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Developing a Tool for Cardiopulmonary Resuscitation Preparedness in the Prone Position: A Methodological Approach

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ABSTRACT

Background: The preparedness of health care providers to respond to cardiopulmonary resuscitation (CPR) while patients are in a prone position cannot be under-estimated. In certain clinical scenarios, health care providers' preparedness to initiate the prone position cardiopulmonary resuscitation timely and effectively is critical to patient outcomes. ***Purpose*:** This study aims to develop a tool to assess the health care providers' preparedness to perform prone position cardiopulmonary resuscitation and to undertake an exploratory factor analysis. ***Methods*:** A mixed-method approach incorporating both qualitative and quantitative designs was used. An English language preparedness tool was constructed and tested for its validity and reliability. An exploratory factor analysis was undertaken among a convenient sample of 305 health care providers in different health care sectors in Jordan. ***Results*:** The exploratory factor analysis resulted in a three-factor solution that explained 69.51% of the variance. These factors are competency and confidence, planning and training, and support and resource availability. The overall Cronbach's alpha was 0.959, which indicates a very good internal consistency. The final version of the tool consisted of 26 items that measure health care providers' preparedness to perform prone position cardiopulmonary resuscitation. ***Conclusion*:** The final constructed prone position cardiopulmonary resuscitation tool was found to be a valid and reliable tool. Moreover, the development of that tool represents a significant step towards assessing health care providers' preparedness to perform prone position CPR. By providing a standardized and comprehensive assessment tool, health care facilities can identify gaps in their readiness and implement targeted interventions to enhance their capabilities. ***Implications for Nursing*:** The findings equip clinical nurse educators with a valuable tool to assess health care providers' educational needs regarding prone position CPR, guiding the creation of targeted staff development programs.

Keywords: Cardiopulmonary resuscitation, Prone position, Preparedness, Tool development.

What does this paper add?

1. This study provides a valid and reliable tool specifically designed to assess health care providers' preparedness for performing cardiopulmonary resuscitation (CPR) in the prone position. The tool offers a comprehensive assessment of competency, confidence, training, and available resources.
2. By utilizing this tool, health care facilities can identify gaps in training and resources, enabling targeted staff development programs and strategic resource allocation to enhance patient safety during prone position CPR.

Introduction

Health care providers (HCPs) purposely maintain patients in a prone position to perform specific interventional and surgical procedures, such as lung biopsy and spinal cord surgeries (Kwee et al., 2015).

Additionally, in intensive care units (ICUs), the prone position is used to improve patients' oxygenation in acute respiratory distress syndrome (ARDS) (Guérin et al., 2020). However, emergencies, such as cardiac arrest, could occur while patients are in a prone position (Mullen & Byrd, 2013).Therefore, the role of HCPs in managing such cases and how they are prepared to respond to such life-threatening situations is crucial. To achieve that, HCPs must implement a set of integrated coordinated life-saving actions to increase patient survival rates (Kwangha, 2012).The advantages of prone position cardiopulmonary resuscitation (PPCPR) include maintaining effective resuscitation without repositioning, thereby reducing delays and potential risks during emergencies.

The American Heart Association (AHA) 2020 cardiopulmonary resuscitation (CPR) guidelines recommendation clearly states that it may be reasonable to initiate CPR for an inpatient with a secured airway while in a prone position until the patient can be safely turned to a supine position (Atkins et al., 2022). Unlike supine CPR, PPCPR requires distinct techniques and resources, emphasizing the need for specific training and preparedness among health care providers (HCPs). However, most HCPs lack familiarity with performing prone position CPR (Tofil et al., 2014). Ulmer et al. (2022) identified a gap between HCPs' preparedness to respond to life-threatening situations in terms of training and applying those acquired skills to the bedside confidently (Ulmer et al., 2022). Furthermore, studies have shown that physicians often lack adequate knowledge and confidence in performing CPR, reflecting poor preparation for supine CPR (Amien et al., 2022). Moreover, studies reported a significant gap remaining in HCP ability to apply their training effectively during emergencies (Hamdan et al., 2024; Ulmer et al., 2022).

The concept of preparedness is used in diverse health care settings to practise preparedness as well as disaster preparedness (Petruzzo et al., 2017). Carter et al. (2018) identified preparedness themes: experience, orientation, knowledge, and understanding (Carter et al., 2018). However, different components of preparedness were presented in the literature, and more attributes, such as training and skills, were identified (Buddhapriya, 2018). The concept of being proactive, which includes planning and predicting change, was also discussed, which in turn develops confidence displayed in preparedness (Hernández-Padilla et al., 2016). Considering these attributes for the concept of preparedness will help explore HCPs' performance in carrying out PPCPR. PPCPR is not widely used in Jordan, yet it can be used at any given time due to the complexity of patient care. Creating a valid tool will help assess HCPs' readiness to perform this procedure as a first step by measuring how competent HCPs are and exploring how ready they are to perform PPCPR.

