ACADEMIC MEDICINE
Journal of the Association of American Medical Colleges

Author: Gordon Morris PhD, MMed, MBChB; Hill Elaine RN, MSc; Stojan Jennifer N. MD, MHPE; Daniel Michelle MD, MHPE

Title: Educational Interventions to Improve Handover in Health Care: An Updated Systematic Review

DOI: 10.1097/ACM.0000000000002236

OPEN

Academic Medicine

DOI: 10.1097/ACM.0000000000002236

Educational Interventions to Improve Handover in Health Care: An Updated Systematic Review

Morris Gordon, PhD, MMed, MBChB, Elaine Hill, RN, MSc, Jennifer N. Stojan, MD, MHPE, and Michelle Daniel, MD, MHPE

M. Gordon is professor of Evidence Synthesis and Systematic Review, University of Central Lancashire, Preston, United Kingdom; ORCID: https://orcid.org/0000-0002-1216-5158.

E. Hill is senior lecturer, School of Health Sciences, University of Central Lancashire, Preston, United Kingdom; ORCID: http://orcid.org/0000-0003-4984-9446.

J.N. Stojan is assistant professor, Department of Internal Medicine and Department of Pediatrics, University of Michigan Medical School, Ann Arbor, Michigan.

M. Daniel is assistant dean for curriculum and assistant professor, Department of Emergency Medicine and Department of Learning Health Sciences, University of Michigan Medical School, Ann Arbor, Michigan; ORCID: http://orcid.org/0000-0001-8961-7119.

Correspondence should be addressed to Morris Gordon, HA244, Harrington Building, University of Central Lancashire, Preston, UK; telephone: 01772 201 201; e-mail: mgordon@uclan.ac.uk; Twitter: @drmorrisgordon.

Supplemental digital content for this article is available at http://links.lww.com/ACADMED/A545 and http://links.lww.com/ACADMED/A546.

Acknowledgements: The authors would like to thank Annette Ramsden from University of Central Lancashire Library Services.

Funding/support: None reported.

Other disclosures: Dr. Gordon has received travel grants from various companies to support attendance as scientific meetings. These companies have had no involvement in this or any other work completed by Dr Gordon.

Ethical approval: Reported as not applicable.

Abstract

Purpose: Effective handovers (handoffs) are vital to patient safety. Medical educators investigated educational interventions to improve handovers in a 2011 systematic review. The number of publications on handover education has increased since then, so authors undertook this updated review.

Method: The authors considered studies involving educational interventions to improve handover amongst undergraduate or postgraduate health professionals in acute care settings. In September 2016, two authors independently conducted a standardized search of online databases and completed a data extraction and quality assessment of the articles included. They conducted a content analysis of and extracted key themes from the interventions described.

Results: Eighteen reports met the inclusion criteria. All but two were based in the United States. Interventions most commonly involved single-patient exercises based on simulation and role play. Many studies mentioned multiprofessional education or practice, but interventions occurred largely in single-professional contexts. Analysis of interventions revealed three major themes: facilitating information management, reducing the potential for errors, and improving confidence. The majority of studies assessed Kirkpatrick's outcomes of knowledge and skill improvement (Levels 1 and 2). The strength of conclusions was generally weak.

Conclusions: Despite increased interest in and publications on handover, the quality of published research remains poor. Inadequate reporting of interventions, especially as they relate to educational theory, pedagogy, curricula, and resource requirements, continues to impede replication. Weaknesses in methodologies, length of follow-up, and scope of outcomes evaluation (Kirkpatrick levels) persist. Future work to address these issues, and to consider the role of multiprofessional and multiple-patient handovers, is vital.

Handovers (sometimes known as handoffs) are defined as the transfer of both information about and responsibility for a patient or patients between health care professionals and settings.[1,2] All health care professionals must learn and maintain excellent handover skills to ensure the effective communication of essential information about patients,[3] to enable interprofessional collaboration,[4] and to ensure patient safety.[5,6]

Background

Resident work hour restrictions put into place by the Accreditation Council for Graduate Medical Education[7] have led to the unintended consequence of increasing the number of patient handovers[8-11]—and, in turn, increased attention to problems resulting from handovers amongst physicians and other health care professionals.

Poorly conducted handovers threaten patient safety and the quality and continuity of care.[5,12-14] Research has linked handovers to inaccurate assessments and diagnoses, delayed and inappropriate treatment, and medical errors—all of which are associated with increased morbidity and mortality, longer hospital stays, and poor patient satisfaction.[8,15-16] Research indicates that handovers may be significant factors in many malpractice claims[9] and in a large percentage of sentinel events.[9,15,17-19]

A decade ago, the Joint Commission[20] and the World Health Organization[5] recognized the need to improve the quality of handovers. The two organizations issued mandates requiring health care organizations to standardize their approach to handovers and to incorporate handover education into the training of employees to improve consistency and reduce vulnerability to errors. More recently, the Association of American Medical Colleges highlighted the importance of handover education by including it as a core entrustable professional activity for entering residency.[21]

Ideally, all health care programs would incorporate handover education,[9] especially since research shows that such training is effective when done well.[1,22] Sadly, in many places handover education is non-existent or inadequate.[8,23-27] Theoretical and pedagogical frameworks are often lacking,[2,13,25] and the teaching and assessment methods used—at both the undergraduate and post-graduate levels—vary greatly,[27] resulting in learners who are unable to apply theory to practice.[15]

Handover education frequently consists of only the provision of tools such as mnemonics and templates that provide structure, but in the absence of any education in their use.[25] More recently, web-based, self-study resources have become available to optimize instructional time, resulting in decreased educational contact.[27] Even when training involves more situated approaches such as simulation, it often inappropriately focuses on or overemphasizes the single-patient handover when multiple-patient handovers are likely more realistic in contemporary practice.[27] In addition, despite the multiprofessional nature of patient care and the importance of effective communication within teams, interprofessional handover education is rare, and this paucity further hampers the authenticity of many of the current handover-focused learning encounters.[6]

Gordon and Findley conducted a systematic review on handover education in 2011.[1] At that time, the published research on handover education generally lacked scientific rigor. The authors of the studies included in the 2011 review often described interventions inadequately and focused on self-reported changes to participants' attitudes and confidence, rather than the development of knowledge and skills. Little evidence supported the transfer of skills into the workplace, and no interventions clearly demonstrated improvements in patient safety. Finally, there was a paucity of reporting of theory, pedagogy, or resource requirements.[1]

The published literature on handover education has increased substantially since Gordon and Findley's review.[1] The aim of this current work is to systematically review the latest evidence regarding handover education, to describe the features of the reported interventions, and to determine if the interventions are effective and how they function.

