

Blindfolding Improves Communication in Inexperienced Residents Undergoing ACLS Training

Emily Scicchitano, RRT-NPS, CPFT

Phillip Stark, RRT, CHSE

Paige Koetter, BS

Nathan Michalak, BA

Adrian D. Zurca, MD, MEd

ABSTRACT

Background Closed-loop communication (CLC) is associated with decreased medical errors and improved time-to-task completion during resuscitations. Depriving team leaders of sight during training may accelerate the acquisition of favorable communication skills; however, its effect on the frequency of CLC is unclear, especially with trainees.

Objective We assessed the effect of depriving interns of sight during advanced cardiovascular life support (ACLS) on verbal communication patterns and resuscitation confidence.

Methods All interns undergoing ACLS training in June 2019 at a single center were eligible. Interns were randomized to blindfolded training (BT) or standard training (ST). BT team leaders were blindfolded during practice sessions and permitted to use sight during testing. Testing scenarios were video- and audio-recorded. Recordings were assessed for teams' performance and communication patterns. Participants were surveyed for confidence with resuscitation skills before and after ACLS training.

Results All 87 eligible interns participated in the study (100% participation). Eighty-five of 87 (98%) interns were included for analysis; 46 were randomized to BT and 39 to ST. Interns in the BT group were significantly more likely to exhibit CLC (mean: BT 20.3, ST 16.6; $P = .003$), directed communication (mean: BT 4.3, ST 1.5; $P < .001$), and follower-initiated communication (mean: BT 12.8, ST 10.2; $P = .028$). There was no significant difference in clinical performance measures or self-reported confidence with resuscitation between BT and ST groups.

Conclusions Blindfolding trainees results in greater instances of CLC, directed communication, and follower-initiated communication during ACLS training.

Introduction

Effective communication is an important aspect of providing safe and reliable patient care.^{1,2} Intra-team communication and team leadership are especially vital components of effective and efficient team performance during resuscitation events,^{3–5} and communication and leadership during resuscitation events has been associated with top performing resuscitation teams.⁶ Closed-loop communication (CLC) is a technique wherein the sender gives a message and the receiver verbally acknowledges receiving the message. CLC has been identified as an important component of optimal teamwork⁷ and has been associated with shorter time-to-task completion during actual resuscitation events.⁸ While communication may have more of an impact on team performance than team leaders' training or experience,⁸ team communication during resuscitation events is often suboptimal.⁹ CLC specifically is frequently underutilized by resuscitation teams during

cardiac arrest situations⁵ or trauma resuscitation training.^{8,10}

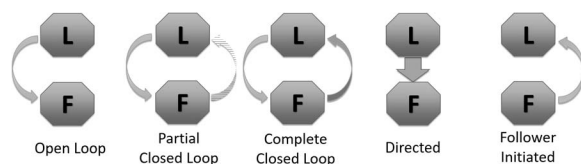
Depriving team leaders of the sense of sight during resuscitation is hypothesized to help teams learn favorable communication skills quicker by removing distracting visual stimuli and forcing them to practice clear verbal communication. Studies have demonstrated blindfolding improves self-reported leadership skills, the use of CLC, and leadership and communication skills.¹² To our knowledge, no study has explored the impact of adding blindfolded training on the outcomes of a standardized resuscitation course, especially with inexperienced physicians. We hypothesized that depriving medical interns of sight during advanced cardiovascular life support (ACLS) training would lead to better verbal communication during a testing session compared to interns not deprived of sight.

Methods

Settings and Participants

All interns undergoing ACLS training at a single academic medical center in June 2019 underwent

DOI: <http://dx.doi.org/10.4300/JGME-D-20-00620.1>

**FIGURE****Five Potential Communication Types**

Abbreviations: L, leader; F, follower.

