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Development and Validation of the 25-item Hikikomori Questionnaire (HQ-25)

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Abstract

Aim: Hikikomori, a form of severe social withdrawal, is an emerging issue in mental health, for which validated measurement tools are lacking. The object was to develop a self-report scale of hikikomori, and assess its psychometric properties and diagnostic accuracy.

Methods: A sample of 399 participants from clinical and community settings completed measures. Psychometric properties were assessed with factor analysis; diagnostic accuracy was compared against a semi-structured diagnostic interview.

Results: The Hikikomori Questionnaire (HQ-25) contained 25 items across three subscales representing socialization, isolation, and emotional support. Internal consistency, test-retest reliability, and convergent validity were all satisfactory. Area under of the curve was 0.86 (95% CI, 0.80 - 0.92). A cut-off score of 42 (out of 100) was associated with a sensitivity of 94%, specificity of 61%, and PPV of 17%.

Conclusions: The HQ-25 possesses robust psychometric properties and diagnostic accuracy in an initial sample of Japanese adults. Additional research on its psychometric properties and ability to support clinical assessment of hikikomori is warranted.

Keywords: mental health; psychometric; reliability; self-assessment; social withdrawal; social isolation

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Introduction

Within the past few decades, a particular form of severe and prolonged social withdrawal called hikikomori has emerged as an issue of clinical, public health, and general societal concern [1]. Although a consensus definition has not been established, typically hikikomori is defined as a state of social withdrawal combined with avoidance of major social interactions or responsibilities (e.g., education, employment, and friendships) lasting at least 6 months [2]. Initially described in Japan, in the last decade hikikomori has become the source of attention globally [3], with cases described in the North America, Europe, and elsewhere in Asia [4–6]. Epidemiologic surveys have suggested a prevalence between 1 and 2% [5,7], and policymakers have expressed concern about the threat to the labor market from hikikomori who inevitably drop out of school or are unable to maintain employment.

Prototypical cases of hikikomori often have their onset in adolescent or young adult men, occur in the context of academic difficulties, troubled family dynamic, and/or other psychosocial stressors, and result in individuals who spend exorbitant amounts of time isolated in their own bedrooms [4]. A systematic review of hikikomori noted that it may be an outcome of developmental problems such as insecure attachment [5]. Small case series have suggested hikikomori frequently have high levels of loneliness and lack of social support received from their social network [8]. Major depression or other psychiatric co-morbidities are also common, although idiopathic cases occur too [9,10].

In our previous work, we proposed a definition of hikikomori to help standardize research on hikikomori [2], and more recently we updated this working definition [8]. One of the next important steps in advancing this emerging area of research is the development of a tool that can be used to assess hikikomori and measure it consistently across varying populations and settings. To date, two instruments related to hikikomori have been developed. The first one, called the *Hikikomori Behavior Checklist* is a 45-item Japanese-language instrument designed to be completed by a parent about his or her child [11]. Each item briefly notes a behavior (e.g., "Your family member smiles without reason") or character description (e.g., "Your family member lacks motivation"), accompanied by a four-point response scale ranging from definitely untrue to definitely true. The other instrument, called the *NEET/Hikikomori Risk Scale*, was developed with the view that both NEET ("not in employment education or training" and hikikomori both represent forms of marginalization in society, occupational withdrawal in the former condition and social withdrawal in the latter. Authors developed and validated a 27-item scale that focuses on work attitudes. In a large-scale, national Japanese sample they found a three-factor structure

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described as: 1) a freeter lifestyle preference (an intentional decision to perpetually seek low-skill, part-time employment), 2) lack of self-competence, and 3) having unclear ambitions for the future [12].

In the present study, we aimed to add to this initial literature on psychometric testing of hikikomori. Our primary goal was to develop and evaluate a self-report instrument that was based on psychosocial characteristics of hikikomori that have been previously described in the medical literature and focused on social (but not occupational) withdrawal. In addition, we sought to explore accuracy of the tool compared to a clinician-administered diagnostic interview for hikikomori.

