

Supplementary Material

Supplementary File 1. Search Strategy

- Databases:
- PubMed (NLM/NIH)
 - Embase (Clarivate)
 - CINAHL Plus with Full Text (EBSCOhost)

- Limits:
- Years: 2013 – 2024
 - Language: English
 - Geographic: US + International
 - Publication Type: Peer-reviewed literature

Table S-1. PubMed search strategy

Set #	Search	# of results
1	(physician*[tiab] OR doctor*[tiab] OR clinician*[tiab] OR "medical staff"[tiab] OR "clinical staff"[tiab] OR practitioner*[tiab] OR "physician nurse"[tiab:~1] OR hospitalist*[tiab] OR "shift to shift"[tiab] OR "Physicians"[Mesh] OR "Patient Care Team"[Mesh:NoExp] OR "Medical Staff, Hospital"[Mesh])	1,221,118
2	(handover*[tiab] OR "hand over"[tiab] OR handoff*[tiab] OR "hand off"[tiab] OR signout*[tiab] OR "sign out"[tiab] OR "signover"[tiab] OR "sign over"[tiab] OR "shift report"[tiab] OR "bedside report"[tiab] OR "Patient Handoff"[Mesh])	6,486
3	"patient safety"[tiab] OR safe*[ti] OR "patient harm"[tiab] OR "Patient Safety"[Mesh] OR "Patient Harm"[Mesh]	263,780
4	checklist*[tiab] OR "check list"[tiab] OR guideline*[tiab] OR intervention*[tiab] OR practice[tiab] OR practices[tiab] OR protocol[tiab] OR policy[tiab] OR policies[tiab] OR path*[tiab] OR standard[tiab] OR standards[tiab] OR standardization[tiab] OR standardisation[tiab] OR "structured approach"[tiab] OR tool*[tiab] OR "tool kit"[tiab] OR "Communication Barriers"[Mesh:NoExp] OR "Checklist"[Mesh] OR "Practice Guidelines as Topic"[Mesh] OR "Practice Guideline"[pt] OR (IPASS*[tiab] NOT Iressa[tiab]) OR "I PASS"[tiab] OR ICATCH*[tiab] OR SBAR*[tiab] OR ISBAR*[tiab] OR SHARQ[tiab] OR PATH[tiab] OR "handover algorithm"[tiab:~2] OR "handover algorithms"[tiab:~2] OR "hand over algorithm"[tiab:~2] OR "hand over algorithms"[tiab:~2] OR "handoff algorithm" [tiab:~2] OR "handoff algorithms"[tiab:~2] OR "hand off algorithm"[tiab:~2] OR "hand off algorithms"[tiab:~2] OR "Safer Sign Out"[tiab]	8,721,274
5	#1 AND #2 AND #3 AND #4	460
6	Address[pt] OR Autobiography[pt] OR Bibliography[pt] OR Biography[pt] OR "Clinical Trial Protocol"[pt] OR "Clinical Trial, Veterinary"[pt] OR "Collected Work"[pt] OR Comment[pt] OR Congress[pt] OR "Consensus Development Conference"[pt] OR "Consensus Development Conference, NIH"[pt] OR Dataset[pt] OR Dictionary[pt] OR Directory[pt] OR "Duplicate Publication"[pt] OR Editorial[pt] OR "Electronic Supplementary Materials"[pt] OR "Equivalence Trial"[pt] OR "Expression of Concern"[pt] OR Festschrift[pt] OR "Historical Article"[pt] OR "Interactive Tutorial"[pt] OR Interview[pt] OR "Introductory Journal Article"[pt] OR Lecture[pt] OR "Legal Case"[pt] OR Legislation[pt] OR Letter[pt] OR News[pt] OR "Newspaper Article"[pt] OR "Observational Study, Veterinary"[pt] OR Overall[pt] OR "Patient Education Handout"[pt] OR "Periodical Index"[pt] OR "Personal Narrative"[pt] OR Portrait[pt] OR Preprint[pt] OR "Published Erratum"[pt] OR "Randomized Controlled Trial, Veterinary"[pt] OR "Retracted Publication"[pt] OR "Retraction of Publication"[pt] OR "Twin Study"[pt] OR "Video-Audio Media"[pt] OR Webcast[pt] OR Proceedings[ti]	3,340,312
7	#5 NOT #6	455
8	#7 AND (2013/1/1:2024/12/31[pdat]) AND (english[Filter])	353

9	"systematic review"[ti:~3] OR "systematic reviews"[ti:~3] OR ((systematic[tiab] OR scoping[tiab]) AND review[pt]) OR "systemic review"[ti] OR "systematical review"[ti] OR "meta analy"[tiab] OR metaanaly[tiab] OR metasynthes[tiab] OR "meta synthes"[tiab] OR ((systematic[ti] OR scoping[ti] OR metanaly[ti] OR metasynth[ti] OR "meta analy"[ti] OR "meta synth"[ti] OR evidence[ti] OR Cochrane[ti] OR literature[ti]) AND (review[ti] OR synthes[ti] OR map[ti] OR mapping[ti])) OR "systematic review"[pt] OR "systematic review"[sb] OR meta-analysis[pt] OR "literature review"[ti:~2] OR "rapid review"[ti:~2] OR "umbrella review"[ti:~2] OR "evidence review"[ti] OR "scoping review"[ti] OR "literature scan"[ti] OR "Systematic Reviews as Topic"[Mesh] OR "Meta-Analysis as Topic"[MeSH] OR "Review Literature as Topic"[MeSH]	735,436
10	#8 AND #9	18

Table S-2. Embase search strategy (Limited to Embase records only, MEDLINE records excluded)

