

The final structural equation model (figure 2) along with the results of multiple logistic regression analysis revealed the individual and neighbourhood factors that may directly or indirectly affect help-seeking decision-making. The neighbourhood factors showed a relatively modest but significant effect compared to the individual factors. These results support the expectation that neighbourhood context, or more specifically neighbourhood social capital, may exert influence on help-seeking for mental illness, as it does on other health behaviours.⁷ Moreover, the significant positive effect of communicative neighbourhood seems to confirm the power of daily interactions with weak ties.²³ People who often interact with weak ties are more likely to have a sense of belonging and thus less likely to hesitate to seek help from people around them. Creating a neighbourhood with a communicative atmosphere may be worth considering as a possible public health strategy for encouraging help-seeking.

In the multiple logistic regression analysis, the highest ORs for informal and formal help intentions were found in tendency to consult about everyday affairs and perceived effectiveness of professional help, respectively. In the path analysis, tendency to consult about everyday affairs and health literacy were represented as a key player in help-seeking decision-making. Tendency to consult about everyday affairs seems to depend largely on personality, so that it may be difficult to achieve drastic changes in this factor using a public health approach. In contrast, health literacy skills can be developed through community-based educational outreach.²⁴ Improved health literacy will contribute to a better understanding of the effectiveness of professional help, which will increase the probability of formal help-seeking.¹² Developing health literacy skills may be worth considering as another possible public health strategy for encouraging help-seeking.

The multiple logistic regression analysis showed no significant association between sociodemographics and help-seeking intentions, except between marital status and informal help-seeking intention. Meanwhile, the path analysis showed that male gender, older age, unmarried status, lower education and lower income were associated with decreased likelihoods of help-seeking intentions through their effects on tendency to consult about everyday affairs and health literacy. More attention should be paid to these high-risk groups when implementing public health strategies for encouraging help-seeking.

This study provides the first step towards understanding the role of neighbourhood in the help-seeking process; however, it has a number of potential limitations. First, the study participants were recruited from a nationwide panel of an online research company. As described in the Methods section, the study participants included twice as many highly educated people as in the Japanese population. Although we confirmed that the distribution of HLS-14 scores in the study participants

was quite similar to that obtained from our previous paper-based survey in Japanese healthcare facilities,²⁵ the selection bias may have influenced the results to some extent. Second, the method of measuring help-seeking intentions was based on the most commonly used methodology,⁹ but its validity has not been confirmed yet. Participants were asked to imagine themselves with serious mental illness and then report their help-seeking intentions. Because no detailed description was given, their answers depended on how they imagined the severity of the condition. Previous studies suggested that the probability of formal help-seeking for mental illness depends on severity of illness.^{18 26 27} The percentages of informal and formal help-seeking intentions, and the magnitude of individual and neighbourhood factors, may vary with different severity assumptions. Third, although the final structural equation model revealed an acceptable fit to the data, it still leaves room for further improvement. The HLS-14 and the LSNS-6 were validated in Japanese people,^{11 14} but the other instruments used in the survey were not. Neighbourhood physical environments such as population density and healthcare resources, which can affect mental health,²² were not included in the analysis. Fourth, the study design is cross-sectional and self-reported, so we cannot reject the possibility of reverse causation or common method bias. Further studies are needed to provide definitive evidence for the role of neighbourhood in the help-seeking process and to elucidate in more detail multifactorial mechanisms for help-seeking. Moreover, the relationship between help-seeking intentions and actual help-seeking should be investigated in future.

CONCLUSION

Help-seeking intentions for mental illness were directly associated with neighbourhood context as well as individual characteristics. Especially note that living in a communicative neighbourhood and having adequate health literacy were acknowledged as possible facilitating factors for both informal and formal help-seeking for mental illness. The effectiveness of efforts to increase help-seeking may be limited if only interventions targeted to individual factors are implemented. It may be worth attempting to incorporate community-based interventions for creating a neighbourhood with a communicative atmosphere and those for developing health literacy skills into public health strategies for encouraging help-seeking or suicide prevention policies.

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Competing interests None declared.



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Relationship between individual characteristics, neighbourhood contexts and help-seeking intentions for mental illness

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Original article

History of diabetes and risk of suicide and accidental death in Japan: The Japan Public Health Centre-based Prospective Study, 1990–2012

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Abstract

Aim. – This study looked at whether a history of diabetes mellitus (DM) is associated with a higher risk of externally caused death (by suicide and accident), using data for a large population-based prospective cohort from an Asian population.

Methods. – Data collected between 1990 and 2012 from the Japan Public Health Centre-based Prospective Study were analyzed, and Poisson regression models were used to calculate adjusted risk ratios (RR) for external causes of death.

Results. – The population-based cohort comprised 105,408 Japanese residents (49,484 men and 55,924 women; mean age: 51.2 [SD 7.9] years). At baseline, 3250 (6.6%) men and 1648 (3.0%) women had a history of DM. During the follow-up period, 113 external deaths (41 suicides and 72 accidents) were noted among those with a history of DM, with 1304 external deaths (577 suicides and 727 accidents) among those without such a history. A higher risk of external death (men, RR: 1.4, 95% CI: 1.2–1.8; women, RR: 1.6, 95% CI: 1.01–2.4) was observed in those with a history of DM. Also, among those aged 40–49 years (RR: 1.9, 95% CI: 1.3–2.7) and 50–59 years (RR: 1.4, 95% CI: 1.05–1.9) at baseline, the risk of external death was significantly higher in those with a history of DM.

Conclusion. – Compared with people with no history of DM, those with such a history had a significantly greater risk of externally caused death (particularly accidental deaths) in both genders and in those aged ≤ 59 years at baseline.

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Keywords: Accidents; Asian population; Cohort studies; Diabetes mellitus; Prospective studies; Suicide

1. Introduction

Diabetes mellitus (DM) has become a serious worldwide public health problem [1]. In particular, the prevalence of type 2 diabetes has reached epidemic levels in Asia [2]. Epidemiological studies indicate that people with a history of DM may face a higher risk of premature death [3] or external causes of death,

the latter of which may include suicide and accidents [4–9]. The higher risk of suicide may be due to mental distress and impairment of physical and/or cognitive functioning due to DM-related conditions such as cardiovascular disease, nerve damage, kidney disease and eye disease [10]. DM is also associated with a higher risk of death by accident. Physical disabilities, such as decreased physical/cognitive capacities and impaired vision [7], and mental distress, particularly depression [11], may also increase the risk of accidental death among those with a history of DM.

