Original Article

CPRural

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Abstract

Introduction: The purpose of our study was to determine if regular cardiopulmonary resuscitation (CPR) practise improved the quality of nurses' chest compressions in a rural hospital.

Methods: The study was a prospective interventional trial measuring the effectiveness of brief, monthly CPR practice for rural nurses. The quality of nurses' chest compressions was measured before and after monthly practise with an interactive feedback device at the Golden and District Hospital, a rural facility in BC.

Results: All three components of high-quality CPR (depth, recoil and rate) improved significantly.

Conclusion: Monthly practise of chest compressions with an interactive feedback device improved the quality and confidence of nurses' CPR skills. These results suggest that a higher frequency of CPR practice (than the minimum annual recertification) would improve both the quality and retention of CPR skills, specifically for low-volume rural hospitals.

Keywords: Cardiopulmonary resuscitation, cardiopulmonary resuscitation, chest compressions

Résumé

Introduction: Notre étude visait à déterminer si la pratique régulière de la réanimation cardio-respiratoire (RCR) améliore la qualité des compressions thoraciques réalisées par le personnel infirmier dans un hôpital en région rurale.

Méthodes: Il s'agit d'une étude interventionnelle prospective ayant mesuré l'efficacité de la brève pratique mensuelle de la RCR par le personnel infirmier des régions rurales. La qualité des compressions thoraciques effectuées par le personnel infirmier a été mesurée avant et après la pratique mensuelle avec un dispositif interactif de rétroaction à l'hôpital *Golden and District*; un établissement situé en région rurale de la Colombie-Britannique.

Résultats: Les trois éléments de la RCR de grande qualité (profondeur, relaxation et rythme) se sont considérablement améliorés.

Conclusion: La pratique mensuelle des compressions thoraciques avec un dis- positif interactif de rétroaction a permis d'améliorer la qualité des compétences en RCR du personnel infirmier et la confiance en ces compétences. Ces résultats laissent croire que la plus grande fréquence de la pratique de la RCR (plutôt que le renouvellement annuel minimal de la certification) améliorerait la qualité et la rétention des compétences en RCR, en particulier dans les hôpitaux des régions rurales à faible volume.

Keywords: Réanimation cardio-respiratoire, réanimation cardio-pulmonaire, compressions thoraciques

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INTRODUCTION

This study examines the quality of nurses' chest compressions when measured before and after monthly practise for 3 consecutive months at a rural low-volume hospital. This paper presents practise guidelines recommended for rural practitioners within low-volume hospitals hoping to improve cardiac arrest outcomes. It is well established that high-quality cardiopulmonary resuscitation (CPR) is a cornerstone of cardiac arrest care and has a direct impact on survival and favourable neurologic outcomes. Certainly, current training and certification methods do not reflect this[1]. While yearly CPR recertification is required of nurses, evidence suggests that CPR skills deteriorate within 3 months.[2,3] Sutton *et al.*[4] assert that low-dose, high-frequency CPR training improves retention in paediatric providers at a high-volume site. The importance of CPR and the inadequacy of current training methods highlight the need for a more regular and reliable method of ensuring CPR retention and quality in low-volume sites. While studies to date have not demonstrated that real-time use of CPR feedback devices improves survival and favourable neurologic outcomes[5], they nevertheless have potential as a training tool.

Low-volume sites

Looking specifically at low-volume rural sites posits an even greater need for regular practise. Shin *et al.*[6] identify that emergency departments with a higher incidence of CPR cases had better outcomes for cardiac arrests than lower-volume sites. An extension of Shin *et al.*'s[7] conclusion suggests that CPR practice is even more important at low-volume hospitals. Regular practise with a feedback device has the potential to help offset the low incidence of cardiac arrest cases at rural sites, allowing rural practitioners to maintain their skills and confidence.

The majority of studies on CPR quality and education were conducted at high-volume sites and/or teaching hospitals with the inclusion of interactive feedback devices. Limited data exist for low-volume sites with more general practise areas.

Literature review

We conducted a literature review using the search terms

CPR, cardiopulmonary resuscitation, CPR training, CPR retention, audiovisual feedback device, rural hospitals and low-volume sites.

METHODS

Trial design

This project was a prospective interventional trial with the primary endpoint being the effectiveness of brief monthly CPR practice with a visual feedback device.

Participants

All registered nurses (RNs) and licensed practical nurses (LPNs) working on the general inpatient ward and/or in the emergency department at the Golden and District Hospital were eligible for inclusion in this study. Providers were not excluded based on timing of previous CPR training, as this was thought to best represent actual in-hospital conditions.

Quantitative cardiopulmonary resuscitation feedback device

A commercial CPR assessment tool (CPRmeter [Laerdal]) was used to both record CPR quality and to provide visual feedback during training sessions.

Assessment and outcome measures

Using the CPRmeter (with the feedback screen covered), individuals were assessed by study investigators in regards to depth, recoil and rate for 2 min of compression-only CPR at the outset of the trial. Results were reported as the percentage of total compressions during the 2 min that met the American Heart and Stroke Association 2015 CPR guidelines. Before this, the CPRmeter was thoroughly explained to each participant and verbal consent was obtained. Participants were then urged to do a 2-min compression-only CPR session each month with the real-time visual feedback from the CPRmeter. The CPRmeter and a mannequin were left set up in a storage room so participants could access it at any time. Percentages were not recorded

as this practise was self-directed. Participants would then inform the study investigators when they had completed their monthly training. After 3 consecutive months, individuals were again assessed by the study investigators with the feedback screen covered for 2 min of compression-only CPR.