Method

No single research paradigm underpins this review. We embraced both positivism (through alignment with the principles of systematic reviewing and synthesizing effectiveness outcomes) and constructivism (through consideration of underpinning theoretical frameworks that inform interventions and synthesis of content and outcomes.) We have reported our findings in alignment with the STORIES (STructured apprOach to the Reporting In healthcare education of Evidence Synthesis) statement.[28]

Data collection

We considered for inclusion in our review all interventional study designs; we excluded surveys, audits, commentaries, and review articles. Our target population comprised medical students, residents, attending physicians, nursing students, nurses, nurse practitioners, physician assistants, operating room technicians, and midwives either practicing in or training to work in acute (hospital-based) health care settings. We excluded studies involving allied health care practitioners whose roles do not include giving or receiving handovers in acute health care settings. We considered reports describing outcomes at all levels of Kirkpatrick's adapted hierarchy.[29]

We conducted our search in September 2016, seeking studies published in or after January 2010. We applied a standardized search strategy (Supplemental Digital Appendix 1, at http://links.lww.com/ACADMED/A545) to the following databases: Cochrane controlled trials,

MEDLINE, EMBASE, CINAHL complete, PsychINFO, ERIC, Proquest health and medical complete, and PubMed. Additionally, we reviewed articles listed as references in included studies, and we contacted experts in the field of medical handovers. We included studies undertaken in any country and published in any language. We, like Gordon and Findley,[1] defined an educational intervention as any structured educational activity. We excluded interventions without an educational component, including those that only introduced new handover systems or mnemonics. If only limited information on an intervention was available, we attempted to contact the authors for further details. We did not seek ethical approval for this review since it does not involve study participants.

Data analysis

Two of us (E.H. and M.G.) independently reviewed the titles our search uncovered, and, using a checklist (Supplemental Digital Appendix 2, at http://links.lww.com/ACADMED/A545), we independently screened potentially relevant abstracts. We assessed agreement using Cohen's kappa statistic. We resolved any disagreements through discussion, involving a third author (J.N.S. or M.D.) only if needed. Next, two of us (again E.H. and M.G.) independently reviewed the full articles, determining which studies met our inclusion criteria.

Once we agreed on the studies to include in our review, the two of us used a data extraction form (Supplemental Digital Appendix 3, at http://links.lww.com/ACADMED/A545) and a quality assessment tool (Supplemental Digital Appendix 4, at http://links.lww.com/ACADMED/A545) to assess, respectively, the content and quality of the studies, based on guidance from the Best Evidence Medical Education (BEME) Collaboration[30] and the recommendations of Reed and colleagues.[31]

Data extraction. Notably, we slightly modified the data extraction tool from Gordon and Findley's review,[1] which allowed us to rate the studies based on 16 quality-based criteria (e.g., description of learner characteristics, statistical tests). We sought details about the educational intervention described in each study; specifics included recording pedagogical and theoretical underpinnings, format, teaching approaches, the number and types of participants, the length of follow-up, setting, and resources needed.

Quality assessment. We incorporated five-point scale (where 1 = weak; 5 = strong) to rate the strength of conclusions drawn from each study.[30] The quality assessment tool we used[31] allowed us to obtain more detailed information relating to potential sources of bias within the studies reviewed.

Neither the scale, nor the quality assessment tools provide an assessment of overall methodological quality, but they do provide measures of how well the data presented support the study conclusions.

Additional analyses. Additionally, we related study outcomes to Kirkpatrick's adapted hierarchy[29] (see Results) to assess the level of their effectiveness. Finally, two of us (E.H. and M.G.) independently undertook a content analysis of interventions, coding and categorizing the data into themes. We had no disagreements.

Results

The initial search of electronic databases yielded 7,118 titles, and other sources (reference lists, experts) provided two more potential articles. We identified 2,719 of these as duplicates. From the 4,401 remaining articles, we identified 96 abstracts for further screening. Agreement between the authors on citation screening was 100%. Agreement on abstract screening was very high (Kappa = .891). Thirty-eight articles met the criteria for full-text screening. We excluded ten of

these,[13,32-40] deeming them irrelevant—with no disagreement between the authors. We excluded another ten reports[41-50] since they included insufficient data to judge whether they should be included, and their authors did not respond to multiple attempts to contact them. Ultimately, 18 reports of intervention studies[9,25,27,51-65] met our inclusion criteria (see Figure 1). Tables 1 and 2 provide a general overview of the 18 reports and the 17 interventions they describe (two reports[63,64] describe the same study). We achieved 100% agreement on the quality ratings after independent data extraction. Supplemental Digital Appendix 5, available at http://links.lww.com/ACADMED/A546, provides a more detailed summary of our ratings of each study's quality based on the criteria from the two assessment tools.

We found significant methodological heterogeneity amongst the 18 studies (and the 17 educational interventions they describe). Study participants included medical students, residents, attending physicians, and nurses. The median number of participants in a study was 51.5 (the range was 11-1,206). The studies included nine pre-post studies,[25,51,55,56,58-61,65] six prospective studies,[27,52,54,62-64] one randomized controlled trial,[53] and two observational studies.[9,57] Sixteen of the studies reported on interventions undertaken in the United States, and only one each reported on an intervention in the United Kingdom[57] and the Netherlands.[58]

All educational interventions described in the studies included both (1) providing or sharing information and (2) opportunities for active practice (see Figure 2)—or, in the case of the two on-line formats,[27,58] information provision and knowledge assessment. The order in which the different elements of the programs were presented to participants, and the number and nature of these, varied according to three formats:

1. practice handover, receive teaching on handover, practice handover again, and receive feedback;

2. receive teaching on handover, practice handover, and receive feedback; and
3. test pre-existing knowledge, receive teaching on handover, practice handover, and receive feedback.

We found the study methodologies to be generally poor. Only four articles provided details about the educational theory underpinning the intervention,[55,57,58,64] and ten did not even mention an educational theory. Similarly, only six articles clearly explained the pedagogy used for the interventions,[51,55,57,58,61,62] and four did not mention a pedagogy at all. We did find, however, authors were likely to provide information about context, learners, and teaching approaches. Twelve studies described the setting and learner characteristics, and thirteen described the curriculum in suitable detail, including the time and resources needed to implement the intervention and enable replication (See Tables 1 and 2).

Our analysis of teaching approaches indicated that the principal teaching methods used were role play and simulation. These techniques were usually included as part of a package of measures, including didactic sessions, feedback, discussions of video examples of handovers, and sharing of learners' own experiences. Only two studies included online teaching materials.[27,58]

We identified three content themes: (1) facilitating information management, (2) reducing the potential for errors, and (3) improving provider confidence (see Figure 3). Facilitating information management was typically addressed by focusing on specific handover techniques, including the use of mnemonics and electronic tools that were aimed at helping providers manage the growing number of increasingly complex and frequent handovers. Reducing the potential for errors was addressed by identifying the components of effective and *in*effective handovers (from experience, examples, observation, and feedback on performance); the goal was to help providers understand the positive and negative implications that their choices have on

patient safety. Improving provider confidence was addressed by ensuring participants felt comfortable challenging or requesting additional information from others—regardless of status or perceived hierarchies.

