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Article

# Reliability and Validity of Bengali Version of the Frailty Assessment and Screening Tool (FAST) Among Older Adults in West Bengal, India

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## Abstract

**Background/Objectives:** Frailty is a multidimensional geriatric syndrome associated with increased vulnerability to adverse health outcomes. In India, where linguistic and cultural diversity is vast, there is a need for culturally adapted frailty assessment tools. This study aimed to translate, culturally adapt, and evaluate the reliability and validity of the Bengali version of the FAST among community-dwelling older adults in Kolkata, India. **Methods:** A community based cross sectional study was conducted among 217 older adults (≥60 years) residing in wards 57 and 58 of the Kolkata Municipal Corporation. Participants were selected through systematic random sampling. The English version of the FAST was translated and back-translated following standard guidelines. Reliability was assessed using Cronbach’s alpha, intra-class correlation coefficients and Cohen’s kappa. Construct validity was tested using confirmatory factor analysis, and criterion validity was evaluated against the Fried Frailty Phenotype using Receiver Operating Characteristic analysis. **Results:** The Bengali FAST demonstrated good internal consistency (Cronbach’s  $\alpha = 0.806$ ), strong intra-rater (ICC = 0.85) and inter-rater reliability (ICC = 0.81), and substantial inter-rater agreement ( $\kappa = 0.602$ ,  $p < 0.001$ ). CFA supported the factorial validity of the scale (CFI = 0.966, TLI = 0.960). Criterion validity analysis showed high sensitivity (0.810) and good discriminative ability (AUC = 0.843,  $p = 0.002$ ). **Conclusions:** The Bengali version of the FAST is a reliable, valid, and culturally appropriate instrument for assessing frailty among Bengali-speaking older adults. Its integration into routine geriatric care can facilitate early detection and preventive interventions, thereby improve overall health and promote healthy ageing.

**Keywords:** frailty; Indian older adults; Bengali FAST scale; reliability; validity; psychometric evaluation; confirmatory factor analysis; weighted least squares

## 1. Introduction

Globally, changing population dynamics have led to an unprecedented increase in the ageing population over the last few decades. According to estimates by the World Health Organization (WHO), the proportion of the global population aged 60 years and older is projected to rise from 12% in 2015 to

22% by 2050, posing substantial challenges to healthcare systems worldwide [1]. In India, the elderly population is projected to triple by mid-century, emphasizing the urgent need for efficient strategies to manage age-related conditions and improve the quality of life for this vulnerable group [2].

Frailty, a common geriatric syndrome, is one such condition that presents a significant challenge for healthcare systems. It is characterised by a decline in functional reserve in various organ systems and increased vulnerability to stressors that lead to higher risks of adverse outcomes like falls, disability, dependency, hospitalisations, and mortality [3]. There is also an intermediate stage termed *pre-frailty*, which, like frailty, is associated with adverse health outcomes [4].

The prevalence of frailty varies globally, ranging from 12% to 24%, while pre-frailty is more common, with a prevalence of 46%, as reported in a systematic review covering 62 countries. Frailty and pre-frailty are generally more prevalent among older women compared to men [5]. In a recent meta-analysis, the pooled prevalence of frailty and pre-frailty among older adults aged 60 years or more in India was found to be 38.18% and 45.14%, respectively [6]. Frailty prevalence was found to be increased with age, with rates of 4% among individuals aged 65–69 years, rising to 26% among those aged 85 years and older [7]. In India, the Longitudinal Ageing Study in India (LASI) Wave 1 data revealed an overall frailty prevalence of 55% among adults aged 50 years and older, with West Bengal exhibiting the highest prevalence at nearly 67% [8]. In a prospective cohort study of 10 years involving community-dwelling older people, the most common condition leading to death was found to be frailty (27.9%), which is even more than organ failure (21.4%), cancer (19.3%), dementia (13.8%) and other causes (14.9%) [9].