Developing this tool will help assess HCPs' preparedness to perform PPCPR on a national level as part of a gap analysis. In addition, knowing the preparedness to perform PPCPR will help build strategies and corrective plans to maintain full preparedness, and this will positively affect patient care outcomes afterward. According to the study's researchers' knowledge, there is no evidence of any valid and reliable tool that has been previously developed to assess the HCPs' preparedness to perform PPCPR. Thus, constructing a new tool is essential in terms of assessing HCP preparedness to perform prone position CPR. Not only that, but also, patient safety is maximized by improving the quality of care provided by equipping HCPs with adequate preparedness to respond to such life-threatening situations whenever they occur.

Methods

Research Design

A mixed-method approach, incorporating both qualitative and quantitative designs, was employed to study HCPs from various health care sectors in Amman and Irbid. The sample included HCPs from a wide range of health care sectors across north and middle of Jordan. Specifically, our study included participants from both public and private health care facilities, which varied in size, scope, and resources. A combination of convenience sampling and snowball sampling was used. Convenience sampling was applied to recruit initial participants who were accessible to the researchers, and snowball sampling was subsequently employed to expand the sample through referrals. The study adhered to relevant guidelines and regulations, ensuring that all methods complied with ethical standards.

Qualitative Component

Literature Review

A comprehensive review of the existing literature on

prone position CPR was conducted, including studies on its efficacy, challenges, and implementation strategies through search using multiple databases, including PubMed, Scopus, Google Scholar, OVID, Up-To-Date, and EBM databases. The search was conducted from 1997 to present. This provided a foundation of knowledge and informed the development of the tool. Previous literature revealed that the concept of preparedness includes many dimensions, such as experience, orientation, knowledge, understanding, training, skills, planning, warning systems, resource mobilization, and feelings of confidence (Buddhapriya, 2018; Carter et al., 2018; Enders, 2001; Petruzzo et al., 2017).

Expert Consensus

A multi-disciplinary team of expert HCPs was assembled, including physicians, nurses, respiratory therapists, and other relevant health care professionals. Experts were selected from diverse health care sectors to ensure a comprehensive perspective on the preparedness for performing prone position CPR. Experts were chosen based on their extensive experience and expertise in the field of critical care, anesthesia, operational room, resuscitation, and health care training. The multi-disciplinary panel of experts was engaged in iterative content validation through the Delphi method, discussions and consensus-building sessions held to identify key domains and components to be included in the assessment tool. Experts' qualitative input helped ensure that the tool covers all critical aspects of prone position CPR preparedness.

Quantitative Component

The tool development and rating scale were based on the literature review and expert consensus findings, leading to the development of a comprehensive tool that encompasses all relevant domains of prone position CPR preparedness. The tool includes specific items that can be objectively evaluated. Our first draft of the tool consisted of two parts: the first part included demographic data, and the second part contained 32 items divided equally into two domains; planning for PPCRP preparation and competency and confidence in performing PPCPR. A rating scale was designed that allowed for a quantitative assessment of the preparedness level. This scale used a Likert scale, enabling the assignment of scores to different checklist items. The rating scale was designed to capture the extent to which each item is adequately addressed or implemented.

Tool Content Validity

In stage one, a panel of experts of HCPs (N=21) was invited to validate the proposed tool quantitatively. The inclusion criteria for the panel of experts were as follows: they were from different health care specialties, and senior staff, mainly from medical, nursing, and allied health care practitioners. Moreover, these experts had at least five years of experience in their fields and had valid basic life support training. The experts were asked to independently rate each item for its levels of relevance and representativeness according to the extent to which it describes the domain of interest using a 4-point Likert scale (4 = item is very representative/highly relevant, 3 = item is quite representative/quite relevant, 2 = item is somewhat representative/somewhat relevant, and 1= item is not representative/not relevant) (Waltz et al., 2018). Additionally, the experts were requested to indicate any items that they would recommend refining, modifying, adding, deleting, or rephrasing and to provide feedback in order for us to meet the tool's objectives. However, only sixteen experts (16) agreed to participate and complete the tool survey. The content validity index (CVI) was calculated based on the responses from the experts: item-level CVIs (I-CVIs) and scale-level CVIs (S-CVIs). The first draft of the tool's S-CVIs had 0.95 and 0.92 for relevance and representation, respectively; however, the I-CVIs for two items were below 0.78, and they were therefore deleted (Polit et al., 2007). The experts recommended merging two items into two other items to improve the tool's clarity and content validity and prevent duplication and redundancy.

