

# Developing and piloting Human Factors/ Ergonomics Handover Observation tools based on SEIPS 3.0

Mahnaz Sharafkhani<sup>1</sup>, Mary Browne<sup>2</sup>, Margaret Codd<sup>2</sup>, Angela O’Dea<sup>3</sup>, Una Geary<sup>4</sup>, Marie E. Ward<sup>1</sup>

<sup>1</sup>Health System Research, Quality and Safety Improvement Directorate, St James’s Hospital, Ireland, <sup>2</sup>Quality and Patient Safety Directorate, Health Service Executive, Ireland, <sup>3</sup>Patient Safety, Human Factors and Simulation, University of Galway, Ireland, <sup>4</sup>Director Quality and Safety Improvement Directorate, St James’s Hospital, Ireland

---

## SUMMARY

Clinical handover is a core component of healthcare delivery and its optimisation is a recognised enabler of patient safety (DoH, 2015), healthcare quality and positive patient and staff experience of care (HIQA, 2012). There are risks associated with poor handover and communication failure. Observational tools have been used to study and improve handover processes. However, not all of these tools capture the full range of systems factors that can impact on handover processes in clinical settings. In this study, a review of handover observation tools was conducted and a new ethnographic observation tool based on the Systems Engineering Initiative for Patient Safety (SEIPS) 3.0 was developed and piloted.

## KEYWORDS

Human Factors / Ergonomics, Clinical Handover, Ethnographic Observation, SEIPS 3.0

---

## Introduction

Clinical handover refers to “*the transfer of professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, to another person or professional group on a temporary or permanent basis*” (DoH, 2015). Given the complexity of the acute hospital setting and the volume of handover activity that takes place in this setting, potentially thousands of handovers on a daily basis, there are risks associated with poor handover and communication failures. These risks include, for example, inappropriate or delayed treatments for patients, delayed discharge, delayed time to a procedure, unnecessary tests and uncertainty in decisions on patient care, inefficient or suboptimal care, inefficient use of time and resources which leads to breakdown in the continuity of care, loss of trust and confidence between staff and patients (Arora, 2005, Agha, 2012; or DoH, 2015 for review). Popovici et al. (2015) also identified risks with the use of a multitude of unintegrated handover tools like pagers, hospital phones, personal phones, Electronic Health Records (EHR), electronic whiteboards and paper based records.

The World Health Organisation (WHO, 2014) named improved communication in handover as one of their top five patient safety goals. Human Factors / Ergonomics (HF/E) approaches can be useful

in identifying issues with handover processes in order to generate solutions designed to improve handover for better and more effective patient care (Agha, 2012). Conceptualising healthcare as a complex socio-technical system made up of elements, their relationships and a defined purpose, promotes a holistic approach to handover improvement and encourages consideration of the healthcare context in which any tool or technology to support handover might be used (Meadows, 2009). The Systems Engineering Initiative for Patient Safety (SEIPS) 3.0 (Carayon et al., 2020) was developed as a socio-technical systems framework to help expound healthcare as a socio-technical system and illustrate the patient’s journey through the socio-technical system (figure 1).

