

วิธีการและผลของการพัฒนาการส่งต่อข้อมูลผู้ป่วย ภายในโรงพยาบาล

รัตใจ เวชประสิทธิ์^{1*}

วงจันทร์ เพชรพิเชฐเชียร²

Mary A. Blegen³

ประณีต ส่งวัฒนา²

The Methods and Outcomes of In-hospital Handoff Improvement.

Ratjai Vachprasit¹, Wongchan Petpichetchian², Mary A. Blegen³, Praneed Songwathana²

¹The Operating Theatre, Songklanagarind Hospital, Faculty of Medicine,

²Department of Surgical Nursing, Faculty of Nursing,

Prince of Songkla University, Hat Yai, Songkhla, 90110, Thailand.

³The Center for Patient Safety Community Health Systems Department, School of Nursing,
University of California, San Francisco, CA 94143, USA.

*E-mail: ratjai.v@psu.ac.th

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บทคัดย่อ:

“การส่งต่อข้อมูลผู้ป่วย” เป็นเครื่องมือสำคัญที่ผู้ให้บริการทางสุขภาพใช้เพื่อช่วยให้ผู้ป่วยได้รับการดูแลที่ต่อเนื่องและปลอดภัย อย่างไรก็ตาม ยังพบเหตุการณ์ไม่พึงประสงค์ที่เกิดจากความบกพร่องในการส่งต่อข้อมูลผู้ป่วยอยู่เสมอ บทความนี้ได้ทบทวนการศึกษาเรื่องการส่งต่อข้อมูลผู้ป่วยภายในโรงพยาบาลซึ่งตีพิมพ์เป็นภาษาอังกฤษ ตั้งแต่ปี พ.ศ. 2548-2554 เพื่อระบุถึงวิธีการและผลที่ได้จากการพัฒนาการส่งต่อข้อมูลผู้ป่วย โดยพบว่า มีวิธีการที่ใช้ในการพัฒนาการส่งต่อข้อมูลผู้ป่วยอยู่หลายวิธี ได้แก่ การส่งต่อข้อมูลแบบตัวต่อตัว การส่งต่อข้อมูลข้างเตียง การใช้แหล่งข้อมูลต่างๆ ประกอบการส่งต่อข้อมูล การใช้แบบกำหนด

¹ห้องผ่าตัด โรงพยาบาลสงขลานครินทร์ คณะแพทยศาสตร์ ²ภาควิชาการพยาบาลศัลยศาสตร์ คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ อ.หาดใหญ่ จ.สงขลา 90110

³The Center for Patient Safety Community Health Systems Department, School of Nursing,
University of California, San Francisco, CA 94143, USA.

รับต้นฉบับวันที่ 25 มิถุนายน 2555 รับลงตีพิมพ์วันที่ 19 กันยายน 2555

ข้อมูล การใช้แนวปฏิบัติในการส่งต่อข้อมูล การส่งต่อข้อมูลด้วยระบบคอมพิวเตอร์ การฝากข้อความเสียง การให้ความรู้หรือฝึกหัดการส่งต่อข้อมูล การใช้วิธีการสะท้อนกลับ และการใช้วิธีการส่งต่อข้อมูลหลายวิธีร่วมกัน มีการประเมินผลที่ได้จากการใช้วิธีการเหล่านี้ใน 4 ด้านหลักๆ คือ ด้านระบบ ด้านข้อมูล ด้านผู้ให้บริการสุขภาพ และด้านผู้ป่วย โดยมีการศึกษาเพียงส่วนน้อยเท่านั้นที่ประเมินผลของการศึกษาที่มีต่อผู้ป่วย ทั้งนี้พบว่า การส่งต่อข้อมูลด้วยระบบคอมพิวเตอร์และการใช้แหล่งข้อมูลต่างๆ ประกอบการส่งต่อข้อมูลส่งเสริมให้เกิดการดูแลที่ต่อเนื่องได้ อย่างไรก็ตาม มีการศึกษาเพียงจำนวนน้อยที่ใช้ระเบียบวิธีการศึกษาที่เข้มงวดในการประเมินผลของการพัฒนาการส่งต่อข้อมูลที่มีต่อผู้ป่วย แต่เนื่องจากการส่งต่อข้อมูลมีวัตถุประสงค์ให้เกิดผลลัพธ์ที่ดีแก่ผู้ป่วย ดังนั้น จึงควรมีการศึกษาวิธีการส่งต่อข้อมูลผู้ป่วยที่ก่อให้เกิดผลดีแก่ผู้ป่วยต่อไป