Note: Complete closed-loop communication: team leader directs task; follower verbally acknowledges specific task. Partial closed-loop communication: team leader directs task; follower gives non-specific acknowledgment ("OK"). Open-loop communication: team leader directs task; follower gives no verbal acknowledgment. Directed communication: leader directs specific team member (by name or role) to perform task. Follower-initiated communication: follower initiates communication with leader to provide input regarding patient status or ask prompting question.

standardized training in accordance with the American Heart Association (AHA) guidelines, which includes a didactic presentation regarding resuscitation team dynamics using an AHA-provided video. The interns were divided into groups, and groups were randomized to either blindfolded training (BT) or standard training (ST). Participants were blinded to the objectives and outcomes of the study. To achieve ACLS certification, each participant was required to function as team leader for one practice and one testing session. Both BT and ST groups were permitted to view the ACLS algorithms during practice sessions; however, BT team leaders' lines of sight to their team members and manikin were removed by privacy curtains during the practice sessions only.

AHA-certified ACLS instructors received written and verbal orientations to the study and study goals and taught practice sessions for both groups. The course faculty read the standardized instructions to the interns at the beginning of the practice sessions. For the BT groups, this included instructions on how they would be deprived of sight. Standardized practice scenarios and testing scenarios provided by the AHA were utilized, all of which progress in similar manners and require defibrillation as a first step following cardiac arrest. The scenarios were preprogrammed to automatically proceed based on either time elapsed or number of shocks delivered.

Interventions

Team leaders in both groups were permitted to use sight during the testing sessions, which were video- and audio-recorded. Instructors for the testing sessions were blinded to whether groups had been randomized to BT or ST. Interns completed anonymous surveys at the beginning (before randomization) and at the end of the course, which asked them

to rate their confidence with resuscitation skills using a 5-point Likert scale. De novo surveys were developed, pre-tested, and reviewed for language, tone, length, content, and consistency by study team members.

Outcomes Measured

Each participant functioned as a team leader for one testing scenario. Recordings of the individual testing scenarios were viewed and evaluated for teams' clinical responses and verbal communication. Communication events were coded into 5 types: complete closed-loop, partial closed-loop, open-loop, directed, and follower-initiated (FIGURE). The initial 2 videos were coded by 3 study team members blinded to which type of training the interns had randomized (P.K., N.M., A.Z.) to ensure concordant definitions for the different types of communication. The next 20% of recordings were double-coded by 2 study team members (P.K. and N.M.) and demonstrated 100% interrater reliability. The remaining videos were coded by 1 of 2 study team members (P.K. and N.M.), and communications that were unclear were flagged. Flagged communications were subsequently discussed (P.K., N.M., A.Z.) to achieve consensus. In addition to verbal communication patterns, performance during the testing scenarios was documented as time from cardiac arrest to each of the following interventions: initiation of chest compressions, defibrillation, and first dose of epinephrine.

Analysis of the Outcomes

Study data were collected and managed using REDCap electronic data capture tools hosted at our institution.¹³ The primary outcome measures were (1) teams' use of the different verbal communication types during the testing scenarios; (2) teams' performance during the testing scenarios; and (3) interns' self-reported confidence with different aspects of resuscitation. For statistical analysis, the 5-point Likert scale variables were recoded as dichotomous measures by combining "strongly agree" and "agree" and comparing them against the other 3 categories, because we did not think there was much clinical difference between "strongly agree" and "agree." Pearson chi-square statistics, Fisher's exact tests, or median 2-sample tests were used as appropriate to test the association between the outcome measures and type of training. A *P* value of $< .05$ was considered statistically significant.

This study was determined to be exempt by the Penn State Hershey Medical Center Institutional Review Board.

TABLE 1

Differences in Clinical Performance During Testing Scenarios Between Participants Who Underwent Standard vs Blindfolded Training^a

Resuscitation Outcomes	Standard Training	Blindfolded Training	P Value
Time from cardiac arrest to compressions, seconds, mean (95% CI)	13.8 (8.7, 19)	13.96 (10.2, 17.8)	.96
Time from cardiac arrest to defibrillation, seconds, mean (95% CI)	50.6 (38.9, 62.3)	55.9 (44.8, 67.1)	.51
Time from cardiac arrest to first dose of epinephrine, seconds, mean (95% CI)	108.9 (89, 128.9)	105.8 (86.4, 125.3)	.82

^a Each testing scenario was analyzed independently.

