

Strengthening Community Emergency Response: Effectiveness of Integrated Lecture–Simulation Training Among Lay Responders and Paramedics in Batu City

Rosaria Dian Lestari^{1*}

¹Medical Doctor Education Programme, Faculty of Medicine, Universitas Islam Malang, Malang, Indonesia

*Corresponding Author Email: rosariadian@unisma.ac.id

ABSTRACT

Out-of-hospital cardiac arrest remains a major public health challenge with persistently low survival rates, particularly in where early emergency response capacity is limited. In Indonesia, insufficient community knowledge and practical skills continue to hinder effective pre-hospital management. Strengthening community-based emergency training is therefore essential to enhance early response and improve patient outcomes. This study aimed to evaluate the effectiveness of an emergency training programme conducted by the Batu City Health Department, in improving knowledge of practical emergency response among multidisciplinary responders. A total of 45 participants met the inclusion criteria, consisted of 30 trained-lay-responders from Indonesian Red Cross, regional disaster management, and fire service personnel, and 15 paramedics from primary healthcare centres. The two-day intervention integrated structured lectures, hands-on skill stations, and disaster simulation exercises. Data were analysed using paired t-test and subgroup comparisons using independent t-tests, with significance set at $p < 0.05$. Overall knowledge scores improved significantly following the intervention (mean difference = 22.889; $p < 0.001$). The calculated effect size (Cohen's $d = -1.34$) indicates a large magnitude of change; however, the negative sign reflects the direction of score difference rather than a decrease in performance. Despite baseline differences ($p = 0.004$), both subgroups demonstrated significant improvements. Paramedics achieved higher post-test scores than trained-lay-responders ($p < 0.001$; Cohen's $d = -1.39$). These findings indicate that integrated lecture–practice training is effective in improving emergency-related knowledge and has the potential to enhance practical response capacity among multidisciplinary responders, supporting its implementation in regional capacity-building strategies.

Keywords: out-of-hospital cardiac arrest, emergency skills training, community-based education, simulation-based learning, pre-hospital care

INTRODUCTION

Cardiovascular disease remains the leading cause of death worldwide, contributing substantially to global morbidity and mortality (Rampengan, 2015). Cardiovascular disorders account for more than 13.5 million deaths annually, representing a major public health burden (Meaney et al., 2013). Among cardiovascular emergencies, cardiac arrest is one of the most critical conditions, defined as the sudden cessation of effective cardiac mechanical activity, characterised by the absence of a carotid pulse, apnoea, and loss of consciousness. When occurring outside healthcare facilities, this

condition is referred to as out-of-hospital cardiac arrest (OHCA) (Darwati & Setianingsih, 2020; Kelmend Pallaska, 2014).

The incidence of OHCA ranges from 20 to 140 cases per 100,000 population annually, with survival rates remaining low at approximately 2–11% (Meaney et al., 2013). In Asia, emergency medical services manage approximately 45.9 OHCA cases per 100,000 population each year, underscoring the magnitude of this emergency in densely populated regions (Kiguchi et al., 2020). In Indonesia, an estimated 30 individuals die each day from sudden cardiac arrest, most of which occur outside hospital settings (Prastya, Drajat, Haedar, & Setijowati, 2016). These data highlight persistent gaps in early recognition and response within pre-hospital emergency care systems.

Effective management of cardiac arrest relies on the timely implementation of the Chain of Survival, including early recognition, activation of emergency medical services, prompt cardiopulmonary resuscitation (CPR), early defibrillation, advanced life support, and comprehensive post-resuscitation care (Berg et al., 2010; Meaney et al., 2013). Among these components, early recognition and decision-making by bystanders are fundamentally knowledge-dependent processes (Barton, 2015). However, evidence indicates that laypersons frequently have lack of confidence and adequate knowledge to identify cardiac arrest and to initiate appropriate early actions (Darwati & Setianingsih, 2020; Travers et al., 2014). In Indonesia, limited public knowledge has been associated with delays and inappropriate initial responses in critical emergency situations (Erawati, 2015; Kase, Prastiwi, & Sutriningsih, 2018).

