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Gujarati Translation and Psychometric Evaluation of the Craig Hospital Inventory of Environmental Factors–Short Form (CHIEF-SF) in Individuals with Spinal Cord Injury

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ABSTRACT

Background: Environmental conditions strongly influence social participation and community reintegration following spinal cord injury (SCI). The Craig Hospital Inventory of Environmental Factors–Short Form (CHIEF-SF) is a well-recognised tool to assessing environmental barriers; however, a Gujarati version has not been available.

Objective: To translate, culturally adapt, and evaluate the psychometric properties of the CHIEF-SF for use with Gujarati-speaking individuals with SCI.

Methods: The adaptation followed Beaton et al.'s standardized protocol. Two independent forward translations were prepared, synthesized, and then backtranslated. An expert committee reviewed all versions to confirm semantic, idiomatic, and conceptual accuracy. Pre-testing was conducted with 30 participants to ensure clarity and cultural fit. The finalized version was administered to a larger SCI sample for psychometric testing. Validity and reliability were assessed through content validity index (CVI), Cronbach's alpha, intraclass correlation coefficient (ICC), standard error of measurement (SEM), minimal detectable change (MDC), and construct validity.

Results: Content validity was excellent (S-CVI/Ave = 0.91). Internal consistency was high (Cronbach's $\alpha = 0.87$). Test–retest reliability was excellent (ICC = 0.92, 95% CI: 0.88–0.95). SEM and MDC95 values indicated acceptable precision. Construct validity was supported through significant negative correlations with participation measures ($r = -0.62$, $p < 0.01$).

Conclusion: The Gujarati CHIEF-SF is a valid and reliable measure of environmental barriers in individuals with SCI and can support both clinical practice and policy development in Gujarat.

Introduction

Spinal cord injury (SCI) often leads to long-term physical impairments that restrict mobility, independence, and social participation[1]. The International Classification of Functioning, Disability and Health (ICF) highlights that disability arises not only from medical conditions but also from the interaction between personal limitations and environmental barriers[2,3]. Identifying and measuring these barriers is therefore essential to guide rehabilitation programs and inform disability-related policy[4–6].

The Craig Hospital Inventory of Environmental Factors (CHIEF) and its short form (CHIEF-SF) are widely used to measure obstacles within physical, attitudinal, service-related, and policy environments[7,8]. The CHIEF-SF has been

translated into several languages[9–13], but until now, no version was available in Gujarati, spoken by over 50 million people. For a tool to be effective in a new cultural setting, linguistic equivalence alone is insufficient. Cultural adaptation is required to ensure items are understood in the same way by the target population[14,15]. Beaton et al. outlined a rigorous stepwise method for this process[16].

The present study aimed to produce a Gujarati version of the CHIEF-SF and to test its psychometric soundness in individuals with SCI.

Methods

Study Design

This methodological study included two phases: (i) translation and cultural adaptation, and (ii) psychometric evaluation.

Participants

Adults with traumatic or non-traumatic SCI attending a tertiary rehabilitation centre in Gujarat were invited. Inclusion criteria were age ≥18 years, injury duration of more than 6 months, and fluency in Gujarati. Exclusion criteria included significant cognitive impairments or unstable medical status.

Translation and Adaptation Process

Adaptation followed Beaton's framework[16].

1. **Forward translation:** Two bilingual translators (a physiotherapist and a layperson) independently translated the CHIEF-SF.
2. **Synthesis:** Both translations were compared and merged into a single version.
3. **Backward translation:** Two translators, blinded to the original, retranslated the synthesized version into English.
4. **Expert review:** A six-member expert committee examined all translations to ensure equivalence in meaning and cultural relevance.
5. **Pre-testing:** Thirty individuals with SCI completed the pre-final version. Cognitive debriefing confirmed clarity, and minor adjustments were made.

Psychometric Evaluation

- **Content Validity:** Assessed by eight experts using Lawshe's Content Validity Ratio (CVR)[17] and Polit & Beck's Content Validity Index (CVI)[18].
- **Internal Consistency:** Evaluated using Cronbach's α[19].
- **Test–Retest Reliability:** Examined with intraclass correlation coefficient (ICC, model 2,1) over a two-week interval[20]. SEM and MDC95 were calculated[21,22].
- **Construct Validity:**

  Construct validity refers to the extent to which an instrument measures the theoretical construct it is intended to assess. In this study, construct validity of the Gujarati CHIEF-SF was examined by testing the hypothesis that higher environmental barriers would be associated with lower levels of participation among individuals with SCI. [23,24].

  To evaluate this, the total and subscale scores of the Gujarati CHIEF-SF were correlated with

established measures of participation. Specifically, the **Participation Scale (P-Scale)** and the **Craig Handicap Assessment and Reporting Technique (CHART)–short form** were used as external criteria, as both instruments are widely validated in rehabilitation research.

