Comparison of Mortality Between Respondents and Non-Respondents in a Mail Survey

Hiroshi Une, Motonobu Miyazaki, and Yoshito Momose

We conducted a population-based mail survey and prospectively compared mortality between respondents and non-respondents. Age-adjusted mortality rates for all causes were higher among non-respondents than among respondents in both sexes. Age-adjusted rate ratios were 1.50 for males and 1.33 for females. Non-respondents also had, in both sexes, higher mortality for three leading causes of death, namely, cancer, heart diseases, and stroke than respondents. In particular, the difference between the two groups was much greater for cardiovascular disease than for cancer. Our results suggested that prospective studies using data from respondents to mail surveys in Japan would have underestimated the mortality for cardiovascular disease.

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mortality, mail survey, respondents, non-respondents

INTRODUCTION

In population based studies, mail surveys are often used to obtain information on present health status and lifestyle factors such as smoking and drinking, because this method involves less expense and labor. However, some papers have reported differences in health status, lifestyles and mortality between respondents and non-respondents, and suggested that this response bias could affect association between risk factors and diseases. We conducted a population-based mail survey to clarify the relationship between body mass index and mortality, and this offered an unique opportunity to compare mortality between respondents and non-respondents. In Japan, there have been few studies on difference in mortality between respondents and non-respondents. Our study might be able to provide valuable information for explaining results in population-based mail surveys.

MATERIALS AND METHODS

We conducted a mail survey in three towns in the western part of Japan during 1987-1989. This mail survey was performed in cooperation with a public health center. In the three towns, the population aged 40-69, which was identified from the municipal population register, was 9,907 males and 11,936 females. We mailed questionnaires of two pages to them, obtaining information on their medical histories, smoking habits, drinking habits, occupational histories and so on. There was no second mailing in cases of non-response. Of the 9,907 males and the 11,936 females, 5,769 males (58.2%) and 7,295 females (61.1%) responded to the questionnaires.

The follow-up period extended from the date of the mail survey to February 28th 1995. Emigrants were identified through the municipal population registers. We identified all deaths among respondents and non-respondents from death certificates. Causes of death were coded according to the 9th revision of the International Classification of Diseases (ICD9).

Age-adjusted mortality rates for selected causes were calculated with the direct method, using observed person-years by age (5 year interval) for both sexes as standard population, and compared respondents with non-respondents. Age-adjusted rate ratio and 95% confidence interval were computed with the Mantel-Haenszel method. The causes of death analyzed were cancer (ICD 140-208), heart diseases (ICD 393-398, 410-429) and stroke (ICD 430-438). The observed periods were

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35,749 person-years for male respondents, 24,935 person-years for male non-respondents, 46,164 person-years for female respondents, and 28,864 person-years for female non-respondents.

RESULTS

1. Response rate
Table 1 shows response rates according to age. The overall response rate was slightly higher in females (61.1%) than in males (58.2%). The response rates increased with age in both sexes; from 48.5% in the 40-49 age group to 72.6% in the 60-69 age group in males and from 52.6% in the 40-49 age group to 69.0% in the 60-69 age group in females.

2. Age-adjusted mortality rates and age-adjusted rate ratios for selected causes of death
Cancer, heart diseases and stroke are the three leading causes of death in Japan. Age-adjusted mortality rates for these three are shown in Table 2. Non-respondents had higher mortality rates than respondents for all causes and for each selected cause both in males and females. Age-adjusted rate ratios for all causes were significantly high in both sexes; 1.50 for males and 1.33 for females. The difference in cancer mortality was relatively small and not statistically significant; age-adjusted rate ratios for cancer were 1.14 for males and 1.24 for females. On the other hand, significantly high rate ratios were observed for heart diseases, stroke and other causes in males, and stroke in females.

3. Mortality rates and rate ratios for all causes of death according to age group
Table 3 shows mortality rates and rate ratios for all causes of death according to age groups in respondents and non-respondents.
Mortality rates for non-respondents were higher than those for respondents in every age group among males as well as females. Although rate ratios in the 40-49 age group and the 60-69 age group were higher than in the other age groups, there was no clear trend between rate ratios and age groups.

