



## Development and Validity Test of Fuel Station Consumer Safety Behavior Questionnaire

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### Abstract

Fuel Stations are facilities for selling fuel to the public which has a potential hazard and a high risk of accidents. During 2017-2018 there were 120 gas station accidents in Indonesia. Additionally, 29 fuel accidents occurred in 2022, most of them involving consumer vehicles. Previous studies have explored fuel station safety by examining its safety climate, health risks to workers, risk and fire assessments. Study on consumer behavior in fuel stations has not yet been discovered. Therefore, this study attempts to fill the gap by developing a Fuel Station Consumer Safety Behavior (FSCSB) Questionnaire. The aim of this study is to introduce a novel instrument to assess fuel station consumer safety behavior and assess its validity and reliability. The first phase of this study uses a qualitative approach on developing the questionnaire through literature review, content validity with field experts and face validity with actual fuel station consumers. In the second phase, a quantitative approach for validity and reliability analysis was carried out by calculating Pearson's Product Moment and Cronbach's Alpha on each variable. All questionnaire items passed the Pearson's validity test, but 3 items did not meet minimum Cronbach's Alpha criterion and have been removed. The final result is a novel FSCSB Questionnaire with 21 items. The questionnaire can be used as a reference for future research with a larger number of respondents.

## Introduction

The number of gas stations operating in the Republic of Indonesia is more than 6700 (Indonesian Data, 2022). With this number, the risk of accidents that have the potential to harm society increases significantly. Accidents in the form of fires at gas stations often have a direct impact on the community, especially gas station consumers.

In the period 2004 to 2008, in the United States there were 5,020 cases of fires at gas stations. Of this number, 61% were vehicle fires (Evarts, 2011). More recent data shows that during the period 2014 to 2018 there were an average of 4,150 gas station fires per year or around 3.67% of the 113,000 gas stations operating in the United States. This number is also dominated by consumer vehicle fires at 56% (Ahrens, 2020). In Indonesia, from 2016 to 2018 there were 120 cases of accidents at gas stations which resulted in losses not only for entrepreneurs but also for consumers and the public (Wachid et al., 2018). In the period September 2021 to August 2022 alone, at least 29 gas station accidents occurred in Indonesia, 82.75% of which involved consumer vehicles. As for the number of incidents, 2 people died and 16 people were injured, mostly gas station consumers (Wibowo et al., 2022).

The high number of gas station fires involving consumer vehicles as well as the existence of external factors that contribute to gas station accidents indicate the need for a new approach in managing gas station safety. There has been a lot of research related to gas station safety. Some studies discuss the safety climate of gas stations (Wibowo et al., 2023), health impacts due to exposure to hazardous materials (D'Alascio et al., 2014), environmental impacts (Kolosov et al., 2020), risk assessment (Cezar-vaz et al. , 2012), as well as analysis of fires (Khalid et al., 2017). Discussions on behavior are mostly carried out for workers and do not include aspects of consumer behavior. Even though the evidence previously presented shows that there are consumer behavioral factors that can contribute to accidents, namely substandard vehicle conditions, modifications to fuel tanks, filling fuel into jerry cans, not turning off the vehicle when filling fuel, and smoking in the gas station environment (Wibowo et al. , 2022).

Therefore, it is important to carry out research in the field of gas station safety that explores the climate of consumer behavior. However, currently there is no instrument to measure consumer safety behavior. This research aims to develop a questionnaire measuring the safety behavior of gas station consumers (Fuel Station Consumer Safety Behavior Questionnaire). It is hoped that the existence of a consumer behavior measurement instrument specifically for gas stations can improve the safety management of gas stations that is more effective in providing a sense of security and increasing safety for consumers.

## Methods

This study uses a combined qualitative and quantitative design. The first qualitative phase is determining measurement variables and preparing questionnaire questions. At this stage, the method used is literature study, namely by collecting behavioral theories and also references from previous research journals to compile the variables used and a list of questions for each variable (Yusoff et al., 2021). The next qualitative phase is to carry out a content validity test to evaluate whether each questionnaire question item represents the variable to be measured. Content validity was carried out by conducting interviews with three experts in the field of safety behavior, where each question was discussed, assessed and it was decided whether the question was retained or deleted. Experts are also welcome to propose other question items that represent variables (Yusoff, 2019). The final qualitative phase is the face validity test, which aims to ensure that each question on the questionnaire can be well understood by potential respondents. For this reason, a Focus Group Discussion (FGD) was carried out with 10 gas station consumers who were divided into two groups. In this test, each question is discussed to determine the potential respondent's understanding. If everyone in a group has the same understanding of a questionnaire question, then the question is saved, while for questions that have ambiguous meaning, a follow-up discussion is held to change the question's redaction. Questions that were difficult to understand and did not reach consensus on editorial changes were removed from the questionnaire (Bai et al., 2018).