Basic Life Support (BLS) training is widely recognized as an effective strategy to improve emergency-related knowledge among community members (Bhanji et al., 2015; Cheng et al., 2018). Educational strategies are pivotal to training effectiveness. Lectures-based education approaches remain the most feasible and scalable method for delivering

such training in community settings, particularly in resource-limited environments. This methods have demonstrated effectiveness in improving cognitive outcomes, including understanding of emergency recognition, response sequences, and decision-making processes (Yardley, Morrison, Bradbury, & Muller, 2015). In the other hand, evidence suggests that integrating lectures with practical training yields superior outcomes compared with single-method approaches (Perkins & Brace-McDonnell, 2015; Plant & Taylor, 2013). While psychomotor skills are also important in cardiac arrest management, their valid assessment requires structured simulation, standardized chacklists, and controlled environments (Jelovsek, Kow, & Diwadkar, 2013), which are not always feasible in large-scale community training programmes. Therefore, evaluating knowledge improvement represents a relevant and methodologically appropriate outcome for assessing the effectiveness of lecture-based emergency training

However, training effectiveness is influenced by participant characteristics, contextual factors, and local health system support (Varela-Kasal, Abelairas-Gómez, Agra-Otero, Barcala-Furelos, & Rodríguez-Núñez, 2021). Batu City, characterised by high tourism activity and population mobility, faces an increased risk of emergency events requiring rapid community response. In this context, trained community responders under the supervision of the District Health Office play a strategic role in strengthening pre-hospital emergency preparedness.

Based on these considerations, this study aims to evaluate the effectiveness of an integrated lecture–practice emergency training programme in improving knowledge of early emergency management among multidisciplinary responders in Batu City. The findings are expected to support the development of scalable, knowledge-focused training strategies to strengthen community-based pre-hospital emergency care systems.

METHODS

Study Design

This study employed a quasi-experimental one-group pretest–posttest design to evaluate changes in participants’ knowledge following an emergency training programme. All participants received the same intervention, and outcomes were measured before and after the training within the same cohort. Subgroup analysis were conducted to describe differences in baseline characteristics and knowledge change; however, these were not treated as controlled group comparisons.

Setting and Study Period

The study was conducted over two consecutive days (30–31 August 2019) at Among Tani City Hall, Batu City, Indonesia, during a community-based emergency skills training programme organized by the Batu City Health Office. Data collection included pre-intervention assessment (pretest), delivery of the training intervention, and immediate post-intervention assessment (posttest).

Participants

A total of 45 participants were included using a total sampling approach. Participants consisted of:

- Trained lay responders (n = 30), affiliated with public service institutions (Indonesian Red Cross, Fire Department, and Regional Disaster Management Agency), and
- Paramedics (n = 15), including nurses and midwives from primary healthcare centres.

Inclusion criteria were age ≥ 18 years, willingness to participate in the full training programme, and provision of informed consent. Participants with incomplete attendance or missing pretest/posttest data were excluded.

Given the heterogeneity of participants, paramedics were recognized as having prior exposure to emergency care concepts, which may influence baseline knowledge levels. Therefore, analyses primarily focused on within-subject changes (pre-post differences) rather than direct comparison of outcome magnitude between subgroups

Training Intervention

Participants attended a two-day emergency skills training programme delivered by certified instructors. The training included:

- a. Lecture-based sessions, covering recognition of emergency conditions, principles of the Chain of Survival, primary survey assessment, and fundamental first aid concepts.
- b. Practical exposure sessions, including demonstrations and guided practice across multiple skill stations: (a) triage and emergency call management, (b) single-rescuer Basic Life Support (BLS), (c) two-rescuer BLS and team communication, (d) splinting and bandaging, (e) safe patient transport using a long spine board, and (f) communication station, using walkie-talkie

The programme concluded with a structured disaster simulation (earthquake scenario), during which participants assumed roles as victims and responders to practise triage, evacuation, and coordinated emergency response.

