Session I: Chairman: Sir James Howie

Collaborative studies of acute respiratory disease in patients seen in general practice and in children admitted to hospital

Aims, field methods and morbidity rates

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Summary

Two collaborative studies of acute respiratory disease were organized, one in patients seen in general practice and the other in children admitted to hospital. The main aims were to study the epidemiology and clinical presentation of these diseases and of the viruses associated with them. The field methods used are described and analyses of the consultation rates in general practice and of hospital admissions in children are presented. Both consultations and admissions were most frequent by far in very young children, especially those under the age of 1 year, but the pattern of incidence for the various clinical categories differed with age. Lower respiratory illnesses were relatively much more frequent in infants and in adults over 65 than in intermediate age groups. Seasonal variations were slight for most upper respiratory tract conditions but pronounced for lower respiratory illnesses, especially bronchiolitis of infants which was epidemic each winter, and for influenza. Changes in the initial diagnosis in patients seen in general practice did not greatly influence the total morbidity pattern but the final diagnoses showed a substantial proportional increase in the number of cases of lower respiratory illness. The shortcomings of the field methods and clinical records available for use in the study and the reliability of the results are discussed.

Introduction

In the last 20 years a profusion of new microbial agents has been isolated from the respiratory tracts of patients with acute respiratory disease. The legacy of these discoveries is a vast and still largely unresolved series of questions about the aetiological significance of these agents, about how they spread and how to prevent and treat the sometimes serious clinical consequences of infection. Most of the early epidemiological and clinical studies of these agents were

carried out in special groups of persons to whom access was easy and in whom infection was common, such as children in residential schools and homes and recruits to the armed services (see *American Review of Respiratory Diseases*, 1963, Vol. 88, part 2). To obtain a broader and more generally valid assessment of the problem in 1961 a Medical Research Council Working Party organized a 3-year study of acute respiratory disease in persons living at home, where most such illnesses occur, and in children admitted to general hospital wards (Medical Research Council, 1965). These studies gave much useful information about the viruses being sought and the clinical syndromes with which they were associated, but there was a clear need to continue and extend the work under more closely stipulated conditions and with strictly applied epidemiological, clinical and laboratory methods. Therefore, two new studies under separate Working Parties were set up jointly by the Public Health Laboratory Service and the Medical Research Council, one to organize a study of patients in general practice and the other a study of children admitted to hospital. Both studies lasted for 2 years and the results are reported in the papers included in this Symposium.

The aims of the two studies were broadly similar:

- (1) To study the epidemiology of acute respiratory disease seen in general practice and in children admitted to hospital.
- (2) To determine the frequency with which viruses and β -haemolytic streptococci could be isolated from patients with acute respiratory disease seen in the course of routine general and paediatric practice.
- (3) To study the patterns of clinical features associated with infection with particular agents.
- (4) To examine some aspects of the technical problems of isolating respiratory viruses.

Field methods

The general practice study

The study was carried out by general practitioners

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FIG. 1. General practice: location of practices.

in twelve practices in England and one in Scotland (Fig. 1), working in collaboration with microbiologists in nearby Public Health Laboratories. The practices were widely scattered with some in urban and some in rural areas, but none was in an area with much heavy industry.

The survey began in October 1964 and lasted for 2 years. A count of patients registered on each practice list by age and sex was compiled in January 1965 and revised in January 1966. Throughout the survey doctors kept weekly records of all patients who consulted them with an acute respiratory illness. An entry of the age and sex of each such patient was made on a special card under one of ten defined clinical categories (Table 1) according to the diagnosis at the time of first consultation. A sample of the patients seen within 5 days of onset of their illness was selected for more detailed study. Each team of general practitioners and microbiologists was free to choose its own sampling ratio to suit local circumstances and resources. Once the ratio was decided the selection of subjects was made by set procedures designed to ensure that patients of all ages and with a range of different diagnoses from the trivial to the serious were included and that doctors would not make the choice based on personal interests or purely clinical criteria.

