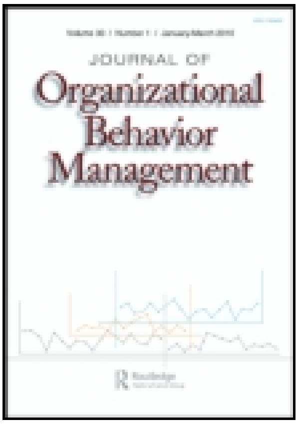

Journal of Organizational Behavior Management
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/worg20

A Comprehensive Approach to Identifying Intervention Targets for Patient-Safety Improvement in a Hospital Setting

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Journal of Organizational Behavior Management, 32:194–220, 2012

ISSN: 0160-8061 print/1540-8604 online
DOI: 10.1080/01608061.2012.698114

A Comprehensive Approach to Identifying Intervention Targets for Patient-Safety Improvement in a Hospital Setting

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Despite differences in approaches to organizational problem solving, healthcare managers and organizational behavior management (OBM) practitioners share a number of practices, and connecting healthcare management with OBM may lead to improvements in patient safety. A broad needs-assessment methodology was applied to identify patient-safety intervention targets in a large rural medical center. This included a content analysis of descriptions of managers' follow-up actions to error reports for nine types of the most frequently occurring errors. Follow-up actions were coded according to the taxonomy of behavioral intervention components developed by Geller et al. (1990). Two error types were identified as targets for intervention, and the outcome of this assessment process indicated a clear need to apply OBM interventions at the management level and thus have a hospital-wide benefit to patient safety. Future implications for using a system-wide approach to identifying and classifying responses to medical error are discussed.

KEYWORDS patient safety, medical error, Organizational Behavior Management

For Organizational Behavior Management (OBM) to have a large-scale impact on patient safety, a broader approach to assessment is needed in

The authors are grateful to Remmie L. Arnold and Phillip A. Randall for their valuable assistance in data collection. Thomas R. Cunningham is currently affiliated with the National Institute for Occupational Safety and Health but was affiliated with Virginia Polytechnic Institute and State University during the writing of this article.

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addition to the traditional paradigm of identifying behavioral targets from the problem descriptions of managers and administrators. Patient safety is "the prevention of healthcare errors, and the elimination or mitigation of patient injury caused by healthcare errors" (National Patient Safety Foundation, 2005). More simply, the Institute of Medicine defines patient safety as "freedom from accidental injury" (Kohn, Corrigan, & Donaldson, 2000). By approaching patient-safety challenges from a broader or systems-based viewpoint, OBM practitioners may be able to identify process-related targets for intervention that will have a greater overall impact than targeting and measuring success in terms of specific behaviors of front-line healthcare workers (HCWs). That is, focusing on one specific frontline behavior at a time is not likely to maximally impact patient safety. However, training managers to identify a problem and provide ongoing feedback to subordinates on their behavior related to that specific problem may lead to large-scale improvements in patient safety.

A DISCONNECT BETWEEN OBM AND THE MANAGEMENT OF HEALTHCARE

OBM has been successful in several diverse sectors of industry (Geller, Eason, Phillips, & Pierson, 1980; Komaki, Barwick, & Scott, 1978; Komaki, Heinzmann, & Lawson, 1980; Sulzer-Azaroff & de Santamaria, 1980; Zohar, Cohen, & Azar, 1980), including healthcare (Alavosius & Sulzer-Azaroff, 1990; Babcock, 1992; Cunningham & Austin, 2007; Devries, Burnette, & Redmon, 1991; Geller & Johnson, 2007; Stephens & Ludwig, 2005). However, healthcare managers do not seek out and use OBM. Instead, a select few healthcare managers receive the attention of the few behavior analysts addressing organizational health and safety issues. Additionally, there is limited attention in medical journals to performance topics relevant for OBM. Thus, most successful applications of OBM solutions to healthcare challenges are published in the domain of behavior analysis, which healthcare decision makers are less likely to read than medical journals. OBM offers several possible solutions, but there is a lack of convincing demonstrations of ways to deliver the message to a wide audience (Geller, 2002).