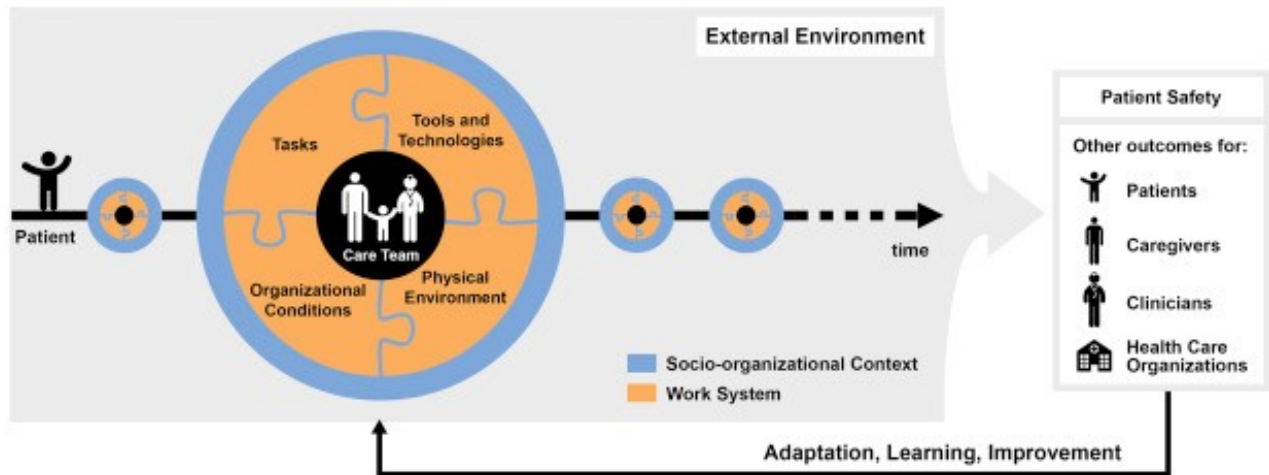


Figure 1: SEIPS 3.0 model Carayon et al., 2020

There have been several HF/E studies on clinical handover processes. Some of these studies used direct observation but did not use any template or checklist for their observations (e.g. Spranzi & Norton 2020, Chien et al., 2022, Agha, 2012, Lang et al., 2019). Those studies that applied observation templates did not consider the whole system effect on handover, exploring only one or two elements of the system rather than the whole system as depicted by the SEIPS 3.0 framework (e.g. Golling et al., 2022, Redley et al., 2017, Keebler et al., 2023, Kowitlawakul et al., 2015, Clancey et al., 2006).

This study describes the development and piloting of a HF/E ethnographic observation tool to study handover processes in the naturalistic environment of an acute hospital setting.

## Method

### Study setting

This study took place across the Emergency Department (ED) and Acute Medical Assessment Unit (AMAU), which consists of two 32 bedded wards, in a large acute teaching hospital in Ireland. The hospital has over 1000 beds, 695 of which are acute, and over 5,000 full time staff working across a 52-acre campus. The study is part of a wider research programme exploring the opportunities and benefits of applying HF/E in healthcare funded by the Health Service Executive (HSE) Ireland. Ethics approval was obtained from the hospital institutional review board (SJH/TUH ref 3725); the HSE Corporate Ethics Committee (ref RRECB0923MS) and the HSE National Ambulance Service (ref 14/12/2023).

### ***Development of the HF/E observation tool***

The observation tool was initially developed by two HF/E researchers embedded in the acute hospital setting (MS, MEW). A review of the literature was carried out to explore existing tools. These tools were then evaluated against the SEIPS 3.0 framework and, for the handover before, during and after ward round observations, the Royal College of Physicians / Royal College of Nursing guidance and checklist for completing modern day ward rounds (2021). Elements from existing tools and guidance were combined with additional items deemed important by the study team to create a new tool more appropriate for the acute hospital setting.

### ***Piloting of the HF/E observation tool***

A fictitious patient persona ‘Carol’ was developed in the main research programme to track the progress of a patient through the healthcare system. Carol is a female in her 40s who attended her General Practitioner (GP), was referred by ambulance to the ED, from there admitted to the AMAU, transferred from there to a ward and later discharged back to home. The aim was to follow Carol on her journey and observe handovers across her patient journey. It was decided to observe the following handovers as a sample of the many handovers of care that can take place:

- Ambulance to ED transfer of care handover
- ED medical-medical shift handover and ED nursing-nursing shift handover
- Acute Medical Assessment Unit –
- Medical ward round & handover between medical, nursing, health and social care professionals
- Medical-medical shift handover
- Nursing-nursing shift handover
- Medical Registrar on Call (MROC)-MROC 9pm night shift handover

## **Results**

### ***Development of the HF/E observation tool***

Three versions of the handover observation tool were developed to cover different types of handovers. HF/E observation of Clinical Handover to cover Medical Shift Handover and Nursing Shift Handover, HF/E Observation of Ambulance to ED handover to cover handovers which take place from ambulance staff to ED staff, HF/E Observation of moments of handover during Medical Ward Rounds. This paper reflects on the first version of the observation tool HF/E observation of Clinical Handover.

The draft observation tool covers the SEIPS 3.0 system elements of care team, patient factors, task, tools and technologies, physical environment, and organisational conditions (full tool is available in Appendix 1). The care team element consists of 12 questions to cover the number and categories of staff present in the handover, role and grade of staff, duration of the handover, if the person leading the handover and other team members introduced themselves, if the new person responsible for the patients was identified, if handover was an opportunity for team members to ask questions, if the last person who saw each patient was involved in the handover, if people’s requests to speak/contribute were responded to in a timely manner.

Under patient factors questions capture the number of patients, the number of complex patients, if each patient was handed over, if there were any inputs from the patients, if the sickest patient was highlighted during the handover, if a team member discussed any adverse events in relation to

patients, if any safety concerns for the shift ahead were highlighted, and if anything was noted on what went well from the previous shift.