คำสำคัญ: การส่งต่อข้อมูลผู้ป่วย, ผลลัพธ์ที่มีต่อผู้ป่วย, วิธีการพัฒนาการส่งต่อข้อมูลผู้ป่วย

Abstract:

“Handoff” is a significant tool used by healthcare providers to ensure continuous and safe care. However, adverse consequences resulting from handoff breakdowns are common. This article reviewed in-hospital handoff studies, published in the English language from 2005 to 2011, to identify handoff improvement interventions and their outcomes. The results revealed that various handoff improvement interventions were undertaken and examined. These included person-to-person handoff, bedside handoff, supplementing the current handoff with other information sources, information templates/checklists/sheets/forms, handoff protocols, computerized handoff systems, and voicemail handoff. Other interventions were handoff education/training/programs, the reflexivity method, and a combination of different handoff methods. The impact of these interventions was assessed mainly in four targets: systems; information; healthcare providers; and patients. Only a few studies reviewed directly evaluated the impact of the interventions on patients. Of these, implementing a computerized handoff system and using information tools appeared to promote continuity of patient care. Moreover, very few studies rigorously evaluated the impact of handoff improvement interventions on patients. Since handoff is ultimately intended to benefit the patient, rigorous studies should be undertaken to identify the best handoff method associated with satisfactory outcomes for patients.

Key words: handoff, handoff improvement interventions, patient outcomes

Introduction

Modern healthcare is dynamic and complex, and thus requires effective communication among healthcare providers to achieve quality of care. In particular, for patient care transfer, continuous and safe care relies on information being communicated. At each time of information transfer, however, there is high potential for loss and degradation of information. In responding to this challenge, handoff, a real-time communication process of passing patient-specific information between healthcare providers or teams plays a pivotal role in accurately and comprehensively transferring patient information in a timely manner in order to ensure continuity of and safety in patient care.^{1,2}

Clinical handoff commonly occurs when a patient's care is transferred to other healthcare providers.³ It can both enable and influence the subsequent healthcare providers to plan, decide, and prioritize appropriate further patient care.⁴ A literature review indicated that, for many decades, nurses were probably the earliest professionals applying handoffs to facilitate the workflow over 24 hours.^{1,5} Traditionally, handoffs have been given verbally in an area away from patients, in so called office-based handoff. However, if staff are occupied elsewhere, this could lead to lack of care provided to patients during the handoff. Therefore, some facilities have consequently devised and introduced other handoff methods as substitutes. Attempts to improve handoffs have been undertaken periodically once caregivers realized that current handoff

systems had defects.¹ In addition to verbal office-based handoffs, several other methods of handoff are currently utilized. These include synchronous communication handoffs, such as verbal bedside-based and telephone handoffs, and asynchronous communication handoffs, such as tape-recorded, written, faxed, computerized, pager, hand-held device, e-mail, voicemail, and video handoffs. All methods have their own particular strengths and weaknesses.^{1,6-8}

Communication failure is one of the key factors contributing to sentinel events occurring as a result of poor handoff.^{7,9} It has been reported that 20 to 43% of communication failures during handoff lead to patient harm or death.^{10,11} To healthcare providers, the non-availability of patient information can result in their providing inefficient and suboptimal care.¹²⁻¹⁴ Problems related to handoffs and their contributing factors have been identified across the board. Common problems are incomplete, inaccurate, disorganized, irrelevant, and untimely information regarding a patient's condition, treatment, plans, and management.^{1,14} Riesenberget al.^{15,16} indicated the following factors contributing to handoff problems: barriers related to communication, equipment, and environment; a lack of standardization, time, training, or education regarding handoff; the complexity or high number of patients; and other human-related factors. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) identified handoff as an issue that required improvement in the 2006 National Patient Safety Goals. Since

then many organizations have sought the most effective method for handoffs, and a number of studies have been conducted to identify and examine interventions to improve handoffs.^{5,9}

Several interventions have been recommended as being beneficial for handoff improvement. However, whether such interventions contribute to improved outcomes for patients needs further investigation. Organizations attempting to apply any of these interventions may need sufficient evidence to ensure that the interventions selected are effective and suited to their local needs and resources. This article reviewed in-hospital handoff studies, published in the English language from January 2005 to September 2011, to identify interventions aimed at improving handoffs and their outcomes, particularly for patients.