Set #	Search	# of results
1	(physician*:ti,ab OR doctor*:ti,ab OR clinician*:ti,ab OR 'medical staff*:ti,ab OR 'clinical staff*:ti,ab OR practitioner*:ti,ab OR 'physician NEAR/1 nurse':ti,ab OR hospitalist*:ti,ab OR 'shift to shift*:ti,ab OR physician/exp OR 'patient care team'/de OR 'medical staff'/de) AND [embase]/lim	1,713,743
2	(handover*:ti,ab OR 'hand over*:ti,ab OR handoff*:ti,ab OR 'hand off*:ti,ab OR signout*:ti,ab OR 'sign out*:ti,ab OR signover*:ti,ab OR 'sign over*:ti,ab OR 'shift report*:ti,ab OR 'bedside report*:ti,ab OR 'clinical handover'/de) AND [embase]/lim	8,694
3	('patient safety':ti,ab OR safe*:ti OR 'patient harm*:ti,ab OR 'patient safety'/exp OR 'patient harm'/exp) AND [embase]/lim	417,135
4	(checklist*:ti,ab OR 'check list*:ti,ab OR guideline*:ti,ab OR intervention*:ti,ab OR practice:ti,ab OR practices:ti,ab OR protocol*:ti,ab OR policy:ti,ab OR policies:ti,ab OR path*:ti,ab OR standard:ti,ab OR standards:ti,ab OR standardization:ti,ab OR standardisation:ti,ab OR 'structured approach*:ti,ab OR tool*:ti,ab OR 'tool kit*:ti,ab OR 'communication barrier'/de OR 'checklist'/de OR 'practice guideline'/de OR ipass:ti,ab OR 'i pass*:ti,ab OR icatch*:ti,ab OR sbar*:ti,ab OR isbar*:ti,ab OR sharq:ti,ab OR path:ti,ab OR ((handover* OR 'hand over*' OR handoff* OR 'hand off*') NEAR/2 algorithm*) OR 'safer sign out':ti,ab) AND [embase]/lim	9,422,195
5	#1 AND #2 AND #3 AND #4	746
6	#1 AND #2 AND #3 AND #4 AND ([article]/lim OR [article in press]/lim OR [review]/lim) AND [english]/lim AND [2013-2024]/py	174
7	#1 AND #2 AND #3 AND #4 AND ([article]/lim OR [article in press]/lim OR [review]/lim) AND [english]/lim AND [2013-2024]/py AND ([cochrane review]/lim OR [systematic review]/lim OR [meta analysis]/lim)	7

Individual Model Searches

Table S-3. I-PASS search strategy (06/12/24)

Database	Search Strategy	# of Results
PubMed	("IPASS"[tiab] OR "I PASS"[tiab]) AND ((2013/1/1:2024/12/31[pdat]) AND (english[Filter]))	86
Embase	(ipass:ti,ab OR 'i pass':ti,ab) AND ([article]/lim OR [article in press]/lim OR [review]/lim) AND [english]/lim AND [embase]/lim AND [2013-2024]/py	10
Total # of de-duplicated results		96

Table S-4. Other Models searches (07/05/23)

Database	Search Strategy	# of Results
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PubMed	(iMIST[tiab] OR "iMIST-AMBO"[tiab] OR DeMIST[tiab] OR " TeamSTEPPS"[tiab] OR "Team STEPPS"[tiab] OR "Targeted Solutions Tool"[tiab]) AND (2013/1/1:2024/12/31[pdat]) AND (english[Filter])	51
Embase	(iMIST:ti,ab OR iMIST-AMBO:ti,ab OR DeMIST:ti,ab OR ' TeamSTEPPS':ti,ab OR 'Team STEPPS':ti,ab OR 'Targeted Solutions Tool':ti,ab)	27
Total # of de-duplicated results		78

Table A-5. Remaining Models Search (07/12/24)

Database	Search Strategy	# of Results
PubMed	("PSYCH"[tiab] OR "PSYCH-PASS"[tiab] OR "ABC"[tiab]) AND ("handoff*" OR "handover*" [tiab] OR "hand off*" OR "hand over*" [tiab]) AND (2013/1/1:2024/12/31[pdat]) AND (english[Filter])	6
Embase	(PSYCH:ti,ab OR PSYCH-PASS:ti,ab OR ABC:ti,ab) AND (handoff* OR handover*:ti,ab OR 'hand off*' OR 'hand over*':ti,ab)	5
Total # of de-duplicated results		4

Supplementary File 2. List of Excluded Studies Upon Full-Text Review

Excluded Studies

The reason for exclusion is noted at the end of the citation.

1. Study: new approach to handoffs slashes errors, preventable adverse events; other medical centers move to implement the protocol. *ED Manag.* 2015 Jan;27(1):6-8. PMID: 25564696. *Design*
2. Abraham J, Pfeifer E, Doering M, et al. Systematic Review of Intraoperative Anesthesia Handoffs and Handoff Tools. *Anesth Analg.* 2021 Jun 1;132(6):1563-75. doi: 10.1213/ane.0000000000005367. PMID: 34032660. *Anesthesia handoffs*
3. Agency for Healthcare Research and Quality. TeamSTEPPS Updates. Rockville, MD; February 2024. <https://www.ahrq.gov/teamstepps-program/updated/index.html>. Accessed on June 4, 2024. *Does not measure clinical safety outcome*
4. Agency for Healthcare Research and Quality. Tool: Handoff. Rockville, MD; May 2023. <https://www.ahrq.gov/teamstepps-program/curriculum/communication/tools/handoff.html>. Accessed on June 4, 2024. *Does not measure clinical safety outcome*
5. Alimenti D, Buydos S, Cunliffe L, et al. Improving perceptions of patient safety through standardizing handoffs from the emergency department to the inpatient setting: a systematic review. *J Am Assoc Nurse Pract.* 2019 Jun 5;31(6):354-63. doi: 10.1097/jxx.000000000000160. PMID: 30829973. *Between unit handoffs*
6. Anderson J, Malone L, Shanahan K, et al. Nursing bedside clinical handover - an integrated review of issues and tools. *J Clin Nurs.* 2015 Mar;24(5-6):662-71. doi: 10.1111/jocn.12706. PMID: 25319724. *SR outdated*
7. Appelbaum R, Martin S, Tinkoff G, et al. Eastern association for the surgery of trauma - quality, patient safety, and outcomes committee - transitions of care: healthcare handoffs in trauma. *Am J Surg.* 2021 Sep;222(3):521-8. doi: 10.1016/j.amjsurg.2021.01.034. PMID: 33558061. *Between unit handoffs*
8. Appelbaum RD, Puzio TJ, Bauman Z, et al. Handoffs and Transitions of Care: A Systematic Review, Meta-Analysis, and Practice Management Guideline from the Eastern Association for the