OBM intervention methods have been used to achieve significant patient-safety improvements, and national media attention has subsequently followed (Gawande, 2007). For example, implementing a critical-behavior checklist intervention in hospital intensive-care units resulted in major reductions (up to 66%) of catheter-related infection rates (Pronovost et al., 2006). The findings of this study were widely reported in several publications; however no reference was made to OBM or related literature. Rather, the checklist is referred to as an evidence-based intervention adopted from aviation safety training (Pronovost et al., 2006).

In another widely-publicized demonstration, implementing a surgical-safety checklist resulted in significant reductions in morbidity and mortality rates, and evaluation included direct observation of critical behaviors before and after checklist implementation (Haynes et al., 2009). These authors reference only the recent use of medical checklists as rationale for their intervention design; and they refer to the Hawthorne Effect as improvement in performance due to awareness of being observed (Mayo, 1933). Although the reference to the Hawthorne Effect can be misleading, as the finding reported in the original research was not an observation effect but resulted from feedback (Parsons, 1974), these significant improvements in patient safety are clearly informed by behavioral science. Yet OBM is not included among the disciplines identified as leading to these improvements.

Additionally, the standards of valid evidence differ between the fields of medicine and OBM. In medicine, the results of randomized, controlled trials are considered to be confirmation of the highest grade, whereas behavior-observational studies are viewed as having less validity because they reportedly overestimate the effects of treatment (Concato, Shah, & Horwitz, 2000). Conversely, in OBM research the multiple-baseline design with nonequivalent controls is often used to demonstrate the impact of a treatment (Baer, Wolf, & Risley, 1968).

Relevance of OBM

Despite clear differences in research paradigms, healthcare managers and OBM practitioners share a number of practices. More specifically, healthcare managers often use OBM intervention techniques in response to errors. However, the application of OBM technology does not necessarily include understanding the principles of behavior management. A common manager response to a reported medical error is to inform the person(s) involved that they contributed to potential patient harm. At a minimum, this could be considered a form of feedback. Yet it is not behavior-specific, and there is no corrective action necessarily planned. Simply telling employees that their behaviors may have contributed to an error might lead to prevention of the same mistakes in the future, but OBM offers methods for boosting the prevention potential of a manager's response to a reported error. Thus, healthcare managers could benefit from greater awareness and appreciation of OBM intervention tactics as a means to maximize the impact of their efforts to improve patient safety.

It is difficult, however, to realize the full potential of applying OBM techniques to patient safety without a clear starting point. For this presentation, a patient-safety needs assessment was conducted to identify optimal targets for intervention relevant for improving patient safety in a hospital setting. This analysis aimed to show how a broad approach to identifying patient-safety intervention targets can be integrated with traditional OBM intervention methods, and thus provide an example for connecting OBM to the management of patient safety.

In taking a broader approach to identifying patient-safety targets, hospital leaders should use cross-level input from ongoing audits, suggestions, and incident reports (Geller & Johnson, 2007). While directives and performance goals can be useful in initiating patient-safety priorities at the hospital level, the most important needs of a particular hospital are best identified with input from HCWs at that site, in addition to a review of multiple data sources. By soliciting input across levels, managers can increase feelings of empowerment and ownership among HCWs (Geller, 1996), and at the same time gain key indicators of relevant proxies for assessing patient safety and designing intervention strategies. Indeed, a patient-safety needs assessment should be conducted prior to the selection of both an intervention target and an improvement technique.

Selecting Intervention Targets

The key to maximizing HCW effectiveness in delivering patient safety is to target the proper behavior for change. Yet OBM practitioners often find it easier to assume the critical behavior is known rather than to determine intervention targets on an empirical basis (Frederiksen & Riley, 1984). This concern was raised recently in the *JOBM* special issue calling for more of a systems-oriented approach in OBM. As Hyten (2009, p. 92) notes "the behavioral approach . . . too often ignores critical aspects of context when applied to organizational settings." Primarily, OBM interventions are applied to needs already identified within an organization, and the means by which these needs are determined vary across applications.