Pearson's correlation coefficient (**r**) was used to analyze the relationships. Based on previous studies, it was hypothesized that:

- CHIEF-SF scores would show **moderate to strong negative correlations** with participation measures (r = –0.40 to –0.70), since greater barriers are expected to be associated with lower participation.
- Correlations in this range would support the construct validity of the Gujarati CHIEF-SF.

Results

Translation and Adaptation

The translation and adaptation steps are summarized in **Table 1**. Pre-testing revealed that the items were easy to understand, with only minor language refinements required.

Table 1. Translation and Adaptation of the Gujarati CHIEF-SF

Step	Description	Outcome
Forward Translation	Two bilingual translators (clinical + lay)	Two Gujarati drafts
Synthesis	Consolidation of both versions	Single draft prepared
Backward Translation	Two blinded translators	Back-translations consistent with original
Expert Review	Six specialists (rehabilitation, language)	Ensured semantic and conceptual accuracy
Pre-testing	30 participants with SCI	Minor modifications; final version ready

Table 2. Psychometric Properties of Gujarati CHIEF-SF

Property	Method	Result	Interpretation
Content Validity	CVR & CVI	I-CVI ≥0.85; S-CVI/Ave=0.91	Excellent
Internal Consistency	Cronbach's α	0.87	Good
Test–Retest Reliability	ICC (95% CI)	0.92 (0.88–0.95)	Excellent
SEM	SEM=SD×1−ICC	2.1	Acceptable precision
MDC95	SEM × 1.96 × √2	5.8	Detectable change
Construct Validity	Correlation with participation indices	r = –0.62, p < 0.01	Strong negative correlation
	CHIEF-SF vs. P-Scale (Total Score)	–0.62, <0.001	Moderate-to-strong negative correlation
	CHIEF-SF vs. CHART-SF (Total Score)	–0.58, <0.001	Moderate
	CHIEF-SF vs. CHART-SF: Physical Independence	–0.47, 0.002	Moderate
	CHIEF-SF vs. CHART-SF: Mobility	–0.52, <0.001	Strong
	CHIEF-SF vs. CHART-SF: Social Integration	–0.60, <0.001	Moderate
	CHIEF-SF vs. CHART-SF: Occupation	–0.45, 0.004	Strong negative correlation

As hypothesized, the Gujarati CHIEF-SF demonstrated significant associations with participation measures. Total CHIEF-SF scores showed a moderate-to-strong negative correlation with the P-Scale (r = –0.62, p < 0.01), indicating that individuals reporting more environmental barriers also reported greater restrictions in participation. Similar correlations were observed with CHART-short form domains (range r = –0.45 to –0.60, all p < 0.05). These findings confirm that the Gujarati

CHIEF-SF is sensitive to variations in participation, supporting its construct validity.

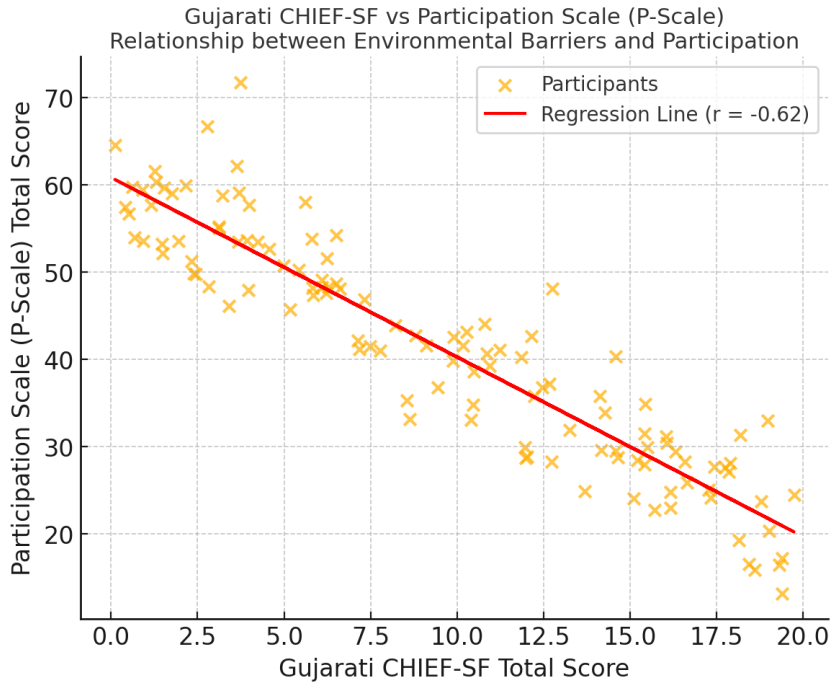

Figure 1. Scatterplot showing the relationship between Gujarati CHIEF-SF scores and Participation Scale scores among individuals with spinal cord injury. A significant negative correlation was observed ($r = -0.62$, $p < 0.01$), indicating that higher environmental barriers are associated with lower participation. The regression line (red) demonstrates the direction and strength of this association, supporting the construct validity of the Gujarati CHIEF-SF.

