

The Prehospital to Emergency Department Hand Over Model (PEDHOM): a conceptual model addressing content, process, and communication in prehospital to Emergency Department handover

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Abstract

Background: Patient handover is closely linked to patient safety. As the first interaction with the healthcare system, emergency department handovers are critically significant. Addressing content, process and communication aspects of handover has the potential to improve patient safety and decrease the incidence of adverse events.

Methods: We used a sequential explanatory mixed methods study to gather data in Study One (quantitative) and Study Two (qualitative). Study One gathered questionnaires from 175 prehospital and 50 emergency department personnel. Study Two drew from the data in Study One and involved conducting face-to-face, semi-structured interviews from 15 prehospital and 15 emergency department personnel.

Results: Study One provided quantitative data related to the importance of variables included in handover content and additional information related to handover within the ED from the perspectives of both prehospital and ED personnel. Study Two provided qualitative data on experiences and perceptions related to handover within the ED from the perspectives of both prehospital and ED personnel. These data were used to develop the Prehospital to Emergency Department Hand Over Model (PEDHOM) conceptual model that was synthesized from the findings.

Conclusion: This PEDHOM addresses some of the content, process and communication aspects in prehospital to ED handover. The PEDHOM identifies barriers to effective ED handover and postulates potential solutions or strategies to addressing these barriers. The PEDHOM has potential for implementation in the ED and in healthcare environments other than the ED where interprofessional handover is practiced.

Introduction

'In many ways, handovers can be considered the "glue" that holds the health care continuum together' [1].

This statement highlights the importance of patient handover in the health care system. Handovers within the emergency department (ED) are critically significant because they have a direct effect on the nature of further treatment usually characterized by specific expertise, precise timing and rapid decision-making (Evans et al. 2010; Fernando et al. 2013). Handover in the ED has been defined as: "a patient-

centred process that presents adequate and contextually relevant patient-specific information from one medical professional to another. The information is presented in a structured format that facilitates optimal information transfer and recall as well as creating a shared understanding of the patient's condition to ensure ongoing continuity of care. Handover serves to transfer responsibility and accountability for continuity of care from one medical professional to another. The handover process is complete once the receiving medical professional indicates (verbally or in writing) that they have taken over responsibility for the patient" [4]. Therefore, at its core handover is a flow of information and is more complex than the linear process postulated by Shannon and Weaver (1949) upon which handover communication theory is often based [6].

Effective handover has been referred to as "integral for the continuity of patient care" [7]. There are several aspects related to the efficacy of handover and that potentially negatively affect patient safety. Emergency centre patients are often characterised as reflecting all sections of society, being of non-specific age categories ("can be of any age") and presenting with a variety of chief complaints or acute minor or major injuries ("many different acute or chronic illnesses") [8]. This heterogeneity is something generally not found in other types of patient handover, the content delivered in a handover is frequently highly contextual and is usually driven by organisational culture or unit practices; this results in differences in content overlap [9].

In addition, the ED environment and the processes in which handover takes place are potentially negative aspects in handover efficacy. The ED has been described as a "complex, high-risk clinical environment" [10] that is also "loud and chaotic" [11]. The noisy ED environment has been identified as a distractor to effective handover by complicating the receiver's ability to listen effectively [12, 13]. The overcrowding and overworked staff results in fatigue which complicates the already challenging ED handover and has been shown to negatively affect performance and safety [13, 14]. The busyness of the ED and task-orientated nature of the ED tends to result in receivers being more focussed on patients and patient assessment than on the handover [15]. The use of mnemonics in handover, either for content or process reasons, is controversial and there exists little evidence to demonstrate a tangible benefit to patient outcomes [16].

Patients are often cared for by a variety of healthcare professionals, which increases the incidence of handover and resultant information dilution [17]. There are clinicians from multiple disciplines working independently but performing complementary roles within the delivery of care to a single patient [10]. Within the ED, the first interprofessional handover takes place between prehospital personnel and either a doctor or nurse [18–20]. Interprofessional and intraprofessional communication is often affected by cultural, organisational, environmental, and behavioural factors [21]. There are also differences in

clinician expectations and perspectives, professional sensitivities, interprofessional relationships and contexts of care delivery [22]. These differences in clinician expectations have the potential to decrease the efficacy of interprofessional communication at handover. There is also recent evidence to suggest that there is a lack of interprofessional knowledge of roles between the prehospital and ED personnel [23, 24].

