Cardiac Arrest Nurse Leadership (CANLEAD) trial: a simulation-based randomised controlled trial implementation of a new cardiac arrest role to facilitate cognitive offload for medical team leaders

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Handling editor Mary Dawood

► Additional material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/emermed-2019-209298).

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Received 15 November 2019
Revised 20 November 2020
Accepted 24 December 2020

To cite: Pallas JD, Smiles JP, Zhang M. *Emerg Med J* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/emermed-2019-209298

ABSTRACT

Background Medical team leaders in cardiac arrest teams are routinely subjected to disproportionately high levels of cognitive burden. This simulation-based study explored whether the introduction of a dedicated 'nursing team leader' is an effective way of cognitively offloading medical team leaders of cardiac arrest teams. It was hypothesised that reduced cognitive load may allow medical team leaders to focus on high-level tasks resulting in improved team performance.

Methods This randomised controlled trial used a series of in situ simulations performed in two Australian emergency departments in 2018–2019. Teams balanced on experience were randomised to either control (traditional roles) or intervention (designated nursing team leader) groups. No crossover between groups occurred with each participant taking part in a single simulation. Debriefing data were collected for thematic analysis and quantitative evaluation of self-reported cognitive load and task efficiency was evaluated using the NASA Task Load Index (NTLX) and a 'task time checklist' which was developed for this trial.

Results Twenty adult cardiac arrest simulations (120 participants) were evaluated. Intervention group medical team leaders had significantly lower NTLX scores (238.4, 95% CI 192.0 to 284.7) than those in control groups (306.3, 95% CI 254.9 to 357.6; p=0.02). Intervention group medical team leaders working alongside a designated nursing leader role had significantly lower cognitive loads than their control group counterparts (206.4 vs 270.5, p=0.02). Teams with a designated nurse leader role had improved time to defibrillator application (23.5 s vs 59 s, p=0.004), faster correction of ineffective compressions (7.5 s vs 14 s, p=0.04), improved compression fraction (91.3 vs 89.9, p=0.048), and shorter time to address reversible causes (107.1 s vs 209.5 s, p=0.002).

Conclusion Dedicated nursing team leadership in simulation based cardiac arrest teams resulted in cognitive offload for medical leaders and improved team performance.

Key messages

What is already known on this subject

- ► Emergency nurses have been identified as capable team leaders in a number of clinical contexts including trauma teams and hospital-based resuscitation teams.
- ► A medical practitioner tasked as the only leader of a cardiac arrest team has a disproportionately higher cognitive burden than that of the other team members.
- ► No published studies were located examining the impact that adding a designated nursing team leader to an arrest team had on the medical team leader's cognitive load.

What this study adds

- ► This simulation-based randomised controlled trial found that adding a nursing team leader role to a cardiac arrest team facilitates both significant cognitive offload for medical team leaders and significant improvements in objective team performance.
- ► The addition of nursing team leaders warrants further investigation as a means of optimising cardiac arrest management in the hospital setting.

INTRODUCTION

An individual's cognitive load is a summative measure of various task-specific demands and a number of psychological and emotional factors, as well as.[1] Iskander suggests that an individual's capacity to manage increasing cognitive load is fixed, thus increasing the importance of finding novel ways to reduce task specific demands and psychoemotional stressors for healthcare providers.[1]

In the traditional composition of a cardiac arrest team, cognitive demand on medical team leaders quickly becomes disproportionate compared with other team members.[2] This can contribute to cognitive overload, in which a clinician is so mentally burdened it becomes difficult to process new data.[3]

While the presence and performance of medical team leaders in cardiac arrest is widely explored in the available literature,[4] evidence exploring the impact of a dedicated nursing team leader on team dynamics and cognitive load is scarce.

A review by Clements and Curtis highlights the significant contribution nurses make to communication, leadership and teamwork within this environment but recommended the need for research in this area.

There is no current data examining how cognitive load affects team performance in the setting of cardiac arrest.