Results

All 87 eligible interns were randomly assigned into 17 training groups (9 BT groups, 8 ST groups) for ACLS training (100% participation rate). Group size ranged from 4 to 6 participants per group, depending on the simulation room to which the group was assigned. However, the average BT and ST group sizes were the same (BT = 5.11 participants per group; ST = 5.13 participants per group). Two interns were excluded from analysis due to issues with video and data acquisition, both of which were in the ST group. In total, 85 of 87 (98%) interns were included in the analysis, of which 39 underwent ST and 46 underwent BT. Of the interns, 37 (43%) reported having been previously ACLS certified.

There were no significant differences in clinical performance between the ST and BT groups, with interns in both groups demonstrating similar times from cardiac arrest to compressions, defibrillation, and first dose of epinephrine (TABLE 1). Differences in communication patterns between the BT and ST groups are detailed in TABLE 2. Interns in BT groups were significantly more likely to demonstrate complete CLC and directed communication, and to initiate communication when in the follower role. Interns in both groups were more likely to report improved confidence in various resuscitation tasks after ACLS training; however, there were no significant differences between interns in the ST and BT groups (TABLE 3).

TABLE 2

Differences in Numbers of Intra-Team Communication Types During Testing Scenarios Between Standard vs Blindfolded Training Groups^a

Communication Types	Standard Training	Blindfolded Training	P Value
Complete closed loop communications, mean (95% CI)	16.6 (14.8, 18.4)	20.3 (18.8, 21.8)	.002
Partial closed loop communications, mean (95% CI)	3.6 (2.7, 4.6)	4.2 (3.2, 5.3)	.39
Open loop communications, mean (95% CI)	11.97 (10.5, 13.5)	12.8 (11.5, 14.2)	.38
Directed communication by team leader, mean (95% CI)	1.49 (0.84, 2.1)	4.3 (3.1, 5.6)	< .001
Follower initiated communication, mean (95% CI)	10.2 (8.7, 11.8)	12.8 (11.2, 14.4)	.024

^a Each testing scenario was analyzed independently.

Discussion

Our study findings indicate that team leaders deprived of sight during resuscitation training demonstrate improved verbal communication patterns when compared to team leaders not deprived of sight during training. Teams randomized to BT demonstrated a significantly increased number of favorable communication interactions, including CLC, directed communication, and follower-initiated communication, without compromising clinical performance. Presumably, depriving team leaders of sight creates an environment that forces teams to learn to rely on effective verbal communication, impacting not only how team leaders function but also how those in the follower role communicate. BT may accelerate the acquisition of important communication skills and should be considered early in training. Interns in the BT group also demonstrated increased numbers of directed communications, which can improve task completion.¹⁴ It is interesting to note the lack of difference in clinical performance between the groups, which may be due to the relative ease of achieving the tasks measured, especially in a simulated resuscitation training environment.

Simulation accelerates trainees' acquisition of non-technical skills, including CLC,^{4,15} via communication-focused interventions and training exercises.^{16,17} However, the educational interventions used for these studies were time-consuming. Additionally, these and other prior studies involving blindfolding as a teaching technique have mostly relied on participants'

TABLE 3

Participants' Confidence in Resuscitation Tasks Before and After ACLS Training

Resuscitation Tasks and Skills	Before Training (n = 87)	After Training		P Value (BT vs ST)
		ST (n = 41)	BT (n = 44)	
Confident managing airway, n (%)	30 (34)	37 (90)	40 (91)	> .99
Confident communicating, n (%)	45 (52)	40 (98)	44 (100)	.48
Confident managing arrhythmias, n (%)	24 (28)	40 (98)	37 (84)	.059
Confident leading, n (%)	11 (13)	37 (90)	34 (77)	.15

Abbreviations: ACLS, advanced cardiovascular life support; ST, standard training; BT, blindfolded training.

self-perceptions regarding CLC skills^{11,17–19} and did not objectively measure differences in communication patterns between groups receiving BT compared to those receiving standard training.²⁰ Incorporating blindfolding into existing educational sessions, such as ACLS, could be a time and cost-effective method of teaching verbal communication skills, and has the potential of being delivered to a larger group of health care providers.

