposed that our modern armamentarium of broad-spectrum antibiotics would prevent widespread fatalities in any severe epidemic. The observations here suggest the startling possibility that the violent haemorrhagic reaction in the lungs may have been due mainly to the virus and not to pathogenic bacteria. The haemorrhage was so severe that the patients virtually drowned in their

own blood. If this is the case, then at present our only hope of preventing such an occurrence lies in active immunization. This should be considered in the light of a possible second wave to the epidemic where the strain of virus may well be enhanced in virulence. As in my cases, the majority of deaths reported in this epidemic occurred in that intermediate group of people between the very young and the very old, and so it would seem desirable that this group should be the first to receive vaccination.

Summary

Three cases of sudden death in young men due to fulminating haemorrhagic influenzal pneumonia are described.

The gross pathological changes present in the lungs of these victims failed to produce correspondingly severe signs and symptoms.

The bacteriological and histological findings suggest that the haemorrhagic pneumonia may have been due primarily to the virus.

ADDENDUM.—Since this paper was written I have seen two further cases of precisely the same nature. The patients were males aged 51 and 24. The latter case is the subject of a medico-legal note on p. 469.

REFERENCES

- Guthrie, J., Forsyth, D. M., and Montgomery, H. (1957). *Lancet*, 2, 590.
 Lim, K. A., Smith, A., Hale, J. H., and Glass, J. (1957). *Ibid.*, 2, 791.
 Roberts, G. B. S. (1957). *Ibid.*, 2, 944.
 Smith, C. E. G., Turner, L. H., and Halliwell, C. J. V. (1957). *Brit. med. J.*, 1, 1412.

THE INFLUENZA EPIDEMIC IN ABADAN

BY

H. A. K. ROWLAND, D.M., M.R.C.P.Ed.
D.T.M.&H.

From the National Iranian Oil Company Hospital,
Abadan, Iran

Abadan is a town of about 240,000 people, just under 143,000 of whom are cared for by the medical department of the National Iranian Oil Company. On the whole the climate is hot and dry, the maximum shade temperature varying from 110 to 122° F. (43.3 to 50° C.), and the maximum temperature in the sun rising to 179° F. (81.7° C.) during the period of the influenza epidemic.

All employed persons work in the oil refinery, there being 4,234 classified as "staff" and 26,351 as "labour." The respective figures for "dependants" are 10,351 and 101,716, the vast majority of whom are either wives or children under the age of 20 years. The standard of living of staff is higher than that of labour. Influenza is an unusual disease in Abadan, the great majority of the population at risk never having experienced the condition before.

For the purposes of this paper, the onset of the epidemic is taken as July 14, 1957. There were a few cases during the two weeks prior to that date, but they represent a minute fraction of the total number of persons affected by the illness.

Abadan can be reached by land, sea, and air. It is on the route of several international and national airlines, planes calling on their way to and from Europe, India, and the Far East. Land traffic into Abadan is comparatively small, but a large number of ships, both tankers and merchantmen, arrive from many parts of the world. During the 10 weeks prior to the onset of the epidemic, at least 28 tankers alone arrived in

Abadan from ports further east where there was known to be influenza at the time of their departure. The first of these arrived from Singapore on May 1. It is therefore rather strange that the onset of the epidemic was delayed as long as it was.

The epidemic lasted nine weeks, the total number of cases being 44,921. The weekly figures are shown in

TABLE I.—Weekly Totals

1st week	3,489	4th week	10,210	7th week	387
2nd "	11,302	5th "	4,488	8th "	79
3rd "	12,897	6th "	2,042	9th "	27

Table I. Various measures, such as the closing of indoor cinemas and other gatherings, were taken, but no vaccine was used.

On the first day of the epidemic a large proportion of the patients were admitted to hospital, but thereafter only those whose condition was poor or who were suffering from complications were admitted, the remainder being treated as out-patients. Altogether 467 were admitted—412 with influenza and 55 with a complication.

When the patients were first seen the diagnosis was made on the presence of fever with one or more of the common symptoms. Details of the large number of patients treated in their own homes is not exact, and in many instances the total duration of the illness is not known. Treatment with aspirin, codeine, and cough mixtures was given to out-patients and in-patients suffering from uncomplicated influenza. Of the 44,483 whose initial illness was not treated in hospital, 55 were subsequently admitted suffering from a complication. Table II shows the number affected and the percentage

TABLE II

		0-19 Years	20-60 Years	Total
Staff	No. affected ..	1,093	1,780	2,873
	Total population ..	6,441	8,468	14,909
	Percentage affected ..	17.0	21.0	19.3
Labour	No. affected ..	25,502	16,546	42,048
	Total population ..	75,365	52,702	128,067
	Percentage affected ..	33.7	31.4	32.8
Total	No. affected ..	26,595	18,326	44,921
	Total population ..	81,806	61,170	142,976
	Percentage affected ..	32.5	29.9	31.4

incidence of the disease in children and adults in the staff and labour groups, from which it can be seen that labour was affected to a much greater degree than staff but that age made little difference.

Patients Admitted Suffering from Uncomplicated Influenza

The 412 patients in this group were selected for admission because of the severity of the attack or for convenience in the case of nursing staff. There were 60 staff employed (29 males and 31 females), 127 labour employed (125 males and 2 females), 59 staff dependants (33 males and 26 females), and 166 labour dependants (69 males and 97 females). Twenty-seven patients subsequently developed a complication, all but one while in hospital. The latter patient was discharged, but a day or two later he was re-admitted suffering from pneumonia. Table III shows the percentages of patients—children and adults, staff and

TABLE III.—Percentage of Patients with Uncomplicated Influenza Admitted to Hospital

	0-19 Years	20-60 Years
Staff and dependants	5.76	3.15
Labour	0.47	0.86