

# Content Validity and Test-retest Reliability of Self-reported Questionnaire Assessing Knowledge and Perception of SMS Thumb: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Continuous texting is associated with more stress on the thumb, which may cause the onset of a variety of wrist and thumb conditions. Today's youth spend the majority of their time on smartphones, which might cause texting thumb symptoms to occur. As there is a lack of a questionnaire that can evaluate their awareness and views, this was the first study that develops as well as evaluates the validity and reliability of a self-designed questionnaire.

**Aim:** To assess the validity and reliability of a self-designed questionnaire that measured knowledge and perception of Short Message Service (SMS) Thumb.

**Materials and Methods:** This cross-sectional pilot survey was conducted in Mangalore, Karnataka, India from June 2022 to July 2022. Validity and reliability were performed in two sections. A panel of four experts reviewed the questionnaire's content validity to determine its Content Validity Index (CVI), while reliability was performed by using test-retest reliability

method which was carried out through an online survey among 31 young individuals with the inclusion criteria of non medical students aged between 18-25 years. CVI was used to analyse the questionnaire's validity. Test-retest statistical analysis was performed by Statistical Package for the Social Sciences (SPSS Inc; Chicago, IL), Version 26.0 and internal consistency were used to assess the reliability. Pearson correlation was used to perform the reliability.

**Results:** The item Content Validity Index (i-CVI) of the questionnaire was 1.00 for 20 of the 25 questions, while the average scale CVI of the questionnaire was 0.95. Test-retest reliability and internal consistency were both evaluated using Cronbach's alpha coefficient and Pearson's correlation ratio, respectively. The questionnaire was significantly reliable with a p-value <0.05.

**Conclusion:** The questionnaire showed acceptable test-retest reliability and content validity which can be a useful tool for measuring awareness and attitude about SMS Thumb.

**Keywords:** Ergonomics, Pilot survey, Psychometric testing, Short message service, Texting thumb

## INTRODUCTION

Smartphones are powerful communication devices and have become an essential part of our daily lives [1]. In present times, where mobile technology has developed, especially among adolescents, who spend an ample amount of time on handheld devices, such as touchscreen mobiles, computers, and iPads [2]. It provides greater accessibility for communication among individuals by allowing us to communicate more easily through voice calls, text messages, and social networking websites like WhatsApp, Facebook, Instagram, and Skype other than voice calls [3]. According to a study on smartphone addiction in Indian teenagers, 39-44% are addicted to smartphones, with 35% using them for SMS purposes [4,5]. In the young adult population, there is an increased incidence of musculoskeletal discomfort in the upper back, neck, wrists/hands, and shoulders, especially in those with smartphone addiction [6].

As a result of frequent gripping and repetitive movements of the thumb, while texting a repetitive type of stress injury may develop into a related syndrome. Various terms including iPod finger, SMS thumb, texting tenosynovitis, and Wii injury, have been used to characterise the "repetitive strain injury" caused by using handheld devices [7].

Several variables may influence the thumb, including the narrow space on the keypad, the phone's size, the steady load, and the thumb's position [8]. Various studies have shown that continuous strain on the thumb and palmar muscles while texting has been associated with conditions such as tendinitis of extensor pollicis longus and adductor pollicis, wrist tendonitis, first metacarpophalangeal arthritis, and Dequervain syndrome [9-11].

Based on knowledge, no studies have been done specifically on creating and evaluating questionnaires addressing young adults awareness and views of the detrimental consequences of smartphone use and excessive texting on the musculoskeletal system. This questionnaire may aid researchers, health, and non health practitioners in identifying youth who require texting ergonomics and preventing long-term difficulties.

The objective of this research was to describe the psychometric properties of a questionnaire that measures SMS thumb knowledge and texting ergonomics. It is hypothesised that questionnaire responses will indicate validity via an expert panel review and reliability as measured by a 14-day test-retest interval.

## MATERIALS AND METHODS

This cross-sectional pilot survey type of study was conducted in Nitte Institute of Physiotherapy, NITTE (Deemed to be University) Mangalore, Karnataka, India. The study was carried out in two stages from 10<sup>th</sup> June 2022 to 18<sup>th</sup> July 2022 and was approved by the Institutional Ethical Committee (IEC) of Nitte Deemed to be University, Mangalore, Karnataka, India (NIPT/IEC/MIN/13/2021-2022).

