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Validity and Reliability of the Commuting Safety Management Practices Questionnaire

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Abstract:
Commuting accidents are a major contributor to worker fatalities and economic losses in Malaysia. Despite the seriousness of this issue, many organizations lack structured approaches to manage commuting risks. This study aimed to develop and evaluate the validation and reliability of the Commuting Safety Management Practices Questionnaire (CoSMaP-Q), an instrument designed to assess organizational practices in commuting safety. Content validation was carried out using a two-round modified Delphi method involved five road safety experts. In the first round, seven items with Content Validity Index (CVI) scores below 1.0 were revised, removed, or reclassified based on expert input. Five additional items were refined for clarity, one new item was added, and a new domain, "Continual Improvement," was introduced. In the second round, the revised 28-item questionnaire achieved full consensus, with I-CVI, S-CVI/Ave, and S-CVI/UA scores of 1.00. To assess reliability, a pilot test was conducted with 30 organizations, resulted in an overall Cronbach's Alpha value of 0.74, indicating acceptable internal consistency for the 28-item instrument. In conclusion, the CoSMaP-Q demonstrates strong content validity and acceptable reliability, offering a practical tool for assessing how organizations manage commuting safety. Its application includes evaluating the efficacy of pre- and post-intervention programs and establishing a foundation for future research in commuting safety management.

Keywords: Commuting safety management practices; Content validation; Modified Delphi technique; Questionnaire development; Reliability

1. INTRODUCTION

Commuting accidents, including those that occur while commuting to and from work, during authorized breaks, or while travelling for work, have emerged as a serious concern. In many countries, including Malaysia, reporting commuting accidents is a mandatory requirement for workers to receive social security protection. The lack of compulsory reporting of commuting accidents can significantly undermine worker safety and limit access to social protection benefits, especially in low-income and developing countries (1).

In Malaysia, there was a 39 percent increase in reported commuting accidents over the past decade, comparing data from 2013 to 2023. These accidents accounted for 71 percent of all worker fatalities in 2023, with 750 deaths, surpassing fatalities from industrial accidents (2). Additionally, these accidents contributed approximately 12 percent of total road deaths in Malaysia in 2023 (3). The financial cost of these commuting-related fatalities is projected to be approximately RM2.7 billion. This estimate is based on the average value of statistical life (VOSL) of RM3.6 million per road traffic death in Malaysia, as determined by the Malaysian Institute of Road Safety Research (4).

One of the leading causes of the increasing number of commuting accidents in Malaysia is the absence of road safety and commuting safety management components in occupational safety and health (OSH) management systems at workplaces (1, 5). The International Labor Organization (ILO) has recognized the importance of commuting safety as a critical aspect of workplace safety and health management (6). Employers have a moral duty to safeguard employees during their daily commutes by implementing Commuting Safety Management (CSM) through self-regulation (1). However, efforts to systematically address this issue are further limited by the lack of a universally accepted tool for evaluating CSM practices.

Therefore, the current study aimed to develop and evaluate the content validity and reliability of the Commuting Safety Management Practices Questionnaire (CoSMaP-Q), a tool used to gauge CSM practices in organizational settings. A panel of subject matter experts provided structured feedback on the instrument's clarity and applicability using a two-round modified Delphi method. The validity of the research instrument is strengthened by this iterative approach, which enhances

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the synthesis of expert perspectives into a unified consensus (7), thus supporting its potential application in policy development and organizational assessments.

2. METHODOLOGY

2.1 Instrument Development

There were two primary sections to the CoSMaP-Q questionnaire. Demographic data about the respondents and the organization were included in the first section. The items in the second section, which pertain to CSM practices, were developed based on the International Organization for Standardization (ISO) 39001 (Road Traffic Safety Management Systems) (8), ISO 39002 (Good Practices for Implementing Commuting Safety Management) (9), ISO 45001 (OSH Management Systems) (10), and extensive literature on OSH management practices across various sectors (11–14).

The development of items related to CSM practices was guided by the core elements of management systems, structured around the iterative Plan-Do-Check-Act (PDCA) cycle. These elements include policy formulation, planning, risk assessment, organizing, implementation, performance measurement and review, and auditing (11, 14). The main components and sub-components are listed in Table 1, along with descriptions and practical examples of CSM practices. These components formed the basis for the initial development of the questionnaire. After validation by subject matter experts, the content was further refined, as detailed in Section 3.2.

Table 1. Key elements of CSM practices based on the PDCA cycle, adapted from (11).

