

Development, Validation and Translation of Cardiopulmonary Resuscitation and Automated External Defibrillator Training and Placement Bilingual Questionnaire

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Research note

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Abstract

Abstract Objectives: The paper describes the development and translation of a questionnaire purported to measure (1) the perception of the placement strategy of automated external defibrillator, (2) the perception on the importance of bystander cardiopulmonary resuscitation and automated external defibrillator (3) the perception on the confidence and willingness to apply these two lifesaving interventions as well as (4) the fears and concerns in applying these two interventions. For construct validation, iterative runs of exploratory factor analysis was performed using principal axis factoring and promax oblique rotation. Results Five factors with eigenvalue >1 were identified. Pattern matrix analysis showed that all items were loaded into the factors with pattern coefficient value >0.4 . One item was subsequently removed as Cronbach's alpha >0.9 which indicates redundancy. After removing the item, the Cronbach's alpha values of all factors were still good, ranging from 0.8 to 0.9. Intra-class correlation coefficient was 0.831.

Introduction

While a number of questionnaire measuring the various dimensions of bystander cardiopulmonary resuscitation (CPR) [1-4] and AED [2-7] have been published, there are few questionnaires that combine both bystander CPR and automated external defibrillator (AED) measurement [8-9]. We reported the development of a questionnaire that comprehensively measures four objectives: (1) the perception of AED placement strategy, (2) the perception on the importance of bystander CPR and AED, (3) the perception on the confidence and willingness to apply these two lifesaving interventions as well as (4) the fears and concerns in applying these two interventions. This questionnaire was then used as an adjunctive tool in our bystander CPR and AED training. As many of our Malaysian participants are not proficient in English language, the local official Malay language translation was also performed.

Methods

Participants

A total of 184 administrative employees from Universiti Malaysia Sarawak, which is a public university in the state of Sarawak, Malaysia, participated in this study. Healthcare employees such as doctors, nurses and paramedic staff were excluded from this study. The mean age of the participants was 37.6 years (standard deviations ± 6.85); and 100 of them (54.3%) were male participants. Convenient sampling was applied in recruiting the participants. The number of participants who responded exceeded the estimated sample size according to Costello & Osborne (2005) (i.e., minimum of 5 responses per item) [10]. As there were 22 items to be validated, the estimated sample size was 110 participants.

Materials

With regards to the construct validation, exploratory factor analysis (EFA) was performed using principal axis factoring as the extraction method. For translation of the questionnaire from English language into the local Malay language, the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) principles of good translation practice for cultural adaptation was adopted as the working framework [11]. According to the ISPOR principles, a good translation has the following steps: (1) forward translation, (2) reconciliation (3) backward translation (4) harmonization [11]. In the forward translation stage, two authors who are fluent in both English and Malay language (SYL, DNK) independently translated the questionnaire into Malay language. After completion of the initial Malay language translation, these 2 authors of this paper then discussed and resolved any discrepancy of the translations (reconciliation). Subsequently, an independent language expert who is fluent in both languages were invited to translate the Malay language version back to English language (backward translation). Finally the original English version and the backward English version would be compared to check for significant discrepancy ("harmonization").

Procedures

Ethical approval was obtained from the Medical Research and Ethics Committee, Ministry Of Health Malaysia and the study was registered under the Malaysian National Medical Research Register (NMRR, website URL: www.nmrr.gov.my) with the research number of NMRR-16-696-39041. Written informed consent was obtained from all participants prior to their participation in this study. Participants were also informed that his or her data would be used anonymously for subsequent analysis, presentation and publication.

With regards to the development and construct validation of the questionnaire, a preliminary version of the checklist was first constructed based on previous works [1, 3-9, 12] as well as opinions from four authors of this paper (KSC, SYL, NS and DNK). A modified Delphi method via iterative email communications and face-to-face discussion sessions were conducted. The purpose of these discussions was to come up with a list of the pertinent items purported to measure (1) the perception of the importance of bystander CPR and public access AED, (2) the perception of the confidence and willingness of bystanders to apply these two lifesaving interventions as well as (3) fears and concerns of bystander that may deter their willingness and (4) the perception of the placement strategies of these AED.