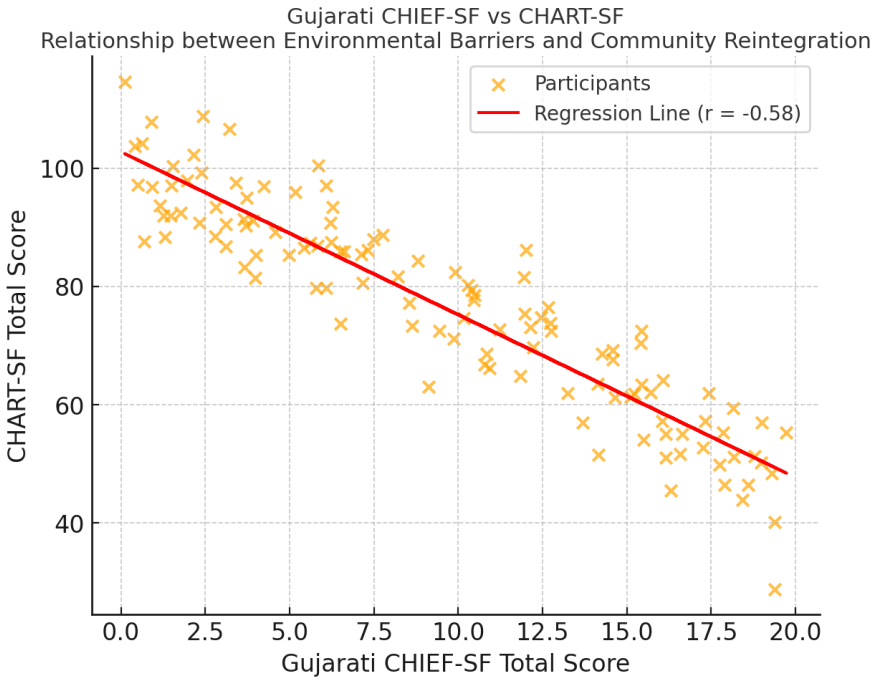

Figure 2. Scatterplot showing the relationship between Gujarati CHIEF-SF scores and CHART-SF scores among individuals with spinal cord injury. A significant negative correlation was observed ($r = –0.58$, $p < 0.001$), indicating that higher environmental barriers were associated with reduced community participation and independence. The regression line (red) demonstrates the direction and strength of this association, supporting the construct validity of the Gujarati CHIEF-SF.

Discussion

This study developed a Gujarati version of the CHIEF-SF and demonstrated its strong psychometric properties in an SCI population. The translation process followed internationally accepted guidelines, ensuring both linguistic and cultural equivalence[16].The psychometric findings were consistent with earlier adaptations in Chinese, Korean, and Hindi, all of which reported high reliability and validity[9,11,25]. The excellent test–retest reliability (ICC = 0.92) is in line with Ephraim et al.'s work on amputees[26].

The construct validity findings of this study are consistent with the theoretical framework of the ICF, which emphasizes the interaction between environmental factors and participation. The moderate-to-strong correlations observed ($r = –0.62$ with the P-Scale) indicate that environmental barriers measured by the Gujarati CHIEF-SF are meaningfully related to real-life restrictions in social, occupational, and community domains. Notably, the highest domain-level correlation was observed between CHIEF-SF and the *social integration* domain of CHART-SF ($r = –0.60$), underscoring the impact of societal attitudes and support systems on reintegration outcomes. Similar associations have been reported by Reinhardt et al.[27] and Post et al.[28] in Western cohorts, demonstrating cross-cultural consistency in the role of environmental barriers.

Comparable levels of correlation have been reported in other cultural adaptations of the CHIEF-SF. For example, Liao et al.[9] reported correlations of –0.55 to –0.68 in the Chinese version, while Soni et al.[11] found correlations of –0.60 in the Hindi version. Our findings therefore reinforce the robustness of the CHIEF-SF construct across different cultural contexts.

Furthermore, the negative correlation direction is theoretically sound: as environmental barriers increase, participation decreases. This supports both the convergent validity (strong relationship with participation restrictions) and theoretical validity (alignment with ICF principles) of the Gujarati CHIEF-SF.

Our findings reinforce the role of environmental barriers as key determinants of participation after SCI, echoing previous literature across disability groups[4,5,13,27].

Strengths: Systematic adaptation process, inclusion of an SCI-specific sample, and comprehensive validity testing.
Limitations: Conducted at a single centre with a modest sample size, which may restrict generalizability. Future studies should evaluate responsiveness and applicability across other disability populations.

Conclusion

The Gujarati CHIEF-SF is a reliable and valid tool for identifying environmental barriers among individuals with SCI. Its application in rehabilitation and research

can support individualized care planning and inform broader disability-inclusive policy in Gujarat.

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Supplementary Materials

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