Seven studies[27,52,55-57,61,65] reported outcomes at Level 1 (reaction) on Kirkpatrick's[29] adapted hierarchy. The overwhelming majority of studies (n = 14) reported outcomes at Level 2 (learning).[9,25,27,51,53-55,59-65] Among these, three studies[25,54,61] reported outcomes at Level 2a, measuring modifications of attitudes or perceptions, and thirteen reported outcomes at Level 2b, measuring changes in knowledge or skills. Only three studies[53,58,63] reported outcomes at Level 3 (behavioral change), showing the transfer of handover skills into the workplace; and only two[62,63] at Level 4b (results), indicating improved patient outcomes as a result of the educational intervention. Some studies reported outcomes at more than one level. Notably, all three of the studies that reported Level 3 and 4 outcomes focused on more practical content (in the form of information management), rather than error reduction or confidence boosting.

The strength of conclusions, which we estimated using the BEME scale,[30] was poor for thirteen of the studies, seven[9,27,51,52,56,57,59] of which achieved scores of 1, indicating that no clear conclusions could be drawn and/or that the results were insignificant. Most of these studies drew general conclusions not directly related to the described educational interventions. Six of the studies (reported in seven articles)[25,53,54,60,61,62,64] achieved scores of 2, indicating that the results were ambiguous but there appeared to be a trend. While the conclusions of these studies were supported by the results, the authors suggested overly broad implications (e.g., concluding that the intervention was a good option to enhance handover teaching upon finding positive learner feedback). Three of the studies achieved BEME scores of 3,[55,63,65] indicating that the conclusions could probably be based on the results. In these studies, which were largely focused on Level 2

outcomes, the authors suggested that their teaching interventions could improve handover knowledge or attitudes in all settings, not just the study setting. Only one study[58] achieved a BEME score of 4, indicating that the conclusions were likely true, supported by the results presented (with conclusions linked to the initial research question and supported by the evidence presented).

Discussion

Despite a marked increase in the number of publications on handover education since Gordon and Findley's 2011 review,[1] their conclusions remain generally valid. The quality of studies on handover education remains poor. With some notable exceptions of studies with sample sizes of at least 80 participants,[27,54,56,58,62-64] sample sizes remain relatively small, and descriptions of interventions that achieve higher levels of Kirkpatrick outcomes remain scarce. We can only speculate on the reasons for this lack of progress, but based on other systematic reviews in medical education, this stagnation seems common. Regrettably, the lack of progress means a paucity of evidence in key areas that educators must address. Specifically, development and advances in research and evidence are necessary to guide curriculum, teaching, and assessment. Importantly, one key development since 2011, uncovered in this synthesis, does have implications: skillful cross-hierarchal communication is clearly core to effective handover education. This finding aligns with wider work in non-technical skills education.[66]

Although we intentionally included nurse practitioners, physician assistants, operating room technicians, and midwives in our inclusion criteria, we uncovered no studies that included them. Study authors often discussed multiprofessional education and practice, but handover skills were largely taught in a single-professional context. Published accounts of multiprofessional handover education remain extremely rare. Only one study[58] included more than one professional group,

and it focused on only two groups (doctors and nurses). Given the interprofessional nature of contemporary patient care, handover education must become truly multidisciplinary if medical educators want to increase good communication among staff and effect safer situations for patients.

As mentioned, we found the study methodologies to be generally poor. A majority of the reports did not mention an educational theory, and fewer than a fourth named a particular pedagogical approach—although most of the reports did include details about the setting, learners, and learning activities. To improve the methodological quality of handover interventions, future reports should not only report details of the intervention in a manner that supports replication by others, but also, importantly, focus on the theoretical and pedagogical approaches they are following.[66] Without specifics on the educational theory, pedagogy, context, learner characteristics, curriculum, and resource requirements, educators will struggle to produce a local intervention that reflects the best evidence.

As with the previous review,[1] the majority of reported outcomes were at level 2 on Kirkpatrick's hierarchy,[29] though we did note some improvements. The results of two studies[58,63] indicated that the knowledge and skills acquired by learners had transferred to the work environment; the findings of another two[62,63] indicated that the health and wellbeing of patients had improved as a result of the educational intervention. For policy makers to invest in handover training, more educational programs must achieve and report outcomes at higher Kirkpatrick levels. Lower Kirkpatrick outcome levels do not in any way denote lower quality studies and, in fact, such outcomes can be very informative; however, such outcomes are not helpful if the study is executed poorly. Of course, study authors must interpret their outcomes based on the context of the strength of their methodology. The authors of thirteen of the studies overstated their

conclusions. Despite the conclusions as stated by some authors, the poor execution of a study results in poor evidence, which diminishes the helpfulness of the outcomes (at any Kirkpatrick[29] level) for teachers and researchers.

The majority of studies used only brief interventions and focused on single-patient, as opposed to multiple-patient, handovers. The most common timeframe for interventions was one hour, though durations varied from 45 mins to one day. Time constraints placed on educational interventions (by work pressures and the requirements of other aspects of educational programs) have the potential to affect both the quality and effectiveness of handover education. The development of longitudinal or spiral (vertical) handover curricula to enhance retention would represent a contribution to the field.

Five studies focused on slightly longer-term retention of handover skills, knowledge, and/or confidence: after two weeks,[53,59] fifteen weeks,[55] seven months,[60] and 8 to 12 months.[65] Such work is clearly of great interest to policy makers and educators across the globe. Only two studies [27, 58] involved multiple-patient handovers, and only one[62] attempted to address the issue of standardized training. Again, it is disappointing that despite a doubling of published evidence in just 7 years, few published studies address these key issues.

The majority of the studies acquired no baseline data regarding participants' handover skills or knowledge prior to the educational intervention. Consequently, we were unable to ascertain whether the educational program was effective at generating improvements. This lack of pre-post comparisons is an identified weakness of handover education programs.[61] Possibly, pre-post studies are not vital in the tapestry of medical education evidence, but—given that the studies we examined do not provide information on pedagogy or theory—well-designed comparisons of skills, knowledge, and confidence before and after would be especially valuable. No

interventions used simulation scenarios then debriefing, an approach generally rated highly by participants, that research has shown to improve performance.[67] Many interventions involved scenarios and role play instead. All of the interventions included not only information highlighting the importance of good communication but also the opportunity—in some format—to practice and gain feedback. Interestingly, only one study[57] drew upon participants' own experiences of handover. Twelve studies included mnemonics,[25,54-56,58-65] and participants received training in their use, a significant improvement over many studies previously reported in the literature. Clearly, learning not only a mnemonic, but also how to use it, is vital.

As noted, three key content themes emerged: managing complex information, reducing the potential for errors, and building confidence in in handover skills. Gordon and Findley also identified the first two themes in 2011.[1] The growth of electronic handover systems has been a focus for education: medical educators want to ensure the appropriate use of emergent technology.