TABLE 1. Acute respiratory disease in general practice: clinical categories

Common cold: <i>Rhinitis</i> causing blocked nose and/or watery, mucoid or purulent discharge. In severe colds there may be malaise and moderate fever.
Pharyngitis: <i>Sore throat</i> with generalized erythema of the pharynx and upper respiratory passages, and often associated with fever and malaise. In <i>tonsillitis</i> (included under the heading 'Pharyngitis') there is selective involvement of the tonsils or tonsillar beds, sometimes with ulceration and/or grey yellow or white exudate.
Primary otitis media: <i>Earache</i> with redness of the drums, swelling or purulent discharge, unaccompanied by any other respiratory symptoms and signs at least when first encountered.
Laryngitis: <i>Hoarseness or loss of voice</i> with some soreness of the laryngeal region and/or cough.
Croup: <i>Stridor or crowing cough</i> with hoarseness, and in severe cases restlessness, greyish pallor or cyanosis. It is confined to infants and young children.
Tracheitis: <i>Dry cough</i> with substernal soreness. In the later stages a small amount of purulent sputum may be raised.
Acute Bronchitis: <i>Moist cough</i> and rhonchi, often with fever, malaise and purulent sputum.
Bronchiolitis: <i>Widespread fine rales</i> and other signs indicating involvement of the small bronchi and alveoli, but without obvious consolidation. There may be variable fever, rapid respiration, moist cough, cyanosis and in severe cases in infants, pulmonary distension and rib recession.
Pneumonia: <i>Clinical and/or radiological evidence</i> of multi-lobular, segmental or lobar <i>consolidation</i> , with other symptoms and signs of lower respiratory tract infection.
Influenza: <i>Sudden onset of headache, body aches</i> , shivering, sweating, fever, pain behind the eyes, usually accompanied by sore throat and tracheitis.

TABLE 2. General practice: sampling rates by age and diagnosis

Age group (years)	Common cold	Primary O.M.	Pharyngitis	Laryngitis and croup	Tracheitis	Bronchitis	Bronchio-litis and pneumonia	Influenza	Other ARD	All diagnoses
0-4										
No. sampled	356	53	200	61	92	89	62	75	0	988
No. consultations	1807	336	1052	207	360	571	157	207	9	4706
Sampling rate (%)	19.7	15.8	19.0	29.5	25.6	15.6	39.5	36.2	0	21.0
5-14										
No. sampled	187	47	525	39	90	49	22	102	3	1064
No. consultations	1130	369	1947	130	367	375	83	387	6	4794
Sampling rate (%)	16.5	12.7	27.0	30.0	24.5	13.1	26.5	26.4	50.0	22.2
15-44										
No. sampled	321	13	566	50	80	40	10	172	3	1255
No. consultations	1809	82	2133	198	487	279	56	602	14	5660
Sampling rate (%)	17.7	15.9	26.5	25.2	16.4	14.3	17.9	28.6	2.1	22.2
45 or more										
No. sampled	180	4	112	40	94	85	24	137	6	682
No. consultations	1132	25	544	193	592	834	198	447	20	3985
Sampling rate (%)	15.9	16.0	20.6	20.8	15.9	10.2	12.1	30.6	3.0	17.1
All ages										
No. sampled	1044	117	1403	190	356	263	118	486	12	3989*
No. consultations	5878	812	5676	728	1806	2059	494	1643	49	19145†
Sampling rate (%)	17.8	14.4	24.7	26.1	19.7	12.8	23.9	29.6	24.5	20.8

* Includes 23 cases with final diagnosis of unspecified ARD which were omitted from further analysis.

† Excludes 3209 consultations in practices where sampling was discontinued in the second year.

More than 19,000 consultations were recorded during the survey and nearly 4000 of the patients concerned were selected for further study. Sampling rates in different practices varied from 8 to 44% with a mean of 21%. They also varied to some extent between age groups and to a greater degree between diagnoses (Table 2), possibly in part owing to non-random selective factors. A standard clinical record card that gave details of symptoms and signs was completed for each selected patient and nose/throat swabs were taken for laboratory examination by agreed methods. Physician and virologist were each ignorant of the other's findings when they recorded their respective observations or results. All records were sent to the Epidemiological Research Laboratory, Colindale, where they were checked and where necessary referred back for completion or clarification before coding and analysis.

The study of children admitted to hospital

In this study physicians in sixteen different hospitals and microbiologists in local laboratories took part. The hospitals were widely distributed geographically (Fig. 2) but the largest numbers of cases were admitted to units in big northern industrial cities.

The survey began in March 1965 and continued until the end of April 1966. Each unit kept a monthly register which recorded the age, sex and diagnosis of

FIG. 2. Children in hospital: location of hospitals.

every child admitted with an acute respiratory illness. A separate set of defined diagnoses appropriate to children in hospital was established for use in this survey (Table 3). A sample of children was selected for more detailed study in a manner similar to that in the general practice survey. They were included in the results only if swabs were taken within 5 days of onset of their illness and within 48 hr of admission to hospital.