The initial stage was establishing the developed questionnaire's content validity with the help of experts. A test-retest study method was used in the second stage of the research to examine the reliability of the content-validated SMS thumb questionnaire [12].

**Development of questionnaire:** Keywords such as texting thumb, ergonomics, grip strength, and de Quervain tenosynovitis were

used in the literature search. The symptoms and risk factors related to texting were identified through various studies [13-15] which aided in the development of the structured questionnaire. The questionnaire was created using a Likert scale and shared with academicians who were physiotherapists with more than five years of clinical and teaching experience in order to receive feedback on potential improvements. Following that, the questionnaire was revised and divided into three sections: smartphone information which included two questions (regarding duration and a number of messages sent per day), knowledge, and perception of texting thumb.

The knowledge domain includes 15 multiple-choice questions. It measures general awareness of symptoms, long-term effects, practice, pain management, and ergonomics. With the exception of K2 and K15, all of the questions have been assigned scores. The knowledge section total score ranged from 0-37 and are categorised into three levels- Good: above 30, Average: between 16-29, and Poor: below 15.

Seven questions are included in the perception domain to analyse their attitude toward ergonomics, there are two options Yes and No assigned as score "1" and "0" allowing respondents to express their views regarding ergonomics. The score between 0 and 7 indicates the better the perception.

**Content validity:** One of the most widely used techniques for evaluating the validity of instruments developed by researchers and chosen at the beginning of the instrument development process is content validity [16]. The developed questionnaire was reviewed by experts who are physiotherapists with more than eight to ten years of background in clinical, teaching, and research, as well as having knowledge of various orthopaedic disorders.

A validation form consisting of a questionnaire and a relevant scale based on the Likert scale [17] was forwarded to the experts through email with a request to complete it. Based on the feedback received, the questionnaire was revised again and the questions were either modified, removed, and resubmitted for re-validation.

**Test-retest reliability:** Following the content validation, an online pilot study was carried out among 31 students to evaluate the questionnaire's reliability.


**Inclusion criteria:** Age of the subjects 18-25 years, subjects using a smartphone for more than one year, participants who could understand and complete the questionnaire in English, and students from various non medical institutions were included in the study.

**Exclusion criteria:** Individuals enrolled in medical and allied courses, professionals, and those who did not participate voluntarily or who couldn't fulfill the inclusion criteria were excluded from the study.

**Study Procedure**

A Google survey was used to collect the data. A Google form link containing (information about the study, data screening forms, informed consent forms, and self-administered questionnaires) shown in [Table/Fig-1] was circulated via social media to non medical students including those studying engineering, commerce, and arts degrees. Responses from students to the link determined participation. The subjects were required to fill out an online consent form after reading an information sheet outlining the study's objectives and procedures.

The information that the participants will be assessed again in 14 days wasn't disclosed to them during the initial test. The prior participants who had given informed consent and met the inclusion criteria were given the link of the questionnaires once again after two weeks. A gap of 14 days was chosen to lessen the chance that participants would recall their earlier responses or the "carry over" effect.