Additionally, the experts recommended modifying the tool scale from a 5-point Likert scale to a yes and no scale for the first domain only to enhance the tool clarity, improve the simplicity of the responses and allow to prioritize clear decision-making in the context of training and resource allocation. Therefore, a consensus decision was made to accept their point of view, and the tool was accordingly revised. Stage two was conducted after two weeks. The second drafted 28-item tool was sent back to the same panel of experts (N=16) to re-evaluate is and to provide their feedback accordingly. One expert dropped out, so fifteen experts returned the

completed tool (N=15). The second draft of the tool had S-CVIs of 0.98 and 0.99 for relevance and representativeness, respectively, and none of the I-CVIs was below 0.78 (Figure 1).

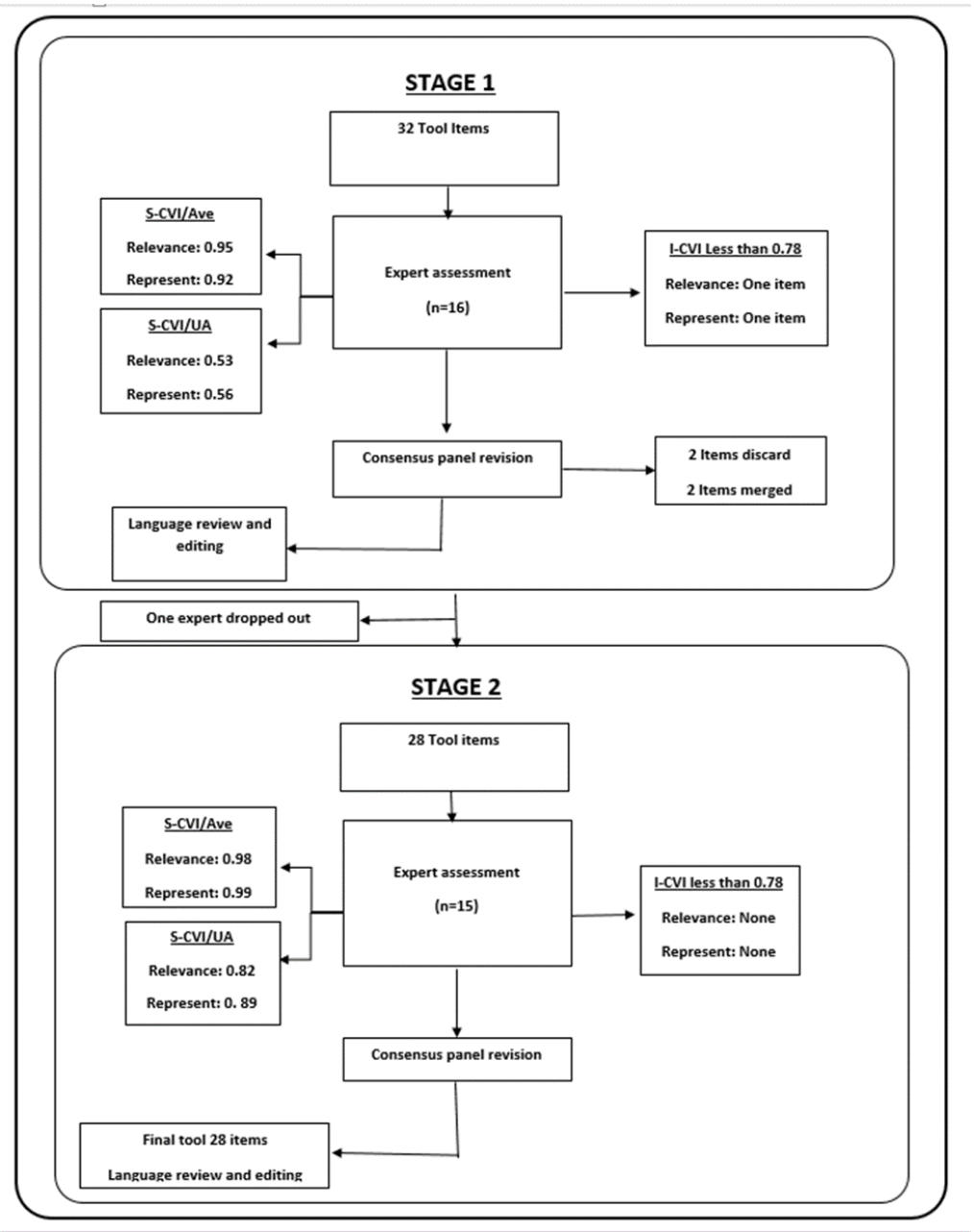

Figure 1. Tool development and validation process

Pilot and Tool Face Validity

The second draft, the 28-item tool, was sent to a sample of 45 senior HCPs as a piloting sample to check the items' clarity and resolve any ambiguity. We sought input and feedback from frontline health care providers who have experience with prone position CPR implementation. Their insights and perspectives helped refine and improve the tool. This iterative feedback process ensures that the tool is practical, user-friendly, and applicable across different health care settings. Meanwhile, the participants were requested to provide feedback and write their comments, if any, subjectively judging the tool's face validity. However, no comments were reported at this stage; therefore, all tool items were understood and clear. This ensures that the tool adequately captures the preparedness level of health care facilities for prone position CPR.