DISCUSSION
Mail surveys are a valuable tool in epidemiological studies

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**Table 1. Number of Respondents and Non-Respondents According to Age.**

<table>
<thead>
<tr>
<th>Age</th>
<th>Males</th>
<th>Females</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Respondents</td>
<td>Non-Respondents</td>
<td>Total %</td>
</tr>
<tr>
<td>40-49</td>
<td>1,789 (48.5)</td>
<td>1,897 (51.5)</td>
<td>3,686 (100)</td>
</tr>
<tr>
<td>50-59</td>
<td>1,935 (56.9)</td>
<td>1,468 (43.1)</td>
<td>3,403 (100)</td>
</tr>
<tr>
<td>60-69</td>
<td>2,045 (72.6)</td>
<td>773 (27.4)</td>
<td>2,818 (100)</td>
</tr>
<tr>
<td>Total</td>
<td>5,769 (58.2)</td>
<td>4,138 (41.8)</td>
<td>9,907 (100)</td>
</tr>
<tr>
<td></td>
<td>2,028 (52.6)</td>
<td>1,827 (47.4)</td>
<td>3,855 (100)</td>
</tr>
<tr>
<td>4,944</td>
<td>1,571 (38.6)</td>
<td>4,065 (100)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2,773 (69.0)</td>
<td>1,243 (31.0)</td>
<td>4,016 (100)</td>
</tr>
</tbody>
</table>

% in parentheses

**Table 2. Age-Adjusted Mortality Rates and Age-Adjusted Rate Ratios for Selected Causes of Death among Respondents and Non-Respondents.**

<table>
<thead>
<tr>
<th>Causes of Death</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age-Adjusted Mortality Rate</td>
<td>Age-Adjusted Rate Ratio (95% C.I.)</td>
<td>Age-Adjusted Mortality Rate</td>
</tr>
<tr>
<td>Respondents</td>
<td>Non-Respondents</td>
<td>Respondents</td>
</tr>
<tr>
<td>All Causes</td>
<td>1,061</td>
<td>1,612</td>
</tr>
<tr>
<td>All Cancers</td>
<td>527</td>
<td>591</td>
</tr>
<tr>
<td>Heart Diseases</td>
<td>124</td>
<td>265</td>
</tr>
<tr>
<td>Stroke</td>
<td>91</td>
<td>165</td>
</tr>
<tr>
<td>Other Causes</td>
<td>319</td>
<td>591</td>
</tr>
</tbody>
</table>

Mortality rate: per 100,000 person-years
C.I.: confidence interval
and are frequently used to clarify associations between exposures and diseases because they involve relatively little expense and labor. For example, US researchers have conducted a large-scale cohort study using mail questionnaires to examine the risk of various diseases among nurses who have in the past used oral contraceptives compared with risk among those who have never used them. This research, which is widely known, produced valuable results on adverse effects of contraceptives, and showed how useful mail surveys can be as a tool in epidemiological studies.

However, non-response in epidemiological studies causes selection bias that could lead to systematic error in estimating the prevalence of risk factors and disease. Caution is therefore required in generalizing results from analyses of the participation group to the total population studied. So it is important to observe differences between respondents and non-respondents in characteristics, morbidity and mortality. Macera et al found differences in characteristics and health status between respondents and non-respondents in a mail survey. The former had better health status and health practices, and smoked less than the latter.

Some studies (not using mail questionnaires) have compared mortality between participants and non-participants in community-based surveys with screening examinations which aimed mainly at clarifying risk factors for cardiovascular disease. Most studies showed that non-participants had higher total mortality than participants. Our results are in agreement with these studies and suggest that non-respondents tend to be less healthy than respondents. Because more non-respondents than respondents may have been ill at the beginning of the survey, we recalculated age-adjusted rate ratios for all causes of death between respondents and non-respondents, excluding data from the first two years of the study. As expected, the age-adjusted rate ratios decreased from 1.50 to 1.39 in males and from 1.33 to 1.15 in females. Walker et al reported that relative risk for non-participants was significantly higher in the first three years of their survey than thereafter.

In our study, non-respondents had higher mortality than respondents for the three leading causes of death: cancer, heart diseases and stroke. The above mentioned community-based surveys with screening examinations had similar findings. In particular, our study showed that the difference in mortality between non-respondents and respondents was much greater for cardiovascular disease than for cancer. Criqui et al reported that persons receiving active medical care had less incentive to respond to medical surveys. In Japan, there are more persons receiving medical care for cardiovascular disease than for cancer. They may be less likely to respond to mail surveys. This could be the reason why the rate ratio for cardiovascular disease was much higher than that for cancer. Our results suggested that prospective studies using data from respondents to mail surveys in Japan are likely to underestimate the mortality for cardiovascular disease. Attention must be paid to this bias when analyzing the results of mail surveys.

Our results were consistent with another Japanese study which reported that response rates among older persons were higher than among younger people. This may be because older persons tend to be more concerned about their health. Walker et al reported that the difference between participants and non-participants in mortality was most marked in the youngest age group. Because response rate increased with age, one might have expected that the rate ratio for all causes of death would decrease with age. In fact, however, although the rate ratio for all causes of death was relative high in the youngest age group of 40-49, no clear trend was observed between the rate ratio and age group in our study.

REFERENCES

4. Romieu I, Willett WC, Colditz GA. Prospective study of