During the survey more than 7500 children were admitted to the units concerned and over 2000 were selected for further study. Sampling rates in different hospitals varied from 16 to 63% with a mean of 32%. The sampling rates did not vary greatly between different age groups, but there was some variation between diagnoses (Table 4). Standardized clinical records and laboratory procedures for the examination of nose/throat swabs, similar to those in the general practice survey but with a more detailed record of symptoms and signs were used for each selected child. Records were checked for errors and omissions before analysis and were referred back to the clinician or microbiologist concerned for correction or completion when necessary. An additional feature of this survey was the inclusion in some hospitals of a small number of children with

no respiratory symptoms from whom swabs were also taken and examined by identical procedures.

Consultation rates in general practice

The age and sex structure of the population under study was similar to that for England and Wales at the time. A total of 22,354 episodes of acute respiratory disease was recorded, a rate of 36 per 100 person-years (Table 5). Rates varied considerably between practices, from 14 to 57 per 100 person-years, and for particular diagnoses the variation was even greater, which suggests that different doctors had individual preferences for the use of particular diagnoses. However, there was relatively little variation in the total number of episodes seen by each doctor: most saw about 500–700 patients with acute respiratory disease a year, though two saw over 900 and one over 1400.

The incidence of consultations was highest in infants under 1 year of age, with a peak at ages 6–8 months (167 per 100 person-years) and a second lower peak in children aged 5 years (118 per 100 person-years): this was followed by a steep fall in rates to the age of 10 years, after which the decline was much slower (Fig. 3). The rates for females were higher than those for males at all ages except

TABLE 3. Acute respiratory disease in children admitted to hospital: clinical categories

Colds:

Illnesses in which the main feature is nasal discharge—watery mucoid or purulent. With more severe colds there is malaise and moderate fever.

Pharyngitis:

Generalized erythema of pharynx and upper respiratory passages without obvious nasal discharge or selective involvement of the tonsils and usually associated with fever and malaise.

Tonsillitis:

Illnesses with varying degrees of fever and malaise. Main local features are redness and swelling of the tonsils, often with grey or yellow exudate.

Otitis media:

An illness with varying degrees of earache, malaise and fever. Main local features are redness of the drum, swelling or purulent discharge. The diagnosis should be given as primary otitis media or otitis media with other respiratory symptoms.

Croup (acute laryngitis or laryngo-tracheitis):

Illnesses of varying severity, often preceded by a cold. Main features are fever, hoarseness, croaking cough and stridor. Restlessness and greyish pallor or cyanosis are present in the severe forms.

Acute bronchitis:

A febrile illness with moderate constitutional upset and often associated in younger children with wheezing. Main features are cough and widespread rhonchi with or without rales.

Acute bronchiolitis:

Acute illness affecting infants and young children. Main features are coryza lasting from 24 hr to several days and followed by the swift development of illness with a variable degree of fever, rapid respiration, frequent harsh exhausting cough, and an expiratory wheeze with (in most cases) widespread fine rales; of special diagnostic significance, the development of pulmonary distention, often with costal recession. Chest radiographs will in most cases show increased translucency, sometimes with linear areas of collapse.

Pneumonia (lobular, segmental and lobar):

Acute illness with fever, pallor or cyanosis, restlessness or prostration, cough and rapid respirations often with movement of the alae nasi. Clinical evidence of consolidation only found in a minority of children; main signs in the lungs are diminished air entry and localized or widespread fine rales. Radiographs show lobular, segmental or lobar consolidation.

Influenza:

An illness of sudden onset with shivering fever, body aches and pain behind the eyes.