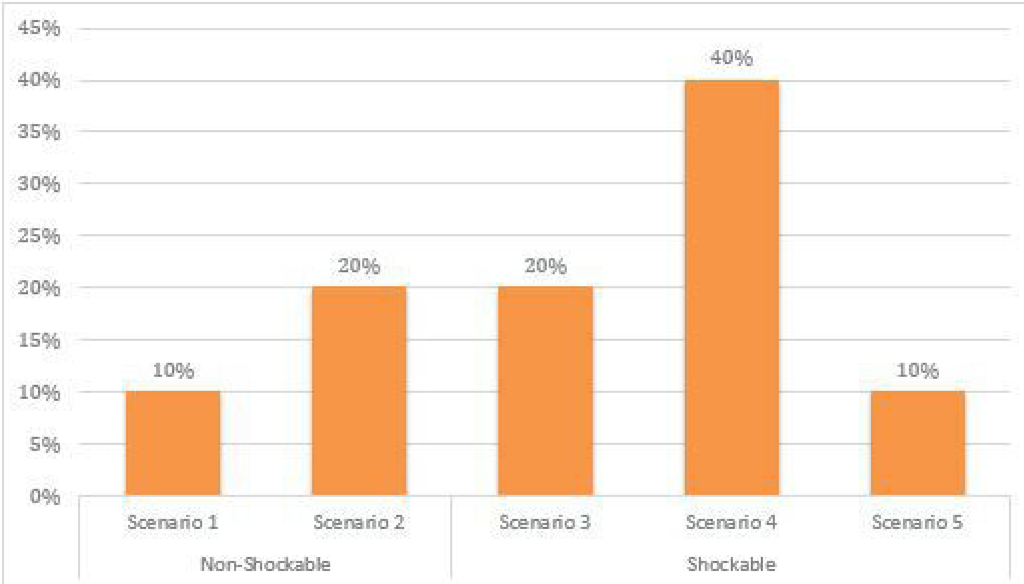

Figure 1 CANLEAD scenario distribution. CANLEAD, Cardiac Arrest Nurse Leadership.

AIM

The primary outcome of this study was to determine whether a dedicated nursing team leader role within a cardiac arrest team positively impacted the cognitive burden of medical team leaders. The secondary outcome was to assess whether the intervention maintained or improved the team's ability to achieve recognised time sensitive resuscitation goals, such as timely defibrillation and high-quality cardiopulmonary resuscitation.

METHODS

Trial design

We conducted a non-blinded, randomised controlled trial within the emergency departments (EDs) of two large metropolitan hospitals in Newcastle, Australia—the John Hunter Hospital and Maitland Hospital. Existing teams performed simulations of ED cardiac arrest resuscitations and were randomised to either an intervention or control group. Within available clinical areas of the ED, high-fidelity simulation equipment (Laerdal Simulation Mannequin and iSimulate ALSi system) was used along with standard resuscitation equipment to improve fidelity.

This trial was intended to run for a maximum of 18 months (starting recruitment in January 2017) or until a point was reached wherein it became impossible to perform further simulations without involving personnel in more than one simulation.

Participants

All participants were recruited from the group of available staff on the day of the simulation. Each participant could take part in only one single simulation during the course of the data collection period.