PDCA Cycle	Domain	Description and Examples of Practices
Plan	Policy	Development of a documented policy that reflects top management's commitment to commuting safety. The policy should be communicated to all employees and relevant stakeholders.
	Risk Assessment	Application of structured risk assessment methods to identify, evaluate, and control commuting-related hazards. Includes periodic review of risks and control measures.
	Planning	Establishment of a structured commuting safety plan with specific objectives and targets. Identification of priority groups (e.g., motorcyclists, shift workers) is emphasized.
Do	Organizing	Assignment of clear roles and responsibilities, appointment of a commuting safety coordinator, allocation of resources, internal communication, and active collaboration with external stakeholders.
	Implementation	Execution of programs such as induction briefings, defensive riding training, distribution of safety equipment, personal vehicle checks, and regular road safety campaigns.
Check	Measuring and Reviewing Performance	Collection and analysis of commuting accident data, investigation of incidents to identify root causes, and regular performance review by management.
Act	Audit	Conduct of periodic audits or reviews, utilization of audit findings for improvement, and involvement of external parties in evaluating commuting safety practices.

2.2 Content Validation

A modified Delphi method was used in this study to assess the research instrument's content validity. Without the need for in-person meetings or group discussions, this approach was chosen to gather expert input in a methodical and structured way while enabling each expert to review the items independently (7, 15). The content validation process employed a structured approach that included preparing the content validation form, selecting the expert panel, implementing the validation process, reviewing domains and items, scoring items, and calculating the Content Validity Index (CVI) (16).

Two content validation forms were used throughout the process. The first form displayed the initial set of questionnaire items along with brief descriptions of each domain measured. Experts were asked to evaluate the clarity of the wording and the relevance of each item to the domain. For both criteria, a four-point ordinal scale was used: 1 for "Not Relevant/Not Clear", 2 for "Somewhat Relevant/Somewhat Clear", 3 for "Quite Relevant/Quite Clear", and 4 for "Highly Relevant/Very Clear". Open-ended comments were also provided for each item, allowing experts to offer recommendations, identify ambiguities, or suggest changes.

A panel of seven experts was identified based on their extensive experience in road safety and commuting safety management. Each member of the panel had over ten years of relevant experience and came from both professional and academic backgrounds, ensuring a balanced viewpoint. Five experts agreed to participate after invitations were sent by email. These experts received the first validation form along with detailed instructions on how to complete the assessment. The Item-Level Content Validity Index (I-CVI), which measures the percentage of experts who provided an item with a relevant rating (a score of three or four), was used to analyze expert responses. Responses on the relevance scale were re-coded as 1 (scores of 3 or 4) and 0 (scores of 1 or 2) for analytical purposes. In accordance with the recommendations for a panel of five experts, a cut-off value of 1.00 was used (17, 18). An overall assessment of the instrument's content

validity was provided by the calculation of the scale-level CVI based on the universal agreement method (S-CVI/UA) and the average method (S-CVI/Ave), as highlighted in Table 2, adapted from (16).

Following the first round, the research team reviewed the feedback and made necessary revisions to the items, including refining wording, structure, and item coverage where appropriate. A second content validation form was then developed, featuring the revised items and a summary of the changes implemented. The same panel of experts was invited to review the second version of the instrument. Using the same evaluation criteria, they once again assessed the items independently. This second round allowed experts to reflect on the revised items, considering their earlier input, which contributed to further refinement and ensured greater clarity and consistency in the final version of the instrument.

Table 2. Definition and formulas for S-CVI/UA and S-CVI/Ave (16).

Item	Definition	Formula
S-CVI/Ave	The average of the I-CVI scores for all items on the scale, or the average proportion relevance judged by all experts. The proportion relevant is the average of the relevance ratings by individual experts.	S-CVI/Ave = (sum of I-CVI scores)/(number of items) S-CVI/Ave = (sum of proportion relevance rating)/(number of expert)
S-CVI/UA	The proportion of items on the scale achieves a relevance scale of 3 or 4 by all experts. The universal agreement (UA) score is given as 1 when the item achieves 100% experts; otherwise, the UA score is given as O.	S-CVI/UA = (sum of UA scores)/(number of item)

2.3 Reliability

To assess the reliability of the CSM practices items, a pilot study was conducted involving 30 organizations selected through random sampling. Each participant who represented their respective organization had a background in OSH. Participants were requested to respond with either "Yes" or "No" to the finalized questionnaire, which was used to determine whether their organizations had implemented specific CSM practices. The instrument's internal consistency reliability was assessed using the Cronbach's Alpha coefficient (19), which was calculated using IBM SPSS Statistics version 27. Items having a Cronbach's Alpha value of 0.60 or above were deemed to indicate acceptable internal consistency (20).

3. RESULT AND DISCUSSION

3.1 Stage 1: Expert Review and Revisions

In the first stage, several essential revisions were made to improve the clarity, relevance, and alignment of the items with the intended domains. Revisions to the demographic section included aligning the classification of industry sectors with the taxonomy used by the Department of Occupational Safety and Health (DOSH), thereby ensuring consistency with national occupational safety reporting frameworks. Additionally, the term "estimated" was removed from items referencing the number of employees to eliminate ambiguity.