Although practical session were included to support learning, no psychomotor skill assessment was formally measured, and the study outcome was limited to knowledge evaluation.

Data Collection and Instruments

The knowledge assessment instrument consisted of 10 multiple-choice questions developed based on the training curriculum, covering emergency recognition, early response, and basic life support principles. Each item had one correct answer, scored as 1 for correct and 0 for incorrect, with total score converted to a 0-10 scale

Content validity was established through expert review by 8 experts in emergency medicine and medical education to ensure alignment with learning objectives and relevance to community-based responders.

As this instrument was designed as a criterion-referenced knowledge test with objective scoring, internal consistency reliability was not formally assessed. Instead, the instrument was constructed to directly reflect key competencies taught during the training, ensuring adequate content representation

Statistical Analysis

Data were analysed using SPSS version 31. Descriptive statistics were used to summarise participant characteristics and knowledge scores.

- Normality of data distribution was assessed using the Saphiro-Wilk test.
- Differences between pretest and posttest scores were analysed using paired t-tests or Wilcoxon signed-rank tests, as appropriate

Subgroup analyses (lay responders vs paramedics) were conducted descriptively and, where appropriate, using independent t-tests or Mann–Whitney U tests; however, these results were interpreted with caution due to baseline differences and potential confounding.

Statistical significance was set at $p < 0.05$. Effect size (Cohen's d) was calculated to estimate the magnitude of change

RESULTS

Participant Characteristics

Of the 53 individuals who attended the emergency training programme, 45 participants met the inclusion criteria and were included in the analysis. These consisted of 30 trained lay responders (from the Indonesian Red Cross, the Regional Disaster Management Agency, and the Batu City Fire Department) and 15 paramedics representing five primary healthcare centres.

Overall, 34 participants (76%) were male and 11 (24%) were female. Male participants predominated across most institutions, particularly within the fire department and disaster management agency.

Table 1: Participant Characteristics

Institution	Sex			
	Male	%	Female	%
Indonesian Red Cross (Batu Branch)	10	22%	5	11%
Batu City Regional Disaster Management Agency	7	16%	1	2%
Batu City Fire Departement	7	16%	0	0%
Batu City Primary Healthcare Facilities	10	22%	5	11%
(n = 45)	34	76%	11	24%

Overall Effect of Training

Across all participants (n = 45), the mean pretest score was 33.89 ± 9.16 , which increase to 56.78 ± 17.46 following the intervention. Paired analysis demonstrated a statistically significant improvement in knowledge scores (mean difference = 22.89 points; $p < 0.001$). The correlation between pretest and posttest scores was weak ($r = 0.297$; $p = 0.048$), indicating variability in individual improvement following the intervention. The calculated size effect (Cohen's $d = 1.34$) indicated a large magnitude of improvement, suggesting that the training had a strong effect on participants' knowledge. The direction of

the effect size was interpreted based on absolute value, as the negative sign in the table reflects the order of subtraction (pretest-posttest) rather than a decrease in performance.

Subgroup Analysis Based on Participant Background

Baseline knowledge differed between participant subgroups. Trained lay responder group ($n = 30$) had a lower mean pretest score (31.17 ± 7.39) compared to paramedics ($n = 15$) (39.33 ± 10.15), with a statistically significant difference ($p = 0.004$). The effect size (Cohen's $d = 0.97$) indicated a moderate to large difference in baseline knowledge.

Following the intervention, both subgroups demonstrated improvement in knowledge scores. Trained lay responders achieved a mean posttest score of 50.00 ± 12.25 , while paramedics achieved 70.33 ± 18.75 . although posttest scores remained higher among paramedics ($p < 0.001$; Cohen's $d = 1.39$), this finding should be interpreted cautiously, as paramedics had higher baseline knowledge and prior exposure to emergent care concepts.

