Handoffs in Hospitals: A review of the literature on information exchange while transferring patient responsibility or control

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Abstract

Background: In hospitals, *handoffs* are episodes in which control of, or responsibility for, a patient passes from one health professional to another, and in which important information about the patient is also exchanged. In view of the growing interest in improving handoff processes, and the need for guidance in arriving at standardized handoff procedures, a review of the research on handoffs is provided.

Methods: The authors have attempted to identify all research treatments of hospital handoffs involving medical personnel published in English through July 2008.

Results: Findings from the literature are organized into six themes: 1) The definition of 'handoff'; 2) The functions of handoffs; 3) The challenges and difficulties of handing off; 4) The costs and benefits of standardization; 5) Possible protocols for standardizing of handoffs; and 6) Questions needing answers, and methods of research.

Conclusions: The large body of relevant literature shows handoff to be highly sensitive to variations in context, to be an activity that is essential for multiple important functions within a hospital that range far beyond patient safety, and to be subject to difficult tensions that necessarily attend efforts to standardize action within a highly differentiated hospital setting. In addition, there is little empirical evidence regarding the magnitude of the impact of handoff on patient safety and service quality, making the potential gains and complications from standardization uncertain.

As a patient moves among specialized services within a hospital, and as shifts of medical personnel come and go, there are numerous episodes in which control of, or responsibility for, the patient passes from one health professional to another, and in which important information about the patient is also exchanged. In this article we review the research literature on the nature and consequences of these episodes, which we collectively label 'handoffs'.

There is increasing interest in handoffs and the closely related transfers known by other names such as 'sign-out', 'handover' or 'report'. Perhaps the single largest factor in the growth of interest in handoffs is the decision of the Joint Commission in 2006 (1) to include requirement 2e in its National Patient Safety Goals: "*Implement a standardized approach to "hand off" communications, including an opportunity to ask and respond to questions.*" The most recent (2008) Joint Commission handbook gives the following rationale for the requirement:

> The primary objective of a "hand off" is to provide accurate information about a [patient's] care, treatment, and services, current condition and any recent or anticipated changes. The information communicated during a hand off must be accurate in order to meet [patient] safety goals. ((2), p.4)[1]

In view of the growing interest in improving handoff processes, and the need for guidance in arriving at standardized handoff procedures, it will be valuable to review results of research on handoffs, and to suggest some questions that might deserve further attention. We have therefore

[1] Beginning in 2009, under a new Joint Commission numbering system, Requirement 2E will become NPSG.02.05.01 .

attempted to identify all research treatments of hospital handoffs involving medical personnel published in English through July 2008.[2]

This is not the first literature review in this area (4-9), but it is the most extensive, and it differs in purpose from earlier reviews. We have organized our treatment of the research with the aim of contributing directly to efforts to improve handoffs, and, in particular, to addressing the issue of how handoffs should be standardized. We do so by raising issues with implications for handoff improvement and discussing current knowledge on those issues. Our review also includes research on handoffs as carried out by several different types of medical professionals (physicians, nurses, technicians, ambulance drivers, ...) since all these groups engage at some points in processes that meet our definition of a handoff, all are potentially subject to Joint Commission requirement 2e, and all are relevant to the overall goals of improving patient outcomes and safety. Moreover, many problems of achieving better handoffs prove to be similar despite surface differences in the content of communications, so the groups have much to learn from each other.

We address a series of issues that have motivated attention to hospital handoffs, including the relation of handoff risks to changes in resident work hours, the difficulties of estimating the magnitude of handoff risks to patient safety, and the inherent problems of standardizing an activity that is necessarily specific to individual patient circumstances and the specialized knowledge of participants. We have also suggested a number of points of contact between handoff research and research on the properties of other organizational routines, since we believe there are valuable lessons that practitioners working to improve handoffs might learn from studies of efforts to improve important organizational routines in other settings.

We have organized our review of the literature into six main sections and a conclusion. While other structures could be drawn from the literature, this structure has been chosen with the aim of contributing to the pressing problems of improving handoffs. Our organizing themes are:

1. The definition of 'handoff'
2. The functions of handoffs
3. The challenges and difficulties of handing off
4. The costs and benefits of standardization
5. Possible protocols for standardizing of handoffs
6. Questions needing answers, and methods of research

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[2] To locate the literature, we searched PubMed using the terms “handoff,” “handover,” “signout,” “sign-out,” “SBAR,” and "shift report." We also used the reference lists of the papers located and bibliographies compiled by other researchers (e.g., (3)) to find additional literature. The complete set of 460+ identified items, with accompanying short summaries, is available at http://www.connotea.org/user/signout. Each item is linked to a full text copy maintained by the authors. Under the fair use provisions of the copyright law, legitimate researchers have a right to access such material and may contact either author for permission to use the full text library. We have deliberately adopted broad criteria of inclusion. Some items are not systematic studies, but rather material with implications for handoff, such as editorials, interviews, or research on a related topic.

7. Conclusions

1. The definition of 'handoff' and scope of the review

As we have mentioned, the transfers covered in the research reviewed here are known by many names. 'Handoff', 'handover', 'nursing report', and 'sign-out' are perhaps the most common. The differences among the names also carry some differences in connotation. (10) Some may emphasize the information content itself, as with 'report'. In contrast, 'handoff' may suggest more strongly the change in control, for example, when there is a change in the health professional who will be near the patient, such as the transfer of a patient between hospital departments.[3] Some labels may connote the change in responsibility, such as 'sign-out' with its suggestion of a temporary delegation of formal authority for decisions and of legal responsibility for consequences, as might occur at a shift change to overnight care. These distinctions can be consequential. For example, a patient can be handed off, in the sense that a move has occurred to a new location with new proximate personnel, without having been signed out, in the sense that no appropriate person at the new location has accepted formal responsibility for making decisions on the patient's care. (11, 12)

Our sense is that the exchange of information establishing the patient's state and context is the essential element in all these differently labeled interactions, even if there are variations in the accompanying events and purposes. We have therefore adopted a definition that is broad, and one that puts patient information exchange at its core. Handoffs, as discussed here, are exchanges in which there is a central goal of summarizing the patient's situation in order to significantly shape subsequent treatment and decision-making. For this review, we have defined handoff as *the exchange between health professionals of information about a patient accompanying either a transfer of control over, or of responsibility for, the patient.* Where we don't qualify the term, we use 'handoff' in a generalized sense that also includes the range of its near-synonyms, such as 'sign-out' and 'report'.

While it puts information exchange at its core, our definition is also tied to significant changes in responsibility and/or control. Without that important added element, 'handoff' would become a label including all forms of information exchange about patients. Though any such communication is potentially significant, and although handoffs do have some features in common with reports in case-conferences (13), we have defined handoffs to encompass just the information transfers during the important personnel changes, those that are subject to strong pressures for brevity and yet have a high probability of affecting safety and quality of care.[4] We have also not included communications with patients or their families. The

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[3] Some reviewers have suggested the label 'coverage' for our concept of control. We feel that it may not be distinct enough from responsibility. No matter what term is preferred, it is clear that handoffs occur in two kinds of transition that can be distinct: change in who should be responsible for patient care decisions, and change in who is actually able to make those decisions.

[4] The scope of handoff in the requirement established by the Joint Commission may include some elements of this broader class of communication activities. For example, the Joint Commission Handbook chapter explicating the 2008 Patient Safety Goals (2) does include in its rationale section as an illustration the "critical laboratory and radiology results sent to physician offices," and the Commission's published handoff resources materials also mention discharge documents. (14) There is no doubt these reports are highly important communications, but in our framework, these would not be classed as handoffs unless they accompanied a transfer of the patient *and* were directed to a well-defined receiving party. In limiting our

differences in role and in medical literacy between patients and health professionals give such conversations a very distinct character. These large differences have given rise to an extensive separate literature on doctor-patient communication. (16) We do not include that material in this review.

We would also like to introduce a convention that will simplify our text. Since we must frequently refer to the parties to a typical handoff and will often need to distinguish their roles, we will call the party giving up responsibility or control the 'handing-off' physician, nurse or technician, and the one(s) assuming control or responsibility the 'receiving' party (or parties).

Discussions of handoff policy may also gain precision if we keep in mind that handoff, though associated with change in personnel, is nonetheless distinct from it. Handoffs usually occur when there are shift changes, for example, but not all the differences in care provided by an oncoming health professional are properly attributed to the handoff that occurred. Other differences in the experience and status of the receiving personnel would play their role even if a handoff could somehow perfectly convey all relevant information about the patient. It is important to keep the logical distinction clear because evidence about effects of handoffs on patient outcomes can often confound the communication effects with the effects of other differences: for example, with differences in expertise between the specific personnel involved before and after, or with the effects of the surrounding conditions that changed along with the handoff, such as transition from daytime to nighttime operating modes in a hospital.

The importance of the distinction can be illustrated by looking at the influential and carefully executed study by Petersen et al. (17) Across all the articles we have reviewed, this is the most widely cited evidence on the importance of handoffs. The study showed that *cross-coverage* is associated with increased incidence of preventable adverse events. The observed increase is often attributed directly to handoffs in the subsequent publications that cite the work, but Petersen et al are careful to point out that theirs is a study of cross-coverage, which they define as patients attended by physicians who were not part of the team to which the patient was assigned. The important contributing factor they isolate is not a handoff, in our sense, but rather a temporary transfer of responsibility for a patient to a physician from outside the team. The extent of transfer of information in these episodes was not measured. The authors (quite plausibly) assume the cross-covering physician to have had a lower level of information about the patient. Petersen et al do make an extensive effort to control statistically for some possible alternative sources of the outcome differences, such as time of day, patient comorbidity, demographic characteristics, and severity of illness. The fact remains that they cannot distinguish between effects of cross-coverage and effects of other, unmeasured, differences between the original and cross-covering personnel, or between normal hospital conditions and the conditions, such as high admission load (18) that may have led to cross-coverage by a physician from outside the team. And since they were not measuring the association of preventable adverse events with handoffs, but rather the association of such events with the partial or complete absence of a systematic information transfer, it is not straightforward to infer from their results just how much patients might benefit from improvements in handoffs.

There are, of course, other strongly suggestive grounds, including a later study by the same authors, (19) to

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definition to transfers of responsibility or control we are aligned with the definition proposed by the British National Patient Safety Agency, which defines handoff as “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.” (15)

suppose that handoffs bear part of the responsibility for adverse events. For example, the Joint Commission has built a collection of sentinel events (adverse events and near-misses), and a root cause analysis has shown that "communication problems" are implicated in a large majority of these cases. (20) Since handoffs are a regular and major locus of information exchange, it is quite plausible that improving them will contribute to patient well-being, and many of the studies we discuss reference the Joint Commission data and make this inference. We have undertaken this review because we too believe that handoffs are highly consequential. Nonetheless, our review has not identified any study done so far that can fully distinguish consequences of handoffs per se from consequences of associated factors such as changes in personnel and in surrounding conditions. It is handoffs for which the Joint Commission now requires standardization. We believe that improved handoffs should lead to improved results for patients, but they may not reduce other sources of difference in patient outcomes that stem from factors correlated with handoffs.

For example, another contextual factor contributing to the rising concern over handoffs was the change made in 2002 by the Accreditation Council on Graduate Medical Education (ACGME) in rules governing resident hours. That change forced many institutions to consider shortening resident work periods. This increases the number of handoffs, and thus the potential for increased communication problems and reduced continuity of care (21-26); however there is some evidence that reduction in resident work periods does not negatively impact patient care (27-29) and may reduce error rates. (30) It is important to note that conforming to the new rules can also decrease the frequency of what we call 'closed handoff loops'. These are staffing schedules in which party B (a physician or nurse) who earlier received a patient from party A (another physician or nurse), later hands the patient back to party A. In a system based on 12-hour shifts this tight-loop (A -> B -> A) interaction will be a very common pattern. If the system moves to 8-hour shifts, the pattern will instead be A -> B -> C -> A. If the number of consecutive days on call is reduced, then even with 12 hour shifts, B may more often be handing back to a new party, C. These loose-loop arrangements are much less conducive to continuous improvement (or "tuning") of the communication process. For example, in loose loops there will less often be feedback of the form "You forgot to tell me X." In addition, with shorter shifts a physician or nurse present when the patient arrives, and therefore well-informed, will be with the patient for a smaller fraction of the patient's total stay. This is just one illustration of the possibility that even if individual handoffs are standardized, other factors may remain that are associated with decreased patient outcomes.

