International Trends in Asthma Mortality: 1970 to 1985*

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Recent international trends in asthma mortality among people aged five to 34 years were examined as a follow-up to an epidemic of asthma deaths in the late 1970s which appeared to be confined to New Zealand. Mortality rates were compared in 14 countries with suitable statistics; Australia, Canada, England and Wales, Finland, France, Japan, Israel, the Netherlands, New Zealand, Singapore, Sweden, Switzerland, the United States, and West Germany, for the period 1970 to 1984/5. In New Zealand, asthma mortality in this age group more than trebled from 1.3 per 100,000 in 1974 to 4.2 per 100,000 in 1979 and since then has declined substantially to 1.85 per 100,000 in 1985. Asthma death rates vary more than six-fold among other countries examined, and although the New Zealand experience has not been seen to the same degree elsewhere, a gradual increase in reported asthma mortality has occurred since the mid to late 1970s in the majority of countries studied. The increase and subsequent decline in asthma mortality in New Zealand could not be explained by changes in diagnostic fashions or in the International Classification of Disease coding rules. Similarly, the US data do not suggest there is diagnostic transfer among diseases of airway obstruction. However, part of the differences in asthma mortality among the countries examined and the recent increases in asthma death rates, could be due to changing diagnostic fashions rather than true differences in mortality. International studies on the validity of asthma death statistics and on asthma prevalence are required to clarify these issues. (Chest 1985; 94:914-19)

ICD = International Classification of Disease

Two epidemics of asthma deaths in people aged five to 34 years have been reported over the last two decades. The first occurred during the mid-1960s in the United Kingdom, Australia, and New Zealand, while the second occurred as an apparently isolated phenomenon in New Zealand in the late 1970s. A full explanation for these epidemics of asthma deaths remains elusive. The cardiotoxic effect of isoprenaline aerosols, over-reliance on symptom relief by bronchodilator treatment in severe acute attacks, and secular changes in the prevalence and severity of asthma have been suggested as contributing factors.

To determine whether the New Zealand experience during the late 1970s was an isolated phenomenon, or the most obvious example of an international trend, this paper examines recent trends in reported death rates from asthma in 14 countries with suitable statistical data.

METHODS

Death rates from asthma during the period 1970 to 1984/5 in the five-to-34 age group were derived from the published national health statistics of Australia, Canada, England and Wales, Finland, France, Japan, Israel (Jews only), the Netherlands, New Zealand, Singapore, Sweden, Switzerland, the United States, and West Germany. Data for 12 other countries in Europe, Asia, and Africa were sought but were either not received, were incomplete, or were in a form unsuitable for this analysis. The 1984 and 1985 data, where given, were obtained from unpublished reports supplied by government statistics departments in each country. Asthma mortality refers to those deaths classified under the rubric 493 covered by the eighth and ninth revisions of the International Classification of Diseases (ICD). To examine the possibility that changes in diagnostic fashion may have caused shifts in classifications of deaths from asthma, deaths from all other respiratory diseases in the five to 34 year age group in New Zealand, England and Wales and the United States were also reviewed. The crude mortality rates are presented without standardization for age as in a previous report standardization made little difference to death rates in the age group under consideration.

RESULTS

Trends in reported annual asthma mortality rates for people aged five to 34 years between 1970 and 1984/5 are shown in Figure 1. For clarity, only data on eight countries are shown. Table 1 gives the average asthma mortality in three-year periods between 1970 and 1984 for each of the 14 countries.

There was a wide variation in asthma mortality rates and mortality trends among countries. Throughout the 15-year period under consideration, New Zealand has consistently had the highest mortality rates while the lowest rates were reported in the United States, the Netherlands, France, and Finland. The difference in asthma death rates between New Zealand and these four countries is as much as tenfold. Figure 1 shows the previously reported rapid increase in asthma mortality in young people in New Zealand between 1975 and 1979, when the death rate trebled from 1.3 to 4.1 per 100,000. Since 1982, the mortality rate has declined almost as abruptly as it increased and by 1985 had fallen to 1.85 per 100,000. None of the other countries examined experienced major increases in

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reported asthma death rates during the period 1970 to 1984/5, but a gradual increase since the mid-1970s is apparent in all other countries except in Finland and Switzerland. It should be stressed that the annual number of asthma deaths in some countries was small (Table 1); in these countries, the calculated percentage changes in death rates are, therefore, intrinsically unstable.

With the exception of Finland, Sweden, and Switzerland, all countries studied introduced the ninth revision of the ICD in 1979. There was, however, little or no change in the mortality rates from asthma between 1978 and 1979 in any of the countries investigated, except in New Zealand, which suggests that the ICD change had only a minor effect on reported asthma mortality rates in this age group (Fig 1).

