Original Article

Characteristics of and gender difference factors of hikikomori among the working-age population: A cross-sectional population study in rural Japan

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Objectives This study aimed to assess the relevance of hikikomori to a variety of socio-demographic characteristics and socio-psychological conditions and examined these relationships by gender.

Methods The study employed a cross-sectional design. A questionnaire survey was conducted among 2,459 participants aged 15–64 years and living in Happo-cho, Akita. The outcome variable, hikikomori, was characterized by "not having participated in any social events nor interacted with others besides family members for more than six months." Exposure variables included sex, age, marital status, occupational status, outdoor frequencies, health, socio-psychological well-being, and availability of social support. Using Chi-square test of independence and multiple logistic regression, the results indicated the impact of the individual factors and the combined impact of all potential variables on the likelihood of being hikikomori in both participant groups: men and women.

Results The effective response rate was 54.5%. Those who socially withdrew for six months or more ($n=164$ (6.7%); 53.7% men, 46.2% women) were classified as being hikikomori; of these, 45.7% had been withdrawn for more than 10 years. Hikikomori men were more likely to have severe symptoms of mental illness, poorer overall self-rated health, feelings of distress, and passive suicidal ideation than non-hikikomori men, but not hikikomori women. Furthermore, after adjusting for all tested variables as possible confounding factors, being jobless and having fewer outdoor frequencies were associated with being a hikikomori man, and being a homemaker and having no social support were associated with being a hikikomori woman.

Conclusion Occupational status and outdoor frequencies are relevant factors for assessing the likelihood of being a hikikomori. Characteristics of hikikomori manifest differently in men and women. Having social support may help women avoid transitioning into a hikikomori. Incorporating emotional and mental health management into intervention programs may help better target potential beneficiaries among Japanese men.

Key words: hikikomori, gender difference, social support, rural Japan, outdoor frequencies

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I. INTRODUCTION

Hikikomori is defined as a situation wherein a person has been staying at home for an extended period, avoiding social participation such as going to school or work, or spending time with others besides his/her family members. Furthermore, the person may leave home but not interact with others, and these conditions can last from six months to a whole lifespan. In the existing literature, there are no standardized tools to assess hikikomori situations[1~4]; however, consensus is that hikikomori is a state of social withdrawal or non-social participation that lasts more than six months. Among the multitude of factors contributing to someone becoming hikikomori, having a psychotic disorder is one that may be underdiagnosed[5].

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The first epidemiological evidence, identified by the World Mental Health Survey Japan (WMHJ), proves that hikikomori aged 20–49 have a 54.5% possibility of being diagnosed with comorbid psychiatric disorders and even higher odds of having a mood disorder[1]. Another survey, conducted by the Cabinet Office Government of Japan, found that among the hikikomori aged 40–64, 36.1% have been socially withdrawn for more than ten years, 23.4% of whom were homemakers[4]. Furthermore, hikikomori people have been reported to have less trust in interpersonal relationships[6,7], lack of appreciation for the community that they live in[8], loneliness[9], depression[9], suicidal ideation[10], comorbidity with mental illness[11~14], and a lower quality of life[15]. These findings mostly represent limited age groups studied in case reports and clinical experiments.

In terms of social roles, men and women usually respond differently to social settings and have different social health behavior[16,17]. Men are usually more socially isolated than women[18], yet women often have a higher depression rate[19], feel lonelier[20], express more, and have more conversations than men[16,21]. Existing literature demonstrates that hikikomori people are younger, most usually men, often from wealthier families, and reside more in the cities; however, it is argued that women as homemakers are often excluded from hikikomori studies because their hikikomori situations can often be overlooked because of the roles of a homemaker (including help with housework, child-raising, or care-giving to family members)[22]. This factor makes clarifying the features of hikikomori women cases difficult. Furthermore, the effects of gender differences in hikikomori have never been explored.