Regarding the primary domain of CSM practices, seven items yielded CVI scores below the acceptable threshold of 1.0. Table 3 presents these items alongside their CVI scores, and the corrective actions undertaken. Additionally, five items were revised to enhance clarity, despite initially achieving a CVI score of 1.0. Notable amendments included redefining the organizational policy item to explicitly encompass both stand-alone and integrated formats and rephrasing the management commitment item to ensure continuity by referencing policy statements and resource allocation.

Additional feedback received from the experts highlighted the importance of documenting employees' commuting profiles to gain a clearer understanding of travel patterns and associated risk exposure. In response, a corresponding item was added under the "Measuring and Reviewing Performance" domain.

Table 3. Items with CVI scores less than 1.0 and associated revisions.

Original item	Question	CVI score	Actions taken
D2	Is there a designated person or team responsible for coordinating commuting safety initiatives?	0.6	Removed due to redundancy with Item D1.
E2	Are employees given training on safe commuting practices (e.g., defensive riding/driving)?	0.8	Revised to reflect needs-based training and align terminology with ISO 39001.
E3	Does your organization provide safety equipment for commuting (e.g., helmets, reflective vests) and ensure its proper use is monitored?	0.6	Revised and divided into two items to eliminate double-barreled structure.

Original item	Question	CVI score	Actions taken
F2	Are commuting accidents investigated to identify root causes and implement corrective actions?	0.8	Split into two distinct items: one retained under "Measuring and Reviewing Performance," and the other relocated to the newly created "Continual Improvement" domain.
G1	Does your organization conduct periodic audits or formal reviews of its commuting safety practices?	0.4	G1, G2, and G3 were reclassified under "Measuring and Reviewing Performance" based on expert recommendation.
G2	Are audit findings used to improve commuting safety management practices?	0.4	
G3	Are external parties (e.g., consultants, certification bodies) involved in reviewing commuting safety practices?	0.4	

3.2 Stage 2: Expert Review and Revisions

The second stage involved the revised questionnaire, which consisted of 28 items on CSM practices, as presented in Table 4. This version incorporated 24 refined items from the first round, one item removed due to redundancy and low I-CVI, and four new items, including three under the newly added "Continual Improvement: domain, and one on commuting profile documentation under the "Measuring and Reviewing Performance" domain. Figure 1 illustrates the updated domains integrated into the PDCA cycle.

The same panel of five experts reviewed the updated instrument. All experts agreed that the revisions made addressed the concerns raised in the first round. All items achieved an I-CVI of 1.00, and the S-CVI for this round also reached 1.00, indicating full consensus among the panel members. This confirmed the strong content validity of the revised instrument and its readiness for further application in assessing CSM practices in an organizational setting.

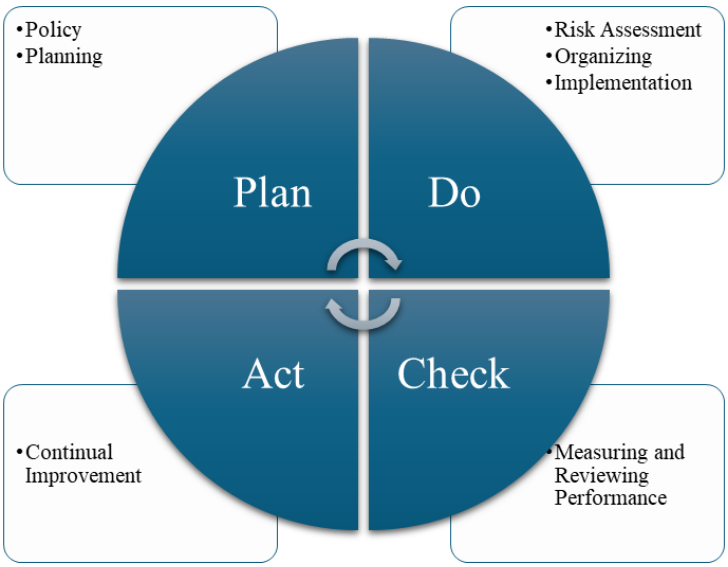

Figure 1. Updated domains within the PDCA cycle.

3.3 Reliability

Based on the pilot test involving 30 organizations, the overall Cronbach's Alpha value is 0.74, indicating acceptable internal consistency (20). This suggests that the items are sufficiently consistent and reliable in measuring the intended domain of CSM practices. However, the findings should be interpreted within the context of the small sample size, which restricts their generalizability. In addition, several other potentially influential organizational factors were not considered in this pilot study.