The final theme, developing confidence, is unique to this review. Handover dynamics change depending on the context in which handovers occur. In circumstances and settings where power gradients are reduced, health care professions feel more empowered to raise questions. These settings are characterized by reduced stress and good teamwork. In contrast, settings with powerful, embedded hierarchies tend to engender higher levels of stress and less teamwork,[68,69] which in turn, effect the quality of handovers and, ultimately, patient safety. Providing multiprofessional handover education at all levels of undergraduate and postgraduate medical training may flatten entrenched hierarchies. Interprofessional education has already been identified as a vital non-technical skill, important for ensuring patient safety and an essential

component of any health care curricula[70] and as such, these findings have significant implications for those planning their own handover teaching.

This review has several limitations. Our findings are—as they would be for any review of the literature—bound by the databases that were available to us. We may have missed some relevant studies. We have focused this review on studies for health professionals working in acute hospital settings; thus, we did not evaluate studies on handover education in other settings. Some of the studies that we excluded (based on the brevity of their educational interventions or the insufficiency of information provided) may have offered relevant insights, but these details were not available in the text, and the articles did not meet the inclusion criteria. Of note, this review focuses only on educational interventions designed to improve handovers—not on any that focus on other approaches to bring about improvements in patient care. The key terms used in the search strategy (e.g., ”handover,” “signout”), which vary internationally, may have affected the number of articles we uncovered. Additionally, due to the limitations of the published literature, we could not complete our synthesis of the findings to the level we had initially planned. Sadly, the lack of multiprofessional studies in handover education precludes our ability to comment upon the quality of handover teaching for teams—or even determine if such teaching occurs. Finally, all of the studies included in the review reported positive results, so the potential for publication bias must be considered.

To advance the field, reports of handover interventions need to improve in quality, utility, and reporting (in all areas; theory, follow-up, etc.). Studies must report in greater detail the theory, pedagogical approach, teaching methods, and learning resources supporting the intervention. Studies investigating more authentic handover teaching, such as interventions that involve practicing multiple-patient handovers rather than single-patient handovers, are needed. Finally,

studies with larger numbers of participants, longer-term follow-up, and an emphasis on multidisciplinary training would add value. These studies should be based upon sound pedagogical principles and ideally demonstrate a positive effect on patient safety outcomes at all levels of Kirkpatrick's[29] hierarchy.

References

1. Gordon M, Findley R. Educational interventions to improve handover in health care: A systematic review. Med Educ. 2011;45:1081-1089.

2. Kicken W, Van der Klink M, Barach P, Boshuizen HP. Handover training: Does one size fit all? The merits of mass customisation. BMJ Qual Saf. 2012;21(SUPPL. 1):i84-i88.

3. Nursing and Midwifery Council United Kingdom. Standards for pre-registration nurse education. September 2010. https://www.nmc.org.uk/globalassets/sitedocuments/standards/nmc-standards-for-pre-registration-nursing-education.pdf. Accessed March 3, 2018.

4. Acharya R, Tham KY, Tan E, et al. Deconstructing the general medical ward rounds through simulation-"simrounds"—A novel initiative for medical students designed to enhance clinical transitions and interprofessional collaboration. Annals of the Academy of Medicine Singapore. Conference Publication: 2013;42(9 SUPPL. 1):S178.

5. World Health Organization Collaborating Centre for Patient Safety Solutions. Communication during patient hand-overs. Patient safety solutions. 2007. http://www.who.int/patientsafety/solutions/patientsafety/PS-Solution3.pdf. Accessed March 3, 2018.

6. Doyle KE, Cruickshank M. Stereotyping stigma: Undergraduate health students' perceptions at handover. J Nurs Educ. 2012;51:255-261.

7. Accreditation Council for Graduate Medical Education. ACGME common program requirements. Updated 2013.

https://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/CPRs2013.pdf. Accessed March 13, 2018.

8. Bump GM, Jacob J, Abisse SS, Bost JE, Elnicki DM. Implementing faculty evaluation of written sign-out. Teach Learn Med. 2012;24:231-237.

9. Britt RC, Ramirez DE, Anderson-Montoya BL, Scerbo MW. Resident handoff training: Initial evaluation of a novel method. J Healthc Qual. 2015;37:75-80.

10. Jimenez ME, Manicone PE, Davies JL, et al. Assessing the impact of a web-based educational intervention on the patient handoff process among pediatric residents: A pre and post test evaluation. International Journal of Child and Adolescent Health. 2011;4:175-181.

11. Antiel RM, Reed DA, Van Arendonk KJ, et al. Effects of duty hour restrictions on core competencies, education, quality of life, and burnout among general surgery interns. JAMA Surg. 2013;148-448-455.

12. Keogh B. Review into the quality of care and treatment provided by 14 hospital trusts in England: Overview report. July 2013. http://www.nhs.uk/NHSEngland/bruce-keogh-review/Documents/outcomes/keogh-review-final-report.pdf. Accessed March 13, 2018.

13. Dekosky AS, Gangopadhyaya A, Chan B, Arora VM. Improving written sign-outs through education and structured audit: The UPDATED approach. J Grad Med Educ. 2013;5:335-336.

14. Benham-Hutchins MM, Effken JA. Multi-professional patterns and methods of communication during patient handoffs. Int J Med Inform. 2010;79:252-267.

15. Gore A, Leasure AR, Carithers C, et al. Integrating hand-off communication into undergraduate nursing clinical courses. J Nurs Educ Pract. 2015;5:70-76.

16. Jeffcott SA, Evans SM, Cameron PA, Chin GS, Ibrahim JE. Improving measurement in clinical handover. Qual Saf Health Care. 2009;18:272-277.

17. Dubosh NM, Carney D, Fisher J, Tibbles CD. Implementation of an emergency department sign-out checklist improves transfer of information at shift change. J Emerg Med. 2014;47:580-585.

18. Riesenberg LA, Leitzsch J, Massucci JL, et al. Residents' and attending physicians' handoffs: A systematic review of the literature. Acad Med. 2009;84:1775-1787.

19. Greenberg CC, Regenbogen SE, Studdert DM, et al. Patterns of communication breakdowns resulting in injury to surgical patients. J Am Coll Surg. 2007;204:533-540.

20. The Joint Commission. Improving America's hospitals: The Joint Commission's annual report on quality and safety. 2007. https://www.jointcommission.org/assets/1/6/2007_Annual_Report.pdf. Accessed March 13, 2018.

21. Englander R, Flynn T, Call S, et al. Core entrustable professional activities for entering residency. 2014. https://icollaborative.aamc.org/resource/887/. Accessed March 13, 2018.

22. Gordon M. Handover in paediatrics: Junior perceptions of current practise within the North West region. Arch Dis Child. 2010;95(Supplement 1):69.

23. Girdley D, Johnsen C, Kwekkeboom K. Facilitating a culture of safety and patient-centred care through use of a clinical assessment tool in undergraduate nursing education. J Nurs Educ. 2009;48:702-705.

24. O'Toole JK, Stevenson AT, Good BP, et al. Closing the gap: A needs assessment of medical students and handoff training. J Pediatr. 2013;162:887-888.e1.

25. Lee J, Mast M, Humbert J, Bagnardi M, Richards S. Teaching handoff communication to nursing students: A teaching intervention and lessons learned. Nurs Educ. 2016;41:189-193.

