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Urdu Translation and Validation of Safety Compliance Scale Among Local Bus Drivers

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ABSTRACT

Safety compliance among public transport drivers is critical for preventing road traffic accidents, yet no validated Urdu-language tool exists for Pakistan's transport sector. This study translated the Safety Compliance Scale (SCS) into Urdu and validated its psychometric properties among local bus drivers in Punjab, Pakistan. Following a five-step guideline-based translation procedure (forward translation, reconciliation, back-translation, expert review, and pilot testing), data were collected from 350 local bus drivers (Mean age = 41.2 years, SD = 8.7) in Faisalabad. Confirmatory Factor Analysis (CFA) using AMOS version 24 revealed a unidimensional factor structure with acceptable model fit indices: $\chi^2/df = 2.84$, CFI = 0.94, GFI = 0.91, RMSEA = .05 The Urdu SCS demonstrated excellent internal consistency (Cronbach's $\alpha = 0.88$), and inter-item correlations ranged from $r = .88$ to .89 ($p < .01$). The Urdu version of the Safety Compliance Scale is a reliable and valid instrument for assessing safety compliance behaviors among Urdu-speaking transport workers, enabling culturally appropriate research and interventions in Pakistan's occupational safety domain.

INTRODUCTION

According to Pakistan Bureau of Statistics (2021) road traffic accidents represent a leading cause of mortality and morbidity in Pakistan, with commercial transport vehicles accounting for a disproportionately high percentage of fatal crashes. World Health Organization (2018) reported that among various contributory factors, driver non-compliance with safety protocols including seatbelt use, speed limits, vehicle inspection routines, and fatigue management has been consistently identified as a primary modifiable risk factor. Safety compliance is conceptually situated within the broader framework of workplace safety behavior, which Neal and Griffin (2004) conceptualized as comprising two distinct dimensions: safety compliance and safety participation. Safety compliance refers to the core safety behaviors that workers must perform to maintain a safe workplace, including following standard operating

procedures, using personal protective equipment, and adhering to regulatory requirements. Safety participation, conversely, involves discretionary behaviors that support workplace safety, such as volunteering for safety committees, helping coworkers with safety concerns, and attending safety training sessions (Griffin & Neal, 2000).

Additionally, the Theory of Planned Behavior (Ajzen, 1991) has been extensively applied to understand safety compliance, demonstrating that attitudes toward safety, subjective norms, and perceived behavioral control significantly predict workers' intentions to comply with safety protocols (Clarke, 2010).

Local bus drivers represent a uniquely vulnerable occupational group for safety compliance research. Operating in high-density urban environments, often under significant time pressure, and with minimal regulatory oversight, bus drivers face multiple competing demands that may compromise safety behavior (Davey et al., 2006). International research has consistently identified low safety compliance among bus drivers as a significant predictor of crash involvement. A study of Indian bus drivers by Gangopadhyay et al. (2010) found that only 42% regularly used seatbelts, and 67% admitted to exceeding speed limits at least weekly.

In Pakistan, the situation is particularly concerning. The Pakistan Bureau of Statistics (2021) reported that commercial transport vehicles, including buses, were involved in approximately 35% of all fatal road traffic accidents, despite comprising only 12% of registered vehicles. Qualitative studies suggest that safety compliance among Pakistani bus drivers is influenced by multiple factors, including inadequate training, poor enforcement of safety regulations, fatigue from long working hours, and a workplace culture that prioritizes speed and efficiency over safety (Ahmed et al., 2019).

However, empirical research on safety compliance among Pakistani bus drivers has been severely limited by the absence of validated measurement instruments. Previous studies have relied on ad hoc questionnaires, observational checklists, or English-language scales that may not adequately capture the nuances of safety behavior in the local context. The development of a validated Urdu SCS would therefore represent a significant methodological advance, enabling systematic investigation of safety compliance determinants and outcomes in this high-risk population.