In addition to gender differences, social environments can contribute to social isolation[18]. Therefore, prevalence of hikikomori in urban and rural areas should be analyzed. Hikikomori has become a growing concern in developed nations[1~4] and fast-developing nations[23~26]. While hikikomori is thought to be more of an urban issue, rural-area surveys have raised concerns regarding the prolonged social withdrawal period of hikikomori, and about the prevalence of hikikomori being 7–8%, which is far higher than the national estimates (1.45–1.79%)[8,27]. The high reported number of hikikomori people in rural areas has drawn our concern about whether there is a common factor shared by developed and fast-developing nations, insofar as urbanization may lead to depopulated rural areas with reduced social and employment opportunities. To address the existing gaps in current literature, we aimed to identify the extent of the problem of hikikomori in rural areas, and to examine the relevant factors of hikikomori based on gender differences.

II. METHODS

1. Setting and participants

This study was a collaborative project between the municipality office of Akita Prefecture and The Department of Public Health, Akita University in Japan. The participants were recruited from a local rural municipality, which had more than 30% reduction in population over the past 45 years, an aging rate of 43%, and two-fold lower fiscal health than the national average. The characteristics of the research area had been marked with economic contributions in farming/fishery/forestry. The most laborious and socially active season in this area has been between March and October, before heavy snowfall, and with two major local festivals held in the month of August.

Local volunteers distributed a set of self-administered questionnaires door-to-door to all registered residents aged 15–64 ($n=4,515$), who stayed at home between Aug 1–12. Institutionalized residents were excluded from the study. Informed consent was obtained from participants before the study, both orally and in written form. The participants had all rights to refuse participation or choose not to disclose specific information. Completed questionnaires were sealed in reply envelopes and collected by the volunteers two weeks later. The Institutional Review Board and the Ethics Committee of Akita University approved the study protocol (December 13, 2011).

2. Measures

The outcome variable was set as hikikomori. Exposure variables were socio-demographic factors, health, socio-psychological well-being, and social support. Socio-demographic factors included sex, age, occupational status, marital status, and outdoor frequencies. Health status was represented by existing sickness and overall self-rated health. Socio-psychological well-being was indicated using yes/no questions for emotional distress, loneliness, isolation, passive suicidal ideation, and severe mental illness symptoms. Social support was defined as having someone to talk to when problems occur.

Symptoms of severe mental illness were measured using a simple six-item questionnaire rated on a 5-point Likert scale (K6), (0=never, 1=a little of the time, 2=sometimes, 3=most of the time, 4=all the time) and Cronbach $\alpha=0.85$[31]. Responses to the six items were calculated to yield a K6 score between 0 and 24 per individual, with higher scores indicating greater depressive tendencies. K6 scores$\geq$13 were considered to indicate significant clinical levels of severe mental illness[28,29]. Detailed descriptions of all the measured items are provided in the appendix.

To further understand the aggregate effect of socio-psychological well-being factors, the total number of socio-psychological well-being factors was created via the summation of all socio-psychological well-being

factors.

3. Statistical analysis

Chi-square tests for proportional differences between hikikomori status and all potential exposure factors were computed for all participants. Multiple logistic regression was then performed on hikikomori to assess the impact of individual variables of health status and socio-psychological well-being factors with adjustment for all socio-demographic factors (Model 1) and adjusted effects of all potential factors (Model 2). For all models, collinearity diagnostics were run according to tolerance, and variance inflation factors were calculated to avoid multi-collinear problems due to having several socio-psychological well-being factors in the model. The goodness of fit of the model was also checked using the Hosmer and Lemeshow test. All models were applied to the entire sample, and to male and female participants separately.

Odds of the total number of socio-psychological well-being factors were obtained using a multiple logistic regression model on hikikomori by adjusting for socio-demographic factors and health status. All analyses were performed for all participants, and for men and women separately, using SPSS V.17.0 (SPSS Inc., Chicago, IL, USA), and the significance level was $P<0.05$.

