ORIGINAL ARTICLE

# Validity Of Mobile Application Scoscreen for Early Screening of Adolescent Idiopathic Scoliosis

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## ABSTRACT

**Introduction:** Scoliosis is characterized by an abnormal lateral curvature that may occur during a child's growth period. Early detection and intervention are needed to prevent the progression of abnormal curvatures. While the gold standard for diagnosing idiopathic scoliosis is x-ray imaging, there is a quick and easy way to perform screening, i.e., using a smartphone. A mobile application with a built-in inclinometer and simple scoliosis tests may help detect scoliosis. Therefore, this study aimed to assess the ScoScreen mobile application's content for early screening of AIS. **Methods:** We recruited five physiotherapists with more than five years of experience in paediatric and musculoskeletal and one spinal surgeon. The validity of this study was assessed using a content validity form. Content validity was assessed by calculating the Item-level Content Validity Index (I-CVI), Scale-level Content Validity Index (S-CVI), and modified kappa. **Results:** The results show that the content validity of ScoScreen has an excellent level of content validity (I-CVI=0.83 – 1.00). The average approach's overall content validity index was high (S-CVI/Ave=0.94). All items in this study were excellent, with the kappa scores greater than 0.74 (kappa= 0.816 – 1). **Conclusion:** The development of ScoScreen for early screening of AIS was proven to have excellent content validity in this study. As a result, the Scoscreen mobile application is appropriate for early detection of AIS in terms of its content.
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## INTRODUCTION

Scoliosis is a three-dimensional spinal abnormality characterized by deviation of the spine (1). Adolescent idiopathic scoliosis (AIS) is the most frequently reported type, accounting for roughly 90% of all idiopathic scoliosis cases (2). It is a structural, lateral, and rotated spine deformity of unknown origin with a Cobb angle, a measure of spine curvature, of at least 10 degrees, that occurs in children and adolescents aged 10 to 18 years (1,2). Scoliosis spinal deformity is manifested by lateral curvature in frontal, lordotic, or kyphotic deviation in sagittal and vertebral axial rotation in the horizontal plane (3). This deformity generally gets worse before maturity of the adolescent skeleton (2). While the cause of AIS is unclear, several theories involving hormonal, neuromuscular, biomechanical, or genetic causes have been proposed (4).

There have been several reports on the incidence of AIS all over the world. In the United States, the prevalence rate of AIS is about 1% to 3% (2). In Asian countries, idiopathic scoliosis had a prevalence of about 0.4% to 7% amongst adolescents (5). In South Korea, a study conducted with a large sample of 1 134 890 school children shows the overall prevalence rate of scoliosis was 3.26 % (6). The same study found higher Cobb angles in girls which was at 4.65% compared to boys at 1.97%. In Malaysia, a study conducted in Kuala Terengganu in 2004 showed the prevalence rate of scoliosis was 1.44% and increased with age (7). Another recent study with a larger population, reported the prevalence rate of AIS in Selangor was 2.55 % (5). Evidently, this data shows that the prevalence rate of AIS in Malaysia is increasing. Hence, the data above shows an alarming sign of increasing AIS in South East Asian countries that can lead to adverse impact to a child's quality of life.

Those with a spinal curvature of more than 40 degrees at puberty age would most likely develop deformation during middle age such as long-term negative health outcomes for example respiratory difficulties,

fatigue, backache, psychological problems, physical complications, and a lower quality of life (2). Although controversial, this condition may be aggravated by applying a spinal brace or surgery. Moreover, studies also show that wearing braces can cause psychosocial issues such as peer pressure from school and social relations, increasing anxiety, decrease of self-image, and mental health-related quality of life (8,9). The study also demonstrated that scoliosis surgery has surgical effects in terms of blood lost, duration of hospitalization, and also health-related quality of life (10). Therefore, the screening of AIS as early as possible is warranted.

