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Measuring Intent to Aid of Lay Responders: Survey Development and Validation

Brian Miller, MS, MSEd, MEd[1,2], and Jeffrey L. Pellegrino, PhD, MPH[3]

Abstract

Background. Increasing lay responder cardiopulmonary resuscitation and automated external defibrillator use during sudden cardiac arrest depends on an individual's choice. Investigators designed and piloted an instrument to measure the affective domain of helping behaviors by applying the theory of planned behavior (TPB) to better understand lay responders' intent to use lifesaving skills. *Method*. Questionnaire items were compiled into 10 behavioral domains informed by the TPB constructs followed by refinement via piloting and expert review. Two samples from an American Red Cross–trained lay-responder population (N = 4,979) provided data for an exploratory (EFA, n = 235) and confirmatory (CFA, n = 198) factor analyses. EFA derived interitem relationships into factors and affective subscales. CFA yielded statistical validation of factors and subscales. *Results*. The EFA identified four factors, aligned with the TPB constructs of attitudes, norms, confidence, and intention to act to explain 57% of interitem variance. The internal consistency of factor-derived subscales ranged between 0.71 and 0.91. Reduction of instrument items went from 47 to 32 (32%). The CFA yielded good model fit with the switching of the legal ramification item from the social norm to intention construct. *Conclusion*. The Intent to Aid (I2A) survey derived from this investigation aligned with the constructs of the TPB yielding four subscales. The I2A allows health education researchers to differentiate modalities and content impact on learner intention to act in a first aid (FA) emergency. I2A compliments cognitive and psychomotor measurements of learning outcomes. The experimental instrument aims to allow curricula developers and program evaluators a means of assessing the affective domain of human learning regarding intention-to-act in an FA emergency. In combination of with assessment of functional knowledge and essential skills, this instrument may provide curricula developers and health educators an avenue to better describe intention to act in an FA emergency.

Keywords

automated external defibrillator, cardiopulmonary resuscitation, factor analysis, first aid education, theory of planned behavior, training

The survival and quality of life of individuals who suffer out-of-hospital cardiac arrest (OHCA) depends on the behaviors of bystanders in the first few minutes to activate emergency medical services and provide oxygenated blood to key organs (Centers for Disease Control & Prevention, 2011; Institute of Medicine [IOM], 2015; International Federation of Red Cross Red Crescent Societies, 2016; Sasson, Rogers, Dahl, & Kellermann, 2010). Beyond individual lives saved, several populations including the state of North Carolina in the United States and Amsterdam, Netherlands, prioritized bystander interventions of cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) with access to training and public awareness, lowering OHCA mortality and increasing rates of individuals leaving the hospital neurologically intact (Blom et al., 2014; Malta Hansen et al., 2015).

Yet the IOM (2015) published a systematic review of the literature demonstrating epidemiologically that the odds of receiving CPR remain unequal when stratified for race, poverty, and geographical location in the United States. Part of the reason may be that CPR education is not equally distributed across the United States, according to Anderson et al. (2014) who examined the training records of the three largest

[1]The University of Akron, Akron, OH, USA
[2]Kent State University, Kent, OH, USA
[3]Aultman College of Nursing & Health Sciences, Canton, OH, USA

Corresponding Author:
Brian Miller, Health Education and Promotion, School of Health Sciences, Kent State University, 125 Nixson Hall, 1225 Theatre Drive, Kent, OH 44242, USA.
Email: bmill149@kent.edu

training organizations. Alternatively, approximately 80% of those trained in CPR by the American Red Cross (ARC; 2017) over the past 5 years took the course because of work requirement, with an unknown desire to learn or intention to apply the skills (D. Toli, personal communication, February 1, 2017). Even for those voluntarily enrolled in a CPR course there may be an assumed desire to learn by education organization but no measure or description of intention to use the skills exists to inform educational approaches.

Lifesaving skills like chest compression depth and rate can be learned in a variety of lay public first aid (FA) courses, including CPR and AED (International Federation of Red Cross Red Crescent Societies, 2016; Singletary et al., 2015). The likelihood of using such knowledge and skills, we hypothesize, rest in a combination of learner's salient values, beliefs, and social expectations that lead to an intention or motivation to help. Unlike the evidence-based guidelines to train individuals and populations on what to do and how to do it (Kleinman et al., 2015), FA educators have less clear evidence on how to effectively develop the affective domain, namely attitudes and confidence, for using lifesaving knowledge and skills. The first step to filling that gap is developing a tool that evaluates a person's intention to act in an emergency.

The IOM, ARC, and American Heart Association (AHA) all support internationally validated resuscitation (CPR) techniques (Daya, Schmicker, May, & Morrison, 2015; Mozaffarian et al., 2015; Sasson, Haukoos, et al., 2013). Nearly 70% of OHCA happen at home (Daya et al., 2015; Mozaffarian et al., 2015), and trained individuals are more likely to provide care (Tanigawa, Iwami, Nishiyama, Nonogi, & Kawamura, 2011). Yet lay responder intervention has not increased significantly and remains disparate with general approaches to educating the public (IOM, 2015; Panchal, Fishman, Camp-Rogers, Starodub, & Merchant, 2015; Sasson et al., 2010; Sasson, Meischke, et al., 2013).

