

Received: 24 August 2022 / Accepted: 15 September 2022 / Published online: 31 October 2022

DOI 10.34689/SH.2022.24.5.008

UDC 616.5-003.829.85

STUDY OF SUICIDE TRENDS AND SOME KIND OF FACTOR IN SEVERAL JAPAN'S PREFECTURES: FOR THE FUTURE STUDY IN THE REPUBLIC OF KAZAKHSTAN

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Abstract

Background: Many countries with high suicide rates may also experience heavy yearly snowfalls. We speculated that Japan's prefectures that have high suicide rates may be in regions with heavy snowfall. Although many suicide-related factors have been studied, few investigations have examined the effects of snow on suicide.

Objective: We investigated regions of Japan along the Sea of Japan (at Japan's west coast) that regularly experience heavy and long-term snowfall. It is also the purpose of applying this perspective to study in the Republic of Kazakhstan.

Materials and Methods: We determined the annual suicide rates in 11 prefectures (Hokkaido, Aomori, Akita, Yamagata, Niigata, Toyama, Ishikawa, Fukui, Tottori, Shimane, and Yamaguchi) along the Sea of Japan with heavy snowfall during the period from 1994 to 2019. We obtained each prefecture's annual maximum depth of snow cover and the annual number of days with snow during the same period. We analyzed the correlations between the suicide rates and these two aspects of snowfall.

Results: The maximum depth of snow cover and the number of days with snow were not significantly correlated with the suicide rate in any of the 11 prefectures. There was no clear link between the effects of the snowfall and suicide. The relationship between multiple factors including snow and suicide merits further research.

Conclusions: Various weather phenomena including snow can cause mental fatigue and poor mental health and could potentially contribute to suicide, and thus aspects of weather and their effects on mental health should be investigated. The public, members of the local community, government agencies, meteorological agencies, medical personnel, and organizations and professionals involved in suicide prevention should work together when necessary to explore suicide prevention. In the future, we are going to perform the study of this side in the Republic of Kazakhstan

Keywords: suicide, snow, climate, effects, Japan, Kazakhstan.

Резюме

ИЗУЧЕНИЕ СУИЦИДАЛЬНЫХ ТЕНДЕНЦИЙ И ДРУГИХ ФАКТОРОВ В ПРЕФЕКТУРАХ ЯПОНИИ: ПЕРСПЕКТИВЫ ПРИМЕНЕНИЯ МЕТОДА ИССЛЕДОВАНИЯ В РЕСПУБЛИКЕ КАЗАХСТАН

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Актуальность: во многих странах с высоким уровнем суицидов, отмечаются климатические изменения, особого внимания требуют изменения снежного покрова и количества осадков. Есть предположение, что префектуры Японии с высоким уровнем суицидов могут находиться в регионах с сильными снегопадами. Было изучено множество факторов, связанных с суицидами, однако в немногих исследованиях изучалось влияние изменений снежного покрова и количества осадков на уровень суицидов.

Цель: исследовать районы Японии, вдоль Японского моря (на западном побережье Японии), регулярно подвергающиеся сильным и продолжительным снегопадам. В перспективе проведение исследования в Казахстане.

Материалы и методы: определены ежегодные показатели суицидов в 11 префектурах (Хоккайдо, Аомори, Акита, Ямагата, Ниигата, Тояма, Исикава, Фукуи, Тоттори, Шимане и Ямагути) вдоль Японского моря подвергающиеся снегопадам в период с 1994 по 2019 год. Получены данные годовой максимальной глубины снежного покрова в каждой префектуре и годовое количество дней со снегом за тот же период. Проанализирована корреляция между уровнем суицидов и вышеперечисленными двумя аспектами снегопада.

Результаты: максимальная глубина снежного покрова и количество дней со снегом существенно не коррелировали с уровнем суицидов ни в одной из 11 префектур. Четкой связи между последствиями снегопада и суицидами не было обнаружено. Взаимосвязь между многочисленными факторами, включающими климатические изменения, в частности изменения снежного покрова и количества осадков и уровнем суицидов, требует дальнейшего исследования.