26. Lyons MN, Standley TD, Gupta AK. Quality improvement of doctors' shift-change handover in neuro-critical care. Qual Saf Health Care. 2010;19:e62.

27. Gaffney S, Farnan JM, Hirsch K, et al. The modified, multi-patient observed simulated handoff experience (M-OSHE): Assessment and feedback for entering residents on handoff performance. J Gen Intern Med. 2016;31:438-441.

28. Gordon M, Gibbs T. STORIES statement: Publication standards for healthcare education evidence synthesis. BMC Medicine. 2014;12:143

29. Kirkpatrick DL. Evaluation of training. In: Craig RL, Bittel LR, eds. Training and development handbook. New York: McGraw-Hill; 1967: 87-112.

30. Hammick M, Dornan T, Steinert Y. Conducting a best evidence systematic review. Part 1: From idea to data coding. BEME Guide No. 13. Medical Teacher. 2010;32:3-15.

31. Reed D, Price E, Windish D, et al. Challenges in systematic reviews of educational intervention studies. Ann Intern Med. 2005;142:1080-1899.

32. Cornell P, Gervis MT, Yates L, Vardaman JM. Improving shift report focus and consistency with the situation, background, assessment, recommendation protocol. J Nurs Adm. 2013;43:422-428.

33. Emlet LL, Al-Khafaji A, Kim YH, Venkataraman R, Rogers PL, Angus DC. Trial of shift scheduling with standardized sign-out to improve continuity of care in intensive care units. Crit Care Med. 2012;40:3129-3134.

34. Gallagher D. Crew resource management... following up. Nurs Manage. 2016;47:50-54.

35. Pukenas EW, Dodson G, Deal ER, Gratz I, Allen E, Burden AR. Simulation-based education with deliberate practice may improve intraoperative handoff skills: A pilot study. J Clin Anesth. 2014;26:530-538.

36. Reyes JA, Greenberg L, Amdur R, Gehring J, Lesky LG.. Effect of handoff skills training for students during the medicine clerkship: A quasi-randomized study. Adv Health Sci Educ Theory Pract. 2016;21:163-173.

37. Ronnebaum J, Carlson J. Does education in an evidence-based teamwork system improve communication with emergency handoffs for physical therapy students? A pilot study. J Acute Care Phys Ther. 2015;6:71-76.

38. Rourke L, Boyington C. A workshop to introduce residents to effective handovers. Clin Teach. 2015;12:99-102.

39. Telem DA, Buch KE, Ellis S, Coakley B, Divino CM. Integration of a formalized handoff system into the surgical curriculum: Resident perspectives and early results. Arch Surg. 2011;146:89-93.

40. Collins G. Using simulation to develop handover skills. Nurs Times 2014;110:8-12.

41. Beck EH, Ahn J. TF-7 emergency medicine resident transitions of care curriculum. Ann Emerg Med. 2012; 60:S158-S159.

42. Godfrey E, Hassan I, Carson-Stevens A, Saayman AG. Safer ICU trainee handover: A service improvement project. Crit Care. 2012;16(Suppl 1):P518.

43. Gresens AA, Britt RC, Anderson-Montoya BL, Ramierz DE, Scerbo M. Improving the quality and content of the surgical handoff: An innovative method. J Am Coll Surg. 2013; 217:S118.

44. Miller AA, Ziegler O. Reinventing the hospital handoff for clinical education. J Physician Assist Educ. 2016;27:99-100.

45. Moss S. A quality improvement project to develop nursing handover in the neonatal intensive and special care unit (nisc). J Paediatr Child Health. 2015;51:93.

46. Mueller S, Patel R, O'Toole J, Schnipper J. Best practices in inpatient handoffs of care. Hosp Med Clin. 2016;5:518-528.

47. Parikh P, Pechman D, Gutierrez K, et al. The effect of structured handover on the efficiency of information transfer during trauma sign-out. J Surg Res. 2013;179:345.

48. Perry K, Fant AL, Farmer B. Ed-pass: A Novel Approach to Standardized Ed Hand-offs. Acad Emerg Med. 2015; 22:S440.

49. Ramirez DW, Britt, RC, Scerbo, MW, et al. Assessing the efficacy of pediatric intern hand-off training. Acad Ped. 2013:13:e2-e3.

50. Wang D, Sabri E, Krympotic K, Lobos A. Using SBAR (Situation, Background, Assessment and Recommendations) to improve resident communication. Paediatr Child Health. 2014;19:e83.

51. Aboumatar H, Allison RD, Feldman L, Woods K, Thomas P, Wiener C. Focus on transitions of care: Description and evaluation of an educational intervention for internal medicine residents. Am J Med Qual. 2014;29:522-529.

52. Aebersold M, Tschannen D, Sculli G. Improving nursing students' communication skills using crew resource management strategies. J Nurs Educ. 2013;5;52:125-130.

53. Airan-Javia S, Kogan JR, Smith M, et al. Effects of education on interns' verbal and electronic handoff documentation skills. J Grad Med Educ. 2012;4:209-214.

54. Allen C, Gould L, Ballantyne J, et al. Improving handover on the intensive care unit: A completed audit cycle. Anaesthesia. 2014;70:56.

55. Avallone MA, Weideman YL. Evaluation of a nursing handoff educational bundle to improve nursing student handoff communications: A pilot study. J Nurs Educ Pract. 2015;5: 65-75.

56. Daniel L, N-Wilfong D. Empowering interprofessional teams to perform effective handoffs through online hybrid simulation education. Crit Care Nurs Q. 2014;37:225-229.

57. Darbyshire D, Gordon M, Baker P. Teaching handover of care to medical students. Clin Teach. 2013;10:32-37.

58. Ebben RH, van Grunsven PM, Moors ML, et al. A tailored e-learning program to improve handover in the chain of emergency care: A pre-test post-test study. Scand J Trauma Resusc Emerg Med. 2015; 23:33.

59. Sawatsky AP, Mikhael JR, Punatar AD, Nassar AA, Agrwal N. The effects of deliberate practice and feedback to teach standardized handoff communication on the knowledge, attitudes, and practices of first-year residents. Teach Learn Med. 2013;25:279-284.

60. Shaughnessy EE, Ginsbach K, Groeschl N, Bragg D, Weisgerber M.. Brief educational intervention improves content of intern handovers. J Grad Med Educ. 2013;5:150-153.

61. Smith CJ, Peterson G, Beck GL. Handoff training for medical students: Attitudes, knowledge, and sustainability of skills. Educ Med J. 2015;7: e15-26.

62. Starmer AJ, Spector ND, Srivastava R, et al. Changes in medical errors after implementation of a handoff program. N Engl J Med. 2014;371:1803-1812.

63. Starmer AJ, Sectish TC, Simon DW, et al. Rates of medical errors and preventable adverse events among hospitalized children following implementation of a resident handoff bundle. JAMA. 2013;310:2262-2270.

64. Starmer AJ, O'Toole J,K., Rosenbluth G, et al. Development, implementation, and dissemination of the I-PASS handoff curriculum: A multisite educational intervention to improve patient handoffs. Acad Med. 2014;89:876-884.