Scoliosis screening has been widely used for many years, but it is still a controversial subject due to concerns about cost-effectiveness, long-term radiographic injury, over-referral to specialists, low sensitivity and specificity, and a weak correlation between clinical deformity and radiographic abnormality (11). In patients with idiopathic scoliosis, earlier identification and diagnosis facilitates early conservative care such as bracing, which can prevent unnecessary surgery and provide a higher health-related quality of life score. Whereas late diagnosis may result in higher patient surgery rates and if left untreated, severe scoliosis will progress (4).

The AIS clinical assessment includes assessing posture and back shape, as well as spine mobility. Posture can be assessed through radiography, Moirй topography, and photogrammetry. However, most clinicians do not have access to these assessments due to costs, requirement of specialized training, and time constraints. Other than the above mentioned assessments, posture can be assessed through scoliometer with Adams forward bend test, plumb line, humpmeter, and goniometer. Nonetheless, radiography imaging is the diagnostic test for diagnosing AIS, but adolescents are not advised to undergo x-ray imaging for screening due to risk of radiation (12).

According to Datillo et al. (13), the latest trend of healthcare has incorporated the "e-patient," with 61% of patients using the internet for health data. This is a growing market for individuals who have put forth the effort by developing internet web sites and smartphone applications to provide patients with self-management and information regarding health care (13). Many mobile applications have been developed recently for example an e-goniometer, e-heartrate extractor, and e-hallux valgus angle calculator applications. Following the introduction of Apple Inc's micro-electromechanical-system, accelerometer, which can reliably capture acceleration and inclination, numerous applications have been introduced to users to facilitate inclination measurement for a variety of purposes (14). Also, smartphone-aided end vertebrae technique is becoming popular in orthopaedic clinics similar to standardized use because its reliability is the same with Cobb angle calculated from printed radiograph using a protractor (15).

According to one Malaysian study, measuring angle trunk rotation (ATR) with a scoliometer is a non-invasive, radiation-free, and relatively inexpensive screening tool compared to radiograph (5). This issue was supported by Larson et al. (17), who discovered that it was a reliable and cost-effective substitute for serial x-ray imaging in overseeing AIS. In addition, many smartphones are now compatible to be used as mobile applications with built-in inclinometers for assessing the inclination of the spine in everyday use (14). If scoliosis screening could be done by evaluating the ATR using a smartphone, it would be cost-effective as it is more economical and convenient (18) compared to traditional scoliosis screening (16).

Even though there is a mobile application that detects ATR, the usage of smartphones to screen AIS is still scarce. In addition, the examiner's professional experience may have an impact on measurement reliability (18). Previous studies stated the application's intratester and intertester angular accuracy and no implementation guidelines were reported, casting doubt on the scientific utility of this approach (18). As a result, the goal of this current study was to validate the content of ScoScreen mobile application in users.

## MATERIALS AND METHODS

This was a cross-sectional study. This study has obtained ethic clearance from the teaching university ethical committees.

### Participants

A total of six panel of experts were chosen to give feedback on the content of this mobile application including videos and audio. The inclusion criteria for the study were physiotherapists and surgeon with more than five years of working experiences in musculoskeletal, orthopaedic, or paediatrics areas, who have worked in the field of AIS. Physiotherapy students and physiotherapists or surgeons with less than five years of working experiences in above mentioned areas were excluded from this study.

### Instruments

A content validity form was used in this study. It captures the agreements between participants. Content validity is the extent to which a tool has a suitable number of items to be measured for the structure and is a major procedure in instrument development (18). In quantitative assessment, the content validity index (CVI) is the utmost frequently used parameter to compute the content validity (19). The description of the domain and the items representing the domain were clearly given to the participants in the content validation form. In the form, it consists of four domains, which are functionality, reliability, usability, and efficiency (19). Each item in the domain has a 4-point scale that is for instance: 1= not relevant, 2= somewhat relevant,

3= quite relevant, and 4=highly relevant. According to Polit et al. (20), CVI has advantages in terms of ease of calculation, understanding, emphasis on agreement of interest instead of on agreement per se, focus on consensus instead of consistency, and information on the item and scale (20).