Exploratory Factor Analysis

An Exploratory Factor Analysis (EFA) was conducted to examine the underlying factor structure of the PPCPR tool. The objective was to identify latent factors contributing to variations in the observed variables. The tool comprised 28 items assessing PPCPR preparedness, with the first 16 items using a yes/no scale and the remaining 12 items using a five-point Likert scale (Li, 2013).

The EFA included a sample of 305 HCPs selected based on their roles in critical care units, operating rooms, and intervention procedure rooms across various health care sectors in Jordan. Participants had at least one year of experience, completed hospital orientation, basic life support training and voluntarily consented to participate. This analysis adhered to an item-participant ratio of 1:10 (Polit & Beck, 2017) . Over-sampling was employed to mitigate incomplete data, reduce sampling error and reduce the risk of biases in the results, by inviting more HCPs than required to complete the exploratory factor analysis to ensure a diverse and representative sample, taking into consideration that different health care sectors and geographic regions in Jordan may have variable responses. Participants completed the tool online *via* a Google Form, which took approximately 15 minutes.

Data Collection Procedure

Data collection took place from January to February 2023 using snowball sampling and a Google Form survey. The researchers initially collaborated with life support training center coordinators (LSTCCs) at hospitals across central and northern governorates of Jordan to identify eligible HCPs. These coordinators referred participants who met the study's inclusion criteria, such as working in critical care units, operating rooms, or interventional procedure rooms, having completed basic life support training, and having at least one year of experience.

The survey link, designed in Google Forms, was distributed *via* e-mail to participants provided by the life support training center coordinators (LSTCCs). Initial participants were invited to participate and encouraged to share the survey with colleagues who also met the criteria. A total of 400 surveys were distributed, and 305 participants completed the survey, yielding a response rate of 76.3%. Participation was voluntary, and informed consent was obtained through an introductory statement at the beginning of the survey.

Ethical Consideration

Ethical approval to conduct the study was obtained from the Institutional Review Board (IRB) at King Hussein Cancer Center, with reference number 22 KHCC 177. Informed consent was obtained from all participants, ensuring their understanding and agreement to participate in the study. The participants were provided with a comprehensive cover letter outlining the purpose, procedures, potential risks and benefits, and any other pertinent information related to the study. Additionally, participants were required to complete an online survey, which served as an explicit confirmation of their willingness to be part of the research. These measures were taken to ensure that participants' approval to participate was well documented and in accordance with ethical standards.

Statistical Analysis

Data was entered and analyzed using SPSS, version 20.0 for Windows. Descriptive statistics were used to describe the participants' demographics and clinical characteristics based on the level of measurement. Cronbach's alpha was used to test internal consistency for the tool domains. An exploratory factor analysis was also used to identify the number of factors and the inter-correlations among scale items. The extraction method was principal component analysis, and the varimax rotation method was used to extract the factors. The factor was retained if the eigenvalue was greater than one, the factor loading should be at least 0.4, and each factor should have a minimum of three items with significant factor loadings.

Results

Demographic Characteristics

A total sample of 305 HCPs participated in this study. Their mean age was 36.01 years (SD = 8.79), and the sample consisted of 73.1% nurses, 19.7% physicians, and 7.2% allied health care providers. The mean years of experience in their profession were 11.81 (SD = 8.10), and the mean years in their current units were 7.37 (SD = 6.26) years. Gender distribution in our sample was skewed, with males comprising 63.6% of the participants. This imbalance may reflect the gender composition of health care providers in critical care and operating room settings in Jordan. However, the

predominance of male participants could influence the findings, particularly in areas where gender norms or roles may affect confidence and preparedness. Future research should explore whether gender differences impact PPCPR-related skills and readiness. Almost 65.2% of the sample hold a bachelor's degree, 19.7% hold a master's degree, and 6.9% hold a PhD degree. More than a half of the sample worked at critical care units (59%), and two-thirds of the sample worked in governmental hospitals and private hospitals (33.1% and 37%, respectively). The rest of the sample was from non-profit hospitals (16.7%) and academic hospitals (13.1%). Participants were categorized into one primary workplace group based on their reported affiliation to ensure exclusivity and avoid overlaps between categories. Finally, more than a half of the sample had taken part in an advanced life support training program (57.4%) (Table 1).