Frailty exists in a dynamic continuum, from robust to pre-frail to frail. Thus, it offers the potential to reverse health conditions to a non-frail or robust stage through timely identification and effective intervention measures. Several tools have been developed to assess frailty, each with varying degrees of complexity and focus. The most commonly used instruments in literature are Fried's Physical Frailty Phenotype, which is based on unintentional weight loss, self-reported reduced energy level, decreased grip strength, slowed gait speed, and low level of physical activity [10], and Rockwood's Frailty Index that measures frailty based on the accumulation of deficits [11]. However, culturally relevant, simple, and easily administered frailty assessment tools remain scarce in low- and middle-income countries like India. The Frailty Assessment and Screening Tool (FAST) are a concise, multi-dimensional instrument developed and validated specifically for the Indian population. FAST evaluates frailty across domains such as nutrition, memory, mobility, functional status, mood, physical performance, general health, medication use, multi-morbidity, continence, and pain [4].

India has a highly diverse population, both socially and linguistically. Thus, cultural and linguistic adaptations are essential to ensure the effectiveness of the FAST questionnaire across such diversity. For example, no validated Bengali version of the FAST questionnaire is currently available, limiting its applicability in states like West Bengal, where a significant proportion of the population primarily speaks Bengali. This gap hinders the reliable assessment of frailty for this demographic, especially in community settings. Considering the distinct sociocultural and linguistic characteristics of the Bengali-speaking population, there is an urgent need to adapt and validate the FAST questionnaire in the Bengali language. This will facilitate appropriate screening and enable healthcare providers to identify at-risk older adults more effectively. In this context, the study was conducted to assess the reliability and validity of the Bengali version of the Frailty Assessment and Screening Tool (FAST) among older adults ( $\geq 60$  years) in Kolkata, India.

## 2. Materials and Methods

### 2.1. Study Design

This study is part of a large project funded by the Indian Council of Medical Research (ICMR), New Delhi, to develop a frailty management model for community-dwelling older adults aged  $\geq 60$  years in India. The study was conducted by the Indian Council of Medical Research – Centre for Ageing and Mental Health (now ICMR-National Institute for Research in Bacterial Infections),

Kolkata, West Bengal, India, from April 2025 to September 2025. The present study employed a cross-sectional design to evaluate the reliability and validity of the Bengali version of the Frailty Assessment and Screening Tool (FAST) for assessing frailty among older adults.

## 2.2. Study Setting and Participants

The present study was conducted among community-dwelling older adults in their settings residing in Ward numbers 57 and 58 of the Kolkata Municipal Corporation (KMC), West Bengal, India. The required sample size was estimated using the *10-item*, which recommends recruiting at least 10 participants per item in the scale [12, 13]. As the FAST questionnaire consisted of 14 items, the minimum required sample size was calculated to be 140 participants. Allowing for a 20% anticipated dropout rate, the final target sample size was increased to 168. Finally, 217 participants were included in the study. A systematic random sampling technique was adopted to recruit the participants from the sampling frame. Eligible participants included both males and females aged 60 years or above in the community setting who consented to participation in the study. Individuals with severe cognitive or psychological impairments, as well as those with significant physical disabilities, were excluded from the study.

## 2.3. Data Collection

For this study, the English version of the FAST questionnaire underwent a rigorous translation process. First, it was translated into Bengali by an independent bilingual expert unaffiliated with the research team. To ensure linguistic accuracy and conceptual equivalence, another expert, also independent of the study team, performed a back-translation of the Bengali version into English. The research team then systematically reviewed and compared the original English version with the back-translated version to identify and resolve any discrepancies [14]. Based on this process, the final Bengali version of the FAST questionnaire was prepared for use in the study. The questionnaire comprised 14 items with dichotomous response options ("yes" or "no"). A response of "yes" was scored as 1, while "no" was scored as 0. The total FAST score was used to classify participants, with a cut-off score of  $\geq 7$  indicating frailty,  $\geq 5$  indicating pre-frailty, and  $< 5$  indicating robust or free from any frailty symptom [15]. In addition to FAST, participants were also assessed for frailty and pre-frailty by the Fried Frailty Phenotype, which served as the gold standard in this study [16]. In Fried Frailty Phenotype, the participants were evaluated based on five criteria: (i) unintentional weight loss, (ii) self-reported reduced energy level, (iii) reduced grip strength, (iv) slowed gait speed and (v) low level of physical activity. The presence of 3 or more of the above-stated criteria denoted frailty, 1–2 criteria denoted pre-frail condition, and the absence of any criterion denoted robust state for Fried Frailty Phenotype [16, 17].

