HSR Health Services Research

DOI: 10.1111/j.1475-6773.2012.01390.x
RESEARCH ARTICLE

Identifying the Latent Failures Underpinning Medication Administration Errors: An Exploratory Study

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Objectives. The primary aim of this article was to identify the latent failures that are perceived to underpin medication errors.
Study Setting. The study was conducted within three medical wards in a hospital in the United Kingdom.
Study Design. The study employed a cross-sectional qualitative design.
Data Collection Methods. Interviews were conducted with 12 nurses and eight managers. Interviews were transcribed and subject to thematic content analysis. A two-step inter-rater comparison tested the reliability of the themes.
Principal Findings. Ten latent failures were identified based on the analysis of the interviews. These were ward climate, local working environment, workload, human resources, team communication, routine procedures, bed management, written policies and procedures, supervision and leadership, and training. The discussion focuses on ward climate, the most prevalent theme, which is conceptualized here as interacting with failures in the nine other organizational structures and processes.
Conclusions. This study is the first of its kind to identify the latent failures perceived to underpin medication errors in a systematic way. The findings can be used as a platform for researchers to test the impact of organization-level patient safety interventions and to design proactive error management tools and incident reporting systems in hospitals.
Key Words. Psychology, latent failures, medication errors, patient safety, ward climate

Since the early 1990s high-risk organizations have adopted a "systems" approach to safety management (Reason 1995). This approach recognizes that errors are made by people at the front line of operations (in the case of medication administration, this is most likely to be a nurse). The systems approach is

important because it recognizes that organizations have inherent weaknesses (latent failures) that can arise from decisions made at senior levels (e.g., plans agreed, buildings designed, staffing levels approved, equipment procured) as well as those external to the organization (e.g., policies imposed, targets set, funding decisions, education provision). Latent failures manifest themselves in local working conditions that promote or permit errors, and it could be argued that the most effective way of managing risk begins with the prospective identification of such failures. Indeed, this approach is well established in the area of patient safety and a number of frameworks for studying systems have been proposed (e.g., System Engineering Initiative for Patient Safety, Carayon et al. 2006; Systems analysis of clinical incidents: the London Protocol, Taylor-Adams and Vincent 2004). However, despite the emergence of these frameworks, there is little empirical evidence that identifies the systems factors (or latent failures) that are relevant in health care. Therefore, there is an urgent need for the systematic identification of latent failures in health care to help develop intervention strategies for minimizing error. These strategies might include improving safety defenses or directly addressing the systems failures (Leape 1999; Carthey, de Leval, and Reason 2001; Toft 2001; Musson and Helmreich 2004; Lawton et al. 2009).

One approach to the identification of latent failures is to analyze the root causes of adverse incidents that have already occurred (e.g., Dean et al. 2002; Gawande et al. 2003; Armitage, Newell, and Wright 2007; Nuckols et al. 2008). A common factor identified across these studies is the problem of failed communication, but other factors include hierarchical medical teams, poor supervision, incompetence, fatigue, high workload, and training.

An alternative approach is to use observations of practice to identify latent failures proactively, before they lead to active failures (e.g., Giraud et al. 1993; Catchpole et al. 2006, 2007; Wiegmann et al. 2007; Barach et al. 2008). However, consistent interpretation of contributory factors from these studies is hampered by the lack of shared terminology or theoretical framework upon which to structure results (but see Catchpole et al. 2006 for an exception).

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A further approach to understanding contributory factors is to use interviews to explore perceptions of the causes of adverse events or patient safety incidents. In a seminal paper, Leape et al. (1995) used this method to identify 16 underlying failures that led to adverse drug events. More recently a number of authors have pointed to the utility of interview techniques in gaining rich information regarding causes of patient safety incidents (e.g., Meurier 2000; Dean et al. 2002; Gawande et al. 2003; Silen-Lipponen et al. 2005).