Once the preliminary list of items was determined, the participants were asked to rank the items in a Likert scale of four, ranging from "1 = strongly disagree" to "4 = strongly agree". Construct validation and internal reliability of these items were then determined using IBM Statistical Package for the Social Sciences (SPSS) software version 25.0. An initial run of EFA was performed in order to determine the number of factors to be fixed. To do so, an eigenvalue > 1 was chosen as the cut-off value to determine the numbers of factors to be fixed. After fixing the number of factors, re-run of EFA was then performed to determine the factor loadings of the items as well as to identify items that may need to be removed.

Promax oblique rotation was again used. In the pattern matrix, pattern coefficient with cut-off value of <0.4 was used as the criteria to determine whether an item was to be removed or not [13]. Pattern coefficient values of less than 0.4 were suppressed. The communality value, which indicates convergent validity of the items, was set at 0.25. Finally, the Cronbach's alpha coefficients were then checked to evaluate the degree of internal consistency of the items in each construct or factor. A cut-off point of Cronbach's alpha >0.6 was set as the criteria of a good degree of internal consistency [13].

With regards to the translation process, two of the authors of this paper (SYL, DNK) independently translated the original English version into the targeted Malay language ("forward translation") version. These two authors are proficient in both English language and Malay language. SYL is a medical doctor working in the emergency department of Sarawak General Hospital while DNK is a nursing educator from UNIMAS. These 2 authors then compared their versions of the translation with the aim of merging their versions into a single forward translation version ("reconciliation" stage). The backward translation was performed by an independent translator who is proficient in both English and Malay languages and who has vast experience in doing journalistic translation work in two languages. After completion of the backward translation, three authors (SYL, DNK, NS and KSC) then compared the back translated English version with the original English version to check for significant discrepancy ("harmonization"). Any significant discrepancy would be discussed, and revised if deemed necessary. In the unlikely event where there is discrepancy in which the authors could not amicably resolve, an independent language expert who is fluent in both English and Malay languages would be called in.

Results

With regards to the development and construct validation of the questionnaire, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.79 which indicates that the sampling adequacy is good for exploratory factor analysis. The p-value for Bartlett's test of sphericity was <0.001 which indicates that there are worthwhile correlations among the items based on the correlation matrix. There are five factors with initial Eigenvalue >1 (also demonstrated in scree plot, see Figure 1). The re-run of EFA using promax oblique rotation showed that the communalities of all items >0.25 . Pattern matrix analysis showed that all items were loaded into the factors with pattern coefficient of cut-off value >0.4 (see Table 1 for the detailed factor loadings after the initial run of EFA). The Cronbach's alpha value for Factor 1 was 0.955 with 6 items loaded into it, suggesting that there are redundant items. When checked for redundancy, it was noted that item "The directions that point to the location of the AED are clear" carries very similar meaning with item "The signage that shows the location of the AED is clear". Hence, item "The directions that point to the location of the AED are clear" was removed. After removal, the internal consistency of Factor 1 is still good with Cronbach's alpha of 0.942. The internal consistency for Factor 2, Factor 3, Factor 4 and Factor 5 were also good with Cronbach's alpha of 0.855, 0.787, 0.914 and 0.893 respectively. The corrected item-total correlation of all items ranged from 0.41 to 0.89. No negative correlation was noted. A re-run of the EFA after deletion of item "The directions that point to the location of the AED are clear" was subsequently performed and showed that the factor loadings are still good.