Under task elements nine questions focus on clinical information shared between the teams, if the information was enough or were clarifying questions needed, clinical categories of patients handed over, if the team coming off duty provided a clear list of priorities, expected timeframes in relation to tests, procedures, discharge etc., actions to prevent risks and adverse events. Under tools and technologies five questions cover what tools and technologies, checklists and systems have been used for handover process. Seven questions cover the physical environment including questions on thermal comfort, lighting, noise, environmental hazards, visual supports, interruptions. Finally, as part of SEIPS 3.0 five questions, to reflect on any other organisational conditions that might affect handover including staffing issues, time pressure, fatigue, staff multitasking, were included.

As this was a pilot of the tool, it was also agreed that at the end of the observations, the observers would ask staff three questions to determine their thoughts on whether it had been an effective handover, what satisfies them when receiving or giving handover and what improvements could be made to handover. This was to determine if any additional areas or questions needed to be explored in the tool.

### ***Piloting of the HF/E observation tool***

In total, 26 hours and 25 minutes of handovers have been observed. Table 1 shows the total time spent on observations for different handover types. Ambulance-ED handover observation time was more than other types of handovers as these are unscheduled and observing involved waiting in the ED for ambulance handover to occur.

Table 1: Details of observations

<b>Handover type</b>	<b>Total observation time</b>	<b>Total handovers observed</b>
ED Medical handover	2 hours	4
ED Nursing handover	2 hours	4
AMAU Nursing handover	1 hour and 30 min	2
AMAU Medical handover	55 min	3
Ambulance-ED handover	4 hours and 40 min	7
MROC AMAU ED medical handover	1 hour and 20 min	2
Ward Rounds	14 hours	6
All	26 hours and 25 min	28

The HF/E observation tool proved to be useful in understanding the complexity of factors that can influence handover. While all the data has yet to be analysed initial findings suggest that the HF/E observation tool picked up on wider systems issues that may not often be the focus of handover education or available to enable effective handover. These HF/E systems issues include roster design and alignment; the physical environments in which handover meetings occur; supporting electronic technologies to support communication, documentation and work-planning. The

qualitative questions to staff identified similar and additional issues to be included in next iteration of the tool.

### Next Steps

A full analysis will take place of all the observational and interview data and a next iteration of the tool will be developed. The SEIPS 3.0 model attempts to link process with outcomes in the healthcare system. As evidenced in the literature referenced above, poor communication and suboptimal handover practices can have a negative impact on patient outcomes. Further research is needed to determine if these HF/E systems factors have an impact on the quality of handover.

### Acknowledgement

This research is funded by the National Quality and Patient Safety Directorate, Health Service Executive, Ireland. The authors would also like to thank all the staff across St James's Hospital Dublin, Dublin Fire Brigade and the National Ambulance Services who participated in this observational study. **References**

- Agha, RA. (2012). Handover in Trauma and Orthopaedic Surgery - A Human Factors Assessment. *Ann Med Surg (Lond)*. 1:25-9. doi: [10.1016/S2049-0801\(12\)70009-2](https://doi.org/10.1016/S2049-0801(12)70009-2). PMID: 26257904; PMCID: PMC4523154.
- Arora, V., Johnson, J., Lovinger, D., Humphrey, H. J. & Meltzer, D O. (2005). Communication failures in patient sign-out and suggestions for improvement: a critical incident analysis. *Qual Saf Heal Care* 2005;14: 401-7. doi: [10.1136/qshc.2005.015107](https://doi.org/10.1136/qshc.2005.015107)
- Carayon, P., Schoofs Hundt, A., Karsh, BT., Gurses, AP., Alvarado, CJ., Smith, M. & Flatley Brennan, P. (2006). Work system design for patient safety: the SEIPS model. *Qual Saf Health Care*. 2006 Dec;15 Suppl 1(Suppl 1): i50-8. doi: 10.1136/qshc.2005.015842. PMID: 17142610; PMCID: PMC2464868.
- Carayon, P., Wooldridge, A., Hoonakker, P., Hundt, AS. & Kelly, MM. (2020). SEIPS 3.0: Humancentered design of the patient journey for patient safety. *Appl Ergon*. 2020 Apr;84:103033. Epub 2020 Jan 10. PMID: 31987516; PMCID: PMC7152782. doi: [10.1016/j.apergo.2019.103033](https://doi.org/10.1016/j.apergo.2019.103033)
- Chien, L.J., Slade, D., Dahm, MR., Brady, B., Roberts, E., Goncharov, L., Taylor, J., Eggins, S & Thornton, A. (2022). Improving patient-centred care through a tailored intervention addressing nursing clinical handover communication in its organizational and cultural context. *J Adv Nurs*. 2022 May;78(5):1413-1430. Epub 2022 Jan 17. PMID: 35038346; PMCID: PMC9304151. doi: [10.1111/jan.15110](https://doi.org/10.1111/jan.15110)
- Clancey, W. J. (2006). Observation of Work Practices in Natural Settings. In K. Ericsson, N. Charness, P. J. Feltovich, R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 127-145). New York, NY US: Cambridge University Press. <https://doi.org/10.1017/CBO9780511816796.008>
- Department of Health. Communication (Clinical Handover) in Acute and Children's Hospital Services. National Clinical Guideline No. 11 November 2015. ISSN 2009-6259. <https://assets.gov.ie/11588/48b91100bd2f483bbe4b88e1a3ae7b0b.pdf>
- Golling, M., Behringer, W. & Schwarzkopf, D. (2022). Assessing the quality of patient handovers between ambulance services and emergency department - development and validation of the emergency department human factors in handover tool. *BMC Emerg Med*. 2022 Jan 19;22(1):10. PMID: 35045828; PMCID: PMC8772155. doi: [10.1186/s12873-022-00567-y](https://doi.org/10.1186/s12873-022-00567-y)

