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Journal of Nursing Measurement, Volume XX, Number X, 2020

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Background and Purpose: Rural healthcare provider's willingness to implement pediatric resuscitation may be impeded by comfort level. The purpose of this study was to evalu-ate the psychometric properties of the Pediatric Advanced Life Support Skill Self-Efficacy Inventory (PALS-SSEI). **Methods:** A 19-item inventory was created based on PALS skills. The PALS-SSEI was completed by 94 participants in a study to test the effects of simulation training on PALS knowledge and skill. **Results:** Six clinical content experts rated the con-tent validity of the PALS-SSEI as high. Item and factor analysis supported the tool's con-struct validity. A Cronbach's alpha coefficient of 0.88 supported the internal consistency of the tool. **Conclusions:** The PALS-SSEI demonstrated good initial psychometric properties. The tool can be used to assess self-efficacy for PALS skills among healthcare providers.

Keywords: pediatrics; rural healthcare; resuscitation; self-efficacy

Early recognition of life-threatening events in pediatric patients and rapid action may mean the difference between life, permanent disability, and death. Through spe-cialty courses like the American Heart Association (AHA) Pediatric Advanced Life

Support (PALS) course, healthcare providers are trained in assessment and interventions specific to critically ill or injured children (AHA, 2015). Rural healthcare providers, com-posed primarily of registered nurses and midlevel providers such as nurse practitioners, often see a limited number of critically ill or injured children in their practices (Rural Health Information Hub, 2018). As a result of this limited exposure, rural healthcare providers may not have the opportunity to apply knowledge or practice skills learned in PALS. When faced with a life-threatening pediatric emergency and the need to rapidly access learned knowl-edge and skills, rural healthcare providers may not be able to apply previously learned skills and may even be reluctant to try these skills. The result is that precious minutes are lost in a rush to save a child's life.

BACKGROUND

Providing basic and advanced life support including, but not limited to, early use of a defibrillator, early intravascular access, and use of a bag valve mask device to provide venti-lation can all positively affect patient outcomes. Rural healthcare is the first line for approx-imately 50 million Americans living in rural designated areas in the United States (Bureau of the Census, 2010; Kids Count, 2017). Children living in rural areas are more likely to live in households at or below the poverty line (Rogers, 2005; United States Depart-ment of Agriculture, 2011) and are more vulnerable to death from injuries (Bureau of the Census, 2010; Office of Rural Health Policy, 2010; Rogers, 2005; United States Depart-ment of Agriculture, 2011). Factors such as poverty, crowding, young maternal age, single parent households, and low parental education levels confer risk for children living in rural areas (U.S. Department of Health and Human Resources, H. R. S. A., Maternal and Child Health Bureau, 2015). Families in rural areas have difficulty accessing healthcare, as they often must travel great distances to reach available services, coupled with risks associated with living in rural areas as mentioned above, rural children suffer higher mortality rates when compared to their urban counterparts (Kids Count, 2017).

There are many characteristics of rural healthcare providers that may affect emergency care for children. Rural healthcare providers often encounter professional isolation (Rural Health Information Hub, 2018). Chronic nursing and primary care provider shortages have troubled rural communities for years. As such, rural nurses and providers may not have a ready cohort of professional peers with whom to share knowledge and experiences (Rural Health Information Hub, 2018). In addition, they may be the only provider available in a community, county, or even several counties covering a large geographic area. Nurses play a special role in rural healthcare, often serving as the only provider caring for a child in need of emergency care until an advanced practice provider arrives at the facility (Hendrickx, Foerster, & Hansen, 2014). Skill performance taught in courses like Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), and PALS change on a regular basis and must be practiced regularly to retain the needed knowledge and skills. Even with regular practice knowledge and skill both tend to wane over time (Donoghue, Nishisaki, Sutton, Hales, & Boulet, 2010; Nadel, Lavell, Giardino, Decker, & Durbin, 2000; Wolfram, War-ren, Doyle, Kerns, & Frye, 2003; Young & Seidel, 1999). Previous research on PALS skills acquisition and knowledge retention were completed in populations of healthcare providers practicing in metropolitan areas and primarily focused on pediatric trained physicians and residents. These providers were more likely to be exposed to pediatric patients in need of resuscitation in their day-to-day duties. In contrast, rural nurses and midlevel providers, including nurse practitioners, are the primary personnel on duty in rural health facilities. Rural nurses and nurse practitioners may go weeks or months without seeing a child in need of life saving skills, thus increasing their reluctance to even initiate intervention (Falgiani, Kennedy, & Jahnke, 2014; Hsia & Shen, 2011).