Surgery of Trauma. J Trauma Acute Care Surg. 2024 Feb 26. doi: 10.1097/ta.0000000000004285. PMID: 38407300. *SR broadly focused*

9. Bakon S, Wirihana L, Christensen M, et al. Nursing handovers: An integrative review of the different models and processes available. Int J Nurs Pract. 2017 Apr;23(2). doi: 10.1111/ijn.12520. PMID: 28176414. *SR broadly focused*

10. Becker's Clinical Leadership. 12 patient handoff communication tools to know. Clinical Leadership & Infection Control. June 29, 2016. *Does not measure clinical safety outcome*

11. Benjamin MF, Hargrave S, Nether K. Using the Targeted Solutions Tool® to Improve Emergency Department Handoffs in a Community Hospital. Jt Comm J Qual Patient Saf. 2016 Mar;42(3):107-18. doi: 10.1016/s1553-7250(16)42013-1. PMID: 26892699. *Outpatient*

12. Blazin LJ, Sitthi-Amorn J, Hoffman JM, et al. Improving Patient Handoffs and Transitions through Adaptation and Implementation of I-PASS Across Multiple Handoff Settings. Pediatr Qual Saf. 2020

Jul-Aug;5(4):e323. doi: 10.1097/pq9.0000000000000323. PMID: 32766496. *Does not measure clinical safety outcomes*

13. Boet S, Djokhdem H, Leir SA, et al. Association of intraoperative anaesthesia handovers with patient morbidity and mortality: a systematic review and meta-analysis. *Br J Anaesth*. 2020 Oct;125(4):605-13. doi: 10.1016/j.bja.2020.05.062. PMID: 32682560. *Anesthesia handoffs*

14. Bowes MR, Santiago PN, Hepps JH, et al. Using I-PASS in Psychiatry Residency Transitions of Care. *Acad Psychiatry*. 2018 Aug;42(4):534-7. doi: 10.1007/s40596-017-0822-1. PMID: 29086242. *Design*

15. Boyd J, Wu G, Stelfox H. The Impact of Checklists on Inpatient Safety Outcomes: A Systematic Review of Randomized Controlled Trials. *J Hosp Med*. 2017 Aug;12(8):675-82. doi: 10.12788/jhm.2788. PMID: 28786436. *SR broadly focused*

16. Bukoh MX, Siah CR. A systematic review on the structured handover interventions between nurses in improving patient safety outcomes. *J Nurs Manag*. 2020 Apr;28(3):744-55. doi: 10.1111/jonm.12936. PMID: 31859377. *SR narrowly focused*

17. Caruso TJ, Su F, Wang E. Introduction of the EMR-integrated I-PASS ICU Handoff Tool. *Pediatr Qual Saf*. 2020 Jul-Aug;5(4):e334. doi: 10.1097/pq9.0000000000000334. PMID: 32766505. *Design*

18. Chladek MS, Doughty C, Patel B, et al. The Standardisation of handoffs in a large academic paediatric emergency department using I-PASS. *BMJ Open Qual*. 2021 Jul;10(3). doi: 10.1136/bmjopen-2020-001254. PMID: 34244172. *Does not measure clinical safety outcomes*

19. Cho S, Lee JL, Kim KS, et al. Systematic Review of Quality Improvement Projects Related to Intershift Nursing Handover. *J Nurs Care Qual*. 2022 Jan-Mar 01;37(1):E8-e14. doi: 10.1097/ncq.0000000000000576. PMID: 34231504. *SR broadly focused*

20. Clements K. High-reliability and the I-PASS communication tool. *Nurs Manage*. 2017 Mar;48(3):12-3. doi: 10.1097/01.NUMA.0000512897.68425.e5. PMID: 28234760. *Design*

21. Cohen MD, Hilligoss PB. The published literature on handoffs in hospitals: deficiencies identified in an extensive review. *Qual Saf Health Care*. 2010 Dec;19(6):493-7. doi: 10.1136/qshc.2009.033480. PMID: 20378628. *SR outdated*

22. Devlin MK, Kozij NK, Kiss A, et al. Morning handover of on-call issues: opportunities for improvement. *JAMA Intern Med*. 2014 Sep;174(9):1479-85. doi: 10.1001/jamainternmed.2014.3033. PMID: 25047049. *No intervention of interest*

23. Dewar ZE, Yurkonis T, Attia M. Hand-off bundle implementation associated with decreased medical errors and preventable adverse events on an academic family medicine in-patient unit: A pre-

post study. *Medicine (Baltimore)*. 2019 Oct;98(40):e17459. doi: 10.1097/md.00000000000017459. PMID: 31577774. *Duplicate*