Interventions for handoff improvement

During recent years, a variety of interventions relevant to handoff have been undertaken. Of these, a study in a simulated setting found that a person-to-person handoff, involving direct face-to-face communication, was more effective in delivering accurate and complete information than a video-based or computer screen-based handoff.⁷ Some studies found that changing from taped or verbal office-based handoff to a bedside handoff led to better handoffs.^{17,18} In other studies, the insufficiency of the current handoff was diminished by being supplemented with other information sources. These included supplementing a verbal handoff with

information tools,⁵ supplementing a written report with a verbal telephone report,¹⁹ and the use of care plans or electronic patient records to support bedside handoffs.^{20,21}

Many studies found using handoff templates, checklists, sheets or forms, in either paper or electronic form, to structure the information transferred, resulted in more effective handoffs.^{2,22-25} In addition, two studies comparing the effectiveness of different handoff methods found that verbal handoffs using a pre-prepared sheet led to more information being retained by the receivers than using a verbal handoff with note taking and a purely verbal handoff.^{26,27} Some studies applied handoff protocols or structured processes to formalize handoff performance.^{28,29} Where technological systems were available, studies implemented computerized handoff systems or voicemail handoffs to facilitate the handoff process.^{6,30-34}

A lack of education or training has been identified as a contributing factor in handoff breakdowns.^{15,16} A number of studies thus introduced handoff education, training, or programs based either on ordinary or on a simulated basis, to equip staff with knowledge of and skill in handoffs.^{9,29,32,35-39} These interventions further aimed to enhance the ability of staff in performing handoffs effectively. Moreover, in an effort to make changes to a current handoff, a study among physicians introduced the reflexivity method (RM), a participative change process, to enable changes to occur.⁴⁰ RM consists of three main elements: reflection; reflexivity; and dialogue.

Such a process is intended to provide a link in changes in actions and behaviors, particularly within complex social and political settings.

Although improvements in handoffs were achieved by specific interventions in many studies, some studies applied a combination of different handoff methods. For example, Wilson⁴¹ employed bedside handoffs using a structured process. Berkenstadt et al.³⁷ introduced a handoff checklist/protocol and simulation-based handoff training. Clark et al.⁴² applied an electronic handoff template and a handoff protocol. Gakhar and Spencer³² implemented a structured sign-out curriculum and an electronic sign-out system. Table 1 presents a summary of handoff improvement interventions utilized in the studies reviewed. The outcomes of the interventions studied were assessed and are presented in the following section.

Outcomes of handoff improvement interventions

Analysis of the studies reviewed yielded the following targeted outcomes aimed at by different handoff improvement interventions: system outcomes; information outcomes; outcomes relating to healthcare providers; and patient outcomes.

System outcomes

Many studies found improvements in system functions resulting from the interventions employed. Commonly, the time taken for handoff was shortened by the employment of a bedside

handoff within a structured process,^{17,18,41} a handoff protocol,²⁸ or a computerized handoff system.³⁰ In particular, a computerized handoff system was able to shorten the handoff process by reducing the time healthcare providers spent hand-copying patients' basic data.³⁰ Furthermore, teamwork and the safety climate was significantly improved through the use of handoff education.⁹ Especially, technical errors were reduced and less teamwork was required when using the handoff protocol developed based on Formula 1 pit-stop and aviation models for patients transfer from surgery to ICU.²⁸ Studies among physicians found the reduction of the frequency of inappropriate tasks left by outgoing healthcare providers when a standardized handoff form was used.^{2,22} If performed electronically, this intervention was able to improve clarity as to the time of transfer of care by letting the other healthcare providers know when responsibility was transferred via a computer screen.²

Improvement in documentation was observed when staff used written records or a computerized handoff system as a source of information in the lead-up to handoff.^{20,32} Moreover, the convenience of conveying and accessing information was facilitated through using voicemail handoff.⁶ Although a study implementing a new computerized handoff system did not detect any effect on the number of medical errors, adverse drug events (ADEs) and reported incidents, it did indicate that the intervention did not make the handoff process worse.³¹

Table 1 Summary of handoff improvement interventions, strengths, weaknesses, and recommendations for implementation of the interventions