Valuable assessment tools for defining behavioral targets are available for OBM practitioners, such as the A-B-C analysis and the performance diagnostic checklist (Austin, 2000). However, these tools are most useful when a particular problem area has already been identified. Plus, a number of potential biases could lead one to select a target behavior, which may not be linked with the greatest patient-safety need of a given hospital.

For example, after consulting with an infection-control manager, one would likely select target behaviors associated with particular infection-related outcomes, even though this may not be the most critical target for large-scale patient safety. It could be the case that other types of errors are not being reported, or not being reported accurately, and thus a more crucial and widespread patient-safety improvement target could be missed. A more broad and comprehensive needs assessment protocol could aid the selection of intervention targets with the greatest potential for patient-safety improvement. In other words, for optimal large-scale results, patient safety should be viewed with a wide-angle assessment lens.

Witkin and Altschuld (1995) developed a highly adaptable and simplified needs-assessment approach, suitable for adaptation at a specific hospital. Health and mental health services are among the domains suggested for this approach, which also includes business and industry, education, and community planning (Witkin & Altschuld, 1995). Critical reviews of the needs-assessment literature have also concluded this particular needs-assessment process is most useful for broad application with organization- and focus-specific customization (Leigh, Watkins, Platt, & Kaufman, 2000).

The basic protocol for this approach involves three phases: (a) preassement, (b) assessment, and (c) postassessment, which we consider *intervention planning* in our process. The first phase consists of exploring the general purpose of the needs assessment and establishing a management plan. The second phase involves the actual data collection. The third phase is devoted to utilization of the data to develop an action plan for implementing solutions. Thus, from the OBM perspective, this phase represents intervention planning.

Given the overlap of practices among healthcare managers with the evidence-based methods of OBM interventions, intervention activities relevant to patient safety should be included in a comprehensive assessment of patient-safety needs. The assessment of OBM intervention components is often best informed by experimental analysis (Austin, Carr, & Agnew, 1999). That is, the best combination of intervention components for a particular application is derived by within-subject comparisons, and not necessarily known a priori. Although the differential comparison of intervention components for general application is not well-developed in OBM, the assessment of ongoing interventions may be informed by the complete taxonomy of behavior-change techniques developed by Geller et al. (1990) and further refined by Ludwig and Geller (2001). This taxonomy was originally developed to define intervention techniques for increasing safe-driving practices among professional drivers. However, as described below, it provided a critical component for a comprehensive approach to assessing patient-safety needs within the OBM paradigm.

The current analysis applied the Witkin and Altschuld (1995) approach to the identification of patient-safety needs within a hospital, and the following description is structured from their basic model of needs assessment. This needs assessment included an analysis of managers' follow-up responses to reported medical errors, based on a taxonomy of behavior-change interventions (Geller et al., 1990; Ludwig & Geller, 2001). The needs assessment was intended to maximize the potential of an OBM intervention to benefit the overall patient safety of a hospital by taking an empirical approach to problem identification, and the assessment process evolved to include the classification of ongoing management practices related to OBM technology.

METHOD FOR THE PATIENT-SAFETY NEEDS ASSESSMENT

Participants and Setting

The location for this study was a 150-bed, privately owned, community hospital located in southwest Virginia. This location was selected based on convenience, as well as the lack of any previous experience with the current research team. The 639 participants were all hospital employees participating in various processes of patient care, including clinical staff (e.g., registered nurses, patient care assistants, techs, and 47 hospital managers).

Phase 1: Preassessment

METHOD

At an initial meeting with a physician administrator in the Department of Medical Affairs, the first author outlined an OBM approach to patient safety based on previous literature reviews and data from previous hospital-safety studies he had directed (Cunningham & Austin, 2007; Cunningham, Geller, & Clarke, 2008). Additionally, a five-phase action plan was introduced, including (a) preassessment, (b) assessment, (c) intervention planning, (d) intervention, and (e) evaluation.[1]

The first phase of the needs assessment was aimed at exploring the possibilities for directions of the needs assessment. The initial task of this phase was to establish a management plan for the needs assessment. In order to manage this needs assessment, as well as the remainder of the project, specific contacts within the hospital were identified. This included, but was not limited to, individuals responsible for quality management and for clinical effectiveness.