2. The functions of handoffs

We have defined handoffs in terms of the exchange of information that occurs as key personnel enter or leave the care of a patient. This is consistent with the vital role of accurate information in maintaining continuity of care, and with the fact that communication breakdowns are potentially so hazardous to patient safety. However, it is important to attend to the numerous additional functions, beyond quality of care and safety that are accomplished during the course of handoffs. (11, 31-34) Our current reasons for interest in handoffs, however compelling the patient safety issues, should not blind us to other functions they simultaneously serve. (35, 36) If we are to intervene in the way handoffs are carried out, for example by proposing standard handoff methods and training staff to use them, then we must be alert to *all* the functions of handoff activity. If we fail to consider the full range of functions, we run the risk of unanticipated (and perhaps very damaging) side effects as we modify handoff practices.

Two of the most important functions beyond the exchange of patient information have already been mentioned briefly. Handoffs can make definite that a transfer of *responsibility* or *control* has occurred.

Even if little information changes hands, it is important to establish who is now responsible for making decisions on a patient's behalf. Unclear responsibility for patients leads, at a minimum, to time-consuming searches, and often to patient adverse consequences. (37) The term 'sign-out' is sometimes used in transfer situations and strongly suggests that responsibility - often including legal responsibility - has passed to new physicians or nurses. In fact, at least one report of a new sign-out protocol includes the "co-signing" a transfer document by both participating physicians (38), and we have often seen sign-out accompanied by a ceremonial transfer of a key communication device, such as a pager or cell phone assigned to the service rather than to a person.

Similarly, handoffs occur when there are transfers of control over a patient, for example, when a patient is moved from an Emergency Department to another service such as Cardiology or Pediatrics. Control and responsibility often are transferred together, but, as we have noted, that does not make them the same thing. We see this in occasional disjunctions, such as an inpatient physician who may have assumed responsibility for a patient from the ED, "but is not free to attend to the individual promptly." (11)

While it is natural to think of handing off individual patients, this can obscure the important fact that transfers of responsibility often occur for groups of patients. In these conditions there is an added dimension that we discuss below as the *portfolio problem*: among the several patients, which ones should have the most attention during the handoff? During the shift of the oncoming party, which ones require the most care or the highest response priority? Knowing this can be crucial for good management of emergent issues, but it is information about the composition of the group, not just about any individual patients.

We continue this discussion of functions of handoffs in four sections that cover functions beyond the transfer of control or responsibility. The first deals with correctly transmitting patient information, the issue that has been a key focus of recent interest. It is followed by sections on other processes going on simultaneously: error correction, individual learning and organizational learning.

2.1 Correct Transmission of Essential Information

The growing interest in patient safety has been a major contributor to interest in handoffs. A very large proportion of the handoff research articles we have identified begin with some reference to their patient safety implications. One of the most referenced studies in this connection is the 2006 Joint Commission report of sentinel events (20), which makes a compelling case for the connection between patient safety and communication practices. As mentioned, communication issues were implicated in nearly 70% of all sentinel events in hospitals and health care institutions in the United States. Other root causes such as training, patient assessment, staffing, and competency were implicated in numerous sentinel events, but no cause was associated with more problems than communication. A related root cause identified in 20% of all sentinel events was availability of information.

The handoff's function in the correct transmission of essential information becomes sharply evident in cases where this function is not fulfilled. (39, 40) Studies that have analyzed near misses and adverse events have implicated handoffs in a number of cases. (41, 42) One study of 889 malpractice claims found that information transfer breakdowns at the handoff contributed to errors in 19% of the cases involving medical trainees and 13% of the cases involving non-trainees. (43) Communication problems at the handoff lead to loss of information or misunderstandings about: care plans (44-47), medications (48-54), patient conditions (48, 55), code status (48, 56, 57), and test results (48, 57-60), and can have serious consequences for

caregivers as well, including the loss of licensure. (61) One study of 134 post-operative sign-outs in a pediatric intensive care unit checked for 18 categories of information deemed critical and found miscommunication occurred in 100% of the cases, with a median of 5 items missing. (62) An experiment with handing off simulated cases has also shown high rates of losing important information. (63) Efforts to improve information exchange and communication and to reduce associated errors include standardizing handoff practices and introducing computerized sign-out systems, both discussed below.

There is some risk that the term 'information' may suggest too narrow a focus. Handoffs very frequently transmit judgments about severity of illness ("I thought we were going to lose her") or about uncertainty of diagnosis ("We've been assuming it was an M.I.") or about patient prospects ("We may be through the worst"). These judgments are not data or facts, in contrast to what a narrow notion of information might lead us to expect, but they are highly informative for a receiving party.

2.2 Error Correction in Patient Information or Treatment

While correct transmission of essential information is clearly a high priority, it is important to understand handoffs as far more than episodes of transmission that may be subject to highly consequential errors of omission or commission. Handoffs are also the occasion of error correction, and this process can take many different forms. (11, 12, 36, 49, 64-69) The Joint Commission has recognized the important role of error correction by including in its 2008 Handbook (2) an implementation expectation for its handoff requirement that "the organization's process for effective 'hand off' communication includes: Interactive communications allowing for the opportunity for questioning between the giver and receiver of [patient] information." And the jointly issued WHO-JCAHO brochure on handover communication strongly suggests the "allocation of sufficient time for communicating important information and for staff to ask and respond to questions without interruptions wherever possible (repeat-back and read-back steps should be included in the hand-over process)." (70)

At the simplest level the handoff certainly is a time for correcting errors in what is - or is not – transmitted. A receiving party might say: "What about her pH level?" or "Isn't that ten times our usual dose?". But correction processes extend far beyond this level. These mundane conversational turns exemplify the error-correcting capacity built into a simple handoff conversation. It is important not to decrease this capability when introducing more rigidly standardized handoff procedures. Thus at least three studies (50, 71, 72) have indicated how computerized physician order entry (CPOE) systems and patient care information systems (PCIS) that tightly specified new procedures could nonetheless introduce new sources of error and eliminate established error-catching capabilities.

Two additional levels beyond simple error correction might be labeled: *anticipatory correction* and *reframing*. An example of anticipatory error correction might be a handing off party, aware of a reporting delay, who might say "the chart looks like she'll need [a diuretic] but they gave it to her while she was over in nuclear medicine." (34) An example of reframing might be a receiving party who says "I know we've been treating him as a case of congestive heart failure, but maybe it's actually pneumonia. That fits the picture just as well."

A problem can be discovered simply because of renewed attention to a patient as preparation for a handoff. (73) The handoff can also bring a "fresh perspective and a rested mind" (64 p. 910) to clinical settings where over-worked health care professionals may be locked into a mistaken appraisal or suffering from

decision-making fatigue[5]. In one study of anesthesia relief handoffs, 28 out of 96 preventable errors studied included "favorable incidents" in which the relief anesthetist discovered an error or the cause of an error generated by the doctor going on break. (65) Wears et al (49) relate the case of an Emergency Department patient diagnosed with acute stroke during the night shift. Later during the morning handoff, the receiving physician questioned this diagnosis and suggested aortic dissection as an alternative diagnosis. Subsequent tests revealed the second diagnosis to be correct.

Although accurate and appropriate transmission of patient-care information is extremely important, in considering handoffs and how we might change them we have to attend as well to important functions accomplished during handoffs that go beyond information exchange. In particular, the people and the organizations involved in handoffs are not static. The technology of health care, the underlying science base, the social, economic and regulatory environment of health institutions, and the health problems themselves are all remarkably dynamic. Hospitals and the highly professional people working in them need to sustain impressive rates of continuous learning in order to adapt to these unrelenting changes. The vast transformations of health care services occurring in recent decades have been possible only because of correspondingly high levels of learning by both the individuals and the organizations involved. Some of this has been via explicit training, but a much larger part has occurred through accumulating the lessons embedded in day-to-day experience. Since handoffs are one of the more frequent and consequential moments of considering patient progress, they are the inherent locus of a large share of this vital learning. We can structure the discussion of the learning functions of handoffs by taking up first learning at the individual level, then at the organizational level.

2.3 Learning at the Individual Level

Every handoff interaction is an opportunity for the participants not only to exchange patient information, but to learn, in the sense of altering the skills and assumptions that will shape their actions beyond their work with the patient at hand. It is, therefore, an occasion for teaching with, as Sir William Osler famously recommended, "a patient for a text". Although such learning can involve very many domains, we describe several that are particularly important in considering possible learning impacts of revised handoff procedures.

2.3.1. Handing off itself

Much of the research literature starts from a presumption that the way handoffs are done by an individual or within a unit is a stable given. But this is clearly not the case. The way health professionals hand off is learned on the job. (31, 77, 78) Furthermore, since the narrative presentation of a patient's case is a central practice of medicine (13), other clinical communication activities from rounds to informal conversations both shape and are shaped by the practice of narrating patient cases at the handoff. Although a few programs have been recently instituted, the vast majority of hospital personnel receive little or no training in handing off as part of their formal education as nurses, physicians, or technicians. (77, 79-82) In a minority of cases this learning might have been supplemented by an hour or two of training within a hospital. Horwitz and

[5] Christiansen calls this reframing process, as observed in Emergency departments, 'updating'. (74) Research on sense-making (75) and creative problem solving (76) provide additional social science perspectives that may illuminate reframing issues.

colleagues (83) recently reported that a concerted search turned up no tested curriculum for use with residents. The formal training may increase now that handoffs are a focus of explicit attention (84), but it will still be true that the cycles of practice and correction that establish handoff routines will occur in work settings. Circulation of personnel, such as rotations of residents to provide training in multiple services, will therefore create tensions between practices preferred in a current unit and the habits or preferences an individual has acquired in earlier training. (85)

Attending physicians we have interviewed are often aware of learning to hand off as one of the processes they must oversee. They have said that in periods following arrival of new residents and interns they expect the quality of handoffs to be lower, and that explicit feedback about handoffs may be necessary. Personnel whose training involves rotation between services are also aware that handoff procedures are learned by participating in the work of a unit. They see clearly that there can be large, and often well-justified, differences between handoffs for fields that are themselves very different. A handoff in pediatrics might routinely mention body mass and recommended dosages might be denominated per kilo, for example, while those details might be absent in other services where body masses vary less.

2.3.2. Best practices and knowledge acquired from more experienced parties.

Handoffs often occur between parties who do not have identical experience and expertise. The most obvious cases of this are interaction among nurses or doctors who have clearly differentiated levels of experience, such as interns handing off to senior residents, experienced nurses handing off to novices, (86-90) or questions asked in group handoffs with mixed expertise. (32, 77, 91, 92) However, there can be significant asymmetries even when the parties are at similar levels. The individuals may differ in prior formal studies, in colleagues with whom they have earlier worked, in relevant cases they have earlier encountered. All of these differences may lead to one member of the pair (or group) having knowledge from which the other(s) can learn. Even when one member is more experienced, such asymmetries may mean that learning can still go in both directions. A new intern who happens to have worked on a research project in medical school may be aware of something not known to a very experienced attending physician.

The actual processes that accomplish this kind of learning are sometimes observable as direct suggestions or corrections, but they can also be implicit and conveyed through as little as a surprised tone of voice or a polite request for clarification. Sometimes the learning occurs not through an exchange but through simple volunteering of a reason, as when a handing off nurse says "we didn't make her walk yet because she's just had [that drug]."