Interventions	Strengths	Weaknesses	Recommendations for implementation
Person-to-person handoff	-Allows information verification, inquiry, and customization	-Requires the provider and receiver of information to be available to perform handoff at the same time -Opens opportunity for a creation of conflicts between interlocutors	-Handoff time should be scheduled in order to enable staff to appropriately manage their time for the handoff -Information should be conveyed in a comprehensive structure in order to eliminate conflicts between interlocutors ⁴³
Bedside handoff	-Promotes patient involvement in care ¹⁹ -Allows patient to ask and add information regarding care, and to correct misconceptions ^{18,44} -Seeing the patient enables health-care providers to better memorize patient information ¹⁸	-Some patients may not be able or desire to participate ⁴⁵ -Some staff may find it difficult and uncomfortable to report in the presence of patients and their families ⁴⁴ -Problematic to maintain patient confidentiality ¹	-Patients should be informed regarding their role during handoffs to guide their participation ⁴⁴ -Knowledge and training in effective communication techniques should be provided to staff, to enable them to be confident and comfortable in conducting bedside handoffs ⁴⁴
Supplement the current handoff with other information sources	-Promotes accuracy and completeness of information transferred ²⁰ -Allows more opportunity to obtain accurate and complete information ¹⁹	-Duplicated information may lengthen the handoff time ¹⁹ -Discrepancies in information between different information sources could lead to confusion	-Duplicated information should be minimized by appropriate approaches -Discrepancies in information between different information sources should be checked and corrected by the handoff provider prior to performing handoff

Table 1 (Continued)

Interventions	Strengths	Weaknesses	Recommendations for implementation
Information templates/checklists/sheets/forms	<ul style="list-style-type: none"> -Inexpensive and do not rely on technology²² -Promote accuracy and completeness of information transferred² -Promote retention of information by receivers^{26,27} 	<ul style="list-style-type: none"> -May not increase accuracy of data transferred²² -May not change caregivers' behavior on safety scans during handoff³⁷ 	<ul style="list-style-type: none"> -Knowledge and training should be provided to users to enable them to use and become familiar with the templates/checklists/sheets/forms -The actual safety scans should incorporate the use of the templates etc³⁷
Handoff protocol	<ul style="list-style-type: none"> -Enables information to be transferred in a consistent format and process²⁸ 	<ul style="list-style-type: none"> -Needs all staff involved to have a clear understanding of their role and others' tasks within the protocol²⁸ 	<ul style="list-style-type: none"> -The protocol should be simple, easily trainable, and established within a timely fashion -Staff should be required to collaboratively educate, train and practice prior to the implementation of the protocol
Computerized handoff system	<ul style="list-style-type: none"> -Information can be provided and received at the most convenient time for both handoff provider and receiver¹ -Allows quick access and printouts of information³⁰ -Eliminates problems of illegibility of written records^{21,30} 	<ul style="list-style-type: none"> -Requires extra financial and technical resources for implementation¹⁷ -Relies on technological systems and is vulnerable to accidental system failure -Diminishes opportunity for information verification, inquiry, and customization 	<ul style="list-style-type: none"> -Requirements of users should be integrated into the system in order to make it viable and effective -Knowledge, training, and assistance should be provided to users to enable them to use and familiarize themselves with the system³¹ -Mechanisms for information verification, questioning,³⁰ and preservation should be incorporated

Table 1 (Continued)