The current paper is concerned with the factors that contribute to medication administration errors. Medication administration errors are one of the most common types of patient safety incident and can result in serious adverse events (Leape et al. 1991; Bates et al. 1995). For example, in a recent study of 10 pediatric wards across five hospitals, 429 medication administration errors were identified in 2,249 opportunities for error, a rate of 19.1 percent (Ghaleb et al. 2010). Furthermore, there is evidence that latent failures can increase the rate of such errors (van den Bemt et al. 2002).

Therefore, the aim of this study was to use interviews with nurses working on medical wards, and their managers, to identify systematically the latent failures perceived to be associated with medication administration errors.

METHOD

Participants and Recruitment Strategy

Twelve senior hospital managers with responsibility for patient safety as part of their role were invited to participate in interviews. Eight managers agreed to be interviewed (including a director of Nursing, a clinical director, and a risk manager).

Letters of invitation were sent to 25 nurses from three medical wards. Eleven nurses agreed to be interviewed, ranging in seniority from student nurse to senior nurse in charge. The number of participants recruited here was informed by Guest, Bunce, and Johnson's (2006) suggestion that 6–12 interviews may be sufficient to achieve saturation in a relatively homogenous group.

Interview Schedule

Interview questions were designed to elicit participants' views on the causes of medication errors. To facilitate discussion, eight vignettes describing hypothetical error scenarios in the form of a nonthreatening, nonpersonal story

(Gould 1996; Rahman 1996; Hughes 1998; Gott et al. 2004; Schwappach and Koeck 2004) were developed by the second author and two senior nurses (see Appendix SA2).

The interview schedule was semi-structured and based on Reason's organizational model of human error (Reason 1990). Questions invited participants to discuss causes of medication errors. These were active failures (e.g., in terms of the people described in this scenario—what actions do you think could have led to this incident?), local conditions (e.g., do you think there were any problems relating to the immediate working conditions which could have made this error more likely?), and organizational perspectives (e.g., in terms of the workplace factor "*x*"—you mentioned earlier—what do you think the organizational or management factors are which could have contributed to this problem?). See http://etheses.whiterose.ac.uk/623/ for the full interview schedule.

Procedure

Ethical approval was obtained from the Local Research Ethics Committee. The interviews were conducted during working hours in a private room or office and lasted between 20 and 90 minutes. All interviews were conducted by the same interviewer and were recorded anonymously using a digital voice recorder.

At the start of the interview, participants were encouraged to think about the inevitability of human error and errors that people make while driving (Reason et al. 1990; Parker et al. 1995). Following this, one of the eight error vignettes was introduced and participants were asked to consider the factors that might contribute to the incident. Reason's (1995) organizational model was shown to participants with an example of how this had been applied to accident analysis of a rail crash (Lawton and Ward 2005) to encourage participants to consider latent failures. At the end of the interview, participants were invited to ask any questions they had about the study.

Data Analysis

Recordings of all 19 interviews were transcribed and stored in NVivo7 (QSR International, Southport, UK). The data were subjected to five stages of Thematic Content Analysis recommended by Braun and Clarke (2006). These were *familiarization with the data*, *generating initial codes*, *searching for themes*, *reviewing themes*, *and defining and naming themes*. Content analysis was then

performed to calculate the number of excerpts (sections of coded interview transcript) associated with each of the themes. To test the reliability of the 10 proposed themes, inter-rater comparison was conducted. One clinical rater (former senior nurse) and a nonclinical rater (senior lecturer in health psychology) were recruited for this task. In the first part of the task, raters were asked to choose which theme best represented each of 135 excerpts (25 percent random sample). Mean inter-rater agreement was 83 percent. In the second stage of the task, raters were asked to assign each of the secondary themes to the most appropriate of the 10 higher order themes. A high mean level of inter-rater agreement (89 percent) was achieved (Miles and Huberman 1994).