Initially, participants were surveyed to obtain demographic information such as age, gender, educational status, occupational status, monthly family income, socio-economic status, household size, and marital status (living with spouse). In addition, clinical history was recorded, which included associated diseases, medication use, and polypharmacy. Anthropometric measurements, including standing height and body weight, were obtained using standard procedures. Body Mass Index (BMI) was subsequently calculated as weight (kg) divided by height squared ( $\text{m}^2$ ) and classified as underweight ( $< 18.5 \text{ kg/m}^2$ ), normal ( $18.5\text{--}24.9 \text{ kg/m}^2$ ), overweight ( $25.0\text{--}29.9 \text{ kg/m}^2$ ) and obese ( $\geq 30.0 \text{ kg/m}^2$ ) [18].

## 2.4. Ethical Clearance

The Institutional Ethics Committee approved the study (19th IEC/CAM/1.5 dated 03-12-2024), and the study was also registered in CTRI (CTRI/2025/01/079470). Prior to data collection, informed written consent was obtained from each participant. The questionnaire was administered to each participant by trained project staff, and privacy & confidentiality were maintained.

## 2.5. Operational Definition

Fried's frailty criteria was considered the gold standard in the present manuscript. Criteria of frailty and pre-frailty depended on the presence of five criteria in an individual: (i) unintentional weight loss, (ii) self-reported reduced energy level, (iii) reduced grip strength, (iv) slowed gait speed, and (v) low level of physical activity. The presence of 3 or more of the above-stated criteria denoted frailty, and 1–2 criteria denoted a pre-frail condition [17]. The FAST scale was tested against this gold standard test. The FAST scale had 14 criteria. FAST scores had a cut-off of  $\geq 7/14$  for frail and  $\geq 5/14$  for pre-frail elderly [15].

## 2.6. Data Analysis

### 2.6.1. Descriptive Statistics

The socio-demographic and clinical characteristics of the study participants were summarised using frequencies and percentages for categorical variables, while means and standard deviations (SD) were reported for continuous variables.

### 2.6.2. Reliability Testing

The internal consistency of the FAST questionnaire was assessed in the overall sample using Cronbach's alpha, with values above 0.70 considered acceptable [19]. For reliability testing, both inter-rater and intra-rater reliability were examined. Inter-rater reliability was evaluated in a sub-sample of 20 older adults, independently assessed by two raters. Intra-rater reliability was measured in a sub-sample of 17 older adults, assessed at two different time points one month apart. Intra-class Correlation Coefficients (ICC) were calculated for both inter- and intra-rater reliability, with values greater than 0.75 indicating good stability [20]. Additionally, Cohen's Kappa coefficient ( $\kappa$ ) was computed to assess the level of agreement between the two raters, beyond that expected by chance. A kappa ( $\kappa$ ) value approaching +1 was considered as strong agreement [19].

### 2.6.3. Construct Validity

A single factor Confirmatory Factor Analysis (CFA) model was hypothesized based on the FAST questionnaire to test the construct validity. Here, the 'latent construct' (interchangeably used as 'dimension' or 'factor') was *frailty*, and all the items of the questionnaire were loaded against this construct. Considering the dichotomous response format of the items, the Weighted Least Squares Mean and Variance adjusted (WLSMV) estimation method was applied. Prior to fitting the CFA model, multicollinearity was checked using the variance inflation factor (VIF). The analysis shows that VIF values ranging from 1.2 to 2.3, which were below the recommended threshold ( $VIF > 5$ ), indicating no multicollinearity concerns [21]. Model fit was evaluated using multiple indices, including Chi-square statistic ( $\chi^2$ ), CMIN/DF, Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). The criteria for acceptable model fit were: a lower  $\chi^2$  statistic,  $CMIN/DF \leq 5$ ,  $CFI \geq 0.90$ ,  $TLI \geq 0.90$ ,  $SRMR \leq 0.08$ , and  $RMSEA \leq 0.08$  [22]. Items with standardized factor loadings ( $\lambda$ )  $\geq 0.40$  were considered acceptable [23]. Further, construct validity and reliability were evaluated using Ordinal Cronbach's alpha (based on tetrachoric correlations), Composite Reliability (CR), and Average Variance Extracted (AVE). The required thresholds were: Ordinal Cronbach's alpha  $\geq 0.70$ , CR  $\geq 0.70$ , and AVE  $\geq 0.50$  [24].