In addition, physical/cognitive impairment and mental distress may be behind the factors affecting the risk of external death in those with DM. Previous studies have suggested that the risk

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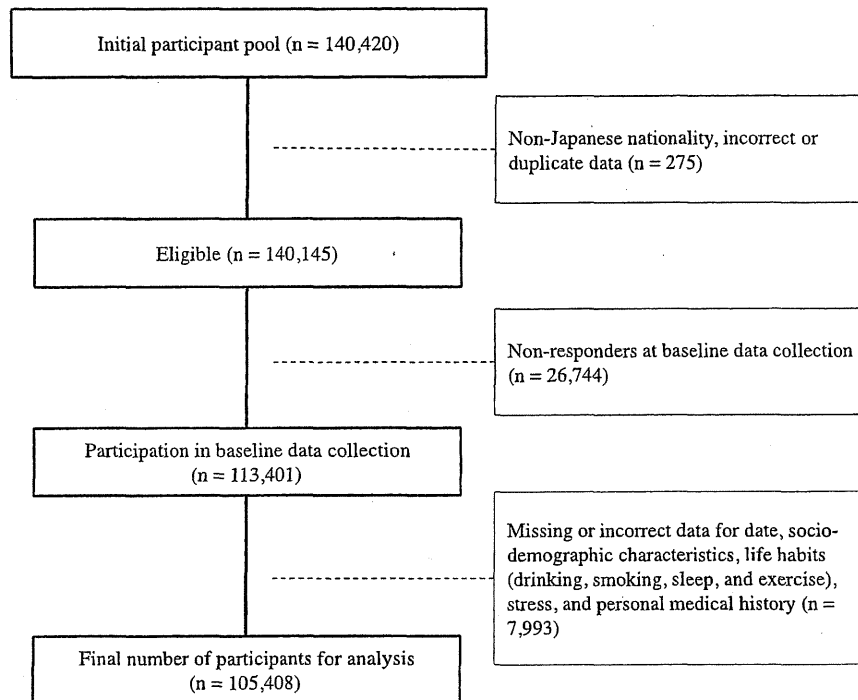


Fig. 1. Flow diagram used to select the study cohort participants.

factors for suicide and accidental death may overlap somewhat [12]. However, to our knowledge, only a few large population-based cohort studies have examined the association between DM history and the risk of external causes of death in Western countries [4,5,9], whereas no population-based prospective study has done so in an Asian population, within which both DM [2] and external causes of death, especially suicide [13], have become major public health issues.

Thus, in the present study, the aim was to examine whether a history of DM is associated with a higher risk of externally caused death (by suicide or accident), using data from the Japan Public Health Centre-based Prospective Study (JPHC Study) [14,15], a multipurpose population-based prospective cohort study that aimed to clarify the risk as well as protective factors associated with various outcomes, including externally caused death.

2. Material and methods

2.1. Study design

In collaboration with nationwide public health centres, the National Cancer Centre, National Cardiovascular Centre and other institutions in Japan, the JPHC Study was initiated in 1990 for Cohort I and 1993 for Cohort II. All residents aged 40–59 years in Cohort I, and those aged 40–69 years in Cohort II, residing in 11 public health centre areas at the time of recruitment were selected as potential participants, resulting in a total of 140,420 residents (68,722 men and 71,698 women), of whom 140,145 were eligible for the present study (Fig. 1). Public health centre areas were selected with due consideration of variations

in mortality rate, geographical distribution and feasibility. The study design has been described in detail elsewhere [14,15].

The study protocol was approved by the Institutional Review Board (IRB) of the National Cancer Centre in Tokyo, Japan, and also by the IRB of the National Centre of Neurology and Psychiatry in Tokyo.

2.2. Baseline survey

A self-administered questionnaire was distributed to all registered residents at baseline to obtain information regarding sociodemographic characteristics; lifestyle habits, including drinking, smoking, hours of sleep, frequency of physical exercise and level of stress; and personal medical history. The questionnaire was distributed mostly by hand (with some sent by post to participants) in 1990 for Cohort I and in 1993 for Cohort II. Incomplete answers were supplemented by telephone interviews. Details of the baseline survey have been reported previously [14]. Of the 140,145 eligible individuals, 113,401 (53,351 men and 60,050 women) responded to the questionnaire at baseline (response rate: 81.0%). Those who completed the baseline questionnaire, which described the purpose and follow-up methods of the JPHC Study, were considered to also have provided their consent to participate in the study.

2.3. Assessment of diabetes mellitus

Information regarding the patient's history of DM, as well as of cancer, stroke and ischaemic heart disease, was obtained in the baseline survey by the following two questions:

- 'has a doctor ever told you that you have any of the following diseases? – diabetes mellitus (Yes/No)';
- 'do you take any antidiabetic drugs? (Yes/No)'.

Consistent with a previous study [16], a 'Yes' response to either question was interpreted to mean that the participant had a history of DM.

Previously, our group reported that the sensitivity and specificity of DM diagnoses were 82.9% and 99.7%, respectively [17], and that the results of the baseline survey for history of illness, lifestyle habits and social background generally corresponded to the geographical characteristics/profiles of people living in Japan [18].

2.4. Follow-up

Study participants were followed until the earliest of any of the following events occurred: date of death; date of moving out of Japan; or 31 December 2012 (the end of the study period). Participants who were lost to follow-up were censored at the last confirmed date of their presence in the study area.

The residential registry in each public health centre area was reviewed annually to obtain information on changes in residence status. The public health centres reported all changes from the original addresses to the JPHC Study Group by referrals to the appropriate local governments. In Japan, the Basic Resident Registration Act requires registration of residency, and a residential registry is maintained by the municipality responsible for each study area.