Выводы: различные погодные явления, в частности изменения снежного покрова и количества осадков, могут вызывать умственное переутомление и ухудшение психического здоровья и потенциально могут способствовать суицидам, именно поэтому изменения климатических условий и их влияние на психическое здоровье требует особого внимания. Общественность, правительственные организации, метеорологические агентства, медицинские учреждения, а также организации и специалисты, занимающиеся профилактикой суицидов, должны сотрудничать, для изучения вопросов предотвращения суицидов. В перспективе планируется проведение аналогичного исследования в Казахстане

Ключевые слова: суицид; снег; климат; последствия; Япония; Казахстан.

Түйіндеме

ЖАПОНИЯНЫҢ БІРНЕШЕ ПРЕФЕКТУРАСЫНДАҒЫ СУИЦИД ТЕНДЕНЦИЯЛАРЫН ЖӘНЕ БАСҚА ФАКТОРЛАРДЫ ЗЕРТТЕУ: БОЛАШАҚТА ҚАЗАҚСТАНДА ЗЕРТТЕУ ӘДІСТЕМЕСІН ЖҮРГІЗУ

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Өзектілігі: суицид деңгейі жоғары көптеген елдерде жыл сайын ауа райы өзгерістері, әсіресе қатты қар жаууы байқалады. Жапонияның жоғары суицид деңгейі қалың қар жауатын аймақтарда, префектураларында болуы мүмкін деген болжам бар. Суицидке байланысты көптеген факторлар зерттелгенімен, бірнеше зерттеулер жыл

сайын ауа райы өзгерістері, әсіресе қатты қар жаууы салдарынан суицид деңгейінің өзгерістері туралы әсерін тигізді.

Мақсаты: Жапон теңізінің бойындағы үнемі қалың және ұзаққа созылатын қар жауатын аймақтарын зерттеу. Сонымен қатар болашақта Қазақстанда осы әдісті қолдану.

Материалдар мен әдістер: 1994-2019 жылдар аралығында Жапон теңізінің бойындағы 11 префектурада (Хоккайдо, Аомори, Акига, Ямагата, Ниигата, Тояма, Исигава, Фукуи, Тоттори, Симане және Ямагучи) суицидтің жылдық көрсеткіштерін анықтадық. Әр префектурада қар жамылғысының жылдық максималды тереңдігін және сол кезеңдегі жылдық күндер санын алдық. Суицид деңгейі мен жыл сайын ауа райы өзгерістері, әсіресе қатты қар түсу арасындағы корреляциясы талданды.

Нәтижелер: қар жамылғысының максималды тереңдігі мен жылдық күндер саны 11 префектураның ешқайсысында суицид деңгейімен айтарлықтай сәйкес келмеді. Жыл сайын ауа райы өзгерістері, әсіресе қардың түсу салдары мен суицидтің арасында нақты байланыс болған жоқ. Көптеген факторлар, соның ішінде жыл сайын ауа райы өзгерістері, әсіресе қар түсу мен суицид арасындағы байланыс қосымша зерттеуге лайық.

Қорытынды: ауа-райының әртүрлі құбылыстары, соның ішінде қар түсу психикалық шаршауды және психикалық денсаулықтың нашарлауын тудыруы мүмкін және суицидке ықпал етуі мүмкін, сондықтан ауа-райының аспектілері мен олардың психикалық денсаулыққа әсері зерттелуі керек. Суицидтің алдын алу мәселелерін зерттеу үшін қоғам, жергілікті қоғамдастық мүшелері, мемлекеттік органдар, метеорологиялық агенттіктер, медициналық персонал және суицидтің алдын алу ұйымдары мен мамандары қажет болған жағдайда ынтымақтасуы керек. Болашақта Қазақстанда осындай зерттеуді жүргізуді жоспарлап отырмыз.

Түйінді сөздер: суицид; қар; климат; салдары; Жапония; Қазақстан.

Bibliographic citation:

Inoue K., Kawano N., Apbasova M., Seksenbayev N., Kameo S., Toleuov E., Akkuzinova K., Karimova Zh., Moldagaliev T., Ospanova N., Shabdarbayeva D., Chaizhunusova N., Dyussupov A., Fujita Ya., Hoshi M. Study of suicide trends and some kind of factor in several Japan's prefectures: for the future study in the Republic of Kazakhstan // *Nauka i Zdravookhraneniye* [Science & Healthcare]. 2022, (Vol.24) 5, pp. 60-67. doi 10.34689/SH.2022.24.5.008