RESULTS AND DISCUSSION

The analysis of the data produced 10 "higher order" themes. The 10 themes, together with their respective definitions and the number of associated excerpts, are shown in Table 1. The most significant theme, with the greatest number of coded excerpts, was *ward climate.* This reflected the values, attitudes and patterns of behavior of the staff themselves and will be the focus of this article. The failures perceived to be the more immediate precursors to error, and prevalent themes in the interviews, were *human resource issues* (particularly too few qualified staff), *workload* (amount of and planning of work), and the *local working environment* (e.g., noise, distractions, ward design, equipment availability). Other important influences on staff behavior and performance were *routine procedures* (e.g., admissions), *bed management*, *team communication* (written or verbal), and *written policies and procedures.* Finally, *supervision and leadership and training* were also considered potential areas where failures led to increased levels of error.

The description of each higher order theme and subtheme is beyond the scope of this article, but details of each theme together with supporting excerpts from the interviews and links to related literature can be found in Appendix SA3 (Tables S1–S9). Only one theme, *ward climate*, is described in full here.

Reason (1998) provides a useful definition of safety culture: "Shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioral norms (the way we do things around here)." In the 10 primary themes reported here, we have captured both the shared values and beliefs associated with medication safety (*ward climate*) and the potential failures in the organization's structure

Table 1: Ten Higher Order Themes Representing Latent Failures in the Context of Medication Errors: Definitions, Secondary Themes, and Results of Content Analysis (Number of Excerpts Representing Each Theme)

Theme	*Secondary Themes*	*Definitions*	*Number of Excerpts*
Ward climate	Described below	The overall atmosphere of a hospital ward determined by predominantly unspoken multidisciplinary shared assumptions, rules, and norms of "the way it is," which have evolved over time and forced individuals and teams to adapt to this environment	139
Human resources	Staffing levels Skill mix Temporary/ contingent workers	Aspects of the provision of health care personnel, including the number of available permanent qualified staff, their respective skill-base, and the employment of contingent workers	70
Local working environment	Patient Ward design Personal issues Fatigue Ward noise levels Equipment design and availability Pharmacy and dispensing issues	Aspects of the individual or the immediate working environment such as work patterns and physical working conditions which hinder the provision of safe patient care and encourage the performance of unsafe acts	64
Workload	Volume of work Cognitive workload Workload planning	Facets of nursing care which place significant physical and/or mental demands upon nursing staff which could affect their ability to care for patients effectively	61
Routine procedures	Checking procedures Patient admission Patient handover Patient discharge	Procedures routinely carried out by nursing staff in the course of a patient's stay in hospital regardless of the patient's condition (e.g., handover and admission)	49
Bed management	Transfers and lodgers or sleep-outs Patient throughput A&E breach rule Bed availability	Organizational procedures to manage either the number of available in-patient beds or the ways in which patients are allocated appropriate beds	44

continued

Table 1. *Continued*

Theme	*Secondary Themes*	*Definitions*	*Number of Excerpts*
Team communication	Written Verbal Team size Multicultural issues	Aspects of an intra- or inter-departmental team or communication channels that prohibit effective communication between individuals or departments	40
Written policies and procedures	Policy knowledge Policy development	Aspects of the development and dissemination process of explicit written policies, guidelines, and procedures that impact upon the knowledge of and subsequent utilization by nursing staff	38
Supervision and leadership	Task delegation Leadership style	Aspects of immediate line management that impact upon the ability of subordinates to provide or be motivated to provide timely, coordinated, and safe patient care	17
Training	Induction and preceptorship (initial ward-based training) Ongoing training	The availability, appropriateness, and process of delivery of training to newly qualified and existing nursing staff	18

and control systems (nine remaining themes). However, safety attitudes and values are regarded as being difficult to change, and so the manipulation of tangible organizational structures and processes that interact with these belief structures has been suggested as a more effective error management strategy (Hofstede 1994). Thus, although we focus here on *ward climate*, we would recommend that safety interventions might more effectively target factors such as written policies and procedures, local working conditions, and training.