24. Downey LV, Zun L, Burke T. What constitutes a good hand offs in the emergency department: a patient's perspective. *Int J Health Care Qual Assur*. 2013;26(8):760-7. doi: 10.1108/ijhcqa-03-2012-0028. PMID: 24422264. *Does not measure clinical safety outcome*

25. Farhan M, Brown R, Vincent C, et al. The ABC of handover: impact on shift handover in the emergency department. *Emerg Med J*. 2012 Dec;29(12):947-53. doi: 10.1136/emered-2011-200201. PMID: 22205783. *Does not measure clinical safety outcomes*

26. Farhan M, Brown R, Woloshynowych M, et al. The ABC of handover: a qualitative study to develop a new tool for handover in the emergency department. *Emerg Med J*. 2012 Dec;29(12):941-6. doi: 10.1136/emered-2011-200199. PMID: 22215174. *Design*

27. Feraco AM, Starmer AJ, Sectish TC, et al. Reliability of Verbal Handoff Assessment and Handoff Quality Before and After Implementation of a Resident Handoff Bundle. *Acad Pediatr*. 2016 Aug;16(6):524-31. doi: 10.1016/j.acap.2016.04.002. PMID: 27090858. *Does not measure clinical safety outcomes*

28. Feraco AM, Starmer AJ, Sectish TC, et al. Reliability of Verbal Handoff Assessment and Handoff Quality Before and After Implementation of a Resident Handoff Bundle. *Acad Pediatr*. 2016 Aug;16(6):524-31. doi: 10.1016/j.acap.2016.04.002. PMID: 27090858. *Duplicate*

29. Fitzgerald KM, Banerjee TR, Starmer AJ, et al. Effect of a Multispecialty Faculty Handoff Initiative on Safety Culture and Handoff Quality. *Pediatr Qual Saf*. 2022 Mar-Apr;7(2):e539. doi: 10.1097/pq9.0000000000000539. PMID: 35369417. *Does not measure clinical safety outcome*

30. Franco Vega MC, Ait Aiss M, George M, et al. Enhancing implementation of the I-PASS Handoff Tool Using a Provider Handoff Task Force at a Comprehensive Cancer Center. *Jt Comm J Qual Patient*

Saf. 2024 Mar 8. doi: 10.1016/j.jcjq.2024.03.004. PMID: 38584053. *Does not measure clinical safety outcome*

31. Fryman C, Hamo C, Raghavan S, et al. A Quality Improvement Approach to Standardization and Sustainability of the Hand-off Process. *BMJ Qual Improv Rep.* 2017;6(1). doi: 10.1136/bmjquality.u222156.w8291. PMID: 28469889. *Does not measure clinical safety outcome*

32. Hada A, Coyer F. Shift-to-shift nursing handover interventions associated with improved inpatient outcomes-Falls, pressure injuries and medication administration errors: An integrative review. *Nurs Health Sci.* 2021 Jun;23(2):337-51. doi: 10.1111/nhs.12825. PMID: 33665950. *SR broadly focused*

33. Holly C, Poletick EB. A systematic review on the transfer of information during nurse transitions in care. *J Clin Nurs.* 2013 Sep;23(17-18):2387-95. doi: 10.1111/jocn.12365. PMID: 23786673. *SR outdated*

34. Huth K, Hart F, Moreau K, et al. Real-World Implementation of a Standardized Handover Program (I-PASS) on a Pediatric Clinical Teaching Unit. *Acad Pediatr.* 2016 Aug;16(6):532-9. doi: 10.1016/j.acap.2016.05.143. PMID: 27188521. *Does not measure clinical safety outcomes*

35. Iedema R, Ball C, Daly B, et al. Design and trial of a new ambulance-to-emergency department handover protocol: 'IMIST-AMBO'. *BMJ Qual Saf.* 2012 Aug;21(8):627-33. doi: 10.1136/bmjqs-2011-000766. PMID: 22626739. *Between unit handoffs*

36. Jewell JA. Standardization of Inpatient Handoff Communication. *Pediatrics.* 2016 Nov;138(5). doi: 10.1542/peds.2016-2681. PMID: 27940799. *Design*

37. Jiang SY, Murphy A, Heitkemper EM, et al. Impact of an electronic handoff documentation tool on team shared mental models in pediatric critical care. *J Biomed Inform.* 2017 May;69:24-32. doi: 10.1016/j.jbi.2017.03.004. PMID: 28286030. *Does not measure clinical safety outcomes*

38. Keebler JR, Lazzara EH, Patzer BS, et al. Meta-Analyses of the Effects of Standardized Handoff Protocols on Patient, Provider, and Organizational Outcomes. *Hum Factors.* 2016 Dec;58(8):1187-205. doi: 10.1177/0018720816672309. PMID: 27821676. *Design*

39. Lam KC, Mok TS. Comparison is beyond IPASS and OPTIMAL. *Hong Kong Med J.* 2014 Jun;20(3):176-7. doi: 10.12809/hkmj144267. PMID: 24914076. *No intervention of interest*

40. Lazzara EH, Simonson RJ, Gisick LM, et al. Does standardisation improve post-operative anaesthesia handoffs? Meta-analyses on provider, patient, organisational, and handoff outcomes.