Based on the items that are loaded into the 5 factors, Factor 1 is labelled as “perception of AED placement strategies”, Factor 2 as “perception of importance of CPR and AED”, Factor 3 as “concerns of injuring victims during CPR and AED”, Factor 4 as “concerns of legality in performing CPR and AED” and Factor 5 as “confidence and willingness to perform CPR and AED”. Intra-class correlation coefficient using two-way random effects model in average measures was 0.831.

The forward translation version (after the reconciliation stage) as well as the backward translation version by an independent translator (after the harmonization stage) are tabulated in *Supplementary Table 1*.

Discussion

The objective (1) perception of placement strategies of public access AED, was captured in Factor 1, labelled as “perception of AED placement strategies”; objective (2) perception on the importance of bystander CPR and public access AED is captured in Factor 2, labelled as “perception of importance of CPR and AED”; objective (3) perception on the confidence and willingness to apply these two lifesaving interventions is captured in Factor 5, labelled as “confidence and willingness to perform CPR and AED” and objective (4) the fears and concerns in applying these two interventions is captured in Factor 3 “concerns of injuring victims during CPR and AED” and Factor 4 “concerns of legality in performing CPR and AED”.

To our knowledge, this questionnaire is probably among the very few published questionnaire that captures all of these four dimensions as mentioned above. To ensure a successful implementation of public access AED program, the preparedness of trained bystanders (with positive attitude and confidence) is as important as the placement of the AEDs itself [14-15]. This type of questionnaire would be useful as a tool to evaluate the effectiveness of a training program for the implementation of a public access AED.

Whitney-Cashio et al (2012) [10] suggested that AEDs should be placed in highly visible locations (“visibility”) that can be easily accessible (even after working hours) and with the “direction” and “signage” to access the AED should an emergency arises. Besides accessibility and visibility, AEDs should have clear instruction on how to use it and be placed in a secure area (e.g. with surveillance cameras) to minimize the risk of the AEDs being stolen (“security”). The corresponding item to measure each of these criterion in Factor 1 “perception of AED placement strategies” is listed in Table 2.

Limitations

The items in this questionnaire were mainly constructed and culled from published papers. In other words, there could have been other valid dimensions that also measures a specific factor or construct but are missed in our questionnaire. This is especially so in the construct of “concerns of injuring victims during CPR and AED”. In this construct, we merely measured the concerns or fears of injuring victims and

contracting infectious diseases that may deter the initiation of bystander CPR and the use of AED. However, there may have been other fears and concerns that are valid and relevant but are not captured in this questionnaire. Perhaps, future studies could include a preliminary qualitative component using focus group discussions to first gain insights from experts, followed by a preliminary survey to gauge the importance of these fears and concerns before performing exploratory as well as to include confirmatory factor analyses in order to develop an expanded version of this questionnaire.

Abbreviations

AED = automated external defibrillator

CPR = cardiopulmonary resuscitation

EFA = exploratory factor analysis

ISPOR = International Society for Pharmacoeconomics and Outcomes Research

NMRR = National Medical Research Register

SPSS = Statistical Package for the Social Sciences

UNIMAS = Universiti Malaysia Sarawak

Declarations

Ethics approval and consent to participate: Ethical approval was obtained from the Medical Research and Ethics Committee, Ministry Of Health Malaysia and the study was registered under the Malaysian National Medical Research Register (NMRR, website URL: www.nmrr.gov.my) with the research number of NMRR-16-696-39041. Informed consent was obtained from all participants prior to their participation in this study.

Consent for publication: Not applicable.

Availability of data and material: The dataset used and analysed in this study are available from the corresponding author on reasonable request.

Competing interests: No competing of interest declared.

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Authors' contributions: All authors (KSC, SYL, AZAZ, SSLW, NS, DNK and HCC) were involved in the initial conception of the study design. KSC, SYL, AZAZ, NS, DNK and HCC were involved in the production of the preliminary list of pertinent items to construct the checklist. SYL, NS and DNK were involved in collecting data; SYL, KSC and SSLW were involved in the exploratory factor analysis. SYL and KSC were involved in

writing up the draft of the manuscript. SYL, DNK were involved in the forward translation into the Malay language. All authors have read and approved the manuscript.