Table 1. Participants' demographic characteristics (n=305)

Characteristics	n	(%)
Gender		
Male	194	63.6
Female	111	36.4
Educational level		
Three-year diploma	25	8.2
BSc	199	65.2
Master	60	19.7
PhD	21	6.9
Profession		
Nurse	223	73.1
Physician	60	19.7
Allied health care provider	22	7.2
Sector		
Governmental hospital	101	33.1
Private sector	113	37.0
Academic	40	13.1
Non-of-profit	51	16.7
Unit		
Operational room	92	30.2
Critical care unit	180	59.0
Interventional procedural room	33	10.8
ACLS certification		
Yes	175	57.4
No	130	42.6
	Mean	**Std. Deviation**
Age	36.06	8.79
Total years of experience in your profession	11.81	8.10
Years of experience in your current unit	7.37	6.26

Exploratory Factor Analysis (EFA)

The study results showed that the Kaiser-Meyer-Olkin (KMO) test was 0.956, and Bartlett's test was less than 0.001, indicating sample adequacy and appropriateness, respectively. Hence, both measures indicate that the tool is significant for factor analysis (Table 2). Additionally, all items' extraction communalities were greater than 0.4 (Costello & Osborne, 2005), and only one item scored less than that: item number 16, which scored 0.38. Therefore, a decision was made to remove it from the final version of the tool (Table 3).

Table 2. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.956
Bartlett's Test of Sphericity	Approx. Chi-square	8316.759
	df	378
	Sig.	<0.001

Table 3. Communalities

	Initial	Extraction
1- My hospital provides new hired health care providers with general orientation on prone position CPR (PPCPR).	1.000	0.608
2- PPCPR is part of my unit-based orientation program.	1.000	0.697
3- I received special training programs on PPCPR within the last 10 months.	1.000	0.740
4- I only heard about PPCPR through unofficial discussions in my unit.	1.000	0.472
5- I had at least one educational drill about PPCPR within the last 10 months.	1.000	0.684
6- My hospital offers multi-disciplinary training programs on PPCPR for health care providers.	1.000	0.720
7- I have access to scientific health care educational resources, like journals, evidence-based practice and searching engines to learn about PPCPR.	1.000	0.577
8- The continuous professional development team is available to help me in meeting my learning needs on PPCPR.	1.000	0.657
9- In case I have a patient who needs PPCPR, I have enough medical supplies and technology that would help me perform PPCPR.	1.000	0.575
10- I have a team with multi-specialties able to perform PPCPR available at all time.	1.000	0.637
11- I have supporting policies and guidelines that will regulate PPCPR procedures.	1.000	0.645
12- My unit has a structured plan on how to handle cardiac arrest while patients are in a prone position.	1.000	0.711
13- I attended planned drills on how to respond to PPCPR.	1.000	0.731
14- I have at least once participated in PPCPR within the last 10 months.	1.000	0.671
15- I have witnessed PPCPR once within the last 10 months.	1.000	0.717
16- I only heard about PPCPR cases in my hospital.	**1.000**	**0.380**
17- I have enough knowledge to manage PPCPR to maximize patient survival.	1.000	0.751
18- Health care providers in my unit have enough knowledge about PPCPR.	1.000	0.775
19- Health care providers in my unit are keen and initiative to seek knowledge and learn about PPCPR.	1.000	0.562
20- I have enough skills to perform PPCPR.	1.000	0.757
21- Health care providers in my unit are able to perform PPCPR successfully.	1.000	0.814
22- I know my role during PPCPR.	1.000	0.807
23- Health care providers in my unit are aware and know their roles during PPCPR.	1.000	0.843
24- Our health care team has harmony and works collaboratively during PPCPR.	1.000	0.829
25- I am confident that I can perform PPCPR correctly.	1.000	0.791
26- I am well prepared to perform PPCPR.	1.000	0.790
27- I trust that health care providers in my unit are prepared to perform PPCPR successfully.	1.000	0.794
28- I believe that patients will receive the best possible safe care in case of PPCPR in my unit.	1.000	0.731
Extraction Method: Principal Component Analysis.		

Furthermore, a total variance component analysis and rotated component matrix confirmed that three factors were retained, explaining 69.5% of the tool variance (Table 4). These were segregated into three domains: competency and confidence, which includes twelve items; planning and training, which consists of ten items; and support and resource availability, which consists of four items, as shown in (Table 5). As shown in Table 6, the Cronbach's alpha improved marginally from 0.959 to 0.961 and 0.960 upon removing items 4 and 16, which were deemed redundant and contributed minimally to overall reliability (Kopalle & Lehmann, 1997; Polit & Beck, 2017). Subsequently, the reliability test for each of the three subdomains was 0.971, 0.947, and 0.860, respectively. This indicates that the final draft of the 26-item PPCPR preparedness tool is valid and reliable.

