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Bridging the Theory - Practice Divide in Cardiopulmonary Resuscitation: Knowledge and Readiness Among Trainees at ILKKM Kota Kinabalu

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ABSTRACT

Cardiopulmonary resuscitation (CPR) is a critical life-saving skill formally embedded within the curriculum of healthcare training programmes in Malaysia. At the Training Institute Ministry of Health Malaysia Kota Kinabalu (ILKKM KK), CPR instruction is a mandatory component of both the Diploma in Medical and Health Sciences (DMHS) and Diploma in Nursing (DPNS) programmes. Although theoretical content is consistently delivered, concerns remain regarding the extent to which trainees are practically ready to perform CPR in real-life emergencies. This study aimed to assess the levels of CPR knowledge and practical readiness among ILKKM KK trainees and to examine the relationship between these two domains. A cross-sectional study was conducted involving 120 trainees (stratified random sampling) who had completed the CPR module. Data collection was carried out using a structured questionnaire administered through Google Forms. The instrument assessed knowledge using multiple-choice questions and practical readiness through self-reported behavioural indicators on a three-point frequency scale. Descriptive statistics summarised participants' performance, while chi-square and independent t-tests were used to determine associations and group differences. The findings showed that 63 of 120 trainees (52.5%) demonstrated high levels of CPR knowledge (M = 13.5, SD = 0.8), while 42 of 120 trainees (35.0%) reported high readiness to perform the procedure (M = 25.5, SD =

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3.2). A statistically significant association was identified between knowledge and readiness levels, $\chi^2(4, N = 120) = 27.06, p < 0.001$, Cramér's V = 0.34, indicating a moderate relationship. There were no statistically significant differences in CPR knowledge or readiness scores between DMHS and DPNS trainees. These results highlight a critical disconnect between theoretical knowledge and applied readiness, despite the mandatory inclusion of CPR in the academic syllabus. Strengthening CPR education through structured simulations, continuous reinforcement, and psychological preparedness may help ensure that trainees are not only knowledgeable but capable of responding confidently and competently in emergencies.

INTRODUCTION

Cardiopulmonary resuscitation (CPR) is a critical, time-sensitive intervention that significantly improves the chances of survival in individuals experiencing cardiac or respiratory arrest. Survival following out-of-hospital cardiac arrest (OHCA) depends strongly on early recognition and prompt, high-quality CPR (Panchal et al., 2020; Kleinman et al., 2015). In Malaysia, recent emergency medical services data from Sarawak, Penang and the Klang Valley showed that 38% of OHCA cases received bystander CPR, while only 4.76% survived to hospital admission (Sarah Shaikh Abdul Karim et al., 2025). These findings highlight continuing gaps in early community response and the importance of ensuring that future healthcare personnel are adequately prepared to respond to cardiac emergencies.

Within Malaysian health training programmes, cardiopulmonary resuscitation is incorporated as a core competency guided by national resuscitation training standards, including the Ministry of Health Malaysia Basic Life Support Training Manual (Ministry of Health Malaysia, 2023). Evidence from the Malaysian context has shown that structured CPR education can significantly improve knowledge and attitudes towards resuscitation (Rahman et al., 2013). At the Training Institute Ministry of Health Malaysia Kota Kinabalu (ILKKM KK), CPR instruction is embedded in both the Diploma in Medical and Health Sciences (DMHS) and the Diploma in Nursing (DPNS) programmes. While DMHS trainees are introduced to CPR in the context of emergency medical response and prehospital care, DPNS students receive CPR instruction as part of broader nursing competencies within acute, chronic and emergency care modules. Despite this inclusion, retention of CPR knowledge and technical performance remains an important educational concern. Evidence from CPR retention studies supports the need for repeated practice and appropriately scheduled refresher training to sustain performance over time (Sand et al., 2021; Oermann et al., 2022). Similar gaps in knowledge, attitude and perceptions towards basic life support training have also been reported among university students in the Malaysian context (Fariduddin & Siau, 2021).

The gap between theoretical learning and practical readiness may also be influenced by psychological and behavioural factors. Stress, anxiety and self-efficacy can influence nursing students' performance during simulated CPR (Mauriz et al., 2021), while attitude, subjective norms and self-efficacy have been associated with nursing students' intention to perform bystander CPR (Wati et al., 2021). Simulation-based resuscitation education offers an important means of addressing these gaps. Studies among nursing students have demonstrated improvements in CPR knowledge, practical performance and self-confidence following simulation-based training (Demirtas et al., 2021), while simulation-based advanced life support education has also been associated with greater knowledge, performance and self-efficacy than lecture-based education alone (Kim et al., 2020). However, limited data exist on Malaysian health trainees, particularly regarding readiness after formal instruction. Comparative evidence across academic programmes also remains limited.