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Tables

Due to technical limitations, tables 1-2 are only available as a download in the supplemental files section

Figures

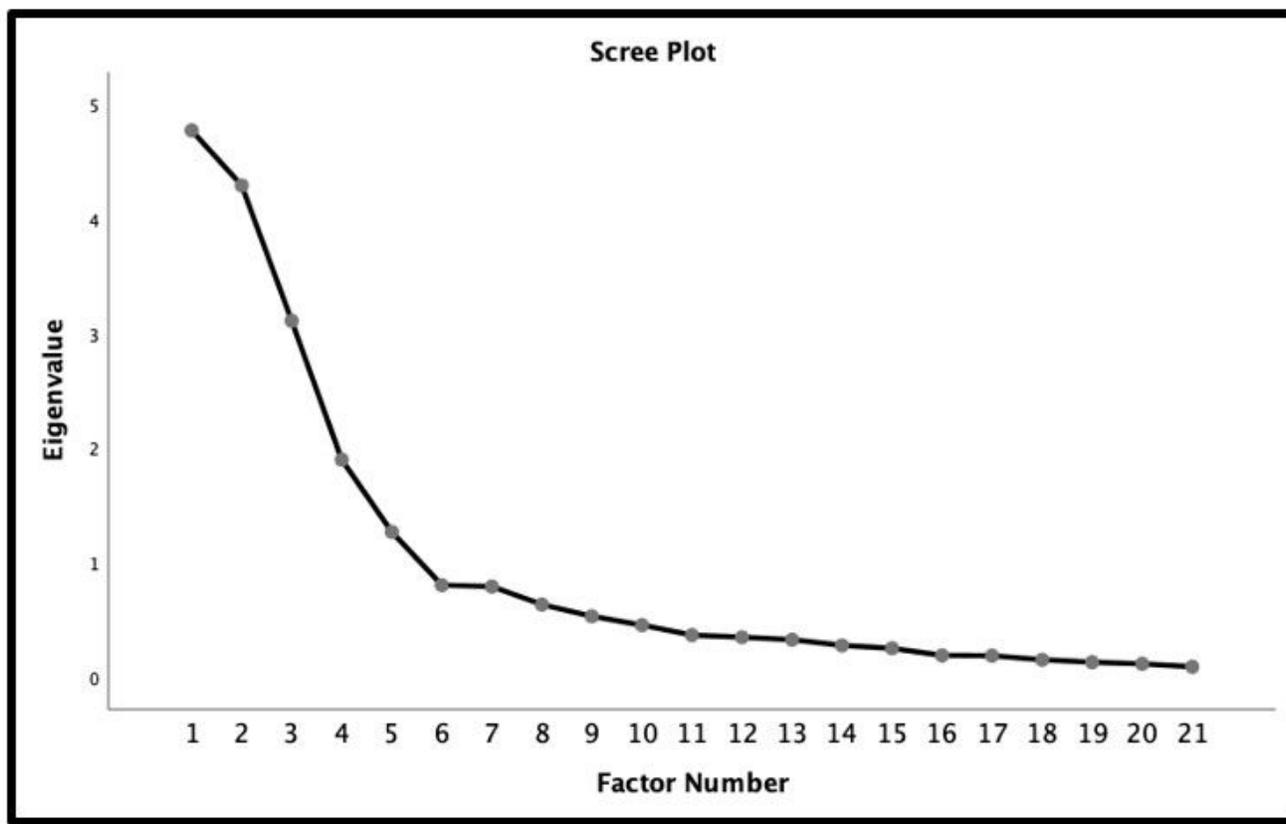


Figure 1

Scree plot shows 5 factors with Eigenvalue >1

Supplementary Files

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