Conceptual Framework

Healthcare providers' lack of confidence has been identified as a barrier to the implemen-tation of life saving skills across all age ranges (Roh, Issenberg, & Chung, 2014; Vaillan-court et al., 2013). Competence in life saving skills requires providers to not only gain the required knowledge and psychomotor skills but also attain a level of confidence or self-efficacy in those tasks involved in the action (Roh & Issenberg, 2014; Tawalbeh &

Tubaishat, 2014). Self-efficacy is an individual's belief in how capable they are to execute and achieve a task (Bandura, 1997, 2006). Self-efficacy theory originated in Social Cog-nitive theory by Albert Bandura and posits the three factors that influence self-efficacy are behaviors, environment, and personal/ cognitive factors (Bandura, 1997). Self-efficacy develops from experiences in which participants are able to reach goals through per-severing, overcoming obstacles, and observing others succeed through sustained efforts (Bandura, 1997). A strong sense of self-efficacy may allow an individual to mobilize their motivation and cognitive resources to produce action and achieve a task such as those required in pediatric life support. When low levels of self-efficacy are present, the like-lihood is high that an individual will not attempt to perform the task expected (Bandura, 1997).

Assessing the level of confidence in the resuscitation skills of rural healthcare providers, including nurses, midlevel providers, and physicians can provide useful insight into the effectiveness of advanced life support courses and the techniques used to teach the course, including the use of high-fidelity simulations. Several researchers have measured health-care providers' and students' self -efficacy or confidence in their resuscitation skills (Arnold, Johnson, & Tucker, 2009; Roh & Issenberg, 2014; Turner, Van de Leemput, & Draaisma, 2008). However, no resuscitation self-efficacy inventory specific to pediatric resuscitation was identified in the extant literature. The aim of this study was to develop a self-efficacy inventory to measure rural healthcare providers' confidence levels in their capabilities when responding to a child in need of resuscitation. The development of this inventory was part of a larger study examining the effects of integration of high-fidelity simulation into a PALS course for rural healthcare providers (Stellflug & Lowe, 2018).

The rural state where the study was completed has consistently ranked in the top five states in the nation with the highest pediatric mortality per 100,000 population (Kids Count, 2017). The first author (SS) has worked in pediatric emergency care during her career as both a registered nurse and nurse practitioner. A pediatric focus was natural given her professional experience and interaction with countless ill and injured pediatric patients transferred to the only pediatric intensive care unit in the state from rural hospitals in the region.

METHODS

Participants, Settings, and Study Design

Healthcare providers participating in a 2-day PALS course in eastern Montana were invited to participate in the study. Eligible participants were defined by AHA PALS course guidelines as emergency medical technicians, paramedics, licensed practical nurses, registered nurses, nurse practitioners, physician assistants, medical doctors, or doctors of osteopathy. Participants had to be willing to participate in follow up testing via the Internet 6 months after completion of the PALS course. Human subject's approval was obtained from University of Colorado Denver Multi-Institutional Review Board and the Billings Area Institutional Review Board. Written informed consent was obtained from all participants.

The main study was a cluster randomized trial of participants in PALS courses with sim-ulation compared to participants in PALS courses without simulation (Stellflug & Lowe, 2018). Data were collected at baseline, immediately after completion of the PALS course, and 6 months later. For the psychometric analysis described here, we used participants' data from the end of the 2-day PALS course to examine the PALS Skill Self-Efficacy Inven-tory's (SSEI) validity and reliability.