Иноуэ К., Кауано Н., Апбасова М., Сексенбаев Н., Камео С., Толлеуов Е., Аккузинова К., Каримова Ж., Молдагалиев Т., Оспанова Н., Шабдарбаева Д., Чайжунусова Н., Дюсупов А., Фуджита Я., Хоши М. Изучение суицидальных тенденций и других факторов в префектурах Японии: перспективы применения метода исследования в Республике Казахстане // *Наука и Здравоохранение*. 2022. 5(Т.24). С. 60-67. doi 10.34689/SH.2022.24.5.008

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Introduction

A report by Japan's National Police Agency indicated that the number of suicides nationwide ranged from ~21,000 to ~24,000 during the years 1990–1997 [24], and in 1998, the number of suicides was over 32,000, representing an abrupt increase of >8,000 suicides from 1997. The number of suicides in Japan remained high during the 14-year period from 1998 to 2011; it decreased to ~30,000 in 2012 and has been decreasing since then. In 2019, 2020 and 2021, there were 20,169, 21,081, and 21,007 suicides in Japan. Over the past 15 years, several nationwide Acts and plans providing a foundation for suicide prevention measures have been enacted. The Basic Act on Suicide Prevention was enacted in 2006, and the Outline of Comprehensive Measures to Prevent Suicides was decided in 2007, followed by The Plan to Accelerate Suicide Prevention Measures in 2008 and the Emergency Suicide Prevention Plan to Protect Life in 2010. Revisions or amendments were enacted for The Outline of Comprehensive Measures to Prevent Suicides (2012 and 2017) and The Basic Act on Suicide Prevention (2016).

The importance of suicide prevention measures has been highlighted worldwide for decades. A variety of factors can contribute to suicide, and these factors may be compounded. For example, many studies have described

the relationship between physical illness and suicide. In Brazil, it was indicated that the incidence of deaths due to suicide from 1979 to 2005 was correlated with the incidence of ischemic heart disease and stroke among people aged ≥40 years [27]. Hooley et al. showed that chronic pain can be a risk factor for suicide, especially if the pain causes its sufferer to stop fearing death [13]. In their study of individuals in rural China, Jin et al. observed that physical illness was correlated with suicide in general, and they noted that physical illness was a key risk factor for suicide attempts [17]. In a retrospective cohort study covering a 10-year period, U.S. military veterans with chronic headaches had a higher risk of suicide attempts than those with other chronic pain, and female veterans with chronic headaches had a higher risk than the males with chronic headaches [1]; chronic headaches associated with a traumatic brain injury further increased this risk among males in particular. Based on the above-cited studies [1,13,17,27], it appears that several types of physical illness can be related to suicide, and thus measures designed to help prevent suicide should take physical illness into account.

The relationship between psychiatric disorders and suicide has also been extensively explored. One such study indicated that the major psychiatric conditions associated with suicidality were mood disorders, alcohol and substance

use disorders, borderline personality disorder, and schizophrenia [30]. The authors of that study also indicated that a history of suicide attempts, feelings of hopelessness, impulsivity, and aggression, adverse childhood experiences, severe psychopathology, and somatic disorders were risk factors for suicide among psychiatric patients [30]. According to the results of an investigation of 6,050 patients at a European psychiatric center, the risk of suicide may be higher among individuals with bipolar disorder with psychotic or mixed features as well as among persons with a substance abuse issue and those hospitalized with severe major depressive disorder [4].

A review of the relationship between mood disorders and suicide revealed that the risk of completed suicide was higher among patients with a bipolar disorder compared to those with a mood disorder, and suicidal acts usually occurred during major depressive episodes or mixed illness episodes [15]. Substance use and cluster B personality disorders also clearly increased the risk of suicidal acts during mood episodes [15]. Bachmann found that depression, substance use, and psychosis were relevant risk factors for suicide and that anxiety, personality-, eating- and trauma-related disorders, and organic mental disorders clearly add to unnatural causes of death compared to the general population [3]. The above findings [3,4,15,30] indicate that numerous psychiatric disorders may be related to suicide, showing that psychiatric disorders must also be considered in suicide prevention measures.

Economic and social problems are related to suicide. An analysis by Gunnell et al. demonstrated that unemployed individuals had a 2- to 3-times higher risk of suicide compared to employed people [12]. In Spain, strong evidence that a decrease in economic growth and an increase in unemployment negatively affected suicide rates during the years 2002–2013 was obtained by Rivera et al [28]. A study conducted in Greece reported that the country's financial crisis definitely affected the mental health of the general public and resulted in an increasing incidence of mental disorders and suicides, and that social and financial factors such as poverty, financial difficulties, and unemployment mediated the effects of the financial crisis on mental health [20]. Research in China noted the effects of several economic and social factors on suicide rates [5]. These studies [5,12,20,28] examined the relationship between economic and social problems and suicide from various viewpoints.

