

# Factor Structure of the Telugu Version of the Insomnia Severity Index Administered to Primary Care Health Workers of Rural Telangana During the COVID-19 Pandemic

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## ABSTRACT

**Objective:** Prevalence of insomnia has been high during the coronavirus disease 2019 pandemic, especially in health care workers. The 7-item Insomnia Severity Index (ISI) is the most commonly used tool to assess insomnia severity and its impact. The ISI has not been translated and validated for use among Telugu-speaking health care workers. The objective of this study was to explore the factor structure of the Telugu-translated version of the ISI, administered among primary care health workers in rural Telangana, India.

**Methods:** The Telugu version of the ISI was administered to 315 grass-root primary care health workers in rural primary health centers of 5 districts of Telangana. Exploratory factor analysis was conducted to measure the factor structure of the translated version of the ISI. Data were collected in August 2021.

**Results:** The principal component analysis showed that the 7 items of the scale significantly loaded on to 1 latent factor with an eigenvalue of 4.036, explaining 57.66% of the total variance. The factor reliability (Cronbach  $\alpha$ ) was 0.876.

**Conclusions:** The results show that the Telugu translated version of the ISI conforms to previously found factor solutions and is valid to assess insomnia severity in primary care health workers.

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The coronavirus disease 2019 (COVID-19) pandemic has had a tremendous impact on people's lives, affecting both physical and mental health. There has been a steep rise in the prevalence of psychological problems in the general population during the pandemic. Insomnia is prominent, with 30.3% of the population being affected.<sup>1</sup> Health care workers may be at a higher risk of developing stress<sup>2-6</sup> and insomnia due to the worry of getting infected and infecting their family members, overwhelming clinical workload due to increasing cases, fear of contagion, and insufficient protective equipment and limited treatment options. A recent meta-analysis<sup>7</sup> found that the rate of insomnia in health care workers was 36.36%.

The total number of COVID cases in the 2 Telugu-speaking states of Andhra Pradesh and Telangana (ie, 2,742,000 [27.42 lacs]) is ranked fourth among the Indian states as of November 2, 2021. This caseload indicates an important need to assess insomnia severity in health care workers in this region, as case load has been shown to be directly related to the mental health issues in these workers. The grass-root primary care health workers are placed at a higher risk of developing mental health issues due to underpayment and lack of compensation,<sup>8,9</sup> apart from the burden of work and risk of infection. Therefore, validation of a local language translation of a tool to assess insomnia severity in the context of the pandemic is necessary to assess grass-root primary care health workers caring for COVID-19 patients in rural areas.

The Insomnia Severity Index (ISI) is the most commonly used tool to detect insomnia and assess self-perceived insomnia severity.<sup>7,10,11</sup> The ISI assesses both insomnia severity and sleep impact. For the Indian population, only the Hindi version of the ISI has been validated.<sup>12</sup> The objective of the current study was to translate the ISI to Telugu, a language spoken across the 2 southern Indian states of Telangana and Andhra Pradesh, and to assess its psychometric properties, specifically its factor structure.

## METHODS

The data were collected as part of the United Nations Children's Fund project titled "Mental Health of Frontline Healthcare Workers of Rural Telangana." The study was approved by the institutional ethics committee (AIIMS/BBN/IEC/AUG/2021/98). The study involved translation (including assessment of interversion [English-Telugu] reliability) and assessment of structural validity (exploratory factor analysis) of the Telugu version of the ISI. Author permission for translation and validation of the ISI was sought.

## The Insomnia Severity Index

The ISI is a 7-item self-report questionnaire that assesses the nature, severity, and impact of insomnia in the last month on a 5-point Likert scale. The 7 items of the questionnaire assess severity of sleep onset, sleep

### Clinical Points

- Use of the Telugu translated version of the 7-item Insomnia Severity Index for assessment of insomnia in grass-root primary care health workers of Telangana is suggested.
- During the COVID-19 pandemic, clinical insomnia is common among primary care health workers even when the COVID case load is lower.

maintenance, early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, and distress caused by the sleep difficulties. The interpretation is based on the total score: 0–7 = absence of insomnia, 8–14 = subthreshold insomnia, 15–21 = moderate insomnia, and 22–28 = severe insomnia. Moderate and severe insomnia are together termed *clinical insomnia*.<sup>10</sup>

### Translation

The initial translation was performed independently by 2 translation experts fluent in English and Telugu. Discrepancies were resolved through discussion between both the translators and one of the bilingually fluent study investigators (S.K.T.). The best translation was back translated to English by another bilingual mental health professional. All 3 translators and the bilingually fluent study investigator were then involved in serial identity checks until the linguistic equivalence was agreed upon.