Overall, the training programme resulted in a significant improvement in knowledge scores among participants. The large size effect size supports the effectiveness of the intervention in enhancing knowledge of emergency management. Improvement were observed across participants with different backgrounds, although variations in baseline knowledge influenced post-intervention outcomes.

Table 2: Pretest and Posttest Score Among All Participants

Group	N	Pretest (Mean $\pm$ SD)	Posttest (Mean $\pm$ SD)	Mean difference	p - value	Cohen's d
All participants	45	33,89 $\pm$ 9,16	56,78 $\pm$ 17,46	+22,89	< 0,001	-1,336
Lay Responders	30	31,17 $\pm$ 7,39	50,00 $\pm$ 12,25	+18,83	< 0,001	-
Paramedics	15	39,33 $\pm$ 10,15	70,33 $\pm$ 18,75	+31,00	< 0,001	

DISCUSSION

Respondent characteristics play important role in interpreting the effectiveness of educational interventions, particularly within quasi-experimental designs (Schweizer, Braun, & Milstone, 2016). In this study, participants represented multiple public service sectors involved in emergency response under the coordination of the Batu City Health Office, reflecting the multidisciplinary structure of local pre-hospital systems. For analytical purposes, respondents were categorised into trained lay responders (from the Indonesian Red Cross, Regional Disaster Management Agency, and Fire and Rescue Department) and paramedics (from community health centres). This distinction is educationally relevant, as paramedics possess formal healthcare training and routine clinical exposure, whereas trained lay responders rely primarily on operational field experience. Such differences provide a plausible explanation for variations in baseline knowledge and subsequent learning trajectories, as prior educational exposure is known to influence cognitive integration and responsiveness to training in clinically complex domains (Kulasegaram, Martimianakis, Mylopoulos, Whitehead, & Woods, 2013; Segretin et al., 2014; Tayade & Latti, 2021).

The sample was predominantly male, consistent with the workforce profile of emergency field services, thereby supporting external validity of the findings. However, as outcomes were not analyzed by sex, interpretation is appropriately focused on professional background rather than demographic variation. Overall, participants' heterogeneity enhances the ecological validity of the study, as it reflects real-world emergency response system that rely on collaboration between healthcare and non-healthcare personnel.

Within this context, the findings demonstrated a statistically significant improvement in participants' knowledge following the emergency training program, with a

large effect size (Cohen's $d = 1.34$). This magnitude indicates that the observed improvement is not only statistically significant but also educationally meaningful (Metsämuuronen, 2024), reflecting substantial gains in participants' understanding of emergency recognition and early response across multidisciplinary responder groups. The interpretation of effect size is based on its absolute value, as the direction of calculation (pretest-posttest) may produce a negative sign without indicating a negative outcome nor decline in performance (Metsämuuronen, 2024). This results therefore support the effectiveness of the intervention in achieving its primary objective, namely improving knowledge among multidisciplinary responders.

The observed increase in knowledge is consistent with existing evidence on the role of structured educational interventions in enhancing cognitive outcomes, particularly in community-based emergency training. Lectures-based delivery provides a systematic framework for understanding key concepts such as Chain of Survival, while complementary exposure to practical sessions may reinforce comprehension through contextualisation. This approach aligns with adult learning theory and experiential learning models, which emphasize active engagement and contextual application as critical determinants of meaningful learning (Collins, 2004; Reed et al., 2014). Previous studies in health professions education similarly demonstrate that integrated educational strategies can enhance both knowledge retention more effectively than single-method approaches (Chang et al., 2017; Goniewicz et al., 2021; McGaghie, Issenberg, Cohen, Barsuk, & Wayne, 2011). However, it is important to emphasize that this study evaluated knowledge outcomes only, and no conclusions can be drawn regarding psychomotor skill acquisition or actual clinical performance.