Factors other physical illness, psychiatric illness, and economic and social problems that may be related to suicide have been reported [9,10,11,19], and an association between climate indices and suicide has been described [2,6,7]. One of the present study's authors identified a relationship between five climate indices (annual values of the mean air temperature, mean sea level air pressure, mean relative humidity, total sunshine duration, and total precipitation) and suicide rates in Japan [14]. However, our large-scale search found no studies of the relationship between snow levels and suicide in Japan. We speculated that the prefectures in Japan that have high suicide rates may be in regions with heavy winter snowfall [22] and that the restrictions on individuals' daily lives due to heavy snow may be related to suicidality. We thus investigated regions of Japan along the Sea of Japan (at Japan's west coast)

that regularly experience heavy and long-term snowfall. We classified the selected prefectures in these regions as having a high or low suicide rate. Using long-term data (a 26-year period), we compared snow indices and suicide rates to investigate whether a relationship exists between snow data and suicide.

Methods

Data collection

Japan has 47 prefectures, and the country can be divided into seven regions: the Hokkaido region, the Tohoku region, the Kanto region, the Chubu region, the Kinki region, the Chugoku/Shikoku region, and the Kyushu region. Prefectures along the Sea of Japan in the four regions of Hokkaido, Tohoku, Chubu, and Chugoku/Shikoku have heavy snowfall. There are 11 prefectures in these regions: Hokkaido, Aomori, Akita, Yamagata, Niigata, Toyama, Ishikawa, Fukui, Tottori, Shimane, and Yamaguchi.

We examined the annual suicide rate (per 100,000 population) in each of the 11 prefectures and in Japan as a whole during the years from 1994 to 2019 by using data published by Japan's Ministry of Health, Labour, and Welfare [23]. We classified the prefectures as having a low or high suicide rate as follows: If the annual suicide rate in a prefecture exceeded the annual suicide rate in Japan as a whole by ≥ 3 times over the 5-year period 2015–2019, the prefecture was classified as having a high suicide rate [23]. If the annual suicide rate in a prefecture was less than one-third of Japan's annual suicide rate during that period, it was classified as having a low suicide rate.

The data published by the Japan Meteorological Agency [16] were used to obtain the annual maximum depth of snow cover (cm) and the annual number of days with snow (day) in each of the 11 prefectures in 1994–2019. The data were based on observations made at the site of the prefectural government in each prefecture. In specific terms, the site in Hokkaido Prefecture was in the city of Sapporo, and the other sites were in Aomori (Aomori Prefecture), Akita (Akita Prefecture), Yamagata (Yamagata Prefecture), Niigata (Niigata Prefecture), Toyama (Toyama Prefecture), Kanazawa (Ishikawa Prefecture), Fukui (Fukui Prefecture), Tottori (Tottori Prefecture), and Matsue (Shimane Prefecture). In Yamaguchi, there was a change in how the number of days with snow was determined prior to 2010 and from 2011, and the data were not uniform. We thus used the uniform data of the weather observations at another site in Yamaguchi Prefecture, i.e., Shimonoseki, instead. All of the weather data were in numerical form only, without individual information.

Statistical analyses

We used EZR ver. 1.36 [18] to determine the Pearson's correlations between the suicide rate and two snow indices in each prefecture during the study period: the maximum depth of snow cover and the number of days with snow.

Determination of the relationship between snow indices and suicide

In addition to the relationship between snow indices and suicide in Japan, we examined the impact of each of the indices on suicidal acts.

Due to the purpose of applying this perspective to study in the Republic of Kazakhstan

Based on these results, we discussed this perspective to study in the Republic of Kazakhstan.