Information as to cause of death was obtained from death certificates with the permission of the Ministry of Health, Labour and Welfare. The cause of death was defined according to the *International Classification of Diseases, 10th Revision (ICD-10)*.

2.5. Incidence of suicidal and accidental deaths

Death by suicide was defined according to the ICD-10 codes X60–X84. As with previous epidemiological studies [4], to reduce the chances of false-negative misclassification, events of undetermined intent (ICD-10 codes Y10–Y34) were included in the definition of suicide. Accidental death was defined by ICD-10 codes V01–X59.

Death registrations are mandatory in Japan, and death certificates must be filed by a physician. The verdict of an external cause of death is based on the results of medicolegal examinations by licensed physicians and police investigations; this system did not change throughout the study period. Thus, the mortality data used in the JPHC Study are considered sufficient in terms of quality and completeness.

2.6. Statistical analysis

The outcome measure of our study was defined as the number of externally caused deaths (by suicide and accident) during the study period. Unadjusted incidence rates (number of outcomes divided by accumulated person-years) of such external deaths

were calculated for those with and without a history of DM. To calculate the risk ratios (RRs) and 95% confidence intervals (95% CIs) of external deaths for those with a history of DM compared with those with no such history, Poisson regression analyses using the number of overall externally caused deaths, and the number of suicidal and accidental deaths as dependent variables, were carried out, using SAS software for the GENMOD procedure. Poisson regression models were fitted to the data with a log-link function, and the models offset by the log of person-years of observation in the cohort. The Poisson regression models were adjusted for gender, age at study entry (40–49, 50–59 or 60+ years), public health centre area, smoking status (never smoker, past smoker or current smoker of either <30 or ≥30 cigarettes/day), alcohol-drinking habits [non-drinker, occasional drinker (1–3 days/month) or regular drinker (1–2 days/week or more) of either <300 or ≥300 g ethanol/week], body mass index (BMI; <18.5, 18.5–25.0 or >25.0 kg/m²), cohabitation (yes or no), employment status (employed or unemployed, including those not in the labour force, such as homemakers), hours of sleep (<5 h, 5–10 h or >10 h), frequency of physical exercise (either 'no exercise' or '1 day/week or more'), level of stress (little, moderate or much), and medical history of cancer, stroke and ischaemic heart disease. In the Poisson regressions, RRs were estimated by gender (Table 2) and by age group (40–49, 50–59 or 60+ years; Table 3).

All analyses were conducted using SAS version 9.4 software (SAS Institute, Cary, NC, USA).

3. Results

Of the 113,401 individuals who responded to the questionnaire at baseline, 7993 had missing or incorrect data regarding dates, sociodemographic characteristics, lifestyle habits, BMI, stress and personal medical histories, and were excluded from the study. Thus, a final population-based cohort of 105,408 Japanese residents [49,484 men and 55,924 women; mean age: 51.2 (SD 7.9) years] was included in the analysis (Fig. 1). During the follow-up period, 18,887 (17.9%) died due to various causes, 89 (0.1%) moved out of Japan and 946 (0.9%) were lost to follow-up. Table 1 summarizes the baseline characteristics of the participants included in the analyses. At baseline, 3250 (6.6%) men and 1648 (3.0%) women had a history of DM.

During the follow-up period (Table 2), among the men, 91 cases of external causes of death (33 suicides and 58 accidents) were identified in those with a history of DM, with 913 cases of external deaths (410 suicides and 503 accidents) in those without a DM history. A higher risk of death from both external causes (RR: 1.4, 95% CI: 1.2–1.8) and accidents (RR: 1.6, 95% CI: 1.2–2.1) were observed among those with a history of DM compared with those without such a history.

For the women (Table 2), there were 22 cases of external deaths (8 suicides and 14 accidents) among those with a history of DM, and 391 cases of externally caused deaths (167 suicides and 224 accidents) among those without such a history during follow-up. Consistent with the risk of overall external causes

Table 1
Baseline characteristics of study participants.

	Men				Women			
	No diabetes		Diabetes		No diabetes		Diabetes	
	n	%	n	%	n	%	n	%
Participants, n	46,234		3250		54,276		1648	
Total person-years	878,150.8	–	55,466.0	–	1,082,400.0	–	30,251.9	–
Age, mean (SD)	50.9 (7.9)	–	53.9 (7.6)	–	51.2 (7.9)	–	55.6 (7.7)	–
Smoking status (%)								
Never smoker	10,738	23.2	646	19.9	49,129	90.5	1456	88.4
Past smoker	11,062	23.9	869	26.7	1040	1.9	54	3.3
Current smoker (<30 cigarettes/day)	16,948	36.7	1169	36.0	3801	7.0	124	7.5
Current smoker (≥30 cigarettes/day)	7486	16.2	566	17.4	306	0.6	14	0.9
Alcohol-drinking (%)								
Non-drinker	10,183	22.0	885	27.2	40,546	74.7	1379	83.7
Occasional drinker	4094	8.9	271	8.3	5781	10.7	107	6.5
Regular drinker (<300 g ethanol/week)	19,401	42.0	1380	42.5	6179	11.4	122	7.4
Regular drinker (≥300 g ethanol/week)	12,556	27.2	714	22.0	1770	3.3	40	2.4
Body mass index (%)								
<18.5 kg/m ²	1296	2.8	92	2.8	2150	4.0	53	3.2
18.5–25.0 kg/m ²	32,421	70.1	2184	67.2	37,832	69.7	928	56.3
>25.0 kg/m ²	12,517	27.1	974	30.0	14,294	26.3	667	40.5
Cohabitation status (%)								
No cohabitation	1593	3.5	117	3.6	2506	4.6	119	7.2
Cohabitation	44,641	96.6	3133	96.4	51,770	95.4	1529	92.8
Employment status (%)								
Unemployed	2818	6.1	407	12.5	20,764	38.3	866	52.6
Employed	43,416	93.9	2843	87.5	33,512	61.7	782	47.5
Hours of sleep (%)								
<5	1676	3.6	160	4.9	2858	5.3	97	5.9
5–10	43,026	93.1	2924	90.0	50,585	93.2	1484	90.1
>10	1532	3.3	166	5.1	833	1.5	67	4.1
Frequency of exercise (%)								
No exercise	37,488	81.1	2454	75.5	44,244	81.5	1245	75.6
1 day/week or more	8746	18.9	796	24.5	10,032	18.5	403	24.5
Stress levels (%)								
Little	6507	14.1	478	14.7	9001	16.6	261	15.8
Moderate	28,458	61.6	1916	59.0	34,827	64.2	1034	62.7
Much	11,269	24.4	856	26.3	10,448	19.3	353	21.4
Positive medical history (%)								
Cancer	561	1.2	90	2.8	1353	2.5	62	3.8
Stroke	370	0.8	54	1.7	178	0.3	19	1.2
Heart disease	604	1.3	108	3.3	413	0.8	42	2.6

of death among men, the risk of such deaths was significantly (albeit just slightly) higher in those with a history of DM (RR: 1.6, 95% CI: 1.01–2.4).

