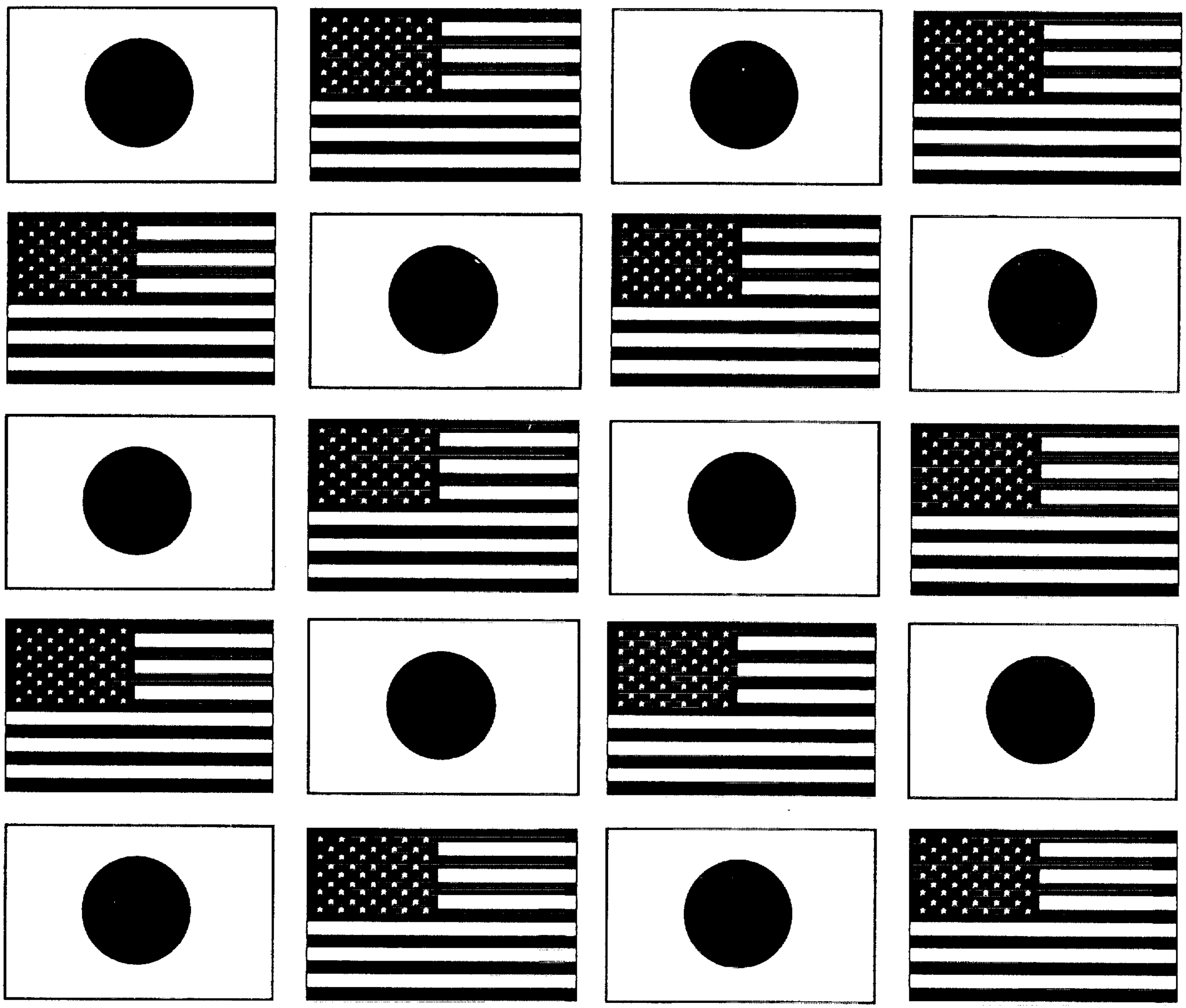
Wind and Seismic Effects

Proceedings of the 30th Joint Meeting

NIST SP 931



U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards and Technology

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NIST SP 931

PROCEEDINGS OF THE 30TH JOINT MEETING OF THE U.S.-JAPAN COOPERATIVE PROGRAM IN NATURAL RESOURCES PANEL ON WIND AND SEISMIC EFFECTS