This study was conceptually informed by Bloom's Taxonomy, particularly its cognitive domain for interpreting CPR knowledge (Bloom, 1956), and Kirkpatrick's Four-Level Training Evaluation Model (Kirkpatrick, 1994). CPR knowledge represented the cognitive learning component, while self-reported readiness reflected perceived preparedness and willingness to translate learning into practice.

Within Kirkpatrick's framework, the study primarily assessed Level 2 learning, while readiness was interpreted as a potential precursor to Level 3 behavioural application rather than a direct measure of behaviour change. Integrating these frameworks offers a theoretically grounded approach for interpreting the relationship between knowledge and readiness and informs the need for instructional interventions that support deeper learning, skill retention, and confidence in real-time application.

This study aimed to evaluate CPR knowledge and practical readiness among Malaysian healthcare trainees, addressing a gap in national-level data on readiness outcomes and informing curricular improvements across allied health education. It further sought to explore the association between knowledge and readiness and to examine whether programme affiliation influences these competencies. The findings are intended to inform CPR education strategies that go beyond knowledge transmission to foster confident, real-time clinical performance.

MATERIALS AND METHODS

A cross-sectional study was conducted to evaluate CPR knowledge and practical readiness among trainees at ILKKM KK. Sample size was calculated using the Raosoft calculator for a finite population of 150 eligible trainees, with a 95% confidence level and 5% margin of error, yielding a minimum required sample of 109 (Raosoft, 2004). A total of 120 trainees were recruited to enhance statistical power. The study was carried out between January and March 2024 and focused on two academic programmes in which CPR instruction is formally embedded: the Diploma in Medical and Health Sciences (DMHS) and the Diploma in Nursing (DPNS).

The study population comprised trainees from both programmes who had completed the CPR module as part of their coursework. Stratified random sampling was employed to ensure proportional representation across programmes and semesters. Trainees who had not yet received CPR instruction were excluded to maintain baseline uniformity in training exposure.

Data were collected using a structured, self-administered questionnaire distributed through Google Forms. The instrument comprised three sections: demographic information, theoretical CPR knowledge and readiness to perform CPR. The knowledge domain consisted of 15 multiple-choice questions developed with reference to the Basic Life Support Training Manual published by the Ministry of Health Malaysia (2023). Knowledge scores were categorised as high (≥12), moderate (8–11) and low (≤7) out of a maximum of 15 points. The readiness domain included 15 items measured using a three-point frequency scale scored as Never = 0, Sometimes = 1 and Always = 2, yielding a total score ranging from 0 to 30. Readiness scores were categorised as high (≥24), moderate (12–23) and low (≤11). These categories were used for descriptive interpretation of the study outcomes. All responses were anonymised at the point of collection and stored securely.

Data were analysed using IBM SPSS Statistics version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise participant characteristics and outcome variables. Internal consistency of the questionnaire was evaluated using Cronbach's alpha, yielding good reliability for the knowledge domain ($\alpha = 0.82$) and excellent reliability for the readiness domain ($\alpha = 0.88$).

The association between CPR knowledge and readiness levels was analysed

using the chi-square test of independence. Independent t-tests were used to compare knowledge and readiness scores between DMHS and DPNS trainees. Statistical significance was set at $p < .05$. The study received ethical approval from the Institutional Ethics Committee of ILKKM Kota Kinabalu. Informed consent was obtained from all participants prior to enrolment. Confidentiality and anonymity were strictly maintained throughout data collection and analysis.

RESULTS

A total of 120 trainees participated in the study, equally distributed between the Diploma in Medical and Health Sciences (DMHS) and Diploma in Nursing (DPNS) programmes. The gender distribution was balanced, with 60 male (50%) and 60 female (50%) participants. Most trainees (n = 87, 72.5%) were between 18 and 22 years old, and the majority had completed secondary education as their highest academic qualification (n = 116, 96.7%). Selected demographic characteristics are presented in Table 1.