III. RESULTS

The sampling flow chart is illustrated in Fig. 1. A total of 3,059 completed questionnaires were received, yielding a response rate of 67.8%. Our analyses were based on 2,459 respondents (48.6% men, 51.4% women; 32.9% age 15–39 years old, 67.1% 40–64 years old), after excluding the incomplete questionnaires. Among them, 288 respondents (11.7%) withdrew from social interaction. There were 164 hikikomori cases (6.7%), of which, 53.7% were men and 46.2% were women. Among them, 28.1% ($n=46$) had socially withdrawn for between six months to three years, 26.3% ($n=43$) for between three to ten years, and 45.7% ($n=75$) for more than ten years (Fig. 1).

The chi-square test (Table 1) reported that a high proportion of hikikomori tended to have significantly fewer outdoor frequencies, poorer overall self-rated health, more emotional distress, more passive suicidal ideation, loneliness, social isolation, and less social support, compared to non-hikikomori. In terms of social demographic factors, there were no significant

Figure 1　Sample Flow Chart

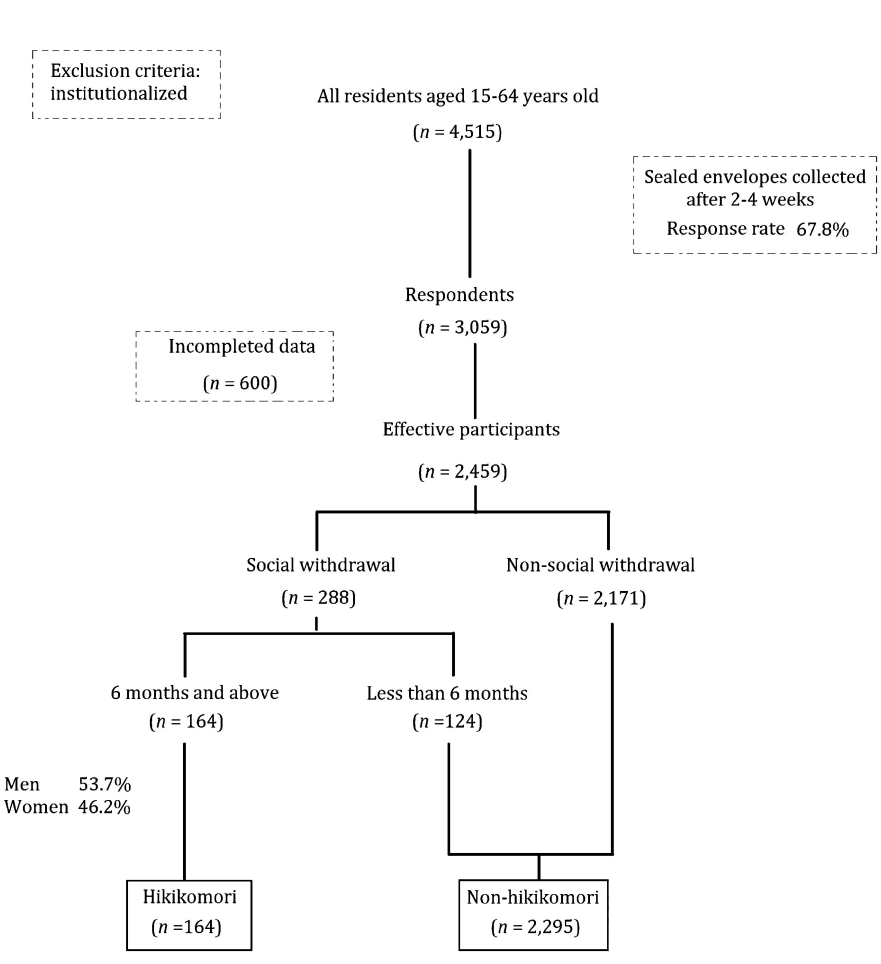

Table 1 Basic characteristics of the participants

	Total			Men			Women		
	Non-hikikomori ($n=2,295$)	Hikikomori ($n=164$)	*P*-value	Non-hikikomori ($n=1,107$)	Hikikomori ($n=88$)	*P*-value	Non-hikikomori ($n=1,188$)	Hikikomori ($n=76$)	*P*-value
Social-demographic factors									
Sex (Women)	1,188(51.8%)	76(46.3%)	0.207[b]						
Age (15–39 years old)	761(33.2%)	48(29.3%)	0.348[b]	369(33.3%)	21(23.9%)	0.088[a]	392(33.0%)	27(35.5%)	0.743[a]
Marital status			0.059[a]			0.130[a]			0.399[a]
Single	623(27.1%)	52(31.7%)		361(32.6%)	34(38.6%)		262(22.1%)	18(23.7%)	
Married	1,506(65.6%)	94(57.3%)		686(62.0%)	46(52.3%)		820(69.0%)	48(63.2%)	
Divorced/Widowed	166(7.2%)	18(11.0%)		60(5.4%)	8(9.1%)		106(8.9%)	10(13.2%)	
