The Royal Society of Medicine

International Congress and Symposium
Series · Number 27

PNEUMONIA AND PNEUMOCOCCAL INFECTIONS

ıblished by The Royal Society of Medicine
Wimpole Street London
Academic Press · London · Toronto · Sydney
Grune & Stratton · New York · San Francisco

Royal Society of Medicine Series
International Congress and Symposium Series

Number 27

Pneumonia and Pneumococcal Infections

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Published jointly by
THE ROYAL SOCIETY OF MEDICINE
1 Wimpole Street, London
ACADEMIC PRESS
London Toronto Sydney
GRUNE & STRATTON
New York San Francisco

1980

ROYAL SOCIETY OF MEDICINE
1 Wimpole Street, London W1M 8AE

ACADEMIC PRESS INC. (LONDON) LTD.
24/28 Oval Road, London NW1 7DX

United States Edition published and distributed by
GRUNE & STRATTON INC.
111 Fifth Avenue, New York, New York 10013

Library of Congress Catalog Card Number: 80–40530
ISBN (Academic Press): 0–12–790756–4
ISBN (Grune & Stratton): 0–8089–1287–9

Printed in Great Britain by The Whitefriars Press Ltd., London & Tonbridge

Royal Society of Medicine

International Congress and Symposium Series

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Pneumonia and Pneumococcal Infections

Proceedings of a symposium, sponsored by Merck, Sharp & Dohme, held at The Royal College of Physicians, London, on 10 December, 1979

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Contents

The Mortality of Acute Respiratory Diseases in the Developed World

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The first part of this paper is concerned with the principal causes of total mortality and the relative importance of the respiratory diseases, and the second describes the relative importance of the various disease complexes of the respiratory system.

Total Mortality

Most of the data concern the "developed world" which, to most of us, means those countries with high socio-economic levels and well developed health services. However, there are also parts of the world where the coverage given by medical services is fairly adequate, although the economic level needs further development before the full potential is achieved. Therefore some brief data are available on two groups of countries. One is composed of 14 which are considered highly developed and are mainly in North and West Europe and North America, but Japan, Australia and New Zealand are also included. The second comprises four countries in Central and South America where medical services are able to provide coverage for most parts of these countries and where reports of mortality are reasonably reliable. All the data are taken from WHO publications, the source being the WHO Data Bank which was established in 1955 and obtains regular information from governments which have agreed to collaborate.

The limitations of such data are well known but, provided these limitations are kept in mind the data can be used with some assurance for broad generalizations. Some improvement in accuracy probably follows from the fact that the data have been regularly collected from a relatively small number of the same individual countries over the years.

Death rates per 100,000 per annum from each of the two groups of countries (not for the individual countries within the groups) are given in Table 1. The information is listed under "all causes" and then under eight broad headings which more or less follow the International Classification of Diseases. In Group A there has been very little

Pneumonia and Pneumococcal Infections: Royal Society of Medicine International Congress and Symposium Series No. 27, published jointly by Academic Press Inc. (London) Ltd., and the Royal Society of Medicine.

Table 1

Causes of death (per 100,000 per annum) in two groups of countries

Causes of Death	Group A[a]		Group B[b]	
	1955–59	1974–75	1955–59	1974–75
All causes	947·7	911·4	1173·2	697·1
Infectious diseases	26·3	7·4	117·7	44·6
Neoplasms	155·2	187·7	54·4	49·7
Circulatory and CNS diseases	447·3	457·3	135·2	132·0
Respiratory diseases	63·7	71·1	199·7	102·0
Digestive diseases	51·8	38·6	195·4	103·2
Perinatal conditions	34·6	10·2	136·3	38·1
Ill defined conditions	40·1	23·1	182·7	82·4
Accidents and violence	65·8	64·0	80·5	77·5

[a] Group A: 14 countries with full developed health services; Group B: four countries in Central and South America.

change in the death rates from all causes between 1955–59 and 1974–75, with by far the most important causes being circulatory and CNS diseases (principally cerebrovascular accidents) and malignant neoplasms, both of which have increased. Next, though on a much lower scale, are the rates of respiratory diseases (which have also increased), and accidents and violence which have not changed. The principal reductions are in the rates of infectious diseases (−72%) and perinatal conditions (−71%). There have also been decreases in the digestive diseases (which include most of the non-specific diarrhoeas).