Issued August 1998

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EARTHQUAKE ENGINEERING

Comparison between the affected populations of indirect health effects after the 1995 Great Hanshin-Awaji earthquake

by

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ABSTRACT

Indirect health effects (any kinds of health outcomes, not directly caused by the structural damages) after the earthquake have come to be the issue after the fatal earthquakes such as the 1995 Great Hanshin-Awaji earthquake. The investigations about the mortality and morbidity due to both direct and indirect health effects at the community level are required to identify the most effective countermeasures in the pre-impact and post impact phase.

As an example of indirect health effects, age-adjusted death rates of acute myocardial infarction were compared among several affected regions. In Nada, Higashi-Nada, Hyogo, Nagata districts in Kobe City we observed the sharp increase in the average death rates between January and March, 1995 in comparison with 1994 and 1996. Outside of Kobe City, the similar increase was observed in Amagasaki and Tsuna. The different patterns in the increase of rates between January and March, 1995 are suggestive of the multiple risk factors. The further investigation is required to identify the environmental factors (structural and non-structural) to reduce the total health outcomes.

KEYWORDS:
indirect health effects
age-adjusted death rate
acute myocardial infarction

1. INTRODUCTION

The first step in preventing adverse health outcomes would be to identify the risk factors and to establish the effective measures in adverse. There have been numerous reports regarding the human casualties directly caused by structural damage after the earthquake (Glass, 1977; de Bruycker, 1985; Coburn, 1987; Jones, 1990; Noji, 1990; Shiono, 1991b). Not only the death and injuries caused by the structural damages but also indirect health effects have also been reported (Logue,1978; 1979; 1980; 1981a; 1981b).

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For instance, it has been reported that the incidence of coronary heart disease increased after the disasters (Trichopoulos, 1983; Katsouyanni, 1986; Suzuki, 1995; Leor, 1996). Nevertheless, there are very few studies to describe the indirect health effects after the earthquake at the population level (Kloner, 1997).

Indirect health effects after the earthquake in this paper refers to as all the medical health consequences not directly caused by the structural damages. Description of the magnitude of indirect health effects and identification of their risk factors would lead us to better implementation of preventive measures after the disasters. For this purpose, we compared age-adjusted death rate of acute myocardial infarction (AMI) in Kobe and seven other cities in Hyogo Prefecture before and after the Great Hanshin-Awaji Earthquake.

2. SUBJECTS AND METHOD

The Great Hanshin-Awaji Earthquake hit the southern part of Hyogo Prefecture on 17 January, 1995. The epicenter was reported to be located on the northern tip of Awaji island. The magnitude was given at 7.2 on the Japan Meteorological Agency. We obtained all death certification data (n=127,474) at Hyogo Prefecture between 1994 and 1996 from the Vital Statistics Recording Office, Ministry of Health and Welfare, Japan. The data included data of death, age of death, sex, area code, date of death for each decedent, but did not include personal name or other identifier. We classified cause of death according to International Classification of Diseases, 9^{th} Revision (ICD-9) for 1994 and 10^{th} Revision (ICD-10) for 1995 and 1996. Age-adjusted death rates of AMI, as standardized to the model population of Japan in 1985, by month were calculated in all nine districts within Kobe City and seven cities in southern part at Hyogo Prefecture (Amagasaki, Nishinomiya, Sumoto, Ashiya, Itami, Takarazuka and Tsuna).

3. RESULT

Fig. 1 shows the age-adjusted death rate of AMI by month. Monthly trends of the age-adjusted death rate of AMI could be classified into two different patterns. One example was presented in Fig. 1A. It was the result in Nada district, Kobe City. Notable increase in the age-adjusted death rate was observed only in January, February and March, 1995. The other pattern was presented in Fig. 1B; Kita district, Kobe City. The death rates did not increase in January, February and March, 1995.

Fig. 2 summarizes the age-adjusted death rates of AMI at each region between January and March in 1994, 1995 and 1996, respectively. We compared the average rates between January and March in each year. The notable increase in the average death rate was observed in some regions such as East Nada, Nada, Hyogo and Nagata districts among Kobe City and Amagasaki and Tsuna. We could not observe uniform trend between men and female in each region.