There are three primary aspects identified in prehospital to ED handover; content, processes involved in handing over, and communication aspects related to the handover [25, 26]. Each of these factors could positively or negatively affect the efficacy of emergency department handover and there is inadequate knowledge-related to managing these three factors to improve handover practices in ED department. Therefore, the researcher explored and described the development of a conceptual model related to content, process and communication in prehospital to ED handover. Specifically, the envisioned new perspective of such a conceptual prehospital to emergency department handover model may contribute to improving handover in the ED.

Problem statement

From the discussion above, it is clear that there are challenges to effective handover. Emergency department handover is often described as a generally poorly performed aspect of patient care (Jamshidi et al. 2019; Dúason et al. 2021), and ineffective handover has been linked to an increase in adverse events [25]. There have been several suggestions that handover requires improvement [29] but there is a lack of clarity on how. Current handover models and practices do not address many of the pertinent issues nor does there appear to be a comprehensive body of research relating to ED handover. This led the researcher to explore the links between the prehospital deliverer of handover and the ED receiver of handover within the context of content, process and communication in prehospital to ED handover.

Aim and objectives

The purpose of a concept article is “to detail, chart, describe, or depict an entity and its relationship to other entities” (Macinnis 2011). Based on data obtained from a mixed methods study in a resource-constrained healthcare environment, the aim of this article is to describe and depict a conceptual model addressing the three identified aspects of emergency centre handover; content, process, and communication. Congruent with this aim, the following objectives are relevant:

- Describe the PEDHOM model developed to address content, process, and communication aspects of prehospital to ED handover
- Depict the PEDHOM as a structured, phase-based flow of information and interpersonal relationships

- Provide guidelines related to the PEDHOM

Development Of The Pedhom

The main concept and central theme underscoring the development of the PEDHOM flow from the tenet that emergency department handover is a process of interpersonal interaction, information transfer and communication relating to the patient and their ongoing care. The definition of a model as proposed by Chinn and Kramer (2017) guided this study. They state that a model represents a type of knowledge within an empirical pattern that details a broad theoretical conceptualization describing the relationships between concepts and presents them using words, symbols and graphic diagrams. The theory adopted for this model was a situation-specific theory that is described by Havenga *et al* as having a narrow scope and focus on specific populations, phenomena and fields of practice [32]. The development of the model followed the four steps described by Chinn and Kramer: concept analysis, placing the concepts on relationships, describing the model and implementing of the model [31]. Each of these steps in the development of the PEDHOM are thus discussed next.

Step 1: Concept analysis

Concept analysis was used to identify and classify the concepts from Study One and Two that were used to develop the model.

Identification of the central concept

The definition for emergency department handover formed the central theme for this conceptual model and took into the account the fact that handover is simultaneously a complex noun and a phrasal verb. The process of theme is described. The design of the conceptual model was based on a sequential explanatory, mixed methods design study [33]. Within mixed methods, the term 'sequential' refers to one dataset building on the results of the previous dataset and the term 'explanatory' refers to the use of the second dataset to better explain the results of the first dataset [34]. Study One comprised a quantitative phase that used a purpose-designed questionnaire to gather data. Study Two was a qualitative phase comprising face-to-face, semi-structured interviews that explored specific results from Phase One in both prehospital and emergency department personnel. The process and flow of the study, data collection and mixing are depicted in Figure 1.

Ethical approval was sought from the University of Cape Town's Faculty of Health Sciences Human Research Ethics Committee and renewed annually for the period of data collection. The ethics approval number is HREC/REF: 624/2012. Informed consent was obtained from all participants The four principles

of ethical research namely; respect for autonomy, non-maleficence, beneficence, were adhered to throughout both the quantitative and qualitative phases of the study [35]. The principle of respect for autonomy was ensured by providing participants with a detailed information document that highlighted the voluntary nature of participation, after which they signed written informed consent and their information was treated with the relevant anonymity and confidentiality where relevant. Participants were able to withdraw at any time without consequence. Despite there being a perceived low risk to participants, the principle of non-maleficence was ensured by providing participants with psychological services should these have been required which also tied in with the principle of beneficence and how the data were protected. The principle of justice was ensured by treating all participants and their data as equals and not singling out any person or group for deliberate inclusion or exclusion.

Population and sample (Study One)

Study One comprised the cross-sectional, quantitative phase of the project and included 175 prehospital emergency care personnel from varying qualifications and experience as well as 50 emergency department personnel which included medical practitioners and nursing staff. These participants were sourced from state-funded and private prehospital emergency services and hospitals.

Data collection (Study One)

Permission to approach potential participants at their places of work was granted prior to beginning with recruitment. Participants were approached using a convenience sampling strategy at their places of work and requested to complete the questionnaire. The busyness of the environment resulted in some participants requesting blank questionnaires be left for them to complete. Two-weekly collection runs were completed where this was the case.