Ward climate is defined here as the overall atmosphere of a hospital ward. This is predominantly determined by unspoken multidisciplinary shared assumptions; the rules and norms of "the way it is," which have evolved over time and which have forced individuals and teams to adapt to this environment. Table 2 provides details and supporting evidence for how this higher order theme is underpinned by each secondary and tertiary theme. Figure 1 provides a thematic map of this theme together with secondary and tertiary themes. Each theme is discussed below with reference to existing research evidence.

Table 2: Interview Excerpts Reflective of the Theme *Ward Climate*

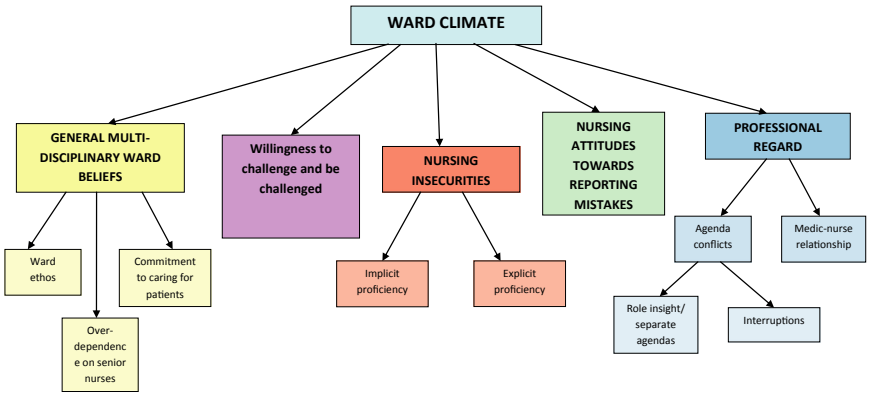
Higher Order Theme	*Secondary Theme*	*Tertiary Theme*	*Excerpt*
Ward climate	General multidisciplinary ward beliefs	Over-dependence on senior nurses	…people come to you [as a senior nurse] all the time for every little thing, to the point where it gets pathetic, they come to you for the most ridiculously easy things that anyone would know… they come to you for everything…anybody who's seen in a sister's uniform is automatically a target for everybody, for doctors, relatives, visitors, everybody wants to speak to the sister
		Commitment to caring for patients	…[providing safe care] is partly down to the staff themselves, whether they feel comfortable in that environment or not, whether they just come to work to come to work and go away again or whether they want to do the best that they can
		Ward ethos	…you can have the climate on the ward…or say a group of wards on a unit where the prevailing culture is on speed rather than on safety and individualized care
	Willingness to challenge and be challenged		…certainly some of the more junior staff would think "well the doctor knows best" and so their instructions must be right. Its tradition isn't it? People don't like militant nurses
	Nursing insecurities	Explicit proficiency	…newly qualified staff think everything has to be done and dusted by the time the sister comes on so they can hand over a straight shift, everything done and organized. They think if they haven't done that, then it's a reflection on how they cannot manage their time. This often means people are rushing to get these jobs done

continued

Table 2. *Continued*

Higher Order Theme	*Secondary Theme*	*Tertiary Theme*	*Excerpt*
		Implicit proficiency	…anybody in any working environment is trying to prove themselves…an inexperienced nurse would be trying to prove to other people they are capable and so they may take risks because of that. I'm sure there are senior nurses who are maybe doing the drug round who won't ask [for help] because they think "well, they'll think I'm stupid, I should know that"
	Nursing attitudes toward reporting mistakes		…I can say quite comfortably and I'm sure it's happened that loads of people have made drug errors and haven't reported them because they're just frightened of the consequences… I will be extremely cagey about how and if I reported another drugs error, not just of mine but of anybody else's. My reaction now is say nothing, it didn't happen
	Professional regard	Agenda conflict (incl. interruptions and role insight)	…people come and interrupt you all the time when you're doing the drugs round, it's just dangerous, really dangerous. It's one of the main [causes of error], being interrupted. People are just working to very separate agendas
		Medic–nurse relationship	…you might come on to shift on a weekend and find out which doctors are on and you might think "oh, great, he's alright, I like him" or it might be somebody you've no confidence in…