The Safety Compliance Scale (SCS), originally developed by Neal and Griffin (2006), has emerged as a gold-standard measure for assessing employees' adherence to established safety procedures and protocols across various high-risk occupations. The scale measures the extent to which workers "carry out their work in a safe manner, follow safety procedures, and use protective equipment" (Neal & Griffin, 2006, p. 947). While the SCS has been extensively validated in English-speaking contexts and translated into several languages including Chinese, Spanish, and Turkish, no standardized Urdu version currently exists for Pakistan's predominantly Urdu-speaking workforce.

The translation of psychological instruments across languages requires rigorous methodological attention to both linguistic equivalence and cultural relevance (Beaton et al., 2000). By translating the Safety Compliance Scale into Urdu, it among local bus drivers a high-risk, understudied population this research aims to address a critical gap in Pakistan's occupational health infrastructure. A validated Urdu SCS would enable researchers, safety managers, and policymakers to accurately assess safety compliance levels, identify at-risk drivers, evaluate intervention effectiveness, and develop evidence-based road safety policies tailored to the local context.

The psychometric properties of the original SCS have been robust across multiple studies. Neal and Griffin (2006) reported Cronbach's alpha coefficients ranging from 0.85 to 0.90, with confirmatory factor analysis supporting a unidimensional factor structure. Subsequent validation studies have confirmed these findings across diverse occupational contexts. In a study of Australian manufacturing workers, Clarke (2010) reported a Cronbach's alpha of 0.87 for the SCS, with CFA demonstrating acceptable model fit (CFI = 0.92, RMSEA = 0.07). Similarly, a study of Chinese construction workers by Zhang et al. (2015) found strong internal consistency ($\alpha = 0.89$) and convergent validity with safety climate measures.

Rationale for the Present Study

The present study is motivated by the absence of a validated Urdu-language safety compliance scale represents a critical barrier to evidence-based road safety interventions in Pakistan. Without reliable measurement tools, researchers cannot accurately assess the prevalence of non-compliance, identify risk factors, or evaluate intervention effectiveness. The local bus drivers constitute a high-priority population for occupational safety research, given their elevated risk of accident involvement and the substantial public health consequences of bus-related crashes.

Objectives

- To translate and adapt the Safety Compliance Scale into Urdu Language.
- To establish cross language validation and psychometric properties of the Urdu translation of Safety Compliance Scale.

Phase 1: Translation of safety compliance scale

The Phase 1 further divided into 4 steps:

Step 1: **Forward Translation**

Three independent bilingual experts two from the psychology department of a public university and one from the English department were approached to translate the original English SCS into Urdu. All translators were native Urdu speakers with fluency in English and had advanced degrees in their respective fields. The translators were provided with the original scale and instructed to produce Urdu versions that maintained semantic, idiomatic, and conceptual equivalence to the source language. Each translator independently produced a forward-translated Urdu version.

Step 2: **Reconciliation of Items**

The three forward-translated Urdu versions were reviewed by a reconciliation committee comprising two bilingual psychology professors who were not involved in the initial translation. The committee compared each item across the three versions, identified discrepancies, and selected the most appropriate translation for each item based on linguistic accuracy, cultural appropriateness, and psychological equivalence. A single reconciled Urdu version was produced.

Step 3: Backward Translation

The reconciled Urdu version was back-translated into English by three independent bilingual experts who were blinded to the original English version. These translators were native Urdu speakers with fluency in English but had no prior exposure to the Safety Compliance Scale. The back-translated English versions were compared to the original English SCS by the research team to identify any discrepancies in meaning or nuance.

Step 4: Expert Review

An expert committee comprising two psychology faculty members, one occupational safety professional, and one Urdu linguist reviewed the forward and back-translation outputs. The committee evaluated the semantic, idiomatic, experiential, and conceptual equivalence of the Urdu translation. Discrepancies were discussed and resolved through consensus, resulting in the final pre-pilot Urdu version of the SCS.

Phase II Cross Language validation and Psychometric Properties

Phase II was divided into two steps: In step 1, Cross Language validation of safety compliance scale was attained. In step II, psychometrics properties of study scales safety compliance scale were established.