In the past decade, governmental and nongovernmental agencies pushed to mandate FA education/training, especially as a high school graduation, driver's license, or employment requirement to create normative behavior toward helping (Bhanji et al., 2015; International Federation of Red Cross Red Crescent Societies, 2010, 2015, 2016). CPR/AED training, as part of comprehensive FA education shows promise in fostering the social norm for people to take responsibility and respective action to help in cardiovascular emergencies (Panchal et al., 2015). Current CPR/AED training programs focus on knowledge acquisition and skills performance criteria as evidenced in the 2015 AHA *Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care* (Bhanji et al., 2015). The same guidelines also raise attitudinal and social barriers of helping, such as fear of legal liability, fear of disease transmission, regulatory compliance, and lack of knowledge and skills, as factors to be addressed in training but miss the call to identify and use a model of behavioral learning and change (Cho et al., 2010; Coons & Guy, 2009; Kuramoto et al., 2008; McDonough et al., 2012; Panchal et al., 2015; Sasson, Meischke, et al., 2013).

Full acquisition, internalization, and enacting of helping behaviors require the integration of psychomotor, cognitive, and affective domains of human learning for a holistic pedagogy. Developing such a behavior aligns with the seminal works of Bloom, Engelhart, Furst, Hill, and Krathwohl (1956) who posited that behavioral learning is developed and reinforced through pedagogy rooted in functional knowledge, essential skills, and affective domains of human learning for a behavior change. Given that CPR/AED is a set of behaviors that are used in stressful and unrehearsed situations, it is inadequate to assume that psychomotor (skill) and cognitive (knowledge) training alone are enough for a person to fully and adequately respond to an OHCA, especially to strangers. Specifically, societal obligation and social norms surrounding universal care behaviors are strong contenders in understanding a person's affective (feelings or attitude) intention to act in situations requiring FA. Exploring the influence of the affective domain shows promise in improving training programs and ultimately the successful utilization of CPR/AED and related outcomes (Panchal et al., 2015).

A social-behavioral public health approach to FA education extends traditional pedagogy to better understand the voluntary nature of offering FA. The constructs of theory of planned behavior (TPB; Ajzen, 1991) help explain the affective domain of learning, which is not currently assessed by FA educators. By connecting learner's attitudes toward the deliberate action of helping, the learner's perceptions of social expectation, and understanding of normative behaviors, and the confidence of the learner to successfully enact the helping behaviors, educators could better improve intentions toward helping behaviors (Panchal et al., 2015). Aligning with Bloom et al. (1956) to elucidate mechanisms of learning, the addition of the TPB constructs to existing knowledge and skills assessments aims to improve the ability to explain emergency response behaviors of lay responders.

In support for using TPB, the Integrated Behavioral Model (Glanz, Rimer, & Viswanath, 2008) suggests that incorporation of the TPB constructs (affective domain) with skills (psychomotor domain) and knowledge (cognitive domain) assessments that currently exist in lay responder FA education could better explain the enactment of target behavior (Bloom et al., 1956). Unlike psychomotor and cognitive domains that can be measured through objective observation or testing, measurement of the affective domain in the context of emergencies does not exist. Measuring the affective results of FA education creates evidence to suggest improvements and innovations in curricular experiences or modalities, opening a new dimension for directly increasing learner intent to help and indirectly improve survival rates.

The importance of community engagement and societal obligation for bystanders to be prepared and willing to administer FA measures prior to arrival of first responders asserts

that people choose to act or not to act and that decision can be modified through the interventions within FA training programs (IOM, 2015). This approach requires a means to measure and evaluate the affective domain of learning to better describe the intention to help in situations requiring FA. A validated tool describing intention to act is a preliminary step to improving FA training/education that ultimately aims to improve enacting helping behaviors. Scrutiny of the TPB regarding its overuse and simplification in correlational studies challenges the application of TPB here. Sniehotta, Presseau, and Araújo-Soares (2014) suggested that the majority of TPB studies have sought to explain the behavior without connection to programs, interventions, and education that changes/improves specific behavior for specific populations. We rather posit that the use of the TPB should be employed to better explain behavior enactment and/or change to then inform interventions and educational programs. An outcome of a TBP-based tool may include future programmers and researchers extending the tool within specific populations in meeting the needs of FA education and training.

The opportunity exists to examine the effect of CPR/AED education programs on learner intentions to perform FA behaviors. Two aims guided this study: first to develop and validate an instrument using factor analysis techniques based on the TPB constructs to assess intention to perform CPR; and the second aim, to derive and describe subscales for each factor resulting from the factor analysis in order to elucidate the affective domain of FA education.