Methods

Phase 1: Item Pool Development

We generated an initial list of 59 candidate scale items. Item generation was guided by themes that have been identified in the hikikomori literature, such as lack of social connectedness [2,4], active social isolation or withdrawal behavior [13], avoidance of social contact [5], and a sense of alienation or marginalization from society [12]. Overall, candidate items reflected psychological features and behavioral patterns that have been summarized in reviews of hikikomori [5]. The lead author (A.R.T.) drafted initial item wording, which was then reviewed and revised by consensus among other research team members with expertise in clinical psychology, psychiatry, and hikikomori (H.K., J.E.A., and T.A.K.). Japanese was used for administration of the scale. Negatively-worded items were included to reduce acquiescence bias [14]. The reference period for scale items ("over the last six months") was chosen to match the duration of symptoms in our current definition of hikikomori [2,15]. Response options for all items were: strongly disagree (0), somewhat disagree (1), neither agree nor disagree (2), somewhat agree (3), and strongly agree (4). Individual items were reverse-scored if indicated, then summed to create a total scale score.

Phase 2: Data Collection

Study recruitment occurred in Fukuoka, a major metropolitan area in southern Japan. All participants provided written informed consent, received a gift card incentive worth approximately $18. The study sample (N = 399) consisted of two groups. First, volunteers at Kyushu University (n = 170) were recruited via posters and flyers seeking "healthy volunteers." Second, patients from nine psychiatric hospitals and clinics affiliated with the Department of Neuropsychiatry of Kyushu University and clients at a community mental health center (n = 229) were recruited during weekly visits by research staff inquiring about interest in participating in a research study. Exclusion criteria included: age < 15 or > 50, inability to understand written Japanese, or a self-reported history of schizophrenia, or severe heart, liver, or kidney disease. Data were collected between February 2014 and December 2016. Participants completed: 1) a semi-structured diagnostic interview for hikikomori; 2) the item pool for the hikikomori scale; 3) a self-report survey including sociodemographic items and measures of psychiatric symptoms

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and psychological constructs; and 4) a computer-administered test and blood sample, both used for a separate research study [16]. The hikikomori scale item pool was re-administered to a subsample of participants for evaluation of test-retest reliability.

The semi-structured diagnostic interview for hikikomori was based on our prior theoretical work [2] and empirical research [9, 8], and it was administered by a clinical psychologist or psychiatrist. Interviewers were unaware of participants' responses on the questionnaire containing candidate scale items. In brief, participants who met the case definition of hikikomori endorsed "yes" with a duration of at least six months to the following questions: "Currently do you spend most of your time at home?" and "Currently do you avoid nearly all social situations?" In addition, individuals with hikikomori endorsed distress associated with these symptoms, or had significant functional impairment associated with their social withdrawal as rated by the study clinician. Finally, when physical or medical etiology for the social withdrawal symptoms was apparent (e.g., pregnancy), individuals were excluded from a hikikomori diagnosis.

Three measures were used to assess convergent validity:

- The Revised University of California, Los Angeles (R-UCLA) Loneliness Scale is a 20-item self-report assessment of one's degree of loneliness [17,18]. Respondents indicate how often they feel the way described in each statement, ranging from 1 ("Never") to 4 ("Often") with a higher score indicating more loneliness. The reliability and validity of the measure have been established for both the English and Japanese versions [17,19].

- The Preference for Solitude Scale (PSS) is a 12-question self-report instrument assessing one's preference for solitude [20]. For each question, respondents are given two statements and then asked to choose which best describes them, with a higher score indicating a stronger preference for solitude. We developed a Japanese version of this scale by using independent translation by two bilingual master's level mental health clinicians (nurse practitioner and clinical psychologist), followed by resolution of translation discrepancies by meetings and final adjudication by a third bilingual psychiatrist.