Although not within the current study, it is worth noting that the pilot test revealed a generally low implementation level, with an average score of 15% across participating organizations. These organizations represented various sectors, including manufacturing, services, utilities, transportation, agriculture, and construction. The low level of implementation observed highlights the need for targeted intervention programs to strengthen organizational readiness and practice in commuting safety.

Compared with OSH management system tools such as ISO 45001 (10) and the broader literature on OSH management practices across various sectors (11–14), the CoSMaP-Q focuses specifically on commuting safety, an area

often overlooked in traditional frameworks. It draws on principles from ISO 39001 (8) and ISO 39002 (9) to emphasize elements related to road safety rather than workplace safety.

Table 4. Finalized CSM practices items.

No.	Items
Policy	
1	Does your organization have a documented policy, either as a standalone policy or incorporated within other policies, that address commuting safety?
2	Does top management demonstrate commitment to commuting safety (e.g., through statements in the policy or resource allocation)?
3	Is the policy communicated to all employees and relevant stakeholders?
Risk Assessment	
4	Is a systematic risk assessment method (e.g., HIRARC) used to assess commuting-related risks?
5	Are commuting-related risks (e.g., road conditions, peak hours) regularly reviewed and updated?
6	Are appropriate control measures implemented to address identified commuting risks?
Planning	
7	Has your organization developed a commuting safety plan or strategy?
8	Are commuting safety objectives and targets established and documented?
9	Are specific groups (e.g., motorcyclists, shift workers) identified and prioritized in commuting safety planning?
Organizing	
10	Does your organization provide clear roles and responsibilities for commuting safety management?
11	Are adequate resources (e.g., budget, dedicated personnel) allocated for commuting safety initiatives?
12	Is information related to commuting safety effectively communicated across all levels of the organization?
13	Is there active engagement or collaboration with external stakeholders (e.g., local authorities, JPJ, PDRM, MIROS, PERKESO) to support commuting safety initiatives?
Implementation	
14	Does your organization provide commuting safety briefings during employee induction or onboarding?
15	Is commuting safety training provided based on identified needs (e.g., safe driving or riding practices)?
16	Does your organization provide safety equipment for commuting (e.g., helmets, reflective vests)?
17	Is there a system or practice in place to monitor whether employees use the provided safety equipment correctly during their commute?
18	Are there measures in place to ensure that personal vehicles used by employees for commuting are regularly inspected for safety?
19	Are road safety awareness campaigns conducted periodically in your organization?
Measuring and Reviewing Performance	
20	Does your organization collect and record data on commuting accidents?
21	Are commuting accidents investigated to identify root causes?
22	Does your organization collect and record information on employees' commuting routes and modes of transport to identify potential risks?
23	Does your organization conduct periodic audits or formal reviews of its commuting safety practices?
24	Is commuting safety performance (e.g., number of commuting accidents, helmet wearing, etc.) reviewed regularly by management?
25	Are external parties (e.g., consultants, certification bodies) involved in reviewing commuting safety management practices in your organization?
Continual Improvement	
26	Does your organization take appropriate corrective or preventive actions based on the findings from audits, investigations, or system reviews?
27	Are improvement actions implemented within an acceptable timeframe?
28	Are corrective or preventive actions evaluated for their effectiveness in mitigating commuting safety risks?

4. CONCLUSION

This study successfully developed and validated the content of the Commuting Safety Management Practices Questionnaire (CoSMaP-Q). Through a two-round Delphi process, expert consensus was achieved on the clarity and relevance of all items, resulting in a refined 28-item instrument. Reliability testing further confirmed its internal consistency, making CoSMaP-Q a practical and robust tool for assessing how organizations manage commuting safety.

The findings also offer important implications for practice. The CoSMaP-Q can be used by organizations to assess their current commuting safety practices, identify areas for improvement, and monitor progress over time. It can also support safety professionals and policymakers in developing targeted strategies, policies, and intervention programs to strengthen commuting safety management and culture.

Future research involving a larger and more diverse sample is recommended to provide stronger evidence and enhance the external validity of the instrument. Overall, CoSMaP-Q offers a valuable foundation for both research and practical application in promoting safer commuting practices within organizations.

AUTHORSHIP CONTRIBUTION STATEMENT

Mohd Hafzi Md Isa: conceptualization, methodology, formal analysis, writing – original draft. Harun Bakar: resources, writing – review and editing. Ahmad Khushairy Makhtar: supervision, writing – review and editing. Wan Mazlina Wan Mohamed: supervision, writing – review and editing.

DATA AVAILABILITY

The data generated from this study is not publicly available but may be obtained from the corresponding author upon reasonable request.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no conflict of interest.

DECLARATION OF GENERATIVE AI

No AI declaration.

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