Of those aged 40–49 years (RR: 1.9, 95% CI: 1.3–2.7) and 50–59 years (RR: 1.4, 95% CI: 1.04–1.9) at baseline, a significantly higher risk of external death was observed in those with a history of DM (Table 3). Similarly, of those aged 40–49 years (RR: 2.3, 95% CI: 1.4–3.9) and 50–59 years (RR: 1.5, 95% CI: 1.1–2.2) at baseline, patients with a history of DM faced a higher risk of accidental death.

Sensitivity analyses which removed participants with a history of cancer, stroke or ischaemic heart disease at baseline from the analyses were also conducted, and found no significant differences in terms of RRs for external causes of death in those with a history of DM.

4. Discussion

To our knowledge, the present study is the first to investigate the risk of death by external causes (suicide and accidents) in patients with a history of DM, using data from a large population-based prospective cohort study of an Asian population.

Poisson regression models revealed that, regardless of gender, the risk of external death in those with a history of DM was approximately 1.5-fold higher than in those with no such history. These present findings are consistent with those of previous population-based cohort studies in Western countries, which reported an increased risk of death by suicide [4] and by accident [4,5] among those with a history of DM. Our present findings are also consistent with a previous epidemiological study that examined a national sample of diabetic patients, and found that those

Table 2
Poisson regression models for total externally caused deaths, suicides and accidental deaths by gender and history of diabetes.

	Men		Women	
	No diabetes	Diabetes	No diabetes	Diabetes
External deaths				
<i>n</i>	913	91	391	22
Total person-years	878,150.8	55,466.0	1,082,400.0	30,251.9
Incident rate/100,000 person-years	104.0	164.1	36.1	72.7
Crude risk ratio (RR)		1.6		2.0
Multivariable-adjusted				
RR ^a	1.0	1.4	1.0	1.6
95% CI	Reference	1.2–1.8	Reference	1.01–2.4
Suicides				
<i>n</i>	410	33	167	8
Total person-years	878,150.8	55,466.0	1,082,400.0	30,251.9
Incident rate/100,000 person-years	46.7	59.5	15.4	26.4
Crude RR		1.3		1.7
Multivariable-adjusted				
RR ^a	1.0	1.2	1.0	1.5
95% CI	Reference	0.9–1.8	Reference	0.7–3.0
Accidents				
<i>n</i>	503	58	224	14
Total person-years	878,150.8	55,466.0	1,082,400.0	30,251.9
Incident rate/100,000 person-years	57.3	104.6	20.7	46.3
Crude RR		1.8		2.2
Multivariable-adjusted				
RR ^a	1.0	1.6	1.0	1.6
95% CI	Reference	1.2–2.1	Reference	0.9–2.8

95% CI: 95% confidence intervals.

^a Multivariable models adjusted for age at study entry (40–49, 50–59, 60+), public health centre area, smoking status (never smoker, past smoker, current smoker of either <30 or ≥30 cigarettes/day), alcohol-drinking habits (non-drinker, occasional drinker, regular drinker of either <300 or ≥300 g ethanol/week), body mass index (<18.5, 18.5–25.0, >25.0 kg/m²), cohabitation (yes or no), employment status (employed or unemployed), hours of sleep (<5, 5–10, >10), frequency of physical exercise (no exercise, 1 day/week or more), stress level (little, moderate, much) and history of major physical illnesses (cancer, stroke, heart disease).

with DM had a higher risk of death by suicide and accidents [6].

Our analyses failed to reveal a significantly higher risk of suicidal death for either gender, or for accidental deaths among women with a history of DM. However, this may be partly due to the fact that the total number of suicidal and accidental deaths reported, as well as the total number of study participants, was relatively small in our population-based cohort compared with those of previous population-based studies in Sweden [4] and the United States [5].

As regards age, the RRs of deaths by overall external causes and accidents in those with a history of DM were significant only in those aged 40–59 years at baseline. One plausible explanation for this is that disabilities such as nerve damage and eye disease [10], and mental distress due to having DM, are more disturbing to younger people than to older people, as they are likely to entail greater changes in lifestyle (for example, losing a job or not being able to work due to impaired eyesight).

It is well known that diabetes is associated with depression [11,19,20], a significant contributor to suicidal behaviours [21]. In addition, cardiovascular disease, nerve damage, and kidney and eye diseases are commonly seen in patients with DM [10]. For instance, reduced physical/cognitive capacities and poor eyesight due to DM are risk factors for fall injuries [22]. Furthermore, depression is associated with higher risks of both

morbidity [23] and mortality [24] in those with a history of DM. Thus, poor mental health, especially depression, physical and cognitive disabilities, being accident-prone and having mental distress as a result of these impairments, as well as enduring difficult treatments such as dialysis, could also increase the risk of externally caused death.

The present study has a number of strengths. First, it had a prospective design, and subjects were selected from the general population in Japan. The study also had a large sample size with a good response rate (around 80%), with a low rate of those lost to follow-up. In addition, statistical adjustments were made for various potentially confounding factors.

The study also has a few limitations. First, assessment of DM history was based on self-reports, although peer reports have previously confirmed that 94% of the self-reported histories of DM in the JPHC Study were consistent with medical records [17]. Nevertheless, it is undeniable that the use of self-reporting is likely to underestimate the true prevalence of DM at baseline.