- The Multidimensional Scale of Perceived Social Support (MSPSS) is a 12-item self-report instrument designed to measure the perceived adequacy of support from family, friends and significant others. Respondents rate items on a 7-point Likert-type scale ranging from 1 ("very strongly disagree") to 7 ("very strongly agree") with a higher score indicating more social support. The reliability and validity of both the English and the Japanese versions of the measure have been established [21,22].

Phase 3: Statistical Analysis

We initially screened items for variability, violation of normality assumptions (skewness or kurtosis exceeding ± 2.0), and poor reliability (item-to-total correlations < 0.50). No items were removed

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based on these criteria. Next, we conducted exploratory factor analysis with Promax rotation. Cattell's scree test and eigenvalues were used to determine the number of factors. Scale items were removed if they met any one of the following four criteria: 1) items that were a factor all by themselves; 2) items that did not load onto any factor (factor loading < 0.5); 3) items that loaded positively onto one factor but also had a large negative correlation on a separate factor (factor loading < -0.4); or 4) items that loaded relatively equally onto two factors. For remaining scale items, we calculated internal consistency using Cronbach's alpha. To assess convergent validity, we calculated correlation coefficients between the hikikomori scale score and other scale measures. When scale scores were skewed, we log-transformed transformed for correlational analyses. Mean substitution was used for handling missing data for scales missing d 50% data.

We evaluated the diagnostic accuracy of the hikikomori scale across multiple cutoff scores using multiple measures: sensitivity (percentage of actual hikikomori cases correctly identified), specificity (percentage of cases without hikikomori correctly identified), positive likelihood ratio (LR+, ratio of true positives to false positives), negative likelihood ratio (LR-, ratio of true negatives to false negatives), positive predictive value (PPV, probability of a positive test result being a true positive), negative predictive value (NPV, probability of negative test result being a true negative), and area under the receiver operating characteristic (ROC) curve. In order to calculate PPV and NPV, we assumed a sample prevalence of hikikomori of 8%. In this case, the area under the ROC curve represents the probability that a randomly selected participant would be correctly classified being with or without hikikomori, with a value of 0.5 representing accuracy no better than chance and greater than 0.8 generally considered excellent [23]. Statistical analyses were conducted in Stata, Version 14.

Results

Factor Structure and Reliability

The scree plot **Figure 1** demonstrated a three-factor structure (eigenvalues of 23.08, 2.56, and 1.66, with remaining eigenvalues below 1.5). Together the factors accounted for 46.53% of the variance. In terms of the internal reliability of the scale, Cronbach's alpha coefficients for the whole scale was 0.96; for the three subscales (i.e., factors) they were 0.94, 0.91, and 0.88, respectively. Among the subsample (n = 121) who completed the HQ-25 at baseline and one-month follow-up, test-retest reliability results showed a correlation of 0.92 (p < 0.001).

After factor analysis, the final version of the scale consisted of 25 items, leading us to name the instrument the *25-item Hikikomori Questionnaire* (**HQ-25**). The first factor addressed socialization (11 items), the second factor isolation (8 items), and the third factor emotional support (6 items). Rotated factor loadings for the items are presented in **Table 1.**

Descriptive Characteristics

Participants (N = 399) had a mean age (SD) of 32 years (9.8), while 50.5% (201) were men and 33.3% (133) lived alone. Their mean total score on the HQ-25 was 41.49 (SD = 22.32, with an observed range of 1 to 98) in comparison to a possible score range of 0 to 100. A detailed description of individual scale item score means, standard deviation, skew, and kurtosis is presented in the **Online Supplementary Table**.

Convergent Validity

The HQ-25 demonstrated convergent validity with both the R-UCLA Loneliness Scale (r = 0.88, p < 0.0001) and Preference for Solitude Scale (r = 0.73, p < 0.0001). In addition, it showed high inverse correlation with the Multidimensional Scale of Perceived Social Support (r = -0.81, p < 0.0001).