The Clinical Effectiveness Director was identified as the principal contact person. A physician was also named to serve as a research supervisor and to provide endorsement for hospital institutional review-board purposes. Institutional Review Board (IRB) approval was also granted by both the hospital and the University at this time.

In this initial phase, it was crucial to define the overall purpose of the needs assessment. From the outset of this collaborative study, it was agreed the focus of the needs assessment was to identify critical target behaviors with the greatest potential for enhancing overall patient-safety.

Given the focus of the needs assessment, hospital personnel were able to identify some major need areas and issues. This task was carried out over the course of two meetings with the relevant contact persons within the hospital, including the Clinical Effectiveness Director, Risk Manager, and

[1] Results of the intervention and evaluation phases that followed the approach reviewed here are reported in Cunningham and Geller (2011) and are available upon request at E-mail: hul6@cdc.gov.

Infection-Control Nurse. These individuals already had some ideas about the most important patient-safety issues at their hospital, which included the "safety culture," event reporting,[2] patient falls, patient identification, and infection control.

The next step was to determine (a) data to collect, (b) data sources to use, (c) methods of data collection, and (d) potential uses of the data. It was decided the data to examine would include error reports, referred to in this hospital as patient-safety event reports. These data were selected because they were drawn from all departments throughout the hospital. The hospital defined a patient-safety event as any activity inconsistent with the routine operation of the facility, care of a patient, or with policies and procedures; any accident, or circumstances, which may cause an accident; significant inappropriate behavior of hospital staff, physicians, patients, or visitors; and/or any critical event.

Reporting guidelines specified an event report should be completed in the following cases: (a) a deviation from standard practice, behavior, or policy that creates an immediate or eminent risk to patients, staff, or visitors; and (b) an unexpected occurrence, with or without patient/visitor injury, which should be reviewed to determine if all standard practices were used. Incentives for completing a report included avoidance of reprimand and/or further disciplinary actions for lack of compliance with hospital policy, as well as possible praise from managers. Formal definitions of event-type categories were not provided within the hospital's reporting guidelines. However, event-report forms included a checklist from which individuals reporting a patient-safety event could select the most appropriate label for the event being reported, and the category labels included language commonly understood among healthcare personnel. The report format also included open-ended written descriptions of the event and follow-up actions taken by managers. Although a category selection and written description were required, there were no criteria specified regarding the quality of the written descriptions.

Event reports were first collected by managers and then forwarded on to the risk management department for review and database entry. The task of gathering data for needs identification mainly included retrieving printed reports of the selected error types from the risk-management information specialist. This presented a unique technological limitation, as a review of error data could have been conducted much more efficiently with access to the patient-safety event-reporting system.[3] However, due to policy

[2] In this particular hospital, process-based errors were referred to as patient-safety events. Event, patient-safety event, error, and medical error are used interchangeably throughout this discussion article.

[3] The reporting system used at this hospital was a RiskMaster reporting system whereby employees' handwritten reports were transcribed into the electronic database by the risk management information specialist.

restrictions at the hospital, the reporting system was not available for direct access by the research team. This is understandable, given the sensitivity of the data examined. All data requests were filled by the risk-management information specialist with an approximate lag time of one to four days.

Printed sets of patient-safety event reports and accompanying descriptions of managers' follow-up actions were obtained in hard copy form from the risk-management information specialist. Reports were organized by event type and included all event reports and follow-up descriptions from January 2007 through May 2008. The printed reports included the following fields: event indicator (the code for event type), event date, event number, and event description (which included descriptions of managers' follow-up actions). For purposes of privacy protection, all patient and employee identifying information were removed.

