Original Research Article

Design and Validation of a Scale to Measure Attitudes towards Abortion Legislation; Application of Explanatory and Confirmatory Factor Analysis

Abstract

General societal attitudes on induced abortion can influence the health sector policy response towards providing safe abortion services. This study aimed to develop a scale and assets validity and reliability to measure public attitudes towards abortion legislation. An scale was developed by adapting existing scales and finalized with experts' opinions. An interview schedule was administered among 728 adults residents in Colombo, Sri Lanka. V**alidity** and reliability were tested after performing Explanatory and Confirmatory Factor Analysis (CFA).

The finalized scale contained 8 items and 2 factors named "Attitudes towards soft reasons" and "Attitudes towards hard reasons". The two factors explained 71% of the total variability. The CFA showed a good model fit. Composite Reliability of the scale for the first and second factors were 0.938 and 0.890 respectively. The scale's internal consistency correlation coefficient was acceptable (Cronbach's alpha = 0.923 and 0.850, McDonald's omega = 0.915 and 0.863 for the first and second factors respectively). The Average Variance Extracted of the two factors were 0.792 and 0.671 whereas the Maximum Shared Squared Variance was 0.054. The correlation between the two factors was 0.23.

The scale is proved to have high validity and reliability to measure the public attitudes towards abortion legislation.

Key Words:- Abortion attitude scale, Explanatory and Confirmatory Factor Analysis, Validity, Reliability, Psychometric Analysis.

Introduction and Background

Unsafe abortion is the termination of an unintended pregnancy either by a person lacking the necessary skills or in an environment lacking minimal medical standards or both (WHO, 2007). Whereas an illegal abortion is an induced abortion performed contrary to the laws regulating abortion in that country (Mosby's Medical Dictionary, 2009). Assuming that all legal abortions performed under a safe environment by a skilled person are safe abortions, all illegal abortions presumably not done under similar conditions need to be considered as unsafe (1). The conditions under which abortion is legally permitted differ from country to country. In some countries, access is highly restricted; in others, pregnancy termination is available on broad

medical and social grounds or on request (2). As per the World Health Organization, in 98% of countries in the world, abortion is allowed to save a woman's life; only in 28% of countries is abortion available on request (3).

Abortion has always been a controversial subject in many societies. While many people believe that it is a woman's right to choose whether or not she elects to have an abortion, others have religious, political, emotional, and personal morals that lead them to believe that having an abortion is wrong. It all comes down to various upbringings, ethics, religious backgrounds, political alignments, and other attributes that play into forming opinions (4). General societal attitudes towards induced abortion can influence not only decision-making by individuals regarding the fate of unwanted pregnancies, but also the health sector policy response towards providing safe abortion services (5; 6; 7). Therefore, developing a simple, valid and reliable tool to measure public attitudes towards legislation is of utmost importance for countries in which abortion laws are restricted but seeking possible legislative changes.

Most of the tools currently available are aimed to measure general attitudes towards abortion but not specific enough to measure the attitudes towards legislative changes (8; 9; 10; 11). Also most of those tools have been tested and validated in countries where abortion is not restricted (8; 9; 8; 11; 12; 13; 14; 15; 16). It is important to note that in identifying the latent variable/s which the scale is supposed to measure (called the factor structure) is important in any scale. The factor structure/model of most of the available tools has not been identified (10; 12; 15; 16). We also identified that most past studies suffer from inadequate sample size or lack of representativeness of the general public (10; 11; 12; 13; 17; 18; 19). Therefore, the current study aims to develop a scale and factor model to measure public attitudes towards the possible legislative changes in the countries where abortion laws are restrictive and to test the validity and reliability with a representative sample.

The current study was conducted in Colombo, Sri Lanka, where induced abortion is highly restricted. Under the Sri Lanka penal code of 1883 section 303, abortion is a criminal offence except when performed to save the mother's life (20). According to section 304, in case of the death of such women, the person performing an illegal abortion shall be punished with imprisonment up to 20 years (21). Several attempts were made in the past (1970, 1995 and 2018) to amend the Sri Lankan abortion law to allow legal abortion for rape and incest with the

leadership of the Sri Lanka College of Obstetricians and Gynecologists (SLCOG). The amendment was developed and much debated among all concerned parties. However, this did not materialize due to social and cultural concerns (2).