Table 4. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.035	53.697	53.697	15.035	53.697	53.697
2	3.152	11.256	64.953	3.152	11.256	64.953
3	1.278	4.564	69.518	1.278	4.564	69.518
4	0.956	3.415	72.933			
5	0.809	2.890	75.823			
6	0.731	2.611	78.434			
7	0.569	2.031	80.466			
8	0.534	1.908	82.374			
9	0.504	1.800	84.174			
10	0.497	1.774	85.948			
11	0.384	1.371	87.319			
12	0.361	1.289	88.607			
13	0.326	1.165	89.773			
14	0.324	1.158	90.930			
15	0.295	1.054	91.984			
16	0.273	0.976	92.960			
17	0.262	0.935	93.895			
18	0.236	0.843	94.738			
19	0.227	0.810	95.549			
20	0.202	0.722	96.271			
21	0.191	0.682	96.953			
22	0.174	0.620	97.573			
23	0.158	0.563	98.135			
24	0.141	0.502	98.637			
25	0.114	0.408	99.045			
26	0.100	0.359	99.404			
27	0.089	0.317	99.721			
28	0.078	0.279	100.000			
Extraction Method: Principal Component Analysis.						

Table 5. Results from Factor Analysis of the PPCPR tool

PPCPR item	Factor loading		
	1	2	3
Factor 1: Competancy and confidence			
17- I have enough knowledge to manage PPCPR to maximize patient survival.	**0.805**	0.309	0.088
18- Health care providers in my unit have enough knowledge about PPCPR.	**0.805**	0.317	0.164
19- Health care providers in my unit are keen and initiative to seek knowledge and learn about PPCPR.	**0.717**	0.004	0.219
20- I have enough skills to perform PPCPR.	**0.823**	0.265	0.090
21- Health care providers in my unit are able to perform PPCPR successfully.	**0.857**	0.232	0.158
22- I know my role during PPCPR.	**0.834**	0.317	0.099
23- Health care providers in my unit are aware and know their roles during PPCPR.	**0.853**	0.273	0.203
24- Our health care team has harmony and works collaboratively during PPCPR.	**0.839**	0.257	0.243
25- I am confident that I can perform PPCPR correctly.	**0.807**	0.340	0.157
26- I am well prepared to perform PPCPR.	**0.808**	0.350	0.122

27- I trust that health care providers in my unit are prepared to perform PPCPR successfully.	**0.822**	0.263	0.222
28- I believe that patients will receive the best possible safe care in case of PPCPR in my unit.	**0.792**	0.194	0.258
Factor 2: Planning and training			
1- My hospital provides new hired health care providers with general orientation on prone position CPR (PPCPR).	0.293	**0.678**	0.251
2- PPCPR is part of my unit-based orientation program.	0.255	**0.763**	0.224
3- I received special training programs on PPCPR within the last 10 months.	0.226	**0.827**	0.069
5- I had at least one educational drill about PPCPR within the last 10 months.	0.210	**0.789**	0.133
6- My hospital offers multi-disciplinary training programs on PPCPR for health care providers.	0.260	**0.746**	0.310
11- I have supporting policies and guidelines that will regulate PPCPR procedures.	0.376	**0.627**	0.333
12- My unit has a structured plan on how to handle cardiac arrest while patients are in a prone position.	0.301	**0.655**	0.437
13- I attended planned drills on how to respond to PPCPR.	0.266	**0.789**	0.195
14- I have at least once participated in PPCPR within the last 10 months.	0.232	**0.779**	0.106
15- I have once witnessed PPCPR within the last 10 months.	0.202	**0.800**	0.191
Facto 3: Support and resource availability			
7- I have access to scientific health care educational resources, like journals, evidence-based practice and searching engines to learn about PPCPR.	0.280	0.348	**0.615**
8- The continuous professional development team is available to help me in meeting my learning needs on PPCPR.	0.345	0.425	**0.598**
9- In case I have a patient who needs PPCPR, I have e0ugh medical supplies and technology that would help me perform PPCPR.	0.365	0.374	**0.550**
10- I have a team with multi-specialties able to perform PPCPR available at all time.	0.338	0.442	**0.573**