### Data Collection

Data were collected from a total of 323 grass-root primary care health workers who were involved in frontline COVID duties, consisting of the Accredited Social Health Activists, Multipurpose Health Workers, and Auxiliary Nurse and Midwives. The participants were working in 10 rural primary health centers of 5 districts (Yadadri Bhuvanagiri, Jayaprakash Bhupalapally, Medak, Vikarabad, and Janagaon) of Telangana. We aimed for a target sample of approximately 300 as per the customary “rule of thumb”<sup>13</sup> of 300 samples for exploratory factor analysis. The number of participants from each primary health center was conveniently sampled and ranged between 24 and 36. Health care workers with a previously (pre-pandemic) diagnosed mental disorder were excluded. Written informed consent was taken from all the participants. Data were collected in August 2021. A uniform standard operating procedure for data collection was followed across the 10 primary health centers. The study tools, including the Telugu version of the ISI, were administered by a psychiatry faculty member, a psychiatric nurse, and a trainee resident. After excluding samples due to incomplete responses, data from 315 participants were used for analysis.

### Pilot Testing

A group of 14 bilingual rural health care workers were administered both the English and the final Telugu versions for comprehensibility and interversion reliability.

Table 1. Sample Characteristics (N = 315)<sup>a</sup>

Characteristic	Sample
Age, mean ± SD, y	38.31 ± 7.89
Sex	
Female	279 (88.6)
Male	36 (11.4)
Marital status	
Married	296 (94.0)
Unmarried	9 (2.9)
Widowed	10 (3.2)
Post	
Accredited Social Health Activists	158 (50.2)
Auxiliary Nurse and Midwives	35 (11.1)
Multipurpose Health Workers	100 (31.7)
Other	22 (6.9)
Education	
High school	11 (3.5)
Secondary school certificate	143 (45.4)
Intermediate	75 (23.8)
Graduate	54 (17.1)
Postgraduate	32 (10.2)
Wages	
Received on time	253 (80.3)
Family type	
Nuclear	214 (67.9)
Joint	101 (32.1)
No. of family members, mean ± SD	4.36 ± 1.49
Children (aged < 18 y) in the family	
None	102 (32.4)
1–2	174 (55.2)
≥ 3	39 (12.4)
Elderly (aged > 65 y) in the family	
No	213 (67.6)
≥ 1	102 (32.4)
Ever tested COVID-19 positive?	
Yes	66 (21.0)
Ever suspected to have COVID-19?	
Yes	125 (39.7)
Ever at high risk for COVID-19?	
Yes	254 (81.7)
Spouse also a frontline health care worker?	
Yes	67 (21.3)
Duration of COVID-related duties, mean ± SD, mo	16.32 ± 2.69
Perceived adequacy of PPE supply	
Adequate	223 (70.8)
Any other person in the family tested COVID-19 positive ever?	
Yes	86 (27.3)
Were you or any family member hospitalized for COVID-19?	
Yes	21 (6.7)
Any death in the family due to COVID-19?	
Yes	6 (1.9)
Ever experienced mental health problems due to the pandemic?	
Yes	210 (66.7)
Ever sought help for mental health problems due to the pandemic?	
Yes	118 (37.5)