The quantitative phase was carried out by a pilot study to test validity and reliability quantitatively. First, validity test using Pearson's correlation coefficient, where each question on one dimension is compared with the total value of that dimension. If the P value obtained is  $<0.05$  then there is a significant correlation and it can be concluded that the question item is valid. Meanwhile, the reliability test was carried out using Cronbach's alpha calculations per variable. An alpha value between 0.6 and 0.7 indicates an acceptable level of reliability, a value above 0.8 indicates very good reliability, but a value of 0.95 indicates redundancy in the question items so perhaps some very similar questions can be eliminated ( Ursachi et al., 2015).

The sample size for the pilot study was determined to be 80 respondents from gas station consumers in the DKI Jakarta area who were selected randomly and attempted to be heterogeneous. This number is greater than the general recommendation for pilot studies, namely a minimum of 30 samples (In, 2017; Whitehead et al., 2016). The criteria for

respondents are people who drive four-wheeled or two-wheeled vehicles and routinely fill up fuel at gas stations at least once a month. Quantitative statistical analysis used JASP software version 0.16.4 (Wagenmakers et al., 2022)

## Results and Discussion

### Qualitative Phase

#### Variable Assignment

Based on the results of the literature study, the two theories chosen to be the basis of this research are the Theory of Planned Behavior (TPB) and the Health Belief Model (HBM). TPB can be used to plan and regulate human behavior by manipulating surrounding conditions (Kim & Han, 2010). Meanwhile, HBM can reveal the reasons why someone wants or does not want to carry out a certain behavior, especially in the health sector (Rosenstock, 1977). Even though it is mainly used in the health sector, HBM has been widely used in the safety sector, including to analyze safe driving behavior (Dadipoor et al., 2020; Razmara et al., 2018), safety in the agricultural sector (Arcury et al., 2020). 2002), to seafarers' safety behavior (Yuen et al., 2020). In TPB, antecedents that can influence a person's behavior are subjective norms, attitude, and perceived behavior control. Meanwhile, in HBM, a person's behavior is determined by perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. In this research, the variables used to predict the safety behavior of gas station consumers are norms, attitude, perceived threat (as a combination of perceived susceptibility and perceived severity), and perceived benefits & barriers, so the questionnaire questions will be prepared for these 5 variables.

#### Preparation of Questionnaire Questions

The Gas Station Consumer Safe Behavior Questionnaire is something new, therefore the preparation of the questionnaire refers to research in other fields that uses HBM and TPB. Some of the references used as reference are as follows: (1) Research by Yuen, et al. (Yuen et al., 2020) which evaluates the factors that influence seafarers' safety behavior using HBM and *Emotional Appeal Theory* (EAT). Latent variables used in research related to HBM include *Perceived Threat*, *Expectation Outcome*, *Self-efficacy*, *Safety Behavior*, and *Cue to Action*; (2) Research by Huang, et al. (Huang et al., 2016) which examined factors influencing health examination behavioral intentions in Taiwan. There are variables *health knowledge*, *self-efficacy*, *social support*, *perceived susceptibility*, *perceived severity*, *perceived benefits*, *perceived barriers*, *cues to action*, and *behavioral intention*; (3) Research by Rezaei, et al. (Rezaei et al., 2018) which examined factors influencing farmers' intention to engage in food safety in Iran. The variables used are *Attitude*, *Perceived Behavioral Control*, *Social Norms*, *Moral Norms*, *Knowledge*, and *Intention to engage in OFFS practices*; (4) Dankachartan, et al. (Dankachartan et al., 2022) which examines the effects of employee behavioral interference using TPB. The variables used are the variables in the TPB; (5) Research by Ledesma, et al. (Ledesma et al., 2015) which researched Implicit Attitude and safe behavior on the road. The variables used are *Implicit Attitude*, *Explicit Attitude*, *Intention to use helmet*, *Actual helmet wearing*, *Social desirability*; (6) Research by Mahasuweerachai, et al. (Mahasuweerachai, 2022) who researched how to influence workers' food safety behavior with TPB. The variables are *Attitude towards food safety behavior*, *Perceived Behavioral Control*, *Subjective Norm*, *Behavioral Intention*, *Moral Norm*, *Job Burnout*, and *Food Safety Behavior*.

Based on the literature study above and several other literatures, a total of 277 questionnaire questions were obtained. These questions are then grouped based on the variables used in this research. Question items that were not relevant to the research variables were discarded, leaving 121 question items. After analyzing the question items for each variable, similar questions were combined to obtain a final draft questionnaire of 45 questions for 5 variables.