Interventions	Strengths	Weaknesses	Recommendations for implementation
Voicemail handoff	<ul style="list-style-type: none"> -Allows quick access to information across time and space⁶ -Information can be provided and received at the most convenient time for both the handoff provider and receiver⁶ -Eliminates conflicts between interlocutors⁶ 	<ul style="list-style-type: none"> -Depends and relies on technical systems⁶ -Information could be outdated, delayed or never accessed⁶ -Omits opportunity for information verification, inquiry, and customization⁶ 	<ul style="list-style-type: none"> -Design a system to alert when voicemail has been made or received to ensure information transfer to the responsible person -Mechanisms for information verification and questioning in a timely manner, as well as information preservation, should be included
Handoff education/training/program	<ul style="list-style-type: none"> -Can improve knowledge, understanding and skills of staff -Promotes consistency of handoff process -Simulation based training has no ethical considerations for either patient care or medical training³⁷ 	<ul style="list-style-type: none"> -May require staff to leave their workplaces and patients to participate in the course, over a length of time for course completion³⁷ -Simulation based training is considered expensive³⁷ 	<ul style="list-style-type: none"> -Allocate appropriate time and resources -Invite experts or appropriate trainers to be instructors -High-level participation by staff involved would be required for program development and progression
Reflexivity method	<ul style="list-style-type: none"> -Creates awareness and impetus in staff for change or improvement, according to local problems⁴⁰ -Encourages and empowers staff taking part and collaborating in the change¹⁷ -Promotes sustaining of change⁴⁶ 	<ul style="list-style-type: none"> -May encounter restraining forces such as ritualism, tradition, and staff fear of change¹⁷ -Needs involvement of all staff to drive change⁴⁷ 	<ul style="list-style-type: none"> -Driving and restraining forces need to be identified and managed prior to and along with the change movement -Policy and support from leaders and staff would be required to drive change¹⁷ -Encourages staff involvement in change process to obtain their collaboration
A combination of handoff methods	<ul style="list-style-type: none"> -Minimizes weaknesses of the interventions included 	<ul style="list-style-type: none"> -May require more time and effort from staff for handoff processing 	<ul style="list-style-type: none"> -The interventions should not create additional complex tasks in the handoff process

Information outcomes

Several studies found improvement in terms of the quality of information transferred. Studies in a simulated setting using a verbal handoff with a pre-prepared sheet found that more information was retained by the receivers than was the case by using a verbal handoff with note taking or by using a verbal handoff only, respectively.^{26,27} Zendejas et al.⁷ found that handoffs employing person-to-person handoff delivered higher word accuracy, and less errors of omission and commission, to the next healthcare providers than video-based and computer screen-based handoffs. In addition, the accuracy, completeness, and clarity of handoff information were also improved by some other interventions. These included interventions such as a handoff protocol,²⁸ a structured handoff form or checklist,^{22,23} handoff training,²⁹ a computerized handoff sheet, form and system,^{2,33,34} and voicemail handoffs.⁶ Similar findings were found where electronic patient records were used to supplement the usual handoff based on written records.²¹

Moreover, the percentage of “compliant” handoffs, handoffs that consisted of accurate, up-to-date, and required information, was increased by using an electronic handoff template and a handoff protocol.⁴² In particular, using an electronic patient record system was able to facilitate handoff because fewer messages needed to be passed on after handoffs and some of the information could be reliably extracted to the handoff form.^{21,24}

Healthcare provider outcomes

A number of studies reported enhancement of the healthcare providers’ functions or percep-

tions as a consequence of the interventions undertaken. Healthcare providers’ satisfaction was usually observed when either a bedside handoff or a computerized handoff system was applied.^{18,33} Berkenstadt et al.³⁷ found that the number of healthcare providers who communicated better during the sessions increased when a handoff checklist/protocol and simulation-based handoff training were implemented, although the interventions did not improve their performance on safety checking during the process.

Healthcare providers’ thinking regarding handoffs as well as their handling of them and the convenience of discussing them with colleagues was improved when RM was introduced.⁴⁰ This intervention was also found to promote information sharing, reflection by healthcare providers on their behavior, and support from leaders. Some studies found improvements in healthcare providers’ perceptions of their abilities, confidence, comfort, skills, and preparedness to perform handoffs effectively after attending either ordinary or simulation-based handoff education.^{35,36,38,39} Their prioritization of tasks and time management was also found to be more effective when a bedside handoff supplemented by care plans or a computerized handoff system was utilized.^{20,30}

A clearer status of care plans for patients was perceived when electronic patient records were used to supplement a verbal handoff.²¹ Stahl et al.²³ found an increased likelihood that healthcare providers would detect and correct faulty tasks or missing information when a structured handoff checklist was applied. Further, healthcare providers were able to spend more time caring for patients when care plans were used as a source

of information for bedside handoffs or when a computerized handoff system was introduced because the interventions reduced the time needed to prepare and process the handoff.^{20,30} Lastly, healthcare providers' learning was enhanced when a structured process was used for bedside handoffs.⁴¹ However, the intervention reduced socializing between the handoff participants which was also noted when using voicemail handoffs.^{6,20}