A mobile application that may be useful in screening scoliosis early is the ScoScreen application. ScoScreen is an application that mimics a manual scoliometer. There are mobile applications available online to measure scoliometer, however the validity and reliability of these mobile applications are unknown. There is no reliability or validity study of other scoliosis applications in the market except Scoliogauce. However, the current validated application (Scoliogauce) is also not available worldwide and needs to be purchased by the customer. Hence, ScoScreen is an application that comprises a brief explanation on what is scoliosis, posture observation, and the most important part is that the application itself resembles a conventional scoliometer. The goal was to create an accessible and convenient tool to be used by all.

## Procedures

The participants were recruited through an email invitation. The participants were contacted and given a brief written explanation regarding the study by the researcher. Next, participants whom expressed interest to take part in the present study contacted the researcher and were given an information sheet and a consent form. Once the participants signed the consent form, a 4-point content validation index (CVI) form and the storyboard of the mobile applications were shared with them. The storyboard has all the context of each screen of the mobile application that will be developed (Fig 1). Generally, the participants review the representativeness

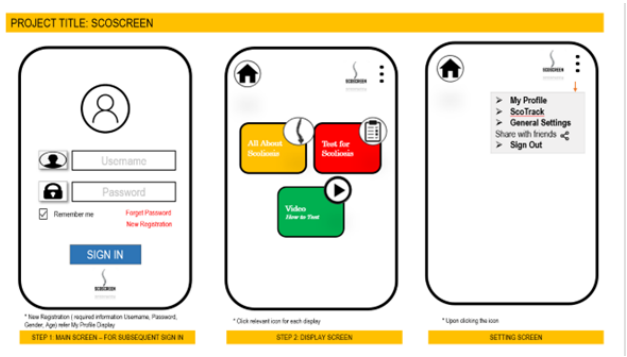


**Figure 1: The first few screens of the storyboard for experts to evaluate**

of the content, clarity, simplicity, and ambiguity of the video, audio, and instruction in ScoScreen Storyboard using the CVI. In the form, the participants were invited to evaluate the items in terms of their suitability. Then, participants are requested to score each item. The four domains include functionality, reliability, usability, and efficiency respectively. Each domain was further subdivided into a few items. Each item was then explained further for better understanding for experts to evaluate.

For functionality, the participants rated the items such as focus, navigation tools, features, wording, and language (Table I). For reliability, the items were personalized, trustable, information delivery, video, and privacy (Table II). As for the usability domain, the items consist of familiarity, learnability, instruction, visuals, and video. The efficiency domain comprises structure flow, video, errors, and information. This application also has data privacy settings that secure all information about users. Participants were also encouraged to provide written comments to improve the relevance of items to the targeted domain. Once the participants finished assessing the content validity, the forms were returned to the researcher to be analyzed.

## Statistical analysis

All the data was transferred to an excel spreadsheet. The item-level CVI (I-CVI) of the ScoScreen was determined by adding the number of participants who rated 3 (item is quite relevant) or 4 (item is highly relevant) divided by the total number of participants. Polit et al. (20) previously reported that strong content validity was considered if I-CVI items had ≥ 0.78 for three or more participants. In this research, there are two methods for calculating the scale-level content validity index (S-CVI), which are the mean of the I-CVI scores for all

**Table I: Functionality domain and items with an explanation**

| Domain | Items | Explanation |
|---|---|---|
| Functionality | Focus | The application overall provides clear function of its purpose, fulfils the need of user and every component of its design and functionality tailored to meet the use of public users. |
| | Navigation tools | The application overall provides clear function of its purpose on each section. |
| | Features | The application provides secondary navigation system that shows user's location on screen. |
| | Wording | The application provides simple and easy to understand wording and use laymen terms. |
| | Language | The applications provide language selections to address users in Malaysia. |