Figure 1: Thematic Map of the Theme Ward Climate with Secondary and Tertiary Theme Descendents



General Multidisciplinary Ward Beliefs

This theme can be defined as an overall implicit "feeling" about the general way patient care is delivered on a ward. The theme comprised three tertiary themes:

1. *Ward ethos*: This was described as an overall ward atmosphere, driven by matrons and senior sisters who would be more concerned with either the speed or the safety of delivering patient care. Several interviewees suggested that experienced nurse managers were more likely to encourage other nurses to focus on delivering safe care regardless of the time taken to do so. Several nurses alluded to the likelihood that focus on speed over safety would inevitably lead to "cutting corners" and violating safe practices (e.g., "speeding up" during the drug round). Although there is very little written on this type of subclimate within health care, this finding is supported to some extent by evidence in the manufacturing industry. Zohar (2000) argues that work groups can develop subclimates which are distinct from the overall safety climate of the organization and driven largely by supervisory commitment to safety and, in particular, their expectations of productivity over safety.
2. *Commitment to caring for patients*: Notably, this theme was only cited during management interviews. Several managers suggested that nurses who perceive their role as "just a job" may be less committed

to the role of caring for patients and as such are less likely to adhere to safe practices. Evidence has suggested that nursing cannot be exclusively understood as the delivery of a number of expert cognitive and technical skills but should be considered as an integration of these concrete skills with an "inner attitude of caring" (Morrison 1991; Gastmans 1999). Although Gastmans (1999) argues that being committed to care for patients enables nurses to reach the "goal of nursing practice," he does not go as far as the managers here in suggesting that a lack of commitment to caring presents a direct risk to patients. However, he does argue that there is a risk that nurses will "lose sight of the patient as an individual and become fixated on 'the problem'"(p. 217). Moreover, nurses' commitment to their role has been shown to be associated with other organizational factors such as leadership, support, access to information, resources and opportunities (e.g., Laschinger et al. 2000).

3. *Over-dependence on senior nurses*: Nurses described an unspoken "rule" of the ward that all queries should be routed through the most senior nurse on shift, regardless of the nature of the problem (e.g., where the fax paper was kept) and the task that the senior nurse was currently involved in (e.g., medication round). Senior nurses claimed that they were "over-used" because of a long-standing belief of everyone entering the ward that senior nurses would "know the answer to everything." They added that while the role of senior nurse involved aspects of ward coordination, they were unable to fulfill this role effectively because staff shortages meant that they were also allocated a patient load.

It is possible that this over-reliance may sometimes be facilitated by senior nurses themselves. For example, junior nurses stated that senior staff often appeared unwilling to allow them to take on responsibilities because they said it was quicker to do it themselves. So, while they did not deny that an over-dependence existed, they maintained it was a deliberate attempt by senior staff to justify their higher position. This poor task delegation reported in previous research (Bowler and Mallik 1998) can result in junior nurses with low self-esteem who are unwilling to take on responsibility. Senior nurses interviewed in this study claimed the over-reliance on their skills and knowledge was not instigated by them and it was a hindrance to the efficient performance of their nursing duties (see also interruptions under "professional regard" tertiary theme).

Willingness to Challenge and Be Challenged

This secondary theme was defined as the perceived ability or confidence of health care staff to challenge the decisions of colleagues they believe to be incorrect and the openness of those individuals to act upon this contradictory advice. During interviews, both managers and nurses suggested that nurses were less likely to challenge decisions made by doctors and proposed two main reasons for this. Firstly, nurses suggested that there was a long-standing tradition of deference: "the doctor knows best." This can have a disempowering effect on nurses who feel it is not their place to question someone in a position of perceived power. Senior nurses suggested that there was a perceived "expertise gap" between doctors and nurses which ultimately affects the confidence of junior nurses *to challenge* doctors and affects the likelihood that doctors would be open *to be challenged* on their decisions by junior nurses. There was a suggestion that this unwillingness to challenge doctors was exaggerated further for nurses from different cultures (e.g., Philippines) where the status differential between nurses and doctors is perceived to be even greater. These propositions are consistent with existing evidence. For example, Sasou and Reason (1999) found "excessive professional courtesy" (e.g., "doctors know best") and "excessive authority gradient" (the real or perceived difference in power between two or more individuals) were significant predictors of failure to highlight and correct mistakes. Similarly, Mearns, Flin, and O'Connor (2001) postulate that where many subgroups interact with one another, it may be unclear within that organization exactly who has ultimate authority. These status differentials between nurses and doctors (Helmreich and Merritt 1998) make it virtually impossible for those considered lower status (by themselves or by others) to challenge their real or perceived superiors when they make errors.