Results

Annual suicide rate during the 26-year period 1994–2019 in the 11 prefectures and Japan as a whole

Figure 1 depicts the annual suicide rates in the 11 Japanese prefectures and Japan as a whole during the 26-year study period. The annual suicide rate (per 100,000 population) during the period ranged from 16.8 to 28.0 in Hokkaido, from 16.9 to 39.5 in Aomori, from 20.3 to 44.6 in

Akita, from 18.1 to 31.7 in Yamagata, from 18.5 to 34.5 in Niigata, from 15.5 to 32.1 in Toyama, from 12.9 to 25.8 in Ishikawa, from 13.9 to 30.1 in Fukui, from 13.1 to 31.0 in Tottori, from 16.1 to 32.4 in Shimane, and from 15.4 to 29.6 in Yamaguchi. The annual suicide rate in Japan as a whole also ranged from 15.7 to 25.5 during the study period. The suicide rate in only Akita Prefecture was notably higher than the national average.

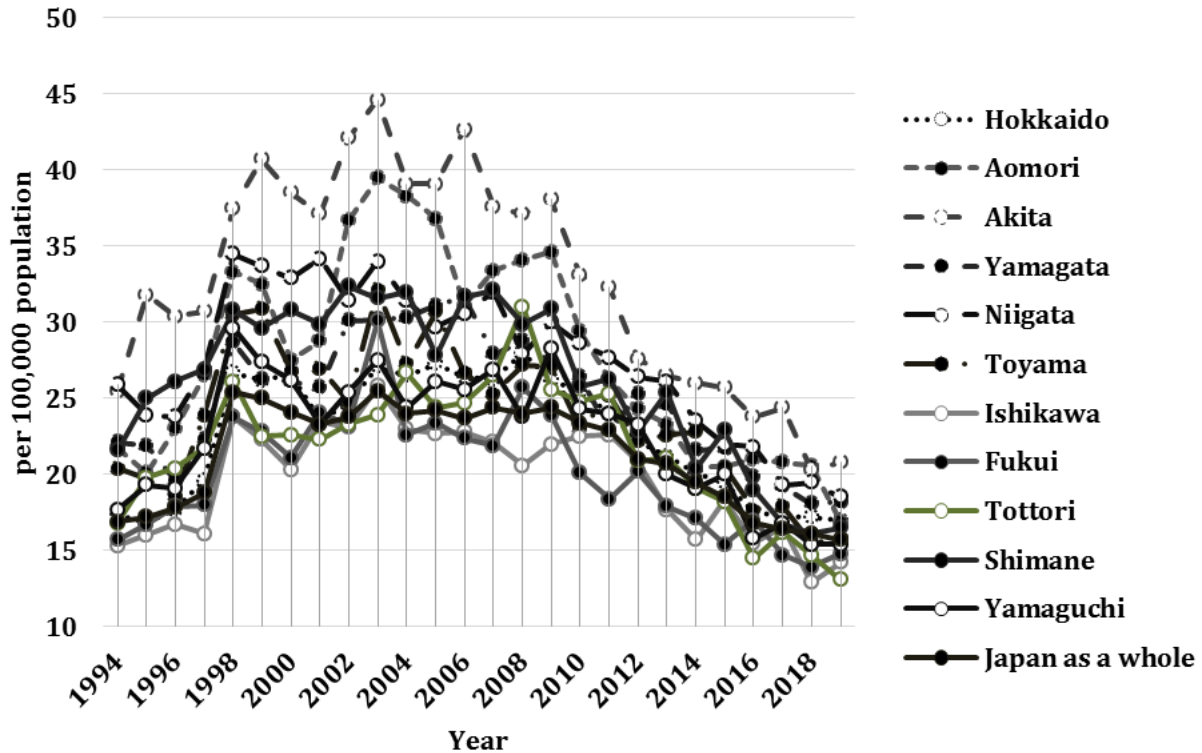


Figure 1. Annual suicide rates in 11 of Japan's 47 prefectures and in Japan as a whole during the 26-year period from 1994 to 2019.