Method

Sample

The research samples were taken from a population of adult learners who completed a RC FA course that was exclusive to or included CPR/AED training in a hybrid format between January 10, 2015, and March 3, 2016, $N = 4{,}979$. Hybrid training included scenario-based learning modules online, followed by instructor-led skills demonstrations. This population self-identified as willing to complete a follow-up survey at the end of their training. 924 (18.6%) took the class for general or personal interest versus required for work or volunteering. 3,513 (70.6%) had previously taken a FA or CPR/AED course. On an overall 6-point rating scale 1 = *extremely poor* to 6 = *excellent*, participants on average rated their overall ARC course experience a 4.87 ± 1.08.

The cumulative sample was obtained in two phases: the first phase (exploratory sample) included $n = 235$ and second phase (confirmatory sample) $n = 198$. Recruitment transpired via e-mails, randomly assigned then sorted in 1,000 learner blocks. A single reminder e-mail to participate was sent 3 days after the initial invitation and the survey closed after 7 days. Surveys were completed via internet-based survey tool, Qualtrics™. The Kent State University institutional review board at the research institute approved the current investigation.

Experimental Instrument

The initial instrument emerged after identifying items that align with the TPB constructs from preexisting instruments. Sources included an RC unpublished internal, but not validated instrument, which included 24 items around confidence and likelihood to perform CPR as well as a British Red Cross 2014 Service Evaluation Feedback Questionnaire that included 13 items on attitude and willingness to act in a FA emergency. Additional items were derived from Engeland, Røysamb, Smedslund, and Søgaard (2002) who modeled variable questions on self-efficacy, attitudes toward giving and learning FA, and intended behavior and emotions, without reporting validation measures. Additional questions and categories around the concept of willingness to perform FA emerged from report of Cho et al. (2010) on willingness to perform bystander CPR. Items were modified for consistent language and other design considerations, including administration time and readability, ≤sixth grade level. Items and scoring were formatted in accordance with the (Francis et al., 2004) *Constructing Questionnaires Based on the Theory of Planned Behavior* manual for the initial instrumentation in addition to guidance by Coons and Guy (2009).

To address initial content validity (the appropriateness of the constructs to reflect the topic being researched) the pilot instrument underwent peer-review from five experts and practitioners in the fields of nursing, health education, emergency medical services, FA science, and education (not including authors). Initial edits were made based on provided feedback, including instrument length and content. Assessment of construct validity (how well the tool constructs distinguish expected variation) came through pilot testing. The survey instrument included 47 behavioral items all measured on a 5-point Likert scale. The initial instrument included a total of 10 question domains. See Table 1 for initial instrument stratified by domain and item identifier.

Statistical Analysis

Sample Characteristics. Sample characteristics (Table 2) were displayed as frequencies and mean ± standard deviations ($M \pm SD$), including number of CPR/AED course completed, age, biological sex, race and a binary indicator of Latin descent, and highest level of education for the exploratory and confirmatory samples with the χ^2 test of independence employed to identify statistical differences between the exploratory and confirmatory sample. Sample characteristics were performed using SPSS Version 22 (IBM, Chicago, IL, 2013).

Exploratory Factor Analysis. Univariate analysis for each item were performed with univariate normality assessed using skewness less than 1.5 *SD* of the respective mean as indicative of normal. For missing values, the item mean was superimposed in accordance with Schafer (1999) who asserted that

Table 1. Survey Instrument Items by Behavioral Domain.

Item identifier	Question text	Domain
To what extent do you agree or disagree with the following statements?		Social responsibility
Q5_1	People in general expect me to help in a first aid emergency.	
Q5_3	I don't have a personal responsibility to help in a first aid emergency.	
Q5_4	Everyone has a responsibility to help in a first aid emergency.	
I am willing to help _____ in a first aid emergency.		Willingness to perform first aid
Q1_1	A member of my family	
Q1_2	A friend	
Q1_3	Another person I know	
Q1_4	A stranger	
Q1_5	A person who looks gross	
Q1_6	A person who is bloody	
I would use my CPR/first aid skills in an emergency if		Situational intentions
Q2_1	there were others at the scene of the emergency (who were not CPR certified).	
Q2_7	I saw someone choking.	
Q2_16	I had to breathe into the victim.	
Q2_6	I had a breathing barrier or mask.	
Q2_3	the person collapsed in front of me.	
Q2_13	I found a person who looked blue or cold.	
Q2_4	I thought I might get in trouble or sued.	
Q2_5	I thought I could catch a disease.	
Q3	If someone collapses and needs CPR, I intend to help them.	Intention to help
I am confident that I could effectively		Execution confidence
Q4_1	call 9-1-1 or get more help in an emergency.	
Q4_6	give back blows correctly.	
Q4_7	correctly give abdominal thrusts.	
Q4_2	tell if a person needed CPR.	
Q4_3	perform CPR if I had a short list of instructions.	
Q4_4	perform CPR if someone coached me on the phone.	
Q4_5	perform CPR if someone helped me.	
Q4_8	perform CPR by myself.	
_____ would want me to perform CPR if needed		Societal expectation
Q6_1	The victim	
Q6_2	The victim's family	
Q6_4	My family	
Q6_5	My friends	
Q6_3	Other bystanders / people near by	
Q6_6	Other people not around	
Performing CPR is		CPR performance attitudes
Q8_1	difficult	
Q8_2	important	
Q8_3	unpleasant	
Q8_4	useful	
Thinking about your training, CPR is		CPR training attitudes
Q59_5	difficult to learn	
Q59_6	important to learn	
Q59_7	practical to learn	
Q33	How nervous would you be giving care in this situation?	Situational confidence to perform aid
Q35	How likely are you to ask someone to call for help or specifically 9-1-1?	
Q36	How likely are you to check your friend for movement or breathing?	
Q37	How nervous would you be using an AED in this situation?	
Q45	How likely are you to use the AED on your friend?	
Q40	How confident are you that you can place the AED pads in the proper location?	
Q41	How likely are you to press the "Shock" button?	
Q42	How confident are you that you can press the shock button at the right time?	
Q32	How likely are you to come across a situation requiring CPR or choking skills in the next year?	Universal situational likelihood