Diagnostic Accuracy

The overall diagnostic accuracy of the HQ-25, measured as the AUC and shown in **Figure 2**, was 0.86 (95% CI, 0.80 - 0.91). To determine a potential cut-off score for the HQ-25 to categorize individuals as "at risk" versus "not at risk" for hikikomori, we examined diagnostic characteristics at each possible cut-off score, compared with our semi-structured diagnostic interview. Full results are presented in **Online Supplementary Table 2**, with more abbreviated information in **Table 2**. Using a cut-off score of 42 (out of a possible 100 points) revealed a sensitivity of 94%, specificity of 61%, PPV of 17%, and LR+ of 2.37. Increasing cut-off to 43 reduced sensitivity to 87% without significant gains in PPV or LR+.

Discussion

This paper introduces the 25-item Hikikomori Questionnaire (HQ-25), a novel self-administered instrument for assessing hikikomori. The HQ-25 is theoretically-grounded and straightforward to use, with a convenient and memorable score range of 0 to 100. In terms of psychometric properties, this study demonstrates initial evidence of internal reliability, test-retest reliability, and convergent validity for the HQ-25. In terms of preliminary diagnostic accuracy of the HQ-25, the AUC fell into the range (0.8 to 0.9) considered excellent [23], and sensitivity and PPV though not specificity are comparable to common cut-off scores on the nine-item Patient Health Questionnaire (PHQ-9) to screen for major depression [24,25]. The sample used to develop this scale, predominantly psychiatric patients in Japan, is relatively consistent with the intended real-world application of the scale, a striking contrast with many psychological measures that are developed in homogenous populations of Western college students (the so-called "WEIRD" phenomenon) [26]. This study also significantly extends prior work developing instruments for social withdrawal by including comparison to a proposed reference standard for hikikomori; one limitation in prior research has been lack of inclusion and verification of individuals with hikikomori [11,12]. Taken together, our results suggest the HQ-25 is worthy of additional psychometric research and also has potential for application in hikikomori clinical research settings.

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There is great need for tools that can assist with evaluation and detection of hikikomori in Japan. The number of affected individuals receiving treatment is not known. However, given population surveys that have suggested upwards of 500,000 among adults below age 40, one-third of whom have been isolated for seven or more years [27], it is highly likely that many are not engaged in care. Further development and testing of the HQ-25 may provide a tool to help identify hikikomori for participation in research studies. The HQ-25 could help in other ways too. For example, deficits in emotional support and socialization, which could be indicated by results on the eponymous HQ-25 subscales, can be targeted in psychotherapy, which is a preferred treatment modality for patients with hikikomori [8].

Finally, it is worth noting that a full version of the HQ-25 is freely available, which we have placed in **Online Table 3,** with the Japanese version in **Supplementary Table 3**. Too often, we believe, clinical and research scales are copyrighted or otherwise inaccessible. (Of note, Japanese was used for administration of the scale. However, to facilitate broader evaluation and use in other populations, we present an English version. This was developed using independent translation by two bilingual individuals with backgrounds in clinical psychology, with adjudication of discrepancies by the authors, TAK and ART).

Limitations and Future Directions

As the first study of the HQ-25, there are a several potential directions for future research that can address this study's limitations. First, we did not conduct confirmatory factor analysis, which implies the stability and replicability of the factor structure (socialization, isolation, and emotional support) is not clear. Second, our sample was a mixture of a clinical population and healthy subjects in one region in Japan, and therefore may not be representative of Japan as a whole. Further, because test characteristics are influenced by the underlying sample tested, additional evaluation outside of Japanese populations is vital to further determine generalizability of the psychometric properties and diagnostic accuracy of the HQ-25. For subsequent research, we would also suggest evaluation of the HQ-25 in younger populations, which could include psychiatric clinics evaluating adolescents and middle/high schools. These settings may be ideal for screening as they match ages typical for the onset of hikikomori. Third, although we used the most rigorous available reference standard for hikikomori, a consensus gold standard test for hikikomori does not yet exist.