Methodology

This study was conducted in two phases; scale development and validation. Literature reviews, soliciting of expert opinions and interviews were conducted in the scale development phase, and psychometric assessment of the scale was conducted in the validation phase.

Scale Development

The study started with a strong literature review to identify the available scales and tools to measure attitudes towards abortion legislation. After carefully evaluating related articles, 18 items which measure abortion attitudes in five-points Likert Scale were identified at the initial stage. The items were presented to a group of experts with experience in researching the field of Sexual and Reproductive Health. The group comprised 12 experts in the fields of Community Medicine, Obstetrician and Gynecology, Public Health, Sociology, Demography and Communication. The experts were requested to evaluate the questionnaire items for content validity and applicability in the Sri Lankan context. The expert opinions were collected qualitatively through face to face interviews or online interviews. Apart from evaluating content validity, experts were requested to suggest amendments to the items, including re-wording, additions and deletions. Based on the expert opinions, the number of items was reduced to 10 and re-worded where necessary to make the scale gender and age neutral.

The questionnaire which includes these 10 closed ended Likert scale type questions and was developed initially in English and translated into local languages (Sinhala and Tamil). The questionnaire was administered among 15 randomly selected individuals. Necessary revisions were incorporated based on the findings from the pilot test. Ethical Approval was received from the Ethical Review Committee of the Sri Lanka Medical Association (SLMA).

Study Population and Sampling

The selected population for this study included all adults, aged 19 to 49 who have lived in Colombo for at least one year. The Colombo city was selected for the study, as the highest rate of abortion is estimated in Colombo city (22) and it represents a fair distribution of all ethnic groups (23). The study included both males and females and was conducted at the Thimbirigasyaya Divisional Secretariat, (DSD), one of the two DSD's in Colombo city. The 20 Grama Niladhari Divisions (GND) of the Thimbirigasyaya DSD were divided into two strata considering the percentage of households (HH) with toilet facilities exclusively for the HHs within the HH (23). The first stratum contained 10 GNDs which reported more than 80 percent of households with toilet facilities whereas the second stratum contained 10 GNDs which reported less than 80 percent of households with toilet facilities. Three GNDs were selected from each stratum (total of six GNDs) using systematic probability proportionate to the size (PPS) cluster selection method. The selected GNDs were divided into housing clusters using the housing data derived from the 2012 department of election report. Five to eight housing clusters and 50 HHs were selected from each GND using a systematic HH selection method. The primary sample size for the HH study was 300 HHs which was arrived at by the application of a standard sample size calculation formula for HH surveys (24). The sample size was calculated at 95 percent confidence interval, 10 percent precision (margin of error = 0.06) and 0.64 expected proportion of residents between the ages of 19-49 from the total population (23).

Data Collection

All the eligible residents in the HH who were willing to participate in the study were interviewed after receiving their written informed consent. A structured questionnaire that included newly deeveloped abortion attitude scale was administered by a team of well-trained enumerators, recruited from the Sociology Special graduates of the University of Colombo. Interviews were conducted for each respondent separately in a confidential environment (one-on-one) without the involvement of and not within the hearing of a third person. A show card containing scale items was used to support the respondents. Of the total of 1022 eligible individuals resident in the 271 households, only 825 (80.72 %) were available for the interview on the visit date. Of those, a

total of 743 responses (90.06 percent) were received. However, only 728 respondents had provided valid responses to the abortion attitude scale.

Data Analysis

Descriptive statistics, Explanatory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and hypothesis testing on validity and reliability were performed to validate the scale. Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 26 and Microsoft Excel. CFA was conducted using Analysis of Moment Structure software (AMOS) version 26. As per the standard scale validation methodology, a final sample with 728 valid responses was randomly divided into two equal groups using the random case selection option available in SPSS (25). First group (n=364) was used for EFA and the second group was used for CFA.

Explanatory Factor Analysis

EFA was performed through Principle Component factor extraction method and Verimax rotation. The Kaiser-Meyer-Olkin (KMO) index was used to determine the sampling adequacy to perform the factor analysis whereas the Bartlett's sphericity test was used to assess whether the data was free of single response bias (25). A KMO of higher than 0.9 was preferred whereas a value greater than 0.7 was considered adequate (25; 26). The factor extraction was based on an absolute factor loading value that should be > 0.5, eigenvalues > 1, communalities > 0.2, and scree plots. The KMO test was evaluated for each variable using the matrix of anti-image correlations main diagonal values. Values equal to or above 0.5 (or 50 per cent) were considered adequate (25). EFA was performed for the original scale (with 10 items) initially. All the above criteria was satisfied. The factor structure obtained from the EFA was examined and established by performing CFA. The final scale after fitting the CFA factor model had only 8 items. The EFA was performed again for the final model (with 08 items).