CPR knowledge

In terms of CPR knowledge, 63 trainees (52.5%) demonstrated high knowledge (M = 13.5, SD = 0.8), 45 (37.5%) had moderate knowledge (M = 8.0, SD = 1.2), and 12 (10.0%) had low knowledge (M = 3.5, SD = 1.5) as shown in Figure 1. When disaggregated by programme, 33 of 60 DMHS trainees (55.0%) demonstrated high knowledge, compared to 30 of 60 DPNS trainees (50.0%). The mean knowledge score was slightly higher among DMHS trainees (M = 10.80, SD = 3.31) than DPNS trainees (M = 10.08, SD = 3.90), although the difference was not statistically significant, $t(118) = 1.10$, $p = .274$, 95% CI [−0.58, 2.03].

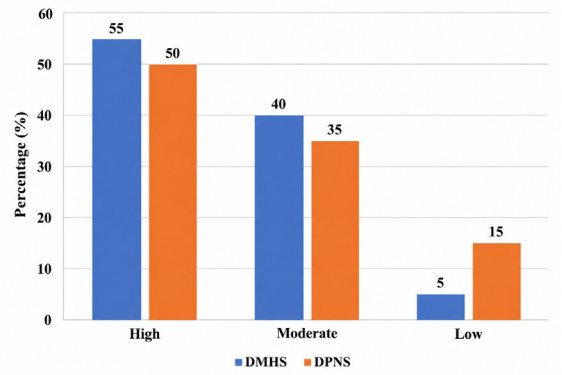

Figure 1: CPR knowledge level by programme.

CPR readiness

Regarding CPR readiness, 42 trainees (35.0%) reported high readiness (M = 25.5, SD = 3.2), 60 (50.0%) demonstrated moderate readiness (M = 15.5, SD = 2.8), and 18 (15.0%) reported low readiness (M = 5.0, SD = 2.5). High readiness was slightly more prevalent among DMHS trainees (40.0%) compared to DPNS trainees (30.0%). Mean readiness scores were slightly higher among DMHS trainees (M = 17.93, SD = 7.73) than DPNS trainees (M = 16.93, SD = 7.30), with no statistically significant difference, $t(118) = 0.73$, $p = .468$, 95% CI [−1.72, 3.72]. Detailed readiness results are shown in Table 2 and Figure 2. Differences in knowledge and readiness between DMHS and DPNS trainees are presented in Table 3.

Table 1: Demographic characteristics (N=120).

Variable	Category	Frequency (Percentage)
Gender	Male	60 (50.00%)
	Female	60 (50.00%)
Programme	DMHS	60 (50.00%)
	DPNS	60 (50.00%)
Highest Academic Qualification	Secondary Education	116 (96.70%)
	Tertiary Education (Diploma)	4 (3.30%)
	Tertiary Education (Degree)	0 (0.00%)

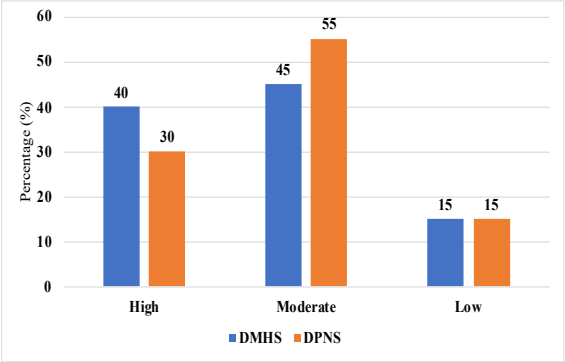

Figure 2: CPR readiness level by programme.

Association between knowledge and readiness

A chi-square test of independence revealed a statistically significant association between CPR knowledge and readiness levels, $\chi^2(4, N = 120) = 27.06$, $p < .001$, indicating a moderate effect size (Cramér's V = .34). Trainees with higher knowledge levels were more likely to report high readiness. The association between CPR knowledge and readiness levels is presented in Table 4.

DISCUSSION

Cardiopulmonary resuscitation (CPR) remains a cornerstone intervention in the management of cardiac arrest, with its timely administration pivotal in improving survival outcomes (Merchant et al., 2020). This study evaluated the level of CPR knowledge and practical readiness among trainees enrolled in the Diploma in Medical and Health Sciences (DMHS) and Diploma in Nursing (DPNS) programmes at the Training Institute Ministry of Health Malaysia Kota Kinabalu (ILKKM KK). The findings offer a holistic view of CPR preparedness among these future healthcare professionals, highlighting both competencies achieved and critical areas for pedagogical enhancement.

The assessment of CPR knowledge revealed that a majority of trainees demonstrated high levels of theoretical understanding, although a substantial proportion remained within the moderate and low knowledge categories. This finding suggests that formal curricular exposure alone may not produce uniform levels of knowledge

Table 2: Distribution of CPR knowledge and readiness levels by programme (N = 120).