Data analysis (Study One)

The questionnaire was comprised of two sections. Section One was comprised of Likert-type and forced binary questions and was analysed descriptively. Section Two comprised open-ended, limited response questions and was analysed using qualitative description [36].

Population and sample (Study Two)

Study Two comprised the qualitative phase of the project and included face-to-face, semi structured interviews with 15 prehospital emergency care personnel of varying qualification and experience levels

and 15 emergency department personnel, including medical practitioners and nursing staff. These participants were sourced from state-funded and private prehospital emergency services and hospitals.

Data collection (Study Two)

Interview questions were compiled based on the results from Study One. Participants were approached using a purposive, maximum variation sampling strategy. Participants were approached at their places of work of continuing professional development activities and invited to participate during a short verbal introduction after which information documentation was distributed. Interviews were either conducted immediately following the information session or at a scheduled time convenient to both the researcher and interviewee. Prior to commencement of the interview, the researcher introduced the research. Interviewees were provided with an information document to read and were required to sign consent to be interviewed and consent to be recorded.

Questions that comprised the interviews for the prehospital emergency care personnel included the availability of emergency department staff to receive handovers, interruption to handovers and multiple handovers for the same patient, whether there was a link between qualification and quality of handover reception and whether handing over directly to a doctor was advantageous. Communication was also explored by asking questions related to whether there was a lack of interest shown by receivers of handover and whether they showed the deliverer appropriate respect. The final questions focussed on education and training as potential handover improvement strategies as well as how to improve the interprofessional relationships between the prehospital and emergency department personnel.

Questions that comprised the interviews for the emergency department personnel included whether there was a link between qualification and the quality of the handover delivered, perceptions of whether there was a poor attitude demonstrated by the deliverers of handover, the quality of patient assessment and how much prehospital emergency care personnel knew about their patients and whether prehospital emergency personnel were prone to rushing their handovers. Mnemonics were explored as possible standardised tools to improve handovers and the questions related to education and training and interprofessional relationships were repeated.

Data saturation focussed on the richness and quality of data as opposed to the number of participants [37]. Saturation was deemed to have been reached when no new information was being gained [38] and no fresh insights were being revealed [39].

Trustworthiness

The four criteria related to trustworthiness, namely; credibility, transferability, dependability and confirmability as suggested by Guba [40, 41]. Credibility was ensured by basing the interview questions on the results of the quantitative phase, conducting interviews with a range of qualifications and experience levels and including all the data from all the interviews. Transferability and authenticity were ensured by providing thick and rich descriptions of the interviews and verbatim quotes from the participants. Dependability was ensured by carrying out a code-recode strategy and comparing the results for congruency. Confirmability was ensured by carefully following and describing all relevant processes involved in the study.

Data analysis (Study Two)

The audio recordings were transcribed and imported into Atlas.ti (v7.5.12; ATLAS.ti Scientific Software Development GmbH, Berlin, Germany). Transcriptions were complete and included all questions and responses in line with the recommendations of Schreier [42]. Data were read both vertically and horizontally to ensure better immersion and contextualization of the data [43]. The primary coding strategy was inductive so as to prevent theoretical concepts from over-defining the analysis [44]. Data were coded in two phases, open and axial, and codes were assigned using both vertical (within interview transcripts) and horizontal (across the sample) coding. After open coding, axial coding was commenced to explore the relationships identified between the codes and to bring together fragmented data segments identified during the open coding phase [44]. To ensure consistency and validity of coding, a code/recode strategy was used and codes from the second round compared with the first [42]. Code comparisons were conducted by the PI and the two experts and there was a high consistency between codes observed with differences primarily related to the wording used to identify codes that still fell under the same category or theme. Codes were grouped into categories, sub-themes and themes and these too were compared. The common themes and sub-themes identified during prehospital emergency care personnel interviews relating to content, process and communication within emergency department handover are depicted in Table 1. The common themes and sub-themes identified during emergency department interviews relating to content, process and communication within emergency department handover are depicted in Table 2. These themes were used to conceptualise the model and to identify aspects of content, process and communication at each phase in the PEDHOM conceptual model.

Table 1: Content, process, communication and improvement dimensions of ED handover: prehospital emergency care personnel.

Table 2: Content, process and communication dimensions of ED handover: Emergency department personnel.