Second, the DM type- and severity-specific mortality rates due to suicides and accidents were not calculated, as the study participants were not asked any questions concerning these parameters in the baseline survey. However, most DM cases in people aged ≥40 years in Japan would be expected to be type 2.

Table 3
Poisson regression models for total external deaths, suicides and accidental deaths by age group and history of diabetes.

	40–49 years		50–59 years		> 60 years	
	No diabetes	Diabetes	No diabetes	Diabetes	No diabetes	Diabetes
External deaths						
<i>n</i>	423	30	583	52	298	31
Total person-years	868,363.2	23,388.5	833,098.2	43,751.2	259,089.4	18,578.2
Incident rate/100,000 person-years	48.7	128.3	70.0	118.9	115.0	166.9
Crude risk ratio (RR)		2.6		1.7		1.5
Multivariable-adjusted						
RR ^a	1.0	1.9	1.0	1.4	1.0	1.3
95% CI	Reference	1.3–2.7	Reference	1.04–1.9	Reference	0.9–1.9
Suicides						
<i>n</i>	245	14	250	20	82	7
Total person-years	868,363.2	23,388.5	833,098.2	43,751.2	259,089.4	18,578.2
Incident rate/100,000 person-years	28.2	59.9	30.0	45.7	31.6	37.7
Crude RR		2.1		1.5		1.2
Multivariable-adjusted						
RR ^a	1.0	1.5	1.0	1.2	1.0	1.0
95% CI	Reference	0.9–2.6	Reference	0.8–1.9	Reference	0.4–2.1
Accidents						
<i>n</i>	178	16	333	32	216	24
Total person-years	868,363.2	23,388.5	833,098.2	43,751.2	259,089.4	18,578.2
Incident rate/100,000 person-years	20.5	68.4	40.0	73.1	83.4	129.2
Crude RR		3.3		1.8		1.5
Multivariable-adjusted						
RR ^a	1.0	2.3	1.0	1.5	1.0	1.4
95% CI	Reference	1.4–3.9	Reference	1.1–2.2	Reference	0.9–2.2

95% CI: 95% confidence intervals.

^a Multivariable models adjusted for gender, public health centre area, smoking status (never smoker, past smoker, current smoker of either <30 or ≥30 cigarettes/day), alcohol-drinking habits (non-drinker, occasional drinker, regular drinker of either <300 or ≥300 g ethanol/week), body mass index (<18.5, 18.5–25.0, >25.0 kg/m²), cohabitation (yes or no), employment status (employed or unemployed), hours of sleep (<5, 5–10, >10), frequency of physical exercise (no exercise, 1 day/week or more), stress level (little, moderate, much) and history of major physical illnesses (cancer, stroke, heart disease).

Third, a diagnosis of DM after the start of our follow-up period may have weakened the true associations between DM and external causes of death. The incidence rate of DM is nearly 9/1000 person-years in Japan [25]. Our team has reported that, of the 99,584 participants in the JPHC Study, 4286 had a history of DM at baseline, while 3707 were newly diagnosed with DM during the follow-up period [3]. Thus, it is possible that some cases of external deaths identified as having no history of DM at baseline may have been among the newly diagnosed cases during follow-up. However, in our analyses, such a misclassification would have led to an underestimation of the risk of external death among those with a history of DM at baseline. In fact, one weakness of our cohort study is that the incidence of DM during the follow-up period was assessed only by 5- and 10-year follow-up surveys after the baseline survey. Thus, it is unclear whether all those who died due to external causes had been diagnosed with DM at the time of death.

Fourth, information on non-fatal suicidal behaviours and accidents during the follow-up period, and the state of mental health at baseline, was not obtained for the JPHC Study cohort. However, our statistical analyses were adjusted for the effects of several general and mental health factors such as BMI, history of illnesses, alcohol-drinking habits, hours of sleep and stress levels; supplementary material. Tables S1–S4 show the results for the risk of external death by BMI and history of illnesses.

Finally, our participants were restricted to Japanese residents aged ≥40 years. Thus, caution should be exercised when generalizing these findings to populations of different ethnic backgrounds.

5. Conclusion

To our knowledge, this is the first study to examine the risks of suicidal and accidental deaths in people with a history of DM in a large population-based prospective cohort from an Asian population. Compared with those with no history of DM, the risk of death by external causes (particularly accidental deaths) in those with such a history was significantly higher in both men and women, and in those aged ≤59 years at baseline. The risk of death by suicide among these individuals also appeared to be higher, but not markedly so. Physical and cognitive disabilities, as well as mental distress as a result of such impairment, could likely increase the risk of death by suicide and accidents. Psychosocial interventions such as cognitive behavioural therapy, antidepressant medications and collaborative care are effective for the treatment of depression in those with a history of DM [26,27]. Support to minimize post-DM physical/cognitive impairment, and close monitoring, assessment and treatment of mental distress, particularly depression, as well as DM preventative programmes that target lifestyle-related issues could all

also help to prevent death by suicide and by accident among those with a history of DM.

Authors' contributions

T.Y., M.I., N.Y. and T.A. designed the study. M.I., N.S., H.I., M.N. and S.T. collected data and provided administrative support. T.Y. analyzed the data. N.Y., M.I. and N.S. interpreted the data. T.Y., M.I., N.Y. and N.S. drafted the manuscript. M.I., N.Y., M.I., T.A., N.S., H.I., M.N. and S.T. provided important input and discussion. All authors read and approved the final version of the manuscript.

Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Supplementary data

Supplementary data (Tables S1–S4) associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.diabet.2015.11.008>.