### 2.6.4. Criterion Validity

To evaluate the criterion validity of the FAST Bengali version against the Fried Frailty Scale (gold standard), Receiver Operating Characteristic (ROC) curve analysis was performed. The ROC curve allowed estimation of the Area Under the Curve (AUC), which provides a measure of the overall discriminative ability of the FAST in distinguishing frail from robust individuals. In addition,

sensitivity (true positive rate) and specificity (true negative rate) were calculated to assess the accuracy of the scale [15, 19].

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 24.0, while Confirmatory Factor Analysis (CFA) was conducted in R software (version 4.5.1). For all analyses, a 95% confidence interval (CI) was applied, and a p-value  $\leq 0.05$  was considered statistically significant.

3. Results

Table 1 describes the socio-demographic and clinical characteristics of the participants. The mean age was  $64.27 \pm 5.02$  years, with the majority aged between 60 to 69 years (82.9%), and most were females (67.3%). Nearly all of the participants were Hindu (98.2%), and 61.3% were non-literate. Home makers (30.4%), retired (26.3%), and self-employed (25.8%) formed the largest occupational groups. Most of the participants (36.45%) belonged to middle socio-economic status (INR 2824–4706). Nearly 41.5% of the older participants lived with their spouse, the most commonly reported cause of not living with spouses was due to widowhood (47.5%). Associated diseases were reported by 74.2% of participants, and 71.0% consumed at least one medicine daily. The mean weight and height were  $53.18 \pm 11.96$  kg and  $1.51 \pm 0.08$  m, respectively. The majority of participants had a normal Body Mass Index (BMI) (51.6%), followed by 26.3% who were classified as overweight.

Table 1. Socio-demographic characteristics of the study participants.

| Variables, n = 217                                   |                                 | N (%)            |
|------------------------------------------------------|---------------------------------|------------------|
| Age groups (years)                                   | 60 - 69                         | 180 (82.9)       |
|                                                      | 70 - 79                         | 34 (15.7)        |
|                                                      | $\geq 80$                       | 3 (1.4)          |
|                                                      | Mean $\pm$ SD                   | $64.27 \pm 5.02$ |
| Sex                                                  | Female                          | 146 (67.3)       |
|                                                      | Male                            | 70 (32.3)        |
|                                                      | Transgender                     | 1 (0.4)          |
| Religion                                             | Hindu                           | 213 (98.2)       |
|                                                      | Muslim                          | 2 (0.9)          |
|                                                      | Christian                       | 2 (0.9)          |
| Education                                            | Non-literate                    | 133 (61.3)       |
|                                                      | Primary                         | 22 (10.1)        |
|                                                      | Secondary                       | 56 (24.0)        |
|                                                      | Higher Secondary                | 7 (3.3)          |
|                                                      | Graduate                        | 2 (0.9)          |
|                                                      | Post Graduate                   | 1 (0.5)          |
| Occupation                                           | Unemployed                      | 2 (0.9)          |
|                                                      | Retired                         | 57 (26.3)        |
|                                                      | Home maker                      | 66 (30.4)        |
|                                                      | Self employed                   | 56 (25.8)        |
|                                                      | Service                         | 24 (11.1)        |
|                                                      | Business                        | 12 (5.5)         |
| Socio-economic status<br>(Modified B G Prasad Scale) | Lower<br>(INR <1412)            | 23 (10.6)        |
|                                                      | Lower-middle<br>(INR 1412-2823) | 63 (29.0)        |
|                                                      | Middle<br>(INR 2824-4706)       | 79 (36.4)        |
|                                                      | Upper-middle<br>(INR 4707-9413) | 46 (21.2)        |
|                                                      | Upper                           | 6 (2.8)          |