Fig. 3 showed different patterns of the monthly trend of age-adjusted death rates of AMI from January to March, 1995. The peak in the death rates in

Nagata district in men and women was observed in January. .On the other hand, the peak in the death rates in Nada district was observed on February, one month later. In case of Ashiya in men, the peak was observed in March. The death rates in men in Tsuna showed two peaks in January and March. The trend in the death rates in Ashiya and Tsuna was different between men and women.

Table 1 showed the actual number of death of AMI according to the 17 regions. We compared the total number of death between January and March in each year. The number of death of AMI in 1995 was more than twice as that of 1994.

4. DISCUSSION

Our population based study showed excess mortality of AMI in some regions after Great Hanshin-Awaji earthquake. The pattern of the increase in death rates were different among the affected regions. Fig. 2 suggests us the need to measure the risk factors at the regional level for the causing inference. The different trend in death rates for the early recovery stage as shown in Fig. 3 are suggestive of the multiple risk factors to AMI.

Several cases reports about the increase in the incidence of ischemic heart diseases after the disasters have been reported (Faich, 1979; Trevisan, 1992). Although the mechanisms to increase the mortality and morbidity of cardiovascular diseases have still to be clarified, the stresses in the post-disaster period could be considered as a possible explanation (Bertazzi, 1989; Willich, 1993).

The following three points are possible explanation of the increase in death rates between January and March, 1995.

One possibility is due to the change of the classification of cause of death, namely from ICD-9 to ICD-10. It was recommended that we should put the exact cause of death on "heart failure" cases. This recommendation could possibly increase the death rate of AMI. The increase of death rates in our study, however, was limited between January and March, 1995. Therefore the monthly trend observed in our study could not be explained by the change of the classification.

The second possibility is due to the deterioration of hospital services by the structural and non-structural elements in the damage by the seismic activities with the same of the incidence of death rates. The increase of death rates could be explained by the increase of fatal rate. We are analyzing the relationship between the function loss in the hospital and prognosis of AMI patients.

The third possibility is the increase of the incidence of AMI. Actually the number of death of AMI from January to March, 1995 became the double of that of the same term, 1994. Considering the magnitude, the possibility cannot be denied.

Identification of the risk factors is mostly required. For this purpose, we are measuring "the inconvenience of daily life due to lifeline disruption" to analyze the relationships between them (Shiono,1989; 1991a).

The further research will be required to identify the additional possible environmental factors to influence the overall health outcomes on the affected populations.

5. CONCLUSION

The epidemiological research at the population level is essential to identify the risk factors for the health consequences after the catastrophic disasters which need the external assistance. The public health approach should be defined on the investigation about the magnitude of health outcomes on the affected population.

6. ACKNOWLEDGMENT

This study was supported in part by Grants-in-Aid for Scientific Research on Priority Areas from the Ministry of Education, Science and Culture of Japan (Grant No. 09234102).