## Validity (Content Validity)

Content validity testing was carried out through interviews and discussions with 3 experts in the field of safety behavior. Content validity also takes into account the safety behavior of gas station consumers that has been previously identified, namely not smoking in the gas station area, turning off the vehicle engine when filling fuel, not filling fuel in jerry cans, and not making telephone calls when filling fuel. Each item was discussed in depth to ensure suitability to the variables being measured and in accordance with the researcher's intentions. Based on the results of the discussion, several questionnaire items from the literature were not relevant for use on the subject of gas station consumers, for example items related to training which is usually given to workers, whereas training was not possible for gas station consumers, so items like this were deleted. Apart from that, preparing the questionnaire also takes into account the number of questions. Ideally, the number of questions is between 25–30 and the time to complete the questionnaire is no more than 30 minutes to maintain respondent interest and focus (Sharma, 2022) . The results of the expert evaluation eliminated 20 questions, bringing the number of questionnaire items to 25.

## Face Validity (Face Validity)

Validity also needs to be checked according to the target population (Connell et al., 2018) . Therefore, the face validity test was carried out through a focus group discussion with a group of gas station consumers who represented future research respondents. The face validity results show that all participants can understand each questionnaire question well, and the average time for filling out the questionnaire is 21 minutes, so that the questionnaire prepared meets the criteria for an efficient questionnaire (Sharma, 2022) and can be continued to the next step.

## Quantitative Phase

### Construct Validity Test (Pearson's correlation coefficient)

The results of the instrument validity test for the safe behavior of gas station consumers can be seen in table 1.

Table 1 Results of Pearson's Product Moment validity test

Question	Pearson's r	p
<i>Norms</i>		
Norm s_1	0.376	< .001
Norm s_2	0.523	< .001
Norm s_3	0.606	< .001
Norm s_4	0.664	< .001
Norm s_5	0.551	< .001
<i>Perceived Threat</i>		
Threat_1	0.669	< .001
Threat_2	0.692	< .001
Threat_3	0.802	< .001
Threat_4	0.769	< .001
Threat_5	0.829	< .001
<i>Perceived Benefits &amp; Barriers</i>		
PBBSE_1	0.778	< .001
PBBSE_2	0.766	< .001
PBBSE_3	0.811	< .001
PBBSE_4	0.728	< .001

Question	Pearson's r	p
<i>Attitude</i>		
Atti tude_1	0.734	< .001
Atti tude_2	0.695	< .001
Atti tude_3	0.798	< .001
Atti tude_4	0.733	< .001
Atti tude_5	0.855	< .001
Atti tude_6	0.902	< .001
<i>Behaviour</i>		
Behavior_1	0.419	< .001
Behavior_2	0.619	< .001
Behavior_3	0.626	< .001
Behavior_4	0.634	< .001
Behavior_5	0.706	< .001

Based on the results of the validity test, all questions have a *P value* smaller than 0.05. Thus, all questionnaire items are declared valid for measuring the desired variables.

## Reliability Test (Chronbach's Alpha)

The results of the reliability test for all variables in the gas station consumer safe behavior questionnaire instrument can be seen in table 2:

Table 2 Results of Cronbach's Alpha Reliability Test

Variable	Cronbach's $\alpha$
Attitude	0.869 *
Norms	0.451*
Perceived Threat	0.814 *
Perceived Benefits & Barriers	0.745 *
Behaviour	0.513 *

\*) Cronbach's alpha value is smaller than 0.60.

Based on the results of the reliability test above, the Behavior and Norms variables have a *Cronbach's  $\alpha$*  value of less than 0.60. Thus, it is necessary to carry out further examination of the questions on these variables. For this reason, the *individual item statistics feature* in the JASP statistical software is used and *Cronbach's  $\alpha$  (if an item is dropped)* is selected to see which questions cause *the Cronbach's  $\alpha$*  value to be small, with the following stages:

### Behavior Variables

The initial value of *Cronbach's  $\alpha$*  for this variable is 0.513. If question No. 1 and being excluded can increase the *Cronbach's  $\alpha$*  value to 0.535, whereas if question No. 3 is removed then the *Cronbach's  $\alpha$*  value increases to 0.522. For this reason, the first step in question no. 1 is removed, then look again at the *Cronbach's  $\alpha$*  value (if item dropped) . The result emerged that *Cronbach's  $\alpha$*  would increase to 0.665 if the Behavior\_3 item was removed. This value is greater than the minimum criterion for *Cronbach's  $\alpha$*  , so it meets the reliability criteria after the Behavior\_1 and Behavior\_3 questions were removed.