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Original Article

Suicide prevention strategies in Japan: A 15-year review (1998–2013)

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Abstract Suicide is a global public health problem and solutions to it can be found only through a global dialog. The suicide rate in Japan has been alarming, but Japan has made substantial efforts to reduce this rate, making prevention a high priority. This report reviews the developmental stages of a comprehensive policy of suicide prevention in Japan from 1998 to 2013. Our review suggests that suicide prevention activities were facilitated by the 2006 Basic Act for Suicide Prevention and the 2007 General Principles of Suicide Prevention Policy. Along with the establishment of a Special Fund program for local governments, the Basic Act and General Principles led to the development of a comprehensive and multi-sector approach to suicide prevention. Suicide rates in Japan, especially among middle-aged men, decreased consistently after 2009, suggesting that the initiatives were effective. Continuous monitoring is needed to evaluate Japan's suicide prevention policy.
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Keywords: suicide; suicide prevention; policy development; Basic Act for Suicide Prevention; Japan

Introduction

Worldwide, inadequate prevention of suicide persists for lack of awareness that suicide is a major public health problem. This has been especially true in the Asia-Pacific region, including Japan.¹ According to the National Police Agency of Japan,² the annual number of deaths by suicide remained at approximately 25 000 or fewer from 1978 to 1997. Except for some notable efforts by local governments and private organizations,³ suicide prevention attracted limited attention during this period. In 1998, the annual number of suicides rapidly increased from 24 391 in the previous year to 32 863, and it remained at over 30 000 until 2011 (Figure 1). This increase, more pronounced among males than among females, affected particularly men aged 45–64 years (Figure 2). Several possibilities may explain the rapid increase in suicide. Fujita, who analyzed vital statistics, found the suicide increase was most notable in males aged 15–69 years, males without an occupation, divorced males, and males in urban areas.⁴ Amagasa suggested the rapid increase in suicides among middle-aged, urban males was associated with three major developments resulting from Japan's economic recession: (i) corporate downsizing (restructuring), (ii) hastily introduced performance evaluations, and (iii) a decrease of regular employment plus rapid expansion of contractual employment.⁵ Greater stress in the work environment would have had a great impact on middle-aged men.

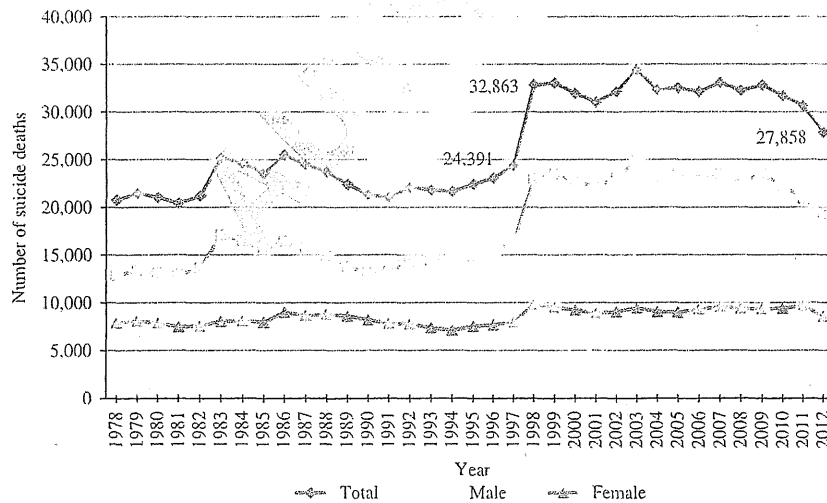


Figure 1: Number of suicide deaths in Japan, 1978–2012.

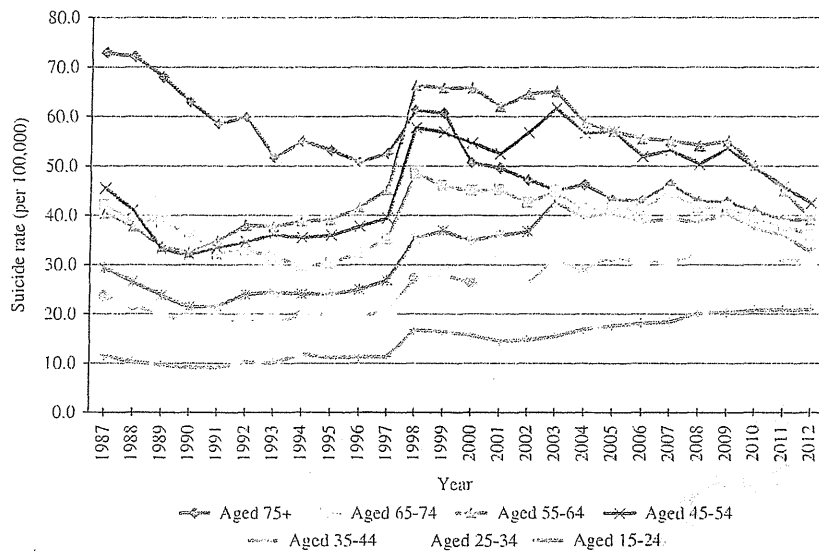
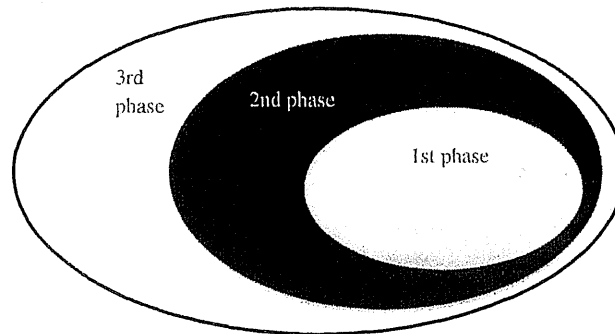


Figure 2: Male suicide rates in Japan by age, 1987–2012.

The rapid rise in suicides highlighted a clear need to develop a national suicide prevention policy. Japan's expansion of suicide prevention efforts can be divided into three phases,⁶ as summarized in Figure 3. The Ministry of Health, Labour and Welfare (MHLW) initiated and led the first phase, from 1998 to 2005. In the second phase, from 2005 to 2006, leadership gradually shifted to the Cabinet Office (CaO), which promoted suicide prevention as a comprehensive government policy. The third phase, which began in 2006, saw passage of the Basic Act for Suicide Prevention (hereinafter, 'Basic Act') in 2006 and a Cabinet decision to adopt General Principles of Suicide Prevention Policy (GPSP) in 2007. Both substantially changed social attitudes toward suicide.