65. Stojan J, Mullan P, Fitzgerald J et al. Handover education improves skill and confidence. Clin Teach. 2016;13:422-426.

66. Gordon M, Box H, Farrell M, et al. Non-technical skills learning in healthcare through simulation education: Integrating the SECTORS learning model and complexity theory. BMJ Simulation and Technology Enhanced Learning. 2015;1:67-70.

67. Dickinson D. Human patient simulation training. Pract Nurse. 2011;41:27-29.

68. Stephan WG, Stephan CW, Gudykunst, WB. Anxiety in intergroup relations: A comparison of anxiety/uncertainty management theory and integrated threat theory. Int J Intercult Rel. 1999; 23:613-628.69. Flin R, O'Connor P, Crichton M. Safety at the sharp end: A guide to non-technical skills. Boca Raton, FL: CRC Press Taylor & Francis Group; 2008.

70. Gordon M. Where is the risk of bias? Considering intervention reporting quality. Med Educ. 2017;51:874–875.

Figure Legends

Figure 1

Flow diagram showing inclusion and exclusion of articles for a literature review of studies (published between January 2011 and September 2016) on teaching handover.

Figure 2

Instructional methods for teaching patient handover in health care, as extracted from studies published between January 2011 and September 2016.

Figure 3

Instructional content for teaching patient handover in health care as extracted from studies published between January 2011 and September 2016.

Table 1

Characteristics and Quality Indices of 18 Studies of Handover Interventions, Published Between January 2011 and September 2016

Author	Location	Study type	Participants	Conclusion	Quality indices[a]						Level of outcome[b]	Strength of conclusion[c]
					E	Cu	S	P	C	S		
Aboumatar 2014[51]	USA	Pre-post	39 postgraduate doctors (medical interns)	The workshop is an effective tool for handover training.							2b	1/5
Aebersold 2013[52]	USA	Prospective	28 undergraduate nurses (baccalaureate students)	The program can potentially improve student nurses' communication skills.							1	1/5
Airan-Javia 2012[53]	USA	Randomized control trial	39 postgraduate doctors (medical interns and residents) and 35 controls	Compared to the controls, the interns who received handoff education demonstrated superior *verbal* handoff skills but the same level of *electronic* handoff skills.							2b and 3	2/5

Allen 2014[54]	USA	Prospective	124 postgraduate doctors (first-year residents)	Both undergraduate and graduate medical education curricula must include formalized training and methods to assess competencies in handoffs. Versions of the program are being offered across the institution.				2a and 2b	2/5
Avallone 2015[55]	USA	Pre-post	28 undergraduate nurses (baccalaureate students in their second semester; 14 study participants and 14 controls)	The handover training program improved students' handover communication skills.				1 and 2b	3/5
Britt 2015[9]	USA	Observational	32 postgraduate doctors (pediatric and surgical interns)	The handover training curriculum is effective in improving handover skills.				2b	1/5
Daniel 2014[56]	USA	Pre-post	103 health care staff (unspecified) observing and not interacting	The course emphasizes the importance of teamwork and was well received by participants.				1	1/5

Darbyshire 2013[57]	United Kingdom	Observational	44 senior medical students	The intervention was pedagogically sound, and other educators can use it as a basis for designing their own materials.			1	1/5
Ebben 2015[58]	Nether-lands	Pre-post	88 postgraduate nurses and doctors in emergency departments and the ambulance service	Results show a relatively high baseline adherence rate to usage and correct sequence of the DeMIST model prior to the tailored e-learning programme. The number of handovers where information was documented during handover slightly increased.			3	4/5
Gaffney 2016[27]	USA	Prospective	84 postgraduate doctors (medical interns, internal medicine)	The M-OSHE is a promising strategy for teaching and evaluating verbal handover of multiple patients.			1 and 2b	1/5
Lee 2016[25]	USA	Pre-post	Undergraduate nurses (unstated number of baccalaureate students)	Teaching and evaluation of handover needs to be included in nursing curricula.			2a and 2b	2/5

Sawatsky 2013[59]	USA	Pre-post	11 postgraduate doctors (first-year internal medicine and transitional residents)	A brief curriculum using deliberate practice is an effective way to improve handoff practices of first-year residents.							2b	1/5
Shaughnessy 2013[60]	USA	Pre-post	20 postgraduate doctors (pediatric interns)	The intervention improved handover performance.							2b	2/5
Smith 2015[61]	USA	Pre-post	59 undergraduate doctors (senior medical students)	The handoff workshop improved participants' attitudes, knowledge, and skills, but performance gains declined in the months following training.							1, 2a, and 2b	2/5
Starmer 2014[62]	USA	Prospective	875 postgraduate doctors (pediatric residents)	Handover training was associated with decreased medical errors and preventable adverse events, with improvements in communication, and with no negative effect on workflow.							2b and 4b	3/5

Starmer 2013/4[63,64]	USA	Prospective pilot study and curriculum design main study	Pilot study: 84 postgraduate doctors (pediatric residents); Main study: 855 postgraduate doctors (pediatric residents) plus 267 faculty	Pilot study: Implementation of a handoff bundle was associated with a significant reduction in medical errors and preventable adverse events among hospitalized children. Improvements in verbal and written handoff processes occurred, and resident workflow did not change adversely. Main study: The comprehensive I-PASS handover curriculum offers a standardized approach to monitoring verbal and written handover skills.					2b[64], 3[63], and 4b[63]	1/5[64], 3/5[63]
Stojan 2016[65]	USA	Pre-post	19 undergraduate doctors (fourth-year medical students)	A handover curriculum appears to improve medical students' handover performance and confidence, as evaluated by independent ratings from faculty members, peers, and the students themselves.					1 and 2b	3/5

Abbreviations: M-OSHE indicates Modified, Multi-patient Observed Simulated Handoff Experience; and I-PASS, Illness severity, Patient summary, Action list, Situation awareness and contingency planning, Synthesis by receiver.
[a]The color legend for the quality index is as follows: white = low risk of bias; grey = unclear risk of bias; black = high risk of bias.
The abbreviations for the quality measures are as follows: E = Educational underpinning; Cu = Curriculum; S = Setting; P = Pedagogy; C = Content; S = Strength of conclusions
[b]Level of outcomes refers to Kirkpatrick's Levels29 where 1 = reaction; 2a = self-reported learning; 2b = learning; 3 = behavior; and 4 = results.
[c]Strength of conclusions refers to refers to how clearly the conclusions made by the authors match the data which comes from the studies (1 = low quality; 5 = high quality).[30]

Table 2
Included studies description of intervention, outcome measure and key result