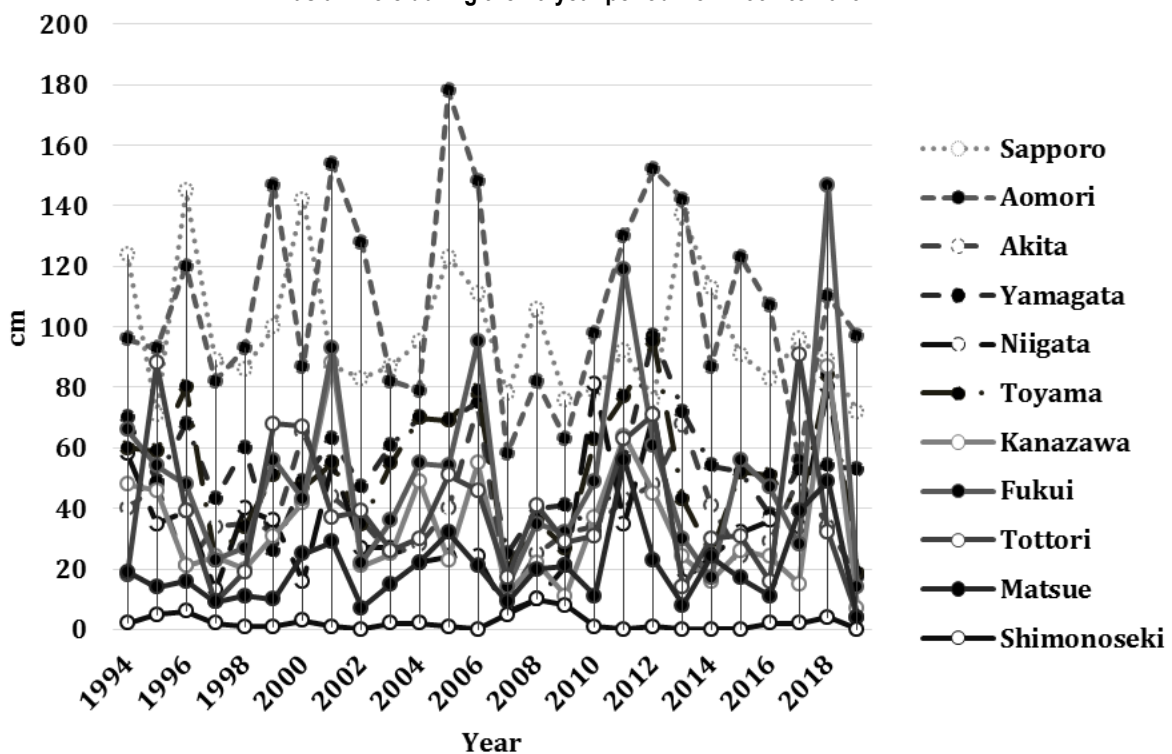


Figure 2. Annual max. depth of snow cover in the 11 prefectures in 1994–2019.

Classification of high and low suicide rates in the prefectures.

Compared to Japan as a whole, seven prefectures were classified as having a high suicide rate (Hokkaido, Aomori, Akita, Yamagata, Niigata, Toyama, and Shimane) and the other four were classified as having a low suicide rate (Ishikawa, Fukui, Tottori, and Yamaguchi).

Annual maximum depth of snow cover during 1994–2019 in the 11 prefectures.

The data of the annual maximum depth of snow cover in the 11 prefectures during the 26-year study period are illustrated in Figure 2. The ranges of annual maximum depth of snow cover (cm) during the period are provided in Table 1. The suicide rate was not significantly correlated with the maximum depth of snow cover in any of the 11

Table 1.

The annual maximum depth of snow cover in the 11 prefectures, and correlations between the suicide rate and the annual maximum depth of snow cover.

Prefecture	Annual max. snow depth, cm	r-value	p-value
Hokkaido	71–145	0.0298	0.885
Aomori	56–178	0.0112	0.957
Akita	10–74	0.0662	0.748
Yamagata	25–97	0.0749	0.716
Niigata	6–81	-0.177	0.386
Toyama	19–95	-0.0724	0.725
Ishikawa	7–88	0.0416	0.840
Fukui	14–147	-0.162	0.428
Tottori	4–91	0.061	0.767
Shimane	4–56	-0.244	0.230
Yamaguchi	0–10	0.0763	0.711

prefectures. Regardless of the prefecture having a high suicide rate (n=7) or low suicide rate (n=4), the same absence of a correlation between the annual maximum snow cover's depth and the suicide rate was observed.

Annual number of days with snow in 1994–2019 in each prefecture

The annual number of days with snow in each prefecture during the study period are depicted in Figure 3, and the prefectural data are presented in Table 2 along with the correlations. The suicide rate was not significantly correlated with the number of days with snow in any of the 11 prefectures. Regardless of the prefecture having a high or low suicide rate, the same absence of a correlation between the number of days with snow and the suicide rate was observed.

Table 2.

The annual number of days with snow in the 11 prefectures, and correlations between the suicide rate and the annual number of days with snow.