Table 6. Reliability test

Cronbach's Alpha	**No. of Items**			
0.959	28			
Item-Total Statistics	**Scale Mean if Item Deleted**	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Cronbach's Alpha if Item Deleted**
1- My hospital provides new hired health care providers with general orientation on prone position CPR (PPCPR).	37.72	280.150	0.627	0.959
2- PPCPR is part of my unit-based orientation program.	37.75	280.288	0.630	0.959
3- I received special training programs on PPCPR within the last 10 months.	37.83	281.699	0.590	0.959
4- I only heard about PPCPR through unofficial discussions in my unit.	37.67	286.427	0.230	**0.961**
5- I had at least one educational drill about PPCPR within the last 10 months.	37.84	281.881	0.580	0.959
6- My hospital offers multi-disciplinary training programs on PPCPR for health care providers.	37.76	280.095	0.651	0.959
7- I have access to scientific health care educational resources, like journals, evidence-based practice and searching engines to learn about PPCPR.	37.61	280.797	0.565	0.959
8- The continuous professional development team is available to help me in meeting my learning needs on PPCPR.	37.58	279.383	0.650	0.959
9- In case I have a patient who needs PPCPR, I have enough medical supplies and technology that would help me perform PPCPR.	37.60	279.834	0.623	0.959

10- I have a team with multi-specialties able to perform PPCPR available at all time.	37.63	279.569	0.642	0.959
11- I have supporting policies and guidelines that will regulate PPCPR procedures.	37.69	278.951	0.693	0.958
12- My unit has a structured plan on how to handle cardiac arrest while patients are in a prone position.	37.70	279.153	0.681	0.958
13- I attended planned drills on how to respond to PPCPR.	37.75	280.133	0.644	0.959
14- I have at least once participated in PPCPR within the last 10 months.	37.86	282.032	0.587	0.959
15- I have once witnessed PPCPR within the last 10 months.	37.83	281.594	0.598	0.959
16- I only heard about PPCPR cases in my hospital.	37.71	283.107	0.440	**0.960**
17- I have enough knowledge to manage PPCPR to maximize patient survival.	35.43	255.673	0.814	0.957
18- Health care providers in my unit have enough knowledge about PPCPR	35.53	255.895	0.842	0.956
19- Health care providers in my unit are keen and initiative to seek knowledge and learn about PPCPR.	35.00	263.536	0.618	0.959
20- I have enough skills to perform PPCPR.	35.48	256.770	0.809	0.957
21- Health care providers in my unit are able to perform PPCPE successfully.	35.39	256.476	0.840	0.956
22- I know my role during PPCPR.	35.44	255.201	0.850	0.956
23- Health care providers in my unit are aware and know their roles during PPCPR.	35.48	255.987	0.876	0.956
24- Our health care team has harmony and works collaboratively during PPCPR.	35.37	255.879	0.868	0.956
25- I am confident that I can perform PPCPR correctly.	35.47	255.105	0.857	0.956
26- I am well prepared to perform PPCPR.	35.52	255.079	0.850	0.956
27- I trust that health care providers in my unit are prepared to perform PPCPR successfully.	35.41	256.216	0.846	0.956
28- I believe that patients will receive the best possible safe care in case of PPCPR in my unit.	35.26	258.148	0.795	0.957

Discussion

The development of the PPCPR preparedness tool is crucial for future studies. This study aimed to develop a valid and reliable tool that measures HCPs' preparedness to perform PPCPR. The current research findings support the previously conducted research in the context of tool development to measure HCPs' responses to life-threatening situations (Hernández-Padilla et al., 2016). However, previous studies indicated a lack of research instruments that are ready to be used due to the variety of perspectives on the preparedness concept (Lorenzoni et al., 2022). Therefore, this tool is novel and has for the first time been explored in Jordan. Moreover, the existing tools measure HCPs' preparedness for disasters and for performing supine position CPR and non-measured PPCPR preparedness (Hernández-Padilla et al., 2016), whereas our current PPCPR tool was developed specifically to measure HCPs' preparedness to perform PPCPR. Moreover, the current tool seems to be comprehensive, multi-dimensional and factor-specific to PPCPR preparedness. The PPCPR tool represents a significant advancement over existing preparedness instruments by focusing exclusively on PPCPR. Unlike generic CPR tools, this instrument addresses domain-specific factors, including unique techniques, training needs, and operational challenges

associated with PPCPR. Methodological innovations, such as engaging a multi-disciplinary panel of experts and iterative content validation through the Delphi method, ensured the tool's relevance and comprehensiveness. These features make it a valuable resource for health care facilities aiming to enhance their readiness for PPCPR.

The first domains in our PPCPR preparedness tool focused on competence and confidence, which is consistent with the previous work by Kohler et al. (2020), in which preparedness embraces cognitive factors, like risk knowledge, specific behaviors and skills which lead to competence and thereafter to confidence (Kohler et al., 2020). However, the dynamic preparedness metric in another study is considered to measure different dimensions, like physical factors, environmental factors, knowledge factors, and infrastructure required to plan and respond to a health emergency effectively (Kandel et al., 2022). The dynamic preparedness metric is especially relevant to PPCPR preparedness. It goes beyond traditional metrics to embrace both individual competency and organizational readiness in the context of team dynamics. This multi-dimensional approach aligns with the complexities of PPCPR, where rapid decision-making and seamless team coordination are critical to success. By incorporating these principles, the PPCPR tool provides a comprehensive framework for assessing and enhancing preparedness. Therefore, our study revealed that the final draft, the 26-item tool, should focus on planning and training in its second domain as part of preparedness. Similarly, our findings are consistent with previous studies on disaster preparedness, which viewed the concept of preparedness as being focused on attributes, such as training and skill development (Heidelburg et al., 2017; Labrague et al., 2018). Moreover, a study reported the same finding, which linked preparedness with education and training (Ugalde et al., 2017).