Additional data to collect and their sources included patient-safety culture-survey data from two annual surveys previously administered, infection-control data from annual reports, and data-based performance improvement goals from the annual hospital-wide Performance Improvement Report for 2007, previously prepared by the risk manager. Patient-safety culture data were collected from electronic versions of two annual reports of results for the *Hospital Patient Safety Culture Survey* (Sorra & Nieva, 2004), provided by the clinical-effectiveness director, as well as annual reports provided in printed documents by the risk manager. The methods of data collection and applications of these data are further detailed below as they evolved over the duration of Phases 2 and 3.

Outcomes

The outcomes of Phase 1 included a preliminary plan for Phases 2 and 3, and a plan for evaluating the needs assessment. The necessary copies of each data source were provided by the appropriate contact persons during individual meetings over a period of approximately one month. Data were then reviewed and analyzed by the first author and two trained assistants during Phase 2 over a period of approximately three months. Evaluation of the needs assessment consisted of providing answers to the following questions: Did we identify one or more targets with a strong potential for intervention impact? Were targets identified using multiple data sources? Do the priorities for medical error prevention identified in this particular setting resemble those determined nationally with epidemiological data by authoritative sources such as the Joint Commission?

Phase 2: Assessment

Method

The second phase of the needs assessment focused on archival data analysis. First, it was necessary to determine the context, scope, and boundaries of the needs assessment. Given the focus to identify hospital-wide targets for error prevention, it was determined that several of the most frequently reported patient-safety event types should be reviewed. One full year of reports for the selected error types was included in the review sample. These criteria were chosen to capture a majority of events reported, yet retain the practical distinction of a limited number of error types.

As noted above, event-report forms included a checklist from which individuals reporting a patient-safety event could select the most appropriate label for the event being reported. Thus, patient-safety event types could be defined as categorizations of the hospital definition of a patient-safety event provided in the Phase 1 section above.

The number of categories of events selected for review was determined according to those which occurred at a frequency of 50 or more in one year. A cursory review of the total number of events reported in each event category revealed nine event types with 50 or more reported occurrences in one year, with the next-highest-ranking category including only 29 reported events. Additionally, it was determined the patient-safety culture survey data for two years should be reviewed to establish potential trends in cultural changes and identify dimensions of the patient-safety culture in need of improvement.

The patient-safety event-reporting system was determined to be the most widely-reaching source for assessing patient-safety needs at the organizational level. Annual reports and culture-survey results were useful references for general areas of concern, but not for identifying potential behavioral intervention targets. Additionally, the infection-control data did not result from processes occurring hospital-wide, as did the other data sources, and were therefore considered too narrow of an indicator of patient-safety needs at the organizational level.

The bulk of the analysis consisted of what Witkin and Altschuld (1995) refer to as performing causal analyses at Levels 1, 2, and 3. In this application, the levels of relevance included Level 1—patients, or those affected most directly by patient-safety events; Level 2—caregivers, or those most proximally responsible for influencing patient-safety outcomes; and Level 3—the hospital as an organization.

The annual reports and culture-survey data were used to identify general themes for areas of need, while the most detailed analysis came from the patient-safety event-reporting system. These data were used to identify the most frequently occurring types of events, behaviors most commonly contributing to errors, and associated variables such as location or unit, type of process involved, time of day or shift, and employee title. Event-report data also served as baseline measures to gauge the impact of subsequent interventions.

In prioritizing need areas, Witkin and Altschuld (1995) suggest beginning with Level 1. Prioritizing needs begins at this level because the impact of interventions on patients is the most important directive. However, while outcomes are prioritized at this level, the purpose of this application of a needs assessment was to identify behaviors contributing to Level 1 outcomes. Thus, while outcomes at Level 1 were the priority in this study, processes occurring at Levels 2 and 3 are more likely to be identified as areas in need of an OBM intervention process. Given the OBM perspective of this study, analyses aimed to answer the following question: What are critical behaviors of patients and caregivers leading to the most frequent, most harmful, and most preventable types of medical error, and how does the hospital facilitate or inhibit these behaviors?