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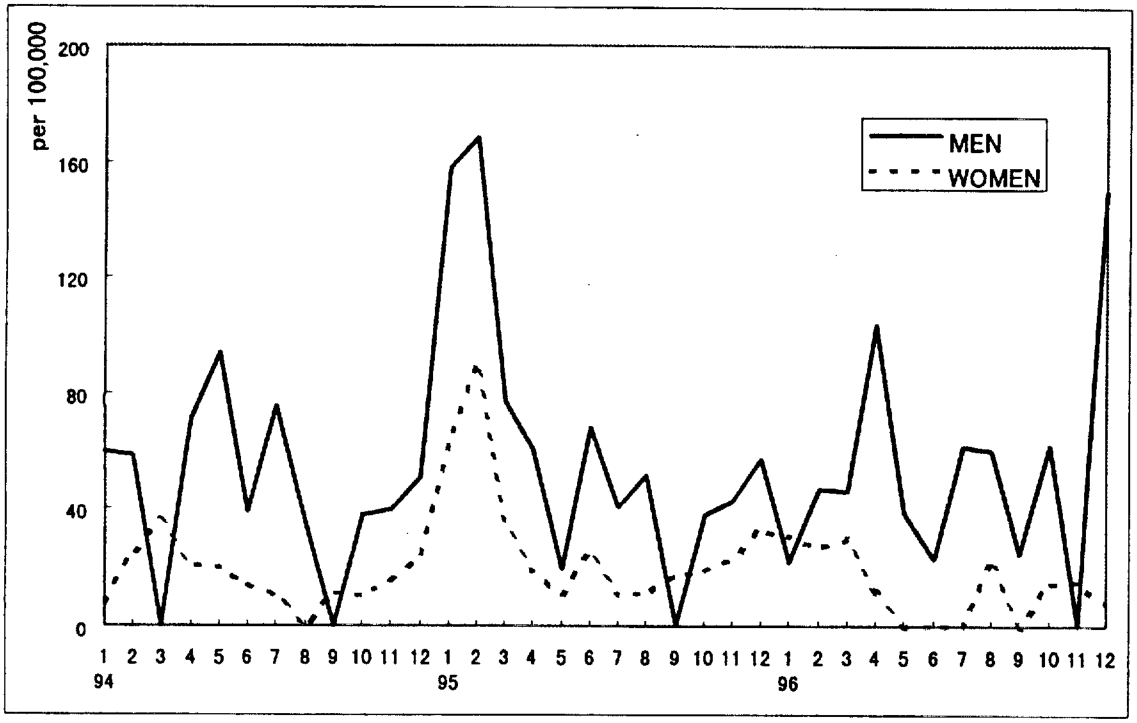

Fig. 1A Age-adjusted death rate of acute myocardial infarction by month in Nada district, Kobe City

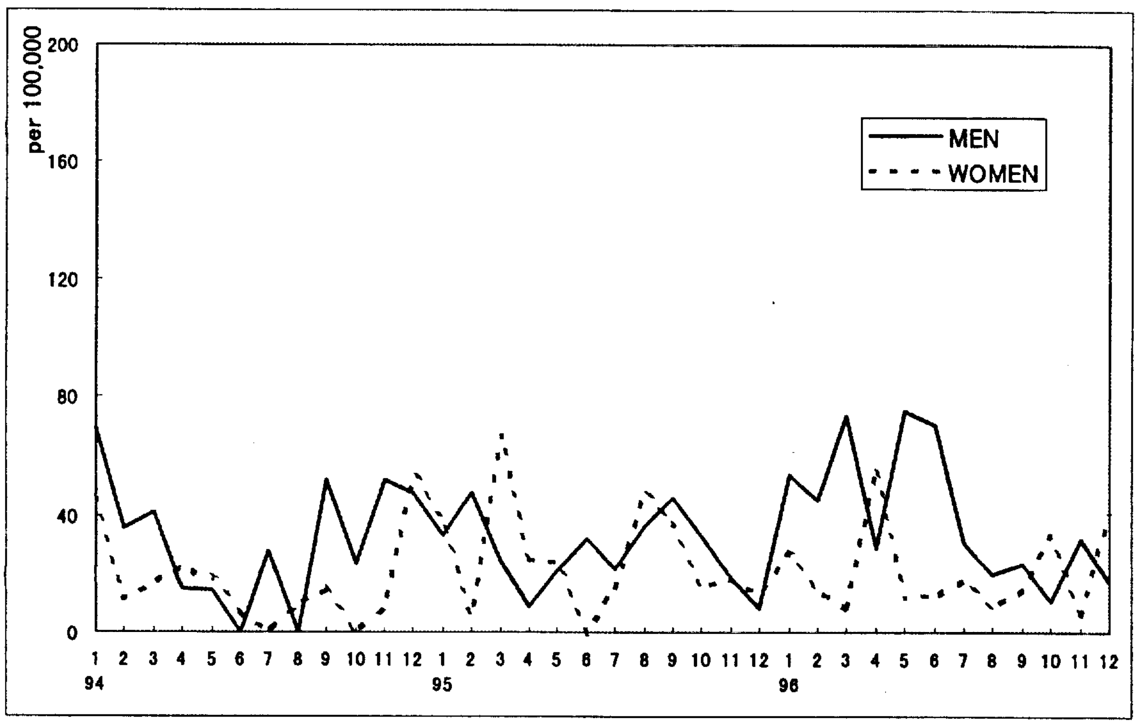

Fig. 1B Age-adjusted death rate of acute myocardial infarction by month in Kita district, Kobe City