Confirmatory Factor Analysis

The factor structure obtained from the EFA was examined and established by performing CFA. Two items that generated a standardized residual covariance of more than 4.000 were removed from the scale at this stage. The resulted factor model had only 8 items. All the items generated a coefficient of correlation higher than 0.5 (26). The Chi-square statistic, Degree of Freedom (DF), Parsimonious Comparative Fit Index (PCFI), Parsimonious Normed Fit Index (PNFI), Minimum Discrepancy Function divided by Degrees of Freedom (CMIN/DF), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Tucker–Lewis index (TLI), and Root Mean Square Error of Approximation (RMSEA) were used as model fit indices (27; 28).

Assessment of Validity and Reliability

The content validity of the scale was established with expert opinions in the initial stage of the study. EFA and CFA were used to assess the construct validity. The convergent and divergent validity of the proposed scale was assessed on the Fornell criteria (29). Average Variance Extracted (AVE), Maximum Shared Squared Variance (MSV), and Composite Reliability (CR) measures were used. In order to establish the convergent validity, AVE must be greater than 0.5 and CR must be higher than AVE. Higher values of AVE compared to MSV proved divergent validity (30).

The reliability of the newly developed scale was evaluated by testing the internal consistency using Cronbach's alpha, McDonald's omega and Average Inter-item Correlation (AIC). McDonald's omega was estimated using SPSS macro utility developed by Hayes (31). Values greater than 0.7 for Cronbach's alpha and McDonald's omega were considered acceptable whereas for AIC, the ideal value is 0.2–0.4 (32). However, AIC between 0.15 and 0.5 is acceptable (33). CR value greater than 0.7 was regarded as desirable reliability (34).

Results

After completion of data cleaning, 728 valid responses were received which were divided into two subsamples to perform EFA and CFA. The average age of the respondents was 33 years (SD

= 11.15) and consisted of 293 (40 percent) males and 432 (60 percent) females. Table 02 describes the socio-demographic characteristics of the sample. Table 01 describes the socio-demographic characteristics of the sample.

Table 01:- Sample characteristics disaggregated by sub-samples; Explanatory Factor Analysis and Confirmatory Factor Analysis (n=728)

Socio-Demographic Characteristic	Category	CFA		EFA		Total Sample	
		#	%	#	%	#	%
Sex	Female	230	63%	202	56%	432	60%
	Male	133	37%	160	44%	293	40%
	Grand Total	**363**	**100%**	**362**	**100%**	**725**	**100%**
Age	Below 25	135	37%	129	35%	264	36%
	25 and Above	229	63%	235	65%	464	64%
	Grand Total	**364**	**100%**	**364**	**100%**	**728**	**100%**
Ethnicity	Sinhalese	193	53%	183	50%	376	52%
	Muslim	69	19%	61	17%	130	18%
	Indian Tamil	7	2%	9	2%	16	2%
	Sri Lankan Tamil	93	26%	107	29%	200	27%

Socio-Demographic Characteristic	Category	CFA		EFA		Total Sample	
		#	%	#	%	#	%
	Burgher	2	1%	4	1%	6	1%
	Grand Total	**364**	**100%**	**364**	**100%**	**728**	**100%**
Religion	Buddhist	158	43%	152	42%	310	43%
	Islam	69	19%	65	18%	134	18%
	Hindu	73	20%	87	24%	160	22%
	Roman Catholic	29	8%	20	5%	49	7%
	Christian	35	10%	40	11%	75	10%
	Grand Total	**364**	**100%**	**364**	**100%**	**728**	**100%**
Marital Status	Married	187	52%	200	55%	387	53%
	Never Married	160	44%	152	42%	312	43%
	Divorced	3	1%	4	1%	7	1%
	Widow	12	3%	8	2%	20	3%
	Grand Total	**362**	**100%**	**364**	**100%**	**726**	**100%**

Note:- # = Number of Respondents, % = Percentage of Respondents

After establishing the content validity, 10-item scale was entered into the construct validity step. The KMO test statistic was 0.781 whereas the Bartlett's test value was 2,958.57 ($P < 0.000$) which confirmed that EFA can be performed. Two factors were extracted using Principle Component factor extraction method and rotated using Varimax rotation. These two factors explained 71% of the total variance. The two factors were named as "attitudes towards soft reasons" (4 items) and "attitudes towards hard reasons (6 items)" (Table 02). Communality as well as the diagonal values of the matrix of anti-image correlations for all the items was greater than 0.5 indicating a satisfactory factor model.