Patient outcomes

Some studies reported benefits by way of improved patient outcomes from improvements in handoffs. Patient satisfaction was commonly reported following a bedside handoff.^{17,18} By using this intervention, patient involvement in care and patient-healthcare provider contact were also promoted.^{20,41} Moreover, patients discussed previously were more likely to be re-discussed by healthcare providers at consecutive handoffs when information tools were used to support a verbal handoff.⁵ A randomized-controlled study showed that the use of a computerized handoff system reduced the number of patients missed on healthcare providers' rounds by half.³⁰ In addition, patients' length of stay was reduced by using an electronic handoff template to structure handoff information.²⁵ The authors claimed that this happened because the intervention was efficient for transfer patient details, thus bringing about better quality of care. Similarly, a study found a reduction in the cost of patient care from supplementing a written report with a telephone conversation.¹⁹

Discussion and recommendations

Clinical handoff is a tool for healthcare providers which can lead to positive patient outcomes. Since handoff breakdown has been widely experienced, a number of interventions aimed at improving handoff have been attempted. However, the impacts of these interventions were assessed for different targets. Some seemed to benefit patients. However, those outcomes were indirectly measured through the healthcare providers' perceptions which were vulnerable to subjective bias. Some enhanced system functions which resulted in more efficient work and some improved quality of the information transferred, but the effects of these interventions on patient outcomes could not be substantiated. The lack of valid measurements of patient outcomes and ethical considerations relating to patient harm could make it difficult and complex to evaluate the impacts of interventions directly on patient outcomes. There is, therefore, little empirical evidence in the literature as to how interventions were able to bring about better patient outcomes. Of the studies reviewed, only a few studies directly evaluated patient outcomes.

In selecting interventions aimed at improving handoffs, organizations should consider which method is most appropriate to their setting, depending on the expected outcomes and available resources. The applicability of the interventions selected should be carefully and thoroughly considered prior to implementation. Table 1 also summarizes the strengths and weaknesses of the interventions described in the studies reviewed, together with recommendations for implementing

each intervention. Riesenberget al.¹⁵ have recommended several strategies that could be incorporated during the implementation of interventions to achieve more effective handoffs. These include enhancing the communication skills of the participants, applying technology-based solutions, and executing handoff in an appropriate environment. Moreover, the handoff process needs to be formalized, and staff need to be involved in the process by being educated and trained for their roles. It is also important that the leaders of the organization should value and support the process.

A majority of the studies of handoff improvement based the measuring of their outcomes on the effect on systems, information, and healthcare providers. Only a few studies objectively assessed the outcome for the patient. Of these studies, it was found that implementing a computerized handoff system and supplementing the handoff with information tools appeared to promote continuity of patient care.^{5,30} Using an electronic handoff template and supplementing a written report with a verbal telephone handoff were also found to promote the quality of patient care.^{19,25} However, to ensure that handoffs are effective and ultimately promote positive patient outcomes, further studies are recommended which objectively assess the association between handoff improvement and patient outcomes. Before generally recommending any intervention to improve handoffs, those interventions need to be rigorously assessed to ensure their effectiveness, which would eliminate the possibility of wasting time, effort, and resources on unsound interventions. Unfortunately, a majority of recent

studies of improvements in handoffs have failed to employ a rigorous study design, which has limited their generalizability. Mostly, the studies reviewed used pre-post intervention evaluation,^{2,5-7,9,18,19,21,22,25,28,29,32-37,42} followed by solely post intervention evaluation.^{17,20,24,39-41} Few studies used group comparison.^{19,26,27} One study was a cohort study.²³ Only two studies applied a rigorous, randomized crossover design.^{30,31} For this reason, more rigorous studies to determine the effectiveness of various handoff improvement interventions are required.

Conclusions

Healthcare providers utilize handoff as a tool for ensuring the delivery of continuous and safe care, but adverse outcomes resulting from handoff breakdown are still commonly found. The JCAHO and many studies have requested healthcare organizations to standardize handoffs. A number of studies have devised and examined interventions aimed at improving handoff quality. Most of these studies seemed to benefit patients, but measured their outcomes on other targets such as the system, information, and the healthcare providers. Only a few studies objectively assessed outcomes on patients.

Healthcare providers could apply the interventions described in this article to improve handoff. However, particular settings may need specific interventions. Therefore, an appropriate handoff needs to be designed by the participants involved in the process in order to meet the needs of units and organizations. To justify the commitment of time, effort, and

resources to making handoffs successful, more rigorous evaluations of the effectiveness of handoff improvement interventions are required. Since the ultimate purpose of handoff is to benefit patients, any improvement should be demonstrated by maintaining or enhancing positive patient outcomes.