In the Group B countries the situation is different. A considerable drop in the rates for all causes of death is recorded, due mainly to the large increase in the proportion of the population in the younger age groups. In 1955–59, respiratory diseases were at the top of the list and the incidence of digestive diseases (including the diarrhoeas) and perinatal conditions was above that of circulatory and CNS diseases, and far above the rate for neoplasms. In 1974–75 circulatory and CNS diseases had the highest rate because of the falls in the other causes. In contrast to the Group A countries, the respiratory disease rate in Group B shows a considerable decrease, as do the rates for digestive diseases and perinatal conditions; perhaps this is associated with modest improvements in environmental conditions, nutritional states, the level of health education, and the availability of health services. This last supposition is supported by the fall in the rates of "ill defined conditions" which are often taken to be an indication of the degree of coverage of a population by the medical services.

Mortality from Infectious Diseases (Table 2)

In both Groups of countries the acute lower respiratory infections (pneumonia, influenza, bronchitis) have a much greater incidence than the other diseases listed, particularly in Group A in which by 1974–75 the fall in the rates of many of the infectious diseases is truly spectacular—especially in those which can be controlled by immunization. Tuberculosis is the only one which is still an important cause of death,

Table 2

Death rates (per 100,000 per annum) from infectious diseases

Causes of death	Group A[a]		Group B[a]	
	1957–58	1974–75	1957–58	1974–75
Pneumonia, influenza, bronchitis	57·9	57·5	199·7	102·0
Tuberculosis	14·6	4·1	29·9	13·7
Measles	0·8	0·1	20·5	3·6
Diphtheria	0·3	0·004	2·0	0·2
Whooping cough	0·3	0·009	19·0	4·1
Tetanus	0·3	0·04	5·8	2·5
Meningococcal meningitis	0·3	0·2	0·2	0·1
Poliomyelitis	0·2	0·003	0·6	0·3
Infectious hepatitis	0·5	0·4	1·1	0·7
Typhoid fever	0·05	0·005	7·5	2·3
Dysentery	1·0	0·02	11·3	3·1
"Enteritis" etc.	No data	1·4	No data	69·9
Malaria (indigenous)	–	–	30·0	0·7

[a] see footnote Table 1

although meningococcal meningitis and infectious hepatitis have shown little change in the two decades for which the data are presented. In Group B as well, the rates for pneumonia, influenza and bronchitis are far ahead of other diseases, though the rate for enteritis is very high. Otherwise there have been falls some of which are substantial; but, because the original rates were so high, there is still a long way to go before the rates of Group B countries are equal to those of Group A. The percentage decreases between

Table 3

Infectious diseases: % decreases in death rates between 1957–58 and 1974–75

Causes of death	Group A[a]	Group B[a]
Acute respiratory infections	–0·7	–48·9
Tuberculosis	–71·9	–54·3
Measles	–88·8	–88·7
Diphtheria	–98·7	–88·6
Whooping cough	–97·0	–78·5
Tetanus	–87·1	–56·6
Meningococcal meningitis	–47·1	–50·0
Poliomyelitis	–98·6	–47·6
Infectious hepatitis	–17·0	–35·5
Typhoid fever	–90·0	–69·3
Dysentery	–98·0	–72·7
"Enteritis" etc. (1969–75)	–33	–36·7
Malaria (indigenous)	–	–97·7

[a] See footnote Table 1

1955–59 and 1974–75 further demonstrate the changes over the two decades (Table 3).

One may summarize at this point by saying that the respiratory diseases in much of the world are third in the list of principal causes of death; they also have such a high mortality compared with most other infectious diseases, that further substantial change in the death rates from the infectious diseases can only come from a reduction in deaths from respiratory infections.