Section B Knowledge		
K1. Have you ever thought about how texting impacts your thumb?	<input type="checkbox"/> Yes, but not sure how <input type="checkbox"/> Yes, I am aware. <input type="checkbox"/> Not aware	• 1 • 2 • 0
K2. Which of the following conditions can be caused by text messaging?	<input type="checkbox"/> Neck Pain <input type="checkbox"/> Elbow Pain <input type="checkbox"/> Thumb Pain <input type="checkbox"/> I do not know	• 2 • 2 • 2 • 0
K3. Have you ever heard of the term SMS Thumb?	<input type="checkbox"/> Yes <input type="checkbox"/> Have never heard If yes, what is your source of information? (Select one of the options)	• 2 • 1
	Social media	
	Academic means	
	Medical professionals	
	Family and friends	
K4. Do you think that constant texting can result in a temporary loss of sensation in the thumb?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I do not know	• 2 • 1 • 0
	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, tick the relevant option	• 2 • 1
K5. Are you aware of the symptoms caused due to continuous text messaging?	<input type="checkbox"/> Headache	
	<input type="checkbox"/> Eyestrain	
	<input type="checkbox"/> Swelling around the thumb	
	<input type="checkbox"/> Discomfort and tingling sensation in the thumb	
	<input type="checkbox"/> Wrist pain	
K6. Do you think texting can reduce gripping movement (such as sewing a needle or buttoning)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I do not know	• 2 • 1 • 0
	<input type="checkbox"/> Yes <input type="checkbox"/> False <input type="checkbox"/> I do not know	• 2 • 1 • 0
K7. Is it true that texting can cause long-term complications (cramping pain, numbness) in the thumb?	<input type="checkbox"/> True <input type="checkbox"/> False <input type="checkbox"/> I do not know	• 2 • 1 • 0
K8. Are you aware of which of the following components continuous texting can affect?	<input type="checkbox"/> Muscles and tendons of the thumb <input type="checkbox"/> Speed of typing <input type="checkbox"/> None of these <input type="checkbox"/> All of the above <input type="checkbox"/> I do not know	• 1 • 1 • 0 • 2 • 0
K9. Do you think that the screen size of your phone and keypad pattern can affect your thumb?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know	• 2 • 1 • 0
K10. Ice packs will be effective for thumb pain caused due to continuous texting?	<input type="checkbox"/> Yes <input type="checkbox"/> Not effective <input type="checkbox"/> I do not know	• 2 • 1 • 0
K11. Are you aware of the availability of the non operative or conservative treatment for thumb pain due to continuous text messaging?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, to the above question select the appropriate option	• 2 • 0
	<input type="checkbox"/> Frequent breaks from texting <input type="checkbox"/> Stretching of thumb and hand muscles <input type="checkbox"/> Steroid injections <input type="checkbox"/> All of the above <input type="checkbox"/> Others (Please specify)	
K12. Do you feel braces could aid with pain relief?	 <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I do not know	• 2 • 1 • 0
K13. Are you aware of the appropriate wrist and thumb positioning when texting?	<input type="checkbox"/> Yes <input type="checkbox"/> No	• 2 • 0
K14. Do you think physiotherapists can treat SMS thumb or thumb soreness induced by smartphone use?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not aware of physiotherapy	• 2 • 1 • 0

K15. What would you do if you experience thumb strain while texting?	<input type="checkbox"/> Self-medication (painkillers) <input type="checkbox"/> Taking a break from texting <input type="checkbox"/> Will continue to text <input type="checkbox"/> Seek medical advice <input type="checkbox"/> None of the above <input type="checkbox"/> Others (specify)	• 2 • 2 • 1 • 2 • 0 • 1
<b>Section C Perception</b>		
P.1) Is it important to maintain the correct posture of the hand (wrist, thumb) while texting?	<input type="checkbox"/> Yes <input type="checkbox"/> No	• 1 • 0
P.2) Do you believe that swapping fingers while texting will be beneficial in preventing thumb discomfort?	<input type="checkbox"/> Yes <input type="checkbox"/> No	• 1 • 0
P.3) To avoid long-term issues, do you think it is necessary to consider the size of the mobile phone?	<input type="checkbox"/> Yes <input type="checkbox"/> No	• 1 • 0
P.4) Do you think supporting your forearm against the table while texting is necessary?	<input type="checkbox"/> Yes <input type="checkbox"/> No	• 1 • 0
P.5) Is it necessary to raise public knowledge of the SMS thumb and texting ergonomics?	<input type="checkbox"/> Yes <input type="checkbox"/> No	• 1 • 0
P.6) Do you agree that using voice note features instead of emailing or texting will be beneficial to your thumb?	<input type="checkbox"/> Agree <input type="checkbox"/> Disagree	• 1 • 0
P.7) Do you think SMS Thumb can be avoided by yourself?	<input type="checkbox"/> Yes <input type="checkbox"/> No	• 1 • 0
<b>Interpretation:</b> The total points score in the knowledge section ranged between 0 and 30. The scores are categorised into three levels: • Good- Above 25 • Average- 15-25 • Poor- Less than 15 The total points score in the perception section ranged between 0 to 7. <b>Interpretation:</b> Higher the score better the perception.		
<b>[Table/Fig-1]:</b> A self-designed questionnaire. Q: Question; K: Knowledge items; P: Perception		

### STATISTICAL ANALYSIS

Statistical analysis was performed by SPSS Inc; Chicago, IL, Version 26.0. The CVI was evaluated using Microsoft excel. Pearson correlation was used to perform the reliability. The level of significance was set at 5%.