References

1. Strophe B, Ottani P. Can technology improve inter-shift report? What the research reveals. *J Prof Nurs* 2006; 22: 197 - 204.
2. Wayne JD, Tyagi R, Reinhardt G, et al. Simple standardized patient handoff system that increases accuracy and completeness. *J Surg Educ* 2008; 65: 476 - 85.
3. Philpin S. 'Handing over': transmission of information between nurses in an intensive therapy unit. *Nurs Crit Care* 2006; 11: 86 - 93.
4. Currey J, Browne J, Botti M. Haemodynamic instability after cardiac surgery: nurses' perceptions of clinical decision-making. *J Clin Nurs* 2006; 15: 1081 - 90.
5. Alem L, Joseph M, Kethers S, et al. Information environments for supporting consistent registrar medical handover. *HIM J* 2008; 37: 9 - 25.
6. Horwitz LI, Parwani V, Shah NR, et al. Evaluation of an asynchronous physician voicemail sign-out for emergency department admissions. *Ann Emerg Med* 2009; 54: 368 - 78.
7. Zendejas B, Ali SM, Huebner M, et al. Handing over patient care: is it just the old broken telephone game? *J Surg Educ* 2011; 68: 465 - 71.
8. Friesen MA, White SV, Byers JF. Handoffs: implications for nurses. In: Hughes RG, editor. *Patient safety and quality: an evidence-based handbook for nurses*. Rockville: Agency for Healthcare Research and Quality; 2008.
9. Beckett CD, Kipnis G. Collaborative communication: integrating SBAR to improve quality/patient safety outcomes. *J Healthc Qual* 2009; 31: 19 - 28.
10. Greenberg CC, Regenbogen SE, Studdert DM, et al. Patterns of communication breakdowns resulting in injury to surgical patients. *JACS* 2007; 204: 533 - 40.
11. Gandhi TK, Kachalia A, Thomas EJ, et al. Missed and delayed diagnoses in the ambulatory setting: a study of closed malpractice claims. *Ann Intern Med* 2006; 145: 488 - 96.
12. Schultz K, Carayon P, Hundt A, et al. Care transitions in the outpatient surgery preoperative process: facilitators and obstacles to information flow and their consequences. *Cogn Tech Work* 2007; 9: 219 - 31.
13. Horwitz LI, Moin T, Krumholz HM, et al. Consequences of inadequate sign-out for patient care. *Arch Intern Med* 2008; 168: 1755 - 60.
14. Ye K, Taylor DM, Knott JC, et al. Handover in the emergency department: deficiencies and adverse effects. *Emerg Med Australas* 2007; 19: 433 - 41.
15. Riesenber LA, Leisch J, Cunningham JM. Nursing handoffs: a systematic review of the literature. *Am J Nurs* 2010; 110: 24 - 34.
16. Riesenber LA, Leitzsch J, Massucci JL, et al. Residents' and attending physicians' handoffs: a systematic review of the literature. *Acad Med* 2009; 84: 1775 - 87.
17. Kassean HK, Jagoo ZB. Managing change in the nursing handover from traditional to bedside handover - a case study from Mauritius. *BMC Nurs* 2005; 4: 1.
18. Anderson CD, Mangino RR. Nurse shift report: who says you can't talk in front of the patient? *Nurs Adm Q* 2006; 30: 112 - 22.
19. Hess DR, Tokarczyk A, O'Malley M, et al. The value of adding a verbal report to written handoffs on early readmission following prolonged respiratory failure. *Chest* 2010; 138: 1475 - 9.
20. Clemow R. Care plans as the main focus of nursing handover: information exchange model. *J Clin Nurs* 2006; 15: 1463 - 5.