Note. CPR = cardiopulmonary resuscitation; AED = automated external defibrillator. Boldfaced values indicate item header text.

Table 2. Subject Characteristics by Factor Analysis Sample.

	Exploratory		Confirmatory		
Characteristic	*n*	%	*n*	%	Significance[a]
Previous CPR courses taken					
1	42	17.9	33	17.5	.920
2	55	23.4	47	24.9	.760
3	39	16.6	28	14.8	.647
4	31	13.2	21	11.1	.543
>5	68	28.9	60	31.7	≤.001
Race					
No response	6	2.6	4	2.1	.773
African American	13	5.5	11	5.8	.898
American Indian	1	0.4	0	0.0	.370
Asian	5	2.1	6	3.2	.504
Native Hawaiian	2	0.9	1	0.5	≤.001
Caucasian	208	88.5	167	88.4	.987
Age (years)					
18-20	9	3.8	8	4.2	.956
21-30	46	19.6	30	15.9	.150
31-40	41	17.4	25	13.2	.109
41-50	46	19.6	41	21.7	.911
51-60	47	20.0	41	21.7	≤.001
>60	46	19.6	42	22.2	.519
Education					
None	2	0.8	3	1.6	.974
High school/GED	38	16.2	34	18.0	.019
Associate	21	8.9	17	9.0	.044
Bachelor	99	42.1	55	29.1	≤.001
Master	64	27.2	13	6.9	≤.001
Doctoral	11	4.7	17	9.0	.010
Sex					
Male	92	39.1	80	42.3	.585
Female	142	60.4	107	56.6	.640
Transsexual	0	0.0	0	0.0	—
Other	1	0.4	1	0.5	.874

Note. CPR = cardiopulmonary resuscitation; EFA = exploratory factor analysis; CFA = confirmatory factor analysis.
[a]The χ^2 test of independence was used to find statistical differences between EFA and CFA subject characteristics.

missing values <5% were inconsequential with mean imputation. An exploratory factor analysis (EFA) using principle component analysis extraction method with Varimax FACTOR rotation was employed to validate the survey instrument based on the constructs of the TPB model which posited four contending factors (attitudes, norms, confidence, and intention). Prior to EFA, initial item-reduction was performed based on interitem correlations $r \geq 0.90$. Assumptions of the EFA procedure that could be statistically tested included sampling adequacy via Kaiser–Meyer–Olkin (KMO) statistic with values approaching 1 indicative of sampling adequacy and pattern of correlations yielding reliable factors. Additionally, sphericity was assessed via the Bartlett's test of Sphericity with statistical significance indicating that the correlation matrix was not an identity matrix. Factors were expressed as variance explained after rotation with item loadings within each factor based on the highest loading absolute value. Loading values <0.40 were to be excluded from the final instrument. For each factor, reliability was assessed using interitem internal consistency via Cronbach's α. Subscales were quantified as $[Subscale\,total = \sum_1^N X]$, where N = number of scale items and X = individual Likert-type scale response. EFA and reliability analysis was performed using SPSS Version 22 (IBM, Chicago, IL, 2013).

Confirmatory Factor Analysis. The hypothesized model was set as an a priori model derived from the results of the factor analysis above. Confirmatory factor analysis (CFA) was performed in accordance with recommendations from (Schumacker & Lomax, 2016) using the latent constructs of Attitudes, Norms, Confidence, and Intentions measured by mean for each domain defined as the average interitem score within each question domain. Domain loadings were allowed in accordance with the EFA factor loadings. In the initial model, no error covariance were allowed to exist in the initial model. Modifications indices recommended by software were allowed if supported by improvements to model fit. However, no cross-loadings were allowed.

Model fit was assessed using the χ^2 model fit index with nonsignificance indicating model fit. Goodness-of-fit (GFI) was used as an indicator of variance explained and for model comparison. The root mean error of approximation (RMSEA) was used as the indicator of model complexity with $\varepsilon \leq 0.05$ indicating model fit. Model comparison was assessed using the comparative fit index as a measure of model improvement. Individual parameter significance was assessed based on the t statistic (df) with significance set at $p \leq .05$. Analysis of CFA modeling was performed using LISREL Student Edition 9.2.