|                                     |             |               |
|-------------------------------------|-------------|---------------|
|                                     | (INR >9413) |               |
| Living with spouse                  | Yes         | 90 (41.5)     |
|                                     | No          | 127(58.5)     |
| Reason of not living with spouse    | Deceased    | 14(6.5)       |
|                                     | Separated   | 4(1.8)        |
|                                     | Unmarried   | 6(2.8)        |
|                                     | Widow       | 103(47.5)     |
| Associated disease                  | Yes         | 161(74.2)     |
|                                     | No          | 56(25.8)      |
| Better to do polypharmacy yes or no | 0           | 63(29.0)      |
|                                     | 1           | 33(15.2)      |
|                                     | 2           | 37(17.1)      |
|                                     | 3           | 23(10.6)      |
|                                     | 4           | 26(12.0)      |
|                                     | 5           | 11(5.1)       |
|                                     | 6           | 12(5.5)       |
|                                     | 7           | 12(5.5)       |
| Weight (kg)                         | Mean ± SD   | 53.18 ± 11.96 |
| Height (mt)                         | Mean ± SD   | 1.51 ± 0.08   |
| BMI (kg/m²)                         | Mean ± SD   | 23.30 ± 4.63  |
|                                     | Underweight | 28 (12.9)     |
|                                     | Normal      | 112 (51.6)    |
|                                     | Overweight  | 57 (26.3)     |
|                                     | Obese       | 17 (7.8)      |

Table 2 presents the reliability statistics of the Bengali version of the FAST scale. The internal consistency was good, with a Cronbach’s alpha value of 0.806. The test–retest reliability demonstrated strong intra-rater agreement (ICC = 0.85, 95% CI: 0.623–0.945,  $p < 0.001$ ). Additionally, inter-rater reliability was also acceptable (ICC = 0.81, 95% CI: 0.507–0.927,  $p < 0.001$ ), and the Cohen’s kappa coefficient indicated substantial agreement ( $\kappa = 0.602$ ,  $p < 0.001$ ) among the two raters.

Table 2. Reliability measures of the FAST Bengali Version.

| Reliability Statistic   |                   | Value | 95% CI      | p-Value |
|-------------------------|-------------------|-------|-------------|---------|
| Internal consistency    | Cronbach’s alpha  | 0.806 | –           | –       |
|                         | ICC               | 0.85  | 0.623–0.945 | <0.001  |
| Intra-rater reliability | (single measure)  |       |             |         |
|                         | ICC               | 0.81  | 0.507–0.927 | <0.001  |
|                         | (average measure) |       |             |         |
| Inter-rater reliability | Cohen’s kappa     | 0.602 | –           | <0.001  |

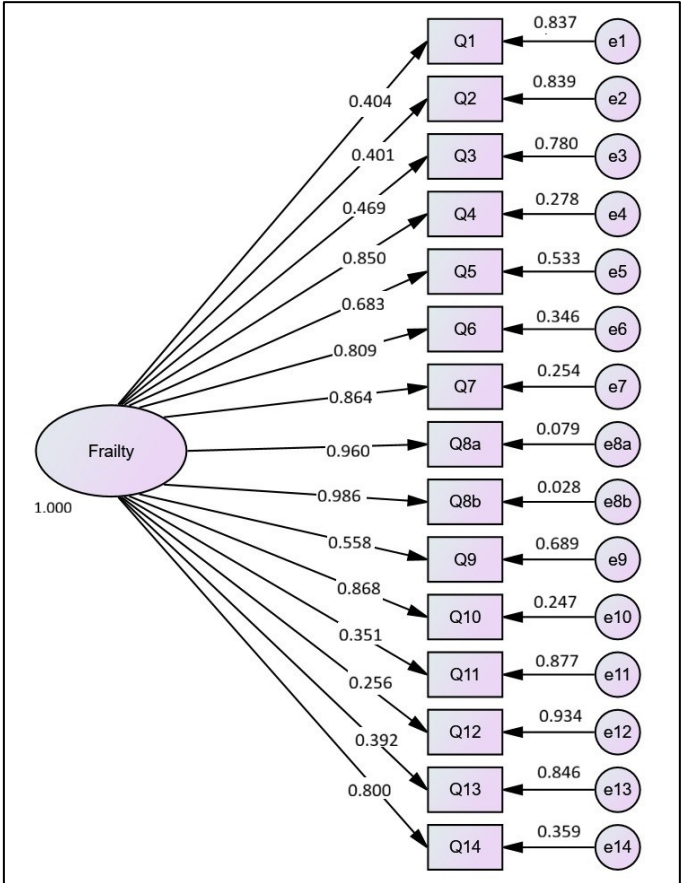
ICC= Intraclass Correlation coefficient, CI= Confidence Interval.