Ergonomics. 2022 Aug;65(8):1138-53. doi: 10.1080/00140139.2021.2020341. PMID: 35438045.
Anesthesia handoffs

41. Li P, Ali S, Tang C, et al. Review of computerized physician handoff tools for improving the quality of patient care. Journal of Hospital Medicine. 2013;8(8):456-63. doi: <https://doi.org/10.1002/jhm.1988>. *SR outdated*

42. Mardis M, Davis J, Benningfield B, et al. Shift-to-Shift Handoff Effects on Patient Safety and Outcomes. Am J Med Qual. 2017 Jan/Feb;32(1):34-42. doi: 10.1177/1062860615612923. PMID: 26518882. *SR inconclusive results*

43. Mariano MT, Brooks V, DiGiacomo M. PSYCH: A Mnemonic to Help Psychiatric Residents Decrease Patient Handoff Communication Errors. Jt Comm J Qual Patient Saf. 2016 Jul;42(7):316-20. doi: 10.1016/s1553-7250(16)42043-x. PMID: 27301835. *Does not measure clinical safety outcomes*

44. Mathias JM. Targeted solutions tool helps banish communication barriers during surgery. OR Manager. 2014 Jan;30(1):14-6. PMID: 24520680. *Design*

45. Merten H, van Galen LS, Wagner C. Safe handover. Bmj. 2017 Oct 9;359:j4328. doi: 10.1136/bmj.j4328. PMID: 28993308. *Design*

46. Methangkool E, Tollinche L, Sparling J, et al. Communication: Is There a Standard Handover Technique to Transfer Patient Care? Int Anesthesiol Clin. 2019 Summer;57(3):35-47. doi: 10.1097/aia.0000000000000241. PMID: 31577236. *Design*

47. Møller TP, Madsen MD, Fuhrmann L, et al. Postoperative handover: characteristics and considerations on improvement: a systematic review. Eur J Anaesthesiol. 2013 May;30(5):229-42. doi: 10.1097/EJA.0b013e32835d8520. PMID: 23492933. *Not a handoff of interest*

48. Mueller SK, Yoon C, Schnipper JL. Association of a Web-Based Handoff Tool With Rates of Medical Errors. JAMA Intern Med. 2016 Sep 1;176(9):1400-2. doi: 10.1001/jamainternmed.2016.4258. PMID: 27479693. *Not a handoff of interest*

49. Nanchal R, Aebly B, Graves G, et al. Controlled trial to improve resident sign-out in a medical intensive care unit. BMJ Qual Saf. 2017 Dec;26(12):987-92. doi: 10.1136/bmjqs-2017-006657. PMID: 28784841. *Not a handoff of interest*

50. O'Toole JK, Calaman S, Anderson M, et al. Utilizing co-production to improve patient-centeredness and engagement in healthcare delivery: Lessons from the Patient and Family-Centered I-

PASS studies. J Hosp Med. 2023 Sep;18(9):848-52. doi: 10.1002/jhm.13055. PMID: 36717094.

Design

51. O'Toole JK, Hepps J, Starmer AJ, et al. I-PASS Mentored Implementation Handoff Curriculum: Frontline Provider Training Materials. MedEdPORTAL. 2020;16:10912. doi: doi:10.15766/mep_2374-8265.10912. *Does not measure clinical safety outcome*

52. O'Toole JK, Starmer AJ, Calaman S, et al. I-PASS Mentored Implementation Handoff Curriculum: Implementation Guide and Resources. MedEdPORTAL. 2018 Aug 3;14:10736. doi: 10.15766/mep_2374-8265.10736. PMID: 30800936. *Does not measure clinical safety outcome*

53. O'Toole JK, Starmer AJ, Calaman S, et al. I-PASS Mentored Implementation Handoff Curriculum: Champion Training Materials. MedEdPORTAL. 2019 Jan 10;15:10794. doi: 10.15766/mep_2374-8265.10794. PMID: 30800994. *Does not measure clinical safety outcome*

54. O'Toole JK, West DC, Starmer AJ, et al. Placing faculty development front and center in a multisite educational initiative: Lessons from the I-PASS handoff study. Academic Pediatrics. 2014;14(3):221-4. doi: 10.1016/j.acap.2014.02.013. *Does not measure clinical safety outcome*

55. Odone A, Bossi E, Scardoni A, et al. Physician-to-Nurse Handover: A Systematic Review on the Effectiveness of Different Models. J Patient Saf. 2022 Jan 1;18(1):e73-e84. doi: 10.1097/pts.0000000000000701. PMID: 32433435. *SR inconclusive results*

56. Parikh NR, Francisco LS, Balikai SC, et al. Development and Evaluation of I-PASS-to-PICU: A Standard Electronic Template to Improve Referral Communication for Interfacility Transfers to the

Pediatric ICU. Jt Comm J Qual Patient Saf. 2024 May;50(5):338-47. doi: 10.1016/j.jcjq.2024.01.010. PMID: 38418317. *Between unit handoffs*

57. Price DW. Viewing Resident Experience With I-PASS Implementation Through Different Implementation, Diffusion, and Sustainability Frameworks. J Grad Med Educ. 2017 Jun;9(3):321-3. doi: 10.4300/jgme-d-17-00217.1. PMID: 28638510. *Design*

58. Pucher PH, Johnston MJ, Aggarwal R, et al. Effectiveness of interventions to improve patient handover in surgery: A systematic review. Surgery. 2015 Jul;158(1):85-95. doi: 10.1016/j.surg.2015.02.017. PMID: 25999255. *SR narrowly focused*

59. Raiten JM, Lane-Fall M, Gutsche JT, et al. Transition of Care in the Cardiothoracic Intensive Care Unit: A Review of Handoffs in Perioperative Cardiothoracic and Vascular Practice. Journal of Cardiothoracic and Vascular Anesthesia. 2015;29(4):1089-95. doi: 10.1053/j.jvca.2015.01.003. *Design*

60. Riesenber LA, Leitzsch J, Cunningham JM. Nursing handoffs: a systematic review of the literature. Am J Nurs. 2010 Apr;110(4):24-34; quiz 5-6. doi: 10.1097/01.NAJ.0000370154.79857.09. PMID: 20335686. *SR outdated*