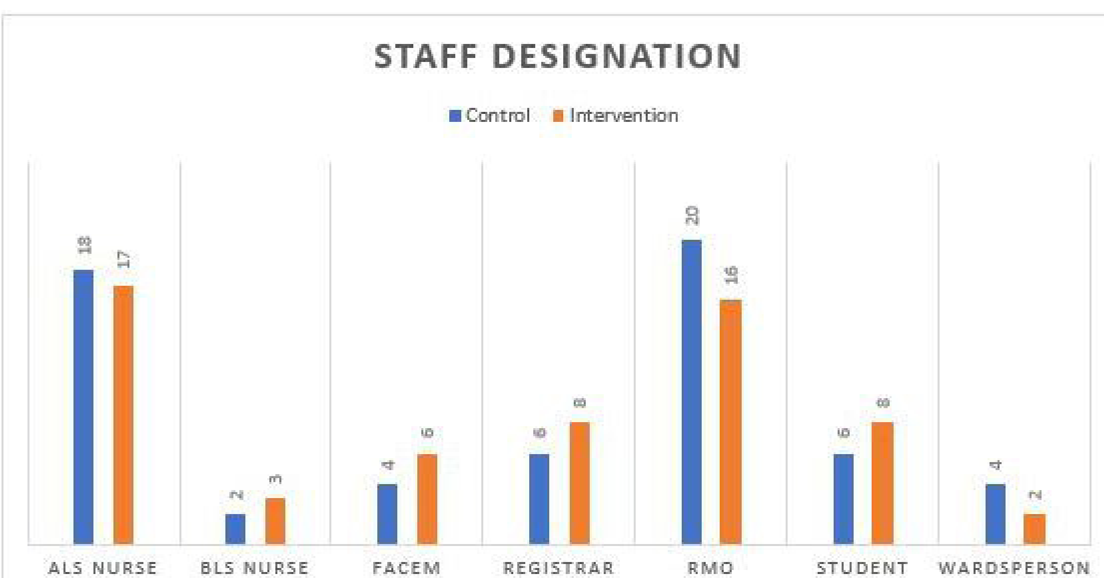

Figure 2 Designations of staff involved all CANLEAD simulations. ALS, advanced life support; CANLEAD, Cardiac Arrest Nurse Leadership; FACEM, Fellow of the Australasian College of Emergency Medicine; RMO, resident medical officer.

Table 1 NASA TLX

	Intervention group		Control group		
	Mean	SD	Mean	SD	P value
Group					
Group Total	1525.1	233.01	1592.5	276.17	0.28
Medical team leader	238.4	64.82	306.3	71.82	0.02
Nursing team leader*	223.0	47.09	255.5	83.82	0.15

*'Nursing team leader' values in the control group relate to the senior control nurse role.
TLX, Task Load Index.

All simulations involved three doctors (at least one at registrar level or above), two advanced life support (ALS) trained nurses, one additional non-ALS trained staff member, one investigator and one simulation confederate (an embedded participant). The simulation confederate provided 'assistance' to the team in the form of chest compressions. The confederate in all scenarios was instructed to perform overtly ineffective chest compressions until they were corrected by a participant. For all subsequent cycles, normal compressions were provided.[5]

Randomisation and blinding

Participating groups were randomised to either an intervention group (with the predefined nursing team leader) or a control group (standard roles). The order of sample allocation was randomised prior to commencement of the study using the 'Research Randomiser' electronic randomisation package.[6] Researchers and participants were blinded to this assignment until the team had been consented and assembled.

Interventions

The primary intervention in this study was the designation of a 'nursing team leader' within the cardiac arrest team. After randomisation, intervention teams underwent a presimulation briefing during which the most senior ALS trained nurse on the team was designated as the nursing team leader. Nursing team leaders in this study did not know this would be their role ahead of time and received no specific training prior to enrollment in the study. During the presimulation briefing, they were told that their role would be to perform a fixed set of tasks during the simulated cardiac arrest. The tasks were selected from International liaison committee on resuscitation (ILCOR) advanced life support (ALS) recommendations to reflect essential elements of the resuscitation process[7] and consisted of:

- Timing 2 min cycles.
- Manually performing rhythm checks and safe defibrillation.
- Supervising the quality of chest compressions.
- Prompting epinephrine administration.

The remaining participants in the intervention groups and all participants in the control groups were instructed to delineate roles at their discretion under the guidance of the medical team leader, as was considered standard practice in the participating departments.

Each scenario was written by an ALS instructor credentialed by the Australian Council of Critical Care Nurses before being ratified by the study investigators.