Results

Model Development Sample

The average time between completing online training and questionnaire was 255 days. Of the 997 questionnaires that were distributed, 309 surveys were started with 243 (79%) completing; 52 (21.4%) took the class for general or personal interest versus required for work or volunteering; and 183 (75.3%) had taken a FA or CPR course prior to this one. The majority of the exploratory sample were Caucasian, women, with 95.7% of the sample reporting English as a first language. The distribution of age was similar across the sample with an average of 45.1 ± 15.7 years. A total of 42 respondents (17.9%) reported having taken more than one prior CPR/AED course. The majority of the sample reported having completed a college-level education. See Table 2 for sample characteristics.

Model Confirmation Sample

For the confirmatory sample, the average time between completing online training and questionnaire was 298 days. Of the 995 that were distributed, 250 surveys were started with 198 (79%) completing. 43 (21.7%) took the class for general or personal interest. 146 (73.7%) had taken a FA or CPR course prior to this one. On an overall 6-point rating scale, the average score was 4.90 ± 0.98. The majority were Caucasian, women, with 98.5% of the sample reporting English as a first language. The distribution of age was similar across the sample with an average of 46.7 ± 16.0 years. A total of 33 respondents (17.5%) reported that this had been their first CPR/AED course. The majority of the sample reported having completed a college-level education. See Table 2 for sample characteristics.

Exploratory Factor Analysis

Instrument items by behavioral domain are illustrated in Table 3. A total of 1.3% of responses resulted in missing values, which were then imputed using mean item values. No item had missing values and respective imputation beyond 5% of individual item responses. Prior to the EFA, Q1_2 and Q4_4 were removed due to strong correlations ($r > 0.90$) with Q1_1 and both Q4_1 and Q4_3, respectively. Questions Q59 and Q33 were reverse coded based on the negative inflection of the item to improve possible loading. Based on the results of the preliminary EFA the KMO statistic indicated that the patterns of correlations were not problematic (KMO = 0.83), thus sampling was adequate and factor analysis was appropriate. Concurrently, Bartlett's test of Sphericity reached significance, $\chi^2(496) = 4{,}816.86$, $p \leq 0.001$ indicating probable relationships within the correlation matrix; thus, factor analysis was appropriate. The EFA identified four factors explaining a total of 55.7% of the interitem variance. Prior to rotation, each factor explained 24.8%, 14.0%, 9.4%, and 7.5% of the variance, respectively. After rotation, each factor accounted for 18.2% and 14.3%, 12.0%, and 11.3%, respectively.

The average communality after extraction was 0.557. Based on the items loading within the factors, 34 of the 47 items were loaded across four factors. Factor 1 (Intentions) had 11 items with 6 from the *Willingness to perform CPR* domain and 5 items from the *Situational Intentions* domain. Factor 2 (Confidence) had 7 items all from the *CPR Execution* domain. Factor 3 (Social Norm) had 8 items with 2 items from the *Social Responsibility* domain, 1 item from the *Situational Intentions* domain, and 5 items from the *Societal Expectations* domain. Factor 4 (Attitudes) had 8 items all from the *Situational Attitudes* domain. Within the *Situational Intentions* domain, Q2_4 was the only item to not load within intentions but rather on Social Norm. Given the nature of this question, the name *Legal* Ramifications was given. Table 3 illustrates all factor loadings in the EFA. The summation of items within each factor yielded four subscales whose internal consistency indicated internal reliability. See Table 4 for scale descriptive statistics and reliability for the scales derived and confirmed by factor analysis techniques.

Table 3. EFA Rotated Component Matrix.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Item domain
Q5_1	—	—	0.47	—	Social responsibility
Q5_4	—	—	0.40	—	
Q1_1	0.61	—	—	—	Willingness to perform CPR
Q1_3	0.76	—	—	—	
Q1_4	0.81	—	—	—	
Q1_5	0.79	—	—	—	
Q1_6	0.76	—	—	—	
Q2_1	0.66	—	—	—	Situational intentions
Q2_7	0.71	—	—	—	
Q2_16	0.59	—	—	—	
Q2_6	0.63	—	—	—	
Q2_3	0.77	—	—	—	
Q2_13	0.69	—	—	—	
Q2_4	—	—	0.44	—	
Q4_1	—	0.73	—	—	CPR execution
Q4_6	—	0.82	—	—	
Q4_7	—	0.84	—	—	
Q4_2	—	0.77	—	—	
Q4_3	—	0.73	—	—	
Q4_5	—	0.71	—	—	
Q4_8	—	0.79	—	—	
Q6_1	—	—	0.70	—	Societal expectation
Q6_2	—	—	0.77	—	
Q6_4	—	—	0.64	—	
Q6_3	—	—	0.81	—	
Q6_6	—	—	0.76	—	
Q59_5[a]	—	—	—	0.44	CPR training
Q35	—	—	—	0.49	Situational attitudes
Q36	—	—	—	0.51	
Q37	—	—	—	0.46	
Q45	—	—	—	0.74	
Q40	—	—	—	0.74	
Q41	—	—	—	0.68	
Q42	—	—	—	0.71	

Note. EFA = exploratory factor analysis; CPR = cardiopulmonary resuscitation. Principal component analysis extraction method and varimax rotation. Item loadings <0.40 were suppressed; items that did not load were excluded from the table.
[a]Reverse-coded item.

