A psychometric evaluation of the RAND-36 scale among Japanese adults with insomnia in 2023

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Background

- Health-related quality of life (HRQoL) is an important measure that assess the impact of diseases, disorders, or disabilities on the physical, mental, and social domains of patient health.[1]
- While the SF-36 has been proven to be a valid and reliable tool for assessing quality of life[3], few studies have evaluated the psychometric properties of the RAND-36, a publicly available version of the SF-36, in a disease-specific population.
- The National Health and Wellness Survey (NHWS) provides a large observational dataset making it a key asset in evaluating the RAND-36.

Objective

To assess the validity of the RAND-36 as a QoL measure in the general Japanese population and in a subset who reported experiencing insomnia, by implementing multiple methods of psychometric evaluation.

Methods

Data Source

Data was sourced from the 2023 Japan NHWS, an internet-based and self-reported survey designed to represent the general adult population in Japan on age and gender.

Key Variables

The eight subscales of RAND-36:

- Physical Functioning
- Role Limitations due to Physical Health Problems
- Pain
- General Health Perceptions
- Emotional Well-being
- Role Limitations due to Emotional Problems
- Social Functioning
- Energy/Fatigue.[3]

Physical and Mental Health Composite scores and the Global Health Composite score derived from the eight subscales were also reported.

Eligibility

The total sample included people who participated in the 2023 Japan NHWS. The insomnia cohort consisted of those among the population who self-reported experiencing insomnia and did not self-report narcolepsy, sleep apnea, or other sleep difficulties.

Statistical Analyses

Descriptives (means, standard deviations, counts, and percentages) were used to characterize the overall sample and insomnia cohort.

Applicable scale items were reverse coded based on item description. Pearson's correlation tests were used to verify reverse coding and item associations.

To determine internal reliability of the RAND-36, Cronbach's alphas were computed for the global scores and 8 subscales. Alphas greater than 0.7 indicate acceptable internal consistency[4].

Mokken scaling analysis (MSA) with automatic item selection procedure (AISP) was used to test unidimensionality and monotonicity of scale items.

- Homogeneity (H) values were calculated to assess dimensionality. Values less than 0.3 are considered unscalable and as values increase, they are considered more scalable. Higher H values provide stronger evidence that there is one latent variable driving item responses.
- zsig values were used as a measure of the number of monotonicity violations. Fewer violations of monotonicity indicate that respondents with better quality of life will score higher on the RAND-36 global and subscales.

Results

Sample Characteristics

The study consisted of **30,013 respondents** who completed the Japan 2023 NHWS, with **2,084 (6.8%)** of these respondents self-reporting ever experiencing insomnia [Table 1]

Table 1. *Japan 2023 demographics overall and for the insomnia cohort (N=2,084)*

	Total N = 30,013 n (%)	Insomnia Cohort N = 2,084 n (%)
Age in years; mean (SD)	52.37 (16.88)	51.26 (16.90)
Median (min - max)	53.00 (18.00 - 99.00)	52.00 (19.00 - 95.00)
Gender		
Male	**14,294 (47.6%)**	**755 (36.2%)**
Female	**15,719 (52.4%)**	**1,329 (63.8%)**
Marital Status		
Single, never married	8,966 (29.9%)	753 (36.1%)
Married or living with partner	**18,009 (60.0%)**	**1,013 (48.6%)**
Divorced/Separated/Widowed/Decline to answer	3,038 (10.1%)	318 (15.3%)
Education		
Less than 4-year college/Decline to answer	14,083 (46.9%)	1,102 (52.9%)
4-year college	13,125 (43.7%)	769 (36.9%)
Other	2,805 (9.3%)	213 (10.2%)
Annual Household Income		
Low (<¥3,999,999)	10,004 (33.3%)	868 (41.7%)
Medium (¥4,000,000-¥6,999,999)	8,209 (27.4%)	508 (24.4%)
High (¥7,000,000+)	7,047 (23.5%)	408 (19.6%)
Decline to answer	4,753 (15.8%)	300 (14.4%)
Employment		
Not Employed	**12,517 (41.7%)**	**1,019 (48.9%)**
Employed full time/part time/self-employed	17,496 (58.3%)	1,065 (51.1%)
Health Insurance		
National Health Insurance	13,763 (45.9%)	1,111 (53.3%)
Social Insurance	12,023 (40.1%)	705 (33.8%)
Late-Stage Elderly Insurance	1,824 (6.1%)	125 (6.0%)
Other	542 (1.8%)	44 (2.1%)
None of the above	1,861 (6.2%)	99 (4.8%)
BMI; mean (SD)	22.27 (3.95)	22.12 (4.23)
Median (min - max)	21.80 (10.00 – 59.40)	21.50 (10.00 – 54.90)

Highlighted rows indicate key characteristics that differ between population and insomnia cohort.