Measurements

At the completion of every simulation, all team members were required to self-rate their own cognitive load using the NASA task load index (NTLX). The NTLX is a comprehensively validated tool that facilitates quantification of each participant's cognitive load. The NTLX has been used extensively across numerous fields (including aviation and medicine) for over 30 years to quantify human performance in relation to workload and has high the test–retest reliability and construct validity[8] The NTLX uses a self-reported score across six distinct dimensions to

Table 2 Individual demand levels

	Intervention group		Control group		
	Mean	95% CI	Mean	95% CI	P value
Group total					
Total demand	1317.1	1166.0 to 1468.2	1379.8	1218.2 to 1541.3	0.26
Mental demand	56.4	50.9 to 61.8	55.5	49.5 to 61.5	0.42
Physical demand*	38.8	10 to 65	38.8	16.23 to 61.23	0.54
Temporal demand	47.7	42.2 to 53.2	50.5	45.5 to 55.6	0.23
Effort required*	60	50 to 65	51.25	47.5 to 75	0.77
Frustration level*	16.25	5 to 30	21.3	6.25 to 45	0.15
Medical team leader					
Total demand	206.4	161.0 to 251.7	270.5	224.0 to 317.0	0.02
Mental demand	64.5	53.1 to 75.9	72	59.5 to 84.5	0.16
Physical demand*	7.5	5 to 17.5	16.3	7.5 to 25	0.15
Temporal demand	49.1	31.6 to 66.6	71	57.9 to 84.1	0.02
Effort required*	60	52.5 to 65	68.8	50 to 80	0.27
Frustration level*	11.3	0 to 25	40	20 to 72.5	0.06
Nursing team leader†					
Total demand	187.5	152.6 to 222.4	223.8	164.7 to 282.8	0.12
Mental demand	60.5	45.7 to 75.3	62	44.4 to 79.6	0.44
Physical demand*	10	2.5 to 15	43.8	5 to 50	0.08
Temporal demand	43.8	27.8 to 59.7	49.3	31.8 to 66.7	0.3
Effort required	51.8	32.3 to 71.2	55.8	37.3 to 74.2	0.37
Frustration level*	16.3	15 to 25	8.8	5 to 35	0.73

Mean values and their 95% CIs are used for the results in this table unless stated otherwise.
*Presented as median and IQR.
†'Nursing team leader' values in the control group relate to the senior control nurse role.

Table 3 Self-rated performance

	Intervention group		Control group		
	Median	IQR	Median	IQR	P value
Group					
Medical team leader	30	20–50	27.5	17.5–65	0.97
Nursing team leader*	31.3	25–50	25	17.5–30	0.12
Group total	30	17.5–50	30	17.5–50	0.71

*'Nursing team leader' values in the control group relate to the senior control nurse role.

produce a reliable numerical measurement of 'workload' immediately following a given task.[9]

Outcomes

The primary outcome assessed by this study was the cognitive load of the medical team leader in the arrest team. As all participants completed the NTLX, an analysis of the remaining participants' cognitive loads was undertaken as a secondary measure.

The cognitive load of the 'nursing team leaders' was evaluated as these individuals were deemed to be at high risk of being cognitively overburdened by the transfer of responsibility from the medical team leader. To compare the cognitive load between the 'nursing team leader' and the usual role of an experienced nurse in an arrest, we compared cognitive load of the 'nursing team leader' in the intervention group to that of the most experienced ALS trained nursing participant in the control group—henceforth referred to as the 'senior control nurse'.

To determine where the intervention had the greatest effect, the investigators of this trial employed a novel analysis that separated the raw NTLX results into two distinct subgroups. The NTLX consists of six domains, 'performance' can be regarded as the individually perceived outcome of performing a task, while the five remaining items (mental demand, physical demand, temporal demand, effort and frustration) are more direct measures of the actual demands required to accomplish the task. We considered that these five items together formed a comprehensive term of 'Demand' to summarise the efforts of the participants to meet their designated tasks. 'Demand' acted as a surrogate for 'cognitive load'. It should be noted that this demarcation between Performance and Demand is specific to this trial and has not undergone an external validation process and the results from this analysis should be interpreted accordingly.