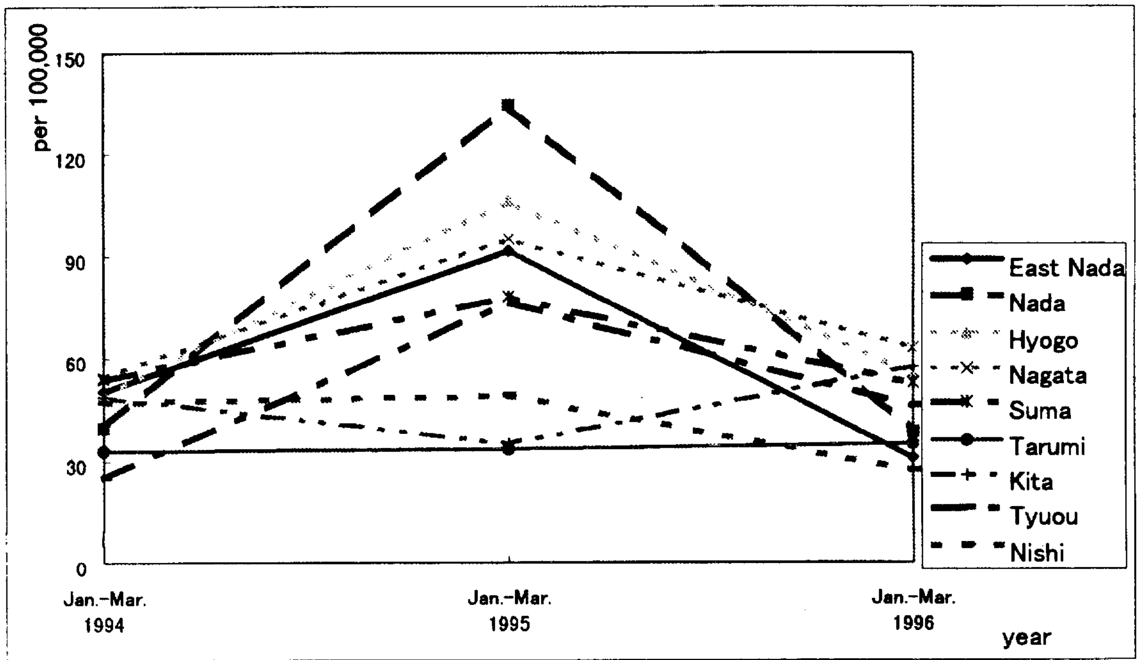

Fig. 2A Age-adjusted death rate of acute myocardial infarction according to the district of Kobe City in men #