TABLE 4. Children in hospital: Sampling rates by age and diagnosis

Age	Common cold	Primary O.M.	Pharyngitis	Tonsillitis	Croup	Bronchitis	Bronchiolitis	Pneumonia	Influenza	Total
0-5 months										
No. sampled	80	23	31	7	12	150	222	154	3	682
No. admissions	255	71	121	22	45	490	697	462	9	2172
Sampling rate (%)	31.4	32.4	25.6	31.8	26.7	30.6	31.9	33.3	33.3	31.4
6-11 months										
No. sampled	30	30	38	24	37	82	46	86	1	374
No. admissions	122	101	101	66	72	337	226	267	6	1298
Sampling rate (%)	24.6	29.7	37.6	36.4	51.4	24.3	20.4	32.2	16.7	28.8
1-4 years										
No. sampled	103	78	148	172	144	177	31	216	6	1075
No. admissions	310	212	317	462	321	664	107	685	16	3094
Sampling rate (%)	33.2	36.8	46.7	37.2	44.9	26.7	29.0	31.5	37.5	34.7
5-14 years										
No. sampled	19	11	27	54	37	44	4	87	4	287
No. admissions	92	37	83	183	77	152	12	376	14	1026
Sampling rate (%)	20.7	29.7	32.5	29.5	48.1	28.9	33.3	23.1	28.6	28.0
All ages										
No. sampled	232	142	244	257	230	453	303	543	14	2418
No. admissions	779	421	622	733	515	1643	1042	1790	45	7590
Sampling rate (%)	29.8	33.7	39.2	35.1	44.7	27.6	29.1	30.3	31.1	31.9

TABLE 5. General practice: consultation rates

	Total consultations	All practices	Median	Rates per 100 person-years	
				Range	
				Low	High
Common cold	7296	11.8	9.0	5.0	23.9
Primary otitis media	975	1.6	1.1	<0.1	3.5
Pharyngitis	6447	10.4	9.2	4.7	18.2
Laryngitis	589	0.9	0.9	0.3	1.9
Croup	200	1.4*	1.4*	0.1*	2.5*
Tracheitis	1867	3.0	1.4	0.2	9.7
Bronchitis	2413	3.9	3.2	0.3	6.8
Bronchiolitis	174	0.3	0.2	0	1.7
Pneumonia	364	0.6	0.3	0	1.5
Influenza	2029	3.3	3.4	0.7	5.9
All diagnoses	22,354	36.1	33.9	14.4	56.8

* Rates based on population aged 0-14 years only.

in children under 3 years of age, those aged 5 years and adults over 55 years of age.

The changes in consultation rates by age varied with the diagnosis (Fig. 4). The rates for common cold, at their highest in infancy, decreased steeply up to the age of 10 years, after which they were static until after the age of 45 years when there was another slight fall. Primary otitis media increased in incidence with age to a maximum at 5 years before declining and was rare in persons over 15 years of age. The rates for pharyngitis showed a very similar pattern to otitis media in children, but in adults they declined more slowly. Laryngitis and tracheitis were commoner in children than in adults, other-

wise their incidence did not vary greatly with age. Otitis media, pharyngitis and croup were all rare in infants under 3 months old. Bronchitis and pneumonia (including bronchiolitis) were most frequent in infants, consultation rates being greatest in those aged 3 months to 1 year; during later childhood rates declined steeply to a very low level in young adults but they increased again in middle age until they reached about three times the young adults' figure in those over 65 years of age. Influenza rates increased in early childhood to a peak at the age of 5 years and declined slowly throughout life thereafter. For all upper and middle respiratory tract conditions, except croup, rates in females exceeded

FIG. 3. General practice: consultation rates by age.

those in males, but male rates were higher for croup and all lower respiratory tract conditions.

Analysis of the percentage distribution of different diagnoses showed that about two-thirds of all episodes were upper respiratory tract conditions; half of these were common colds and most of the rest were pharyngitis, with a small number of cases

of otitis media (Fig. 5). Middle respiratory tract conditions, mostly tracheitis, accounted for about 12% of the total, and lower respiratory tract conditions, the majority of them bronchitis, for 13%. Influenza accounted for 9%. These proportions differed with age. Up to 20 years of age upper respiratory tract conditions formed a gradually increasing proportion of all episodes, with a decline in the proportion due to common cold and otitis media after infancy being more than offset by an increase in pharyngitis. In adults there was a strong trend for middle and, particularly, for lower respiratory tract conditions to assume an increasingly prominent role.

Seasonal variations in rates for different diagnoses are shown in Fig. 6. The winter rate for common cold and primary otitis media was up to three or four times the summer rate in all age groups. The increase began sharply in September and October while the decline in the spring was more gradual. In contrast, the rate for pharyngitis changed relatively little with season. In the middle respiratory tract, laryngitis and croup showed a greater winter increase in children than in adults; in the second winter there was a particularly large increase in the rate for tracheitis, more in children than in adults, just before and during the influenza epidemic. Lower respiratory tract illness rates in the winter were three to four times as high as in the summer; this difference was greater in children under 5 years

FIG. 4. General practice: consultation rates by age for each diagnosis.