To ensure that improved cognitive load did not come at the expense of high-quality goal directed care, we also assessed each team's performance in managing the arrest. A 'task time checklist' (online supplemental appendix A) was developed by the trial investigators to record the time taken to achieve critical goals in the management of each arrest. Outcomes to be measured were drawn from international best practice recommendations for the treatment of cardiac arrest.[10] To facilitate accurate measurement of these values, each simulation was video recorded. To improve the reliability of the data collected, a single designated trial investigator completed the task time checklist following the completion of each individual simulation.

Finally, the study group also developed a standardised Cardiac Arrest Nurse Leadership (CANLEAD) debriefing tool (online supplemental appendix B) to guide a succinct defusing debrief following each simulation. The tool used a plus-delta model to explore the positive elements of team performance, and areas requiring improvement.[11] Field notes were recorded by the trial investigators during each of the 20 debriefings using the CANLEAD debriefing tool. To guide the qualitative analysis of

Table 4 Task time checklist results

	Intervention group		Control group		
	Mean	95% CI	Mean	95% CI	P value
Time to defib app (s)*	23.5	15 to 34	59	35 to 78	0.004
Time to first rhythm check (s)*	72	50 to 110	89	66 to 103	0.43
Time off chest for					
First rhythm check (s)*	10	5 to 11	9.5	7 to 10	1.0
Second rhythm check (s)*	10	9 to 11	9	8 to 10	0.42
Third rhythm check (s)	9.6	7.8 to 11.4	10.5	8.0 to 13.0	0.26
Fourth rhythm check (s)	11.67	8.3 to 15.0	11	8.1 to 13.9	0.37
Average time off chest (s)	9.94	8.2 to 11.7	10.5	9.0 to 11.9	0.3
Algorithm followed, n (%)	9 (90)		7 (70)		
Time to first shock (s)	4.75	2.7 to 6.8	4.43	2.8 to 6.1	0.39
Time to second shock (s)	5.25	3.7 to 6.8	4.38	3.3 to 5.5	0.14
Time to third shock (s)	5.89	4.0 to 7.8	6.25	3.3 to 9.2	0.4
Time to fourth shock (s)*	6	5 to 9	5	4 to 7	0.31
Average preshock pause (s)	6.42	4.6 to 8.2	4.25	2.4 to 6.1	0.04
Time to first check for reversible causes (s)	107.1	76.4 to 137.8	209.5	144.6 to 274.4	0.002
Time to airway (s)*	68.5	40 to 180	82	60 to 180	0.45
What airway adjunct, n (%)	OPA 5 (50), LMA 5 (50)		OPA 3 (30), LMA 7 (70)		
Compression fraction	91.30%	90.1% to 92.5%	89.90%	88.5% to 91.3%	0.048
Time to correct ineffective compressions (s)*	7.5	5 to 10	14	10 to 20	0.04
Length of first CPR cycle (s)	95.4	74.9 to 115.9	110.8	82.3 to 139.3	0.17
Length of second CPR cycle (s)*	117	110 to 127	116	102 to 127	0.76
Length of third CPR cycle (s)*	109.5	102 to 118	115	97 to 142	0.60
Length of fourth CPR cycle (s)	120.7	111.2 to 130.2	111.8	88.9 to 134.7	0.21
Average CPR cycle length (s)	113.7	105.1 to 122.2	114.2	101.4 to 127.1	0.53

Mean values and 95% CI are used for the results in this table unless stated otherwise.
*Presented as median and IQR.
CPR, cardiopulmonary resuscitation; LMA, laryngeal mask airway; OPA, oropharyngeal airway.