Author	Educational intervention	Outcome measures	Results
Aboumatar 2014[51]	Two-hour workshop comprising (1) handover practice in pairs, based on a scenario; (2) didactic presentation; (3) video showing handover using the same scenarios; (4) training on a computer-based tool; and (5) practice in pairs again using different scenarios. Each participant had the chance to practice handover and to provide feedback on the other's performance.	1. Participants' self-evaluations of whether their skills and knowledge, and that of their partners, had improved after the workshop. 2. Participants' opinions on whether patients were being managed safely three months later.	Increased quality, confidence, and understanding of problems regarding handover.
Aebersold 2013[52]	Three-part training: (1) nursing crew resource management training day comprising a six-hour didactic workshop (containing five modules); (2) two-hour simulation (role play) mid semester to practice communication skills; and (3) a second high-fidelity simulation at the end of the semester.	Participants' enjoyment of the program, whether they felt they had developed new skills, and their opinion on the likelihood these would be used and on the effectiveness of the teaching strategies used.	Students were satisfied with the program and demonstrated the ability to use the communication techniques learned in a subsequent simulation.
Airan-Javia 2012[53]	Intervention group: 45-minute educational session on handover communication skills for interns and residents that included the following: case studies; reasons for improving handover; essential elements of verbal and electronic handover; an electronic handover tool; and video clips of good, mediocre, and poor handover. In addition, residents received 15 minutes of handover feedback training. Control group: no handover training.	Interns' self-evaluations regarding handover knowledge and error rates.	Compared to the control group, interns in the intervention group felt they had greater knowledge of handoff and that they made fewer errors.
Allen 2014[54]	One day of handover training comprising 25-minute didactic session on the importance of good medical communication, 20-minute instruction on interprofessional communication skills, 15-minute introduction to the iCATCH mnemonic, discussion of scenarios in multi-speciality groups, and simulated handover.	Participants' ability to identify more clinical errors resulting from poor handover and whether they felt more competent at giving handover after training.	Participants recognized the importance of better communication in improving handover.
Avallone 2015[55]	Three-hour workshop (followed by formative evaluation and feedback) including communication strategies, how to use SBAR, a didactic presentation, handover videos, role play using case studies, and practice at giving, receiving, and observing handover (students worked in groups of three).	Observed changes in students' handover skills and students' views on the helpfulness of the workshop and on the changes in their skills.	Training in handover resulted in improved handover skills compared to controls. Participants also rated the workshop as helpful.

Britt 2015[9]	Two components: (1) Interactive lecture on handover structure and handover toolkit and (2) reading scenarios and using these to practice handovers. Feedback given on quality of handover using a rating tool. 50% of the participants had the lecture then handover practice. 50% had the opposite. Afterwards all participants were asked to evaluate and handover three simulated emergency patients then handover four inpatients from written records.	Observed quality of participants' handover skills.	Trained interns performed significantly better than untrained, and handover was better for emergencies than for surgery and pediatric cases.
Daniel 2014[56]	Four components: (1) 15-minute multiple-choice pre-test to gauge knowledge of communication; (2) PowerPoint presentation on communication techniques from Team STEPPS[a] program; (3) watching videos of five high-fidelity simulations; and (4) post-test.	Participants' opinions of how helpful they found the program.	Participants' knowledge of communication improved.
Darbyshire 2013[57]	One-hour education session comprising (1) group discussion regarding participants' own handover experiences; (2) role play (in twos and threes) using scenarios to handover patients, plus feedback; (3) watching a video of good and bad handovers; and (4) participating in a multidisciplinary handover scenario.	Students' opinions of how helpful the educational session was.	Students' perceived abilities to perform handover was high following the intervention.
Ebben 2015[58]	eLearning program to assess knowledge of DeMIST model and handover involving (1) skills in using the model, (2) simulated scenarios (relevant to the perspective of the profession), and (3) a knowledge test.	Observation of whether the educational intervention improved adherence to an agreed handover structure.	No significant difference in the number of handovers with the DeMIST[d] model and the number of handovers with the correct sequence of the DeMIST[d] model following the eLearning program.
Gaffney 2016[27]	On-line teaching package comprising (1) video highlighting handover pitfalls; (2) 15-minute didactic session; and (3) multiple-choice questions to assess knowledge acquisition. Also participated in simulated handover and feedback on performance.	Attempts at observing skills acquisition and learners' self-perceptions of how useful the program was.	Participants felt better prepared to undertake handover after undertaking the program. Prior handover training and more handover experience was associated with better performance.

Lee 2016[25]	Two-hour, classroom-based workshop on handover reporting, including an opportunity to practice and critique a colleague.	Students' opinions on their own handover skills and on their ability to use a standardized handover method.	Students became significantly more comfortable and skilled on some (but not all) outcome measures.
Sawatsky 2013[59]	Three components: (1) brief didactic session on the importance of handover; (2) learning the SIGNOUT mnemonic and considering examples of good and bad handovers using the mnemonic; and (3) videoed handover practice in pairs with a facilitator, plus debrief and feedback.	Observation of handover skills and inclusion of relevant information.	The curriculum resulted in increased comfort and perceived efficiency in performing handover.
Shaughnessy 2013[60]	SAFETIPS mnemonic and one-hour educational workshop comprising didactic session, discussion, case handover example, and practice with supervision.	Observation/evaluation of whether handover skills improved.	Participants demonstrated improved handover skills, both immediately and seven months later.
Smith 2015[61]	Three-hour educational workshop covering both written and verbal handover that included handover practice in student dyads and responding to mock nurse calls.	Observed changes in handover attitudes and skills and participants' enjoyment of the workshop.	Self-reported attitudes towards handover and skills improved following the intervention.
Starmer 2014[62]	I-PASS handoff bundle including the mnemonic, two-hour teamwork and communication skills workshop, one-hour role playing and simulation session, and a computer model.	Observation of whether oral and written handover improved.	Medical error rates and preventable adverse events decreased significantly for patient admissions following the intervention.
Starmer 2013/4[63, 64]	Pilot study: handover education bundle comprising (1) two-hour communication training session; (2) the introduction of the SIGNOUT mnemonic to standardize verbal handovers; (3) a new team handover structure, and (4) in just one clinical area, a new electronic handover tool. Main study: *For residents* (1) two-hour didactic and interactive session to teach I-PASS techniques and concepts; (2) one-hour interactive role play (handoff simulation exercise) to practice techniques learned; and (3) computer module (videos and questions) for those who could not attend the workshop and for independent skills refreshment. *For faculty* (1) faculty development resources; (2) faculty observation tools; and (3) campaign toolkit to	Pilot study: Documentation of number of medical errors and preventable adverse events and of key handover elements observed. Main study: Participants' self-reports of handover skills.	Pilot study: 1. Reduced rates of medical errors and preventable adverse events. 2. An increased number of key elements included in handovers. Main study: Participants reported increased handover skills.

	support curriculum implementation.		
Stojan 2016[65]	One-hour handover workshop including (1) education on importance of handover and consequences of poor handover; (2)watching/discussing videos of good and poor examples; and (3) learning the SIGNOUT mnemonic.	Trained observers' observations of students' handover skills; students ratings' of their enjoyment of the workshop and their confidence in handover.	Students' handover performance significantly improved after the workshop. Students reported that the workshop was effective and they felt more prepared to undertake handovers.