Procedures

A total of five classes were randomized to experimental clusters and six classes were ran-domized to control clusters. Data were collected between August 8, 2013 and November 13, 2014. Both control and experimental classes completed the 2-day PALS course as specified by AHA standards and taught by AHA certified instructors. The only difference between the classes was the experimental/simulation classes used a high-fidelity manikin (SimBaby Laerdal Corporation) for all hands-on portion of the PALS training and the control classes used a static manikin. Participants agreeing to be a part of the study were provided a study packet. The study packet included a consent form and demographic form to be filled out and returned immediately after they checked-in for the course on day one. Data collected upon completion of the PALS course included PALS written exam scores, Core Case Sce-nario time-to-task, and the PALS. At 6-month follow up, data collected included PALS written exam scores and the PALS-SSEI.

Measures

Demographic Characteristics. Demographic data collected included participant age, gen-der, education, professional designation, and months in practice, see Table 1. These were measured via a demographic survey collected on the first day of the PALS course, after participants checked-in. In addition to the above information, the demographic form also asked about previous experience taking care of critically ill or injured children and number of previous PALS courses the participant had completed.

PALS-SSEI. Designed for the primary study, the inventory consisted of 19 PALS skills or tasks that participants rated their confidence level for performing. Participants were asked to imagine themselves in a pediatric resuscitation. For each task or behav-ior, participants were asked to score themselves on how certain they were that they could complete the item during the resuscitation. A 1-10 Likert scale was used. A score of 1 correlated with the statement "Not confident at all" and a score of 10 indicated "com-pletely confident." There were no degree labels for numbers falling between 1 and 10. The 19-item PALS-SSEI was created based on Bandura's self-efficacy theory and the AHA PALS course objectives (AHA, 2010, 2015; Bandura, 2006). During development, a panel of six experts including one emergency physician, two pediatric intensivist physicians, and three pediatric nurses reviewed the PALS-SSEI. Based on Lawshe's method, experts were asked to rate each item as "essential," "useful but not essential," and "not necessary" (Lawshe, 1975). The PALS-SSEI was planned as an additive scale of the responses to the 19 items. Scores on the PALS-SSEI were added then divided to obtain a mean of the 19 items. Possible score ranges were 1 to 10 with a higher mean score suggesting the partici-pant felt more confident in his/her abilities to perform the identified items.

Data Analysis

International Business Machine (IBM) Statistical Package for the Social Sciences (SPSS) Version 24 was used for data analysis. The data from the experimental and control groups

TABLE 1. Participant Demographics

Characteristic	*n* = 94	
	M	*SD*
Age	33.9	0.3
Months in Practice	150	139.9
	N	%
Gender		
Male	29	30.9
Female	65	69.1
Education		
Some College	4	4.3
Associate Degree	16	17
Bachelor Degree	62	66
Master's Degree	8	8.5
Doctorate Degree	1	1.1
MD/DO[a]	3	3.2
Profession		
MD/DO	4	4.3
Nurse Practitioner	1	1.1
Physician Assistant	31	33
Registered Nurse	42	44.7
Respiratory Therapist	5	5.3
Paramedic	5	5.3
EMT-I[b]	5	5.3
Pharmacist	1	1.1

[a] Medical Doctor (MD)/Doctor of Osteopathy(DO); [b]Emergency Medical Technician Intermediate.

were combined for this psychometric analysis. Descriptive statistics were calculated for the demographic variables. Content validity for the PALS-SSEI was determined following Lawshe's methods to calculate the Content Validity Index (CVI) for the inventory and the individual items that comprised the inventory based on the responses of the panel of six experts. Construct validity for the PALS-SSEI was estimated by performing item analysis and principal component analysis (PCA).

Factor structure of the PALS-SSEI was examined by conducting an unlimited factor analysis with Varimax rotation. An eigen value of >1, a clear graphic representation of the plot of eigen values, a factor loading greater than or equal to 0.4 were considered criteria to retain a factor. Appropriateness for PCA was examined by using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity. Cronbach's coefficient alpha was also calculated in order to estimate the internal consistency reliability of the PALS-SSEI.