A two-tailed *t*-test for dependent means was used to compare the pre- and post-practise depth, recoil and rate results. This test requires data to be normally distributed, with the scale of measurement being either interval or ratio and the two sets of scores being paired or matched in some way. We used an online calculator, which can be found at www.socscistatistics.com/tests/ttestdependent/Default2.aspx.

Our significance level was predetermined at a $P < 0.05$.

Survey

Participants were also asked to complete an online survey, which was administered near the end of the study.

RESULTS

Participation

In total, we had 18 RNs and LPNs enroll in the study. Two RNs were lost to follow-up (one to maternity leave and one who moved). Both of these nurses had completed all 3 monthly practise sessions, and as such, we opted to include them in our completion calculation. A total of 13 of the 18 nurses (72%) completed all 3 monthly training sessions.

Depth, recoil and rate

The results from the pre- and post-practise testing for 16 nurses that completed both were compared [Table 1].

A mean improvement was observed for depth (22%), recoil (28%) and rate (44%). This difference was statistically significant for depth ($P = 0.0056$), recoil ($P = 0.19$) and rate ($P = 0.0077$).

Table 1: Pre- and post-practise results

	Pre-study average (%)	Post-study average (%)	Mean difference (%)	*P*
Depth	78	99	22	0.0056
Recoil	56	84	28	0.019
Rate	30	68	44	0.0077

SURVEY RESULTS

Ten of the 18 nurses in the study completed the survey. Eight of the 10 respondents had increased confidence in their CPR quality from monthly practise. All 10 thought regular CPR practice would benefit their overall skill-set. Eight respondents admitted to not having an accurate perception of their ability to perform CPR before the study and 5 respondents (50%) had actually practised more than once per month. Nine respondents (90%) thought the CPRmeter adequately represented CPR on a person, yet only 5 (50%) said they would be more likely to use the CPRmeter during a real cardiac arrest.

DISCUSSION

Regular CPR practice with interactive feedback tools improves the quality, retention and confidence of nurses' chest compressions in rural hospitals. Brief, high-frequency practise of CPR bridges recertification gaps and provides opportunities for personal practise needs. Oermann *et al*.[8] agree that CPR practice as brief as 6 min/month could improve psychomotor CPR skills over time. While it is hard to draw firm conclusions from a survey that was completed by only 10 participants, it does seem to suggest that frequent use and familiarity with the CPRmeter generates increased interest in CPR and leads to nurses taking pride in their CPR quality. Familiarity with the CPRmeter is crucial to replicate high-quality CPR in clinical cardiac arrests.

In small rural hospitals, the frequency of CPR is lower in practise, yet no less important in the outcome. Rural hospitals are often underserviced and medical personnel work in small teams which means nurses are often doing CPR. Implementing practise recommendations for low-volume sites ensures nurses are adequately prepared to deliver high-quality CPR. This concept is widely recognised in rural settings with the use of simulation to practise lesser-used skills, however, the foundational skill of CPR is often neglected.[9-11]

Nurses delivering high-quality CPR contribute to better patient outcomes. Examining successes of higher-volume hospitals reflect differences in individual sites' approach to resuscitation education, care and quality improvement. Girotra *et al.*[12] assert that innovative methods, with the inclusion of simulation and feedback devices, all contribute to improving cardiac arrest outcomes. Edelson *et al.*[13] argue that the use of a feedback device, in combination with debriefing, contributes to improved clinical outcomes represented in higher rates of return of spontaneous circulation. Using interactive feedback devices in rural settings offsets low volume occurrences with frequent, high-quality practise. Rural nurses have diverse skill sets that they are expected to maintain for various practise areas. The use of a feedback device for compressions allows self-directed high-quality practise of basic lifesaving skills. Traditional CPR training and recertification have involved time outside of work, coordinating courses and instructors and for some rural sites, even travel from home. Regular use of the feedback device is a simple and effective way to maintain skills on an individual basis outside of the confines of annual courses.

Study limitations

This study has a small sample size reflective of rural hospitals. Further studies could include and compare a greater number of rural hospitals. Our data do not include clinical outcomes but suggest that increased practise and confidence in CPR will lead to better clinical outcomes. In addition, feedback devices used in actual cardiac arrests provide data to compare between practise and real-time CPR.

A second limitation of this study is that 5 of the 10 nurses who completed the questionnaire (and thus at least 5 of the 18 total nurses) admitted to violating the study protocol by practicing more than once per month. While this protocol violation makes it difficult to conclude specifically that monthly practise improves CPR quality, it does not detract from the conclusion that regular practise improves CPR quality at low-volume sites.

A visual inspection of the raw data reveals a seemingly unusual number of zero per cent scores for rate, which made us question whether in fact the rate data are normally distributed.

CONCLUSION

Implementing regular CPR practice for nurses at low-volume sites reduces gaps between training and fosters confidence in life-saving skills. Increasing the frequency and quality of CPR practice with the use of interactive feedback devices may lead to better cardiac arrest outcomes in low-volume sites.

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