Differences between trained lay responders and paramedics were evident at baseline and persisted after the intervention. Paramedics demonstrated higher initial

knowledge, which is expected given their formal healthcare background and prior exposure to emergency care. Although they also achieved higher posttest scores, this should not be interpreted as a greater effect of the intervention itself. Rather, these findings likely reflect pre-existing differences in knowledge levels, as prior knowledge has been identified as a key predictor of responsiveness to educational interventions, particularly in technically complex domains such as emergency care (Goniewicz et al., 2021; Torani, Majd, Maroufi, Dowlati, & Sheikhi, 2019). Importantly, the significant improvement observed among trained lay responders highlights the capacity of structured training programmes to increase knowledge among non-healthcare personnel. Given that lay responders often serve as the first point of contact in pre-hospital emergencies, strengthening their knowledge base is both educationally and operationally significant (Orkin et al., 2021)

Furthermore, the relatively weak correlation between pretest and posttest scores suggests that baseline knowledge did not fully determine learning outcomes, indicating that the training contributed independently to knowledge improvement. This finding underscores the potential of structured educational programmes as effective tools for capacity building across participants with diverse backgrounds. From a practical perspective, training model should therefore account for variability in baseline competence and incorporate adaptive instructional strategies, such as additional foundational support for lay responders and more advanced scenario-based learning for healthcare personnel. The integrated lecture–practice model appeared effective across groups with differing educational foundations, suggesting that structured, multimodal training can bridge theoretical and practical gaps between lay and healthcare responders. These findings support the role of cross-sectoral emergency training as a strategic approach to enhancing regional pre-hospital capacity, particularly in systems that depend

on collaboration between professional and non-professional responders (Hedqvist & Herrera, 2025; Sriram, Gururaj, Razzak, Naseer, & Hyder, 2016).

Limitations

Several limitations of this study should be considered when interpreting these findings. First, the use of one-group pretest-posttest design without a control group limits causal inference, as improvements may be influenced by external factors and testing effects. Second, participants heterogeneity, particularly the inclusion of paramedics with prior medical knowledge, introduces potential bias that was not controlled analytically. Third, the sample size was relatively small and derived from a single geographic area, which may limit the generalizability of the findings to other populations or settings. Fourth, outcomes were assessed immediately after the intervention, and therefore does not provide information on long-term knowledge retention. Fifth, the study focused exclusively on cognitive outcomes without formal assessment of psychomotor skills or real-life emergency performance. Finally, internal consistency reliability of the measurement instrument was not formally evaluated, which may affect the precision of measurement, although content validity was ensured through alignment with training objectives.

Implications and Recommendations for Future Research

Despite these limitations, the findings suggests that structured emergency training programs can effectively improve knowledge and contribute to community preparedness in emergency situations, particularly in settings with limited resources. Future research should aim to strengthen methodological rigor and expand outcome evaluation by:

1. Employing controlled or randomized study designs to improve causal inference;

2. Stratifying participants based on baseline competence or applying stratified analysis to reduce bias;
3. Utilizing validated and standardized instruments, including formal reliability testing;
4. Incorporating objective assessment of psychomotor skills and behavioral performance, such as through objective structured clinical examinations (OSCE) or simulation-based assessment;
5. Evaluating long-term retention of knowledge and real-world emergency outcomes, including actual emergency response performance and patient-related outcomes; and
6. Developing adaptive or tiered training models, tailored to different level of participants background and experience.

CONCLUSION

This study demonstrates that a structured emergency training programme significantly improves knowledge of early emergency management among multidisciplinary responders. The observed pre–post improvement, supported by a large effect size, indicates that the intervention provides meaningful educational benefits in enhancing participants’ understanding of emergency recognition and response.