2.3.3. Calibration of the performance of equipment, individuals, and units

By similar processes, participants in handoffs also learn what to expect about the performance of the huge array of systems, people, and organizational units that make up a modern hospital. (11, 93) The immediate context of a conversation may be a patient at hand. But when a handing-off physician says "I asked for the consult three hours ago and they haven't come", the receiving physician not only hears that she should be sure to follow up, but also learns something about the performance of the unit that hasn't responded. A passing phrase such as "she's on six, not four, so they'd already done it", can reveal a comparative judgment about the competencies of two nursing staffs. And, of course, handoff participants learn about the competence of other handoff participants (7, 34, 91), a fact that may inhibit the asking of questions that could be judged naïve. (94)

It is entirely natural that conversations directly about the needs of patients will be shot through with such observations, questions and justifications. But each of these events also provides an occasion for significant learning, for changes in knowledge and assumptions that become part of the health professional who hears them and that help produce better care for subsequent patients. As Atkinson observed, based upon his analyses of medical talk among hematologists, "the narratives of case-talk do not merely chronicle the events of the patient's past history and current hospital admission: they contain evaluations of prior and current medical work and implicitly construct the trust that is to be placed on it." (95, p. x)

This learning is crucial to the efforts of hospital staff to make the hospital's resources work effectively for the patients. Despite all the efforts to regularize processes, the unique and shifting needs of individual patients guarantee that hospitals cannot perform as massive clockworks in which each process runs exactly according to a pre-specification[6]. (96) Instead, personnel must continually make judgments about who to involve in a patient's care and on what schedule. "Should we get him up now?" may depend on whether the meals are expected to be late. Asking for a consultation before seeing the all-but-certain test result may be sensible if waiting an hour might mean missing a workload window and losing a half day. These kinds of adjustments may improve care, shorten hospital stays or increase patient safety, but they are impossible without the underlying learning of performance expectations that handoffs so naturally engender.

2.4 Learning at the Organizational Level

In addition to what individuals may learn as a result of handoff interactions, there is also learning at the organizational level. Indeed, since handoffs are intrinsically social interactions, the separation of the individual and social levels of learning, though it is analytically convenient here, can be somewhat artificial when designing actual handoff processes.

Organizational learning that occurs via handoffs can take a number of forms.[7] Because it has been uncommon for researchers studying handoffs to inquire about these issues, these remarks about modes of organizational learning are less often supported by citations from the existing literature. We do however, offer illustrations for the various learning modes that are based upon our own field observations.

2.4.1. Saturation of beliefs

Since handoff occurs with high frequency(101), some pieces of knowledge or opinion may become very widely diffused, so as to be part of what most members of the organization are presumed to know or believe. (102-105) This idea is stressed by Coiera (106) in a thoughtful analysis of the differences between face-to-face "communication" and technology based "information transmission". He points to the role of "common ground" in mutual understanding and successful joint action and to the important role of frequent daily communication such as handoffs in diffusing such shared understanding throughout hospital work

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[6] In fact, even sophisticated factories cannot operate this way, as can be seen in the literature on the success of the Toyota Production System, where the most productive assembly lines have surprisingly high levels of time spent talking about processes rather than directly producing. (97)

[7] For a broader discussion of the forms of organizational learning see (98-99). Gawande (100) provides impressive examples of improvements over time that can come with systematic effort.

groups. Foster et al (107) report that integrating collection of patient safety data with a sign-out tool accelerates the process of surfacing consensus on needed changes.

2.4.2. Reinforcement of Norms

Exchanges during handoffs can spread, reinforce, or undermine informal norms, changing the way the group perceives its duties and obligations. (108-110) For example, Lally (32) says "During the inter-shift handovers observed, junior nurses learnt 'the way things are done around here.' … [T]he shaping and guiding of nurses which takes place at the report not only socializes nurses into the ward culture, but by enhancing a shared value system, also increases the cohesiveness of the group." Although the role of handoff in reinforcing norms is particularly well documented in the nursing report literature (see e.g., (9, 34, 35, 90, 111, 112)), similar effects are seen for young physicians as well. Stiles et al (91) report similar effects after implementing a group morning report for handoff of general surgery patients.

2.4.3. Responding with structural change

Wide diffusion of pieces of knowledge or opinion can lead to structural change which alters the organization's future capabilities. For example, unit resources and services delays are frequent topics of handoff conversation. (113) Over a series of handoff sessions it can become evident to the residents on a staff that requests to the pharmacy during the night have not arrived by the time of a shift change. This might lead to a suggestion from the attending physician in the unit that staffing policies in the pharmacy be examined. This could contribute, in turn, to a change in late night staffing, or a change in particular personnel. The overall performance of a hospital as a system is maintained and improved via many hundreds of such feedback loops, and a large number of those channels may be driven to a significant degree by information that is surfaced in, or diffused through, handoff interactions. New safety-oriented processes in hospitals, such as Patient Safety Rounds (114) or "reflexive ethnography" (103) are designed to capture the insights that emerge around handoffs and other informal conversations and convert them to systemic improvements. (107) The organizational learning processes around handoffs are far from perfect (see e.g., (115-117)), but they are vital to continuous change in hospitals nonetheless.

While we have focused on some broad categories of functions that are especially relevant to the organizational problem of improving and standardizing handoffs, it is important to recognize that our categories do not fully exhaust the observations in the literature. In particular, handoffs have also been observed to provide occasions for emotional support (35, 77, 86, 112, 118-121), for workgroup scheduling (118), and for informal evaluation of staff. (108)

Once we observe that handoffs are the occasion for all these functions, and particularly for important forms of both individual and organizational learning, it follows that it can be important to consider how those functions may be affected by efforts at handoff improvement. It is quite possible that, without careful design, a protocol or associated training regime that could maximize the safety of the individual patient might do so at a substantial cost to the learning processes of health care professionals and their units, possibly undermining learning that is vital to the safety and quality of care received by populations of patients in the longer run.

3. The challenges and difficulties of handing off

The handoff is a complex, social interaction; simultaneously accomplishing its many functions is not easy, to be sure. Consciously attending to concerns of individual learning, for instance, may distract from the correct transmission of essential information. Yet in the health professions, where considerable learning is expected to happen in clinical settings as work is being accomplished, learning at the handoff should be encouraged. Similarly, the reinforcement of norms for handoff concision and standardized content may inhibit asking questions or challenging assumptions, thus undermining error correction.

To make a handoff process more effective, process designers or policy makers must keep many distinct functions in mind, access tradeoffs among them, and establish a large number of features that interact to influence handoff quality. Many challenges confront handoffs, and these challenges are discussed to varying degrees in the literature. For the sake of our discussion, we have organized these challenges into five sections which address how handoffs are affected by 1) the mix of individuals who participate, 2) the content that is covered, 3) the time pressures and length of the handoff, 4) the location and communication media used, and 5) the social structure within which the handoff is conducted. We find these categories of challenges useful for organizing our discussion, but we acknowledge that they are interrelated, and some challenges do not fit neatly into a single category. Figure 1 provides a representation of how these challenges exert influence over the handoff. In keeping with our goal of contributing to the conversation on standardization and the improvement of handoff practices, we conclude each section with implications for handoff improvement.

[Insert Figure 1 here]

3.1 Participants

It is a central goal in a handoff to convey to a receiving party the knowledge that will best support safe and effective care. However, as shown below, there is usually severe time pressure that limits how much can be said. It follows that the handoff not only conveys isolated facts about the patient, but also a larger sense of what type of patient this is and how events are unfolding, what we will call a 'mental model' of the case. Since future developments may be hard to predict, these more general impressions organized into the mental model can play an important role in guiding the receiving party's responses to events that cannot all be explicitly anticipated during the handoff.

The fact that a handoff can convey both "data" and a mental model of the case implies that the mix of individuals participating in a handoff can profoundly affect the dynamics of the interaction and can sometimes create serious challenges. In particular, it suggests three broad categories of handoffs that we have frequently encountered in our own informal observations, categories that distinguish three different combinations of how the participants understand the patient: [8]

(1) a *continuing patient transfer* between personnel with similar expertise and training who are both familiar with the case. For example, such a continuing patient handoff might occur when overnight staff transfers a patient to the control of returning day shift staff who originally admitted the patient. In this category of

[8] Closely related distinctions are suggested by Behara et al. (11)

handoff the two parties already share a mental model of the case. Often the information exchange can be very brief, or confined to details of important developments within a larger shared context.

(2) a *new patient transfer* between personnel with similar expertise and training. For example, personnel who were on duty when the patient was admitted to a unit might hand off for the first time to oncoming night personnel. In such a new patient handoff, the parties have strongly similar backgrounds that provide common terminology and practices that serve as resources for establishing a mental model that the receiving party does not yet have.

(3) a *cross-boundary transfer* of a new patient between personnel with distinct expertise and training. For example, personnel from an Emergency Department or Surgical Intensive Care Unit might hand off a patient to a service such as pediatrics or internal medicine or a patient might be moved from one institution to another with greater expertise. In a cross-boundary handoff there can be significant differences in the terminology and work practices of the two parties, which makes building an appropriate mental model in the recipient even more challenging. There may also be less chance for feedback as the patient's history unfolds, thus limiting opportunities for handoff improvement. (58)

While there is a logically possible fourth category, we don't discuss it, since a cross-boundary transfer is highly likely to involve a new patient. We think the three categories we have stressed highlight useful distinctions because they extend the concept of handoff to include not just factual information, but also the mental model that supports later inferences, and because they bring out two very general features that heavily influence handoffs: how much the recipient already knows about the patient and the extent of shared terminology and practices between the handing off parties. Similar distinctions among handoff types are offered in several reports. (11, 106, 113) All of these, like ours, turn on the notion of the varying difficulty of aligning the understandings of the participants.

We also observe that cross-boundary transfers are more commonly conducted for an individual patient, while handoffs within units are more likely to involve groups of patients, and hence to present what we labeled the portfolio problem: that the attention of the parties during and after the handoff has to be allocated properly across the several patients being transferred. (36) A practice of handing off new patients before continuing ones will thus tend to give more attention to those for whom the receiving party has no mental model. But it is worth noting that this can lead to different outcomes than would follow from the practice of handing off the "most worrisome" patients first.

Beyond these large factors of similar backgrounds and patient novelty however, are many more variations in who participates that can also shape the dynamics of the handoff interaction. For example, even when participants are in the same specialty different parties may have different amounts of experience. (122) In some cases interns hand off to other interns, while in other cases they hand off to attending physicians. Inter-personal relationships may affect the handoff as well. Two nurses who work together daily may find conducting handoffs between themselves quick and efficient in ways that two other nurses who rarely or never work together would not. Handoffs occur within and across various inter-personal, organizational, cultural, and linguistic lines. These similarities or differences between the parties involved can certainly impact the handoff.

The necessary participation of particular parties in particular handoffs is a natural byproduct of the policies and organizational structures created by hospital leadership. Hierarchies, formal divisions of labor within

and between units, asset location choices, and shift schedules are examples of structures which often have the effect, intentional or not, of determining when handoffs are necessary and who must be involved. (37, 123, 124) Many of the policies that create these structures are set in place for purposes other than the effects they have on handoffs or in an effort to improve one aspect of handoffs that produces consequences for other aspects. For example, at several points below we discuss the question of bedside handoff for nurses, a policy that may be chosen for its value of including patients and their families, but which is highly consequential for the content and location of handoffs. (125) Efforts to improve handoffs will often been entangled with the rethinking of various organizational policies and structures that determine who hands off to whom. (126-128) Similarly location decisions made to increase group interaction and useful overhearing may also increase interruption. (129)

3.1.1 Implications for handoff improvement from participation challenges

Those engaged in handoff improvement face the reality of a hospital that is a complex system in which changes to one part are likely to have effects on - and provoke reactions from - other parts. Considering the effects of various organizational polices and structures—most of which are not handoff-specific—may provide insight into constraints which hinder effective care transitions. Shift, team, departmental, and other such work structures often dictate when handoffs must occur and who must be involved. Rearranging such structures may, in some cases, provide for better handoff interaction or reduce the needed frequencies of such transitions. (130) Likewise, efforts to improve handoffs may need to distinguish between different kinds of handoffs to be most effective. Handoffs of new patients and handoffs of continuing patients, particularly where those patients are known to both health care professionals, likely demand different kinds of interactions and conversations. Similarly, handoffs within units or specialties will likely engender different kinds of problems and require different kinds of improvement interventions than handoffs that cross unit and disciplinary boundaries.