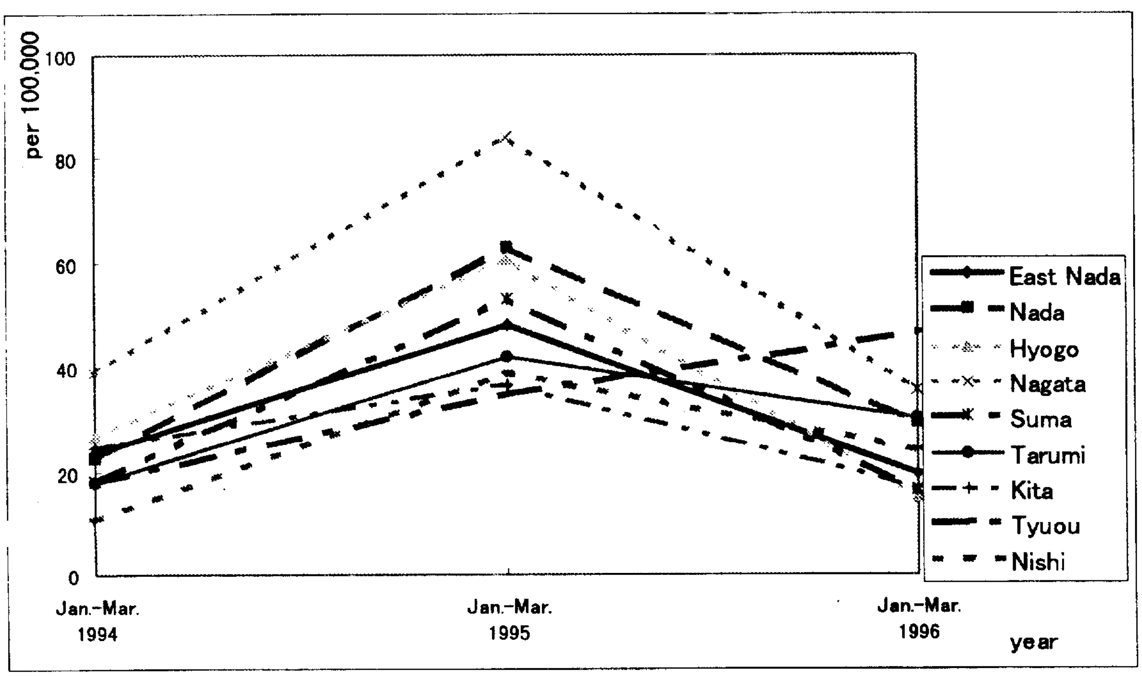

Fig. 2B Age-adjusted death rate of acute myocardial infarction according to the district of Kobe City in women #

The values are the average rates between January and March in each year

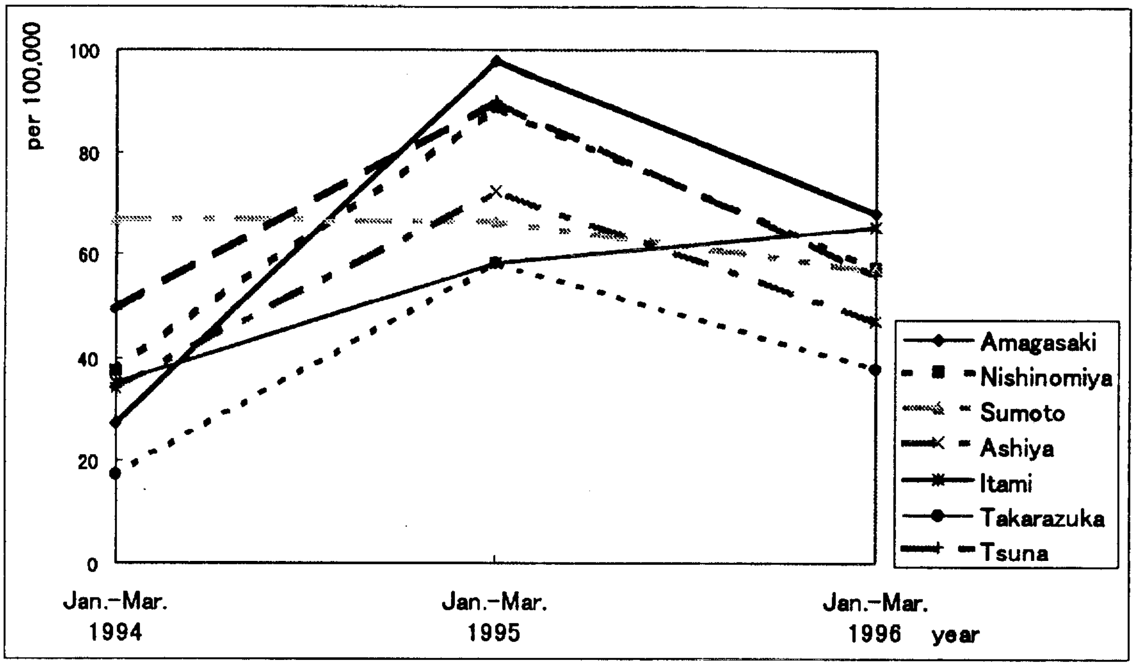

Fig. 2C Age-adjusted death rate of acute myocardial infarction according to the city of Hyogo Prefecture in men #