Prefecture	Annual no. of days with snow	r-value	p-value
Hokkaido	104–138	-0.0364	0.860
Aomori	89–125	-0.216	0.289
Akita	79–120	-0.00584	0.977
Yamagata	72–111	-0.15	0.463
Niigata	50–92	-0.0119	0.954
Toyama	34–79	-0.243	0.232
Ishikawa	39–76	-0.145	0.480
Fukui	33–71	-0.105	0.609
Tottori	25–64	-0.00698	0.973
Shimane	23–59	-0.0771	0.708
Yamaguchi	7–32	-0.0387	0.851

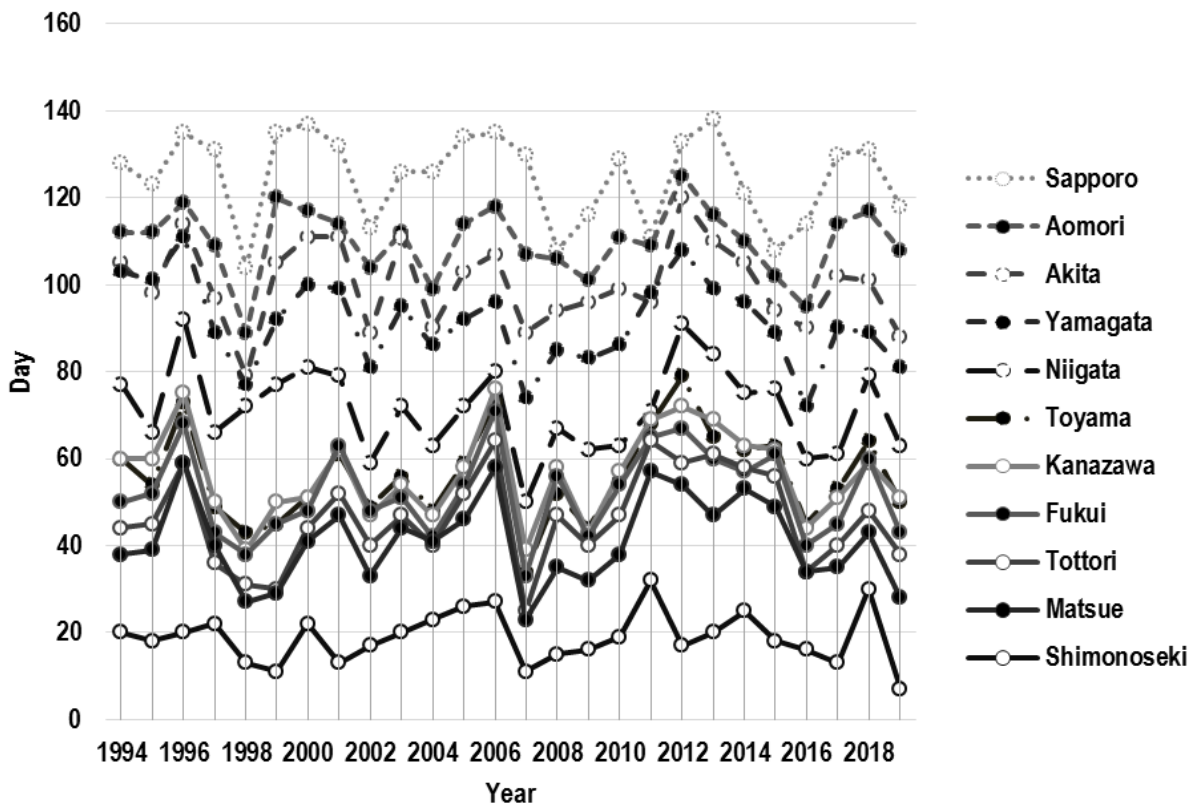


Figure 3. Annual number of days with snow in the 11 prefectures in 1994–2019.

Discussion. We analyzed the data of 11 prefectures along the Sea of Japan with heavy snowfall; of those, seven prefectures (64%) had a high suicide rate and the other four had a low suicide rate. Two snowfall indices (annual values of snow cover depth and number of days with snow) were not found to be correlated with suicide regardless of the prefecture having a high or low suicide rate. A study using the geographic characteristics of municipalities in a prefecture located on the Pacific (east) coast of Japan (Wakayama prefecture) reported that the municipalities with the highest suicide rates were located high above sea level and on steep slopes in the mountains, and that these municipalities had both a declining population and snow cover in the winter [26]. According to a systematic review by Cianconi et al., climate change posed various threats to public health in different geographic regions, affecting many people [8]. Their report also indicated that climate change affected mental health at different times [8]. Moreover, the effects of climate change may be direct or indirect, short-term or long-term. According to the Cianconi et al. report, acute climate-related events can lead to traumatic stress and that long-lasting climate-related events can lead to post-traumatic stress [8]. Sher's study of weather, climate, and suicidality demonstrated that suicidal acts involve numerous factors, including loss and conflict in interpersonal relationships, financial problems, and problems at work, and that suicidal behavior may be affected by long-term weather factors [29].