Table 02:- Communality and factor loadings of initial and final two factor model (n=364)

Item	Initial Model			Finalized Model		
	Com	Loadings		Com	Loadings	
		F_2 (Hard)	F_1 (Soft)		F_2 (Hard)	F_1 (Soft)
1 The Government of Sri Lanka must not legalize abortion under any circumstances.	0.6140	0.7832				
2 The Government of Sri Lanka must legalize abortion to save the mothers' life	0.6645	0.8152		0.5798	0.7613	
3 The Government of Sri Lanka must legalize abortion to terminate a pregnancy resulting from rape	0.7360	0.8501		0.8278	0.9062	

	Item	Initial Model			Finalized Model		
		Com	Loadings		Com	Loadings	
			F_2 (Hard)	F_1 (Soft)		F_2 (Hard)	F_1 (Soft)
4	The Government of Sri Lanka must legalize abortion to terminate a pregnancy resulting from incest	0.7163	0.8092		0.8043	0.8758	
5	The Government of Sri Lanka must legalize abortion to terminate a pregnancy with fetal abnormalities – lethal conditions of the fetus	0.6380	0.6990		0.6201	0.7183	
6	The Government of Sri Lanka must legalize abortion to terminate a pregnancy with fetal abnormalities – fetus may survive with major abnormal conditions	0.5213	0.5295				
7	The Government of Sri Lanka must legalize abortion to terminate a pregnancy resulting from a contraceptive failure.	0.7417		0.8516	0.7535		0.8561
8	The Government of Sri Lanka must legalize abortion to terminate a pregnancy on account of bad economic conditions of the parents.	0.7551		0.8602	0.7798		0.8711
9	The Government of Sri Lanka must legalize abortion on the request of the couple.	0.8376		0.9098	0.8526		0.9133
10	The Government of Sri Lanka must legalize abortion on the request of the mother	0.8437		0.9126	0.8602		0.9171

Note: - Com=Communality, Loadings=Factor loadings after Varimax rotation, F1=Factor one (Attitudes towards soft reasons), F2=Factor two (Attitudes towards hard reasons)

In the CFA, item 1 and item 6 shows high values (greater than 4.000) for standardized residual correlation and resulted in lack of overall model fit. Therefore, those two items were removed from the scale. It is noteworthy that those two items resulted in lowest communality values in the initial EFA too. After certain modifications, the finalized model with 8 items shows an overallgood model fit (Table 03). The path diagram of the final CFA model is presented in figure 01.

Table 03:- Model fit indices and model fit criteria of the final CFA model with 8 items (n=364)

Indices	Result	Model fit criteria
Degrees of Freedom (DF)	16	
chi-square (χ2) statistic	37.929	Lower the X^2, better the model fit (28).
P-Value	0.002	Assuming that the Default model is correct, the probability of getting a discrepancy as large as 37.929 is .000.

Minimum Discrepancy Function divided by Degrees of Freedom (CMIN/DF)	2.371	If CIMN/DF is less than 5 indicate good absolute model fit (28).
Root Mean Square Error of Approximation (RMSEA)	0.061	RMSEA less than 0.06 indicate good absolute model fit. Up to 0.08 acceptable (28).
Parsimonious Normed Fit Index (PNFI)	0.562	Higher the value, better the model. PNFI greater than 0.5 indicate good parsimonious model fit (28).
Parsimonious Comparative Fit Index (PCFI)	0.566	Higher the value, better the model. PCFI greater than 0.5 indicate good parsimonious model fit (28).
Tuker-Lewis Index (TLI)	0.984	TLI greater than 0.90 indicate good incremental model fit (35; 34).
Incremental Fit Index (IFI)	0.991	IFI greater than 0.90 indicate good incremental model fit (35; 34).
Comparative Fit Index (CFI)	0.991	CFI greater than 0.95 indicate good incremental model fit (28).