Confirmatory Factor Analysis

Initial CFA. A total of 1.4% of responses resulted in missing values, which were then imputed using mean item values. No item had missing values and respective imputation beyond 5% of individual item responses. CFA was performed with the mean values of each domain identified and its respective factor identified in the EFA as follows; see Figure 1 for

Table 4. Scale Descriptive Statistics.

Scale	Scoring Range	Minimum	Maximum	*M*	*SD*	Cronbach α	Items
EFA							
Intentions	0-55	12.0	55.0	51.8	4.8	.90 (.91)	11
Attitudes	0-45	19.3	40.0	36.2	3.7	.72 (.79)	8
Norms	0-45	9.0	35.0	29.7	4.7	.81 (.83)	8
Confidence	0-35	7.0	35.0	32.3	4.9	.91 (.91)	7
CFA initial							
Intentions	0-55	11.0	55.0	51.4	6.2	.93 (.94)	11
Attitudes	0-45	13.1	40.0	35.7	3.8	.73 (.77)	8
Norms	0-45	13.0	35.0	30.1	3.9	.74 (.79)	8
Confidence	0-35	7.0	35.0	31.0	6.7	.95 (.95)	7
CFA modified							
Intentions	0-60	13.0	60.0	55.1	6.7	.91 (.93)	12
Attitudes	0-45	13.1	40.0	35.7	3.8	.73 (.77)	8
Norms	0-40	8.0	30.0	26.3	3.6	.77 (.82)	7
Confidence	0-35	7.0	35.0	31.0	6.7	.95 (.95)	7

Note. EFA = exploratory factor analysis; CFA = confirmatory factor analysis. Values in parentheses are standardized values.