Step 2: Placing concepts into relationships

As per the guidelines of Chinn and Kramer (2017), the concepts within the model are connected by relationship statements. These relationship statements linked the central concepts with the essential attributes that serve as its building blocks [31]. The model developed thus makes several assumptions within the context of the definition postulated and the relationships that exist. In the context of this study, these include:

- the handover takes place within the emergency centre between prehospital emergency care personnel and staff in the emergency centre,
- there are several phases through which information travels from the time it is collected by the deliverer at the scene to when it is finally interpreted by the receiver,
- there is a decrease in both the quality and quantity of information during the handover,
- each phase has both barriers and facilitators to handover efficacy and
- that communication is a bidirectional interaction.

Step 3: Description of the purpose and the structure of the PEDHOM model

An overview of the purpose, structure and phases of the PEDHOM model is described below. The PEDHOM model is depicted in Figure 2.

The purpose of the PEDHOM model linked to the question asked by Chinn and Kramer as to why the theory was formulated [45]. In the case of this study, the purpose was to develop a model for an improved understanding of the emergency department handover. This purpose closely links with the principles of Batho Pele (putting people first) and to the statement within the White Paper by then Minister for Public Service and Administration, Zola Skweyiya: "I am asking them (Departments) to identify the small but important improvements in their service delivery processes which can be immediately attended to and implemented" [46].

The structure refers to what Chinn and Kramer call "the overall morphological arrangement of specific elements, especially concepts" [45] and is based on a conceptual framework that loosely follows a linear information flow. The yellow spiral represents the sequential flow of information and uses a flow circle to

represent the five phases of handover. Yellow symbolizes being more mentally analytical and critical, both of self and others, of new ideas and of being a practical thinker (Scott-Kemmis 2018a); and these characteristics are desirable within the context of the entire handover process. Each directional circle is representative of both the quality and quantity of information that decreases with each sequential phase. The blue background represents trust, honesty and reliability [48] related to the environment in which emergency centre handover takes place and the one-on-one communication characteristic of handover. The phase descriptors are depicted in white because white represents impartiality, neutrality and a clean slate [49] which is what each phase is before the handover processes reaches it. The bidirectional arrows represent factors that have the potential to simultaneously promote or impede effective handover between the phases. The red half of the arrow represents factors that impede and the green factors that promote effective handover. The three factors that affect handover efficacy at each phase are indicated as equal pie slices of a circle and their colours have specific context within the model. Content is depicted as grey due to its association with being unemotional, impartial and neutral [50] which is essentially what the information pieces are that make up a handover. Process is depicted in black due to its association with authority, power and control [51] which encapsulates how established processes are often viewed. Communication is depicted in orange because it relates to social communication and stimulating two-way conversations as well as self-respect and respect from others [52].

There are five phases presented in the model. Each phase represents a step in the handover process where information is processed or transferred. Each phase is represented by a circle with three component; content, process and communication. Phase One and Two relate to the deliverer, Phase Three to the actual transfer of information and Phase Four and Five to the receiver of handover, each of which is briefly described below.

Collection and encoding in phase one includes the prehospital emergency care personnel collecting information related to the patient's physiological variables, their history, surroundings and chief complaint. This initial patient information is encoded and processed to determine a diagnosis and treatment plan. Much of this information is contextualized for future inclusion into handover and factors that may affect handover efficacy include; lack of appropriate handover training (process), lack of medical knowledge (content) and language proficiency (communication).

Encoding and compilation (phase two) entails the deliverer of handover preparing for the handover by compiling what they believe to be the most appropriate and relevant information relating to the patient into a structured format. There are several factors that affect how the handover is compiled, these include the hierarchical nature of the prehospital/emergency department relationship (process), the anticipation

of inattentive listening and needing to perform multiple handovers (process), the use of mnemonics (content) and existing or anticipated interprofessional relationships and interactions (communication).

Transmission in phase three takes place when the handover is transmitted via a channel that is usually a verbal process accompanied by a written patient care record. External noise has the potential to negatively affect both process and communication during the handover. The language in which the handover is conducted as well as the medical literacy of both deliverer and receiver have the potential to affect efficacy of both content and communication. Phase Three is the actual interaction between the deliverer and receiver of handover where interprofessional relationships and courtesies (or lack thereof) can affect process and communication, as can the use of a common language and where medical knowledge and literacy can affect not only the content, but also how well the content is transmitted or received.

Receiving and decoding in the fourth phase occurs when the receiver collects and begins decoding the information from the deliverer's handover. Physiological factors such as fatigue, hunger, thirst, and irritation because of overworking can affect the efficacy of handover process and communication. Inattentive listening can result in information loss (content) and the task-orientated approach of some emergency department staff can negatively affect the process. The way in which the deliverer structures the handover may affect content in that many mnemonics used to structure handovers are not commonly used in both prehospital and emergency department environments. Content can also be affected by the receiver's medical knowledge or literacy.