Job classifications			<.001[a]			<.001[a]			0.002[a]
Full-time workers	1,284(55.9%)	77(47.0%)		761(68.7%)	54(61.4%)		523(44.0%)	23(30.3%)	
Freeters/Part-time workers	362(15.8%)	18(11.0%)		84(7.6%)	5(5.7%)		278(23.4%)	13(17.1%)	
Homemakers/Jobless	322(14.0%)	48(29.3%)		101(9.1%)	21(23.9%)		221(18.6%)	27(35.5%)	
Students/Others	327(14.2%)	21(12.8%)		161(14.5%)	8(9.1%)		166(14.0%)	13(17.1%)	
Fewer outdoor frequencies	443(19.4%)	58(35.4%)	<.001[b]	217(19.6%)	30(34.1%)	0.002[b]	226(19.1%)	28(36.8%)	<.001[b]
Health status									
Existing sickness	744(32.4%)	56(34.1%)	0.711[b]	343(31.0%)	31(35.2%)	0.480[b]	401(33.8%)	25(32.9%)	0.977[b]
Poor overall self-rated health	566(24.7%)	59(36.0%)	0.002[a]	273(24.7%)	36(40.9%)	0.001[b]	293(24.7%)	23(30.3%)	0.339[b]
Socio-psychological well-being factors									
Severe mental illness	133(5.8%)	19(11.6%)	0.005[b]	59(5.3%)	13(14.8%)	0.001[b]	74(6.2%)	6(7.9%)	0.737[b]
Emotional distress	488(21.3%)	50(30.5%)	0.008[b]	172(15.5%)	27(30.7%)	<.001[b]	316(26.6%)	23(30.3%)	0.572[b]
Loneliness	719(31.3%)	73(44.5%)	0.001[b]	301(27.2%)	36(40.9%)	0.009[b]	418(35.2%)	37(48.7%)	0.024[b]
Isolation	391(17.0%)	44(26.8%)	0.002[b]	177(16.0%)	25(28.4%)	0.004[b]	214(18.0%)	19(25.0%)	0.171[b]
Passive suicidal ideation	427(18.6%)	44(26.8%)	0.013[b]	156(14.1%)	24(27.3%)	0.002[b]	271(22.8%)	20(26.3%)	0.573[b]
Social support	1,993(86.8%)	129(78.7%)	0.005[b]	900(81.3%)	67(76.1%)	0.296[b]	1,093(92.0%)	62(81.6%)	0.003[b]

[a] *P*-value derived using the Pearson chi-square test

[b] *P*-value derived using the continuity correction computer only for a 2×2 table chi-square test

Table 2 Associations between the hikikomori condition and the individual variables of interest among all participants, and its comparison between men and women