3.2 Content

Since the exchange of information is a core function of handoff, the selection of appropriate content is a central challenge. (11, 48, 131-133) In this section we discuss the difficulty of knowing what information to share during the handoff, the role that information artifacts play in this challenge, and how language issues can further complicate the communication of handoff content.

3.2.1 Knowing what to communicate

Handoffs are challenged by the problem of knowing which information to communicate in the transfer. In some cases, the parties handing off try to communicate too much information while in other cases they share too little, or they may communicate irrelevant or unnecessary information or omit important items. Sharing information that the receiving party already knows is problematic, in part, because doing so may take up valuable time that could be better spent caring for patients. On the other hand, de-emphasizing or omitting crucial information that a healthcare professional will need to manage the patient's care is frustrating at best and can be dangerous at worst. While the end result was not disastrous, Wachter and Shojania (57) vividly recount how a handoff that omitted DNR code status produced emotional strain on a patient's family members as they were forced to make the agonizing decision of whether or not to continue resuscitation efforts already underway.

Furthermore, communicating irrelevant or already-familiar information may cause the receiving party to lose interest or focus, thereby potentially missing relevant, important information. Conversely, a handoff in which very few details are shared might present the receiving party with the assumption that a given patient is not likely to require much care or close attention when in fact the opposite might be true. The appropriate content for a handoff is not confined to patient information: discussions about patient populations and unit resources, such as beds and equipment, may also be necessary. (113, 123) Whatever the pertinent information, failure to communicate it during the handoff can contribute to adverse events (82, 134) and result in increased operating expenses due to poorly utilized resources, the duplication of diagnostic tests (48, 135) or the ordering of unnecessary tests. (48)

There is only a little empirical research to explain the omission of crucial information or the communication of irrelevant, redundant, erroneous, or unnecessary information during handoff; (133, 136, 137) however several contributing factors are easily inferred. To a certain extent, each handoff is necessarily unique, and as a result the information selected for transfer must be chosen appropriately. Uncertainty regarding a patient's condition will influence the content and form of the handoff to some degree. (113) In addition, the experience and knowledge of the receiving party must be judged relative to both the situation and the patient's needs in order to determine what information should be conveyed explicitly, what should be emphasized, and what is already understood or no longer important and, therefore, may be omitted. Lack of experience likely plays a significant part in the tendencies of some healthcare professionals to ramble or share irrelevant information during the handoff (83), and there is some evidence that less experienced providers may communicate different kinds of information than more experienced providers. (138) At the same time, experienced health care providers may fail in some cases to adapt their handoff practices to the needs of their less experienced colleagues. At least one study found instances of attending physicians occasionally providing insufficient information when handing off to less experienced residents. (44)

Other contextual factors may need to be considered as well. Some are related to the patient (such as background, general mental state(139), the presence of the patient's family, level of concern about the patient (140), etc.), while others may be un-related to the patient (e.g., handoff time required by other patients, such as new admits (141), present conditions in the hospital , staffing levels, the possibility of severe weather, etc.), In short, there is an enormous set of factors which may potentially affect continuing care. Understanding how such factors affect what is communicated during the handoff is important for standardization and other handoff policy efforts. Perhaps some detailed examination of how senior practitioners who are regarded as experts at handing off determine what to cover in the handoff may yield insights into how students and less experienced individuals may be trained.

Beyond the sharing of objective medical data about patient conditions, effective handoffs may also require the exchange of less concrete subjective information, often based on intuition and "gut feelings" and which usually will not be formally documented. (140) The nursing handoff literature contains several discussions of the inclusion or omission of psycho-social and contextual information about the patient, including affective state, personality, family involvement, etc.—items which, if included at all, are likely to be transferred verbally. (142-144) Sharing emotional concern and care for patients has also been observed among nurses (108, 120) . In our own field observations we have seen strong identifications conveyed when an ICU nurse says during report "My heart rate was 65." Physicians also may discuss emotional anecdotes about patients and families, although some have difficulty doing so given the emphasis in medicine placed on factual data. (140) Does the exchange of psycho-social and contextual information or the relaying of

emotional concern for patients during the handoff impact subsequent care of patients, and if so, how? To our knowledge, researchers have not examined the patient impacts of transferring such information and concerns.

3.2.2 Documents, record systems and content

The challenge of knowing what to communicate is also influenced by the documents and record systems that healthcare professionals may use during the handoff. This issue is multi-faceted and we have separated our discussion of its overlapping aspects. In this section we discuss the possible effects on attention, memory and content of introducing various kinds of documents into handoff interactions. In Section 3.4 we take up the effects on the handoff interaction of alternate media of communication such as online patient records, telephone, or face-too-face communication. In section 5 we discuss more detailed efforts to determine specific information content that should be included in a standard handoff.

User interfaces and other designed aspects of such tools shape cognition to some extent by drawing attention to certain information while obscuring other information. (145) Documents and systems may structure the handoff in certain ways, serve as memory aids, and even capture some details from the handoff for subsequent use, and they may also produce negative effects by increasing cognitive burdens. Alem and colleagues (36) introduced three artifacts (a patient information sheet, an event sheet, and a patient list) into the handoff processes of a general medical unit and an emergency department (ED) of one hospital and found that the tools did not change the content of the handoffs but did support greater continuity in terms of which patients were discussed from one handoff to the next. In (136) a mnemonic system to structure ambulance staff handoffs was found to produce no gain in retention of key information by the receiving ED nurses.

One study of the content of 23 nursing handoffs found that almost 85 percent of information discussed could be located within existing documentation. (146) While the considerable overlap may seem excessive, the authors' conclusion that handoff content can be significantly curtailed presupposes that documentation can be easily scanned for important, relevant information, which is not necessarily the case. The ease of access is highly contingent upon the design of that documentation. The presence of certain information in a patient medical record or another documentation system is not sufficient to ensure that the receiving party will become aware of that information. Verbal highlighting, repetition, convenient summary, and other forms of stressing important information during the handoff can set priorities and guide the receiving party's attention appropriately. (147)

Documents and record systems can shape the handoff even if those artifacts are not directly accessed or referred to during the handoff conversation. In one study of large status boards in a UK pediatrics ward and a US emergency department, researchers found that, although caregivers rarely looked at status boards during the handoff, they routinely used the boards in preparation for the handoff and immediately after the handoff. (67) Oncoming team members would gather in front of the status boards, absorbing a sense of the previous shift's activities and copying down patient names and locations on paper.

3.2.3 Language-related issues

The clear, effective communication of handoff content is further complicated by language issues. Broadly speaking there are at least three categories of language-related issues that plague handoffs: ambiguity,

unfamiliar jargon, and second-language issues. Ambiguity of language in the handoff arises from the use of imprecise or subjective non-medical terms and can result in confusion at best and adverse events at worst. Mukherjee (55) relates the case of an intern, receiving a patient from a harried Emergency Room physician, being too embarrassed to ask what the physician meant when he described the patient as "lethargic". As this word continued to be used in subsequent conversations regarding the patient, misunderstandings about the patient increased while her condition worsened. Mukherjee notes: "Even ordinary words – 'lethargy', 'stable', 'exhausted' – lose meaning; they become tripping wires laid out to make our batons slip." (55)(p. 1823) The author goes on to say, "it should not have taken us three hours to figure out that different people were using the same word in different ways." (55)(p. 1823) The use of ambiguous identifiers when referring to patients can also challenge handoff communication. Bed numbers, room numbers, and even patient names when used as identifiers can be sources of potential confusion. (15, 148)

Providing subjective descriptions of patients, such as stating that they are "OK," "unchanged" or "about the same," is potentially ambiguous, may be based on questionable reasoning, and involves relative, individualized judgments about what constitutes "change" or "sameness." (143) Most importantly these comments "may dictate how a whole shift will perceive the patient and his needs." (143) (p. 21) It is important to note that the degree to which such assessments are ambiguous depends heavily on the robustness of the handoff loop. In closed loop handoffs of continuing patients, where two parties share a mental model formed by handing the same patient back and forth to one another, such assessments of change and sameness may be unambiguous and characteristic of effective, efficient transitions – although we have so far found no research to test this hypothesis. On the other hand, in loose-loop or cross-boundary handoffs the potential for ambiguity would certainly increase. Similarly, the use of labels to describe patients at the handoff (e.g., "a real pain", "belligerent", "a sweetheart", etc.) may bias a receiving party's perceptions of patients for better or worse (33, 109, 116, 149); however these conceptual shortcuts may also enable receiving parties to become familiar with the patients quickly and improve recall (150), thereby playing an important part in workload management and mutual support, key elements of effective teamwork. (151)

A great deal of ambiguity is avoided by using standardized medical terminologies that are more precise than lay terms, but even the use of medical terms and jargon can complicate matters when handoffs occur between members of different health professions (152) or when one of the parties is otherwise unaccustomed to the terminology used, as may frequently be the case with students. (153) Both nurses and physicians have unique terms, abbreviations, and language structures which they use in handoffs within their respective groups and specialties (34, 154) but which may not be immediately understandable to the others outside the group or specialty. Furthermore, the use of certain medical terms and jargon may make comprehension of the handoff difficult for students of those professions, particularly when handoffs are conducted with considerable speed. (155, 156) Even in written communications, common medical abbreviations can be a source of confusion, which has prompted the Joint Commission to publish an official "do not use" list of abbreviations, symbols and terms (see (157)).

Problems can also arise when health professionals are forced to communicate in a language that is not their native tongue. Solet and colleagues (82) warn about the effects of language barriers, pointing to the increasing number of physicians practicing medicine in the US today whose first language is not English. The use of idioms and colloquialisms can be confusing as can non-standard abbreviations. As one remedy for this, and to ensure comprehension even among native speakers of English, the use of linguistic checks

such as “repeat backs” in which the receiving party repeats back, in her own words, the orders or information received from the party handing off, are now widely recommended. (82, 94, 158-161)

3.2.4 Implications for handoff improvement from content-related challenges

A better understanding of the factors that make the selection of appropriate handoff content challenging for inexperienced health professionals as well as the ways that those who are adept at handing off navigate this challenge should yield insights into ways that handoff education, tools and practice could be restructured to facilitate more effective, efficient care transitions. Examination of the designs of the artifacts, documents, information systems and other such tools used during the handoff will indicate how these tools shape the handoff for better or worse and suggest areas for improvement. Finally, attention to the language and terminologies used at handoff and the development of practices to measure and ensure comprehension may yield improvements as well.

3.3 Time Pressures and Length of Handoff

In the busy hospital environment, where time is often in very short supply, the efficient compression of handoff conversations is a challenge for healthcare professionals. The time-costs of careful handoffs can be quite daunting. (162) To take a simple hypothetical example: if a dozen patients were to be handed off at the beginning and end of an eight hour shift, then 5 minutes per patient would use up a quarter of the entire work period! (122) It is not surprising that long handoffs can result in staff working overtime (163) or in time lost to other aspects of care. (164) At the same time overly brief, rushed handoffs can cause confusion (109), reduce opportunities to clarify information or thought processes (58), and threaten quality of care. (15) In some cases, time pressures can result in handoff communications being omitted altogether. (58) Time pressure is therefore a fundamental tension that must be addressed in any effort to improve handoffs.