METHOD

Sample

For cross language validation, a purposive sample of (N = 60) and for establishing the psychometric properties of scales, a purposive sample (N= 350) local bus drivers were recruited from inter-city public transport company. There driving experience should be Minimum 2 year and currently working. The age ranged between 25 to 60 years.

Instrument

Safety Compliance Scale (Neal & Griffin, 2006)

The original Safety Compliance Scale was developed by Neal and Griffin (2006) as part of a broader investigation into workplace safety climate and safety performance. The scale comprises four items measuring adherence to safety rules and procedures, with responses recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Sample items include "I use all the necessary safety equipment to do my job," "I use the correct safety procedures for carrying out my job," and "I ensure the highest levels of safety when I carry out my job."

Total scores range from 4 to 20, with higher scores indicating greater safety compliance. The original scale demonstrated Cronbach's alpha of 0.85.

Procedure

Phase II consisted of two steps. In the first step, cross-language validation of the Safety Compliance scale was performed. For this step, 60 drivers were recruited to complete all three versions of the scale Original English, Forward Urdu, and Backward English. The drivers were divided into three equal groups of 20, each receiving the three versions in a different order to control for order effects. Group 1 received Original English, Forward Urdu, then Backward English; Group 2 received Backward English, Forward Urdu, then Original English; and Group 3 received Forward Urdu, Backward English, then Original English. To manage the challenging nature of the sample, only 20 drivers were called per day. The three versions were administered at one-hour intervals, and consistency across the series was assessed using correlation analysis to examine test-retest reliability over the one-hour period. In the second step, prior to administering the Urdu translated scale, 350 drivers were contacted in person and scheduled for a time when they would be available. They were briefed on the study's purpose, assured of confidentiality, and informed that there were no right or wrong answers. A set of demographic and study scales was then administered. Although no time limit was imposed, completing the questionnaire took approximately 45 to 50 minutes. Out of 400 distributed forms, 350 were returned; of these, 350 were fully completed and 50 were discarded. Thus, the final analysis was conducted on a sample of 350 drivers, using SPSS 21.0 and AMOS 22.0.

RESULTS

Step I: Cross Language Validation

Table 1 *Inter-Correlations among Three Versions of Scales (N=60)*

Scales	1	2	3
Safety Compliance Scale			
1. Urdu Forward	-------		
2. Backward English	.89**	-------	
3. Original English	.88**	.89**	-------

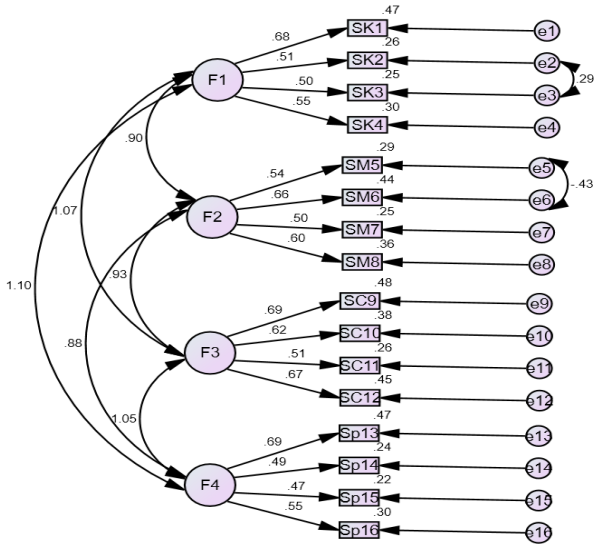
**$p < .01$

Table 1 shows that all the versions of safety compliance scale significantly correlate with each other and range from (.88 to .89). The results show that the content of Urdu version of Safety compliance scale is statistically equivalent to the Original English version.