FIG. 5. General practice: percentage distribution of consultations by diagnosis for each age group.

old and in adults over 45 years than in the intermediate age groups. There was little influenza in the first winter, but in early 1966 there was a sharp outbreak in which attack rates were highest in children, particularly those of school age. Seasonal variations in particular types of respiratory illness depend at least partly on changes in the prevalence of the agents that cause them, which may vary between different localities and from one year to another. It would be unwise, therefore, to generalize from these observations.

The diagnosis made at the time of first consultation was the only one recorded for the majority of patients and was used for all analyses of consultation rates. However, in some cases the initial diagnosis may be altered as the character of the illness changes. In the patients selected for detailed study the final diagnosis was recorded up to 7 days after the first consultation. This showed that the initial diagnosis was altered in about 9% of all cases (Table 6). The net effect of these

FIG. 6. General practice: consultation rates by 4-week periods.

changes on consultation rates was slight for upper and middle respiratory tract conditions, but it increased the number of cases of bronchitis by 15% and those of pneumonia or bronchiolitis by 35%. The rates recorded for these conditions, therefore, correspondingly underestimate the true rates. It should be noted, however, that after allowing for the changes, the proportion of patients who had lower respiratory tract illnesses increased by only 2.4% from 13.2% to 15.6%.

Admissions of children to hospital

It was not possible in this survey to measure the rates of admission to hospital of children with acute respiratory diseases since the populations served by the participating hospitals were not accurately known. Nor was there any satisfactory way of estimating referral rates of children seen by general practitioners with acute respiratory disease.

The total number of admissions recorded during the survey in all hospitals was 7590 and the range was from 109 to 1090 in different hospitals. Nearly 60% of the total were admitted to five hospitals situated in large industrial cities and only about 30% to eight hospitals in small towns.

Table 7 shows the percentage distribution of admissions between diagnoses for all hospitals combined and the median percentage when the distribution is calculated for each hospital separately. About one-third of the children were admitted with an upper respiratory illness; of these about half had

TABLE 6. General practice: frequency of changes in diagnosis

Initial diagnosis	Final diagnosis										Losses		Net changes	
	Common cold	Primary otitis media	Pharyngitis	Laryngitis/croup	Tracheitis	Bronchitis	Pneumonia/bronchitis	Influenza	Initial total					
										No.	%	No.	%	
Common cold	925	2	33	12	32	17	7	13	1041	16	11.1	—56	—5.4	
Primary otitis media	1	111	2	0	1	0	1	1	117	6	5.1	—2	—1.7	
Pharyngitis	32	1	1314	7	15	12	3	15	1399	85	6.1	—22	—1.6	
Laryngitis/croup	8	0	3	166	3	5	1	4	190	26	13.7	+1	+0.5	
Tracheitis	8	0	3	5	296	15	15	11	353	57	16.1	+2	+0.6	
Bronchitis	4	1	2	1	3	243	8	1	263	20	7.6	+39	+14.8	
Pneumonia/bronchiolitis	0	0	1	0	1	4	113	2	121	11	9.1	+42	+34.7	
Influenza	7	0	19	0	4	6	15	431	482	51	10.6	—4	—0.8	
Final total	985	115	1377	191	355	302	163	478	3966	372	9.4			
Gains														
No.	60	4	63	27	59	59	53	47	372					
%	6.1	3.5	4.6	14.1	16.6	19.5	32.5	9.8	9.4					

TABLE 7. Children in hospital: percentage distribution of admissions by clinical category

	Admissions: all hospitals		Median (%)	Range (%)	
	No.	%		Low	High
Common cold	779	10.3	7.8	2.6	28.4
Primary otitis media	421	5.5	4.3	1.2	13.1
Pharyngitis	622	8.2	5.0	0.3	20.9
Tonsillitis	733	9.7	11.4	3.3	20.4
Croup	515	6.8	9.0	3.3	22.4
Bronchitis	1643	21.6	19.3	5.7	39.3
Bronchiolitis	1042	13.7	9.3	2.8	33.8
Pneumonia	1790	23.6	22.8	12.4	41.4
Influenza	45	0.6	0.3	0.0	3.2
All diagnoses	7590	100			

a common cold or otitis media and half had pharyngitis or tonsillitis. Another 7% were admitted with croup. Bronchitis and pneumonia each accounted for more than one in five of all admissions and bronchiolitis for about one in seven. Less than 1% of illnesses were diagnosed as influenza. The percentages of admissions for each diagnosis showed wide range between hospitals, but, except in the case of pharyngitis and tonsillitis, the proportions were generally clustered closely about the median.