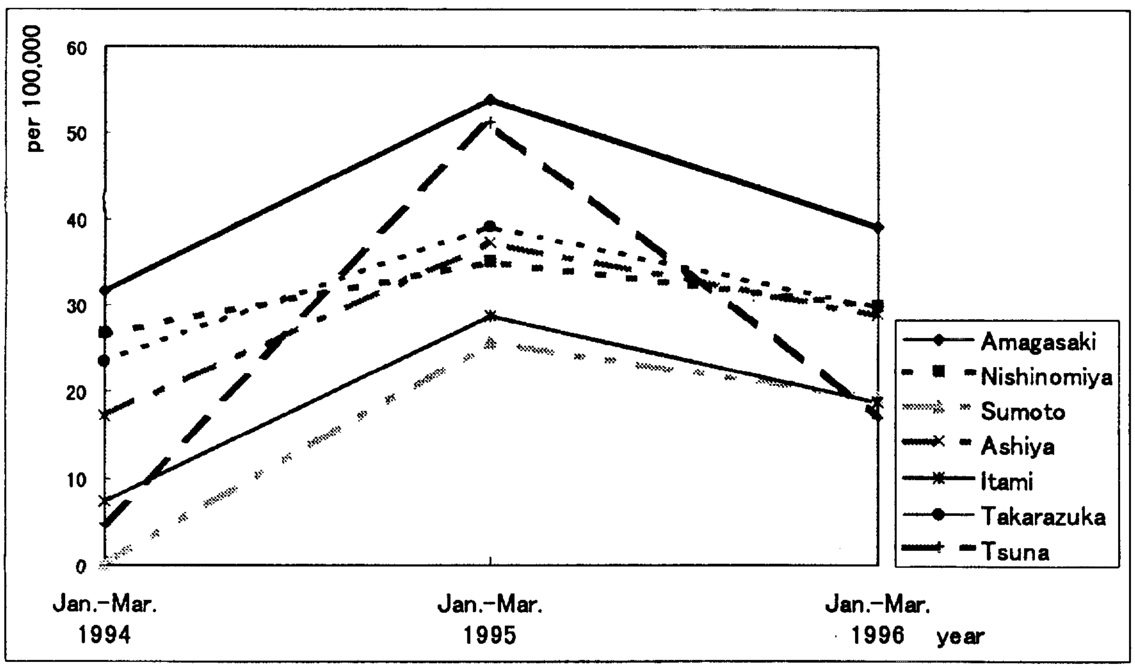

Fig. 2D Age-adjusted death rate of acute myocardial infarction according to the city of Hyogo Prefecture in women #

