Changes in the Standardized Mortality Ratios of Lung Cancer and Tuberculosis for Cities, Towns, and Villages in Japan

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The standardized mortality ratios (SMRs) of lung cancer and tuberculosis in males by area (city, town and village) in Japan during the periods 1969–78 and 1979–88 were calculated and illustrated by mapping of diseases. Changes in the SMRs for these two periods also were charted. Mortality from lung cancer increased in all areas during the two periods, but no remarkable increase in mortality was observed in metropolitan areas and industrialized districts in Japan. However, regional differences in mortality decreased in the latter period. Mortality from tuberculosis, on the other hand, decreased remarkably throughout Japan, but regional differences in mortality became more notable. No common rule was found in the pattern of changes in the SMRs. Correlation between the changing mortality rates for the two diseases — one is increasing and the other is decreasing — is under study.

Lung cancer, Tuberculosis, SMR, Changes in mortality

INTRODUCTION

I. Shigematsu et al. examined differences in the standardized mortality ratios (SMRs) of 20 major diseases in Japan, according to small geographical areas, and to clarify the reasons for regional differences, they published a “National Atlas of Major Disease Mortalities for Cities, Towns and Villages in Japan, 1969–1978”[1]. The calculated SMRs for cities, towns and villages based on the standard mortality rates for 1969–78 were classified into 5 ranks: highest, high, intermediate, low and lowest.

In the present study, changes of the areal distribution of mortality from lung cancer and tuberculosis were examined based on the mortality data for 1969–1978 and 1979–1988. The
changes in the SMRs\(^{(2)}\) for cities, towns, and villages from 1969–78 to 1979–88 were also examined statistically.

**METHOD**

The SMR

1. Mortality data for the earlier 10-year period (1969–78) and the latter 10-year period (1979–88) were obtained from the Statistics and Information Department, Ministry of Health and Welfare of Japan.

2. The SMR is a ratio of the number of observed deaths to the number of expected deaths. That is,

\[
\text{SMR} = \frac{\text{Number of observed deaths}}{\text{Number of expected deaths}} \times 100
\]

Standard mortality rate for the calculation of SMR for each period was sex- and age-specific mortality rate for respective period.

Changes of the SMR

1. The change in mortality is expressed by a ratio of the areal SMR in 1969–1978 to that in 1979–1988. This ratio was further divided by that for all Japan. The calculation is as follow:

\[
\text{Change in the SMR} = \frac{b}{a} / \frac{B}{A} \times 100,
\]

where

\[
\begin{align*}
a & : \text{areal SMR, 1969–1978} \\
b & : \text{areal SMR, 1979–1988} \\
A & : \text{SMR, 1969–1978, for all Japan} \\
B & : \text{SMR, 1979–1988, for all Japan}
\end{align*}
\]

20 years mortality from 1969 to 1988 was used as the standard mortality for the SMR calculation in this formula.

2. Changes of the SMRs were obtained from the areal ratios of SMRs and the ratio of SMRs for all Japan as mentioned above. However, the ratio was not calculated in the areas where total deaths in 1969–88 were less than 5.

**RESULTS**

Lung cancer

The mortality rate from lung cancer in Japan began to increase in about 1955. The crude death rate in 1988 was 9 times greater than that in 1955, and the age-adjusted death rate was 5 times greater for this period. The tendency was more pronounced in males than in females.