In other words, the effects of snow alone do not lead to suicide. However, a residence's height above sea level and other topographical features are related to snow indices. When weather (including snow) is compounded by financial problems, problems with interpersonal relationships, and/or problems at work, the effects of weather might be linked to suicide. A long winter's snowfall may also be compounded with other problems, potentially affecting mental health.

For example, heavy flooding in the northern part of New South Wales, Australia was reported to potentially greatly increase mental health risks among the affect population, and socioeconomic risks were likely to be based on the flooding and/or the loss of one's home [21]. A study of the effects of the heavy snowfall in northern Norway included aspects related to suicide as well as social aspects related to the effects of the snow [25].

The Republic of Kazakhstan is also a country with heavy-snowfall, and there are various cities. Therefore, the focus of this study is very helpful.

Study Limitations

There are some study limitations to address regarding our present findings. (1) The direct relationship between snow indices and suicide could not be studied in every municipality in every Japanese prefecture. (2) The study investigated only the correlation between the effects of snow and suicide, and the relationship between suicide and the effects of various other factors was not examined. (3) The use of only numerical data is a limitation when researching the detailed effects of weather on health problems, including mental health. Nevertheless, the potential relationship between the effects of a winter's snowfall and health problems including suicide merits further examination. The relationships between completed suicides/suicide attempts and various snow-related factors

including the effects of snow itself, snow indices, and the reduced sunlight during the winter in many locations also remain to be investigated.

Conclusion. No clear link between the direct effects of snow indices and the rate of suicide in 11 of Japan's prefectures was revealed by our analyses. The links between many factors and suicide must be determined, including the relationship between multiple factors and suicide, in order to design fully effective suicide prevention measures. Weather phenomena including snow are just one factor that can cause mental fatigue and poor mental health and potentially lead to suicide, and thus weather should be studied from the perspective of its effects on physical and mental health.

The public, members of the local community, government agencies, meteorological agencies, medical personnel, and organizations and professionals involved in suicide prevention should work together when necessary to explore suicide prevention, and they should craft specific proposals and build partnerships to prevent suicide that are tailored to their specific locales.

Author Contributions

Ken Inoue: Conceptualization, Methodology, Data collection, Validation, Formal analysis, Writing-original draft, Writing-review and editing, and Funding acquisition.

Noriyuki Kawano: Conceptualization, Writing-review and editing, and Funding acquisition.

Madina Apbassova, Nursultan Seksenbayev: Validation, Writing-review and editing, and Some supports including contribution.

Satomi Kameo: Conceptualization, Writing-review and editing, and Funding acquisition.

Elaman Toleuov, Kamila Akkuzinova, Zhanna Karimova, Timur Moldagaliyev, Nargul Ospanova, Dariya Shabdarbayeva, Nailya Chaizhunusova, Altay Dyussupov: Writing-review and editing.

Yasuyuki Fujita: Conceptualization, Validation, and Writing-review and editing, and Funding acquisition.

Masaharu Hoshi: Conceptualization, Writing-review and editing, and Funding acquisition.

Funding: This work was supported by JSPS KAKENHI Grant-in-Aid for Scientific Research (C) Number 17K09194 awarded to K.I.; JSPS KAKENHI Grant-in-Aid for Scientific Research (B) Number 19H04355 awarded to N.K.; JSPS KAKENHI Grant-in-Aid for Scientific Research (A) Number 19H01149 awarded to M.H.; JSPS KAKENHI Grant-in-Aid for Scientific Research (C) Number 19K11714 awarded to S.K.; and JSPS KAKENHI Grant-in-Aid for Scientific Research (C) Number 21K02383 awarded to K.I. ; and JSPS KAKENHI Grant-in-Aid for Scientific Research (C) Number 22K02494 awarded to Y.F.

Conflict of Interests: None.

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