61. Riesenber LA, Leitzsch J, Little BW. Systematic Review of Handoff Mnemonics Literature. Am J Med Qual. 2019 Sep/Oct;34(5):446-54. doi: 10.1177/1062860619873200. PMID: 31479296. *SR outdated*

62. Robertson ER, Morgan L, Bird S, et al. Interventions employed to improve intrahospital handover: a systematic review. BMJ Qual Saf. 2014 Jul;23(7):600-7. doi: 10.1136/bmjqs-2013-002309. PMID: 24811239. *SR outdated*

63. Rosenbluth G, Destino LA, Starmer AJ, et al. I-PASS Handoff Program: Use of a Campaign to Effect Transformational Change. Pediatr Qual Saf. 2018 Jul-Aug;3(4):e088. doi: 10.1097/pq9.0000000000000088. PMID: 30229199. *Does not measure clinical safety outcome*

64. Rosenthal JL, Doiron R, Haynes SC, et al. The Effectiveness of Standardized Handoff Tool Interventions During Inter- and Intra-facility Care Transitions on Patient-Related Outcomes: A

- Systematic Review. *Am J Med Qual*. 2018 Mar/Apr;33(2):193-206. doi: 10.1177/1062860617708244. PMID: 28467104. *SR broadly focused*
65. Ryan SL, Logan M, Liu X, et al. Long-Term Sustainability and Adaptation of I-PASS Handovers. *Jt Comm J Qual Patient Saf*. 2023 Dec;49(12):689-97. doi: 10.1016/j.jcjq.2023.07.007. PMID: 37648628. *Does not measure clinical safety outcome*
66. Sadri A, Dacombe P, Jeong E, et al. Handover in plastic surgical practice: The ABCD principle. *European Journal of Plastic Surgery*. 2014;37(1):37-42. doi: 10.1007/s00238-013-0892-6. *Does not measure clinical safety outcomes*
67. Schmidt T, Kocher DR, Mahendran P, et al. Dynamic Pocket Card for Implementing ISBAR in Shift Handover Communication. *Stud Health Technol Inform*. 2019 Sep 3;267:224-9. doi: 10.3233/shti190831. PMID: 31483276. *Does not measure clinical safety outcomes*
68. Scott AM, Li J, Oyewole-Eletu S, et al. Understanding Facilitators and Barriers to Care Transitions: Insights from Project ACHIEVE Site Visits. *Jt Comm J Qual Patient Saf*. 2017 Sep;43(9):433-47. doi: 10.1016/j.jcjq.2017.02.012. PMID: 28844229. *No intervention of interest*
69. Shahian DM, McEachern K, Rossi L, et al. Large-scale implementation of the I-PASS handover system at an academic medical centre. *BMJ Qual Saf*. 2017 Sep;26(9):760-70. doi: 10.1136/bmjqs-2016-006195. PMID: 28280074. *Does not measure clinical safety outcomes*
70. Sheth S, McCarthy E, Kipps AK, et al. Changes in Efficiency and Safety Culture After Integration of an I-PASS-Supported Handoff Process. *Pediatrics*. 2016;137(2):e20150166. doi: 10.1542/peds.2015-0166. *Between unit handoffs*
71. Sheth S, McCarthy E, Kipps AK, et al. Changes in Efficiency and Safety Culture After Integration of an I-PASS-Supported Handoff Process. *Pediatrics*. 2016 Feb;137(2):e20150166. doi: 10.1542/peds.2015-0166. PMID: 26743818. *Duplicate*
72. Singh N, Yun C, Likhtshteyn M, et al. Systematic Handoffs to Improve Patient Outcomes and Resident Satisfaction: a Single-Center Observational Study. *J Gen Intern Med*. 2019 Jul;34(7):1092-3. doi: 10.1007/s11606-019-04842-w. PMID: 30734191. *Not a handoff of interest*
73. Skaret MM, Weaver TD, Humes RJ, et al. Automation of the I-PASS Tool to Improve Transitions of Care. *J Healthc Qual*. 2019 Sep/Oct;41(5):274-80. doi: 10.1097/jhq.0000000000000174. PMID: 31483392. *Does not measure clinical safety outcome*
74. Solet DJ, Norvell JM, Rutan GH, et al. Lost in translation: challenges and opportunities in physician-to-physician communication during patient handoffs. *Acad Med*. 2005 Dec;80(12):1094-9. doi: 10.1097/00001888-200512000-00005. PMID: 16306279. *Design*
75. Starmer AJ, O'Toole JK, 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 Jun;89(6):876-84. doi: 10.1097/acm.0000000000000264. PMID: 24871238. *Does not measure clinical safety outcomes*

76. Starmer AJ, Schnock KO, Lyons A, et al. Effects of the I-PASS Nursing Handoff Bundle on communication quality and workflow. *BMJ Qual Saf.* 2017 Dec;26(12):949-57. doi: 10.1136/bmjqs-2016-006224. PMID: 28679836. *Does not measure clinical safety outcomes*

77. Starmer AJ, Spector ND, O'Toole JK, et al. Implementation of the I-PASS handoff program in diverse clinical environments: A multicenter prospective effectiveness implementation study. *J Hosp Med.* 2023 Jan;18(1):5-14. doi: 10.1002/jhm.12979. PMID: 36326255. *Duplicate*

78. Stenquist DS, Yeung CM, Szapary HJ, et al. Sustained Improvement in Quality of Patient Handoffs After Orthopaedic Surgery I-PASS Intervention. *J Am Acad Orthop Surg Glob Res Rev.* 2022 Sep 1;6(9). doi: 10.5435/JAAOSGlobal-D-22-00079. PMID: 36067218. *Duplicate*