Table 3a shows the result of CFA of the items in the Bengali version of the FAST under the latent construct of frailty. It was found that the factor loadings ranged from 0.256 (Q12) to 0.986 (Q8b), with most items demonstrating strong and statistically significant loadings ( $p < 0.05$ ), indicating good association with the latent factor. Notably, items Q8a ( $\lambda = 0.960$ ) and Q8b ( $\lambda = 0.986$ ) showed the highest loadings. The items Q13 ( $\lambda = 0.392$ ), Q12 ( $\lambda = 0.256$ ) and Q11 ( $\lambda = 0.351$ ) loaded relatively lower on the factor, though these questions were retained in the questionnaire as were clinically relevant. Figure 1 illustrates the path diagram of the Bengali version of the FAST scale, showing standardized factor loadings of each item onto the latent frailty construct. The threshold values ( $\tau$ ) varied across items, reflecting some items (such as Q2, Q4, Q6) were endorsed even at comparatively low frailty levels, while others (such as Q9, Q11) were endorsed only at comparatively high frailty levels. This spread suggests that the FAST Bengali version was well-calibrated to differentiate

participants across the full range of frailty severity. Overall, the findings support the factorial validity of the Bengali FAST scale.

**Table 3a.** Factor loadings of FAST Bengali Version.

| Latent Factor | Items | Factor Loading ( $\lambda$ ) | p-Value | Threshold ( $\tau$ ) |
|---------------|-------|------------------------------|---------|----------------------|
| Frailty       | Q1    | 0.404                        | <0.001  | -0.168               |
|               | Q2    | 0.401                        | <0.001  | -0.335               |
|               | Q3    | 0.469                        | <0.001  | -0.348               |
|               | Q4    | 0.850                        | <0.001  | -0.539               |
|               | Q5    | 0.683                        | <0.001  | 0.133                |
|               | Q6    | 0.809                        | <0.001  | -0.422               |
|               | Q7    | 0.864                        | <0.001  | -0.087               |
|               | Q8a   | 0.960                        | <0.001  | -0.145               |
|               | Q8b   | 0.986                        | <0.001  | -0.215               |
|               | Q9    | 0.558                        | <0.001  | 1.028                |
|               | Q10   | 0.868                        | 0.007   | -0.168               |
|               | Q11   | 0.351                        | 0.012   | 0.971                |
|               | Q12   | 0.256                        | <0.001  | 0.122                |
|               | Q13   | 0.392                        | <0.001  | 0.215                |
|               | Q14   | 0.800                        | <0.001  | -0.263               |



**Figure 1.** Path diagram of FAST Bengali Version.

Table 3b presents the model fit indices and psychometric validity of the FAST Bengali version. The model fit indices demonstrated an acceptable fit, with CFI (0.966) and TLI (0.960) exceeding the recommended threshold of 0.95, indicating a good comparative and incremental fit. The chi-square statistic was also significant ( $\chi^2 = 449.19$ ,  $df = 90$ ,  $p < 0.001$ ), while the CMIN/df ratio (4.99) fell within

the acceptable range. However, the SRMR (0.157) and RMSEA (0.130, 95% CI: 0.118–0.143) were above conventional standards, suggesting some degree of model misfit. Reliability analysis showed strong internal consistency with ordinal alpha (0.898) and composite reliability (0.942) exceeding recommended values. The Average Variance Extracted (0.472) was marginally below the threshold, although it indicated acceptable convergent validity given the high factor loadings observed.

**Table 3b.** Model fit indices and validity measures of FAST Bengali Version.

| Model Fit Indices                                  | Values                         |
|----------------------------------------------------|--------------------------------|
| Scaled chi-square ( $\chi^2$ )                     | 449.19<br>(df : 90; p < 0.001) |
| CMIN/df                                            | 4.99                           |
| Comparative Fit Index (CFI)                        | 0.966                          |
| Tucker-Lewis Index (TLI)                           | 0.960                          |
| Standardized Root Mean Square Residual (SRMR)      | 0.157                          |
| Root Mean Square Error of Approximation (RMSEA)    | 0.130<br>(95% CI: 0.118–0.143) |
| <b>Reliability &amp; Validity</b>                  |                                |
| Ordinal Cronbach’s alpha (Tetrachoric correlation) | 0.898                          |
| Composite Reliability (CR)                         | 0.942                          |
| Average Variance Extracted (AVE)                   | 0.472                          |

Table 4 summarizes the diagnostic accuracy of the FAST Bengali Version against the Fried Frailty Scale as the gold standard. The FAST scale demonstrated good sensitivity (0.810) that indicates correct identification of the majority of frail individuals. The ROC curve analysis showed that the FAST scale had good overall discriminatory ability, with an AUC of 0.843 (p = 0.002, 95% CI: 0.755–0.930).