A handful of empirical studies, many from the UK and Australia, report data on length of handoff (e.g., (47, 88, 113, 143, 144, 164-170)). These studies report considerable variation in the time spent handing off. For instance, one study of acute medical and surgical nursing wards in two UK hospitals found that the handoff lasted anywhere from 15 to 55 minutes per shift report. (144) An Australian study found report taking from seven to twelve percent of a shift, depending on nurse professional level. (171) Similarly, a survey of directors of basic physician training at 76 Australian hospitals found handoffs ranged from 5 to 60 minutes per shift report. (88) Some studies have asked respondents to estimate the average length of handoff, and these results also reflect wide variation in practice. For example, studies have found handoff length averaging: less than 15 minutes (168), 18.7 minutes (82), and 34 minutes (144) per overall handoff report. The amount of time spent on any one patient has also been found to vary. Studies have reported handoff discussions of individual patients lasting only a fraction of a second (172), averaging 36.5 seconds per patient in a PICU (excluding those discussed for 0 seconds) (113), and ranging from one minute per patient on some wards to six minutes per patient in critical care settings. (167) Sixty-one percent of physicians surveyed in one Australian hospital reported that they never conduct handoffs for stable patients. The amount of time spent handing off may vary considerably for several reasons, including the perceived severity of individual patients’ conditions (11, 172), the unique needs of different medical disciplines (82), the demands of other work-related tasks (113, 172, 173) which often occur along side of handoffs (168), the uncertainty of the case rather than the severity of illness (113), and the characteristics and habits of the practitioners involved. (174) Some researchers report reduction in average length of handoff through

restructuring of handoff practices (163, 170, 175) and adoption of computerized sign-out systems. (176, 177)

3.3.1 Implications for handoff improvement from time-related issues.

Handoff restructuring efforts must take into consideration the demands placed on health professionals' time. If better handoffs require more time of hospital personnel, then that additional time may have to come from time allotted to other duties. To make the most efficient use of time, standardization efforts will need to be flexible enough to permit handoff time to be focused where it can be most useful, and practitioners will have to make sound judgments in allocating time across a portfolio of patients. We have found only a little research on how time allocation across a set of patients is determined. (11) Nemeth et al. (113) observed switching in a PICU between handing off in "bed order" and handing off "sickest first". Distinguishing old from new patients is a common heuristic, but it may not perfectly match an actual patient portfolio, and it could be better to explicitly consider the best allocation of scarce handoff attention.

3.4 Location and Communication Media

The parallel - and highly interrupted - character of hospital work also poses challenges for where and via which media handoffs are conducted. Many traditional forms of handoffs require ceasing work with patients in order to hand off; however finding the individuals who need to be involved can be challenging at times given the competing demands of clinical work (135, 159) and may necessitate the repetition of handoff information. (178) Furthermore, in some settings the prevalence of interruptions and the need to multitask may challenge the handoff and hinder information flow, potentially compromising patient safety. (179) Thus there has been a question of whether or not handoffs can be conducted by means of written or electronic reports or recorded dictations, or whether a conversation is expected at a given point of transfer and, if so, where and how that conversation is to take place. We discuss location and media under a single heading because they are so closely intertwined. Telephones, printouts, or tape recordings may be used because shift schedules don't allow participants to be collocated. If computer-delivered test results or images are to be discussed in a handoff, it may have to occur at a suitable display.

The media by which handoffs may occur have received considerable attention in the literature, especially within the studies of nursing shift reports. Broadly speaking, handoffs may include either a verbal or recorded component or both. Verbal components include face-to-face (82, 180) and telephone conversations (135, 177), even hybrid forms such as a phone follow-up to either a phone-based recording (181) or face-to-face meeting. (38) An issue of concern related to verbal conversations is the locations of these interactions, which can vary considerably (173), ranging from private offices (86) to team rooms (182) to hospital hallways and cafeterias (183) to the patient bedside (86, 170, 175, 184), among other possible locales. In the telephone case, the parties may even be in information-asymmetric environments, with only one having access to documents or displays. Recorded components take many possible forms as well, including, informal notes (48, 155, 185), audio recordings (86, 119, 131, 181, 186), formal sign-out documents (108, 159), and official entries in patient medical records and computerized handoff systems. (125, 154, 187, 188)

Each medium has its own advantages and disadvantages, making it impossible to identify a single ideal medium. (6, 86) Verbal conversations are important for handoffs because such interactions provide the receiving party an opportunity to clarify information, ask questions, and get immediate answers. As a result,

numerous researchers and protocols recommend the inclusion of a verbal interchange as part of the handoff, and the opportunity for exchange has been incorporated in the Joint Commission handoff requirement.

This, in turn, raises the question of where the conversation is to take place. The physical environment can affect the handoff conversation negatively when it distracts with background noises and interruptions or hinders confidentiality, (77, 82, 189) but it may improve the handoff when it provides access to resources such as lab results, patient medical records, and other information systems. (15) Furthermore, conducting the handoff in certain shared physical spaces, such as team rooms, or patient bedsides, can afford greater input from third-parties. (184) Research in other settings has found benefits to collocated work arrangements that allow organizational members to overhear the conversations of their coworkers and, thus, to step in with help and expertise as appropriate. (35, 129, 190) Indeed, in our own informal observations in team rooms we have observed healthcare professionals not directly involved in a given handoff, overhearing the conversation and then adding insight into perplexing problems. In an ICU, for example, nurses who are with a particular patient almost continuously can be valuable sources of information for a physician handoff, and can gain useful information as well. In addition supervisors or other staff members who listen to other parties hand off may become more aware of situations in the unit or hospital and better prepared to improve processes. (191) Thus in selecting a handoff location, the goals of reducing distractions and privacy breaches might need to be balanced with the goals of leveraging staff or patient knowledge, and of driving organizational learning.

It is valuable to distinguish face-to-face interaction as a special case of verbal conversation. While a telephone connection will allow for questions and answers, it does not allow for the subtleties of the face-to-face situation. (192, 193) Handoffs conducted face-to-face often involve pointing to part of the body to indicate relative positions and non-verbal gestures that indicate the speaker's feelings about events or persons. It can be difficult to achieve the effect of a shrug or a raised eyebrow on the telephone, but such actions can convey extremely important and memorable evaluations.

Issues of confidentiality further complicate the selection of a handoff location or medium. (68, 82, 118, 192, 194) Within the nursing literature, there is considerable discussion about the relative advantages and disadvantages of conducting the handoff at the patient’s bedside. While this practice enables a rich interaction between providers, involves the patient (175, 194, 195), and sometimes includes the patient's family, it may risk embarrassing the patient (86) and potentially threatens the confidentiality of patient information (9, 194), even if some patients are not concerned about such breaches. (196) Similarly, the handwritten notes that healthcare professionals may take during a handoff or use to conduct the handoff, if not properly guarded and disposed of, may create risks to patient privacy. (122, 185)

Even in instances where verbal handoffs might seem to be required, verbal exchanges do not always occur as one or more of the parties may be otherwise occupied in wards and operating rooms, in transit, or otherwise out-of-reach. (159) Staffing reductions can also make verbal interactions difficult if not impossible to coordinate. (197) Furthermore, for all their interactive richness, verbal handoffs have their downside: recall of verbally-transmitted information is understandably more difficult than recall of information that has been recorded electronically or in writing. (137)

Media that allow written documentation of handoff information are not without their own pitfalls. They may permanently record events or observations about patients or families that contribute to care but should be transient. (86) If handwritten, handoff documentation may be illegible, and even where clearly typed,

documented information may include errors of omission and commission. (51, 135) Documentation steps themselves may make claims on time that are onerous. (168) If computerized, handoff documents may reduce cognitive load. (198) They may also reduce some errors or transcription, but, though they may be rarer, the remaining errors may propagate more widely, and be less subject to doubt. (50) Arora and her colleagues found through a careful comparison that about eighty percent of sign-outs by a sample of interns contained at least one error in recording medications when compared to the patient's medical administration record. Many of these were assessed as presenting serious potential danger, and the majority of errors were replicated across several days by means of "cut-and-paste." (51, 199) While such errors are possible with verbal conversations as well, documentary media when used alone will not provide opportunities discussed above for feedback, clarification and questions that may help correct errors and anticipate potential problems. (70)

3.4.1 Implications for handoff improvement from location and media challenges

The literature suggests a wide variety of significant factors linked to choices of handoff location and media. Each possible arrangement entails its own list of factors that not only trade off against each other (broader participation reduces privacy), but also interact (persisting records aggravate legal concerns) and may be context dependent (involving family is different in pediatrics and surgery)., Since any single medium for conducting the handoff has both advantages and disadvantages, handoffs may best be served by incorporating multiple media to leverage their comparative strengths and balance out their weaknesses.

3.5 Social Structure

By its very nature the handoff is social. As such, formal and informal social structures influence handoff interactions and hold implications for efforts to improve them. In this section we discuss the role of status asymmetry, produced by hierarchical, shift and professional divisions, and draw from the literature on organizational routines to highlight some important characteristics of repetitive work processes.

3.5.1 Status Asymmetry

Medical hospital work, as it is structured in much of the developed world, particularly in teaching hospitals, is notably hierarchical. Formal power and authority structures influence how healthcare professionals interrelate and communicate. These hierarchies affect an individual's willingness to exchange information, ask questions, and seek clarification or help. (37, 44, 82, 94, 200) To be a conversation, the handoff requires a certain amount of give and take in which individuals work towards a common understanding of the situation, priorities, and the plan of action. (11) This aligns with the Joint Commission mandate that an opportunity to ask and respond to questions be included as part of a standardized handoff. (1) However, given the power dynamics common in many hospitals, such give and take may be difficult at best, unless supportive norms are established.

Shojania and colleagues (147) note that supervision poses significant problems in teaching hospitals, yet receives little theoretical attention. Attending physicians supervise senior residents, who supervise less experienced residents, who, in turn, supervise medical students. Nursing supervision is similarly layered. Professionals at lower levels of this hierarchy are constantly vying for better positions at higher levels. The need to appear capable, knowledgeable, cooperative or talented may result in an unwillingness to seek clarification during the handoff for fear that asking questions will make one seem ignorant, difficult or inept.

(44, 194) In the case documented by Mukherjee (55), an intern who was afraid to ask what the attending meant by "lethargic" contributed to an adverse event. The willingness of residents to question or challenge their superiors is influenced by their superiors' responses to previous episodes. (200) Furthermore, when it comes to willingness to ask questions or seek clarification, power dynamics resulting from formal authority structures affect more individuals than just those at the lower levels. In fact, the steep hierarchies of health care cultures can make individuals at all levels reluctant to seek help when they need it most. (147)

Informal power and authority relationships can also influence handoffs in negative ways. In many large hospitals, handoffs occur between teams of physicians. In many cases, day teams, which have primary responsibility for decisions regarding the care of patients, hand off responsibility for the maintenance of those patients to night teams. Adversarial attitudes between these day and night teams have been shown to hinder handoffs. (77) All of this is not to suggest that power structures are inherently bad or harmful to the practice of handing off, only that such structures create challenges for the handoff.

Another social problem, arising with the increased use of teams in medical care, is what Gandhi (60) calls "diffused responsibility." When multiple individuals are involved in the care of a single patient, there is a tendency to assume someone else is going to handle the next step in the plan of care, such as following up on a test result. In a busy hospital environment, teams make it easy to shirk individual responsibility. (201) Given this phenomenon, it is understandable that the Australian Medical Association (87), in outlining general guidelines for improving handoffs, states that handoffs require effective leadership.