79. Tam P, Nijjar AP, Fok M, et al. Structured patient handoff on an internal medicine ward: A cluster randomized control trial. *PLoS One.* 2018;13(4):e0195216. doi: 10.1371/journal.pone.0195216. PMID: 29672526. *Duplicate*

80. Tortosa-Alted R, Martinez-Segura E, Berenguer-Poblet M, et al. Handover of Critical Patients in Urgent Care and Emergency Settings: A Systematic Review of Validated Assessment Tools. *J Clin Med.* 2021 Dec 8;10(24). doi: 10.3390/jcm10245736. PMID: 34945032. *Design*

81. Tortosa-Alted R, Reverté-Villarroya S, Martínez-Segura E, et al. Emergency handover of critical patients. A systematic review. *Int Emerg Nurs.* 2021 May;56:100997. doi: 10.1016/j.ienj.2021.100997. PMID: 33887611. *Between unit handoffs*

82. Tufts LM. Response to "Introduction of the EMR-integrated I-PASS ICU Handoff Tool". *Pediatr Qual Saf.* 2020 Jul-Aug;5(4):e333. doi: 10.1097/pq9.0000000000000333. PMID: 32766504. *Design*

83. Tufts LM, Damron CL, Flesher SL. Addition of CORES to the I-PASS Handoff: A Resident-led Quality Improvement Study. *Pediatr Qual Saf.* 2020 Jan-Feb;5(1):e251. doi: 10.1097/pq9.0000000000000251. PMID: 32190796. *Does not measure clinical safety outcomes*

84. Walia J, Qayumi Z, Khawar N, et al. Physician Transition of Care: Benefits of I-PASS and an Electronic Handoff System in a Community Pediatric Residency Program. *Acad Pediatr.* 2016

Aug;16(6):519-23. doi: 10.1016/j.acap.2016.04.001. PMID: 27090859. *Does not measure clinical safety outcomes*

85. Wang XL, He M, Feng Y. Handover Patterns in the PACU: A Review of the Literature. J Perianesth Nurs. 2021 Apr;36(2):136-41. doi: 10.1016/j.jopan.2020.05.005. PMID: 33168405. *Design*

86. Wentworth L, Diggins J, Bartel D, et al. SBAR: electronic handoff tool for noncomplicated procedural patients. J Nurs Care Qual. 2012 Apr-Jun;27(2):125-31. doi: 10.1097/NCQ.0b013e31823cc9a0. PMID: 22126852. *Between unit handoffs*

87. Wibrandt I, Lippert A. Improving Patient Safety in Handover From Intensive Care Unit to General Ward: A Systematic Review. J Patient Saf. 2020 Sep;16(3):199-210. doi: 10.1097/pts.0000000000000266. PMID: 28452913. *Between unit handoffs*

88. Zipursky JS, Dhhar G, Weinerman A, et al. I-CATCH: A Novel Bundle to Improve Postcall Morning Handoffs. J Grad Med Educ. 2018 Dec;10(6):702-6. doi: 10.4300/jgme-d-18-00178.1. PMID: 30619533. *Does not measure clinical safety outcome*

89. Zjadewicz K, Deemer KS, Coulthard J, et al. Identifying What Is Known About Improving Operating Room to Intensive Care Handovers: A Scoping Review. Am J Med Qual. 2018 Sep/Oct;33(5):540-8. doi: 10.1177/1062860618754701. PMID: 29374964. *Between unit handoffs*

Background

1. Abraham J, Duffy C, Kandasamy M, et al. An evidence synthesis on perioperative Handoffs: A call for balanced sociotechnical solutions. Int J Med Inform. 2023 Jun;174:105038. doi: 10.1016/j.ijmedinf.2023.105038. PMID: 36948060. *Background*

2. Bressan V, Mio M, Palese A. Nursing handovers and patient safety: Findings from an umbrella review. J Adv Nurs. 2020 Apr;76(4):927-38. doi: 10.1111/jan.14288. PMID: 31815307. *Background*

3. Nasarwanji MF, Badir A, Gurses AP. Standardizing Handoff Communication: Content Analysis of 27 Handoff Mnemonics. J Nurs Care Qual. 2016 Jul-Sep;31(3):238-44. doi: 10.1097/ncq.0000000000000174. PMID: 26845420. *Background*

4. Ryan JM, Simiceva A, Eppich W, et al. End-of-shift surgical handover: mixed-methods, multicentre evaluation and recommendations for improvement. BJS Open. 2024 Mar 1;8(2). doi: 10.1093/bjsopen/zrae023. PMID: 38568851. *Background*

5. Shahian D. I-PASS handover system: a decade of evidence demands action. BMJ Qual Saf. 2021 Oct;30(10):769-74. doi: 10.1136/bmjqs-2021-013314. PMID: 33893212. *Background*

6. Yung AHW, Pak CS, Watson B. A scoping review of clinical handover mnemonic devices. Int J Qual Health Care. 2023 Sep 8;35(3). doi: 10.1093/intqhc/mzad065. PMID: 37616494. *Background*

Supplementary File 3. Risk of Bias and Certainty of Evidence of Included Studies

Table S-1. Risk of Bias for RCTs (Cochrane Risk of Bias)

Author, Year	Random	Allocation Concealment	Blinding Participants	Blinding Outcome Assessment	Selective Reporting	Attrition
Jorro-Barón, 2021 [1]	Low risk	Low risk	High risk	Uncertain risk	Low risk	Low risk
Parent, 2018 [2]	Uncertain risk	Uncertain risk	High risk	Uncertain risk	Low risk	Low risk
Tam, 2018 [3]	Low risk	Uncertain risk	High risk	Low risk	Low risk	Low risk
Verholen, 2021 [4]	Low risk	Uncertain risk	Low risk	Uncertain risk	Low risk	Low risk