Table 3 Cronbach's Alpha if item dropped for Consumer Behavior variable

Step 1		Step 2	
Initial $\alpha$ value	0.513	Initial $\alpha$ value	0.535
<b>Items</b>	<b><i>Cronbach's <math>\alpha</math></i></b> <b><i>If item dropped</i></b>	<b>Items</b>	<b><i>Cronbach's <math>\alpha</math></i></b> <b><i>If item dropped</i></b>
Behavior_1	0.535	Behavior_2	0.466
Behavior_2	0.491	Behavior_3	0.665
Behavior_3	0.522	Behavior_4	0.398
Behavior_4	0.390	Behavior_5	0.339
Behavior_5	0.345		

### Variable Norms

The initial value of *Cronbach's  $\alpha$*  for this variable is 0.451. If question No. 3 removed can increase the *Cronbach's  $\alpha$*  value to 0.690. For this reason, the first stage of Question No. 1 issued. Because the *Cronbach's  $\alpha$*  value is more than 0.60, it meets the reliability requirements.

After carrying out the above process, the conclusion is that the reliability test results are fulfilled after issuing questions Behavior\_1, Behavior\_3, and Norms\_3. In general, the instrument is very good because each variable still has a minimum of 3 questionnaire questions remaining. Even Hayduk & Littvay concluded in their research on the number of indicators in latent variables, that it is better to use fewer indicators, but which truly represent the variable

you want to measure, and 3 indicators can help obtain a good representation (Hayduk & Littvay, 2012).

### Final Questionnaire Items

After conducting validity and reliability tests, the final questionnaire consisted of 22 question items. The list of questions can be seen in table 4.

Table 4 Questionnaire items list

Variables	Questionnaire items
Attitude	<ol style="list-style-type: none"> <li>1. As a customer, I feel it is important to help maintain safety at gas stations.</li> <li>2. If all consumers comply with safety regulations, gas stations become safer for all.</li> <li>3. It is important for every visitor/consumer to comply with gas station safety regulations.</li> <li>4. Safety signs and warnings make me aware of the dangers at gas stations.</li> <li>5. In my opinion, taking part in maintaining the safety of gas stations is good and wise behavior.</li> <li>6. To maintain the safety of gas stations, consumer involvement is needed.</li> </ol>
Norms	<ol style="list-style-type: none"> <li>1. I feel I have a moral obligation to help maintain safety at gas stations.</li> <li>2. I would feel guilty if something I did/did not do caused an accident at the gas station.</li> <li>3. The people closest to me (who are important to me) want me to comply with safety regulations when filling up with fuel at gas stations.</li> <li>4. When I ride with my family, I will make sure gas station safety rules are followed.</li> </ol>
Perceived Threat	<ol style="list-style-type: none"> <li>1. Behaving unsafely at a gas station could cause me injury.</li> <li>2. The thought of my vehicle catching fire at a gas station makes me feel scared.</li> <li>3. The possibility of a fire increases many times when filling the fuel tank with fuel.</li> <li>4. If I was involved/become a victim of a gas station fire, it would make my family sad.</li> <li>5. The impact of injuries due to accidents/fires when refueling can last a long time.</li> </ol>
Perceived Benefits & Barriers	<ol style="list-style-type: none"> <li>1. I'm trying to find out things related to safety at gas stations.</li> <li>2. Not smoking at gas stations gives me a sense of security when filling up fuel at gas stations.</li> <li>3. Turning off the vehicle while refueling makes passengers feel uncomfortable.</li> <li>4. The prohibition on calling while refueling hinders me from communicating with colleagues.</li> <li>5. Filling fuel using jerry cans is profitable because it can store large amounts of fuel.</li> </ol>
Consumer Safety Behavior	<ol style="list-style-type: none"> <li>1. Every time I fill up fuel at a gas station I comply with the safety regulations as directed by the officer.</li> <li>2. I don't smoke at gas stations when filling up with fuel.</li> <li>3. While refueling, I turned off the engine.</li> </ol>

### Conclusion

In this article, we have shown the preparation of the Fuel Station Consumer Safety Behavior Questionnaire which consists of 5 variables and 22 question items. The questionnaire prepared

has also gone through a content validity and face validity process, as well as a pilot study process with 80 respondents and meets the criteria for validity testing with Pearson's Product Moment and reliability testing with Cronbach's Alpha. Thus, this questionnaire is ready to be used in field research with a larger number of gas station consumer respondents. However, this research still has limitations, namely testing with Pearson's Product Moment and Cronbach's Alpha is a bivariate analysis method. Future research can carry out multivariate analysis, for example using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (EFA), and to carry out both analyzes a larger sample is needed. Through multivariate analysis, it is hoped that core factors will be obtained that better represent each variable and minimize the correlation between one item and other factors (Watkins, 2018). Thus, it is hoped that the questionnaire prepared will be better in terms of validity.

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