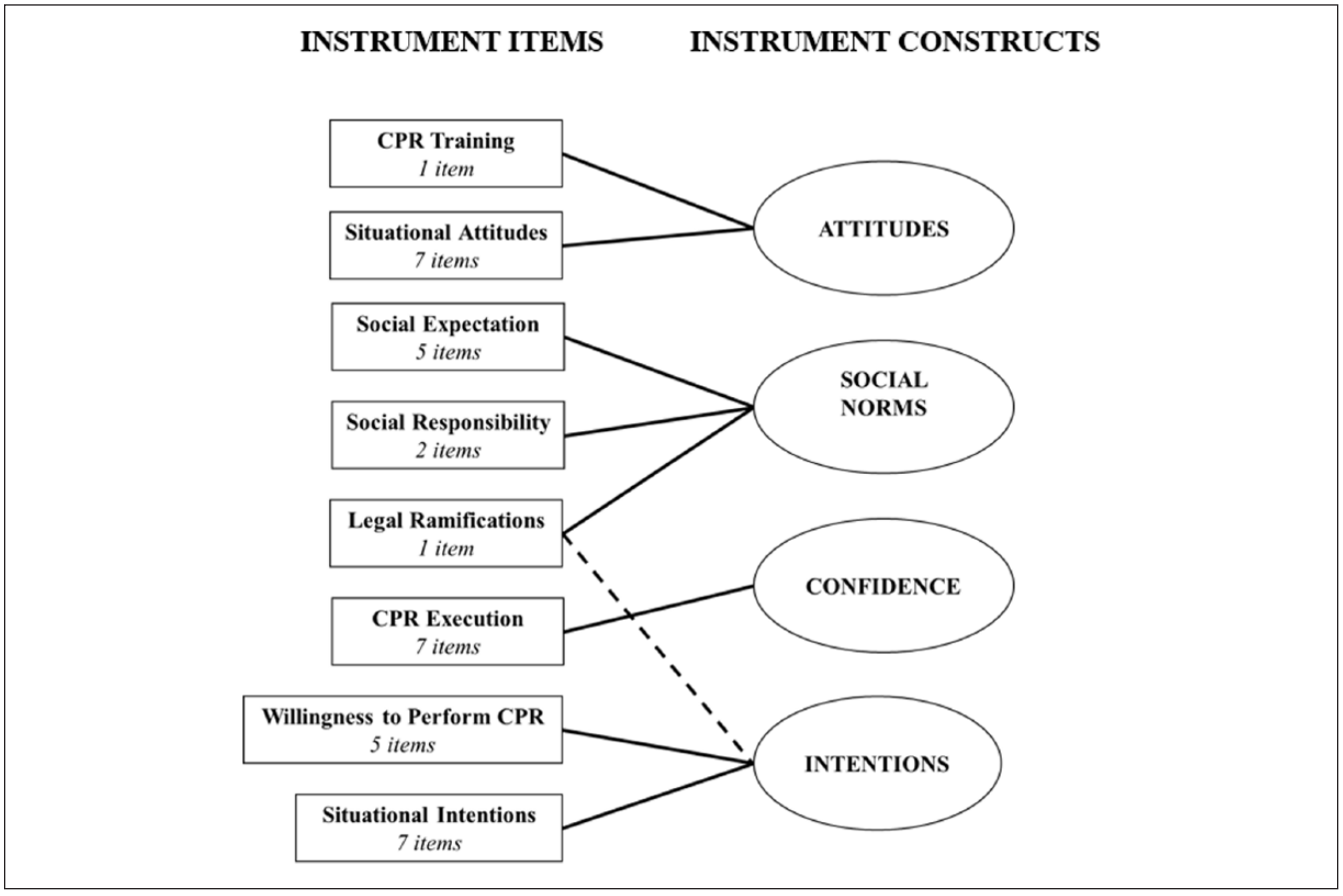

Figure 1. Confirmatory factor analysis (CFA) item domain loading by theory of planned behavior (TPB) construct.
Note. Squared items represent measure questions domains, elliptical items represent latent TPB constructs. Solid lines indicate factor loading. Dashed line(s) indicate CFA improvement modifications. No cross-loading were allowed.

visual display of factor loading: *CPR Training* and *Situational Attitudes* were allowed to load on Attitudes, *Social Expectations, Social Responsibility, and Legal Ramifications* were allowed to load on Social Norms, *CPR Execution*

Table 5. Confirmatory Factor Analysis Model Fit Parameters.

Fit parameter	Initial model	Modified model	Fit criteria
$\chi^2(df)$, p value	32.17(14), p = .004	15.73(13), p = .264	$p > .05$
RMSEA	0.081	0.033	<0.05
SRMR	0.076	0.049	<0.05
GFI	0.964	0.981	>0.95

Note. RMSEA = root mean error of approximation; SRMR = standardized root mean square residuals; GFI = goodness-of-fit index.

Table 6. Confirmatory Factor Analysis Factor Loading by Model.

	Attitude		Norms		Confidence		Intention	
Factor model	Initial	Modified	Initial	Modified	Initial	Modified	Initial	Modified
Factor loadings:								
CPR training	0.24	0.24	*	*	*	*	*	*
Situational attitudes	0.82	0.83	*	*	*	*	*	*
Social expectations	*	*	0.72	0.77	*	*	*	*
Social responsibility	*	*	0.42	0.40	*	*	*	*
Legal ramifications	*	*	*0.24*	*	*	*	*	*0.67*
CPR execution	*	*	*	*	0.99	0.99	*	*
Willingness to perform CPR	*	*	*	*	*	*	0.37	0.38
Situational intentions	*	*	*	*	*	*	0.87	0.80

Note. CPR = cardiopulmonary resuscitation. All loading reached statistical significance ($p \leq .001$). *Italicized values* indicate item switched factor from initial to modified models.
*Indicates scale does not load on construct.

was allowed to load on Confidence, and *Willing to Perform CPR and Situational Intentions* were allowed to load on Intentions. Table 5 describes the model fit parameters for the initial and modified model. The initial model met only one criterion for indicating good model fit. The χ^2 test indicated a statistically significant difference between S and $\sum$ indicating a departure from model fit. The RMSEA of 0.081 indicated marginal model fit. The standardized root mean square residual (SRMR) was >0.05. The only model fit parameter indicating good fit was the GFI parameter indicating that 96.4% of the S matrix was predicted by the $\sum$ matrix. The above model fit parameters indicate marginal model fit. In the initial model, all loadings reached statistical significance, $p \leq .001$; see Table 6 for factor loadings.

Modified CFA. Program recommended modification indices included switching the factor loading of Legal Ramifications from Social Norms to Intention ($\downarrow\chi^2 = 16.44$). Thus, the path of Legal Ramifications to Social Norms was removed and a pathway was allowed to load on Intentions. Table 4 describes the model fit parameters for the initial and modified model. The initial model met only all criteria for indicating good model fit. The χ^2 test indicated that there was not a statistically significant difference between S and $\sum$, thus indicating good model fit. The RMSEA of 0.033 indicated good model fit. The standardized root mean square residual was <0.05. The GFI parameter indicated that 98.1% of the S matrix was predicted by the $\sum$ matrix. In the modified model, all loadings reached statistical significance, $p \leq .001$; see Table 5. The above model fit parameters indicate good model fit. With the given modification, the internal consistency for Social Norms improved from 0.74 to 0.77.