### RESULTS

**Content validity:** Out of the five content experts invited to participate in the study, four consented. They were all Professors in physiotherapy institutes in Karnataka. Except for five items that received a score of 2, which is considered slightly relevant according to the relevancy scale [17] and was recommended to be rephrased, the majority of items were relevant according to the I-CVI calculation [18]. The result of the expert review is shown in [Table/Fig-2]. The questionnaire’s average universal agreement (S-CVI/UA) of item scores is 0.8 and its overall average content validity (S-CVI/Ave) is 0.95, which is regarded as excellent validity [18].

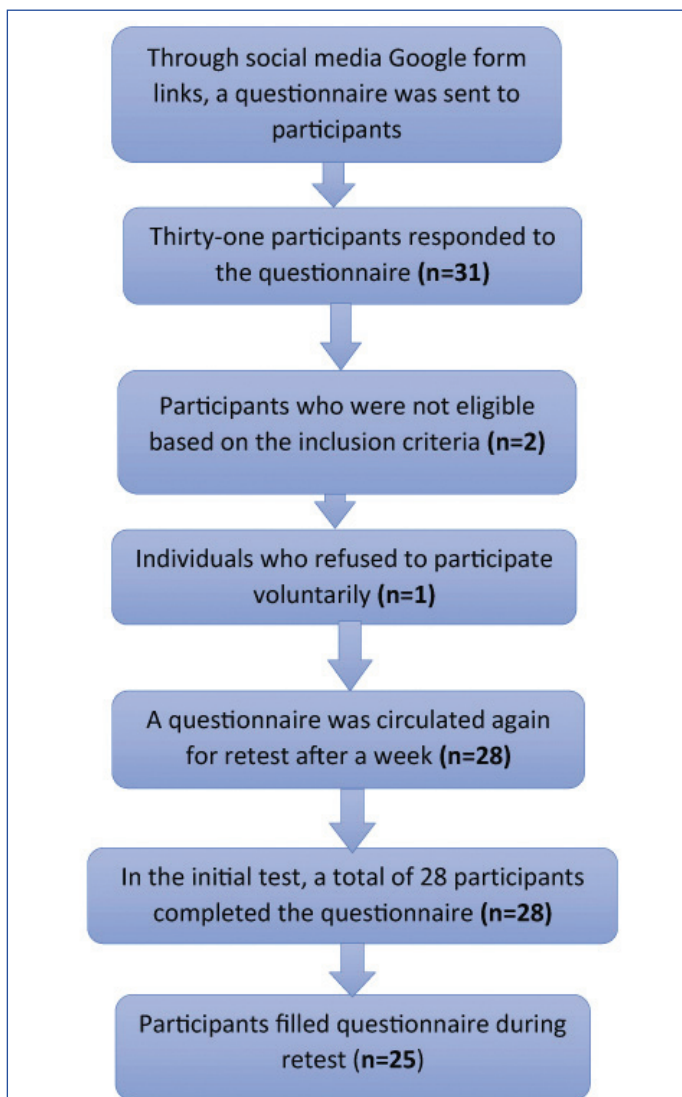
Item	Expert raters				I-CVI	Interpretation	Recommendation
	R1	R2	R3	R4			
Q 1	4	4	4	4	1.00	Appropriate	Included
Q 2	4	4	4	4	1.00	Appropriate	Included
K 1	4	4	4	3	1.00	Appropriate	Included
K 2	4	4	4	4	1.00	Appropriate	Included
K 3	4	4	4	4	1.00	Appropriate	Included
K 4	4	4	4	4	1.00	Appropriate	Included
K 5	4	4	3	4	1.00	Appropriate	Included
K 6	4	4	3	2	0.75	Slightly relevant	Rephrased
K 7	4	3	4	4	1.00	Appropriate	Included
K 8	4	3	4	4	1.00	Appropriate	Included

K 9	4	2	4	4	0.75	Slightly relevant	Rephrased
K10	4	4	4	4	1.00	Appropriate	Included
K 11	4	2	4	4	0.75	Slightly relevant	Rephrased
K 12	4	4	4	2	0.75	Slightly relevant	Rephrased
K 13	4	4	3	4	1.00	Appropriate	Included
K 14	4	3	4	4	1.00	Appropriate	Included
K 15	4	2	3	4	0.75	Duplicated with K16	Deleted
K 16	4	3	4	3	1.00	Appropriate	Included
P1	4	4	4	4	1.00	Appropriate	Included
P2	4	4	4	4	1.00	Appropriate	Included
P3	4	4	4	4	1.00	Appropriate	Included
P4	4	3	3	4	1.00	Appropriate	Included
P5	4	3	4	4	1.00	Appropriate	Included
P6	4	3	4	4	1.00	Appropriate	Included
P7	4	3	4	4	1.00	Appropriate	Included
					S-CVI/ Ave-0.95		