Respiratory Diseases

The WHO have recently published information for individual countries instead of groups of countries (Bouvier and Guidevaux, 1979). In order to clarify the tables, 11 representative countries have been selected: six European countries; the USA and Australia; and three from Central and South America (Table 4). For further clarity, the analysis has been confined to males (except in one table for which the separate data were not available). It should be remembered that death rates in males are from about 1·1 to 2-fold greater than in females.

Table 4

Diseases of the respiratory system in males 1968–72. (Death rates/100,000/annum and respiratory deaths as % of total deaths)

Country	Rate/100,000	% of all deaths
Sweden	63·3	5·7
Netherlands	72·7	7·8
Denmark	72·9	6·7
Spain	110·8	12·2
West Germany	112·4	8·8
England and Wales	197·8	16·0
USA	74·0	6·8
Australia	85·1	8·5
Uruguay	66·7	6·2
El Salvador	85·6	8·6
Mexico	202·5	20·2

Source—Bouvier and Guidevaux (1979).

It is immediately obvious that there are wide variations in death rates between countries. These are difficult to explain but we are dealing with total deaths from the respiratory diseases and so do not have to take into account possible differences in diagnostic labels, e.g. chronic bronchitis versus emphysema. However, it is probable that the variations are real; this being so, it is obvious that Sweden has the lowest rate among the European countries listed. The rates for Netherlands and Denmark are about 15% higher, those for Spain and West Germany almost twice as high and for England and Wales more than three times higher. Rates for the USA are similar to those for the Netherlands and Denmark, but the Australian rates are higher and there is other evidence of the high mortality from respiratory disease in that country. In the three

South American countries there are also wide variations, with Mexico having the highest rate of all countries listed. In the percentages column the proportions vary from 20% in Mexico to 5·7% in Sweden.

If one takes 1958 as the base and uses an index value of 100, one can see that over the period of 1972, the rates in individual countries have varied and, in most, there have been fairly large fluctuations at different times within the period (Table 5). Only in three countries have there been falls between 1958 and 1972 and only in Sweden was the fall substantial. In all other countries there were increases, some of them very large (e.g. in

Table 5

Diseases of the respiratory system in males (all ages).
(Changes in mortality rates between 1958 and 1972)

	Years and indices			
Country	1958	1963	1968	1972
Sweden	100	95	114	69
Netherlands	100	102	91	147
Denmark	100	158	196	232
Spain	100	102	75	94
West Germany	100	120	140	112
England and Wales	100	126	124	117
USA	100	117	176	149
Australia	100	127	160	160
Uruguay	100	121	122	128
El Salvador	100	105	96	140
Mexico	100	96	99	77

Source—Bouvier and Guidevaux (1979).

England and Wales). These rate increases may, in part, be associated with a change in the International Classification of Diseases which came into effect in 1968, but this is by no means the whole explanation. The increases are not due to an ageing population either, because changes in the age structure were allowed for in making the calculations.

It may be said with some assurance, therefore, that, in the past 15 years or so, deaths in males of all ages have not in general decreased and in many instances there has been a distinct increase. However, this is not true for males in the younger age group (Table 6) where the rates are high and the variations between countries are even greater than those in Table 4. They range from 94·5/100,000 in Sweden to the extraordinary level of 2,238·6/100,000 in Mexico. In contrast to the rates for males of all ages, there have been very substantial falls in the younger age group. The decreases are greatest in Denmark, West Germany, Sweden, the Netherlands and Spain. The other countries have fared less well. Nevertheless, the general picture is encouraging and though this is not shown in the table it applies to children of all ages and both sexes.

Hitherto the respiratory diseases have been considered as a group. In the last three tables the principal diseases or disease complexes are shown separately.*

* In these tables "pneumonias" include all pneumonias—bacterial, viral and unspecified (ICD 8th Revision No. 480–486, 510 and 573). Under "bronchitis" is included also emphysema and asthma (ICD No. 490–493). "Influenza" etc. also includes acute infections of the respiratory tract not shown elsewhere (ICD 460–466 and 470–474). The "other respiratory diseases" include a variety of conditions ranging from enlarged tonsils to pneumoconiosis (ICD 500–508, 511, 512, 514–519).