	Total		Men		Women	
	Model 1 OR (95%)	Model 2 OR (95%)	Model 1 OR (95%)	Model 2 OR (95%)	Model 1 OR (95%)	Model 2 OR (95%)
Social-demographic factors						
Sex (Women)		0.75(0.53–1.07)				
Age (15–39 years old)		0.76(0.50–1.15)		0.54(0.30–0.98)		1.12(0.60–2.09)
Marital Status						
Single		1		1		1
Married		0.76(0.49–1.17)		0.60(0.35–1.04)		1.07(0.52–2.23)
Divorced/Widowed		1.20(0.64–2.25)		1.03(0.42–2.50)		1.69(0.65–4.39)
Job Classifications						
Full-time workers		1		1		1
Freeters/Part-time workers		0.86(0.50–1.49)		0.67(0.25–1.75)		1.07(0.53–2.18)
Homemakers/Jobless		2.30(1.53–3.45)		2.00(1.10–3.64)		2.60(1.43–4.74)
Students/Others		1.03(0.60–1.76)		0.74(0.33–1.65)		1.57(0.73–3.39)
Fewer outdoor frequencies		1.83(1.28–2.62)		1.72(1.03–2.85)		2.12(1.26–3.57)
Health status						
Existing sickness	0.88(0.61–1.27)	0.78(0.53–1.15)	0.93(0.57–1.53)	0.76(0.45–1.28)	0.83(0.48–1.42)	0.81(0.45–1.46)
Poor overall self-rated health	1.39(0.98–1.97)	1.28(0.86–1.91)	1.66(1.04–2.66)	1.41(0.82–2.42)	1.12(0.66–1.90)	1.12(0.45–1.46)
Socio-psychological well-being factors						
Severe mental illness	1.55(0.91–2.66)	1.12(0.60–2.05)	2.22(1.11–4.44)	1.42(0.62–3.27)	0.96(0.39–2.34)	0.69(0.25–1.87)
Emotional distress	1.44(1.01–2.07)	1.19(0.77–1.84)	2.00(1.22–3.30)	1.53(0.82–2.85)	1.03(0.62–1.74)	0.98(0.52–1.83)
Loneliness	1.52(1.09–2.11)	1.30(0.88–1.91)	1.52(0.97–2.46)	1.12(0.63–1.97)	1.44(0.89–2.32)	1.40(0.82–2.42)
Isolation	1.46(1.01–2.13)	1.08(0.69–1.69)	1.63(0.98–2.73)	1.18(0.63–2.23)	1.25(0.72–2.19)	0.94(0.49–1.81)
Passive suicidal ideation	1.38(0.95–2.01)	1.03(0.66–1.63)	1.78(1.05–3.00)	1.16(0.60–2.26)	1.04(0.61–1.79)	0.92(0.48–1.75)
Social support	0.76(0.50–1.16)	0.89(0.57–1.39)	1.05(0.60–1.83)	1.40(0.77–2.52)	0.45(0.24–0.85)	0.44(0.22–0.88)

Model 1 = Individual effect of each health status and socio-psychological wellbeing factors with an adjustment for social demographic factors
Model 2 = Effect of all health status, socio-psychological well-being factors and social-demographic factors

differences between men and women (Table 1). In terms of socio-psychological well-being factors, men and women had opposite significant characteristics, except for loneliness. Both sexes demonstrated the significant proportional difference between loneliness and hikikomori (Table 1).

Table 2 shows that the likelihood of hikikomori being unemployed/homemakers (Model 2, OR＝2.30, 95%CI＝1.53–3.45) and having fewer outdoor frequencies (Model 2, OR＝1.83, 95%CI＝1.28–2.62) remained significantly high. The logistic regression analysis showed that individuals who were unemployed/homemakers (Model 2, men, OR＝2.00, 95% CI＝1.10–3.64; women, OR＝2.60, 95%CI＝1.43–4.74) and had fewer outdoor frequencies (Model 2, men, OR＝1.72, 95%CI＝1.03–2.85; women, OR＝2.12, 95%CI＝1.26–3.57) were consistently at risk of transitioning to the hikikomori lifestyle. Overall, self-rated health (Model 1, OR＝1.66, 95%CI＝1.04–2.66), emotional distress (Model 1, OR＝2.00, 95% CI＝1.22–3.30), severe mental illness (Model 1, OR＝2.22, 95%CI＝1.11–4.44), and passive suicidal ideation (OR＝1.78, 95%CI＝1.05–3.00) were significantly associated with hikikomori men. Social support was significantly negatively associated with female hikikomori in both models (Model 1, OR＝0.45, 95% CI＝0.24–0.85; Model 2, OR＝0.44, 95% CI＝0.22–0.88).