During and just before these three periods, Japan enacted or revised other laws to support people at high risk. These included the Long-term Care Insurance Act (1997), the Act for the Prevention of Child Abuse (2000), the Health Promotion Act (2002), the Act for Special Measures concerning Assistance in Self-Support of Homeless (2002), the Money Lending Business Act revision (2006), the Labour Contract Act (2007), the Basic Act for Measures against Alcohol-related Health Harm (2013), and the Act on Support for People Living in Poverty (2013).



The first phase (1998-2005)

- 2000 Numerical target set as part of "Healthy Japan 21"
- 2001 Budget for suicide prevention set by MHLW
- 2002 Report by Suicide Prevention Council
- 2004 Introduction of Policy for Depression

The second phase (2005-2006)

- 2005 Upper House resolution to wrap up a comprehensive strategy against suicide
- 2005 Suicide Prevention Liaison Committee (SPLC) established
- 2005 A report on national suicide prevention strategy by SPLC

The third phase (2006-)

- 2006 Basic Act for Suicide Prevention (Basic Act) passed
- 2006 Foundation of the Center for Suicide Prevention (CSP) in NIMH, NCNP
- 2006 Basic Act enforced
- 2007 General Principles of Suicide Prevention Policy (GPSP) established
- 2008 Partial Revision of the GPSP
- 2009 Preparation of special fund for local governments
- 2012 Complete revision of the GPSP

Figure 3: Developmental stages and chronological chart of suicide prevention policy in Japan.

The purpose of the Basic Act was to prevent suicide and provide support to survivors of suicide, thus helping to create a more stable society where people could lead healthy and meaningful lives. Its basic principles were as follows: (i) suicide prevention activities should be examined with an understanding of the complexity of factors related to suicide and be supported by the entire society; (ii) suicide prevention efforts should be based on the social context of suicide and not be dismissed as a mere mental health issue; (iii) suicide prevention activities must include prevention, intervention, and *postvention* (an intervention which involves provision of support to family members and others affected by a suicidal behavior)⁷; and (iv) suicide prevention should be carried out effectively with the close cooperation of central government, local governments, medical institutions, workplaces, schools, and non-governmental organizations (NGOs).



The Basic Act also mandated the Government of Japan to establish a set of immediate objectives, the General Principles of Suicide Prevention Policy. The GPSP, developed in 2007, was based on the Basic Act and provided a practical framework for suicide prevention activities. The immediate objectives of the GPSP were: (i) to promote research on suicide; (ii) to deepen citizens' understanding of suicide prevention; (iii) to secure and train human resources; (iv) to promote mental health; (v) to develop mental health services; (vi) to act on social factors; (vii) to support the survivors of suicide attempts; (viii) to support the bereaved; and (ix) to support the activity of NGOs. The GPSP was revised in part in 2008, establishing 50 activities under these nine immediate objectives. The revision included measures to provide suicide-related information on the Internet plus outreach to high-risk individuals, such as people with schizophrenia or alcohol/drug dependence, as well as young people who exhibit self-injurious behavior. The GPSP was totally revised in 2012.

Other countries have also developed national suicide prevention programs.⁸ Research indicates that such programs are effective, particularly for the elderly and young people.⁹ The United States enacted the Garrett Lee Smith Memorial Act in 2004 to support youth suicide prevention programs.¹⁰ To our knowledge, in 2006, Japan became the first country to pass a law specifically creating a comprehensive suicide prevention policy. As of 2013, only a few countries had enacted legislation for suicide prevention, including the United States,¹⁰ Japan, South Korea,¹¹ and Canada.¹² Because suicide rates in East Asian countries tend to be high,¹³ the legislation in Japan and South Korea were important events for improving public health policy. As yet, no academic research has reviewed the development of suicide prevention policies in Japan or South Korea.

The purpose of our current study is to review the development of Japan's suicide prevention policy under the Basic Act and the GPSP from a public health perspective.

Developmental Phases of Suicide Prevention Policy in Japan

The first phase (1998–2005)

In the first phase, the MHLW initiated Japan's suicide prevention policy as part of the "National Health Promotion Movement in the 21st Century (Healthy Japan 21)" in 2000,¹⁴ and set a budget for suicide

prevention in fiscal year 2001. At that time, the MHLW led Japan's suicide prevention policy, organizing the Suicide Prevention Council. The council's 2002 report strongly recommended that suicide prevention include prevention, intervention, and postvention, and should be carried out through an integrated effort, following guidelines published by United Nations in 1996 for implementing national suicide prevention strategies.¹⁵

We present the development of suicide prevention efforts by prefectures and designated cities in Table 1. In the first phase, only 10.3 per cent (6 local governments of the 58 local governments) formally established suicide prevention committees, while 13.8 per cent (8 local governments of the 58 local governments) prepared budgets. These local governments were primarily those with historically high suicide rates.

Nevertheless, this phase sowed the seeds for the future development of suicide prevention policy. In 2000, the situation began to change when children who had lost their parents by suicide began to break the taboo by speaking out their experiences in the media.¹⁶ They published a book to tell of experiences that they had not been able to confide to anyone for a long time. In 2001, the children met Prime Minister and petitioned him to develop suicide prevention policy.

The second phase (2005–2006)

In the second phase (see Figure 3), the NGO LIFELINK collaborated with a member of the Diet to organize the first forum on suicide prevention. At the forum, LIFELINK and other NGOs submitted

Table 1: Suicide prevention efforts by local governments in Japan

<i>Time of investigation (number of local governments)</i>	<i>December 2002 (58)</i>	<i>March 2008 (64)</i>	<i>April 2009 (65)</i>	<i>April 2010 (66)</i>	<i>April 2011 (66)</i>	<i>April 2012 (67)</i>
Cross-sectional network in local government	—	37 (57.8%)	45 (70.3%)	51 (77.3%)	56 (84.8%)	54 (80.6%)
Suicide prevention committee	6 (10.3%)	61 (95.3%)	64 (98.5%)	64 (97.0%)	63 (95.5%)	65 (97.9%)
Budget for suicide prevention	8 (13.8%)	63 (98.4%)	65 (100.0%)	65 (98.5%)	66 (100.0%)	—



proposals for comprehensive suicide prevention. The Minister of MHLW, who attended the forum, vowed as a representative of the government to tackle the issue of suicide. This vow was widely reported in the media.¹⁶ With suicide deaths still exceeding 30 000 annually, the Upper House of the Diet resolved to create and implement an urgent, comprehensive policy for suicide prevention. The government then organized the Suicide Prevention Liaison Committee with related ministries and agencies represented.