By this needs assessment the research team attempted to detect problem behaviors related to medical error recurring in a pattern, discernible from archival verbal reports of behavior. However, the review of event-report data revealed a lack of distinctive behaviors related to specific types of errors. Event reports were written with varying degrees of detail, often without clear descriptions of specific HCW behaviors contributing to errors. Thus, specific behaviors causing many of the errors could not be readily identified. This prohibited intervening on a set of critical behaviors that would be predicted to significantly impact specific patient-safety outcomes. However, it was still possible to detect patterns of reported behavior that could be key contributors to patient safety by shifting the focus of analysis to managers' responses to reported patient-safety events.

Analyzing and synthesizing all of these data consisted of (a) identifying patterns and trends in patient-safety event reports, and (b) summarizing content from this principle data source. Table 1 depicts patient-safety event categories identified as the most frequently reported during a 17-month period. The frequency of occurrence (n) of each event category is indicated.

OUTCOMES

The outcomes of the assessment phase consisted of criteria for action based on high-priority needs. Nine patient-safety event categories were

TABLE 1 The Nine Most Frequently Reported Patient-Safety Event Categories

Patient-safety event category	n
Procedure or treatment variance	303
Unwitnessed falls	198
Medication (other)	177
Medication omission	135
Policy or practice (other)	133
Witnessed falls	86
Patient identification	70
Medication wrong dose	66
Policy or practice documentation	63

identified as occurring more frequently than any other event category and thus offered several types of errors to target for intervention. Additionally, the Performance Improvement Annual Report prepared by the hospital risk manager identified patient-fall events and patient-identification events, to be related specifically to the National Patient Safety Goals (Joint Commission, 2008) in the assessment phase, and these were among the event categories identified as potential intervention targets. Furthermore, the data from the patient-safety culture survey indicated nonpunitive responses to errors, and the nonreporting of patient-safety events were among the dimensions of patient-safety culture most in need of improvement.

A surprising finding of the assessment phase was that among the nine most frequently reported patient-safety events, it was not possible to identify critical behaviors among those HCWs in direct contract with patients that could be targeted for intervention on a hospital-wide level. However, it was evident that managerial behaviors in response to reported patient-safety events had the potential to impact nearly all clincal staff members throughout the hospital at various points in time. Managers' insufficient or ineffective corrective actions in response to patient-safety events hence represented an area with much room for improvement with hospital-wide implications.

Phase 3: Intervention Planning

Method

The third and final phase of the needs assessment focused on using the information gained in Phase 2 to develop an action plan for addressing high-priority patient-safety events. First, it was necessary to set priorities on these error types at all applicable levels, based on the outcomes of Phase 2.

At Level 1, the priority was to identify the types of errors causing the most potential harm to patients. The nine types of events occurring most often (see Table 1), were considered a proxy for potential harm, and thus were given top priority as potential intervention targets.

At Levels 2 and 3, the prioritizing of needs consisted of identifying processes contributing to the most frequently occurring types of errors. At Level 2, managers were influencing HCW behavior via ineffective or insufficient follow-up to errors. At Level 3, the organization was influencing how managers shape HCW behavior via policies for managing reported patient-safety events. Across both Levels 2 and 3, dimensions of the patient-safety culture influenced the behaviors of HCWs and managers.

Given the errors and relevant contributing behaviors that were revealed, several potential intervention techniques were considered. It would have been ideal to have found several critical HCW behaviors associated with specific error types. This would have enabled the application of an OBM framework to address medical error with evidence-based behavioral interventions (Cunningham & Geller, 2008). However, as explained above, this was not possible. Instead, a method for addressing the identification and improvement of existing management responses to reported patient-safety events was deemed necessary.

To identify and improve existing management responses to errors from an OBM perspective, a comprehensive list of behavioral intervention techniques was needed. Research on improving road safety provides a useful tool for differentiating among the various intervention techniques available (Geller et al., 1990; Ludwig & Geller, 2001). The application of this taxonomy of behavior-change interventions is detailed below. The intervention planning developed from this needs assessment included the identification and coding of various forms of OBM intervention techniques currently being used by hospital managers in response to reported patient-safety events across the nine most frequently reported types of patient-safety events identified above. This represented an adaptation of content-analysis methodology to identify OBM interventions.