Attitudes among the different medical professions toward one another can also interfere with communication when handoffs occur across disciplinary boundaries. (58, 132, 202) The sense that some professions are superior in terms of knowledge, ability or authority has been shown to affect perceived handoff effectiveness. In surveys of ambulance staff and emergency department physicians, Thakore and Morrison (202), among others (178, 203), note that ambulance staff felt that the physicians did not pay attention when ambulance crews were handing off patients to them. If such a perception is true, it is easy to imagine how valuable information would be ignored and lost at the inter-service handoff. Even if the perception is not accurate, if it is believed, it could result in some professionals not bothering to communicate pertinent information under the assumption that it will not be taken seriously. Thus a view of patient care as a group endeavor where professionals with a diverse set of skills coordinate work in an atmosphere of mutual acceptance and respect is needed. (183)

3.5.2 Routinization

However the issues of content, time, place and media may be resolved, because they are action patterns frequently repeated in similar circumstances, handoffs become routines (204), grounded in human memory for habits. (205, 206) As such, handoffs can be flexibly adapted, like skills, but may also be subject to the pathologies of routines including the assimilation of novel circumstances to familiar patterns, that is, a failure to be fully responsive to important novelties. (207) Behara et al (11) notice these routinized action patterns which they denote with the term 'genres'. Wolf (34) touches related themes using 'ritual'. Williams and colleagues (37) use 'institutional habits'.

Routines are fundamental building blocks of activity that enable an organization to respond to recurring situations somewhat automatically, and in a coordinated and adaptable manner. This capability is central to the efficiency and persistence of an organization. However, it is not uncommon for routines to produce sub-

optimal results when they are triggered in circumstances that call for a more customized approach. (208) Wrong-site surgery provides some of the most striking examples. Long experience at handing off patients with similar diagnoses might lead to omitting discordant details precisely when they are indicators of a misdiagnosis. (183) This is just one example. We can easily conceive of many others where unique aspects of a particular patient's case demand a variation in a handoff interaction that has become too rigidly routinized or "mindless." (209)

Because routines rely on highly durable procedural memory (207) they tend to resist change. They are like deep ruts in the road that the wheels of a car naturally follow and out of which the car is not easily turned. (119) When routine functioning is efficiently meeting targets or achieving objectives, this characteristic may be quite beneficial. Action that works is likely to continue and can be counted on. Problems arise, however, when routine functioning produces undesirable or less-than-desirable results and changes to routines seem necessary. The durability of procedural memory may thwart improvement efforts that require altering the routine. (194, 210) Efforts to introduce change may be greeted with "That's not how we do it around here." "Old habits die hard" as the aphorism goes.

3.5.3 Implications for handoff improvement from social structure challenges

Handoffs may also be improved by attention to the habits, mindfulness, cultures, norms, attitudes and relationships that develop across shift, departmental, hierarchical, disciplinary, and other such boundaries. (211) The difficulty with which organizational routines are changed implies that handoff practice improvements may meet considerable, although not necessarily conscious, resistance.

For practitioners seeking to improve them, recognizing that handoffs become a routine introduces an important distinction: the long-term pattern of action, the *practice*, is what needs to change, but what one can actually analyze is always an immediate realization of the pattern in a context, the *instance* of the routine. Improvement efforts seek to alter the practice, to shift the persistent dispositions that generate instances as those dispositions encounter the shifting context. But monitoring and change efforts are mostly done at the level of instances, and so require analysis of the ways in which the context was, or was not, typical. (212, 213) As we point out below, this tension is particularly acute when attempting to standardize activity in a setting where each patient's unique combination of circumstances needs to be appreciated in delivering quality care. A community seeking to establish a standard will also establish a tolerated range of permissible deviations from it. Determining that range in the face of the complexity and variability of modern hospital operations can be difficult, but is vital. The range must be wide enough to accommodate genuine needs while remaining tight enough to keep the standard alive in people's minds, maintaining its ability to usefully guide actions in context.

This section on the challenges of handoff, like its predecessors, shows handoffs to be very sensitive to a large number of contextual factors. Their accuracy, completeness and efficiency can be enhanced or undermined by literally dozens of considerations. And those contextual factors themselves vary widely across the many types of professionals, specialized facilities, and practices that must be coordinated to care for patients. As a result, we should not expect that a single best way to hand off will emerge from research. Rather, research on the challenges of handing off reveals important factors that may otherwise be underestimated and shows how they operate and how they may interact. This provides improved working knowledge for those who must devise actual practices in specific health care settings.

4. The costs and benefits of standardization

One major motivation for undertaking this review has been the evident need of hospitals to shape their policies and practices in light of the Joint Commission requirement that they "Implement a standardized approach to "hand off" communications … ". The Joint Commission does not present, nor have we identified, any direct research evidence that standardization per se results in improved handoffs and increased patient safety. (136) The Commission, like the literature in general, relies on observations made in other high performance organizational settings, along with plausible arguments that standardization should improve safety, reduce costs, and increase teamwork, informal education, staff emotional support, error identification, and care continuity. (14, 214, 215)

While it is clear that standardization is not the only path to improvement of hospital handoff communications, it is plainly a major approach to improvement and also a requirement from a highly influential regulatory body. This suggests it could be clarifying to examine the notion of standardization in greater detail.

As the preceding sections make clear, there is great variety within a typical hospital in the purposes and circumstances of handoff activities. (106, 216) Transporter personnel routinely deliver stable patients for visits to radiology. Emergency department residents hand off critically injured patients to trauma surgeons. Attending physicians hand off to other attendings at the close of a week's duty cycle. Overnight nurses report to the morning's returning staff on any significant changes. Handoffs occur on the telephone, face-to-face, in a team room, in the cafeteria, at the bedside, with computer-generated data summaries, or computer-presented x-rays, or from notes jotted on a card at bedside.

This impressive variety naturally raises the question of what it can mean to have a standardized approach to handoff. Since the patients, professional participants, immediate purposes, and appropriate technologies can all be so different, and since the time required is so precious, it does not seem attractive to impose on every handoff within the institution a uniform pattern of behavior. (31, 217) And yet, there are widespread observations of handoffs that fail to convey vital information, often with dire consequences for patients. (48, 60, 218-220) These observations seem to suggest that a standard for handing off would reduce such errors. (82, 83, 192, 221) Using a sample of surgical malpractice cases, Greenberg et al (94) estimate that from eleven to thirty-five percent of the observed errors would have been prevented by standardized handoff and transfer protocols.

With such variety in the activities, across a modern hospital what should it mean to have a "standardized approach"? The question has been asked of the Joint Commission, and their response reflects the tensions in the situation: "Ideally the handoff process would be similar throughout the organization, but practically the hand-off process may differ from one setting or function to another…."(222)

4.1 Standardizing in a differentiated hospital

Our consideration of the way the problem of standardizing has been approached in the literature suggests that there are three main kinds of responses.[9]

(1) *Content standardization* includes efforts to list essential elements that should always be mentioned in a handoff. Typically these are patient identifiers such as name and location, key treatment constraints such code status, allergies, or fall risk, and fundamental measurements such as vital signs. A number of efforts have been made to specify such mandatory handoff elements, often as part of computerizing handoff documents. (82, 182, 183, 223-225) Most of these reports, however, are at the level of a service or department, rather than at the level of a whole hospital. An exception is. (224)

(2) *Topic standardization* includes efforts to specify more general topical areas that should be covered during a handoff. In this approach the effort is to be sure that particular *kinds* of information are transmitted in all handoffs, while leaving the specifics to be determined by the handoff participants. By far the largest number of protocol analyses and reported standardization efforts are of this type, e.g., (226) . The details of these approaches are discussed more fully in the following section on standardization protocols.

(3) *Performance standardization* focuses not on handoff content or form, but on the process that workgroups use to develop a standard suitable to their conditions and to specify the ways their results can be evaluated. Rather than fixing the information to be conveyed, or the information topics to be covered, this approach (159) lays out the kinds of needs that a workgroup should be sure to address as it develops or critiques its handoff practices along with the kinds of measures that can be used to assess progress. (173, 227) To construct a hypothetical comparison, instead of stipulating that a handoff should always include, say, recent vital signs, this approach would ask a group developing a handoff practice to consider what information about the patient, if any, should always be conveyed and then how it would monitor compliance with the norm it had defined.

As mentioned, the largest number of the reports of handoff standardization found in the literature are of the second type, topic standardization. A few are focused on content standardization. A very small set pursues standardization in the performance sense. All of these sets focus on efforts of units within a hospital to improve handoffs. These studies generally do not consider in any detail whether the approaches they report would be appropriate for other units in the hospital or for other classes of health personnel.

The Joint Commission appears to be responding in this spirit of unit-level standardization and to be invoking all three notions of standardization when it offered this response to a Frequently Asked Question, saying that:

> "A standardized approach should identify the following items:
>
> - The "hand-off" situations that it applies to
> - Who is, or should be, involved in the communication
> - What information should be communicated, for example,
>   - Diagnoses and current condition of the patient/client/resident

[9] Of course, there are some studies or reports that are blends of these ideal types. We cite them in multiple categories.

    - Recent changes in condition or treatment
    - Anticipated changes in condition or treatment
    - What to watch for in the next interval of care
- Opportunities to ask and respond to questions ideally in-person
- When to use certain techniques (repeat-back; SBAR)
- What print or electronic information should be available"(222)

And, in a book of resources, *Improving Hand-off Communication*, published by the Joint Commission in 2007 the Commission particularly commends the SBAR topic protocol, and says that handoff standards must:

- "use a standardized process for each type of hand-off situation"
- "include specific minimum content"
- "allow an opportunity for the receiver … to review relevant patient historical data"
- "use a verification process, such as read-back, or repeat-back, for critical information, as determined by the organization"
- "allocate a specific schedule for hand offs"
- "allow for the opportunity to ask and respond to questions"
- and "limit interruptions."(14)

These statements appear to indicate that the Joint Commission generally does not expect hospitals to use an identical handoff methodology across the entire organization, but rather to define handoff standards so that each unit or work group has defined specific content and a process meeting procedural requirements. The Joint Commission's most extensive discussion (14) also stresses the importance of monitoring and continuing education after standards are established. Taken together, these positions show the Commission to be applying all three notions of standardization, though not clearly distinguishing among them.

If care protocols, priorities and technical expertise need to be organized into distinct operating units, it does seem sensible that, at least to some degree, handoffs within those units might need to be as well. (228) Hospital-wide standardization of topic and content would run a risk of focusing time and attention on exchanges that in some units will be less relevant than topics the participants might choose themselves. (167, 217) It is true that such locally valuable topics can be added on to a global template. But in a world where time and attention are scarce, some topic will usually be compressed or squeezed out at the margin whenever another topic is mandated. Recent reports by (229) and (230) indicate that the Joint Commission recognizes this tension.

A natural approach to implementation at the hospital level may be to concentrate not on how to standardize handoff behavior per se, but rather on how to establish - and then meet – differentiated standards for handoff performance. This approach usually would not lead to uniformity in handoff activities - although that could happen if it were judged to be the best solution. Instead, a hospital taking a performance-standardizing approach would be more likely to focus on implementing workgroup processes that define measures of satisfactory handoff activity, (231, 232) on defining the boundaries of units responsible for unit-level handoff procedures, on training incoming staff in the handoff procedures expected in the units where they work, on collecting information about breakdowns in handoff processes, on feeding it back to individuals responsible at the unit level, such as attending physicians or charge nurses, and on checking responses to feedback.

In this approach to handoffs, hospitals would establish definite processes designed to monitor and improve their handoff performance. Those processes would allow the hospitals to know how they were doing, and those same processes would provide evidence to surveyors for regulatory agencies that handoff processes were subject to clear standards at the hospital level - standards of process and consequences, rather than of behavior.