Table 6

Diseases of the respiratory system in males less than one year old. (Changes in mortality rates between 1958 and 1972)

Country	Rate/100,000 in 1958	Years and indices			
		1958	1963	1968	1972
Sweden	117·4	100	58	25	22
Netherlands	94·5	100	57	36	26
Denmark	208·0	100	31	35	10
Spain	869·4	100	106	40	34
West Germany	386·2	100	44	25	19
England and Wales	265·1	100	133	99	68
USA	280·2	100	92	91	56
Australia	205·3	100	90	85	69
Uruguay	532·3	100	104	110	69
El Salvador	852·5	100	123	107	111
Mexico	2238·6	100	86	100	77

Source—Bouvier and Guidevaux (1979).

Table 7 shows the total rates (repeated from Table 4) and the proportional distribution of diseases in males of all ages. The "other respiratory diseases" are mostly under 10% of the total and need not be further considered. Deaths from "influenza and other acute infections" were mostly ascribed to influenza and it is interesting that over the 5 year interval, 1968–72, influenza contributed a relatively small proportion of the total deaths—except in El Salvador where one suspects a difficulty in the recording system. The great bulk of the deaths are divided between the pneumonias and

Table 7

Diseases of the respiratory system in males of all ages 1968–72. (All respiratory diseases—rate/100,000/annum and percentage distribution between causes)

Country	Rate	Percentage distribution of diseases			
		Pneumonias	Bronchitis etc.	Influenza and other acute infections	Other respiratory diseases
Sweden	63·3	58·8	27·2	6·9	7·1
Netherlands	72·7	31·3	52·5	9·1	6·9
Denmark	72·9	32·0	53·0	9·2	5·8
Spain	110·8	31·6	40·3	14·8	13·3
West Germany	112·5	26·9	51·9	11·4	9·8
England and Wales	197·8	40·0	48·6	7·0	4·3
USA	74·0	47·0	33·1	5·5	15·4
Australia	85·1	28·8	58·8	5·8	6·6
Uruguay	66·7	54·4	38·4	15·5	10·7
El Salvador	85·6	33·1	40·4	27·2	3·3
Mexico	202·5	70·6	8·2	17·3	3·9

Source—Bouvier and Guidevaux (1979).

Table 8

Diseases of the respiratory system in males aged 65+ years, 1968–72. (All respiratory diseases—rate/100,000/annum and percentage distribution between causes)

		Percentage distribution of diseases			
Country	Rate	Pneumonias	Bronchitis etc.	Influenza and other acute infections	Other respiratory diseases
Sweden	420·7	62·2	25·3	6·2	6·3
Netherlands	642·6	35·0	50·7	8·2	6·1
Denmark	506·4	35·9	49·2	9·3	5·6
Spain	881·3	29·4	46·3	12·4	11·8
West Germany	813·1	27·1	53·2	10·4	9·4
England and Wales	1455·6	42·4	48·2	5·7	3·7
USA	562·9	44·9	35·9	3·8	15·3
Australia	831·5	26·3	63·4	3·8	6·4
Uruguay	476·5	27·2	49·4	13·2	10·3
El Salvador	432·7	31·1	24·9	37·8	6·2
Mexico	972·9	58·3	17·6	13·0	11·1

Source—Bouvier and Guidevaux (1979).

bronchitis. Among the European countries Sweden has a higher proportion of deaths from the pneumonias and a smaller proportion from bronchitis than the others, in which about 50% of the deaths are due to bronchitis and 25–33% to the pneumonias. This is also seen from the Australian data but the USA has more pneumonia and less bronchitis.