After this OBM content analysis of managers' follow-up action reports, intervention targets could be selected based on the least effective management follow-up responses and the most frequently occurring error types. Obviously, the most frequent error type was not necessarily followed by the worst follow-up. By considering the most frequently reported patient-safety event and the error type with the least effective management follow-up responses, intervention efforts could target not only the least effective follow-up responses, but also the most frequent occasions for follow-up responses.

OBM content analysis

In order to identify and quantify the various forms of OBM intervention techniques currently being used by hospital managers in response to reported patient-safety events, a content analysis of 17 months of patient-safety event reports was conducted across the nine most frequently reported types of patient-safety events revealed in the needs assessment described above. The methodology used for the content analysis was based on established methods (Neuendorf, 2001) and required incorporating a content analysis method along with the functional assessment approach of OBM (Austin, 2000).

The goal of a functional assessment is to determine what features of a targeted environment are serving to maintain the undesired behavior(s). In this case, managers' responses to errors (or lack thereof) can be viewed as a feature of the environment that influences the occurrence of HCWs' desired or undesired behaviors related to patient safety. Thus, analyzing the content of descriptions of managers' actions taken in response to reported errors served to identify factors that influence those HCW behaviors relevant to patient safety.

Research assistants were trained to code intervention types based on brief definitions of 24 different techniques to motivate behavior change (coded as "1" through "24"; see Table 2 for a list of the behavior-change techniques and definitions from Geller et al., 1990[4]). This list of definitions served as a codebook (Neuendorf, 2001) providing a set of complete and unambiguous definitions used to minimize discrepancies among coders. These definitions were applied to the content of the printed text describing event-report follow-up actions by managers.

Intervention codes

The main variables of interest in this study were the intervention types used by managers in response to reported patient-safety events. The intervention codes were based on Geller and colleagues' (1990) taxonomy of behavior-change intervention techniques (see Table 2).

Following the content analysis methodology described above, the research team conducted coder training with open discussion. This consisted of the team reviewing a set of event reports together and discussing the appropriate intervention codes to assign. Next, the assistants practiced coding together while engaging in consensus-building discussion.

Based on consensus discussions, the codebook was revised to include codes not included in the original list of 24 intervention techniques. These additional intervention codes included (a) no intervention (coded as "0"), (b) environmental alteration (coded as "25"), and (c) referral to another committee or individual for follow-up (coded as "26"). Definitions for the additional intervention codes are included in Table 2.

Each report of a patient-safety event was reviewed independently by two trained research assistants who assigned one or more intervention codes to each description of the managers' follow-up actions in response to the reported event. Each research assistant was supplied with a complete set of printed event reports to allow for independent coding. The assistants recorded intervention codes in the margins of printed report copies. These codes were later entered into an electronic database, along with the associated event numbers, dates, and indicators. All database entries were verified by independent research assistants.

Each database entry represented a single patient-safety event, associated identifying data (event number and date), and all intervention actions taken by managers in response to the event. Thus, a single entry could include one or more intervention codes.

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[4] The original form of this taxonomy (Geller et al., 1990) was selected instead of more recent versions of the taxonomy (e.g., Ludwig & Geller, 2001) because the revisions added self-initiated interventions (i.e., self-observation and self-reward), which could not be assessed through patient-safety event reports.

TABLE 2 Taxonomy of behavior-change techniques based on Geller et al. (1990)