The values are the average rates between January and March in each year

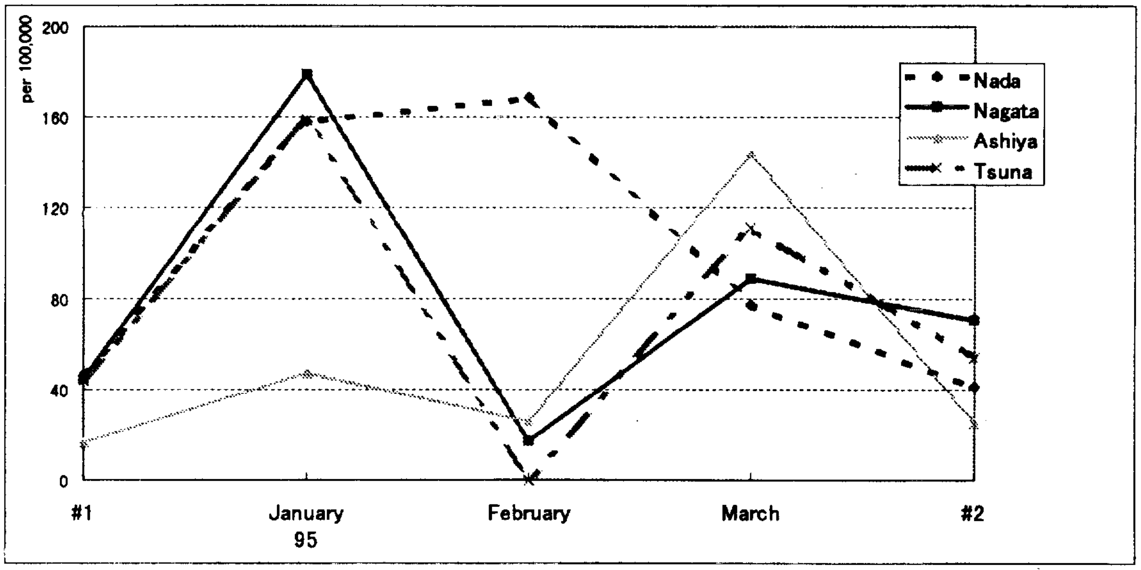

Fig. 3A Age-adjusted death rate of acute myocardial infarction in January, February, and March, 1995 in men

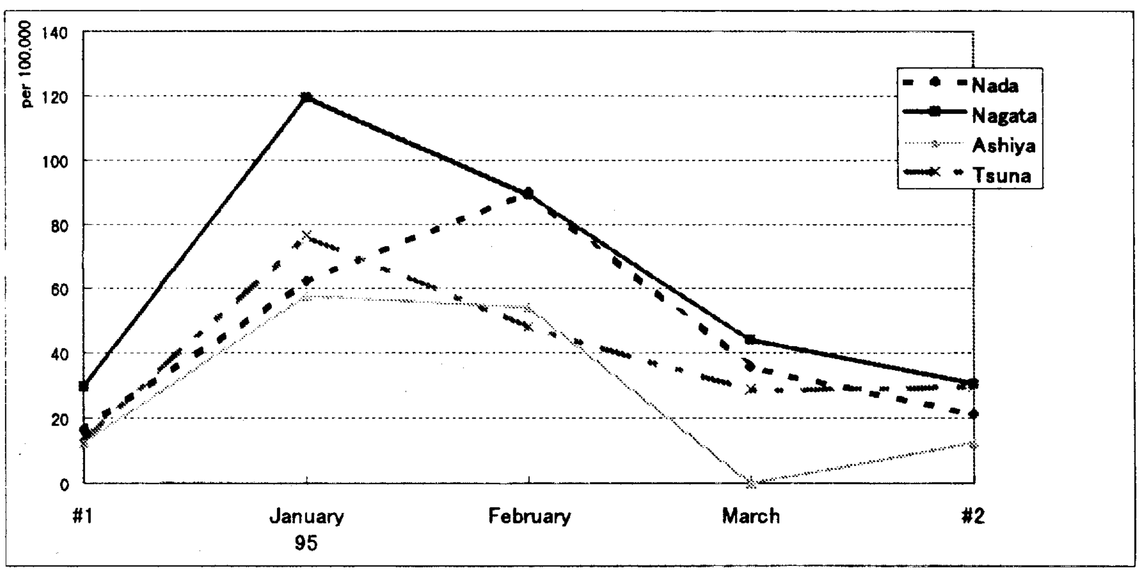

Fig. 3B Age-adjusted death rate of acute myocardial infarction in January, February, and March, 1995 in women

#1 The values are the average rates between January, 1994 and December, 1994.

#2 The values are the average rates between April, 1995 and March, 1996

Table1 Number of death of acute myocardial infarction between January and March in each year

REGION	NUMBER OF DEATH FOR THREE MONTH IN 1994	NUMBER OF DEATH FOR THREE MONTH IN 1995	NUMBER OF DEATH FOR THREE MONTH IN 1996
East Nada District, Kobe City	19	34	12
Nada District, Kobe City	11	35	11
Hyogo District, Kobe City	17	38	14
Nagata District, Kobe City	20	38	18
Suma District, Kobe City	16	33	17
Tarumi District, Kobe City	16	28	25
Kita District, Kobe City	23	24	24
Cyuou District, Kobe City	9	20	17
Nishi District, Kobe City	13	25	16
Amagasaki	44	105	80
Nishinomiya	39	69	51
Sumoto(Awaji island)	5	9	6
Ashiya	7	15	10
Itami	8	20	19
Takarazuka	12	28	20
Tsuna(Awaji islamd)	7	25	14
TOTAL	266	546	354