The AVE, CR, and MSV results confirmed the convergent validity and discriminant validity (Table 04). The MSV of the two factors was less than AVE and the correlation between two factor was very low (0.23). This confirmed that the extracted factors are separate from each other and second-order CFA is not required. The results of the Cronbach's alpha, McDonald's omega of the two factors confirmed the internal consistency of the abortion attitude scale. The CR of the two factors also shows that there is a good composite reliability (Table 04).

Figure 01:- The Final Confirmatory Factor Analysis Model with two factors and 8 items (n=364).

Table 04: The indices of the convergent validity, discriminant validity and reliability.

Factor	AVE	MSV	CR	AIC	α	Ω
Factor 01:- Respondents attitudes towards the Soft reasons	0.792	0.054	0.938	0.752	0.923	0.914
Factor 02:- Respondents attitudes towards the Hard reasons	0.671	0.054	0.890	0.586	0.850	0.863
Both factors together				0.430	0.852	0.769

Note: - AVE = Average Variance Extracted, MSV = Maximum Shared Squared Variance, CR = Composite Reliability, AIC = Average inter-item Correlation, α= Cronbach's alpha, Ω= McDonald's omega

Discussion:-

This study aimed to develop and validate a scale to measure public attitudes towards abortion legislation in the countries where the induced abortion is restricted. The study finalized with an eight-items and two factors scale. The first factor which explained the highest variance of the initial 8 dimension system was named as “attitudes towards soft reasons” whereas the second item was named as “attitudes towards soft reasons”. Those names were given based on solid theoretical ground. Soft reasons are the causes where the people perceive that pregnancy was within the control of the women (which could have been avoided), such as contraceptive failures, bad economic conditions, etc. On the other hand, the “hard reasons” are the causes of pregnancy relatively beyond the women’s control. Previous studies clearly show a significant difference in public attitudes in accepting liberal abortion laws for soft and hard reasons. For example, the majority of respondents agreed to accept liberalization of Sri Lankan abortion laws in the situations of rape (65%), incest (55%) and lethal fetal abnormalities (53%). However, less than one tenth of the population approved the legalization of abortion in the situation of contraceptive failure (6%), bad economic conditions (7%) and on-demand (4%) (19; 17). The proposed scale will facilitate the measurement of this variation by having a factor structure with two latent variables.

It is noteworthy to highlight that as per the current study, the two factors (soft and hard) are not strongly related (r=0.23) and divergent validity between two factors was proved. Therefore, it is recommended to study the two scenarios separately using two sub-scales to make firm conclusions. This makes sense as legal reform in any country is happening progressively, step-by-step. Studying two scenarios separately will provide strong evidences to inform and influence future advocacy and communication strategies. However, if it is necessary, researchers can analyse both factors together based on the context.

The ultimate objective of developing any scale is to reduce the number of dimensions/variables to make further analysis easier. For this, it is necessary to calculate a score for each participant of the study called factor scores. Most of the researchers preferred to use non-refined factor scores. Ex: - Developing a score by calculating the simple summation or average of the scores (raw score) of the original variables (observed data) loading into a particular factor or the scale. Non-

refined scores are easy to calculate and interpret compared to refined scores. Whereas, statistical estimations are required to calculate refined scores. Ex:- Calculating factor scores such as linear combinations of the observed variables which consider what is shared between the item and the factor (i.e., shared variance) and what is not measured (i.e., the uniqueness or error term variance) (36). For the current study, we calculated a non-refined score by calculating simple average of the scale items (Strongly agreed=5, Agreed=4, Neutral=3, Disagree=2, strongly disagree=1) and estimated the correlation with a refined factor score generated by applying a regression method. Results show that two scores are highly correlated for both factors; hard ($r=0.983$, $p<0.001$, $n=728$) and soft ($r=0.986$, $p<0.001$, $n=728$). The refined factor score as well as the non-refined factor score did not follow a normal distribution. This results reveal that researchers can use either a refined e or non-refined score based on their preference.

Conclusion

The proposed scale with 8 items and 2 factors is proved to have high validity and reliability to measure the public attitudes towards abortion legislation especially in the countries where abortion is restricted. It is recommended to study the two factors separately using sub-scales to make firm conclusions. Either refined factor scores or a non-refined factor scores can be used for further analysis based on research objectives.

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