**Table II: Reliability domain and items with an explanation**

| Domain | Items | Explanation |
|---|---|---|
| Reliability | Personalized | The application is tailored to users. The application recommends screening tests the user should undergo and actions the user needs to take. |
| | Trustable | The application is able to keep personal information especially medical data in a secured manner. |
| | Information Delivery | The application provides sufficient information and contains up-to-date information. |
| | Video/Audio | The application provides correct instructions on the screening process. |
| | Privacy | The application provides settings that allow privacy in screening and data. |

items on the scale (S-CVI/Ave) and the amount of items on the scale that attain a significant scale of three or four by all participants (S-CVI/UA) (20). The S-CVI/Ave was determined by dividing the total of the I-CVIs separated by the overall number of items (20). While S-CVI/UA was computed by adding all items with an I-CVI of 1 by the overall number of items. The cut-off value for both S-CVI/Ave and S-CVI/UA are ≥ 0.90 and 0.80 respectively (20). In addition, a study by Polit et al. (2007) also stated that the I-CVI was estimated using a modified kappa index. Kappa statistics computing requires calculation of chance probability (Pc), i.e., Pc = (N! / A! (N – A)!) Ч 0.5N. N is the number of participants in the research, A is the number of participants who agreed that the item is relevant. After that, the kappa statistic is determined as follows: K = (I-CVI – Pc) / (1 – Pc). Kappa values more than 0.74 are considered excellent, 0.60 to 0.74 are regarded good, and 0.40 to 0.59 were regarded fair (21).

## RESULTS

### Participants

The content validity index (CVI) for ScoScreen to detect AIS was carried out by five physiotherapists and one surgeon. The data showed that the participants possessed the necessary competence to assess the instrument (Table III). Three participants obtained further training in paediatrics field, one participant is an orthopaedic specialist and spinal subspecialist, and the other two are specialized in musculoskeletal and spine conditions. The panel of participants were requested to judge on the content of the mobile application based on the 4-point scale for relevancy.

### Items-level Content Validity (I-CVI)

All the I-CVI for each item are in Table IV. All 24 items were marked as strong content validity and the I-CVI's ranged from 0.83 to 1.00. Sixteen items had an I-CVI = 1.00 and 8 items score of 0.83. All the items were considered to have strong content validity. Strong content validity was considered if I-CVI items with ≥ 0.78 for three and a greater number of participants. Hence, none of the items were below 0.78, which would indicate rejection of the item.

**TABLE IV: Calculation of Item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI) for four domains using 4-point scale**

| Domains (Items) | Items CVI | Modified kappa |
|---|---|---|
| Functionality | | |
| Focus | 1.00 | 1.0000 |
| Navigation tools | 1.00 | 1.0000 |
| Features | 0.83 | 0.8161 |
| Wording | 1.00 | 1.0000 |
| Language | 1.00 | 1.0000 |
| Reliability | | |
| Personalized | 1.00 | 1.0000 |
| Trustable | 0.83 | 0.8161 |
| Information delivery - overall | 1.00 | 1.0000 |
| Information delivery – all about scoliosis | 1.00 | 1.0000 |
| Information delivery – test for scoliosis | 1.00 | 1.0000 |
| Video/ audio – overall | 0.83 | 0.8161 |
| Video/audio – back observation | 1.00 | 1.0000 |
| Video/audio – Adam forward bend test | 0.83 | 0.8161 |
| Video/audio - Scoliometer | 0.83 | 0.8161 |
| Privacy | 1.00 | 1.0000 |
| Usability | | |
| Familiarity | 1.00 | 1.0000 |
| Learnability | 1.00 | 1.0000 |
| Instruction | 1.00 | 1.0000 |
| Visual / audio / video -Use simple visual and audio cues | 0.83 | 0.8161 |
| Video -addressed in correct tone and instructions are easy to understand | 0.83 | 0.8161 |
| Efficiency | | |
| Structure flow | 1.00 | 1.0000 |
| Video | 0.83 | 0.8161 |
| Few errors | 1.00 | 1.0000 |
| Information | 1.00 | 1.0000 |
| S-CVI/Ave | 0.94 | |