Table 5 Thematic analysis coding examples

Theme	Subtheme	Example
Communication	Closed loop communication was beneficial	'…closing the communication loop saved me having to chase people which freed me up to think about what comes next'—Doctor (Intervention)
	Good communication improved task performance	'COACHED (defibrillation algorithm) ran really well with someone saying the different steps out loud to the group'—Nurse (Intervention) 'I wanted to correct the chest compressions earlier but I wasn't sure if it was my place so I just let them carry on'—Nurse (control)
	Clear communication improved team members receptiveness	'The way you used my name and touched me on the arm when you spoke made everything very clear. It was easy to process what you were asking'—Nurse (Intervention)
Team leadership	Nurses found the leadership role empowering	'I'm a big believer in the importance of the nursing team leader. Running an arrest gives us a great chance to use the skills we train for'—Doctor (Intervention)
	Collaborative leadership was well received	'Being able to collaborate and share the decision making is really helpful'—Doctor (Intervention)
	A calm leader calms the team	'he way you were able to stay calm through the scenario set a good tone for the rest of the team'—Nurse (Control)
	Role ownership impacted team performance	'There was a lot of movement between the different team roles, 1 min I was helping with the airway and the next I had nothing to do'—Nurse (Control) 'When you took over the defibrillation and started running the ALS stuff the whole scenario turned around'—Doctor (Control)
Perception of time	Offloading tasks gave perception of increased time	'It was really nice to have the time to think more clearly with some tasks offloaded to the nurse leader'—Doctor (Intervention) 'having the nursing team leader was great, it made the 2 min between rhythm checks feel like a long time rather than being rushed'—Doctor (Intervention)
	The nursing team leaders' impact on timing took some acclimatisation	'I felt like I wasn't doing much, I am so used to having to be hands on'—Doctor (Intervention) 'It felt really odd having so much time when I am used to having to manage both aspects of the arrest'—Doctor (Intervention)

the electronically stored field notes and participant reactions recorded during the post simulation debriefing sessions, two trial investigators used Braun and Clarke's thematic analysis model.[12] The thematic analysis incorporated the complete set of debriefing data rather than individualising analysis to the intervention or control groups. This process allowed for general themes relating to team performance to be extracted and presented.

Sample size

Due to the resource implications of the simulation methodology, no formal sample size calculation was performed. The intention of the study group was to complete as many simulations as possible within an 18-month time frame before reaching a point where it was no longer possible to recruit groups based on the inclusion criteria. After a period of 14 months the availability of new staff to was reached and the study was ended.

Statistical methods

All quantitative data from the NTLX and Task Time Checklist were transferred to a central Excel spread sheet. The results of the NTLX were interpreted in their raw format for the purpose of this study. No value was weighted over another. The use of raw NTLX data to represent workload has been demonstrated to yield similarly reliable results when compared with a weighted NTLX score.[8] Two-way contingency tables were created and used to analyse the association patterns between participants in the control and intervention groups. Mean values and SD were calculated on continuous variables with data distribution that is close to normality as assessed by Shapiro-Wilk W test. CIs were derived to reflect the precision of these estimates. Inferential statistical tests such as Student's t-test were applied to compare the NTLX scores and the performance of the participants against the set criteria outlined in the task time checklist. For the data that deviated significantly from normal distribution, median values and IQR were used to describe the central tendency of the distributions and their associated spreads. Non-parametric tests such as Wilcoxon rank sum test were used for the comparison between groups. Statistical significance is assumed based on $p<0.05$. No adjustment for significance level was made for various hypotheses in view of the exploratory nature of this study. Professional statistical software including R V.6.4 3.3.2 and Stata V.14.2 were used to carry out these statistical tests.

Information collected from post simulation debriefing was transcribed into preformatted deidentified datasheets, examined and subsequently coded into categories to allow development of relevant themes.