However, these findings should be interpreted in light of several methodological limitations. To strengthen future research, it is recommended that studies employ controlled or randomised designs to improve causal inference and minimise potential bias. In addition, stratification of participants based on baseline competence or the use of more homogeneous samples may help reduce confounding effects related to prior knowledge differences. The use of validated and reliable measurement instruments, including formal

assessment of internal consistency, is also necessary to improve the accuracy of outcome evaluation.

Furthermore, future studies should extend outcome assessment beyond immediate knowledge gains by incorporating long-term follow-up, as well as objective evaluation of psychomotor skills and real-world emergency performance. The development and evaluation of adaptive or tiered training models, tailored to participants' backgrounds, may also enhance training effectiveness and applicability in diverse community settings.

In conclusion, while this study supports the effectiveness of emergency training in improving knowledge, further methodologically robust research is required to optimise training design and to evaluate its impact on practical performance and patient outcomes.

ACKNOWLEDGEMENTS

The author would like to acknowledge and thank colleagues who helped in the training process and the writing for their support, recommendations and suggestions. Special thanks to Universitas Islam Malang (UNISMA), Batu City Health Department, and also for colleagues from Universitas Pesantren Tinggi Darul Ulum Jombang (UNIPDU) for providing resources and support in completing this work

REFERENCE

- Barton, P. J. M. (2015). *On First Undertaking CardioPulmonary Resuscitation: a Philosophical Hermeneutic Inquiry*. University of Glasgow, Faculty of Education. Retrieved from <https://theses.gla.ac.uk/8044/1/2015BartonEd.D.pdf>
- Berg, M. D., Schexnayder, S. M., Chameides, L., Terry, M., Donoghue, A., Hickey, R. W., ... Hazinski, M. F. (2010). Pediatric basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Pediatrics*, 126(5). <https://doi.org/10.1542/peds.2010-2972C>
- Bhanji, F., Finn, J. C., Lockey, A., Monsieus, K., Frengley, R., Iwami, T., ... Yeung, J. (2015). Part 8: Education, implementation, and teams: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with