A relatively large proportion of admissions in large towns were for common cold and otitis media (Table 8); this was accounted for mainly by the admission patterns in two towns in the north of

England. Surprisingly the proportion of admissions for croup was much higher in small towns than in large towns and conurbations, whereas lower respiratory conditions accounted for nearly two-thirds of admissions in the conurbations, but only about one-half elsewhere.

Nearly half the children were under 1 year old and almost two-thirds were under 2 years old (Table 9). The pattern was similar in most hospitals, though collectively the proportion of young infants was relatively greater in hospitals in conurbations and that of older children was relatively greater in small towns.

The percentage of admissions within each age

TABLE 8. Children in hospital: percentage distribution of admissions by diagnosis and size of town

Size of town	Common cold and primary otitis media	Pharyngitis and tonsillitis	Croup	Bronchitis, bronchiolitis and pneumonia	Influenza	Total admissions
Conurbations	13.4	16.3	4.2	65.4	0.7	3608 (100)
Large towns	24.5	17.7	5.0	52.6	0.2	1784 (100)
Small towns*	12.7	20.5	12.5	53.5	0.7	2198 (100)
All hospitals	15.8	17.9	6.8	59.0	0.6	7590 (100)

* Population less than 150,000.

TABLE 9. Children admitted to hospital: percentage distribution of admissions by age and size of town

Size of town	Age						All ages
	0-2 months	3-5 months	6-11 months	1 year	2-4 years	5-14 years	
Conurbations	17.0	16.6	18.9	19.1	19.3	9.1	3608 (100)
Large towns	13.6	12.8	16.3	18.2	21.4	17.8	1784 (100)
Small towns*	11.5	10.7	14.8	19.0	26.7	17.4	2198 (100)
All hospitals	14.6	14.0	17.1	18.8	21.9	13.5	7590 (100)

* Population less than 150,000.

Fig. 7. Children in hospital: percentage distribution of admissions by diagnosis for each age group.

group for every clinical category are set out in Fig. 7. This shows changes in the relative importance of any particular diagnosis with age. The proportion of patients admitted with common cold changed relatively little with age, whereas for otitis media it climbed steadily to nearly 9% at the age of 1 year and then declined. The proportion of cases of pharyngitis increased slowly through the age groups, but the rise was much more pronounced for tonsillitis, mainly after the age of 1 year. Croup accounted for a rising proportion of cases, with a maximum of just over 11% in 2-4-year-old children and then declined. The picture for lower respiratory illnesses was strikingly different: bronchiolitis accounted for more than one in three admissions in infants under 3 months of age but the proportion decreased rapidly through the first year of life to insignificant proportions thereafter; bronchitis remained an important reason for admission up to the age of 5 years when it gave place to pneumonia as the principal cause. Influenza was diagnosed in an insignificant proportion of children.

The percentage distribution of patients between age groups within each of the four serious lower respiratory tract diagnoses is shown in Fig. 8. This adds a new dimension to classification (Court, this symposium) and raises questions for pathogenesis at present unanswered: 62% of children with croup

were between 1 and 4 years of age; 66% of children with bronchitis were less than 6 months old and 89% were under 1 year. Thus bronchiolitis is clearly a disease of infancy occurring mainly in the first 6 months of life, whereas the age span of bronchitis and pneumonia is more extended, with 50% and 59% of cases respectively occurring after the first year.

Males outnumbered females by about three to two in all age groups. This disproportion between the sexes was particularly great for patients with croup, in which the male/female ratio was about 2 to 1.

Seasonal variations in the number of admissions for each diagnosis are shown in Fig. 9. There was a small winter increase in the frequency of common cold and otitis media but, as in the general practice survey, there was very little seasonal variation in the frequency of pharyngitis and tonsillitis. Cases of croup showed greater seasonal variation, with a particularly large number in the last 3 months of 1966. All three lower respiratory illness categories showed high winter peaks: the maximum number of cases of bronchitis and pneumonia in the winter months was about three to four times the minimum number in the summer. The seasonal difference for bronchiolitis was even greater, with very few cases in the summer months and explosive outbreaks

Fig. 8. Children in hospital: percentage distribution of admissions by age for each diagnosis.

each year from November to January, illustrating the epidemic nature of this condition.