This approach to standardization may more readily accommodate the need for differentiation. It would be more likely therefore to serve the needs for effective communication *within* each unit. It has a corresponding downside, of course. By relaxing the pressure for hospital-wide behaviors it may increase the risks of communication breakdowns *between* different units. Differentiation in response to the refinement of technologies and practices is such a powerful force in the organization of medical care that work on handoffs tends to take high and increasing levels of specialization as givens without much notice that each increase of specialization increases the number of units that must mutually coordinate treatment. [10]

For example, many hospitals admit a significant fraction of their patients through their emergency departments. If the ED has a standard internal format for handing off within the unit, one that meets its own special needs but differs from the approach in, say, Internal Medicine, that will still leave potential for handoff breakdowns between the ED and other units. (132) However, if both units meet hospital minimum standards, such as providing occasions to ask and answer questions, or providing key information such as code status, the possibilities for errors will at least be reduced. And if each unit had a standard approach to handoffs, that would reduce the wide variation at the level of individual practitioners that now reigns in many hospitals. If the whole ED generally followed a standard for handing off, other units would likely be able to learn fairly rapidly "how they do it over there" and then be prepared to compensate for differences between the ED and their own units. (234)

Hospitals are facing increased stress on *both* kinds of handoffs, within (continuing or new patient transfers) and between (cross-boundary transfers). As specialization increases, patients experience more frequent transfers *between* units. These risks are increased when there are no institution-wide standards. Where work hour restrictions or resident rotations increase the number of personnel changes, patients experience more handoffs *within* units. One study estimates that internal medicine interns handed off forty percent more often, 300 times per month, after changes in shift rules. (235) Every such within-unit handoff comes with risks that would be increased if less-relevant global handoff contents were to distort locally superior solutions. We believe it can clarify efforts to comply with the requirement to standardize if hospitals understand that the costs and benefits are driven by two major, and distinct, contemporary trends in hospital organization: increasing specialization and increasing rates of personnel change. Those designing standards must therefore reconcile cost-benefit tradeoffs on two different dimensions.

[10] The theoretical statement by Arora et al (233) is one of the few that explicitly recognizes the dynamic involved. Even this thoughtful analysis concludes that the main answer is better communication training, and does not suggest that coordination costs might act as a limit on increasing specialization.

4.2 Standardizing across variable patients

Observations of very brief handoffs such those reported by Nemeth et al (172) are consistent with some of our own informal observations. We have seen handoff sessions in which a few new patients received extensive discussion, while, in the same session, several other continuing patients were handed off with no discussion whatsoever. (78) In such an instance there is no significant variation in the institutional context, but there still is significant variation across patients. The judgment of the handing-off physician in such a session may well be correct: for example, that a receiving physician who has cared for a patient 12 hours earlier now needs no additional information, and that the scarce available time is best spent on the patients whom the receiving physician has not previously seen.

Observations like this raise a further aspect of the costs and benefits of standardization that is driven by the variety of individual patients, even those being seen within a single specialized service. And, of course, the variability is not only in terms of length of stay, but also in terms of condition severity, comorbidities, family circumstance, and a host of other factors that can significantly affect treatment decisions and therefore should affect handoff content. (113, 138, 172)

While it is plausible that standardization may protect the individual patient against omissions and errors in handoff communication, it is also clear that – in a time-constrained environment - this protection is traded off, to a significant degree, against accommodating the distinctive aspects of individual patients as well as fluctuations in total workload. (10, 48, 236)

The literature on handoffs has been influenced substantially by efforts to analyze and borrow from knowledge of effective handoffs in other high performance settings, such as aircraft piloting, nuclear power plant operations, or racing car pit stops. (66, 237-241) But the irreducible variability at the patient level raises questions about the limits on such conceptual borrowing. (57, 134, 242) For example, checklists are essential for pilots and have provided important reductions in infections during line insertions, (243) but how far can the checklist idea be extended into the handoff domain? (31, 244) Though some medical specialties such as anesthesiology may be appropriate analogs, (245) an average patient in, say, a Neurology service or a Pediatrics ICU is not as near to being prototypical as is a preparing-to-take-off Boeing 737. In the latter case the list of dimensions to be visited may be long, but it is quite well understood and extremely similar across all instances of that type of airplane. In the hospital case, the set of complicating factors that can arise is huge, full of novelty, and continually changing. Under such conditions, the design of a handoff standard will have to determine what parts of the handoff are well-understood and essential, and could be incorporated in a relatively rigid device such as a checklist, and which parts should be included only on the judgment of the physicians and nurses involved, the judgment that selects the information likely to be pertinent for the person assuming responsibility or control.

5. Possible protocols for standardizing of handoffs

Over the course of the growing interest in handoffs there have been a large number of specific proposals for standardizing the content or topics of handoff communication. Having established a broader context in the preceding sections, we turn now to this sizeable body of publications.

It is striking that among the recent efforts to formalize standard procedures for handoffs the vast majority have presumed essentially the same idealized handoff situation (an exception is (237)). The proposals that

have been put forward for standard handoff procedures generally have specified the conduct for a face-to-face information exchange that permits questions. There has been some, but comparatively much less, attention to surrounding issues that we have identified above from the larger literature, such as location, roles for other participants, technology for information exchanges, or choices of media.

To date we have identified nineteen such proposed systems of handoff standards[11]: SBAR (including the variants I-SBAR I-SBARQ and I-SBAR-R) (10, 14, 48, 70, 177, 192, 226, 227, 232, 244, 246-255), SIGNOUT (83), I PASS the BATON (236), FIVE-Ps (231), PACE (256), ANTICipate (59, 182, 235, 257), HANDOFF (258), Data TRIANGLE (259), HANDS (115), Essence of Care (260), ASHICE (261), DeMIST (136), CUBAN (189), BSAP, SEAM(14), PEDIATRIC, PSYCHIATRY (159), STICC (37), and the Great Ormond Street Protocol. (237)

SBAR is overwhelmingly the most mentioned system being considered, and several of the others are derived from it. (83, 236) It is explicitly recommended by the Joint Commission. (14) We will therefore concentrate on SBAR here. The SBAR framework has been borrowed from the United States Navy where it has been taught as an approach to making situation reports. Kaiser Foundation Hospitals were early adopters of SBAR for medical briefings, and many of the later applications cite their precedent-setting implementation. (262)

The initials SBAR stand for Situation, Background, Assessment and Recommendation. The extended versions I-SBAR, I-SBARQ, and I-SBAR-R add to these categories first 'I' (for ***I***ntroduction, or for patient ***I***dentifiers) then ***Q***uestions, and, in the last case, ***R***eadback. (249) The further components have been added to emphasize elements deemed important in the hospital setting that are not stressed in the original SBAR list, in particular questions, which are explicit in the Joint Commission requirement, and readback, which adds a confirmation step for error reduction, creating a place for what might otherwise be an unnatural conversation turn.[12] (83, 192)

As with many of the other proposed standard handoff methods, the initials are intended to serve as a mnemonic device, reminding those trained in the system of the fundamental categories that should be used, in a recommended sequence, to structure a handoff interaction. The topic sequence itself has value. It puts contextual information necessary for appreciation before discussion of action possibilities, and, once it is familiar, the established sequence allows receiving parties to postpone questions about issues they can expect to have covered later. SBAR and its many cousins thus function as a communication genre, a collectively known format, like that of a memorandum or a sonnet, that organizes the shared expectations of the participants. (11, 132, 226, 263, 264) Moreover, any fixed sequence may be an aid to memorability. (86)

Of course, by themselves, the Situation, Background, Assessment, and Recommendation category labels are not nearly detailed enough to determine specific contents for handoff communication. SBAR thus involves a strong element of what we have called topic standardization. However, in some cases, it can be made more

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[11] Although we have made a strenuous effort to identify all print publications about such proposals, we may have overlooked some new options or variations on those reported, especially if they are not mentioned in electronic indexing systems.

[12] However, Patterson and her colleagues in their review of handoff observations in 21 "high reliability organizations" (31, 66) found that *no* such organizations use readback or always use a fixed structured order in handoffs.

specific, so that as a starting point for discussion it may lead to content standardization. (132, 257) Most of the reports in the literature are about results observed when SBAR, or one of its variants, has been developed into a training module and implemented in various hospitals or portions of hospitals. A typical report in this class provides details on how SBAR was made more specific, on the training process that was used to make the members of the community aware of it, and perhaps survey studies of self-reported levels of adherence to the SBAR method. (83, 177, 248, 251, 252)

We also note that even when a hospital uses performance standardization, the many proposed systems of standard topics remain relevant, although their role is transformed. Rather than defining the detailed behavior of those handing off in terms of SBAR, or one of the other schemes, hospitals can use such schemes as guides for shaping the discussions units must engage in as they define their own handoff protocols and performance measures. (227) Units might want to consider whether their handoffs should routinely contain a Recommendation, to pick just one of SBAR's category suggestions. Or they might want to discuss whether to regularly observe whether each handoff conveys a Purpose, to use the third of the 5-Ps. (231)

6. Questions needing answers, and methods of research

A "Sounding Board" essay in the *New England Journal of Medicine* has warned that the urgency of protecting patient safety can itself entail a risk. The authors remind readers of the long-noted dangers of standardizing new hospital practices before appropriate evidence on effects and side-effects is fully in hand:

"…[I]ndividual hospitals may pursue promising quality-improvement strategies on the basis of scant evidence, including anecdotal reports or face validity. However, clinical practices based on such limited evidence would never become broad standards of care, much less requirements for accreditation or reimbursement. Similarly, recommending or mandating the widespread adoption of interventions to improve quality or safety requires rigorous testing to determine whether, how, and where the intervention is effective – just as in the rest of medicine." (265)

Our review reinforces some elements of this concern. It has shown that handoffs are instrumental in multiple functions within the hospital, ranging from the transmission of information pertinent to immediate patient needs through the provision of social support among health workers and on to the learning processes of both individuals and organizational units. Handoffs are essential links in the organization of a modern hospital, without which it can maintain neither its highly specialized division of labor nor its complex schedule for work-shifts of personnel. Because handoffs subserve so many vital functions, it seems plausible to warn that premature convergence on a handoff standard could do harm, not only to the safety and care of the patients involved, but to the longer run capabilities of a hospital's personnel and systems. The problem instead seems ripe for the continuing experimentation that will occur as hospital develop standards in response to Requirement 2E and for research that can provide, over the course of several years, a solid foundation for a consensus on how handoffs can be improved.

This appropriate caution, together with the highly varied results found in the handoff literature, lead naturally to a discussion of the kinds of further research that would most contribute to developing handoff procedures that would be more reliable and effective. What do we need to know in order to do handoffs better?

We have clustered the future research issues around three overlapping questions.

1. How can we be more precise in determining the large-scale consequences of handoff procedures?
2. How can we assess handoff quality at the operational level?
3. Which research methods and data sources are most promising for which research issues?

6.1 How can we be more precise in determining the large-scale consequences of handing off?

As we noted above, there are actually rather few studies (17, 19, 266, 267) that specifically link handoffs or similar communication to non-interview measured outcomes for either patient safety or quality of care. Other studies, often using interview data do add to our understanding of how much handoffs may matter. They suggest, for example, that poor handoffs can cause delays or repetitions for hospital staff or patients. Horwitz et al (268) found in 503 patients signed out 5 patients with delayed treatment (one resulting in an ICU transfer) and four near-misses. Ye et al (47) found patient delays reported in five percent of 914 observed patient-handoffs. Nonetheless, we lack solid, non-interview estimates of magnitude of the effects on safety and quality of care that are traceable to handoff. As far as we are aware, no interview-based study of a population of handoffs has attributed a preventable death to a handoff deficiency. It is not hard to understand that interview respondents or researchers might be reluctant to make such an attribution without an extremely detailed investigation.

Yet it is vital to have good estimates of the size of the effect improved handoff might have on major patient outcomes. Without it, we cannot say with full confidence what magnitude of investment in handoff change is merited. The review shows that some steps that might be effective – for example, dramatically restructuring workflows to reduce handoff frequency (130) – could possibly be quite disruptive and costly. If handoffs were among the largest sources of preventable adverse events, such initiatives might be warranted. If handoffs appear to have much more modest role in determining patient safety, a correspondingly more modest strategy might be in order.