RESULTS

Recruitment

In total, 20 simulations were attended in this study involving a total of 120 simulation participants. An even number of intervention and control groups participated in each of the five prewritten scenarios figure 1. All nursing participants (excluding those acting in the BLS 'chest compressor' role) were accredited to provide ALS. Outside of nursing team leader role, each group required at least one senior doctor to act as a team leader. Due to staff availability on any given day the distribution of team members at all levels differed (figure 2), however, no significant difference in the distribution of senior team members existed between the groups (Fisher's exact df=6, p=0.902).

NASA Task Load Index

Evaluation of the raw NTLX scores revealed similar total scores in the Intervention and Control groups (p=0.28) (table 1). However, the medical team leaders in the Intervention group had a significantly lower NTLX (238.4, 95% CI 192.0 to 284.7) compared with those in the control group (306.3, 95% CI 254.9 to 357.6; p=0.02). No statistically significant difference of NTLX was observed between the nursing team leader of the intervention group (mean 223, 95% CI: 189.3 to 256.7) and the senior control nurse (mean 255.5, 95% CI 195.5 to 315.5; p=0.15).

Task demand

Using the combination of the five domains for demand, the mean demand of the medical team leaders was found to be 24% lower in the intervention group compared with the control (p=0.02). The domain contributing to the most significant reduction in demand for medical team leaders was temporal demand (p=0.02) (table 2). Frustration results were also notably improved in this group, however the difference did not reach statistical significance. Among the medical team leaders' minor improvements were noted in the intervention groups across all remaining domains.

The overall demand levels for nursing team leaders in the intervention groups (mean 187.5, SD 152.6–222.4) was 17% lower than for the senior control nurses (mean 223.8, SD 164.7–282.8). but this difference was not statistically significant (p=0.12).

Team performance

Overall, self-rated performance of the medical team leader, nursing team leader and entire group did not differ statistically between control and intervention. Performance was rated on a scale of 0–100 with a lower score indicating better perceived performance (table 3).

Time task checklist results

Teams in the Intervention group had a shorter time to apply a defibrillator (median 23.5 s vs 59 s, p=0.004), earlier assessment for reversible causes (mean 107.1 s vs 209.5 s, p=0.002), and shorter time to correct ineffective compressions (median 7.5 s vs 14 s, p=0.04) (table 4). The compression fraction of the intervention group was significantly greater in the intervention group (mean 91.3% vs 89.9%, p=0.048). Longer average preshock pauses were seen in the intervention groups (mean 6.4 s vs 4.3 s, p=0.04). Many of the remaining areas showed improvement in the intervention group which was not statistically significant, while others remained relatively unaffected.

Debriefing thematic analysis

Following analysis of the available debriefing data, three primary themes were identified: team leadership, communication and perception of time (Table 5).

Communication was the most notable a factor that determined perceived success or failure. The debriefing discussion ranged from complimentary reinforcement of desirable behaviours, to identification of communication factors that negatively impacted performance. The value of clear communication between the nursing and medical team leaders was reinforced by the participants.

Another central theme with variation between control and intervention was team leadership. While there was limited discussion of nursing leadership throughout the control group, however, this was a central theme in the intervention groups. One notable exception followed a single control scenario where a senior nurse shifted her role from preallocated team member to functioning in almost an identical way to the nursing team leader role from the intervention arm. All participants in this debrief identified this as a positive turning point.

Perception of time was a prevailing theme within the intervention group. In more than half of the intervention debriefs team members remarked about feeling they had more time than they were used to and linked this perception directly to the presence of the nursing team leader.

DISCUSSION

Interpretation

Within this study, the introduction of the nursing team leader resulted in a direct reduction in cognitive load for medical team leaders without any subsequent increase in total cognitive load for the team. The cognitive load of the nursing leaders was actually found to be less than that of the senior control nurses. It is possible this preservation of cognitive capacity may be related to the allocation of a finite number of tasks rather than a less well-defined position of 'leader.'