This study had some important limitations. It was performed at a single center, although interns from multiple specialties were included. Other institutions with different intern leadership training exposures or with interns with other pre-residency experiences may have different findings; however, integrating BT into ACLS makes it easy for other centers to replicate. Second, the training sessions were dedicated to residents of the same level of training and did not reflect the multidisciplinary and multi-professional team usually required for resuscitation.²¹ Third, since there was variation in group sizes, participants in larger groups would have had more experiences to practice; however, we believe we mitigated this potential confounder since the average number of participants per team was the same between BT and ST. Finally, since the surveys were anonymous, we were unable to assess changes in individual interns' comfort levels or control for prior ACLS training. Further studies will be required to assess the long-term effects of BT on communication patterns, especially with multi-professional and multi-disciplinary teams in actual clinical settings.

Conclusions

Blindfolding is an effective method of helping medical professionals acquire verbal communication skills that may affect leadership skills during resuscitation events.

References

- Baker DP, Day R, Salas E. Teamwork as an essential component of high-reliability organizations. *Health Serv Res.* 2006;41(4 Pt 2):1576–1598. doi:10.1111/j.1475-6773.2006.00566.x.
- Kohn LT, Corrigan JM, Donaldson MS, eds. *To Err Is Human: Building a Safer Health System.* Washington, DC: National Academy Press; 2000.
- Marsch SCU, Müller C, Marquardt K, Conrad G, Tschann F, Hunziker PR. Human factors affect the quality of cardiopulmonary resuscitation in simulated cardiac arrests. *Resuscitation.* 2004;60(1):51–56. doi:10.1016/j.resuscitation.2003.08.004.
- Hunt EA, Shilkofski NA, Stavroudis TA, Nelson KL. Simulation: translation to improved team performance. *Anesthesiol Clin.* 2007;25(2):301–319. doi:10.1016/j.anclin.2007.03.004.
- Andersen PO, Jensen MK, Lippert A, Østergaard D. Identifying non-technical skills and barriers for improvement of teamwork in cardiac arrest teams. *Resuscitation.* 2010;81(6):695–702. doi:10.1016/j.resuscitation.2010.01.024.
- Nallamothu BK, Guetterman TC, Harrod M, Kellenberg JE, Lechrich JL, Kronick SL, et al. How do resuscitation teams at top-performing hospitals for in-hospital cardiac arrest succeed? A qualitative study. *Circulation.* 2018;138(2):154–163. doi:10.1161/CIRCULATIONAHA.118.033674.
- Salas E, Sims DE, Burke CS. Is there a “big five” in teamwork? *Small Gr Res.* 2005;36(5):555–599. doi:10.1177/1046496405277134.
- El-shafy IA, Delgado J, Akerman M, Bullaro F, Christopherson NAM, Prince JM. Closed-loop communication improves task completion in pediatric trauma resuscitation. *J Surg Educ.* 2018;75(1):58–64. doi:10.1016/j.jsurg.2017.06.025.
- Bergs EAG, Rutten FLPA, Tadros T, Krijnen P, Schipper IB. Communication during trauma resuscitation: do we know what is happening? *Injury.* 2005;36(8):905–911. doi:10.1016/j.injury.2004.12.047.
- Härgestam M, Lindkvist M, Brulin C, Jacobsson M, Hultin M. Communication in interdisciplinary teams: exploring closed-loop communication during in situ trauma team training. *BMJ Open.* 2013;3(10):e003525. doi:10.1136/bmjopen-2013-003525.