S-CVI/Ave = Scale-level Content Validity Index/Average

### Scale-level Content Validity Index (S-CVI) results

The S-CVI was calculated for all 24 items. It is based on the universal agreement method (S-CVI/UA) = 0.67 and the scale-level content validity index is based on the average method (S-CVI/Ave) = 0.94. The universal agreement is calculated by adding all the I-CVI's equal

**TABLE III: Characteristics of participants n=6**

| Participant | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Age (years)** | **32** | **34** | **42** | **50** | **31** | **60** |
| Gender | Female | Female | Female | Female | Male | Male |
| Position | Medical rehabilitation officer (physical) | Medical therapist | Senior Physiotherapist | Consultant orthopaedic Spinal Surgeon | Junior Physiotherapist (Special interests in Musculoskeletal conditions) | Senior Physiotherapist (expertise in Musculoskeletal / Manual Therapy and spine) |
| Experience as general Physiotherapist (years) | 9 years | 13 years | 2 years | 24 years (general Dr.) | 9 years | 31 years |
| Experience as Paediatrics Physiotherapist (years) | 6 years | 11 years | 18 years | 23 years (as orthopaedic) 11 years (treating scoliosis) | - | - |
| Level of education | Degree | Diploma | Master | Masters in Orthopaedics with Spine Subspeciality | Master | Master |
| Working Sector | Semi government | Semi government | Public | Public and Private | Public | Self-owned private practice |

to 1.00 (16 items) divided by 24, while the average takes the sum of all the I-CVI (22.64) divided by 24. The cut-off value for S-CVI/UA and S-CVI/Ave are 0.8 and 0.9 respectively. Overall, the agreement approach demonstrates poor content validity whereas the average method reveals high content validity of the ScoScreen to early detect adolescents with idiopathic scoliosis. The results for both S-CVI/UA and S-CVI/Ave are summarized in Table IV.

### Kappa Statistics

The kappa statistics is computed and the results ranged from 0.816 to 1 for all 24 items. Since the kappa values in this study are more than 0.74, all items were considered as excellent. The kappa calculation is in Table IV.

### Comments by participants

The changes to the mobile application's content were made based on the CVI scores and the comments by the participating panels. Based on the comments and opinions given by them, two out of six participants could not understand item 3 from the functionality domain which is the feature that represenst a secondary navigation system that shows the user's location on the screen. Two participants also commented on rewriting phrases for users to better understand items which specify wording, personalized, and trustable categories respectively. Similarly, three out of six participants remarked on the overall video presentation, the back observation video, Adam's forward bending test video, and the video on how to use a scoliometer respectively. They advised using fewer wording, using a real-time subject demonstration, and to use a real back photo which shows the asymmetrical posture. One of them gave a recommendation on rewording some of the descriptions. The participants also advised that instead of extended descriptions that may confuse people, the video should feature a real-time demonstration. The comments are summarized in Table V.

## DISCUSSION

Even though numerous ways of treating scoliosis have been developed, early screening remains the most effective treatment. The goal of this study was to validate the content of ScoScreen. Five physiotherapists and a