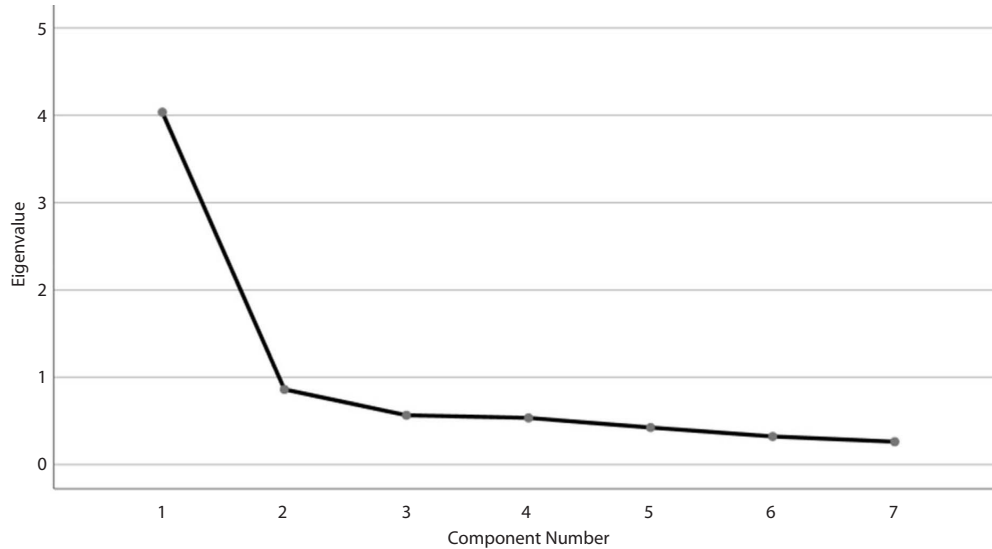
<sup>a</sup>Values are presented as n (%) unless otherwise specified.

Table 2. Interitem Correlation Matrix<sup>a</sup>

Item	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
2	0.679*					
3	0.505*	0.505*				
4	0.482*	0.476*	0.437*			
5	0.387*	0.381*	0.510*	0.498*		
6	0.530*	0.495*	0.566*	0.589*	0.636*	
7	0.407*	0.381*	0.490*	0.482*	0.475*	0.680*

<sup>a</sup>Values are correlation coefficients (r).

\*P < .001.

Figure 1. Scree Plot Showing the Eigenvalues for Components of the Principal Component Analysis<sup>a</sup>

<sup>a</sup>One extracted factor: (1) 4.036 was above the threshold.

### Structural Validity

Exploratory factor analysis was conducted to determine the structural validity of the translated version of the ISI. Completed forms of the 7-item Telugu version of the ISI from 315 participants were analyzed. Analysis was conducted using the Statistical Package for Social Sciences version 23 (IBM Corporation, New York). Assumptions for the exploratory factor analysis were analyzed using the Kaiser-Meyer-Olkin (KMO) test (for sample size adequacy), the Bartlett test of sphericity (for interitem correlation significance), and the communality assessment (for strength of factor extraction). Factor extraction was conducted using the principal component analysis (PCA) and confirmed using the parallel analysis (<https://analytics.gonzaga.edu/parallelengine/>). As the PCA showed a 1-factor solution, no rotation was involved.

### Factor Reliability

The items that correlated within the extracted factor were assessed for reliability using Cronbach  $\alpha$ . Item deletion was planned if the factor reliability for any of the extracted factors was found to have a Cronbach  $\alpha < 0.07$ . Pearson coefficient was calculated for correlations between the total scores and the scores on each of the extracted latent factors.

## RESULTS

### Sample Characteristics

Characteristics of the sample are described in Table 1.

### Pilot Testing

No issues with comprehensibility were raised by the study participants. The Cronbach  $\alpha$  coefficient for interversion correlation was 0.89.

### Structural Validity

The mean ISI score for the participants was 5.79 (SD = 5.55, range, 0–27). The quartiles Q1, Q2, and Q3 were 2, 4, and 8, respectively. The proportion of participants with subthreshold, moderate, or severe insomnia was 22.2%, 5.4%, and 2.2%, respectively; 7.6% were considered to have clinical insomnia.

The assumptions for exploratory factor analysis were assessed and found to be satisfactory as follows:

- The sample size of 315 was sufficiently larger than the recommended sample size of 105 (ie, 15 participants per item [7 items]), almost reaching the customary rule of thumb of 300 samples.<sup>13</sup> This sample size adequacy was further confirmed using the KMO test measure, which was found to be 0.870.
- Several correlations between each of the 7 items were found to be statistically significant ( $P < .001$ ) (Table 2). The Bartlett test of sphericity was also found to be statistically significant ( $\chi^2 = 1024.06$ ,  $P < .001$ ).
- The strength of extraction (ie, communality) for all the items was found to be  $> .5$ .