Discussion

The scale of the investigations required to answer the questions we set ourselves could be mounted only through co-operative endeavours in many centres. Collaborative research of this type demands that all participants adhere strictly to standardized methods in order to minimize the various types of bias that may enter into the results. We were handicapped in this respect by the signal lack of laboratory, clinical and epidemiological methods suitable for use in a field survey of acute respiratory disease and by the many logistic problems in the organization of a study among participants all of whom had heavy routine service commitments. This led to some compromises between what was technically ideal and what was practical.

Fig. 9. Children in hospital: admissions by month and diagnosis.

First, all participants in the two surveys were self-selected and for this reason the general applicability of our findings may be questioned. However, the broad geographical distribution of the survey practices and hospitals, the fact that in the general practice survey the age distribution of registered patients corresponded to that of England and Wales, the fact that the hospitals concerned gave general district services and the coherence of our results with those of other studies before and since, are all reasons for confidence that the findings are broadly true of usual experience in Britain.

Other difficulties arose from the need to adopt field methods which were simple enough for it to be practical for all participants to follow them diligently and consistently for 2 years, and which gave a fair chance that the agents we were looking for could be isolated from the specimens that arrived in the laboratory. These requirements precluded selection of a strictly random sample of illnesses for detailed study and meant that variation in sampling ratios had to be allowed. The sampling method used was designed to ensure that the selection of cases was not left to the whim of the clinician, but it did not eliminate bias due to the order in which patients presented or the time of day that they were seen and

possibly other factors. In the event sampling rates were demonstrably uneven between different clinical categories as well as between different centres in both surveys. For this reason we cannot be certain that the cases sampled were necessarily representative.

Agreement on the definition of diagnoses and reproducibility in their use by different doctors is notoriously difficult to obtain, but no standardized questionnaire for use in acute respiratory disease surveys existed. Nor was there any established procedure for testing the reliability and consistency of performance in the isolation of respiratory viruses between laboratories using similar methods. However, a major effort was made to reduce differences in interpretation of the clinical definitions and in the laboratory methods used in the surveys by discussions between all participants before and at intervals during the survey and through checks on all records for obvious errors or deficiencies by an independent observer. Despite this care later papers show evidence of lack of uniformity between centres in the application of clinical and laboratory methods.

These difficulties and deficiencies must be faced since they place in question the validity of our results and the interpretation to be placed on them. We cannot say with confidence that our findings, particularly those related to the aetiological agents to be found in acute respiratory disease, are wholly reliable and much work remains to be done before we have a full and final picture. Nevertheless, the results of these two surveys provide the most comprehensive and, for the reasons already stated, probably the most complete and accurate account of acute respiratory illness in the general population of this country yet published.

The consultation rates recorded in the general practice survey are a good practical measure of the burden that acute respiratory illness places on patients and on doctors. They are, however, only one index of the incidence of respiratory illness in the population. A number of factors enter into whether or not a patient consults his doctor, par-

ticularly for minor illnesses, such as ease of access to the doctor, the nature of the patient's work and whether or not he gets sick pay, as well as the patient's assessment of the need for medical attention. Parents are more likely to consult for their children's illnesses than for their own and mothers may find it easier than fathers to visit the doctor. The great predominance of acute respiratory illness in childhood, particularly in infants under 1 year of age is shown very clearly, as is the changing emphasis with age in the nature of illnesses seen by family doctors. The relatively small seasonal variation in incidence (and its absence in cases of pharyngitis) is perhaps surprising in the light of traditional expectations. The figures we obtained, the rates for *spells* of illness, can be compared with those for *patients consulting* and *all consultations* in a study by the General Register Office and Royal College of General Practitioners (Logan & Cushion, 1958) (Table 10). As would be expected, the rates for spells mostly lie between those for consultations and persons consulting.