A final consideration for additional work is examining the potential clinical applications of the HQ-25. Although we have proffered one potential cut-off score for the HQ-25, selecting an optimal cut-off score is a combination of science and art, and should vary by the setting in which is being used. For settings where ruling-in hikikomori is more useful, a higher cut-off score characterized by higher specificity and LR+ would be warranted [8]. Also, we were unable to examine potential risks of using the HQ-25 as a diagnostic tool. Because a substantial number of false-positives are expected to occur with use of our scale, additional work is needed to determine potential harms from screening for hikikomori (e.g., psychological distress or overtreatment).

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Future research could also address issues whether the HQ-25 might be simplified or otherwise revised. Many of these approaches have previously been succinctly summarized [24], and here we suggest a few. For screening purposes, a shorter scale is desirable. It is possible that a briefer scale limited to just the 11 items on socialization would suffice because this (first) factor explained the largest portion of the variance. Prospective studies examining sensitivity to change in score would be useful for treatment monitoring of hikikomori. Elimination of reverse-scored items and attempts to further reduce number of scale items would improve practicality of the instrument. Ability to assess severity of hikikomori and adaption of the HQ-25 into other languages are also desirable.

Conclusions

The HQ-25 is a self-report instrument with novel potential for assisting with evaluation of a relatively new mental health issue. As concern about social withdrawal heightens, particularly in economically developed parts of the Western and Eastern world, this scale offers an important new tool in the ability to study and better understand individuals at risk for hikikomori.

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The authors declare that they have no conflict of interest.

Author's contributions:
Alan R. Teo, M.D., M.S.: study design; lit search; data analysis; data interpretation; writing
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Figure Legend:

Figure 1: Rotated Scree Plot Indicating a Three-factor Structure to the 25-item Hikikomori Questionnaire (HQ-25)

Figure 2: Receiver Operating Curve Showing Accuracy of the Hikikomori Scale for Identifying Individuals with Hikikomori (N = 385)

List of Supporting Information:

Supplementary Table 1: Descriptive Characteristics of Items in the Hikikomori Questionnaire (HQ-25)

Supplementary Table 2: Diagnostic Characteristics of the Hikikomori Questionnaire (HQ-25) Across All Possible Cut-off Scores

Supplementary Table 3: Hikikomori Questionnaire (HQ-25) [Japanese Version]

Table 1: Factor Loadings for the 25 Items Included in the Hikikomori Questionnaire (HQ-25)

Item Text	Factor 1	Factor 2	Factor 3
Factor 1: Socialization (± = .94)			
I stay away from other people.	0.58		
I love meeting new people. [a]	0.74		
People bother me.	0.68		
I feel uncomfortable around other people.	0.71		
I don't like to be seen by others.	0.59		
It is hard for me to join in on groups.	0.74		
I enjoy being in social situations. [a]	0.76		
I avoid talking with other people.	0.73		
I much prefer to be alone than with others.	0.68		
I strongly prefer to be around other people. [a]	0.74		
I don't enjoy social interactions.	0.64		
Factor 2: Isolation (± = .88)			
I spend most of my time at home.		0.68	
I shut myself in my room.		0.50	
I spend most of my time alone.		0.73	
I rarely meet people in-person.		0.63	
I do not live by society's rules and values.		0.45	
I have little contact with other people talking, writing, and so on.		0.51	

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I rarely spend time alone.	0.54
I spend very little time interacting with other people.	0.55

Factor 3: Emotional Support (± = .89)

There really isn't anyone with whom I can discuss matters of importance.	0.76
There are people in my life who try to understand me. [a]	0.63
I can share my personal thoughts with several people. [a]	0.63
There are few people I can discuss important issues with.	0.62
There really isn't anyone very significant in my life.	0.55
I have someone I can trust with my problems. [a]	0.85

[a]*All items were rated on a scale ranging from "0" Strongly Disagree to "4" Strongly Agree.*

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Table 2: Diagnostic Characteristics of the Hikikomori Questionnaire HQ-25 Across Selected Cut-off Scores