Variable	DMHS	DPNS	Total
Knowledge Level			
High Knowledge, n (%)	33 (55.0%)	30 (50.0%)	63 (52.5%)
Moderate Knowledge, n (%)	24 (40.0%)	21 (35.0%)	45 (37.5%)
Low Knowledge, n (%)	3 (5.0%)	9 (15.0%)	12 (10.0%)
Readiness Level			
High Readiness, n (%)	24 (40.0%)	18 (30.0%)	42 (35.0%)
Moderate Readiness, n (%)	27 (45.0%)	33 (55.0%)	60 (50.0%)
Low Readiness, n (%)	9 (15.0%)	9 (15.0%)	18 (15.0%)

Table 3: Comparison of CPR knowledge and readiness scores between DMHS and DPNS trainees (N = 120).

	DMHS Mean ± SD	DPNS Mean±SD	Mean Difference	t(df)	p-value	95% CI
CPR Knowledge Score	10.80 ± 3.31	10.08 ± 3.90	0.73	1.10 (118)	.274	-0.58 to 2.03
CPR Readiness Score	17.93 ± 7.73	16.93 ± 7.30	1.00	0.73 (118)	.468	-1.72 to 3.72

Table 4: Association between CPR knowledge and readiness levels (N = 120).

Knowledge Level	Low Readiness	Moderate Readiness	High Readiness	Total	χ^2	p	Cramér's V
Low Knowledge	5	6	1	12	X^2 (4, N=120) = 27.06	< .001	0.34
Moderate Knowledge	6	32	7	45			
High Knowledge	7	22	34	63			
Total	18	60	42	120			

across trainees. Variability in CPR knowledge, attitude and practice has also been reported among healthcare professionals in Malaysia (Mughni, 2024). Similar concerns have been observed internationally. Mohammed et al. (2020), for example, reported adequate CPR knowledge among only 31.7% of junior doctors and 6.2% of medical students despite generally positive attitudes towards CPR training. Retention is another important consideration. Aqel and Ahmad (2014) found that although high-fidelity simulation improved CPR knowledge and skill acquisition and retention compared with traditional instruction, significant deterioration in both knowledge and skills was evident three months after training. These findings reinforce the importance of continued reinforcement rather than reliance on a single episode of CPR instruction.

Readiness to perform CPR, as captured in this study, extends beyond cognitive understanding to include willingness, perceived preparedness and confidence in responding to an emergency. A substantial proportion of trainees reported only moderate or low readiness despite relatively favourable knowledge levels, suggesting that knowledge alone may not translate directly into willingness to act. Evidence from nursing students supports this distinction. Wati et al. (2021) found that attitudes, subjective norms and self-efficacy were significantly associated with intention to perform bystander CPR. Similarly, Mao et al. (2021) reported that behavioural attitudes, subjective norms and perceived behavioural control were significant predictors of willingness to perform bystander CPR among university students. These findings support the view that readiness is influenced by cognitive, psychological and behavioural factors rather than knowledge alone.

Several factors may contribute to the observed readiness gap. Limited opportunities for repeated practice, insufficient exposure to realistic resuscitation scenarios and psychological responses during emergencies may affect a trainee's ability to translate knowledge into action. Mauriz et al. (2021) demonstrated that stress, anxiety and socio-emotional factors are relevant to nursing students' clinical performance during simulated CPR. Simulation may help address some of these challenges. Demirtas et al. (2021) reported improvements in CPR knowledge, practical skills and self-confidence following simulation-based CPR training, while Takhdat et al. (2022) found higher CPR knowledge retention and self-efficacy following high-fidelity simulation compared with case-based learning. Repeated simulation experience has also been associated with improved perceived self-efficacy among nursing students (Al Gharibi et al., 2021). Collectively, these findings support educational strategies that combine cognitive learning with repeated experiential practice.

The significant association observed between knowledge and readiness in this study supports the interrelated nature of cognitive and behavioural components of CPR education. Trainees with higher knowledge levels were more likely to report greater readiness, although the moderate effect size (Cramér's V = .34) indicates that knowledge does not fully explain readiness. Self-efficacy and behavioural intention may contribute to this relationship, as demonstrated among nursing students by Wati et al. (2021). Training frequency and instructional format may also

influence longer-term competence. Oermann et al. (2022) demonstrated that the spacing and scheduling of CPR practice influenced subsequent skill retention, while Takhdat et al. (2022) showed that high-fidelity simulation supported both knowledge retention and self-efficacy. These findings suggest that the relationship between knowledge and readiness should be interpreted within the wider context of training exposure, psychological preparedness and opportunities for repeated practice.