- Health Information and Quality Authority (HIQA) (2012), A Guide to the National Standards for Safer Better Healthcare, <https://www.hiqa.ie/sites/default/files/2017-01/Safer-BetterHealthcare-Guide.pdf>
- Holden, R.J., Carayon, P., Gurses, A.P., Hoonakker, P., Hundt, A.S., Ozok, A.A. & RiveraRodrigues, A.J. (2013). SEIPS 2.0: a human factors framework for studying and improving the work of healthcare professionals and patients,' *Ergonomics*, 56(11), pp. 1669– 1686. <https://doi.org/10.1080/00140139.2013.838643>.
- Keebler, J.R., Lynch, J., Ngo, F., Phelps, E., Huang, N., Guttman, O. Preble, R & Minhajuddin, A.T. (2023). Leveraging the science of teamwork to sustain handoff improvements in cardiovascular surgery, *The Joint Commission Journal on Quality and Patient Safety*, 49(8), pp. 373–383. <https://doi.org/10.1016/j.jcjq.2023.05.006>.
- Lang, A., Simmonds, M., Pinchin, J., Sharples, S., Dunn, L., Clarke, S., Bennett, O., Wood, S. & Swinscoe, C. (2019). The Impact of an Electronic Patient Bedside Observation and Handover System on Clinical Practice: Mixed-Methods Evaluation. *JMIR Med Inform.* 2019 Mar 6;7(1):e11678. PMID: 30839278; PMCID: PMC6425312. doi: 10.2196/11678.
- Kowitlawakul. Y., Leong, B.S., Lua, A., Aroos, R., Wong, JJ., Koh, N., Goh, N., See, K.C., Phua, J. & Mukhopadhyay, A. (2015). Observation of handover process in an intensive care unit (ICU): barriers and quality improvement strategy. *Int J Qual Health Care.* 2015 Apr;27(2):99104. Epub 2015 Feb 2. PMID: 25644706. doi: 10.1093/intqhc/mzv002.
- Meadows, D. H. (2008). *Thinking in systems: A primer.* Chelsea Green publishing.
- Pennell, C., Flynn, L., Boulton, B., Hughes, T., Walker, G. & McCulloch, P. (2017). A before-after study of multidisciplinary Out-of-Hours handover: combining management and frontline efforts to create sustainable improvement. *Int J Qual Health Care.* 2017 Apr 1;29(2):228-233. PMID: 28339636. doi: 10.1093/intqhc/mzx002
- Popovici, I., Morita, P.P., Doran, D., Lapinsky, S., Morra, D., Shier, A., Wu, R & Cafazzo, J.A. (2015). Technological aspects of hospital communication challenges: an observational study. *Int J Qual Heal Care* 2015;3:27. DOI: [10.1093/intqhc/mzv016](https://doi.org/10.1093/intqhc/mzv016)
- Redley, B., Botti, M., Wood, B & Bucknall T. (2017). Interprofessional communication supporting clinical handover in emergency departments: An observation study. *Australas Emerg Nurs J.* 2017 Aug;20(3):122-130. Epub 2017 Jun 7. PMID: 28595847. doi: 10.1016/j.aenj.2017.05.003
- Royal College of Physicians and Royal College of Nursing. (2021). *Modern Day Ward Rounds. Good practice for multidisciplinary inpatient review.* <https://www.rcplondon.ac.uk/projects/outputs/modern-ward-rounds>
- Spranzi, F. & Norton, C. (2020) From handover to takeover: should we consider a new conceptual model of communication. *British Journal of Midwifery*, Volume 28, issue 3 <https://doi.org/10.12968/bjom.2020.28.3.156>