**TABLE V: Comments from participants**

| Domains | Items | Comments |
|---|---|---|
| Functionality | Focus | *Easy for the public to understand how to use it* |
| | | *Generally, it is a good idea. You may purchase some of the available Scoliometer application in the market and study it.* |
| | Features | *Is the location like GPS that indicate the address of the location?* |
| | | *I don't understand this part.* |
| | Wording | *Wording "effect on lung" can be interpreted differently by laymen. Maybe can change to "lead to breathing difficulty"* |
| | | *Can be improved though* |
| Reliability | Personalized | *Reword- The application is well tailored for users. It recommends adequate screening tests that are necessary.* |
| | Trustable | *Data safety not mentioned.* |
| | | *Suggested rewording- The application is well designed to record all findings in a proper manner.* |
| | Information delivery – all about scoliosis | *Basic scoliosis information were stated* |
| | Video/ audio – overall | *Need improvement on the video presentation. Less wording, more graphic, smooth* |
| | | *Need to improve the quality if video. Too many speech, lack of real subject demonstration. The public need to see rather than doing it with verbal information and too much wordings on the video.* |
| | | *Correct instructions are extremely important* |
| | Video/audio – back observation | *I suggest you add an example of a real back photo with asymmetrical posture that shows a vertebra that has a mild, moderate and severe curve* |
| | | *It would be good to have a real subject* |
| | | *Some recommendations for back posture assessment.* |
| | | *Step 1: Subject position- Stand straight with back exposed, feet slightly apart (you can choose to have it as "feet together". Look straight in front (not head forward. What is head forward? That would be bad posture). Arms relaxed by the side.* |
| | | *Step2: The slide gives the impression that the user should ask the subject to keep the head straight. But no. The users is to look out is there a tilt or rotation of the head. The same would apply for the rest. The video is good but not quite well worded.* |
| | | *Step 3,4 & 5: look at the level of the ears, shoulder and the bottom part of the shoulder blades.* |
| | Video/audio – Adam forward bend test | *Instead of relying on drawing diagram because laymen may not be able to compare with actual appearance especially in the presence of mild scoliosis* |
| | | *It would be good to have a real demonstrations on subject. Too much speech.* |
| | | *Recommendations for Adam's forward bend test.* |
| | | *Step 3: Examiner's position- stand at the back of the subject. Look out for any asymmetry* |
| | | *Step 4: ask the subject to put both palms together. Bend forward and bring both hand between the knees. See if one side of the rib cage is higher (it is important to have both palms together to prevent an induced rotation and also a more accurate reading of the rotation). Flexion will increase rotation. If palms are not together, the reading will be higher, hence not accurate.* |
| | Video/audio - Scoliometer | *Awaiting for full video* |
| | | *It would be good to have a real demonstrations on subject. A real time demonstrations.* |
| | | *Provide a video that has a real time demonstrations instead of long descriptions.* |
| | | *Noted on using the scoliometer application- The presenter says heads up but the hands show chest up. Why heads and not head. The layman will very likely interpret head up as "chin up", i.e. putting head in an extension position and not neutral. The presenter says 'Mark the most prominent area which budges when you touch'. That will need to be rephrased. It doesn't give a clear idea of what is required. The word budge means move. Nothing moves or budges when palpated.* |
| | | *An example of rephrasing, 'look out for nay bulge or prominences or a hump and you could mark it with the marker'* |
| | | *The presenter later on says "the key to use the scoliometer", this should be mentioned as the "key to use the ScoScren application scoliometer"* |
| | | *The part. "Place both thumbs close to place thumbs here" will be clearer if the video shows exactly the placement of the thumbs and the phone.* |
| Efficiency | Video | *Video still in progress to complete* |

spine surgeon took part in this current study which followed the approach recommended by Polit et al. (20). Studies recommended that 6 to 10 experts are sufficient in conducting content validity of a study (22,23). When six or more experts are involved, experts can disagree with one or more items and the instruments will be assessed as content validity (28). The study also claimed that saturation is more important than sample size in a content validity study (29). This method is widely used in health care and nursing research. Polit et al. (20) believe that when there are six or more participants, the CVI should be no less than 0.78 for an item to be considered acceptable (25). Owing to this, the CVI for this study has a value from 0.83 to 1.00. which represents having an appropriate level of content validity.

The importance of the participant's competence cannot be overstated. There are many various characteristics that can be utilized to certify a person's status as a participant and there are no hard and fast standards for defining a participant (25). Hence, participants in this study were chosen in the same manner as in a study of the development of the dementia-oriented evaluation system in individuals with dementia by Halek et al. (25). In that research, the participants worked as practitioners or scientists in the field of dementia care. As with this study for early screening of AIS, the participants had a background of paediatrics, spine, and scoliosis. Conversely, the participants in that study had an average of 20 years of working experience, whereas participants in this study have an average of 14 years of working experience. Even so, this does not affect the results of the study as both studies have excellent content validity (CVI: >0.78).