Further analyses on aggregated socio-psychological well-being factors (Table 3) were conducted to further determine their impact on being hikikomori, and the results demonstrated that being a homemaker/jobless and exhibiting fewer outdoor frequencies remained significant factors in the populations of men and women. When men had more socio-psychological problems, there were higher odds (OR＝1.21, 95%CI＝1.03–1.42) that they would be hikikomori. Multicollinearity among socio-psychological factors were not identified as all tolerance values far exceeded 0.1, and VIF values were less than 2. Hosmer and Lemeshow Test showed a *P*-value of 0.065, indicating the model is good-fit.

IV. DISCUSSION

1. Prevalence and social withdrawal duration of hikikomori

To our knowledge, this is the first study relating to hikikomori in rural areas at the population level. Given the previous surveys, the prevalence of hikikomori was 1.8% in 2009[2], 1.57% in 2015 among people aged 15–39[3], as well as 1.45% older hikikomori among people aged 40–64 in 2018[4]. The prevalence of hikikomori in this study is relatively high (6.7%) compared to the national estimates (0.56%–1.8%)[1~4]. Although the previous surveys and the present study are not targeted at the same population, our study demonstrates that age group is not a factor affecting the transition to a hikikomori lifestyle. Furthermore, almost half of our hikikomori samples have been socially withdrawn for more than a decade. In an earlier study, the proportion of hikikomori people was smaller in residential areas with more busi-

Table 3 Associations between the hikikomori condition and the individual variables of interest among all participants, and its comparison between men and women considering the effect of all potential factors

	Total OR (95%CI)	Men OR (95%CI)	Women OR (95%CI)
Social-demographic factors			
Sex (Women)	0.74(0.53–1.05)		
Age (15–39 years old)	0.74(0.49–1.13)	0.56(0.31–1.01)	1.06(0.57–1.97)
Marital Status			
Single	1	1	1
Married	0.73(0.48–1.12)	0.62(0.37–1.07)	1.01(0.49–2.09)
Divorced/Widowed	1.20(0.64–2.24)	1.03(0.43–2.46)	1.70(0.66–4.39)
Job Classifications			
Full-time workers	1	1	1
Freeters/Part-time workers	0.86(0.50–1.49)	0.65(0.25–1.69)	1.05(0.52–2.12)
Homemakers/Jobless	2.34(1.56–3.51)	1.98(1.10–3.59)	2.66(1.47–4.82)
Students/Others	1.04(0.61–1.77)	0.71(0.32–1.58)	1.64(0.76–3.52)
Fewer outdoor frequencies	1.89(1.33–2.69)	1.70(1.04–2.78)	2.24(1.34–3.73)
Health status			
Existing sickness	0.77(0.53–1.14)	0.79(0.47–1.32)	0.77(0.43–1.37)
Poor overall self-rated health	1.40(0.92–2.02)	1.44(0.85–2.43)	1.25(0.68–2.29)
Socio-psychological well-being (Aggregated)	1.10(0.98–1.24)	1.21(1.03–1.42)	0.99(0.83–1.17)

ness opportunities compared to other residential characteristics[10], indicating that socio-economic characteristics may contribute to the high prevalence of hikikomori situations in rural areas. Contextual factors between urban and rural areas should be further investigated to design proper strategies to tackle the hikikomori phenomenon.

2. Characteristics of hikikomori: homemakers, unemployment, and fewer outdoor frequencies

In our study, 10.4% of the hikikomori samples are homemakers, all of which are women. Interestingly, the prevalence of homemakers found in this study is half of the nation's estimates (23.4%)[4], suggesting that homemakers living in rural areas are less likely to be hikikomori.