By comparison, several managers suggested that nurses do not challenge mistakes that doctors make since they believe it is the doctors own responsibility and that of their own management (e.g., registrars and consultants) to monitor and question their behavior and decisions. Managers suggested that this was a deliberate distancing of responsibility (e.g., "it's not my job as a nurse to check doctors are doing everything right") by nurses for ensuing errors. Managers argued that this attitude to challenging potential mistakes would undoubtedly be affected by the relationship between nurses and medical staff on any given ward (see also *professional regard* subtheme).

Senior nurses and managers suggested that promoting an acceptable challenging climate on a ward partly relies on increased emphasis during

nursing and medical undergraduate training. Managers further speculated that improving communication between the different disciplines would improve nurse–physician relationships overall. Furthermore, senior nurses felt that challenging the decisions of others was a skill which could be learned like any other clinical skill. They believed that it was their responsibility to "lead by example" and demonstrate to junior members of staff the "right" way to challenge colleagues and other health professionals.

Nursing Insecurities

This theme is distinct from other secondary themes in the sense that it relates only to idiosyncrasies pertaining to nurses and, as such, is not driven or mediated by any other health professional. Nurses described feeling a constant pressure and awareness that they should prove their worth and was described in two main ways:

1. *Explicit proficiency*: This was described by nurses as the perceived need to prove their level of concrete skill and knowledge. Nurses described feeling that they must prove daily to other nurses that they have a good level of skill and expertise. This was thought to occur in a cyclical way. Senior nurses suggested that they were unlikely to seek advice from a nurse who was one or two grades below them for fear they would be judged as "unworthy" of their superior position and salary. They reported that they would feel "ashamed" to ask for help from a junior nurse, because they would be judged on something they should already know according to their grade. Similarly, junior nurses claimed that they would be unlikely to seek advice from senior nurses due to a desire for respect and a need to prove themselves. As a result of this "stand-off," both senior and junior nurses suggested they would sometimes rather take the risk of being wrong than ask for help.[1]
2. *Implicit proficiency*: This was described by nurses as the perceived need to prove their intrinsic ability to manage under pressure and that they were a "good" nurse. Both senior and junior nurses suggested that there was an unspoken expectation within nursing that each shift should start on a "clean sheet" without outstanding jobs from the previous shift. Nurses suggested that, because of this expectation, they would be likely to cut corners and speed up during tasks (including

the medication round) to appear to the next shift that they had managed their time well.

Although there is little published evidence on nursing insecurities, a number of studies of student behavior suggest that the avoidance of help-seeking may serve several functions: it prevents negative judgments such as "being dumb" (Ryan, Pintrich, and Midgley 2001) and maintains an image or reputation of expertise (Hicks 1997), thus protecting their perceived social status (Ryan, Hicks, and Midgley 1997).

Attitudes toward Reporting Mistakes

This secondary theme relates to the attitudes, held by various health professionals on a ward or unit, which govern the likelihood they will report errors. Surprisingly, managers did not cite reporting mistakes as an important precursor of future error. However, all nurses interviewed suggested that reporting climate was vital for understanding why the same errors occur repeatedly and for targeting appropriate interventions to prevent them. Nurses identified eight main reasons why reporting at a ward level might be reduced. These were as follows: being unsure of the definition of error, the unwillingness to report errors that did not cause harm, only reporting errors for which they were responsible, the burden of completing incident forms, the lack of confidentiality, a previous punitive experience following reporting, lack of feedback following incident reports, and a blame culture.