Table 9

Diseases of the respiratory system in both sexes aged ⩽ 1 year, 1968–72. (All respiratory diseases—rate/100,000/annum and percentage distribution between causes)

		Percentage distribution of diseases			
Country	Rate	Pneumonias	Influenza and other acute infections	Chronic disorders	Other respiratory diseases
Sweden	36·9	73·2	22·0	2·4	2·4
Netherlands	31·0	58·4	29·4	7·1	5·2
Denmark	47·8	57·3	26·6	11·5	4·6
Spain	484·9	51·3	40·0	5·3	3·4
West Germany	114·8	61·8	34·9	2·0	1·2
England and Wales	313·9	62·0	30·2	2·6	5·1
USA	214·8	81·2	9·3	1·9	7·5
Australia	201·6	66·1	23·7	2·1	8·1
Uruguay	553·6	71·3	21·9	2·6	4·3
El Salvador	926·3	32·2	18·8	47·5	1·5
Mexico	2149·6	77·1	18·2	4·2	0·5

Source—Bouvier and Guidevaux (1979).

In the South American countries, the Mexican rate of pneumonias stands out as the highest of all, perhaps because of the very high rate in young children but I think there is other evidence that pneumonia is a special problem in all age groups in Mexico.

The rates for males 65 years and over are much higher than for males of all ages; but the distribution of the separate disease manifestations is similar—most of the deaths occur in this age group (Table 8). As one would expect, "other respiratory diseases" and "chronic disorders" are unimportant in children of both sexes under 1-year old (Table 9). Deaths are mainly associated with the pneumonias but in this age group "influenza and other acute infections" are also important.

Comments

The most important conclusion from the information on deaths from all causes is that the most effective means of reducing deaths has not been the treatment of diseases but the intensive application of preventive measures—vaccination, improvements in environment, better nutrition, and, more apposite, health education.

Among the respiratory diseases, influenza *per se* is not, at the present time, one of the greatest causes of death, and one may speculate whether we are re-entering a prolonged period in which influenza epidemics cease to be important, as in the 50 or so years between the late 1830s and the pandemic of 1889–90. Perhaps such a speculation may be strengthened by the fact that most of the subtypes of influenza virus A, prevalent since 1890, have reappeared in recent years and no completely new subtypes have appeared. But it is unwise to prophesy about influenza and a constant alert has to be kept for the emergence of a new pandemic subtype.

So far as the commonest causes of death from the respiratory diseases are concerned, it is clear that in the young the pneumonias and the other acute infections of the lower respiratory tract are the most important, whereas in the older adults the more chronic diseases are the principal problem.

Over the past two decades, the most encouraging observation is the considerable fall in death rates in infants, who are at particular risk, and in younger children. The experience of Denmark, West Germany and Sweden is particularly impressive because the changes have occurred over quite a short period. A study of the probable factors which have induced this amelioration might be of great practical value to other countries such as England and Wales, Australia, the USA and the other countries in America listed in the tables where the changes, though present, are much less extensive.

The improvements are not due to the application of specific preventive measures. Most probably they are the result of a variety of factors, such as a better awareness of the importance of acute respiratory infections in the young, earlier and more adequate treatment, some improvements in the environment e.g. less atmospheric pollution and a greater appreciation of the need for careful nursing in a suitable warm environment. However there is considerable scope for the development and use of more specific measures, for example an effective vaccine to control the outbreaks of RS virus disease which occur in the early months virtually every year.

In contrast to the improvement in the young, there is no change among the older adults, where the death rates and disability rates are highest. For one group, the pneumococcal pneumonias, vaccination has been shown to be an effective measure of prevention but the pneumonias due to other bacterial causes are not yet preventable and many respond poorly to treatment. By far the commonest problems are the bronchitics and the patients with emphysema. The problem is complex because the disease is the end result of a lifetime of injuries to the respiratory tract from

environmental pollution, smoking, alcoholism and certain chronic systemic diseases. In these the strategy of prevention must be long-term and is not directly medical. One step of very practical value would be to find means of preventing the occurrence of the two or three annual exacerbations, the acute infection of the chronic condition, which fill the practitioners consulting room with patients each winter and which have such serious consequences to the patient himself in terms of loss of work and, ultimately, severe disability and death.

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