The comparative analysis between DMHS and DPNS trainees revealed no statistically significant differences in CPR knowledge or readiness scores. Although minor variations were observed between the programmes, programme affiliation was not associated with meaningful differences in these outcomes. This may reflect comparable exposure to core CPR content across both programmes. Nevertheless, contextual factors such as instructional approaches, opportunities for skills practice and clinical exposure may warrant further investigation. Examining these factors in future cohorts could help determine whether differences in educational experience influence subsequent CPR competence and readiness.

The findings have important implications for CPR education. Regular reinforcement should form part of efforts to sustain CPR competence, as skill retention is influenced by both the frequency and spacing of training (Sand et al., 2021; Oermann et al., 2022). Simulation-based learning should therefore be considered a longitudinal educational strategy rather than a one-time activity. High-fidelity simulation has demonstrated benefits for CPR knowledge and skill acquisition and retention (Aqel & Ahmad, 2014), while simulation-based advanced life support education has improved nursing students' knowledge, performance and self-efficacy (Kim et al., 2020). More recent evidence also indicates that both mannequin-based and virtual simulation approaches can improve nursing students' CPR learning outcomes (Abbasi et al., 2024). Repeated simulation may further support self-efficacy and provide opportunities for learners to identify and correct performance gaps (Al Gharibi et al., 2021). Tucker et al. (2023) similarly found improved resuscitation self-efficacy following simulation, although rapid cycle deliberate practice did not provide a significant additional advantage over standard simulation. Psychological preparedness should therefore be addressed alongside technical competence, particularly because stress, anxiety and self-efficacy can influence performance during simulated CPR (Mauriz et al., 2021).

These findings carry significant implications for health education policy, particularly regarding the standardisation of CPR curricula and the reinforcement of instructor training strategies across academic programmes. The variability in CPR knowledge and readiness levels, even within structured institutional syllabi, supports the need for formal integration of recurring CPR instruction throughout the academic cycle. National guidelines should prioritise longitudinal simulation-based assessments rather than limiting CPR evaluation to a single module. Institutions such as the Ministry of Health and the Malaysian Qualifications Agency may consider endorsing policies that embed repeated exposure to high-fidelity simulations and practical assessments throughout healthcare training. Additionally, CPR instructor training should extend beyond technical skills to include pedagogical strategies that strengthen learners' confidence, reduce psychological barriers, and enhance real-time decision-making. Competency frameworks for educators may include modules on emotional preparedness, scenario-based debriefing, and cognitive-behavioural facilitation techniques. Institutionalising these enhancements will strengthen CPR education quality and support national objectives to improve early response rates and survival outcomes in cardiac emergencies.

Despite its strengths, this study is not without limitations. The cross-sectional design

restricts causal inference, and the reliance on self-reported readiness introduces potential for social desirability bias. Future research should incorporate objective skill assessments, behavioural simulations, and longitudinal follow-up to evaluate the evolution of CPR competence over time. Triangulating quantitative data with qualitative insights from students and instructors may also provide a more nuanced understanding of what facilitates or impedes CPR readiness in the academic environment.

In conclusion, this study contributes critical insight into the interdependence of CPR knowledge and readiness among healthcare trainees in Malaysia. While theoretical instruction appears effective in imparting foundational knowledge, readiness to act remains a multifactorial challenge that requires curricular innovation. Embedding refresher courses, simulation-based practice, and psychological readiness training into CPR education can help bridge the theory-practice divide. Preparing future healthcare professionals for real-time cardiac emergencies demands more than knowledge and requires confidence, competence and readiness to respond without hesitation.

CONCLUSION

The findings suggest a need to strengthen CPR curriculum guidelines through structured refresher training, simulation-based assessments, and reinforcement of readiness beyond theoretical instruction. Incorporating confidence-building strategies and repeated hands-on practice within national academic frameworks may improve trainee preparedness. Future curriculum revisions should prioritise practical readiness and consider standardising instructor development to ensure consistent delivery across institutions.

CONFLICT OF INTEREST

The authors declare no conflicts of interest. No financial or external support was received that could have influenced the design, conduct, or reporting of this study. The research was conducted independently as part of academic work within the Training Institute Ministry of Health Malaysia Kota Kinabalu.

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