The barriers to incident reporting outlined above are supported in a number of studies that have identified factors that hinder incident reporting, including uncertainty surrounding the need to report less serious errors, no clear guidelines for who is responsible for reporting, lack of confidentiality, time taken to complete forms, and complexity (Lawton and Parker 2002; Uribe et al. 2002; Jeffe et al. 2004). In addition, the absence of feedback and the presence of a blame culture also make reporting less likely (Waring 2005).

Professional Regard

This secondary theme concerns the *implicit* inter-personal relationships between health professionals and the subsequent impact on providing safe patient care. This subtheme comprised two tertiary themes.

Nurse–Medic Relationship. Nurses referred to their relationship with medical staff as being a particularly important predictor of medication errors. Senior nurses suggested that junior nurses were not taken seriously by doctors who were more likely to act on the advice of a senior rather than junior nurse, even if that advice was the same. This relationship was described as having a knock-on effect on the confidence of junior nurses to challenge doctors' mistakes (*nursing attitudes toward challenging others*), which in turn leads to an over-reliance on senior nurses by junior nurses and the medical team (*general multidisciplinary ward beliefs*). All nurses reported that there were some doctors they were happy to work with and others in whom they had no confidence or rapport. Several nurses said that if they needed medical support or advice regarding a patient, they would rather wait for another doctor to come on shift than bleep the doctor with whom they did not have a good working relationship or a consultant who they thought might "snap their head off."

Stein (1967) describes the relationship between nurses and doctors as a "game" whereby nurses learn to show initiative and offer advice while appearing to "defer passively to doctor's authority." More recently Stein notes a deterioration of public respect for doctors and recognition of their "fallibility" and an increase in the number of female doctors and male nurses (Stein, Watts, and Howell 1990) which together with an expansion of university–based nursing degrees (Mackay 1993) may have altered the power relationships, making nurses less passive. Whether inter-disciplinary working relationships have improved over the years, there is evidence to suggest that where relationships are poor this has profound implications for patient safety. For example, in a review of the determinants of patient mortality, Tourangeau, Cranley, and Jeffs (2006) cite two studies which found that the hospitals with the highest patient mortality rates had the worst nurse–physician relationships (Knaus et al. 1986; Mitchell et al. 1989).

Agenda Conflicts. This tertiary theme represents the inter-disciplinary disparity in planning essential patient care activities to achieve the same goal. This theme was discussed as a manifestation of two main problems: lack of role insight and interruptions.

Role insight: Nurses suggested that although the aims of nurses, doctors, and other health professionals working in the hospital were essentially the same—to provide safe, timely, and effective treatment for patients—the methods that each discipline applies in order to achieve this goal was not

considerate of other disciplines. For example, the timing of the ward round to coincide with the drug round, and the resulting interruptions, could increase the number of medication errors. This lack of role insight may be due, in part, to the fact that members of health care delivery teams are generally educated separately without reference to other disciplines (West 2000). Others have argued that this "structural secrecy" (Vaughn 1996) can lead to an increased potential for errors when a task or information falls between the "gaps" in role responsibilities.

Interruptions: Interviewees claimed that interruptions to safety critical tasks are common on medical wards. Moreover, these interruptions appear to have become accepted practice over time and although the interviewees acknowledged that this was "poor practice," they suggested that it was the cultural "norm." The nature of these interruptions ranged from patients' visitors asking how their relatives were faring to a ward clerk asking where the fax paper was stored. All nurses emphasized that interruptions were frequent and a constant source of annoyance and stress.

In support of this finding, Wolf et al. (2006) found that, during clinical observations, nurses were interrupted mid-task on average 3.4 times per hour. This resulted in them changing focus from one patient to another an average of 9.1 times per hour (once every 7 minutes). In an observational study of 102 medication administration rounds, Biron, Lavoie-Tremblay, and Loiselle (2009) found that nurses were interrupted 374 times, at a rate of 6.3 work interruptions per hour. There is considerable evidence supporting a relationship between task distractions and errors (Mandler 1982; Rudolph and Repenning 2002; Pani and Chariker 2004).