In this trial, the presence of nursing team leader also led to statistically significant improvements in a number of the secondary outcomes including compression fraction, time to attach a defibrillator and time to address reversible causes. Of the 10-performance measures assessed in the task time checklist, only one measure experienced a negative impact (preshock pause). This suggests that the nursing team leader has a positive impact on an arrest team's ability to achieve optimal performance of time critical interventions. These findings address an important evidence gap by providing quantitative evidence of improvement associated with a nursing leadership role, where the majority of the existing evidence is of a qualitative nature.[13]

Given that the nursing team leaders' presence improved both cognitive load and objective performance, it is suggested that the medical team leaders' cognitive offload allowed them to focus more attention on higher order tasks. This inference is supported by the debriefing theme relating to the team leader's perception of time; in which medical team leaders in the intervention groups reported feeling they had more time than they expected while managing their simulated patient. The utility of a nurse leader role was also illustrated when a control group, a perceived a major performance boost when a senior nurse shifted from an undirected follower to a leadership role (*similar to the nursing team leader role* in the intervention arm).

Limitations

Simulation was used in this study to mitigate the potential ethical issues related to a relatively unquantified intervention in the critical context of cardiac arrest.[14] The simulation methodology may also have had a bearing on the stress levels reported by the participants. While observational studies have demonstrated acute stress responses to be similar for healthcare providers across simulated or real-life medical emergencies, there is little data examining the difference in response as quantified using a self-rated tool such as the NTLX.[15] However, we were comparing responses between two groups, both undergoing simulation.

To aid data collection and analysis, all simulations in this study were video recorded with participant consent. It is possible that the use of video recording may have influenced the performance of the participants. While this influence is difficult to substantiate, the standardised use of video recording across all scenarios ensured that all participants were being subjected to the same circumstances.

The use of in situ simulation in the context of a large metropolitan ED posed a number of challenges, ranging from staff availability and patient factors, to the availability of equipment.[16] These challenges impacted recruitment, resulting in a lower than anticipated sample size of 20 simulations before it became logistically unmanageable to collect additional data without including participants in multiple simulations. This limited sample size restricted the ability to make generalisable statements of impact from data collected in a simulation-based trial with a relatively small sample size

Complete blinding of participants or investigators was not possible. As with any unblinded study, there is an inherent risk of bias. It is possible that cognitive load ratings were influenced in the intervention group by the new 'role' delegated. Attempts were made to mitigate bias including self-ratings of cognitive load, a standardised time task list, and attention to the differences in the debrief sessions.

As an attempt to more directly apply the raw NTLX data to the concept of 'cognitive load' the trial investigators made the decision to separate the raw NTLX data into two groups (being performance and demand). This novel dichotomy of NTLX results has not been externally validated and as such, the results associated with this interpretation should be tempered accordingly. Additionally, no correction for multiple comparisons was made due to the exploratory nature of this study.

CONCLUSION

The introduction of a designated nursing team leader significantly reduced the cognitive burden of the existing medical team leader of a cardiac arrest team and was associated with improvements in team performance. Applying these findings to clinical ED management of cardiac arrest may translate to improved patient outcomes. Further studies involving resuscitation of real-life patients would be required to substantiate the effect of this intervention in the clinical environment.

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Acknowledgements Endless thanks to Stephen Croft, Amie Mosgrove, Emma Gordon, Dr Hemal Patel, Kathryn McCutchan, Ellen Seib, Dr Cate McIntosh, Kylie Watson and Dr Tim Stewart without whom this project would not have been possible.

Contributors JDP, JPS and MZ conceived the study and designed the trial. JDP and JPS supervised the conduct of the trial and data collection. MZ provided statistical advice on study design and analysed the data. JDP drafted the manuscript, and all authors contributed substantially to its revision. JDP took responsibility for the paper as a whole.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethics approval for our study was granted through the Hunter New England Health Research Ethics and Governance Office.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as online supplemental information. All data relevant to this study are included in this manuscript. Research protocols may be acquired by emailing the principle author.

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