Unemployment and fewer outdoor frequencies appear to be the predominant socio-demographic factors that control all other socio-psychological factors for hikikomori in general, as well as male and female hikikomori. These findings further validate the hikikomori samples found in this study. However, our study also includes a noticeable number of people who classify themselves as having a job. Although almost half of the hikikomori in this study report being full-time workers, it is unlikely that they would be able to meet the criteria for both these social identities simultaneously. Spring and summer are the busiest seasons in a town that supports a primary sector economy, and it is virtually impossible to retain employment when avoiding job appointments or social events in this period. As such, we believe that the occupational status reported in these instances may represent the participants' preferred social identity moreso than their actual employment status.

3. Difference in characteristics between men and women

The impacts of having severe mental illness symptoms, poorer overall self-rated health, emotional distress, and passive suicidal ideation are stronger in hikikomori men than in non-hikikomori men. Since the frequency of the socio-psychological factors are significant, we hypothesize that it might be due to a dose-response relationship, where men must reach a certain level of poor socio-psychological factors to become hikikomori.

We believe that gender role expectations for men in Japanese society—for example, avoiding any display of their weaknesses in front of others, being the breadwinner in the family, and being out in the field—contribute to worsening mental health situations in hikikomori men. Jones (1998) identified how unemployment affects an individual's social identity, causing the person to feel like a social misfit[30]. When a man does not attend work, the reversal in social status can have a negative impact on self-efficacy, thereby creating enormous stress that would significantly impact the mental health of a hikikomori man[16,21,31].

In contrast to the men, there is no significant relationship between these variables in hikikomori and non-hikikomori women. We believe that this can be explained using the generalization that women more often report being depressed and having suicidal thoughts regardless of whether they are hikikomori.[19,20]. Therefore, being a hikikomori may not necessarily make them more mentally vulnerable than non-hikikomori women.

However, hikikomori women can feel lonelier than non-hikikomori women since they may have less social support. Women who do receive social support benefit from the positive impact, which can reduce the risk of being a hikikomori by half. Thus, the availability of social support, in this case, being able to articulate personal problems to others, may be a factor preventing women from being hikikomori. As women often have more social support than men[18], this may also explain why hikikomori tend to be men. We previously reported that conversational power increased when hikikomori people felt secure[32]; therefore, we suggest that incorporating a secure platform for social interactions into hikikomori intervention may be helpful. Furthermore, as men generally display less help-seeking behavior than women[16,21], effective intervention methods for hikikomori men may need to be developed more proactively.

4. Limitations

There are several limitations to this study. First, this was a cross-sectional study, so we were not able to examine the cause-effect relationships between the indicators and the outcome factors. Additionally, sample bias may have occurred as people in more severe hikikomori conditions may have rejected the survey, leading to an underestimation of the prevalence. As there are no formal questionnaires to determine the prevalence of hikikomori, we cannot conclude if the prevalence from this study is comparable to those from other studies. However, a simple yes/no question stating the definition provided by the Ministry of Health, Labour and Welfare was used to gauge the prevalence, in addition to the participants' duration of social withdrawal.

Social desirability bias may also lead respondents to underreport characteristics of hikikomori. Furthermore, details of physical and mental illness among hikikomori have not been assessed. Thus, the classification of hikikomori may include existing psychiatric disorders or physical disabilities. It should also be noted that though there are many types of social support available, opportunities to articulate personal problems is the only factor measured in this study. Also, other crucial socio-economic factors, such as education level and household income, are not available for further analysis. Lastly, there is only one study area selected for this study, and the possibility of generalizability of the results is limited to rural areas.

5. Strengths and future implications

This study is one of few studies that report hikikomori among a general population inclusive of all working adults. This study is not only one of the very few studies on the association of mental health and hikikomori, but also the first to report these associations separately in men and women. Also, the high response rate encourages the generalizability of the findings. We believe that this study provides insight into hikikomori in highly competitive societies with fewer job opportunities and developed countries that fear rapid aging and the growing number of depopulated areas due to urbanization.