Cut-off Score	Sensitivity	95% CI	Specificity	95% CI	LR+	95% CI	LR-	95% CI	PPV	95% CI	NPV	95% CI
e 10	100.00%	88.80%-100.00%	5.71%	3.57%-8.59%	1.06	1.03-1.09	0.00	N/A	0.08	.83-.86	1.00	N/A
e 20	100.00%	88.80%-100.00%	18.48%	14.60%-22.80%	1.23	1.17-1.29	0.00	N/A	0.10	.92-.10	1.00	N/A
e 30	96.77%	83.30%-99.90%	37.77%	32.80%-42.90%	1.56	1.40-1.72	0.09	.01-.59	0.12	.11-.13	0.99	.95-1.00
e 40	96.77%	83.30%-99.90%	52.99%	47.70%-58.20%	2.06	1.81-2.34	0.06	.01-.42	0.15	.14-.17	0.99	.97-1.00
e 50	80.65%	62.50%-92.50%	70.92%	66.00%-75.50%	2.77	2.19-3.51	0.27	.13-.56	0.19	.16-.23	0.98	.95-.99
e 60	74.19%	55.40%-88.10%	81.25%	76.09%-85.10%	3.96	2.94-5.33	0.32	.18-.58	0.26	.20-.32	0.97	.95-.99
e 70	58.06%	39.10%-75.50%	89.40%	85.80%-92.40%	5.48	3.59-8.35	0.47	.31-.71	0.32	.24-.42	0.96	.94-.97
e 80	32.26%	16.70%-51.40%	95.38%	92.70%-97.30%	6.98	3.50-13.90	0.71	.56-.91	0.38	.23-.55	0.94	.93-.95
e 91	9.68%	2.04%-25.80%	98.37%	96.50%-99.40%	5.94	1.56-22.60	0.92	.82-1.03	0.34	.12-.66	0.93	.92-.93