## APPENDIX 1

### Care team

1. Number of staff in attendance. (Clancey et al., 2006)
2. Categories of staff in attendance. (Clancey et al., 2006)
3. Anyone not present?
4. Note start and end time of handover

5. Person leading the handover identified themselves (person handing over care)? (Keebler et al., 2023 & RCP/RCN, 2021)
6. Team members introduced themselves. (Keebler et al., 2023)
7. The role and grade of team members were stated at the beginning of the handover? (Keebler et al., 2023)
8. The new person responsible for the patients was clearly identified? (Golling et al., 2022)
9. The handover was an opportunity for the person taking on responsibility for the patients to ask questions. (Golling et al., 2022)
10. Was the last person to see the patient involved in their handover?
11. There was mutual respect between the teams? (Golling et al., 2022)
12. Team members requests to speak/contribute were responded to in a timely manner?

### **Patient Factors**

1. How many patients were handed over? (Pennell et al., 2017)
2. Was each patient handed over?
3. Was there any input from patients themselves (directly or through what staff were saying)? (RCP/RCN, 2021)
4. Were 'sickest' patients highlighted? (Agha et al., 2012)
5. Was past harm (Adverse Events) linked to any patient discussed?
6. There were a large number of high complex cases handed over (note number)? (Golling et al., 2022)
7. Were any safety concerns raised for the shift ahead (staffing levels, resources, number of patients that might need extra care ('sickest' patients)? (Clancey et al., 2006)
8. Was there anything shared on what went well? (Learning from Excellence)

### **Tasks**

1. Was clinical information shared between the two teams?
2. Did the handover include enough information (neg -were clarifying questions needed)?
3. What types of patient were handed over (new admissions, unwell ward patients or ICU patients)? (Pennell et al., 2017)
4. Was all needed information handed over - including patient diagnosis, history of present illness, comorbid conditions, management plan, incomplete tasks, etc.? (Pennell et al., 2017 & RCP/RCN, 2021)
5. Did the team coming off duty provide a clear list of priorities for action for the new team (EPR/ written/ verbal)?
6. Were the tasks to be completed assigned to the team coming on duty?
7. Were expected timeframes in relation to tests, procedures, going home etc. discussed?
8. Were actions to prevent risks and adverse events (AE) articulated?
9. Did both teams jointly assure that handover was complete? (Golling et al., 2022)

### **Tools and Technologies**

1. Were tools & technologies was used for handover process? (Clancey et al., 2006) 2. Was Electronic Patient Record (EPR) used for each patient?
3. Was there a checklist used for handover e.g. I-PASS, ISBAR, ISBAR3? (RCP/RCN, 2021)
4. Did staff sign in their attendance at handover?

5. What system was used to support sign-in?

**Physical Environment**

1. Thermal comfort (hot/ cold/ AC/window) (Agha et al., 2012)
2. Was overhead lighting reasonable? (Agha et al., 2012)
3. Were there any noise or confidentiality issues (could handover be overheard?) (Clancey et al., 2006)
4. Could all people be heard when speaking?
5. Any environmental hazards present e.g. any risks of slips, trips and falls?
6. Any interruptions during the handover (bleeps etc.)? (Redley et al., 2017)
7. Were visual supports for handover (whiteboard etc.) used?

**Other organisation conditions**

1. Were staffing issues identified if needed to be? (Golling et al., 2022)
2. Were all staff included in decision making particularly those who had most recently attended to the patient? (Agha et al., 2012)
3. Was there evidence of time pressure? (Golling et al., 2022)
4. Was there any evidence of fatigue in the staff present? (how many hours had staff worked prior to handover) (Clancey et al., 2006)
5. Were staff multi-tasking during handover? (emails, bleeps, phone etc.) **Staff subjective**

**feedback**

1. Did you think this was a good handover? If yes, why? If no, why not?
2. What satisfies you when receiving or giving a handover?
3. What improvements could be made to handover and patient safety outcome?