Concluding Discussion

The primary aim of this article was to identify the latent failures that are perceived to underpin medication errors and to describe the way these latent failures manifest themselves in local working conditions. We describe one of these factors, ward climate, in detail, providing supporting evidence from both the transcripts and existing literature. Nine other latent failures were identified and defined during this work and are described in Table 1, with further details in the Appendices. While these factors were elicited during interviews focusing on medication errors, we would predict, based on the theory of organizational accidents (cf. Reason 1990, 2000), that these same failures might underpin the majority of errors and violations that occur on inpatient hospital

wards. This hypothesis requires further investigation, but, with the exception of bed management, the latent failures described here have been identified as contributing to patient safety incidents and adverse events in a variety of other domains such as operating rooms (e.g., Silen-Lipponen et al. 2005; Alfredsdottir and Bjornsdottir 2008), surgery (Gawande et al. 2003; Catchpole et al. 2006, 2007; Barach et al. 2008), anesthetics (e.g., Blike et al. 2005), and intensive care (e.g., Kopp et al. 2006). Moreover, the themes identified here provide empirical support for components of the existing "systems" models of patient safety. For example, this work helps elucidate the components of the Systems Engineering Initiative for Patient Safety model (Carayon et al. 2006) that are related to organization of work and the work environment. The work also expands on the categories presented within the London protocol (Taylor-Adams and Vincent 2004) and serves to define each of the failure types. Thus, the findings here provide an initial evidence base from which further work to understand the causes of error can build. The development of a theory of latent failures in hospital care (which can be informed by these findings) will be critical as we endeavor to build a model of how organizational-level patient safety interventions (e.g., bedside handovers, bar-coding, safety briefings) have their effect.

Limitations

Inevitability, the list of latent failures is based on self-reports and therefore they cannot be regarded as definitive. Neither can this model provide any notion of causation, that is, the direction of the association between latent factors or their importance in contributing to error. For example, staff suggested that the ward climate had a general impact on other organizational factors. However, it is equally plausible that local working environments (e.g., where equipment is unavailable, staff cannot attend for training or leadership is poor) will have an impact on the climate of the ward/unit. The findings of this research provide a basis for further empirical research to measure these factors, test the relationships between them, and to test causation through experimental interventions that target particular failures.

Practical Implications

The findings here have several implications for policy and practice. First, knowledge of these latent failures could be used to inform measurement for patient safety at the organizational level. In other words, the development of

indicators (e.g., questionnaire items) that allow the measurement of these failures will provide another means by which safety in organizations can be assessed. This approach has been adopted in other high hazard industries and integrated into error management systems (Reason 1997; Helmreich 2000).

Knowledge of these latent failure types could also be used as the basis for the improvement and design of incident reporting systems. Those responsible for making an incident report could be asked to rate the extent to which each of the latent failures contributed to the incident. Over time, this would facilitate an understanding of the organizational factors that are most frequently implicated in incidents and which should be a target for intervention and improvement.

ACKNOWLEDGMENTS

Joint Acknowledgment/Disclosure Statement: This research was funded by an ESRC (Case) studentship. The external funding partner were Bradford Institute for Health Research, Bradford Royal Infirmary, UK, and we would like to acknowledge their generous contribution to this research.We would also like to acknowledge the advice and guidance provided by Gerry Armitage during this project. Thanks go to the nurses and their managers for volunteering their time to support this research.

Disclosures: None.

Disclaimers: None.

NOTE

1. Although at first sight this may appear to contradict the "reliance on senior nurses" theme above, it does not. Junior nurses are happy to ask a senior nurse about aspects of the organization of care, planning, etc. However, they are much less likely to ask about some clinical or technical aspect of a patient's care.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.
Appendix SA2: Example Vignette.
Appendix SA3: Description of Nine Remaining Themes.

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