It seems likely to us that research will isolate statistically significant effects that justify widespread interventions on some scale, but not clear that we really know the orders of magnitude that are stake. The chain of arguments that is found at the start of many of the papers we have reviewed is not airtight. It typically argues that preventable adverse events are common (269), notes that analyses of JCAHO-collected sentinel events (270)frequently implicate breakdowns in "communication", and proceeds on the assumption that handoffs are a major form of communication in which patient-harming breakdowns are likely to occur. This chain is weak at a number of points. Among them, "communication" is too broad a designation and runs the risk, as Patterson has noted (31), of being a diagnostically unproductive catchall as has happened with "human error" in some other safety domains. It is also a major leap to assume that the handoff is the place where patient-harmful communication breakdown is most likely to occur. A reanalysis of the sentinel events data, or other similar data, might establish this, but for the moment the assumption needs to be flagged – not to stop research, but to clarify which assumptions are still to be verified.

As mentioned, the most widely cited work on this question is the 1994 study by Petersen et al. (17) showing an association of cross-coverage and preventable adverse events. This is augmented by a second study, using the same techniques, showing that a decline in chances of adverse events during cross-coverage was

contemporary with the introduction of a computerized sign-out tool. (19) It would be valuable to have additional studies that replicate and refine these two, both of which were done in a single hospital, especially if a new research design could directly isolate the role of handoff as opposed to drawing inferences about handoff from results on the cross-coverage condition, as has been the approach of the earlier work.

Some additional work has begun to fill out the picture on the key question of handoff consequences. The study by Singh et al (43) of medical malpractice cases showed that breakdowns in handoff communication were involved in 129 of 889 cases sampled. This study did distinguish handoffs from "other communication problems" and from "lack of clear lines of responsibility". All could be judged present simultaneously in a case. The latter two categories were present 116 and 87 times, respectively.[13] The malpractice sample studied by Greenberg et al (94) also found many cases involving handoffs, and highlighted especially the role of status asymmetry. Such studies make an important contribution by demonstrating the frequent presence of handoff problems in malpractice cases. They cannot help us, however, to estimate the frequency or consequences of handoff problems in normal hospital practice. It seems especially likely that transfers of responsibility or control will be implicated in the post-hoc investigation of problematic cases. Nonetheless these studies make use of novel data to contribute to the overall picture of the substantial relation of handoff issues to cases with severe adverse consequences.

6.2 How can we assess handoff quality at the operational level?

For hospitals to improve the way handoffs are conducted, it must be possible to distinguish good from bad handoffs – or, at a minimum, good or bad features of handoffs. This problem is related to, but distinct from that in the previous section, assessing the role of handoff in determining patient outcomes. It is possible to show, by analyzing a large sample in retrospect, how consequential handoffs are, without being able to reliably assess within a managerial time frame how well handoffs in a hospital are being done. But it is this latter problem that must be faced by hospitals attempting to improve the way their patients are handed off. Arora and her colleagues also make this point: "To drive the creation and dissemination of tools for education and assessment, we encourage educators and accreditation and certification bodies to invest in resources to sponsor initiatives designed to yield standardised educational programmes and a robust assessment system for these critical skills to ensure safe patient care during times of discontinuity."(233)

To understand how to hand off more effectively, research has turned naturally to the many issues reviewed above as the functions and challenges of handing off. In contrast to the epidemiological research style that is appropriate to assessing the consequences of hand offs, the methodologies for studies of handoff quality tend to be questionnaires, case reports and field observations. The overwhelming majority are reports from one or a few services within one or a few hospitals. As they frequently acknowledge, this raises some barriers for efforts at generalization.

The many research reports that have accumulated do not converge on any simple characterization of a good handoff. They highlight pitfalls, advantages and tradeoffs associated with existing handoff methods, or with

[13] In light of changes to resident hours that have increased handoffs, it is useful to note that "fatigue" was identified as a factor in only 18 of the 889 sampled cases with both harm and error, which occurred before the work hour reform. More evidence on small impact of duty hour reform is in (271-274).

experimentally implemented procedures, such as bedside nursing report, telephone callback, or computer-produced handoff documents. We have tried to organize the many studies in a way that will make them accessible and useful to physicians, nurses and other hospital personnel as they investigate their own handoff processes and consider innovations.

The literature we have found may suggest problems to avoid, promising ideas for experiments, or pros and cons of novel practices that have to be weighed in context. However, the studies do not, in our opinion, add up to a clear and universal characterization of a good or bad way of handing off. To consider just one aspect of handing off, it seems very unlikely that there is a single best list of required handoff information *content*. Patients need to be unambiguously identified, for example. That is more or less intrinsic to the concept of handing off a patient. But even for this feature, the most efficient practice can sensibly vary with location (bedside or team room) or with patient history (new, or well known to all parties). The Joint Commission requirement of an opportunity for questions may identify a process element that should be deemed essential. But that necessity can be met in myriad ways, ranging from having the receiving party lead the whole face-to-face discussion (38), to scheduling substantial shift overlaps. It would seem wise for the leadership of a hospital unit to ask whether code status should always be covered in handoffs, but one can imagine circumstances in which the ensuing discussion concludes that the best practice is only to report code status when the patient is new, for example, or only when the patient is not to be resuscitated in a setting where that code status is rare.

Just as the literature establishes no best specific content for all handoffs, neither does it establish generally best solutions for participants, locations, durations, manner, or media for handing off. Given the variety of hospital contexts, it seems there cannot be a standard of handing off that specifies the many features of handoff in fine-grained detail and is still best across an entire hospital, not to mention across a diverse population hospitals. If this conclusion is accepted, the scope of needed research expands.

There will continue to be a need for the lines of work already undertaken, which reveal unappreciated consequences of established practice or document new experimental approaches to handoff. We surely do not know everything we should about the functions of handoffs and design challenges they must meet. If, however, a handoff is good or bad largely in terms of how well it provides the oncoming party with a useful and yet highly-compressed representation of the patient's condition and foreseeable needs, then some new kinds of research may be called for.

If a good handoff is one that delivers the most important information in the currently unfolding context, then it can be valuable for a unit, or for a frequently handing off pair of units, to study what the participants believe about what is likely to be important, how they form their impressions of those most important aspects of patients, and how they might form more accurate expectations. (275-277) The literature already contains examples of studies that have moved in this direction. The study by Arora et al. (48) used a "critical incident" questionnaire method to get at the kinds of problems a unit was encountering with sign-outs during the previous shift and over the past year. Horwitz el al. (58) made a similar examination of problems occurring between an emergency department and inpatient care, and used group discussion as well, in developing a sign-out curriculum. (83) Wesorick et al (278) and Lurie et al (279) shadowed cross-covering physicians and catalogued the most common problems of their patients, and others (46, 280, 281) have collected similar data at the conclusion of resident shifts.

Other work in this spirit has also emphasized non-survey methodologies (37, 82) . Broekhuis and Veldkamp (102) have used a structured sequence of conversation processes to elicit needed changes. The growth of this line of research is incomplete, however. The studies so far develop and use research methods to inform the design of handoff improvements, but, with only a few exceptions (102, 103, 282) , they do not explicitly evaluate the effectiveness of their methods. The problem of how to assess a process of inquiry aimed at improving handoffs in units, or between pairs of units, is only now coming into focus. Studies of comparable groups of medical professionals using different processes to understand and improve their handoffs could be very valuable.

Some insight into effective inquiry methods might be derived from examining the procedures used by software engineers, who often employ systematic approaches to understand the workflow of their clients. This group is unfortunately a minority (283), but growing. (11) Their work is relevant because of the underlying parallels between a unit analyzing its definition of a good handoff and software designers need to determine what information should be available at various points in a complex workflow. There are many flavors of these software inquiry procedures with varying labels, but one common label is 'requirements elicitation.' (284) Indeed, these two worlds meet when physicians or nurses become intensively involved in design of computerized sign-out tools, as is increasingly the case. (19, 36, 140, 176, 188, 210, 224, 280, 285-290) It is encouraging that many of these studies are distinguished by a clear sense that handoff communication involves more than just transmission of information and that good IT design must support the additional functions that handoffs accomplish. (106, 140, 216) Continuing collaborations among physicians, nurses and information system designers appears to have considerable promise for producing both more useful software and improved elicitation of unit level handoff requirements.

6.3 Which research methods and data sources are most promising for which research issues?

In the preceding sections we have suggested two major questions that research can help address: what costs are justified in implementing improved handoff processes?, and what kinds of improvements will prove worth implementing?. For research to provide the answers we may need innovation in both data sources and research designs. We mention briefly five possibilities that may intrigue handoff researchers.

1. Questionnaires have been a workhorse of research in this area, especially on the studies related to defining good handoffs. But the possibilities for innovations in questionnaire instruments are nowhere near exhausted. This remaining potential is demonstrated by two recent examples: the previously mentioned use of critical incident recall questions by Arora et al (48), and the scale of nursing communication developed by Vogus and Sutcliffe (209) which proved sensitive enough to predict differences in patient fall rates measured six months later. New instruments in survey studies may improve our insights into handoff procedures and attitudes.

2. Intensive field observation, often using ethnographic methods, has already made useful contributions, especially in revealing the flexible adaptation of handoff activity to the variations in patients and contexts. (11, 68, 96, 172) This form of observation is expensive in skilled investigator time and therefore does not readily scale up to studying populations of organizations. But it can illuminate particular examples that prove highly instructive in combination with other methods, such as the study by Reddy et al (291) showing

that temporal rhythms of ICU work that can change the meaning of "the same" handoff utterances when they occur at different points in the day.

3. Simulated patients have already been used in handoff studies. (292) This technology is rapidly increasing in realism and offers striking possibilities for controlled experiments with the advantage that the experimenters know the correct diagnosis and treatment exactly .

4. Video data on handoffs has been used as a means to stimulate reflection by practitioners. (103) Video of handoffs would seem to offer still more possibilities, especially for analysis of handoff behavior that is not captured well in surveys, interviews or even real-time observations, which cannot be replayed for examination of details. For example, actions that facilitate – or discourage – asking of questions are particularly of interest in light of the Joint Commission stress on such exchanges. Nemeth and colleagues are already applying related analytic techniques to audio recordings. (172) These generated the surprising result that, in their PICU sign-out sample (113), handoff length was uncorrelated with severity of illness, but was related to uncertainty about patient condition. With video, non-verbal actions such as eye-rolls or shrugs can also be studied for the contributions they make to organizational learning as they convey feelings about those outside the group of handoff participants.

5. There have been some pioneering examples of using data from computerized handoff systems to measure frequency of system use. (19, 224, 288) A related technique uses a mixture of computer records and observation to carry out random audits of planned processes or mandated procedures. (293) As more handoff information moving through hospital computers increases, there will be interesting opportunities to match such usage data to other records, and it may be possible also to analyze the content of the computerized portion of handoff reports. Hospitals now routinely catalog sentinel events (adverse events and near misses) – though there still are under-reporting problems. (294) As these files grow they will offer opportunities for matching with other computerized hospital records. (271, 295) This approach was first demonstrated by Petersen et al, (17) but the rapid growth of such collections should soon support innovative extensions.

7. Conclusions

Our aim in this review has not been to provide definitive prescriptions for how handoffs can be improved. Rather it has been to deepen and broaden the questions that are asked as the efforts to improve handoffs go forward. There is an inherent bias in the literature that favors the perspective of teaching hospitals. Handoffs and associated improvement efforts in non-teaching institutions may differ in important ways that are not clearly identified or represented in the research. The literature reveals that handing off is a process that could be quite significant for patient safety, and therefore one meriting substantial investment to understand and improve it. At the same time it shows handoff to be highly sensitive to variations in context, to be an activity that is essential for multiple important functions within a hospital that range far beyond patient safety, and to be subject to difficult tensions that necessarily attend efforts to standardize action within a highly differentiated setting. All these factors make the determination of the best handoff procedures a contextual – and likely effortful – process of inquiry, design and implementation. The research we have reviewed provides important guidance for such efforts, and the research that should now be forthcoming can help even more.

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