Future studies should consider testing ideas comparing rural and urban areas. Also, qualitative studies should be considered to gain understanding of why and how hikikomori is related to geographic factors, and more quantitative studies are needed to clarify the association between hikikomori and other social determinants including social inequalities such as gender, social support, social values, diversification of activities, lifestyle, infrastructure, and economic activities.

V. CONCLUSION

In this study, we found that occupational status and outdoor frequencies are important factors in assessing the potential for being hikikomori. It should also be noted that characteristics of hikikomori differ between men and women. Moreover, social support may help women avoid hikikomori, while incorporating emotional and mental health management into the design of intervention programs may help hikikomori men.

RY, KF, and HS contributed to the conception and design of the study. KF organized the database, RY and PC performed the statistical analyses, and RY wrote the first draft of the manuscript; PC and KF edited sections of the manuscript. All authors contributed to the manuscript revision, read, and approved the submitted version.

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Appendix

Variables	Questions	Scale (orignial)	Scale (modified)
1 Hikikomori	1.1 "Have you not been participating in any social activities* and not having close interpersonal relationship with others than your family members for a long time?" (*Social activities including attending schools, going to work, joining local events, volunteering, socializing.) 1.2 "How long have you been in this situation?"	①Yes (go to question 2) ②No ①x＜1 month ②1≤x＜3 months ③3≤x＜6 months ④6≤x＜12 months ⑤1≤x＜3 years ⑥3≤x＜5 years ⑦5≤x＜10 years ⑧x≥10 years	1. Non-hikikomori (①–③) 2. Hikikomori (④–⑧)
2 Sex		①Male ②Female	
3 Age		①15–39 years old ②40–64 years old	
4 Marital Status	"What is your current marital status?"	①Unmarried ②Married and cohabiting ③Married but living separately ④Married but widowed ⑤Divorced	1. Single (①) 2. Married (②–③) 3. Divorced/Widowed (④–⑤)
5 Job Classifications	"What is your current job?"	①Agriculture/Forestry/Fishery (including family employees) ②Buisness/Self-employed ③Clerical ④Manager (department chief and above) ⑤Professional skilled ⑥Technical/labored ⑦Service industry ⑧Corporate CEO ⑨Freeters ⑩Part-time ⑪Housewives/husbands ⑫Jobless ⑬Students ⑭Others	1. Full-time workers (①–⑧) 2. Freeters/Part-time workers (⑨–⑩) 3. Homemakers/Jobless (⑪–⑫) 4. Students/Others (⑬–⑭)
6 Outdoor frequencies	"How often do you go out from your house?" (for students and people who are working, please answer according to your off-days)	①very often ②quite often ③not often ④almost never	1. More (①–②) 2. Fewer (③–④)
7 Existing sickness	"Are you seeing a doctor now or do you have a sickness that needs medical follow-up?"	①no ②yes	
8 Poor overall self-rated health	"In general, how would you rate your health?"	①very healthy ②quite healthy ③not so healthy ④not healthy	1. Healthy (①–②) 2. Not healthy (③–④)
9 Severe mental illness	K6 scales (detailed description please refer to reference 31)	①normal (K6＜13) ②severe mental illness (K6≥13)	
10 Emotional distress	"Have you been having emotionally distressed?"	①no ②yes	
11 Loneliness	"How often do you feel lonely in life?"	①often ②sometimes ③not so ④rarely	1. Yes (①–②) 2. No (③–④)
12 Isolation	"How often do you feel being isolated from the community that you are living in?"	①often ②sometimes ③not so ④rarely	1. Yes (①–②) 2. No (③–④)
13 Passive suicidal ideation	"Have you ever wished to die?"	①no ②little ③yes	1. Yes (③) 2. No (①–②)
14 Social support	"Do you have someone that you can talk to about your problems?"	①no ②yes	