Table S-2. Risk of Bias in Pre-Post studies

Author, Year	Were eligibility/selection criteria for the study population prespecified and clearly described?	Was the sample size sufficiently large to provide confidence in the findings?	Was the test/service/ intervention clearly described and delivered consistently across the study population?	Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?
Dewar, 2019 [5]	Yes	Yes	Yes	Yes	Yes
Goldraij, 2021 [6]	Yes	No	Yes	Yes	Yes
Kuzma, 2023 [7]	Yes	Yes	Yes	Yes	Yes
Khan, 2018 [8]					
Sonoda, 2021 [9]	Yes	No	Yes	Yes	Yes
Starmer, 2013 [10]	Yes	Yes	Yes	Yes	Yes
Starmer, 2014 [11]	Yes	Yes	Yes	Yes	Yes
Starmer, 2023 [12]	Yes	Yes	Yes	Yes	Yes
Stenquist, 2022 [13]	Yes	Yes	Yes	Yes	Yes
Ting, 2017 [14]	Yes	Yes	Yes	Yes	Yes

Table S-3. Certainty of Evidence

Finding	Study Limitations	GRADE Domains Consistency	Directness	Precision	Other sources of evidence Mechanistic/Theoretical Evidence	Parallel Evidence	Final Certainty of Evidence	Change in Certainty of Evidence due to other Supporting Evidence
Use of IPASS for shift-to-shift handoffs reduces medical errors and adverse events	Serious limitations	Serious limitations	No serious limitations	No serious limitations	Supportive	Supportive	Moderate	+1

References

1. Jorro-Barón F, Suarez-Anzorena I, Burgos-Pratx R, et al. Handoff improvement and adverse event reduction programme implementation in paediatric intensive care units in Argentina: a stepped-wedge trial. *BMJ Qual Saf* 2021;**30**(10):782-91 doi: 10.1136/bmjqs-2020-012370[published Online First: Epub Date]].
2. Parent B, LaGrone LN, Albirair MT, et al. Effect of Standardized Handoff Curriculum on Improved Clinician Preparedness in the Intensive Care Unit: A Stepped-Wedge Cluster Randomized Clinical Trial. *JAMA Surg* 2018;**153**(5):464-70 doi: 10.1001/jamasurg.2017.5440[published Online First: Epub Date]].
3. Tam P, Nijjar AP, Fok M, et al. Structured patient handoff on an internal medicine ward: A cluster randomized control trial. *PLoS One* 2018;**13**(4):e0195216 doi: 10.1371/journal.pone.0195216[published Online First: Epub Date]].
4. Verholen N, Vogt L, Klasen M, et al. Do Digital Handover Checklists Influence the Clinical Outcome Parameters of Intensive Care Unit Patients? A Randomized Controlled Pilot Study. *Front Med (Lausanne)* 2021;**8**:661343 doi: 10.3389/fmed.2021.661343[published Online First: Epub Date]].
5. Dewar ZE, Yurkonis T, Attia M. Hand-off bundle implementation associated with decreased medical errors and preventable adverse events on an academic family medicine in-patient unit: A pre-post study. *Medicine (Baltimore)* 2019;**98**(40):e17459 doi: 10.1097/md.00000000000017459[published Online First: Epub Date]].
6. Goldraij G, Tripodoro VA, Aloisio M, et al. One chance to get it right: improving clinical handovers for better symptom control at the end of life. *BMJ Open Qual* 2021;**10**(3) doi: 10.1136/bmjopen-2021-001436[published Online First: Epub Date]].
7. Kuzma N, Khan A, Rickey L, et al. Effect of Patient and Family Centered I-PASS on adverse event rates in hospitalized children with complex chronic conditions. *J Hosp Med* 2023;**18**(4):316-20 doi: 10.1002/jhm.13065[published Online First: Epub Date]].
8. Khan A, Spector ND, Baird JD, et al. Patient safety after implementation of a coproduced family centered communication programme: multicenter before and after intervention study. *Bmj* 2018;**363**:k4764 doi: 10.1136/bmj.k4764[published Online First: Epub Date]].
9. Sonoda K, Nakaishi L, Salter C. Standardizing Sign-out With I-PASS Handoff in Family Medicine Residency. *PRiMER* 2021;**5**:8 doi: 10.22454/PRiMER.2021.678175[published Online First: Epub Date]].
10. 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**(21):2262-70 doi: 10.1001/jama.2013.281961[published Online First: Epub Date]].
11. Starmer AJ, Spector ND, Srivastava R, et al. Changes in medical errors after implementation of a handoff program. *N Engl J Med* 2014;**371**(19):1803-12 doi: 10.1056/NEJMsa1405556[published Online First: Epub Date]].
12. Starmer AJ, Spector ND, O'Toole JK, et al. Implementation of the I-PASS handoff program in diverse clinical environments: A multicenter prospective effectiveness implementation study. *J Hosp Med* 2023;**18**(1):5-14 doi: 10.1002/jhm.12979[published Online First: Epub Date]].
13. Stenquist DS, Yeung CM, Szapary HJ, Rossi L, Chen AF, Harris MB. Sustained Improvement in Quality of Patient Handoffs After Orthopaedic Surgery I-PASS

- Intervention. *J Am Acad Orthop Surg Glob Res Rev* 2022;**6**(9) doi: 10.5435/JAAOSGlobal-D-22-00079[published Online First: Epub Date]].
14. Ting WH, Peng FS, Lin HH, Hsiao SM. The impact of situation-background-assessment-recommendation (SBAR) on safety attitudes in the obstetrics department. *Taiwan J Obstet Gynecol* 2017;**56**(2):171-74 doi: 10.1016/j.tjog.2016.06.021[published Online First: Epub Date]].