**Table 4.** Sensitivity and Specificity of FAST Bengali Version against Fried Frailty Scale.

| Scales |                     | Fried Frailty       |          | Total      |
|--------|---------------------|---------------------|----------|------------|
|        |                     | Frail and Pre-Frail | Robust   |            |
| FAST   | Frail and pre-frail | 170 (81.0)          | 4 (57.1) | 174 (80.2) |
|        | Robust              | 40 (19.0)           | 3 (42.9) | 43 (19.8)  |
|        | Total               | 210 (100)           | 7 (100)  | 217 (100)  |

Sensitivity = 0.810, Specificity = 0.429; Area Under the Curve (AUC) = 0.843(p = 0.002), 95% CI=0.755–0.930.

4. Discussion

Frailty has increasingly been recognized as a major public health concern globally in recent decades due to its strong association with functional dependence, falls, disability and frequent coexistence with multimorbidity among older adults. This situation is even more concerning in developing countries like India, where the ageing population is expanding rapidly, yet the available resources and healthcare infrastructure have not evolved proportionately to meet the growing needs. A systematic review encompassing frailty related studies from India have reported that the prevalence of frailty is the highest among hospitalized older adults (44.99%), followed by those attending geriatric centres (37.65%) and community-dwelling elderly (34.16%). Older adults with chronic diseases also face a considerably higher risk of frailty (40.83%), underscoring the importance of routine frailty screening in this group [6]. Early identification and management of frailty are therefore crucial to achieving the objectives of the National Programme for Health Care of the Elderly (NPHCE), which emphasizes preventive and promotive health strategies for India’s ageing population.

Several frailty assessment tools exist, including the Groningen Frailty Indicator [25], Edmonton Frail Scale [26], Tilburg Frailty Indicator [27], Kihon Checklist [28] and FRAIL Scale [29], each incorporating different aspects of geriatric evaluation in their design. However, many of these instruments have been criticized for not encompassing all essential domains of frailty, and for lacking

cultural adaptability and psychometric robustness when applied to non-English-speaking populations. To address these gaps, [15] developed the FAST scale with 14 items relevant for the Indian context, and added some novel components such as pain, the Timed Up and Go (TUG) test and multimorbidity. The scale was validated in Hindi and designed for ease of administration by trained healthcare workers. Building on this, the present study enhances the cultural and linguistic relevance of this FAST scale by validating its Bengali version, thereby extending its applicability for community-based programs to tertiary care frailty screening among older adults in Eastern India, where Bengali is the predominant language.

The Bengali version of FAST scale was validated among community dwelling older adults with a mean age of  $64.27 \pm 5.02$  years, mostly aged 60–69 (82.9%). Majority were Hindu (98.2%), non-literate (61.3%), widow (47.5%) and belonged to the middle socio-economic class, with home makers, retired, and self-employed individuals forming the largest occupational groups.

The psychometric properties of the FAST Bengali version showed high internal consistency, where the total items had a Cronbach's alpha of 0.806; thereby confirming that the items reliably assessed the intended construct. The test-retest reliability showed significantly strong intra-rater (ICC = 0.85, 95% CI: 0.623–0.945,  $p < 0.001$ ) and inter-rater reliability (ICC = 0.81, 95% CI: 0.507–0.927,  $p < 0.001$ ), indicating that the tool provides stable and consistent results over time and assessors. According to established benchmarks, an ICC above 0.75 indicates good reliability, and above 0.80 indicates excellent reliability, supporting the instrument's robustness in repeated measurements [30]. Additionally, Cohen's kappa coefficient indicated substantial agreement ( $\kappa = 0.602$ ,  $p < 0.001$ ) between the two raters, aligning with [31] benchmarks, where values from 0.61 to 0.80 reflect substantial agreement. Overall, these results confirm that the instrument produces reliable and consistent results across different raters and over time.