A comparison of the mean three-year rates for 1976 to 1978 and 1982 to 1984 shows increases of 20 percent or more in Australia, Canada, England and Wales, the Netherlands, Sweden, the United States, and West Germany. Furthermore, the general trend of increasing asthma mortality continued after the introduction of ICD 9. Eleven of the 14 countries examined had a higher average mortality in 1982 to 1984 than in 1979 to 1981 (Table 1); in six countries, this increase was 20 percent or more.

Figure 2 shows trends in reported asthma mortality and in mortality from all respiratory disease other than asthma in New Zealand, England and Wales, and the United States in people aged five to 34 years. The increase and subsequent decline in asthma mortality between 1970 and 1985 in New Zealand is clearly not associated with reciprocal trends in deaths for other respiratory diseases. In England and Wales and in the United States, the increases in asthma mortality coincide with a decline in all other reported respiratory disease deaths. Numerically a transfer of deaths from other respiratory categories to asthma could therefore account for the recent increase in asthma mortality rates in these two countries. However, a more detailed breakdown of respiratory disease mortality data from the United States (Fig 3) indicate that total deaths due to any form of obstructive airways disease in the five to 34-years age group have increased since the late 1970s. As a change in diagnostic fashions is most likely to involve a shift within the obstructive airway disease categories, for example from bronchitis or emphysema to asthma, this suggests that the reported increase in asthma deaths in young people in the United States is, in fact, real. This conclusion may not be relevant for the older age groups.

FIGURE 1. Asthma mortality in people aged five to 34 years, 1970 to 1984/5 in eight countries.

DISCUSSION

This article has documented the wide international variation in asthma mortality rates in people aged five
### Table 1—Asthma Mortality by Three-Year Time Periods 1970 to 1984* (Rates Per 100,000 Population Averaged Over Three-Year Periods Five- to 34-Year-Old Subjects)

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<tbody>
<tr>
<td>New Zealand (21-68)</td>
<td>1.93</td>
<td>1.38</td>
<td>2.96</td>
<td>3.63</td>
<td>2.67</td>
<td>-7</td>
<td>-28</td>
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<tr>
<td>Singapore (6-24)</td>
<td>1.27</td>
<td>0.60</td>
<td>0.78</td>
<td>0.62</td>
<td>0.91</td>
<td>17</td>
<td>47</td>
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<tr>
<td>Australia (54-106)</td>
<td>1.18</td>
<td>1.13</td>
<td>0.91</td>
<td>0.97</td>
<td>1.09</td>
<td>20</td>
<td>12</td>
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<tr>
<td>Japan (180-532)</td>
<td>0.84</td>
<td>0.49</td>
<td>0.40</td>
<td>0.36</td>
<td>0.42</td>
<td>5</td>
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<tr>
<td>England/Wales (113-199)</td>
<td>0.82</td>
<td>0.59</td>
<td>0.60</td>
<td>0.76</td>
<td>0.86</td>
<td>43</td>
<td>13</td>
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<tr>
<td>West Germany (106-227)</td>
<td>0.44</td>
<td>0.51</td>
<td>0.66</td>
<td>0.82</td>
<td>0.83</td>
<td>26</td>
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<td>Israel (0-8)</td>
<td>0.35</td>
<td>0.41</td>
<td>0.15</td>
<td>0.15</td>
<td>0.38</td>
<td>153</td>
<td>153</td>
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<tr>
<td>Finland† (1-11)</td>
<td>0.32</td>
<td>0.26</td>
<td>0.24</td>
<td>0.13</td>
<td>0.16</td>
<td>-33</td>
<td>23</td>
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<tr>
<td>Sweden† (8-25)</td>
<td>0.32</td>
<td>0.32</td>
<td>0.37</td>
<td>0.66</td>
<td>0.46</td>
<td>24</td>
<td>-30</td>
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<tr>
<td>Switzerland† (5-13)</td>
<td>0.30</td>
<td>0.26</td>
<td>0.37</td>
<td>0.25</td>
<td>0.23</td>
<td>-38</td>
<td>-8</td>
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<tr>
<td>United States (183-408)</td>
<td>0.29</td>
<td>0.22</td>
<td>0.19</td>
<td>0.26</td>
<td>0.34</td>
<td>78</td>
<td>31</td>
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<tr>
<td>Netherlands (6-25)</td>
<td>0.21</td>
<td>0.24</td>
<td>0.18</td>
<td>0.25</td>
<td>0.30</td>
<td>67</td>
<td>20</td>
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<tr>
<td>Canada (21-62)</td>
<td>0.20</td>
<td>0.28</td>
<td>0.32</td>
<td>0.40</td>
<td>0.48</td>
<td>50</td>
<td>20</td>
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<tr>
<td>France (33-91)</td>
<td>0.20</td>
<td>0.20</td>
<td>0.25</td>
<td>0.25</td>
<td>0.29</td>
<td>16</td>
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†Countries still using ICD 8 after 1979.
‡Range in annual numbers of asthma deaths between 1970-84.

To 34 years over the last 15 years. New Zealand is the only country to have experienced a major epidemic in this period, although reported asthma mortality rates have been increasing in recent years in most other countries examined.