17

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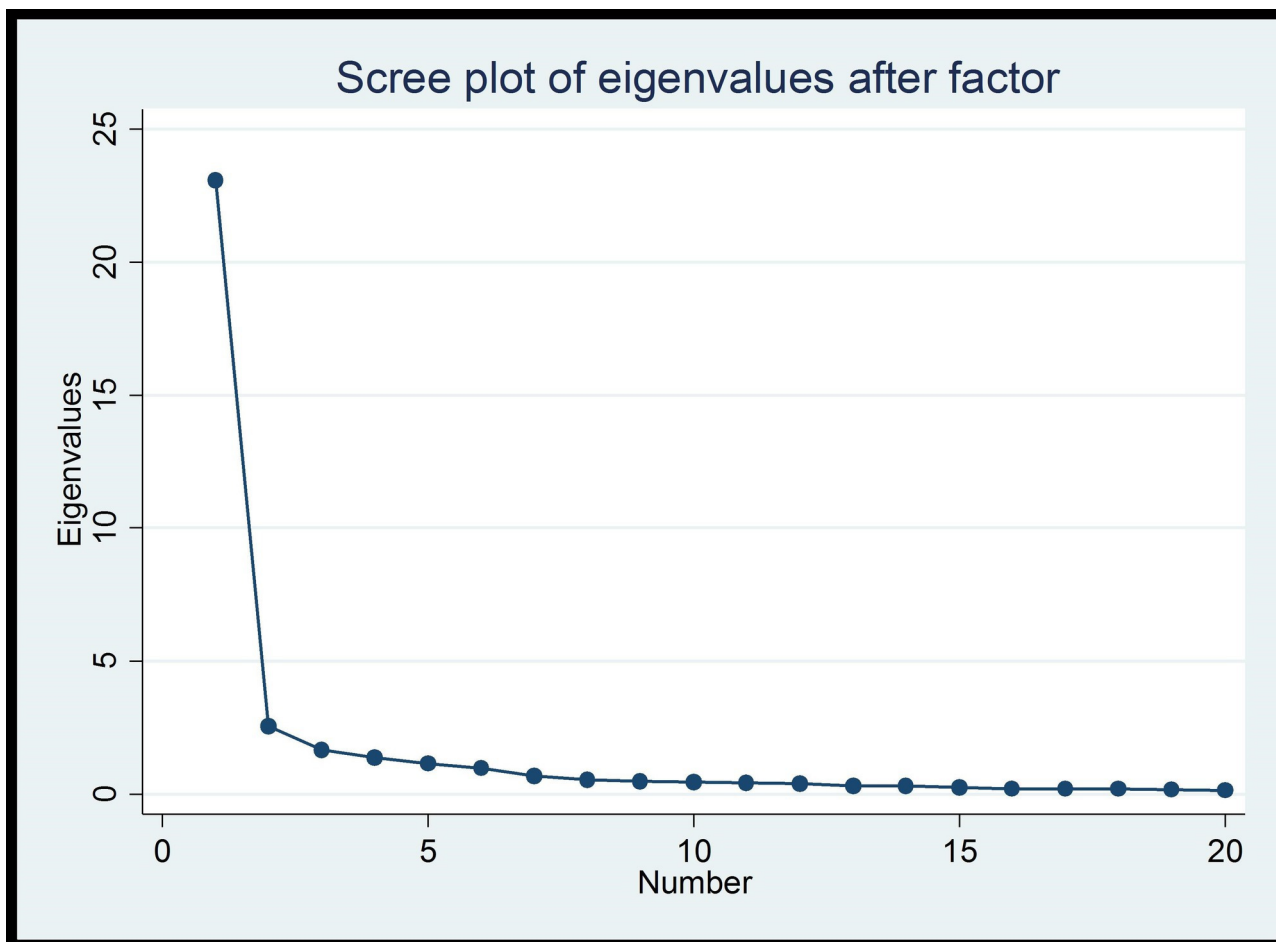
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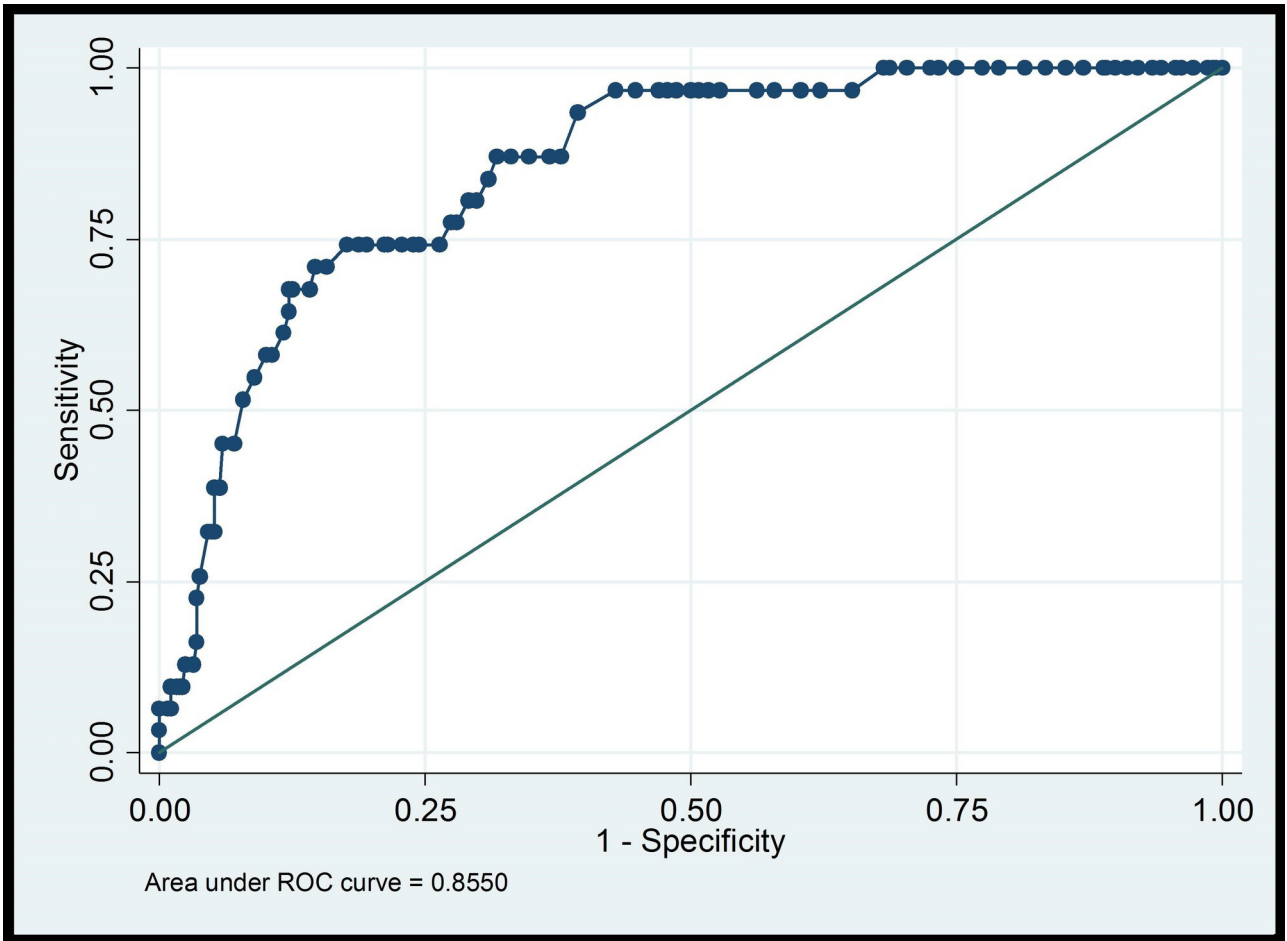
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Scree plot of eigenvalues after factor