Figs. 1 and 2 show distributions of the SMR for male lung cancer by area in 1969–78 and in 1979–88. No clustering areas with the highest category of SMR were observed in metropoli-
tan zones such as Tokyo/Yokohama/Chiba, Nagoya, Osaka/Kobe and Fukuoka, but some clustered zones with low SMRs were seen in central Honshu island and in some areas in western Japan. Higher SMR areas were observed in villages and towns with small populations in Hokkaido and in the northern part of the Tohoku district, although they might be incidental. Many towns with small populations along the coast in Kyushu and in the northern part of Japan showed higher SMRs during the two periods. Some towns with mines showed a higher SMR for lung cancer. Comparing Fig. 1 and Fig. 2, no marked changes in the areal distribution of SMRs were demonstrated, but during these periods, the number of areas showing the highest SMRs (greater than 140) or the lowest SMRs (less than 59) decreased, whereas those of areas showing intermediate SMRs (80 – 119) increased. Thus, the areal differences in SMR became less the marked. This is supported by the fact that the mean value and standard deviation for the SMR are 92.1±37.5 in the earlier period and 95.8±29.3 in the latest period.

Fig. 3 shows the areal distribution of the changes of the SMR of lung cancer in male. It should be noted that changes in the SMR is, as stated in the method, a relative trend of areal SMR to the trend of nationwide SMR, and does not show the absolute trend. Fig. 4 shows the relationship between the changes in the SMR and the ratio of the SMR. The figure implies that lung cancer increased 42% during the period higher than the nationwide SMR. The absolute trend in SMRs, the ratio of SMR, between lines A and B is increasing as well as those above line B. Areas on the map with SMRs greater than 100 increased in number.

It may be seen from Fig. 3 that the changes in the SMR for male lung cancer differed considerably in each area during the earlier and the latter periods. No marked clustering of areas with increased or decreased change in the SMR was observed.
Tuberculosis

The mortality rate from tuberculosis decreased sharply after the Second World War, and the crude death rate per 100,000 population in 1988 was 3.0 for respiratory tuberculosis and 0.2 for other types. Fig. 5 shows that the death rates from tuberculosis were higher in Kyushu, Hokkaido and the northern part of the Tohoku district, whereas the areas in the middle and southern part of Tohoku, Kanto and the eastern part of Chubu districts were clustered with lower SMRs. Fig. 6 shows a similar distribution of SMRs compared to that in Fig. 5, except for Hokkaido. Many areas in metropolitan zones such as Osaka/Kobe and Fukuoka showed higher SMRs, but not in the Tokyo/Yokohama/Chiba zone. In general, it might be said that the SMR was higher in the west than in the east for the observation period. However, the number of areas showing the highest SMRs (more than 140) or the lowest SMRs (less than 59) increased, and areas showing intermediate SMRs (80 - 119) decreased between the two periods. Thus areal differences in SMRs in the latter period became more marked. In the earlier period 443 cities, towns, or villages had SMRs higher than 140 and 1022 had SMRs lower than 59; in the latter period, they were 468 and 1160, respectively. The number of areas in which the SMRs were less than 10 increased from 103 (earlier period) to 302 (latter period), and those with SMRs greater than 200 increased from 106 (earlier period) to 159 (latter period).

Fig. 7 shows the areal distribution of changes of SMR of tuberculosis for males. The nationwide ratio of SMRs decreased by 65% in the latter period.

Fig. 8 showed the relationship between the change of SMRs and the ratio of SMRs (1969-78/1977-88). It should be noted that absolute trend in SMRs between lines A and B is decreasing as well as those under line B. More remarkable changes of SMRs were seen for tuberculosis than for lung cancer.

![Figure 8](image)

Figure 8  Relation between changes in the SMR and the ratio of SMR
This increased in lung cancer mortality seems to be associated with a decrease in mortality from tuberculosis in many areas. Coglan, Cherry and others\textsuperscript{(3,4)} suggested that the decrease in tuberculosis mortality was compensated for by an increase in cancer mortality in a communities. Lung cancer deaths showed a close negative correlation to tuberculosis mortality.

In several countries including Japan, similar statistical correlations have been observed\textsuperscript{(5,6,7)}. Excess deaths from lung cancer among the tuberculosis patients who survived until the cancer-prone age also have been reported\textsuperscript{(5,7)}. Analyses of changing patterns of mortality from the two diseases in the studied areas may suggest some common causative factors.

\textbf{REFERENCES}