The fifth *decoding and understanding* phase involves the receiver decoding the final patient information that they have received and interpreting this within the context of the patient, diagnosis and management plan. A lack of medical knowledge and literacy can negatively affect the decoding, where the receiver may not understand the terminology, termed semantic noise [53] (content) or be able to contextualise the information and act accordingly (process). The busyness and task-orientated nature of the emergency department may result in the receiver not having sufficient time to adequately decode the received information and to make the appropriate referral decisions (process).

The model concludes with a two-way *feedback loop* between the receiver back to the deliverer. It is important that handover is continually evaluated to ensure that relevant quality improvement strategies are identified and implemented. Constant engagement and evaluation are the cornerstones to improved handover practice and patient safety.

Step 4: Implementation of the model

Recommendations were developed to address the issues identified for implementation into the prehospital to emergency department handover. These include:

- A standardized set of patient information variables most relevant to the patient being handed over in the emergency department should be developed.
- The development of an emergency department specific mnemonic should be considered despite mnemonic use being inconclusive, primarily due to different mnemonic applicability and familiarity between the two environments,
- A standardized language should be used for handover, with English currently being the most appropriate language.
- The introduction of a guideline on how to conduct a handover is recommended and this should include a greeting and introduction, positive body language and appropriate verbal, nonverbal and paraverbal cues.
- The handover environment should be evaluated, and an area dedicated where patient confidentiality is ensured and where external distractions and interruptions can be limited.
- Cross-pollination activities should be facilitated, and better understanding of each other's environment encouraged along with strategies to improve interprofessional relationships.

Conclusion

This article provides a description of the development of the PEDHOM model to facilitate improved content, communication, and process in emergency department handover. Guidelines for addressing issues in the ED handover are also provided and could contribute to improved management of ED handovers. This PEDHOM model addresses some of the issues related to content, process, and communication aspects of the ED handover and is more appropriate than traditional one-way communication models. This model applies to prehospital emergency care personnel who deliver the handover within the emergency department as well as to the emergency department personnel who receive the handover. This model may also have application in several other environments where patient handover takes place. The emerged PEDHOM model will add value and has the potential to improve handover practice in the ED and in doing so, to improve patient safety and the risk of adverse events.

Declarations

Ethics approval and consent to participate

This study was performed in accordance with the Declaration of Helsinki. All methods were carried out in accordance with relevant guidelines and regulations. This study was conducted after receiving research ethics approval from the University of Cape Town's Faculty of Health Sciences Human Research Ethics

Committee and renewed annually for the period of data collection. The ethics approval number is HREC/REF: 624/2012. All participants signed written informed consent before participating in the survey.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analysed during the study are not publicly available due to the fact that they were not stored in a public repository and participants did not give consent for their data to be shared in the public domain. Datasets are available from the corresponding author on reasonable request and will be deidentified as necessary prior to distribution.

Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article

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Authors' contributions

AM conceptualized the study, conducted the research, developed the model and wrote the first draft of this article. CS and SB were the supervisors and provided ongoing review and editorial comment to finalise the article. All authors actively contributed to the final version of the manuscript. All authors read and approved the final version.

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Tables

Tables 1-2 are in the supplementary files section.

Figures

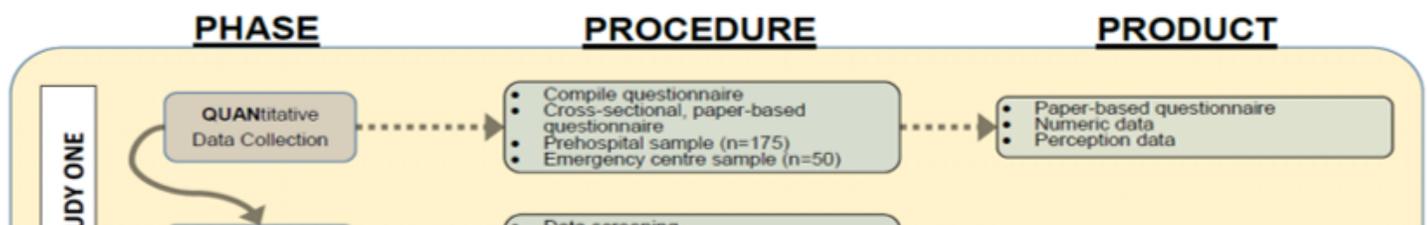


Figure 1

Process and flow of the data collection and mixing

Figure 2

A depiction of the PEDHOM conceptual model to facilitate improved content, communication, and process in emergency department handover

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Tables.docx](#)