

# Combined Effects of Working Hours, Income, and Leisure Time on Suicide in All 47 Prefectures of Japan

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**Abstract:** This study describes an ecological study that evaluated the combined effects of working hours, income, and leisure time on suicide in all 47 prefectures of Japan. In men, the age-adjusted rate of suicide (per 100,000 population) was significantly correlated with working hours ( $r=0.587$ ,  $p<0.0001$ ) as well as significantly and negatively correlated with income ( $r=-0.517$ ,  $p=0.0002$ ) and times for the leisure activities of self-education ( $r=-0.447$ ,  $p=0.0016$ ) and hobbies ( $r=-0.511$ ,  $p=0.0002$ ). In addition, a stepwise multiple regression analysis identified time for leisure social activities as a determining factor in suicide rate, even after adjusting for working hours and income. However, the impact of time for leisure social activities on suicide rate was smaller than that of working hours and income. In contrast, none of these factors affected suicide rate in women. These results suggest that increasing leisure time may be useful for preventing suicide among men in Japan.

**Key words:** Ecological study, Income, Leisure time, Suicide, Working hours

Suicide is a major public health problem in Japan as well as around the world. In Japan, suicide accounted for 2.5% of all deaths in 2010, making it the seventh leading cause of death<sup>1</sup>). Suicide risk has been associated with several factors such as mental disorder, unemployment, and low income<sup>2</sup>). Furthermore, depression is an important risk factor for suicide. Several studies have reported that increasing leisure physical activity lowers the likelihood of depression<sup>3</sup>). However, studies have neither focused on the relationship between leisure time and suicide. In addition to suicide, during the economic recession in Japan, which started in the 1990s, unemployment rate has increased and overwork has become a serious problem. In this study, we focused on working hours and leisure time from a time

perspective and income from an economic perspective. We hypothesized that leisure time may significantly influence suicide, and we conducted an ecological study to assess the combined effects of working hours, income, and leisure time on suicide in all 47 prefectures of Japan.

The age-adjusted rate of suicide (per 100,000 population) in all 47 prefectures of Japan in 2010 was obtained from the Specified report of vital statistics, 2010, age-adjusted death rates by prefecture published on the official website of the Ministry of Health, Labour and Welfare (MHLW), Japan<sup>4</sup>). In addition, means of monthly total hours worked (working hours, hours per month) and monthly total cash earnings (income, yen per month) for establishments in all 47 prefectures of Japan with five or more employees in 2010 ( $N=44,145,100$ ) were obtained from the Monthly labour survey, 2010, published on the official MHLW website<sup>5</sup>). The daily average leisure time (minutes per day) for persons over 15 years of age in all

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**Table 1. Characteristics of men and women of all 47 prefectures of Japan**

|  | Mean $\pm$ SD           | Minimum   | Maximum   |
|--|-------------------------|-----------|-----------|
| Age-adjusted rate of suicide<br>(per 100,000 population) <sup>1)</sup> |                         |           |           |
| Men  | 31.3 $\pm$ 4.0          | 24.1      | 39.5      |
| Women  | 11.3 $\pm$ 1.4          | 8.0       | 16.1      |
| Working hours (hours per month) <sup>2)</sup>                          |                         |           |           |
|  | 149.0 $\pm$ 4.9         | 137.3     | 160.6     |
| Income (yen per month) <sup>2)</sup>                                   |                         |           |           |
|  | 289,111.0 $\pm$ 28281.0 | 238,346.0 | 414,539.0 |
| Leisure activity (minutes per day) <sup>3)</sup>                       |                         |           |           |
| Men (n=156,364)  |                         |           |           |
| Passive leisure  | 157.2 $\pm$ 9.5         | 134.0     | 176.0     |
| Self-education   | 10.5 $\pm$ 2.6          | 6.0       | 18.0      |
| Hobbies  | 50.8 $\pm$ 4.1          | 40.0      | 60.0      |
| Sports   | 15.5 $\pm$ 1.9          | 11.0      | 20.0      |
| Social activities  | 4.8 $\pm$ 1.7           | 2.0       | 11.0      |
| Total *  | 400.0 $\pm$ 11.5        | 379.0     | 426.0     |
| Women (n=175,819)  |                         |           |           |
| Passive leisure  | 147.6 $\pm$ 8.4         | 130.0     | 168.0     |
| Self-education   | 9.0 $\pm$ 1.8           | 6.0       | 13.0      |
| Hobbies  | 34.3 $\pm$ 3.7          | 26.0      | 42.0      |
| Sports   | 8.9 $\pm$ 1.6           | 5.0       | 12.0      |
| Social activities  | 4.1 $\pm$ 1.1           | 2.0       | 7.0       |
| Total *  | 374.2 $\pm$ 8.6         | 357.0     | 404.0     |