RESULTS

Ninety-four participants enrolled in the study. The sample was comprised of subjects enrolled in a 2-day PALS course through the eastern Montana AHA training center. On average, the participants were 34 years old and had been in practice for approximately 12 years (150 months). They were predominantly female (65%) with a baccalaureate degree (62%), and registered nurses (42%; see Table 1).

Content Validity

The 19-item PALS-SSEI was developed as a tool to measure healthcare providers' self-confidence in performing specific PALS related skills. Item ratings by the panel of six clinical content experts resulted in a CVI of 1 for the 19 items of the PALS-SSEI individually and as a composite. The experts' ratings indicated that all the items actively contributed to the construct of confidence and were rated as essential in PALS skills. No items were removed from the inventory on the basis of the expert review.

Item Analysis and Internal Consistency Reliability

The mean of the 19-item PALS-SSEI was 7.60, the median was 8.50, and the standard deviation was 2.77. Descriptive statistics of PALS-SSEI scores and item analysis are presented in Table 2. Mean scores ranged from 5.40 to 9.55. Item to total correlations (ITC, the correlation between the scores of one item and the total scores of all other items) ranged from 0.26 to 0.72. A higher value of ITC suggests the item measures the same characteristics of the other items. For the 19 items of the PALS-SSEI, two had ITC values below 0.40: Item 12, Perform appropriate bag valve mask ventilations (ITC = 0.37) and Item 13, Intubate a pediatric patient (ITC = 0.26). However, removal of either item did not substantially increase the tool's Cronbach's alpha coefficient (Table 2). Because these two skills are critical to pediatric resuscitation, both items were retained in the final inventory. A Cronbach's alpha coefficient of 0.88 was calculated for the PALS-SSEI suggesting a high level of internal consistency among the inventory items (Table 2).

Construct Validity

An exploratory PCA was performed on the 19 items of the PALS-SSEI (see Table 3). The KMO measure of sampling adequacy was 0.85, indicating it was appropriate to conduct component analysis due to the sufficiency of and high variability in the data. The Bartlett Test for Sphericity was also significant (^{2} = 1,083.150, p < .000) which indicated the correlation matrix was not an identity matrix. An identity matrix would indicate that our variables are unrelated and therefore unsuitable for structure detection (Tabachnick & Fidell, 2007).

The four identified factors with Eigen values >1 accounted for 63.1% of the total variance. Nine items loaded on Factor 1, Evaluation and Identification. Five items loaded on Factor 2, Intervention. Three items loaded on Factor 3, Advanced Intervention, and two items loaded on Factor 4, Treatment. Item 18, Perform appropriate chest compressions for a pediatric patient loaded on Factor 1 with a value of 0.39 and on Factor 2 with a value of 0.36. Although a factor loading of 0.4 was set a priori, this item was assigned to Factor 2 because of logical congruence. Loadings of the 19 items to their respective factors ranged from 0.36 to 0.93.

TABLE 2. Item Analysis and Reliability Estimates of the PALS-SSEI (n = 94)