Discussion

The purpose of the current investigation, to assess bystander intentions to act in an FA emergency, developed through a systematic validation of the affective domain of CPR/AED behaviors based on constructs from the TPB. The EFA yielded four factors, including Intentions, Attitudes, Norms, and Confidence that aligned with the TPB. Standardized internal consistency of each subscale except for Attitudes ($\alpha = .77$) exceeded the threshold of internal consistency of $\alpha = .80$. Using factor analysis techniques, the investigational instrument was able to explain 55.7% of the variance in intention to act in a CPR/FA emergency. Using Bloom et al. (1956) who postulated that behavioral learning is composed of three domains (knowledge, skills, and affective), the ability for this instrument to explain more than half of the variance exceeded a priori expectations. Integrating all three domains warrants investigation to better explain CPR/FA behaviors and improve related curricula.

The Intention construct was based on an 11-item subscale from factors based on *Willingness to Perform CPR* and

Situational Intentions domain questions. These findings posit that intention-to-act is a multidimensional construct dependent on the relationship of the victim to the FA provider and dependent on the type of action they are willing to perform. Additionally, the universal intention item (Q3) did not load on this construct and had a low intercorrelation ($r = 0.08$). Factor 3 included eight items from three domains of question, including predominantly *Social Responsibility* domain and *Societal Expectations*. The main dimensions of this construct suggest that the learners' perception of society's expectations and self-derived expectations drive this construct. Interestingly, one item from the *Situational Intentions* domain loaded on this factor, item Q2_4, which details the perception of being sued for wrong doing as an influential portion within this construct. This item relates to the perceived societal and normative influences thus deemed appropriate and was labeled *Legal Ramifications* for the CFA.

Using EFA, the initial number of instrument items was reduced by 32% from 47 to 32 items. The CFA yielded good model fit with the switching of the legal ramification item from the social norm to intention construct. The formal name given to this pilot instrument is the *Intent to Aid* (I2A) survey. Future studies are warranted to confirm the relationship between theory constructs (attitudes, social norms, and confidence of intentions to act) in addition to exploring the contribution of knowledge, skills, and attitudes on intentions to act, as measured in the I2A, as well as actual enacting of CPR/AED behaviors.

Limitations

The intention of this investigation was to develop and validate a generalizable I2A instrument to assess the affective domain of human behavior to better explain intentions to act in CPR/FA emergency. In accordance with Wetzel (2012), a theory-based instrument needs to be piloted by employing statistical development and refinement techniques to establish internal validity prior to establishing external validity and generalizability to other populations. The findings of this study should not to be generalized, as further investigation is needed to investigate this instruments applicability across race, sex, age, rationale for completing the FA training, and educational level.

The population surveyed for this instrument design and validation was limited to adults who self-identified as willing to respond to a survey. Participants were all from North America and homogenous in race, gender, and educational attainment. From a theoretical perspective, TPB's generalizability could be more contextually examined through other lenses, like the construct of Citizen Performance in the work place. In accordance with the recommendations by Sniehotta et al. (2014), future studies using the I2A must include a baseline in the local community to identify if populations that take FA training are different based on multiple aspects of the behavior. If so, what factor of TPB or its extensions, in addition to knowledge and skills, could be addressed by educators, policy makers, or social leaders? This statistical analysis is based on the construction and validation of the survey instrument. As an instrument design study, the value of the I2A survey is not fully realized until it is implemented in a pre/post research methodology, or comparative research design is now needed to identify outcomes of actual training.

The existence of an intent-to-act is not causal of an act in an actual emergency because of mitigating factors. Future research needs to take place with either longitudinal studies of application of FA helping behaviors or the use of experimental deception-based studies to identify actual behaviors. For the health educator, the lay responder I2A instrument in conjunction with knowledge and skill-based assessments provides a more holistic understanding of the educational impact of learning interventions. Future research on helping behavior modules or components in FA/CPR education may contextualize clinical skills. This attention to behavior and measuring it within populations and participants fills a gap of understanding the learner, to better engage her or him in future FA educational activities.

Implications

The construction and validation of the I2A survey can now provide researchers and curricula designers a means to assess the affective state of individuals toward helping behaviors in situations requiring bystander FA. Individual instructors or training organizations can use this instrument to compare outcomes between various learning experiences and modalities to improve CPR/FA curricula. The I2A instrument compliments and diversifies current program evaluations. The instrument would also be valuable in a pre/post learning experience scenario to see changes in learner attitude and intent to use learned skills. Additionally, the subscales developed within this instrument offer a validated mechanism for future research to employ TPB or extend it to specific populations or set of learners. Future research is needed to establish levels and their meanings within each subscale for interpretability by curricula developers, instructors, and program evaluators.

Considering the lifesaving nature of FA education to the lay public, educational organizations now have tools for measuring the cognitive, psychomotor, and affective domains of learners. The lay responder I2A instrument provides a means for those interested in the application of FA helping behaviors to measure outcomes of educational interventions, test or compare modalities, and describe populations of learners. We recommend that future data from this instrument be collected and analyzed to inform content, engagement, and outcome goals of FA courses for the lay public to maximize a learner's propensity to act in an emergency.

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The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: The authors disclose that they have voluntary affiliation and service to the Scientific Advisory Council of the American Red Cross.

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