This study provided content validity of the ScoScreen that assesses multiple domains relating to development of the mobile application for early screening of adolescent idiopathic scoliosis. As both methods (I-CVI and the S-CVI) can be used to calculate content validity, most studies report either the I-CVI or the S-CVI but not both (21). Nonetheless, this study adheres to the approach taken by Rodrigues et al. (21), who used both methods in their research. The 24 items in the present study had an excellent I-CVI (≥ 0.78) as recommended by Polit et al. (20). Moreover, the S-CVI/UA showed poor content validity but the S-CVI/Ave showed high content validity. This is because as the number of participants grow, the values became more complex. According to Polit et al. (20), S-CVI/UA ignores the possibility of chance agreement. Thereupon, the S-CVI/Ave is more applicable as the averaging feature inherently contains information about the performance of each item.

The main point of contention is the method used to calculate the agreement indices, as well as the importance of the number of participants in determining the likelihood of inaccuracy (25). CVI is often utilized by researchers to determine the content validity of their findings. It does not, however, account for exaggerated values that may arise as a result of the likelihood of chance agreement (21). As a result, Wynd et al. (26) recommended computing the kappa coefficient that confirms an improved comprehension of content validity because it eliminates any coincidental agreement. This index offers data on the degree of agreement that is not resulted by chance. Therefore, this study opted to deal with the chance agreement by using this approach. Besides, participants' opinions helped in the improvement of making choices regarding the categories of problems that occurred for certain items. Correspondingly, CVI along with modified kappa and participants' opinions provided precision to the validation process.

The content evidence of validity generally establishes how closely the contents of an inventory (i.e., statements or items) match the qualities intended to measure the inventory (26). Since there are not many studies related to the content validity of the mobile application to detect scoliosis, the comparison between an article by Rodrigues et al. (21) was used in this research. In that research, they also used content validity to assess a novel instrument to quantify the mediators, obstacles, and training programmes in individuals with osteoporosis. They computed CVI as well as content validity ratio (CVR). CVR was introduced by Lawshe (27) who computed the index of inter-rater agreement for scale items (CVR) with dichotomous ratings on the items. To get an overall content validity index, Lawshe (27) suggested averaging CVRs which uses a different method compared to I-CVI. The results of that study had a good content validity (I-CVI range: 0.50 to 1.00) and the questionnaire had moderate to high overall content validity (S-CVI/UA = 0.63; S-CVI/Ave = 0.91) in the preliminary versions. Nonetheless, this present study did not utilize the CVR approach as proposed by Lawshe (27) as none of these coefficients appear to have been adopted as content validity indicators by researchers in the medical and allied health fields.

For the validity of the content validity form, different attributes of both questions and answers should be evaluated (25). Most questions were considered relevant by participants; even so, constructive feedback was identified. According to Halek et al. (25), participants' evaluations and comments gave thorough information about each item's strengths and faults. Although the wording was critiqued in this study, the majority of the questions were judged to be relevant. The improvements were facilitated and made more understandable by this distinction. Other than that, the written comments indicate that there were problems with the video provided. Almost every participant had suggested using a real-time demonstration as the visual graphic will be more understandable to the users. As a result, this study modified the video presentation based on the participants' suggestions.

Because this study is part of a larger project, the next stage is to finalize all the participants' recommendations. Before sending the new rectified items to the mobile application developer, the participants must receive a finalized content validity form. Only then the construct validity and reliability study can be conducted to further confirmation whether the ScoScreen measurement taken by this mobile application is consistent (reliable) over time.

The are a few limitations in this study. Firstly, there are more physiotherapists participants than surgeons or specialists, hence the feedback view may somehow be biased based on the job expertise. However, the application will be tried on physiotherapists as they are the person in charge of early scoliosis screening. Secondly, the other limitation of this study is language. This application is only available in English and the Bahasa Malaysia version of this study will be conducted in the next phase of the project.

## CONCLUSION

To sum up, this study found that the content validity of ScoScreen for early screening of AIS as excellent. In accordance with the hypothesis, the content for early screening of AIS is adequate for the development of the ScoScreen.


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