n=47. \* Total activity time includes all time except physiologically necessary time (such as sleep, personal care and meals) and obligatory time (such as work, housework and child care), which corresponds to what is usually called "free time". Sources: 1) Specified report of vital statistics, 2010, age-adjusted death rates by prefecture, Japan Ministry of Health, Labour and Welfare. 2) Monthly labour survey, 2010 (N=44,145,100), Japan Ministry of Health, Labour and Welfare. 3) Survey on time use and leisure activities, 2011, time use for prefectures (N=332,183), Japan Ministry of Internal Affairs and Communications. Gender-segregated data on the age-adjusted rate of suicide and leisure time were available from the sources, whereas those on working hours and income were not.

47 prefectures of Japan in 2011 (N=332,183) was obtained from the Survey on time use and leisure activities, 2011, time use for prefectures published on the official website of the Ministry of Internal Affairs and Communications, Japan<sup>6)</sup>. The number of samples from each prefecture was listed in each data source. These data from each prefecture (each n=47) obtained from data sources were used in this study. Gender-segregated data on the age-adjusted rate of suicide and leisure time were available from the sources, whereas those on working hours and income were not. In this study, the categories of leisure activities included the following: passive leisure (watching TV, listening to the radio, and reading newspapers or magazines), self-education (learning, self-education, and training (excluding schoolwork)), hobbies (hobbies and amusements), sports, and social activities (volunteer and social activities). Vol-

unteer activities referred to the activities that were mainly performed for the sake of society, and included such activities as cleaning roads and parks, visits to welfare homes, procurement of relief supplies for disaster areas, daily life assistance to the elderly, guiding at an art museum, and traffic safety campaigns. Social activities included such activities as labor movements, political activities, missionary work, and voting in an election.

Simple and multiple regression analyses were performed, and a multiple regression analysis was adopted to identify the primary factors influencing suicide rate. The independent variables included working hours, income, and times for each leisure activity. The variables were entered into the regression model in a stepwise fashion;  $p < 0.05$  was considered statistically significant. The variance inflation factor (VIF) was used to assess multicollinearity.

**Table 2. Correlation of the age-adjusted rate of suicide with variables**

| Variables                          | Men                                  |                 | Women                                |                 |
|------------------------------------|--------------------------------------|-----------------|--------------------------------------|-----------------|
|                                    | Correlation coefficient ( <i>r</i> ) | <i>p</i> -value | Correlation coefficient ( <i>r</i> ) | <i>p</i> -value |
| Working hours (hours per month)    | 0.587                                | < 0.0001        | 0.134                                | 0.3683          |
| Income (yen per month)             | -0.517                               | 0.0002          | -0.176                               | 0.2359          |
| Leisure activity (minutes per day) |                                      |                 |                                      |                 |
| Passive leisure                    | 0.245                                | 0.0966          | 0.012                                | 0.9377          |
| Self-education                     | -0.447                               | 0.0016          | 0.060                                | 0.6907          |
| Hobbies                            | -0.511                               | 0.0002          | -0.216                               | 0.1445          |
| Sports                             | -0.094                               | 0.5302          | -0.076                               | 0.6105          |
| Social activities                  | -0.022                               | 0.8852          | -0.023                               | 0.8789          |
| Total                              | -0.048                               | 0.7482          | -0.062                               | 0.6769          |

n=47

Characteristics of the subject group are summarized in Table 1. The mean of the age-adjusted rate of suicide (per 100,000 population) for men and women was  $31.3 \pm 4.0$  and  $11.3 \pm 1.4$ , respectively. A simple regression analysis indicated that suicide rate for men was significantly correlated with working hours ( $r=0.587$ ,  $p<0.0001$ ) as well as significantly and negatively correlated with income ( $r=-0.517$ ,  $p=0.0002$ ) and times for the leisure activities of self-education ( $r=-0.447$ ,  $p=0.0016$ ) and hobbies ( $r=-0.511$ ,  $p=0.0002$ ). In contrast, the suicide rate in women was not significantly correlated with any of the variables (Table 2). Table 3 displays the results of the multiple regression analysis of suicide rate in men and each factor. Working hours, income, and time for leisure social activities were significantly associated with suicide rate. The standardized partial regression coefficients ( $\beta$ ) were 0.539 for working hours ( $p<0.0001$ ),  $-0.375$  for income ( $p=0.0019$ ), and  $-0.250$  for time for leisure social activities ( $p=0.0307$ ). The multiple correlation coefficient adjusted for the degrees of freedom (adjusted  $R^2$ ) was 0.482 ( $F=15.262$ ,  $p<0.0001$ ). VIF values for all variables were  $<2$ , indicating the absence of multicollinearity among the independent variables. In women, none of the factors affected suicide rate (data not shown).