Response distribution and Cronbach alphas

- Respondents with insomnia had lower mean scores compared to the total sample [Table 2].
- Cronbach alphas of the subscales in the insomnia cohort were all above 0.7, indicating internal consistency [Table 3].
  - The social functioning subscale had an alpha < 0.7

Table 2*. RAND-36 Global and Subscale scores in the 2023 Japan NHWS*

	Total N = 30,013 Mean (SD)	Insomnia cohort N = 2,084 Mean (SD)
Global composite score	46.59 (9.53)	37.71 (10.41)
Mental health composite score	45.52 (10.43)	36.51 (11.17)
Physical health composite score	49.21 (7.72)	42.82 (8.95)
Energy/Fatigue	45.09 (9.57)	38.68 (8.58)
Emotional well-being	44.00 (11.13)	36.34 (10.82)
General health perceptions	42.47 (8.89)	35.51 (8.59)
Pain	50.29 (9.06)	44.43 (9.80)
Physical functioning	54.33 (7.51)	51.63 (9.14)
Role limitation due to emotional problems	49.07 (10.89)	40.35 (15.20)
Role limitations due to physical problems	52.07 (8.58)	46.37 (11.69)
Social functioning	49.35 (11.00)	42.10 (13.07)

RAND-36 scales

Table 3*. Cronbach alphas of the RAND-36 items globally and among the 8 subscales*

Scale	Total (N=30,013)	Insomnia (N=2,048)
Total	0.938	0.937
Physical Functioning	0.942	0.931
Role limitations due to physical health	0.875	0.861
Role limitations due to emotional problems	0.877	0.873
Energy/fatigue	0.749	0.777
Emotional well-being	0.818	0.850
Social functioning	0.693	0.724
Pain	0.794	0.814
General Health	0.819	0.847

Less internally consistent values in red and more internally consistent values in green.

Mokken Scaling Analysis (MSA)

- All H-values were much greater than 0.3, indicating scalability [Table 4].
- The subscale with the lowest H-value and thus the lowest scalability was Energy/Fatigue.
- The subscales with the highest number of monotonicity violations were Energy/Fatigue and General Health [Table 5].
  - The number of monotonicity violations were much greater in the overall population compared to the insomnia cohort.

Table 4. *Homogeneity values of the total sample and insomnia cohort*

Scale	Total (N=30,013) Mean (SD)	Insomnia (N=2,048) Mean (SD)
Total	0.373 (0.003)	0.372 (0.009)
Physical Functioning	0.739 (0.004)	0.705 (0.013)
Role limitations due to physical health	0.732 (0.005)	0.705 (0.014)
Role limitations due to emotional problems	0.788 (0.005)	0.797 (0.014)
Energy/fatigue	0.459 (0.004)	0.502 (0.015)
Emotional well-being	0.505 (0.004)	0.570 (0.013)
Social functioning	0.542 (0.006)	0.584 (0.019)
Pain	0.742 (0.005)	0.753 (0.017)
General Health	0.533 (0.004)	0.581 (0.014)

Less scalable values indicated in red and more scalable indicated in green.

Table 5. *Responses that violated monotonicity in each subscale*

RAND Item	Total N = 30,013 Monotonicity	Insomnia cohort N = 2,084 Monotonicity
Energy/Fatigue		
RAND 23	6	0
RAND 27	3	1
RAND 29	10	1
RAND 31	8	1
Emotional well-being		
RAND 24	0	0
RAND 25	0	0
RAND 26	6	5
RAND 28	0	0
RAND 30	6	1
General health		
RAND 1	0	1
RAND 33	2	0
RAND 34	10	0
RAND 35	6	0
RAND 36	4	0

Subscales with no monotonicity violation were not shown.

Conclusions

The results demonstrate that the RAND-36 scale is a valid measure in a largely representative sample of Japanese adults, and even more so in an insomnia cohort. In future studies, the RAND-36 could be further validated in additional disease areas.

Limitations

- Because diagnoses are self-reported, misclassification of insomnia patients is possible. Data may not be representative of the insomnia population in Japan.

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