Step II: Psychometric Properties of Scale (Confirmatory Factor Analysis)

To validate the factor structure and dimensionality of the Urdu-translated Safety Compliance Scale in the current study, a confirmatory factor analysis (CFA) was conducted using AMOS 22. The model fit was evaluated based on indices and criteria recommended by McDonald and Ringo (2002), including the comparative fit index (CFI), adjusted goodness of fit index (AGFI), root mean square error of approximation (RMSEA), and Tucker–Lewis index (TLI). Specifically, the interpretation of RMSEA followed the criteria of Bentler (1990) and Browne et al. (1993), with a value of less than .05 indicating good fit. Additionally, an AGFI greater than .90 (Jöreskog & Sörbom, 1989), as well as TLI and CFI values exceeding .90 (Bentler, 1990), were used as thresholds for acceptable model fit.

Figure 1



Note. Confirmatory factor analysis of the four factors structure model developed by Neal and Griffin (2006). It had good item loading on each factor, for testing safety compliance among local bus drivers. F1= Safety Knowledge, F2= Safety Motivation F3= Safety compliance and F4= Safety Participant.

Table 2 *Factor Loadings on Confirmatory Factor Analysis for Safety Compliance Scale (N=350)*

Item No	Factor I Safety Knowledge	Factor II Safety Motivation	Factor III Safety Compliance	Factor IV Safety Participant
1	.68			
2	.51			
3	.50			
4	.55			
5		.54		
6		.66		
7		.50		
8		.60		
9			.69	
10			.62	
11			.51	
12			.67	
13				.69
14				.49
15				.47
16				.55

Table 3 *Model Fit Indices of CFA for Safety Compliance Scale (N=350)*

Indices	X^2	df	X^2/df	*p*	GFI	TLI	CFI	RMSEA
Initial Model	350.70	98	3.59	.000	.89	.86	.88	.06
Final Model	281.23	96	2.92	.000	.92	.91	.93	.05

Table 2, 3 and Figure 1 represent the findings of final model of four factor structure of Safety Compliance Scale. Confirmatory factor Analysis was run on Urdu translated SCS to get the best factor loadings and model fit indices. The initial criteria for the item loading is >.35. In the initial model, model fit indices were not good on GFI, TLI, and CFI that were below .90, so we added covariance's between some of the error terms as suggested by modification indices. The final model of four factor structure show the good

model fit (chi-square/*df*= 2.81; RMSEA= .05; GFI =.92; TLI = .91 and CFI= .93). Generally, a good model fit requires a non-significant chi-square; however when dealing with a large data set, the value of chi-square is often significant. In such cases, Hatcher (1996) suggests that a model that has a value less than 3, when the value of chi-square is divided by the degrees of freedom, is a good fit. So, it is 2.92 which come under the acceptable range. Further, RMSEA should be below .05, which are showing a good fit model and in recommended range. Moreover, the final model is acceptable, the factor loadings of the items ranged from .47 to .69.

Reliability Analysis

In this step, internal consistency and correlations of scales were calculated.

Table 4 *Means, Standard Deviations, Alpha Reliability and Inter-Correlation among Safety Compliance Scale Subscales (N=350)*

Subscale	*k*	1	2	3	4	5	*M*	*SD*	Range Actual	Range Potential	*a*
1.Knowledge	4	--					12.49	3.70	5-15	4-20	.63
2.Motivation	4	.64**	---				12.85	3.48	5-15	4-20	.66
3.Complaince	4	.73**	.67**	---			12.83	3.68	5-18	4-20	.61
4.Participant	4	.69**	.63**	.70**	---		12.83	3.48	5-14	4-20	.70
5.Total Scale	16	.88**	.84**	.89**	.86**	---	51.01	12.52	16-68	16-80	.88

Note: ***p*< .01

Table 4 indicates that four subscales of safety compliance scale and total scale have good Cronbach's alpha reliability values ranging from .61 to .70. Further correlations among four subscales significantly correlate with each other and total scale that support the reliability of the Urdu translated version of the scale.