Our study led to three main findings: a) the age-adjusted rate of suicide in men was significantly correlated with working hours and negatively correlated with income and b) after adjustment of working hours and income, time for leisure social activities was a determining factor in suicide rate in men. c) In women, none of the factors affected suicide rate.

Amagasa *et al.* hypothesized that long working hours may cause depression, which can lead to suicide<sup>7)</sup>. Our results support their hypothesis. On the other hand, Fujino

*et al.* reported that there were no consistent results linking working hours and mental health burden<sup>8)</sup>. The subjects enrolled in many previous studies were specific populations that belonged to the same company and/or the same job group with apparently similar characteristics. The mental health burden seemed to be influenced not only by working hours, but also by description of their job groups. In this ecological study, the original data were obtained from various industrial employees from all 47 prefectures of Japan and were averaged. In addition, the maximum of working hours was 160.6 h per month. Therefore, the differences in the various characteristics of this original group were considered as one of the possible causes of the inconsistent results obtained. Moreover, our results may provide the overall characteristics of the relationship between working hours and suicide in Japan. Further research is needed to assess the relationship between working hours, job description, depression, and suicide.

In a related study, Qin *et al.* reported that low income was strongly associated with suicide risk<sup>2)</sup>. McMillan *et al.* found significantly higher levels of suicidal ideation and suicide attempts among low-income groups than among high-income groups<sup>9)</sup>. Our results agree with their findings, suggesting that low income might be a significant risk factor for suicide.

In this study, no correlation was observed between suicide rate in men and time for leisure sports, which refers to leisure with physical activity, as assessed using a simple regression analysis. However, a multiple regression analysis with various factors indicated that time for leisure social activities was related to suicide rate. Therefore, these results suggest that active leisure, rather than passive leisure, has a large impact on suicide rate. Even after

**Table 3. Multiple regression analysis for the influential variable of the age-adjusted rate of suicide for men**

| Variables                           | Standardized partial regression coefficient ( $\beta$ ) | <i>p</i> -value | Variance inflation factor (VIF) |
|-------------------------------------|---|-----------------|---------------------------------|
| Working hours (hours per month)     | 0.539   | < 0.0001        | 1.22                            |
| Income (yen per month)              | -0.375  | 0.0019          | 1.13                            |
| Social activities (minutes per day) | -0.250  | 0.0307          | 1.11                            |
| Adjusted R <sup>2</sup>             | 0.482   |                 |                                 |
| F-value                             | 15.262  |                 |                                 |
| <i>p</i> -value                     | < 0.0001  |                 |                                 |

n=47

adjusting for working hours and income, time for leisure social activities predicted a significant variance in suicide rate in the multiple regression analysis. However, a comparison of the  $\beta$  values suggested that the effect of time for leisure social activities on suicide rate was smaller than that of working hours and income. From these results, we concluded that a decrease in working hours and an increase in income are essential for preventing suicide. In addition, an increase in leisure time may result in a more beneficial effect. Wada *et al.* reported that depressive symptoms were associated with a lack of regular leisure activity with or without physical activity<sup>10</sup>. Recently, Suzuki *et al.* showed that the recognition about leisure was significantly and negatively correlated with depressive symptoms<sup>11</sup>. Our results support their findings. In women, we did not find any factors that were associated with suicide rate. Therefore, suicide among women may be affected by other factors, such as family status and gender roles, and is a subject for our future research.

As this was an ecological study, it has potential limitations. First, the link between suicide and working hours, income, and leisure time may not apply for all individuals. Second, the effects of several confounding factors (*i.e.*, economic, medical, and personal and interpersonal factors, such as tolerance, educational background, and sociability) and their interactions were not evaluated in this study. Third, we were unable to obtain gender-segregated data regarding working hours and income from data sources. These limitations may have induced inaccurate results, and further research is needed to more accurately assess factors related to suicide.

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