Abbreviations: iCATCH indicates Identify, Chief complaint, Active problem list, Therapies and interventions, Clinical trajectory, Help me; SBAR, Situation, Background, Assessment, Recommendation; DeMist, Demographics, Mechanism, Injuries, Signs and Symptoms, Treatment; M-OSHE, Modified, Multi-patient Observed Simulated Handoff Experience; SIGNOUT, Sick or DNR, Identifying data, General hospital course, New events of the day, Overall health status / clinical condition, Upcoming possibilities with plan, Tasks to complete overnight with plan; SAFETIPS, Stats, Asseessment, Focused plan, Exam, To do, If / then, Pointers / pitfalls, Sick-o-meter, Repeat back; I-PASS, Illness severity, Patient summary, Action list, Situation awareness and contingency planning, Synthesis by receiver

[a]Team STEPPS (Framework and competencies: Knowledge [shared mental model], Attitudes [mutual trust, team orientation], Performance [adaptability, accuracy, productivity, efficiency, safety])

Figure 1

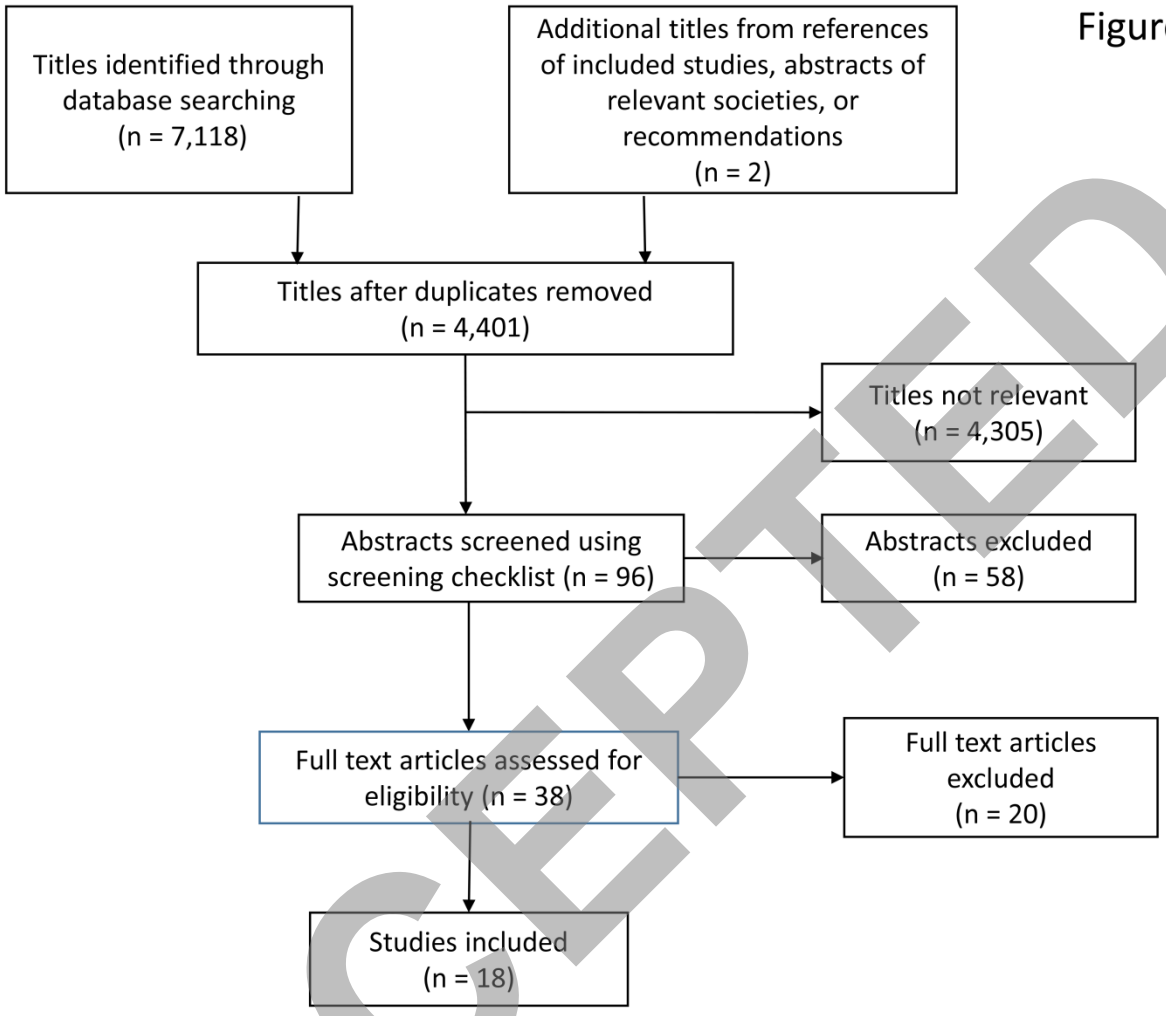

Figure 2

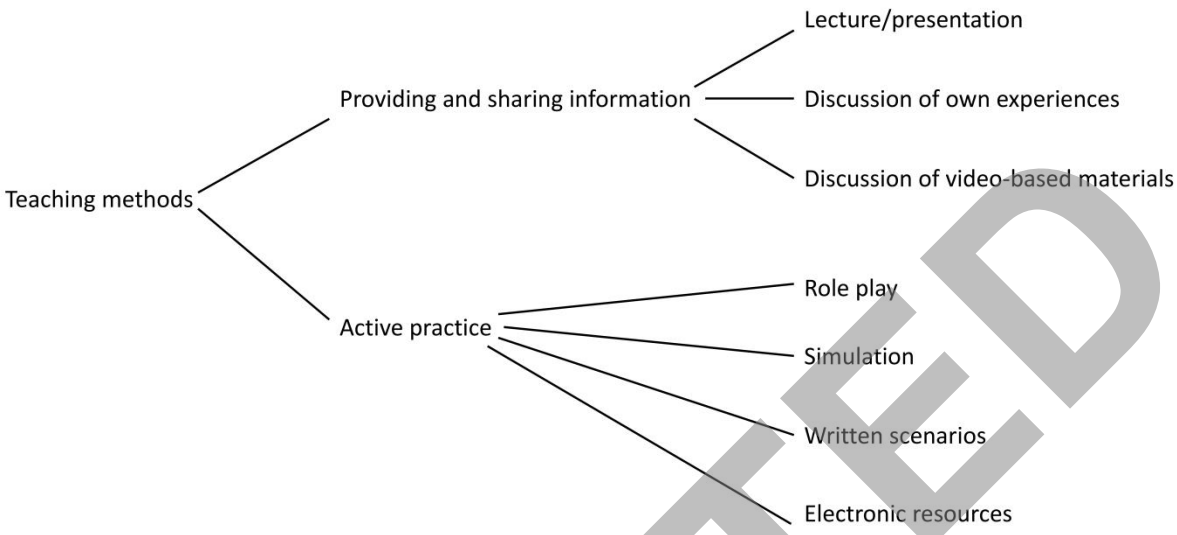

Figure 3