Unfortunately, it is not possible from our data to calculate admission rates for children with acute respiratory illnesses and such information is difficult to obtain. Analysis of the distribution of cases between different diagnoses and age groups, as we have done, is a less satisfactory approach. However as in the general practice survey, the facts about the relative burdens of different types of illness and the ages of children concerned can be seen. The cases admitted to any particular hospital are determined in part by the location of the hospital, in part by the decisions of doctors about whether or not to request their patients' admission and, where there is a choice, which hospital they select. Considerations such as these affect the admission pattern in particular hospitals. Comparison between the distribution of diagnoses in our survey and data from the Hospital In-Patient Enquiry suggests that there was an exceptionally high proportion of lower respiratory illnesses admitted to the survey hospitals

TABLE 10. Consultation rates in general practice

	All consultations	Persons consulting	Spells
	After Logan & Cushion (1958) (rates/100 per annum)		PHLS/MRC Survey (rates/100 per annum)
Common cold	17	8	12
Pharyngitis or tonsillitis	15	6	10
Other URTI	4	2	—
All URTI	36	17	22
Laryngitis/tracheitis	3	1	4
All LRTI	30	7	5
Influenza	11	4	3
Total	80	29	36

TABLE 11. Children in hospital: percentage distribution of admissions for each diagnosis by age

	Age (years)							
	0-1		1-4		5-14		Total	
	MRC/PHLS	HIPE	MRC/PHLS	HIPE	MRC/PHLS	HIPE	MRC/PHLS	HIPE
Common cold	16	—	17	—	13	—	16	—
Pharyngitis and tonsillitis	9	—	25	—	26	—	18	—
All URTI	25	32	42	56	38	66	34	50
Croup	3	—	10	—	7	—	7	—
Bronchitis	24	26	21	21	15	13	22	21
Bronchiolitis	27	—	3	—	1	—	14	—
Pneumonia	21	42	22	23	37	21	24	29
All LRTI	75	68	57	44	60	34	66	50

HIPE = Data from Hospital In-Patient Enquiry, 1967.

(Table 11). The frequency of admissions with upper respiratory tract conditions also seems high. Presumably many of these children were admitted with hyperpyrexia or convulsions (see Court, this symposium) or because of poor social circumstances. The results also showed the critical importance of bronchiolitis as an epidemic condition in infants. The predominance of croup in small towns and of lower respiratory illnesses in conurbations is difficult to explain without access to information on admission rates for each diagnosis and it needs to be seen in relation to the viruses prevalent in the different localities.

It is interesting to note that whereas nearly half the children admitted to hospital were under 1 year old and more than four-fifths were under 5, of the children seen in general practice only 1 in 10 was under 1 year old and only one-half were under 5. This implies a much greater admission rate in infants than

in older children which is not surprising since analysis of the causes of admission shows that the great majority of children under 1 year of age who were admitted to hospital had a serious lower respiratory illness. In contrast, in general practice, though consultation rates for lower respiratory illnesses were highest in young children and infants, upper respiratory illnesses remained by far the most important reason for consultation in these age groups.

References

- LOGAN, W.P.D. & CUSHION, A.A. (1958) Morbidity statistics from general practice. I. *G.R.O. Studies on Medical and Population Subjects*, No. 14. H.M.S.O., London.
- MEDICAL RESEARCH COUNCIL (1965) A collaborative study of the aetiology of acute respiratory infections in Britain 1961-4. A report of the Medical Research Council Working Party on acute respiratory virus infections. *British Medical Journal*, 2, 319.

Discussion

Question 1. Could differences in the observed morbidity between practices have been due to the existence of an appointments system.

Answer. No information is available on this point. All but three practices had very similar rates per doctor. In one practice with a particularly high rate the doctor encouraged patients to consult him early, even if they had only minor symptoms, and he had a very careful system for recording every contact between patient and doctor. These two factors may account for the high figure.

Question 2. Was any limit set to the number of days from the onset of illness at which swabs were taken and how were the controls selected? Was the control the nearest member of the household in age to the index patient, as in the previous M.R.C. study?

Answer. Patients had to be swabbed within 5 days of onset of illness. Controls were children with non-respiratory illnesses in the same age group and admitted to the same ward or seen in out-patient clinics within 1 week of the index case.

Question 3. What happened to patients seen initially by the G.P. and then referred for urgent hospital admission? There would clearly have been less opportunity to document symptoms in such people.

Answer. Only 1 or 2% were admitted to hospital which would not have significantly influenced the results.

Question 4. All the children studied were selected because they were the ones who reacted to the infection and were ill enough to be admitted to hospital. Other children infected with the same virus were less ill. Was the past experience of the child in relation to the pattern of illness studied?