The PCA showed that the eigenvalues were  $> 1$  for 1 extracted factor (4.036); Figure 1 provides the Scree plot. The factor accounted for 57.66% of the total variance. The PCA calculated eigenvalue for the factor was greater than the mean eigenvalue of the factor in the parallel analysis (1.207). The second factor's calculated eigenvalue (0.860) was smaller than the mean eigenvalue of the second factor (1.127) in the parallel analysis. The component factor

**Table 3. Items Loading on the Latent Factor**

Item	Mean	SD	Latent Factor 1	Mean	SD	Cronbach $\alpha$
			Component Factor Loading			
1	0.66	0.99	0.749	5.79	5.56	0.876
2	0.71	1.04	0.734			
3	0.83	1.16	0.755			
4	1.09	1.10	0.745			
5	0.81	0.99	0.731			
6	0.76	0.99	0.854			
7	0.94	1.03	0.738			

loadings for each of the 7 items of the ISI along with means and SDs for each item total score are shown in Table 3.

### Factor Reliability

The factor reliability for the extracted factor was found to be good (Cronbach  $\alpha = 0.876$ ).

## DISCUSSION

Assessment for insomnia, depression, anxiety, and perceived stress is considered a crucial aspect of the overall psychosocial care of frontline health care workers in India.<sup>14</sup> The most commonly used assessment tool for the assessment of insomnia is the ISI.<sup>15</sup> The ISI has acceptable psychometric properties when administered in the Indian population using a Hindi-adapted version.<sup>12</sup> The English version of the ISI has been used to assess rates of insomnia in Indian populations.<sup>16,17</sup>

Our study found that the Telugu version of the ISI has a single factor solution and is valid for administration to grass-root primary care health workers. A recent meta-analysis<sup>18</sup> on the structural validity of the ISI showed that 3 types of dimensionality (ie, 1-factor, 2-factor, and 3-factor) and 13 models of dimensionality have been observed. While the majority of studies have found a 2-factor solution with the 2 latent factors being “severity” and “impact,” 4 studies<sup>19–22</sup> have shown a 1-factor solution for the ISI, which is similar to our study results. While the English version used to assess insomnia in war veterans with traumatic brain injury found a 1-factor solution,<sup>19</sup> the other 3 studies used German,<sup>20</sup> Swedish,<sup>21</sup> and Arabic<sup>22</sup> versions of the ISI. These results indicate that ISI item scores of grass-root primary care health workers denote a single dimension and may not be interpreted as severity, impact, or type of insomnia.

The rate of clinical insomnia in grass-root primary care health workers in the current study was 7.6%. This rate is lower than the reported global rates<sup>7</sup> (ie, approximately 36%). It has been observed that the rates of insomnia in southeast Asia (19%),<sup>23</sup> especially in India (15.2%),<sup>16</sup> have been lower than the global rates. The rates found in our study may be lower because the data were collected during the pandemic phase when the caseload was very low. However, rates of 7.6% for clinical insomnia and 22.2% for subthreshold insomnia during the aftermath of the severe second wave of the COVID-19 pandemic in India suggest that there is a need to address these problems.

### Strengths and Limitations

An adequate sample size for the exploratory factor analysis is an inherent strength of our study. The interviews for data collection being face to face, rather than an online assessment as in most studies,<sup>16,17</sup> which has questionable validity,<sup>24</sup> is also deemed an important strength of our study.

The 2-factor solution, compared to the 1-factor solution used in our study, has been considered a more “vigorous presentation” of ISI dimensionality. A previous study<sup>25</sup> has shown that 2 language versions of the ISI may show different factor solutions in the same population. While a 2-factor solution was found for the English version, a 3-factor solution was shown for the French version of the ISI in a single sample of Lebanese adolescents.<sup>25</sup> Lack of an adequate sample to form 2 subsets to conduct exploratory and confirmatory factor analysis is a limitation of our study. As the sample was restricted to only health care workers, the generalizability of the psychometric characteristics, including the dimensionality, of the Telugu version of the ISI should be examined among other subsamples and the general population at large.

## CONCLUSION

The Telugu version of the ISI has single dimensionality and is valid for administration. Although our study findings conform to previously found factor solutions, conducting a multimodel confirmatory factor analysis in a separate sample may be necessary to account for the less common 1-factor dimensionality found in this study.

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