Labrague et al. (2018) focused on another aspect of preparedness-equipment and resources – due to the fact that emergencies are mainly unpredictable (Labrague et al., 2018). The currently developed PPCPR preparedness tool consistently focuses on resource availability to perform PPCPR in its third domain. Furthermore, our findings, as with Kohler et al. (2020), endorse that the most common indicator for emergency preparedness is the availability of emergency supplies and resources (Kohler et al., 2020). However, many previously conducted studies that reviewed and analyzed preparedness tools found a wide variety of preparedness evaluation categories, such as communication, information dissemination, plans, and protocols, as well as staff workforce, training, exercises, policy determinants, supplies and equipment (Lorenzoni et al., 2022). Nevertheless, all of these evaluation categories are consistent with our study findings.

The cultural and systemic contexts in Jordan significantly impact PPCPR preparedness. Health care centers operating in rural regions compared to urban facilities tend to have limited access to advanced training and fewer resources that may impact the preparedness of HCPs to perform PPCPR. Moreover, disparities in preparedness levels are also due to the hierarchical structure of the health care systems and variations in the implementation of national policy. Focusing on local needs to deliver PPCPR training and protocols would be effective. Exploring such contextual factors is key to helping inform the iterative and on-going process of developing, not just PPCPR, but other community interventions as well.

Implications for Nursing

The present study's findings indicate that PPCPR preparedness is a valid tool that helps clinical nurse educators identify the gap in practice. Therefore, it enables them to develop a targeted PPCPR educational program. Most importantly, the training programs cover all the knowledge and skills needed for successful PPCPR, subsequently enhancing nurses' confidence in performing PPCPR. Additionally, the study encourages nurse administrators to advocate for adequate resource allocation and availability to ensure safe patient care. Hence, the results provide valuable insights for hospital administrators to exert every single effort to assess whether health care facilities are equipped with equipment and resources needed to perform PPCPR safely and effectively. Finally, the tool supports nursing leadership in influencing hospital decision-makers to identify areas of improvement and obtain a full picture of the existing state of HCPs' preparedness to perform PPCPR. It is important to incorporate PPCPR into specialized unit orientation programs, and unit-specific competencies, as well as to implement effective strategies for improving PPCPR practices, ultimately contributing to better patient outcomes.

Recommendations

HCPs' readiness to perform PPCPR when needed seems less investigated than the readiness to perform traditional supine position CPR; this is undetermined and needs further investigation to enable more insight into future development plans. Encouraging health care educators and administrators to pay more attention to this area would help them assess HCPs' preparedness to perform PPCPR. In addition, replicating this study in different countries would increase its generalization internationally.

Finally, using a Likert scale with five response categories, including a neutral response, might increase measurement error due to a participants' tendency to choose to be neutral in their answers. Modifying the Likert scale to encompass four categories by eliminating the neutral choice from the final version of the PPCPR preparedness tool would provide more insight, understanding, and assessment in reflecting HCPs' preparedness status (Johns, 2006).

Limitations

One of our study limitations is that the PPCPR tool is specific to measuring HCPs' preparedness to perform PPCPR at specialized units, mainly in the OR, ICU, and invasive procedural areas. Subsequently, if it is used in different hospital settings, it may need to be tested accordingly in order to re-validate the tool. Moreover, the study conducted in one country and in different health care sectors with different resource availability can be considered a limitation in generalizing the findings. Additionally, data collection was restricted to Amman and Irbid, which may limit the geographic representativeness of the results. The participants' hesitation to criticize the tool during the pilot phase is another limitation. Using additional methods for gathering feedback in future iterations of the tool would allow for more valuable qualitative insights. Finally, HCPs participating in the exploratory factor analysis study phase might be unfamiliar with PPCPR due to low exposure.

Conclusion

The final constructed 26-item PPCPR preparedness tool was found to be a valid and reliable tool to assess health care providers' preparedness to perform PPCPR in upcoming studies. Having a valid and reliable tool would help HCPs identify areas of improvement and practise gap analysis to adopt development programs and strategies, which will reflect positively on the care provided, patient safety, and a better overall outcome.

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Conflict of Interests

The researchers have no conflict of interests to declare.

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