	Item *M SD*[a]	Range	ITC[b]	Cronbach's Alpha If Item Deleted
For each of the following tasks or behaviors, please rate how certain you are that you could do each during a resuscitation of a child . . .				
1. Use effective communication with team members throughout a resuscitation	8.71 ± 1.28	6	0.49	0.87
2. Assess the pediatric airway	8.68 ± 1.29	5	0.72	0.87
3. Assess pediatric breathing	8.75 ± 1.31	5	0.77	0.87
4. Assess pediatric circulation	8.71 ± 1.51	10	0.67	0.87
5. Place defibrillator pads on a pediatric patient	9.36 ± 0.87	4	0.67	0.87
6. Place cardiac monitor leads and pulse oximetry on a pediatric patient	9.32 ± 1.08	5	0.59	0.87
7. Recognize pediatric cardiac arrest	8.87 ± 1.38	7	0.68	0.87
8. Recognize pediatric respiratory distress	8.88 ± 1.19	5	0.69	0.87
9. Recognize pediatric shock	8.01 ± 1.29	5	0.61	0.87
10. Administer oxygen via a nasal cannula to a pediatric patient	9.52 ± 0.86	5	0.47	0.88
11. Administer oxygen via a nonrebreather to a pediatric patient	9.55 ± 0.88	5	0.52	0.87
12. Perform appropriate bag valve mask ventilations	9.29 ± 1.36	10	0.37	0.88
13. Intubate a pediatric patient	5.40 ± 2.97	9	0.26	0.89
14. Place a pediatric intravenous line	6.69 ± 2.76	9	0.56	0.88
15 Place a pediatric intra-osseous line	6.80 ± 2.42	9	0.46	0.87
16. Administer a fluid bolus of isotonic crystalloid to a pediatric patient	8.83 ± 1.50	6	0.58	0.88
17. Calculate the correct dosage of medication for a pediatric patient	8.42 ± 1.72	9	0.44	0.88

(*Continued*)

TABLE 2. Item Analysis and Reliability Estimates of the PALS-SSEI (*n* = 94) (*Continued*)

	Item *M SD*[a]	Range	ITC[b]	Cronbach's Alpha If Item Deleted
18. Perform appropriate chest compressions for a pediatric patient	9.27 ± 1.36	10	0.40	0.88
19. Assess the patient response to interventions implemented	9.06 ± 1.11	4	0.61	0.87
Overall	7.60 ± 2.77	6.7		0.88

Note. PALS-SSEI = Pediatric Advanced Life Support Skills Self-Efficacy Inventory.
[a]Item M SD: Item Mean Standard Deviation.
[b]ITC: Item-total correlation.

TABLE 3. Factor Loadings and Total Variance Explained From the Rotated Factor Structure for the Pediatric Advanced Life Support Skills Self-Efficacy Inventory (*n* = 94)

Item By Factor	Factor			
	1	2	3	4
1. Evaluation and identification				
Assess pediatric breathing	0.93			
Assess the pediatric airway	0.82			
Assess pediatric circulation	0.79			
Recognize pediatric respiratory distress	0.77			
Recognize pediatric cardiac arrest	0.73			
Assess the patient's response to interventions implemented	0.68			
Recognize pediatric shock	0.60			
Use effective communication with team members throughout the resuscitation	0.51			
2. Intervention				
Administer oxygen via a nonrebreather to apediatric patient		0.90		
Administer oxygen via a nasal cannula to apediatric patient		0.88		
Place cardiac monitor leads and pulse oximeter on a pediatric patient		0.71		
Place defibrillator pads on a pediatric patient		0.71		

(*Continued*)

TABLE 3. Factor Loadings and Total Variance Explained From the Rotated Factor Structure for the Pediatric Advanced Life Support Skills Self-Efficacy Inventory (n = 94) (*Continued*)

Item By Factor	Factor			
Perform appropriate bag valve mask ventilations		0.50		
Perform appropriate chest compressions for a pediatric patient	0.39	0.36		
3. Advanced Interventions				
Place a pediatric intraosseous line			0.92	
Place a pediatric intravenous line			0.60	
Intubate a pediatric patient			0.58	
4. Treatment				
Administer a fluid bolus of isotonic crystalloids to a pediatric patient				0.80
Calculate the correct dosage of medication for a pediatric patient				0.65

TABLE 4. Internal Consistency of the PALS-SSEI and Its Factors (n = 94)

	Item *M SD*[a]	Range	Internal Consistency Cronbach's Alpha
Total PALS-SSEI	7.60 2.77	6.7	0.88
Evaluation and identification	8.70 1.05	1.1	0.92
Intervention	9.38 0.81	0.3	0.84
Advanced Intervention	6.29 2.23	1.4	0.74
Treatment	8.61 1.46	0.4	0.76

Note. PALS-SSEI = Pediatric Advanced Life Support Skills Self-Efficacy Inventory.
[a]Item M SD: Item Mean Standard Deviation.