The data were based on statistical coding of information on death certificates, but only in three countries (New Zealand, United States, and United Kingdom) had the validity of these data been examined. The age group five to 34 was chosen to maximize the validity of the data. In this age group, it has been shown that false positive death certificates are exceedingly rare in both New Zealand and the United Kingdom; false negatives were also found to be rare in one small New Zealand study.

The change from the eighth to the ninth revision of the ICD in 1979 had little effect on asthma mortality rates in the five- to 34-year old age group. In the eighth revision, asthma with mention of bronchitis was coded as bronchitis, whereas under the ninth revision, it was coded as asthma unspecified. In New Zealanders aged five to 34 years, the maximum possible increase that could be attributed to the change in selection rules in 1979 was calculated as approximately 5 percent. When cases included in the 1981 to 1983 New Zealand National Asthma Mortality Study were coded under both the eighth and ninth revisions of the ICD, the difference in coded deaths in five- to 34-year-old subjects was only 2.4 percent (unpublished data). A bridge coding exercise undertaken on a sample of asthma deaths in the United Kingdom in 1979 indicated that the increase in asthma mortality which could be attributed to the ICD revision in five- to 34-year-olds was only 6 percent.

The finding that recent increases in asthma mortality in England and Wales and the United States coincided with a decline in deaths from other respiratory diseases raised the possibility that there may have been a shift in the classification of respiratory deaths in these countries. However, the decline in other respiratory deaths occurred chiefly in the infective categories rather than in diseases characterized by airways ob-
obstruction which are the more likely to be misclassified. Since asthma has received much attention in both the lay and the medical press over the last decade, it is possible that it has become a more popular death certificate diagnosis. With the increased availability and use of effective bronchodilators, reversible airway obstruction may be demonstrated in more cases of obstructive respiratory disease which may then be diagnosed as asthma. Therefore, asthma deaths which may have previously been diagnosed as due to other obstructive respiratory diseases (ie, false negatives) may now be diagnosed correctly. However, this effect...
could not account for the recent increase in asthma mortality in the United States. The combined death rate from all obstructive airways diseases has been increasing since the late 1970s, while deaths attributed to bronchitis or emphysema have been stable (Fig 3). There could be, however, a reduction in false negative reporting of asthma deaths previously coded, for example, as cardiac deaths.

The lack of reciprocal trends in mortality from asthma and from all other respiratory diseases in the New Zealand data indicate that the epidemic there in the late 1970s was likely to have been real, and explanations other than changes in diagnostic fashions must be sought. The epidemic appears to be explained by several factors. A striking increase in the sales of asthma drugs in New Zealand in 1980 which did not occur to the same extent in the United Kingdom or Australia may indicate that the management of asthma has changed in New Zealand, but may also reflect, in part, an increase in asthma severity or prevalence. Prescribed pharmaceuticals were available free of charge in New Zealand during the period of the epidemic, while the cost of primary care consultations was increasing, and this may have encouraged excessive self medication. Inappropriate self treatment with bronchodilators is likely to delay the initiation of corticosteroid and oxygen therapy in acute severe attacks, and the major cause of preventable deaths in the New Zealand epidemic was related to the delays in receipt of potentially life-saving care in emergencies. This commonly occurred in association with inadequate maintenance therapy and long-term management. Increased awareness among doctors and their patients of the potential dangers of poor acute and long-term care may have contributed to the subsequent decline in deaths.

Considerable attention has been devoted to the New Zealand asthma epidemic, and it is gratifying that the mortality rates are now declining. However, this study highlights two important issues which require further investigation. First, despite the favorable trends in New Zealand, the asthma mortality rate there remains over ten times higher than the lowest rate described, and there is a more than sixfold variation in mortality among the other countries examined. Second, although deaths from asthma, particularly in this age group, are essentially preventable, and despite the resources devoted to the treatment of asthmatics, many countries appear to be experiencing an increase in reported asthma mortality.

If the international mortality differences and the recent mortality trends can be shown to be real, then the variations in mortality between countries and with time must be due either to differences in prevalence or case fatality. International comparisons of asthma prevalence in children suggest that any differences between countries and changes over time are small. Most mortality from asthma occurs in adults, however, and prevalence data among adults of various countries are very sparse, and perhaps, unreliable. Based on childhood studies, it seems unlikely that international variations in prevalence would account for the mortality differences. By exclusion, this suggests preventable factors relating to asthma management are involved.

It is clearly of considerable importance to ascertain in countries with increasing reported asthma mortality rates, whether these trends are real or due to changes in accuracy of certification or in diagnostic fashions. The central issue is the validity of mortality data. It would be useful to establish a uniform international protocol to examine the accuracy of death certificates in terms of false positive and false negative coding. In addition, standardized asthma prevalence studies in adults similar to those recently carried out in children in New Zealand, Australia, and Canada may help to clarify whether validated international mortality differences are a function of asthma prevalence, severity or variations in management.

REFERENCES