PCN_12691_FIG1.jpg

PCN_12691_FIG2.jpg

Table 3Appendix: Hikikomori Questionnaire (HQ-25) [English Version]

Over the last <u>SIX MONTHS</u>, how accurately do the following statements describe you?

		Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
1	I stay away from other people.	0	1	2	3	4
2	I spend most of my time at home.	0	1	2	3	4
3	There really isn't anyone with whom I can discuss matters of importance.	0	1	2	3	4
4 [a]	I love meeting new people.	0	1	2	3	4
5	I shut myself in my room.	0	1	2	3	4
6	People bother me.	0	1	2	3	4
7 [a]	There are people in my life who try to understand me.	0	1	2	3	4
8	I feel uncomfortable around other people.	0	1	2	3	4
9	I spend most of my time alone.	0	1	2	3	4
10 [a]	I can share my personal thoughts with several people.	0	1	2	3	4
11	I don't like to be seen by others.	0	1	2	3	4
12	I rarely meet people in-person.	0	1	2	3	4
13	It is hard for me to join in on groups.	0	1	2	3	4
14	There are few people I can discuss important issues with.	0	1	2	3	4
15 [a]	I enjoy being in social situations.	0	1	2	3	4
16	I do not live by society's rules and values.	0	1	2	3	4
17	There really isn't anyone very significant in my life.	0	1	2	3	4
18	I avoid talking with other people.	0	1	2	3	4
19	I have little contact with other people talking, writing, and	0	1	2	3	4

	so on.					
20	I much prefer to be alone than with others.	0	1	2	3	4
21 [a]	I have someone I can trust with my problems.	0	1	2	3	4
22	I rarely spend time alone.	0	1	2	3	4
23	I don't enjoy social interactions.	0	1	2	3	4
24	I spend very little time interacting with other people.	0	1	2	3	4
25 [a]	I strongly prefer to be around other people.	0	1	2	3	4

The HQ-25 has a theoretical score range of 0 to 100.
[a]Item was reverse-scored.