Finally, descriptive statistics and estimates of internal consistency reliability for the four identified factors were computed. As presented in Table 4, the means for the four factors ranged from 6.29 to 9.38. Cronbach's alpha for the four factors ranged from 0.76 to 0.92 with an overall Cronbach's alpha of 0.88 for the inventory as a whole. Continued use and further psychometric assessment of the inventory and its factors is recommended.

DISCUSSION

We developed an inventory to measure rural healthcare providers' self-efficacy for PALS related skills and evaluated its initial psychometric properties. Initial content validity of the PALS-SSEI was supported during its development by a panel of experts who rated all items on the inventory as essential to the measurement of the construct of self-efficacy for PALS related skills. Item analysis and factor analysis of data from the administration of the PALS-SSEI to rural healthcare providers after participating in PALS training provided support for the construct validity of the instrument. The inventory's Cronbach's alpha suggests a high level of internal consistency among the inventory items.

The new PALS-SSEI fills previously unmet need for research designed to study the effectiveness of PALS training in the short- and long-term. The 19-item PALS-SSEI offers a quick and simple tool to measure self-efficacy for PALS skills necessary to implement life saving measures for children, a vulnerable patient population. Further research into the effects of PALS training on rural healthcare providers' performance and behavior during resuscitation in the rural setting is necessary, especially for first line providers like registered nurses and midlevel providers.

Exploratory factor analysis procedures revealed a four-subscale structure of the PALS-SSEI. The Evaluation and Identification, Intervention, Advanced Intervention, and Treatment subscales are reflective of the systematic approach AHA PALS stresses in the course which, includes the following: Evaluate, Identify, and Intervene occurring in a repetitive cyclical fashion (AHA, 2015). Interventions and Advanced Interventions both fall under the Intervene portion of the systematic approach, advanced interventions are those typically performed by an advanced practitioner, such as a nurse practitioner or physician.

A lack of confidence has been suggested as a barrier to early intervention in providing resuscitation (Roh et al., 2014; Vaillancourt et al., 2013). The PALS-SSEI provides PALS instructors with a reliable and validated tool to measure participants' confidence in PALS skills. External factors can modify levels of self-efficacy; if the strength of the individual's self-efficacy is low, challenging situations like advanced life support can inhibit performance of the activity. Although advanced life support training does not necessarily imply the skills have been acquired, training has been identified as a way to strengthen advanced life support skill self-efficacy (Roh & Issenberg, 2014; Roh et al., 2014; Vaillancourt et al., 2013).

Our analysis had limitations including the small sample size and use of data acquired immediately after the completion of PALS training. There is a need for further psychometric testing of the PALS-SSEI in larger samples of healthcare providers with more diverse characteristics, in longitudinal studies evaluating retention of self-efficacy, and in studies that evaluate the relationship of self-efficacy to actual PALS skill performance. As previously discussed, self-efficacy does not necessarily indicate proficiency of skill performance. Further research is necessary to examine potential relationships between PALS-SSEI scores, the identified subscales, and actual skill performance. The PALS-SSEI was developed specifically based on AHA guidelines available in 2010 and 2015. Guidelines are updated by the AHA every 5 years, thus this inventory will likely need regular evaluation and modification to reflect updated PALS objectives and guidelines.

CONCLUSION

The PALS-SSEI demonstrated good initial psychometric properties for the measurement of self-efficacy in the skills healthcare providers need to care for critically ill or injured pediatric patients. The PALS-SSEI is a quick and easy to use tool that could facilitate the assessment of self-efficacy as part of the completion of a PALS course. This could foster the implementation of targeted educational strategies to increase self-efficacy for rural healthcare and other providers and ultimately contribute to better patient outcomes. Further use and continued assessment of the PALS-SSEI is recommended.

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Disclosure. The authors have no relevant financial interest or affiliations with any commercial interests related to the subjects discussed within this article.

Funding.The author(s) received no specific grant or financial support for the research, authorship, and/or publication of this article.

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