**[Table/Fig-2]:** Expert review for relevance rating and comments.  
 Q: Question (2 items); K: Knowledge items (16 items); P: Perception items (7 items); R: Rater; I-CVI: Item content validity index

### Test-retest reliability

The pilot study’s sample size was 31 non medical students. However, only 28 students participated in the initial test. The distribution of the questionnaire is illustrated in [Table/Fig-3]. In the sample, there were



**[Table/Fig-3]:** Flowchart illustration of questionnaire distribution in the test-retest reliability study.  
 N: Number of participants



17 males (60.7%), compared to 11 females (39.3%). The average age of the students was 20.6 years.

Cronbach alpha of the questionnaire was 0.77 indicating that it has good internal consistency [19]. The test-retest reliability was evaluated by Pearson correlation which shows good reliability for both the knowledge and perception sections. The result of test-retest reliability is shown in [Table/Fig-4].

Domain	Pearson's correlation	p-value
Knowledge	0.820**	<0.001*
Perception	0.703**	<0.001*

[Table/Fig-4]: Result of test-retest reliability.

\*\*Correlation is significant at the 0.01 level; \*Level of significance set at 5%; Test applied- Pearson correlation

## DISCUSSION

The goal of this study was to construct a questionnaire and evaluate the validity and reliability of the results. Knowledge and perception studies reveal what the public knows, and perceives about the topic of interest. A survey is frequently used to assess the level of knowledge, attitude, and practice in a certain field of interest [20]. Understanding the baseline knowledge and perception of the targeted group is essential before setting any interventional programmes into practice [21]. According to research conducted by Shah PP and Sheth MS found that students who were addicted to their smartphones reported to have musculoskeletal issues with their neck and hands (most commonly the thumb), which could initially be short-term but could potentially result in long-term disability [2]. In a study on the prevalence of SMS Thumb, Ahmed S et al., found that 29% of college students had thumb pain after using their smartphones for an extended period of time [22]. In terms of ergonomics, Sujatha Baskaran B et al., suggested that the smartphone with a screen size of less than or equal to 4.7 inches and a thickness of 1.5-2 cm held in landscape orientation while seated with the forearm rested to prevent complications of hand [23]. Keeping in view the increased prevalence of thumb pain caused by constant smartphone use, it is necessary that young individuals are aware of the risks associated with smartphone use. To the best of the knowledge, there is no questionnaire assessing the knowledge and perception of SMS thumb. The present study was the first to establish a reliable and valid measure that can evaluate student's knowledge and perception of the harmful effects of smartphone use on the thumb.

Vakili MM and Jahangiri N, stated that items with scores of 0.70-0.79 requires modification [16], this study shows that the majority of the items had an I-CVI score of 1.00 with the exception of five questions, one of which was omitted as it was remarkably similar to another question, and the other four were rephrased.

According to Zaujan NA et al., the internal consistency of Cronbach's alpha values should be evaluated while performing the reliability test [24]. Thus, Cronbach's alpha coefficient was used in the current study for the reliability analysis. This tool can aid the researcher in evaluating youth's awareness of the harmful implications of constant texting, which will help them develop strategies to prevent the long-term effects of stress on the thumb. Research in the future may support public health programs that can educate smartphone users on ergonomics in order to prevent symptoms and potential issues [8]. Also, this questionnaire will aid medical professionals in providing patients with smartphone-related thumb symptoms with better counselling and appropriate awareness. Regardless of the subjects educational background, the items are written in simple terms so that they can understand. Hence, before utilising the tool with another demographic, such as healthcare professionals and students in clinical settings, it may need to be modified.

## Limitation(s)

This pilot study was conducted among 31 subjects further research could be done on large sample size as well as different populations.

## CONCLUSION(S)

The self-developed questionnaire had good validity and test-retest reliability, is simple to understand, and can be completed quickly by participants; thus, it can be used to assess the general public's level of knowledge more reliably and easily. The validated questionnaire will simultaneously raise adolescents awareness of and realistic perspective of avoiding the harmful consequences of frequent texting as well as maintaining wrist posture when texting.

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