- treatment recommendations. *Circulation*, 132, S242–S268.
<https://doi.org/10.1161/CIR.0000000000000277>
- Chang, A. L., Dym, A. A., Venegas-Borsellino, C., Bangar, M., Kazzi, M., Lisenenkov, D., ... Eisen, L. A. (2017). Comparison between simulation-based training and lecture-based education in teaching situation awareness: A randomized controlled study. *Annals of the American Thoracic Society*, 14(4), 529–535.
<https://doi.org/10.1513/AnnalsATS.201612-950OC>
- Cheng, A., Nadkarni, V. M., Mancini, M. B., Hunt, E. A., Sinz, E. H., Merchant, R. M., ... Bhanji, F. (2018). *Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest: A Scientific Statement From the American Heart Association*. *Circulation* (Vol. 138).
<https://doi.org/10.1161/CIR.0000000000000583>
- Collins, J. (2004). Education Techniques for Lifelong Learning: Principles of Adult Learning1. *RadioGraphics*, 24(5).
<https://doi.org/https://doi.org/10.1148/rg.245045020>
- Darwati, L. E., & Setianingsih. (2020). Peningkatan Pengetahuan Orang Awam tentang Penanganan Out of Hospital Cardiac Arrest melalui Aplikasi Resusitasi Jantung Paru pada Smartphone. *Jurnal Ilmiah Permas*, 10(1).
<https://doi.org/https://doi.org/10.32583/pskm.v10i1.620>
- Erawati, S. (2015). *Tingkat pengetahuan masyarakat tentang Bantuan Hidup Dasar (BHD) di Kota Administrasi Jakarta Selatan*. Universitas Islam Negeri Syarif Hidayatullah Jakarta.
- Goniewicz, K., Goniewicz, M., Włoszczak-Szubzda, A., Burkle, F. M., Hertelendy, A. J., Al-Wathinani, A., ... Khorram-Manesh, A. (2021). The importance of pre-training gap analyses and the identification of competencies and skill requirements of medical personnel for mass casualty incidents and disaster training. *BMC Public Health*, 21(114). <https://doi.org/https://doi.org/10.1186/s12889-021-10165-5>
- Hedqvist, A. T., & Herrera, M. J. (2025). Ambulance clinicians' perspectives on interprofessional collaboration in prehospital emergency care for older patients with complex care needs: a mixed-methods study. *BMC Geriatrics*, 25(1).
<https://doi.org/10.1186/s12877-025-05975-w>
- Jelovsek, J. E., Kow, N., & Diwadkar, G. B. (2013). Tools for the direct observation and assessment of psychomotor skills in medical trainees: A systematic review. *Medical Education*, 47(7), 650–673. <https://doi.org/10.1111/medu.12220>
- Kase, F. R., Prastiwi, S., & Sutriningsih, A. (2018). Hubungan Pengetahuan Masyarakat Awam Dengan Tindakan Awal Gawat Darurat Kecelakaan Lalulintas Di Kelurahan Tlogomas Kecamatan Lowokwaru Malang. *Nursing News*, 3(1), 662–674. Retrieved from <https://publikasi.unitri.ac.id/index.php/fikes/article/view/838>
- Kelmend Pallaska, B. L. (2014). Cardiac Arrest - Cardiopulmonary Resuscitation. *General Medicine: Open Access*, 02(02), 2–5. <https://doi.org/10.4172/2327-5146.1000131>
- Kiguchi, T., Okubo, M., Nishiyama, C., Maconochie, I., Ong, M. E. H., Kern, K. B., ... Iwami, T. (2020). Out-of-hospital cardiac arrest across the World: First report from the International Liaison Committee on Resuscitation (ILCOR). *Resuscitation*, 152(February), 39–49. <https://doi.org/10.1016/j.resuscitation.2020.02.044>
- Kulasegaram, K. M., Martimianakis, M. A., Mylopoulos, M., Whitehead, C. R., & Woods, N. N. (2013). Cognition before curriculum: Rethinking the integration of basic science and clinical learning. *Academic Medicine*, 88(10), 1578–1585.
<https://doi.org/10.1097/ACM.0b013e3182a45def>
- McGaghie, W. C., Issenberg, S. B., Cohen, E. R., Barsuk, J. H., & Wayne, D. B. (2011). Does simulation-based medical education with deliberate practice yield better results