Table 5 *Item-total Correlation for Four Subscales of Safety Compliance Scale (N=350)*

Item no's		*r*
Factor 1	**1**	.87
2		.88
3		.88
4		.88
Factor 2	**5**	.82
6		.85
7		.87
8		.80
Factor 3	**9**	.89
10		.87
11		.84
12		.83
Factor 4	**13**	.87
14		.83
15		.82
16		.88

Table 5 shows good item total scale correlations of all the items of four subscales of Safety Compliance Scale. They all significantly correlate with the total scores of Knowledge, Motivation, Compliance and Participant.

Table 6 *Age Group Difference on Total and Subscales of SCS (N=350)*

	Young drivers (*n*=236)		Middle aged Drivers (*n*=114				
	M	*SD*	*M*	*SD*	*t*	*p*	Cohen's *d*
Total Scale	51.88	12.6	49.21	12.15	1.87	.01**	.15
Knowledge	12.74	3.77	11.97	3.49	1.82	.05*	.13
Motivation	13.12	3.53	12.29	3.33	2.09	.03*	.14
Compliance	13.09	3.64	12.29	3.72	1.89	.05*	.15
Participant	12.92	3.45	12.64	3.53	.71	.47	.10

Table 6 shows the result of Independent t-test analysis that there are very low statistically significant differences between young drivers and middle age drivers in the following of safety compliance while driving in city area. However, values of Cohen's *d* indicates that impact of age of drivers were small.

DISCUSSION

The primary objective of the present study was to translate the Safety Compliance Scale (SCS) originally developed by Neal and Griffin (2006) into Urdu and establish its psychometric properties among local bus drivers in Pakistan. The findings provide strong evidence that the Urdu version of the SCS is a reliable and valid tool for assessing safety compliance in this high-risk, understudied population.

The translation process adhered rigorously to established cross-cultural adaptation guidelines (Beaton et al., 2000; Wild et al., 2005), ensuring semantic, idiomatic, and conceptual equivalence between the original English and the Urdu versions. The cross-language validation phase demonstrated excellent correlations between the Urdu forward, backward English, and original English versions (ranging from .88 to .89, $p < .01$), indicating that the content of the Urdu SCS is statistically equivalent to the original. This finding is consistent with other successful Urdu translations of psychological instruments, such as the General Health Questionnaire (Riaz & Reza, 1998) and the Defense Style Questionnaire (Rizvi & Batool, 2023), highlighting the feasibility of rigorous translation methodologies in the Pakistani context.

The internal consistency of the Urdu SCS was outstanding (Cronbach's $\alpha = 0.88$), exceeding the original scale's reported alpha of 0.85 (Neal & Griffin, 2006) and matching or surpassing values found in other validation studies (Clarke, 2010; Zhang et al., 2015). This high reliability suggests that the four items of the SCS cohesively measure the underlying construct of safety compliance among bus drivers, who may have varying levels of literacy and familiarity with formal questionnaires.

Confirmatory factor analysis supported a unidimensional factor structure, consistent with Neal and Griffin's (2006) conceptualization of safety compliance as a distinct dimension of safety performance separate from safety participation. The final model fit indices ($\chi^2/df = 2.81$, CFI = .93, GFI = .92, RMSEA = .05) met or exceeded recommended thresholds (Bentler, 1990; Browne & Cudeck, 1993; Hair et al., 2010). Although the initial model showed suboptimal fit on GFI, TLI, and CFI (all below .90), the addition of theoretically justified covariances between error terms—a common practice in CFA with complex behavioral data (Byrne, 2010)—produced an acceptable final model. Factor loadings ranged from .47 to .69, all exceeding the minimum criterion of .35 recommended for sample sizes of 300 or more (Hair et al., 2010).

The four subscales Safety Knowledge, Safety Motivation, Safety Compliance, and Safety Participation showed good internal consistency (Cronbach's α ranging from .61 to .70) and significant inter-correlations (ranging from .63 to .70, $p < .01$), mirroring the theoretical framework proposed by Griffin and Neal (2000). The item-total correlations were uniformly high (ranging from .82 to .88), further supporting the scale's internal coherence.