The construct validity of the Bengali FAST was supported by the confirmatory factor analysis, demonstrated that the items were generally well-aligned with the latent construct of frailty. Most items exhibited strong and statistically significant factor loadings ( $p < 0.05$ ), indicating that they reliably measured the underlying frailty construct. Notably, items related to "mood" (i.e., Q8a and Q8b) showed loading values above 0.9, suggesting that these items were particularly effective indicators of frailty in the target population. In contrast, items related to "medication and multimorbidity" (i.e., Q12 and Q11) loaded relatively lower indicating that these items are less strongly associated with the overall construct or that they capture more specific aspects of frailty not as central to the latent factor. The variability in threshold values further highlights that the items related to "nutrition" (Q2), "mobility" (Q4), and "functional status" (Q6) were endorsed at lower levels of frailty, whereas items like "physical performance" (Q9) and "medication" (Q11) were endorsed primarily at higher frailty levels. This spread suggests that the Bengali FAST is sensitive across a wide range of frailty severity, making it suitable for both early identification of pre-frailty and detection of more severe frailty. Overall, these findings provide strong evidence of the factorial validity of the Bengali FAST scale. The scale appears to be both conceptually coherent and psychometrically sound, supporting its use in clinical and community settings to assess frailty among Bengali-speaking older adults. research could further explore the predictive validity of the scale and examine whether the lower-loading items (Q11, Q12) could be revised or complemented to improve overall measurement precision.

Also, the psychometric evaluation of the Bengali FAST scale showed mostly good model fit and high reliability. The comparative fit index (CFI = 0.966), Tucker–Lewis index (TLI = 0.960) and CMIN/df ratio of 4.99 surpassed the recommended thresholds indicating strong comparative and incremental fit. However, the standardized root mean square residual (SRMR = 0.157) and root mean square error of approximation (RMSEA = 0.130, 95% CI: 0.118–0.143) exceeded typical cutoff values, suggesting a minor degree of model misfit that may be due to sample features or item-specific variation. Additionally, the tetrachoric correlation showed excellent internal consistency, with an ordinal alpha of 0.898 and a composite reliability of 0.942, both surpassing recommended thresholds. The Average Variance Extracted (AVE = 0.472) was just below the typical 0.50 cutoff, but acceptable

convergent validity is indicated by the high factor loadings for most items. Overall, these results establish that the Bengali FAST has a solid psychometric structure, capable of capturing the multidimensional nature of frailty across physical, functional, and psychosocial domains.

In terms of criterion validity, the Bengali version of the FAST scale also showed good diagnostic accuracy compared to the Fried Frailty Scale, which served as the gold standard. The sensitivity of 0.810 indicates that the scale effectively identified most frail and pre-frail individuals, demonstrating its usefulness in screening environments. ROC curve analysis further confirmed the scale's performance, with an area under the curve (AUC) of 0.843 ( $p = 0.002$ , 95% CI: 0.755–0.930), indicating strong overall discriminatory ability. These results suggest that the FAST Bengali version is a dependable and efficient tool for detecting frail and pre-frail conditions in older adults, suitable for both clinical and community assessments.

The results of the present study are not directly comparable with previous research findings due to its distinct objective of culturally adapting and validating the FAST scale specifically in the Bengali language for use among Bengali-speaking older adults. However, certain limitations should be acknowledged. The study sample was confined to two urban wards of Kolkata, which may limit the generalizability of the findings to rural populations or other sociocultural contexts. Moreover, the cross-sectional study design limits the ability to assess predictive validity; therefore, future longitudinal studies are recommended to evaluate whether FAST scores can predict adverse health outcomes, such as hospitalization, disability, and mortality. Further refinements to the scale may also be considered to improve item-level performance and model fit indices.

## 5. Conclusions

The present study established the Bengali version of the Frailty Assessment and Screening Test as a reliable and valid tool for assessing frailty among community-dwelling older adults in Kolkata, India. The brevity, multidimensional structure, and cultural adaptability of the tool make it suitable for use in both clinical and community settings. Incorporating the Bengali FAST into routine geriatric care can facilitate early detection and preventive actions, thereby further delaying disability and reducing healthcare costs. Addressing frailty not only cuts expenses but also improves quality of life, making it a crucial focus in India's growing healthcare system.

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**Data Availability Statement:** All data analysed during this study can be obtained from the corresponding author upon reasonable request.

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