- than traditional clinical education? A meta-analytic comparative review of the evidence. *Academic Medicine*, 86(6), 706–711.
<https://doi.org/10.1097/ACM.0b013e318217e119>
- Meaney, P. A., Bobrow, B. J., Mancini, M. E., Christenson, J., De Caen, A. R., Bhanji, F., ... Leary, M. (2013). Cardiopulmonary Resuscitation Quality: Improving Cardiac Resuscitation Outcomes Both Inside and Outside the Hospital: A Consensus Statement from the American Heart Association. *Circulation*, 128(4), 417–435.
<https://doi.org/10.1161/CIR.0b013e31829d8654>
- Metsämuuronen, J. (2024). *Common Language Interpretation of r Effect Size, Cohen's d, and Cohen's f*. University of Turku. Retrieved from
<https://www.researchgate.net/publication/378713752>
- Orkin, A. M., Venugopal, J., Curran, J. D., Fortune, M. K., McArthur, A., Mew, E., ... Vanderburgh, D. (2021). Emergency care with lay responders in underserved populations: A systematic review. *Bulletin of the World Health Organization*, 99(7), 514–528H. <https://doi.org/10.2471/BLT.20.270249>
- Perkins, G. D., & Brace-McDonnell, S. J. (2015). The UK out of Hospital Cardiac Arrest Outcome (OHCAO) project. *BMJ Open*, 5(10), 1–12.
<https://doi.org/10.1136/bmjopen-2015-008736>
- Plant, N., & Taylor, K. (2013). How best to teach CPR to schoolchildren: A systematic review. *Resuscitation*, 84(4), 415–421.
<https://doi.org/https://doi.org/10.1016/j.resuscitation.2012.12.008>
- Prastya, A., Drajat, R. S., Haedar, A., & Setijowati, N. (2016). Hubungan Moda Transportasi Dengan Upaya Resusitasi Prehospital Pada Pasien Henti Jantung Diluar Rumah Sakit Yang Dirujuk Ke Igd Rsud Dr. Iskak Tulungagung. *Medica Majapahit*, 8(2), 31–46. Retrieved from
<https://ejournal.stikesmajapahit.ac.id/index.php/MM/article/view/260>
- Rampengan, S. H. (2015). *Kegawatdaruratan Jantung*. Jakarta: Fakultas Kedokteran Universitas Indonesia.
- Reed, S., Shell, R., Kassis, K., Tartaglia, K., Wallihan, R., Smith, K., ... Mahan, J. D. (2014). Applying adult learning practices in medical education. *Current Problems in Pediatric and Adolescent Health Care*, 44(6), 170–181.
<https://doi.org/10.1016/j.cppeds.2014.01.008>
- Schweizer, M. L., Braun, B. I., & Milstone, A. M. (2016). Research Methods in Healthcare Epidemiology and Antimicrobial Stewardship – Quasi-Experimental Designs. *Infect Control Hosp Epidemiol*, 37(10), 1135–1140.
<https://doi.org/10.1017/ice.2016.117>
- Segretin, M. S., Lipina, S. J., Hermida, M. J., Sheffield, T. D., Nelson, J. M., Espy, K. A., & Colombo, J. A. (2014). Predictors of cognitive enhancement after training in preschoolers from diverse socioeconomic backgrounds. *Frontiers in Psychology*, 5(MAR), 1–21. <https://doi.org/10.3389/fpsyg.2014.00205>
- Sriram, V., Gururaj, G., Razzak, J. A., Naseer, R., & Hyder, A. A. (2016). Comparative analysis of three prehospital emergency medical services organizations in India and Pakistan. *Public Health*, 137, 169–175. <https://doi.org/10.1016/j.puhe.2016.02.022>
- Tayade, M. C., & Latti, R. G. (2021). Effectiveness of early clinical exposure in medical education: Settings and scientific theories – Review. *Journal of Education and Health Promotion*, 10(January), 1–6. <https://doi.org/10.4103/jehp.jehp>
- Torani, S., Majd, P. M., Maroufi, S. S., Dowlati, M., & Sheikhi, R. A. (2019). The importance of education on disasters and emergencies: A review article. *Journal of Education and Health Promotion*, 8(1), 85. https://doi.org/10.4103/jehp.jehp_262_18
- Travers, S., Jost, D., Gillard, Y., Lanoë, V., Bignand, M., Domanski, L., ... Mendibil, A.

- (2014). Out-of-hospital cardiac arrest phone detection: Those who most need chest compressions are the most difficult to recognize. *Resuscitation*, 85(12), 1720–1725. <https://doi.org/10.1016/j.resuscitation.2014.09.020>
- Varela-Kasal, C., Abelairas-Gómez, C., Agra-Otero, M., Barcala-Furelos, R., & Rodríguez-Núñez, A. (2021). Teaching Basic Life Support to 5- to 8-Year-Old Children: A Cluster Randomized Trial. *Pediatrics*, 148(4). <https://doi.org/https://doi.org/10.1542/peds.2021-051408>
- Yardley, L., Morrison, L., Bradbury, K., & Muller, I. (2015). The Person-Based Approach to Intervention Development: Application to Digital Health-Related Behavior Change Interventions. *JMIR Publications: Advancing Digital Health & Open Science*, 17(1). <https://doi.org/doi:10.2196/jmir.4055>