21. Hertzum M, Simonsen J. Positive effects of electronic patient records on three clinical activities. *Int J Med Inform* 2008; 77: 809 – 17.
22. Salerno SM, Arnett MV, Domanski JP. Standardized sign-out reduces intern perception of medical errors on the general internal medicine ward. *Teach Learn Med* 2009; 21: 121– 6.
23. Stahl K, Palileo A, Schulman C, et al. Enhancing patient safety in the trauma/surgical intensive care unit. *J Trauma* 2009; 67: 430 – 5.
24. Flanagan ME, Patterson ES, Frankel RM, et al. Evaluation of a physician informatics tool to improve patient handoffs. *J Am Med Inform Assoc* 2009; 16: 509 – 15.
25. Ryan S, O’Riordan JM, Tierney S, et al. Impact of a new electronic handover system in surgery. *Int J Surg* 2011; 9: 217 – 20.
26. Pothier D, Monteiro P, Mooktiar M, et al. Pilot study to show the loss of important data in nursing handover. *Br J Nurs* 2005; 14: 1090 – 3.
27. Bhabra G, Mackeith S, Monteiro P, et al. An experimental comparison of handover methods. *Ann R Coll Surg Engl* 2007; 89: 298 – 300.
28. Catchpole KR, de Leval MR, McEwan A, et al. Patient handover from surgery to intensive care: using Formula 1 pit-stop and aviation models to improve safety and quality. *Pediatr Anesth* 2007; 17: 470 – 8.
29. Lyons MN, Standley TD, Gupta AK. Quality improvement of doctors’ shift-change handover in neuro-critical care. *Qual Saf Health Care* 2010; 19: e62.
30. Van Eaton EG, Horvath KD, Lober WB, et al. A randomized, controlled trial evaluating the impact of a computerized rounding and sign-out system on continuity of care and resident work hours. *J Am Coll Surg* 2005; 200: 538 – 45.
31. Van Eaton EG, McDonough K, Lober WB, et al. Safety of using a computerized rounding and sign-out system to reduce resident duty hours. *Acad Med* 2010; 85: 1189 – 95.
32. Gakhar B, Spencer AL. Using direct observation, formal evaluation, and an interactive curriculum to improve the sign-out practices of internal medicine interns. *Acad Med* 2010; 85: 1182 – 8.
33. Patel VP, Raptis D, Christofi T, et al. Development of electronic software for the management of trauma patients on the orthopaedic unit. *Injury* 2009; 40: 388 – 96.
34. Pickering BW, Hurley K, Marsh B. Identification of patient information corruption in the intensive care unit: using a scoring tool to direct quality improvements in handover. *Crit Care Med* 2009; 37: 2905 – 12.
35. Chu ES, Reid M, Schulz T, et al. A structured handoff program for Interns. *Acad Med* 2009; 84: 347 – 52.
36. Horwitz LI, Moin T, Green ML. Development and implementation of an oral sign-out skills curriculum. *JGIM* 2007; 22: 1470 – 4.
37. Berkenstadt H, Haviv Y, Tuval A, et al. Improving handoff communications in critical care: utilizing simulation-based training toward process improvement in managing patient risk. *Chest* 2008; 134: 158 – 62.
38. Farnan JM, Paro JA, Rodriguez RM, et al. Hand-off education and evaluation: piloting the observed simulated hand-off experience (OSHE). *JGIM* 2010; 25: 129 – 34.
39. Filichia L, Halan S, Blackwelder E, et al. Description of web-enhanced virtual character simulation system to standardize patient hand-offs. *J Surg Res* 2011; 166: 176 – 81.
40. Broekhuis M, Veldkamp C. The usefulness and feasibility of a reflexivity method to improve clinical handover. *J Eval Clin Pract* 2007; 13: 109 – 15.
41. Wilson R. Improving clinical handover in emergency departments. *Emerg Nurse* 2011; 18: 22 – 6.
42. Clark CJ, Sindell SL, Koehler RP. Template for success: using a resident-designed sign-out template in the handover of patient care. *J Surg Educ* 2011; 68: 52 – 7.

43. Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf* 2006; 32: 167 - 75.
44. Caruso EM. The evolution of nurse-to-nurse bedside report on a medical-surgical cardiology unit. *Meds Nurs* 2007; 16: 17 - 22.
45. Chaboyer W, McMurray A, Wallis M. Bedside nursing handover: a case study. *Int J Nurs Pract* 2010; 16: 27 - 34.
46. Hall JE. Professionalizing action research- a meaningful strategy for modernizing services? *J Nurs Manage* 2006; 14: 195 - 200.
47. Jeffcott SA, Evans SM, Cameron PA, et al. Improving measurement in clinical handover. *Qual Saf Health Care* 2009; 18: 272 - 6.