In this phase, leadership for suicide prevention gradually shifted from the MHLW to the CaO. It promoted suicide prevention as a comprehensive government policy. Thus, the second phase transformed Japan's suicide prevention policy into a more comprehensive model. Even so a limited number of local governments took active measures to promote suicide prevention.

The third phase (2006–present)

What happened to improve policy? By 2007 the Diet had passed the Basic Act and the Cabinet adopted the GPSP. After the global economic crisis of 2008, Japan's government established a Special Fund for local governments to reinforce suicide prevention efforts. Central government expenditure for the Fund reached 16.7 billion JPN Yen, in total, between fiscal year 2009 and 2013. In fiscal year 2011, the total national budget for suicide prevention, according to the CaO, was 11 655 million JPN Yen (approximately US\$1 = 80 JPN Yen in October 2011).²

After the Cabinet adopted the GPSP, three entities – the Center for Suicide Prevention (CSP) at the National Center of Neurology and Psychiatry (NCNP) of Japan, CaO, and MHLW – collaborated on a survey to review implementation of activities by local governments. All prefectural and designated city governments participated in the study.

As shown in Table 1, all local governments established budgets for suicide prevention in fiscal year 2011. Figure 4 shows the activities undertaken by local governments between fiscal years 2008 and 2011 to achieve the nine GPSP objectives.¹⁷ These increased sharply in fiscal year 2010 because the central government provided Special Funds. (The decrease in 2011 was likely caused by a change in reporting methods.) The increase in universal prevention activities to “promote mental health”, “deepen citizen's understanding of suicide prevention”, and “secure and train human resources” was greater than the increase in selective and

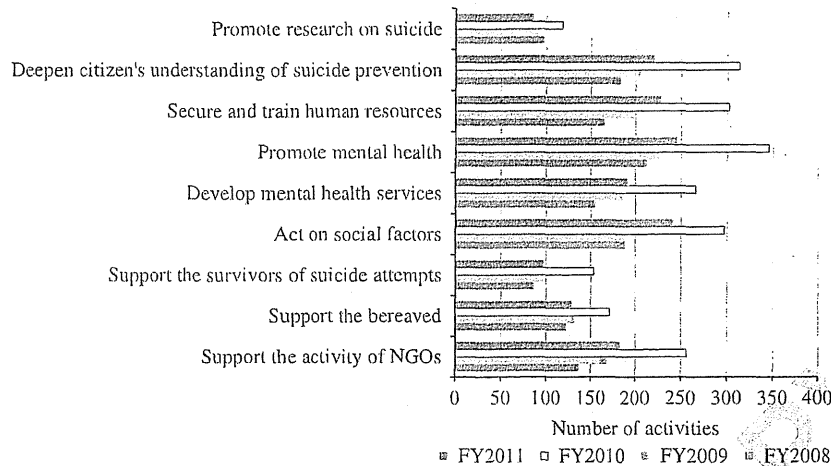


Figure 4: Number of suicide prevention activities by local governments, fiscal years 2008–2011.

indicated prevention measures, such as “support the survivors of suicide attempts” and “support the bereaved”. The survey also found that the implementation rate was high in fields targeted to “deepen citizen’s understanding of suicide prevention”, “secure and train human resources”, and “promote mental health”. It was low in areas targeted to “support the survivors of suicide attempts”.¹⁸

The survey found that local governments tended to focus on universal prevention activities. An audit of Special Funds conducted by the CaO showed that local governments and municipalities had improved selective prevention activities.¹⁹ For instance, an activity led by a prefecture and a municipality intended to promote networking between primary care physicians and psychiatrists treating insomnia or sleep-related problems among middle-aged men attracted nationwide attention as a promising effort.²⁰ A revision of the Money Lending Business Act of 2006, plus a task force in the central government and councils in local governments to address multiple debts, supported counseling services for people with multiple debts. Decrease in suicide rates among men aged 45–64 after 2009 (see Figure 2), may, in part, be the result of efforts that specifically targeted middle-aged men.

Notably only a limited number of suicide prevention activities included objective evaluations. This underscores the need to heighten awareness about evaluation methods.



Evaluation

In January 2012, the NCNP invited a World Health Organization (WHO) team for a field visit to review Japan's national program for suicide prevention. The WHO report emphasized the importance of conducting efficacy and effectiveness evaluations for each suicide prevention effort, as well as promotion of selective and indicated prevention measures.²¹ To discuss the evaluation of suicide prevention initiatives in Japan, we summarize some major activities.

Recommendations by the Ministry of Internal Affairs and Communications (MIC)

The Administrative Evaluation Bureau of the MIC released a report on suicide prevention policies in June 2012.²² From May 2011 to June 2012 it surveyed many entities: the CaO; National Police Agency; Financial Services Agency; Consumer Affairs Agency; MIC; Ministry of Justice; Ministry of Education, Culture, Sports, Science and Technology; MHLW; Ministry of Agriculture, Forestry and Fisheries; Ministry of Economy, Trade and Industry; Ministry of Land, Infrastructure, Transport and Tourism; Ministry of Defense; 47 local governments (including 30 municipalities); 3 independent administrative corporations, including the NCNP; and 52 private organizations. The report:

1. noted that evaluations of suicide prevention activities performed under the GPSP were insufficient, particularly as they offered few good examples of suicide prevention measures undertaken by local governments and focused on high-risk groups and individuals;
2. recommended additional support for private organizations that provide counseling services for people at risk of suicide;
3. recommended further cooperation among related organizations, including clarification of procedures and connections among emergency and critical-care centers and community support for those who attempt suicide;
4. recommended that educational activities for preventing suicide be reinforced, with a focus on concrete objectives;
5. recommended that suicide prevention activities be enhanced for the disaster area of the 2011 Tohoku Earthquake and Tsunami, as it is important to monitor the mental health of victims, volunteers, support staff from local governments, and other affected persons.