11. Ahmed R, Hughes K, Hughes P. The blindfolded code training exercise. *Clin Teach*. 2018;15(2):120–125. doi:10.1111/tct.12639.
12. Buyck M, Manzano S, Haddad K, Moncousin AC, Galetto-Lacour A, Blondon K, et al. Effects of blindfold on leadership in pediatric resuscitation simulation: a randomized trial. *Front Pediatr*. 2019;7:10. doi:10.3389/fped.2019.00010.
13. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377–381. doi:10.1016/j.jbi.2008.08.010.
14. Siassakos D, Draycott T, Montague I, Harris M. Content analysis of team communication in an obstetric emergency scenario. *J Obstet Gynaecol*. 2009;29(6):499–503. doi:10.1080/01443610903039153.
15. Emani S, Allan C, Forster T, Fisk AC, Lagrasta C, Zheleva B, et al. Simulation training improves team dynamics and performance in a low-resource cardiac intensive care unit. *Ann Pediatr Cardiol*. 2018;11(2):130–136. doi:10.4103/apc.APC_117_17.
16. Bank I, Snell L, Bhanji F. Pediatric crisis resource management training improves emergency medicine trainees' perceived ability to manage emergencies and ability to identify teamwork errors. *Pediatr Emerg Care*. 2014;30(12):879–883. doi:10.1097/PEC.0000000000000302.
17. Diaz MCG, Dawson K. Impact of simulation-based closed-loop communication training on medical errors in a pediatric emergency department. *Am J Med Qual*. 2020;35(6):474–478. doi:10.1177/1062860620912480.
18. Hughes PG, Ahmed RA. Blindfolded trauma team resuscitation: a strategy for improved leadership and communication. *BMJ Sim Technol*. 2019;5:174–175.
19. Diaz MCG, Dawson K. Impact of Simulation-Based Closed-Loop Communication Training on Medical Errors in a Pediatric Emergency Department. <https://pediatrictraumasociety.org/meeting/abstracts/2018/61.cgi>. Accessed December 2, 2020.
20. Brindley PG, Hudson D, Lord JA. The blindfolded learner—a simple intervention to improve crisis resource management skills. *J Crit Care*. 2008;23(2):253–254. doi:10.1016/j.jcrc.2007.10.036.
21. Calder LA, Mastoras G, Rahimpour M, Sohmer B, Weitzman B, Cwinn AA, et al. Team communication patterns in emergency resuscitation: a mixed methods qualitative analysis. *Int J Emerg Med*. 2017;10(1):24. doi:10.1186/s12245-017-0149-4.



Emily Scicchitano, RRT-NPS, CPFT, is Respiratory Therapist and Resuscitation Specialist, Penn State Health Medical Center; **Phillip Stark, RRT, CHSE**, is Respiratory Therapist and Resuscitation Specialist, Penn State Health Medical Center; **Paige Koetter, BS**, is a Medical Student, Penn State College of Medicine; **Nathan Michalak, BA**, is a Medical Student, Penn State College of Medicine; and **Adrian D. Zurca, MD, MEd**, is Assistant Professor of Pediatrics, Division of Pediatric Critical Care, Penn State Health Medical Center, and Program Director, Pediatric Critical Care Medicine Fellowship, Penn State Children's Hospital.

Funding: Access to REDCap for this project was supported by the National Center for Advancing Translational Sciences, National Institutes of Health, through Grant UL1 TR002014 and Grant UL1 TR00045.

Conflict of interest: The authors declare they have no competing interests.

The authors would also like to thank Dr David L. Rodgers for generously sharing his expertise, guidance, and moral support.

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Corresponding author: Adrian D. Zurca, MD, MEd, Penn State Health Medical Center, azurca@pennstatehealth.psu.edu, Twitter @zurcapicu

Received June 12, 2020; revisions received August 10, 2020, and November 2, 2020; accepted November 30, 2020.