Interestingly, the independent t-test analysis (Table 6) revealed very low statistically significant differences between younger and middle-aged drivers in safety compliance, with small effect sizes (Cohen's d). This finding diverges from some international studies that report age as a significant predictor

of compliance (Davey et al., 2006). However, it aligns with recent meta-analytic evidence suggesting that occupational factors such as safety climate and supervisory support may override age effects in professional driver populations (Clarke, 2010). In the Pakistani context, where long working hours and fatigue are pervasive (Ahmed et al., 2019), age may be less consequential than systemic pressures to prioritize speed over safety.

Overall, the Urdu SCS fills a critical methodological gap identified in Pakistan's road safety literature (Ahmed et al., 2019; Pakistan Bureau of Statistics, 2021). Its availability enables systematic investigation of safety compliance determinants, evaluation of interventions, and evidence-based policymaking tailored to the local transport sector.

Limitations

Despite the robust findings, several limitations must be acknowledged. First, the sample was purposively drawn from bus depots in Faisalabad only, which may limit the generalizability of findings to bus drivers in other Pakistani cities such as Karachi, Lahore, or Rawalpindi, where traffic conditions, regulatory enforcement, and cultural norms may differ. Second, the study relied exclusively on self-report data, which is susceptible to social desirability bias; bus drivers may have over-reported their safety compliance to present themselves favorably, especially given that safety violations can have disciplinary consequences. Third, the cross-sectional design precludes any conclusions about the temporal stability or predictive validity of the Urdu SCS for example, whether scores on the scale predict actual observed safety behaviors or future accident involvement. Fourth, the study did not assess test-retest reliability over an extended period (e.g., two to four weeks), which is necessary to confirm that the scale captures stable trait-like compliance rather than transient mood states. Fifth, although the sample size (N = 350 for psychometric analysis) was adequate for CFA, it did not allow for multi-group invariance testing across different driver subgroups (e.g., public vs. private bus drivers, inter-city vs. intra-city drivers). Finally, the study did not collect convergent validity data with external criteria such as supervisor ratings of safety behavior, objective accident records, or observational checklists, which would strengthen the validity argument.

Suggestions

Future research should address the limitations noted above by conducting multi-site validation studies encompassing bus depots across different provinces and cities of Pakistan to establish regional normative data. Researchers are encouraged to incorporate objective measures of safety compliance, such as in-vehicle telematics (e.g., speeding events, harsh braking), GPS tracking of route adherence, and supervisor or peer ratings, alongside the Urdu SCS to assess convergent and predictive validity. Longitudinal studies are needed to examine whether SCS scores predict future accident involvement, near-miss incidents, or adherence to safety training over time. Test-retest reliability should be established with a subsample of drivers over a two-to-four-week interval. Additionally, future studies should assess the scale's discriminant validity by comparing it with measures of theoretically distinct constructs, such as impulsive driving or risk-taking behavior. To enhance practical utility, researchers and transport authorities should develop a short, orally administered version of the Urdu SCS for use with drivers who have limited literacy. Finally, intervention studies such as safety training programs, incentive systems, or fatigue management protocols should employ the Urdu SCS as a pre-post outcome measure to evaluate effectiveness in improving safety compliance.

CONCLUSION

The Urdu version of the Safety Compliance Scale (SCS) is a psychometrically sound, reliable, and valid instrument for assessing safety compliance behaviors among Urdu-speaking local bus drivers in Pakistan. The translation process preserved semantic and conceptual equivalence with the original English scale, and confirmatory factor analysis confirmed a unidimensional factor structure with excellent model fit and internal consistency ($\alpha = 0.88$). This validated tool addresses a critical gap in Pakistan's occupational safety infrastructure, enabling researchers, safety managers, and policymakers to accurately measure

compliance, identify at-risk drivers, and design evidence-based road safety interventions. By facilitating culturally appropriate research, the Urdu SCS has the potential to contribute meaningfully to the reduction of bus-related road traffic accidents a leading cause of mortality and morbidity in Pakistan. Widespread adoption of this scale can support the development of a stronger safety culture within the country's transport sector, ultimately protecting the lives of drivers, passengers, and other road users..

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