Behavior-change technique	Intervention code	Definition
Passive communication		
Lecture	1	Unidirectional oral communication by an agent concerning the rationale and purpose for behavior change and subsequent intervention. Target subjects are told what behaviors are in their best interest.
Demonstration	2	Modeling or acting out appropriate performance or behavior for target subject(s).
Policy	3	A written document communicating the standards, norms, or rules for appropriate performance or behavior within a given context.
Active communication		
Commitment	4	A written or oral pledge or promise by a subject to perform or behave in specific way or to attain a certain goal.
Discussion/ consensus	5	Bidirectional oral communication between agents or facilitators of an intervention program and the subjects targeted by the intervention. Communication focuses on generating consensus regarding the particular behavior change technique(s) or program.
Intervention agent	6	When a person promotes the desired behavior among other individuals.
Activators		
Written activator	7	A written communication that attempts to prompt or activate desired performance or behavior.
Oral activator	8	An oral communication that attempts to prompt desired performance.
Assigned individual goal	9	An intervention agent decides for an individual the level of desired behavior he or she should accomplish by a certain time.
Personal goal	10	An intervention agent encourages an individual to decide the level of desired behavior he or she should accomplish by a specific time.
Competition	11	An intervention that promotes competition between individuals to see which person will accomplish the desired performance level first (or best).
Incentive	12	An announcement to an individual in written or oral form of the availability of a reward that is dependent upon the occurrence of a desired behavior by the individual, according to a contingency defined by the agent(s) of the intervention.
Disincentive	13	An oral or written announcement to an individual specifying the possibility of receiving a penalty contingent upon the occurrence of a particular undesired behavior. The contingency is defined by the agent(s) of the intervention.
Group activators		
Assigned group goal	14	An agent decides for a group the level of desired performance the group should accomplish by a certain time.

(*Continued*)

TABLE 2 (Continued)

Behavior-change technique	Intervention code	Definition
Team goal	15	An agent encourages group members to decide for themselves (i.e., come to a consensus) the level of desired performance that the group should accomplish by a specific time.
Competition	16	An intervention that promotes competition between specific groups to see which group will accomplish the desired performance level first (or best).
Incentive	17	An oral or written announcement to a group specifying the availability of a group reward that is dependent upon the occurrence of desired group performance, according to a contingency defined by the agent(s) of the intervention.
Disincentive	18	An oral or written announcement to a group that specifies the possibility of a penalty contingent upon the occurrence of undesired group behavior. The contingency is defined by the agent(s) of the intervention.
Individual consequences		
Feedback	19	Presentation of either oral or written information to an individual concerning his or her level of performance regarding desired or undesired behavior.
Reward	20	Either the presentation of a "pleasant" item or event to an individual emitting a desired behavior, or the withdrawal of an "unpleasant" item or event from an individual for emitting a desired behavior.
Punisher	21	Either the presentation of an "unpleasant" item or event to an individual emitting an undesired behavior, or the withdrawal of a "pleasant" item or event from an individual for emitting an undesired behavior.
Group consequences		
Feedback	22	Presentation of either oral or written information to specific group concerning the participants' level of performance regarding desired or undesired behavior.
Reward	23	Either the presentation of a "pleasant" item or event to a group or team emitting collectively a desired level of performance, or the withdrawal of an "unpleasant" item or event from a group or team for emitting collectively a desired level of performance.
Punisher	24	Either the presentation of an "unpleasant" item or event to a group or team emitting collectively an undesired level of performance, or the withdrawal of a "pleasant" item or event from a group or team for emitting collectively an undesired level of performance.
Additional intervention codes		
Environmental change	25	An intervention agent alters the physical environment to either eliminate undesired behavior or to enable desired behavior.
Referral	26	An intervention agent refers a reported incident to another individual or committee.
No follow-up intervention	0	An intervention agent takes no corrective action.

Reliability

The interrater reliability of the content analysis data collection was checked by comparing independent database entries for both independent coders on 100% of the observations. Thus, interrater reliability was obtained for all of the observations because the qualitative nature of the content analysis methodology presented difficulty in adhering to standard methods of obtaining reliable observations in behavioral research. That is, the development of the innovative approach used here could be improved by rigorously assessing the reliability of the data-collection process.

The more senior research assistant was designated as the primary coder, and the other assistant was the reliability coder. The frequency that two independent coders agreed and disagreed on each particular intervention code was totaled and a percentage of agreement was calculated for each intervention code across each of the patient-safety-event categories. This allowed for the calculation of interrater reliabilities on each type of intervention coded across each of the patient-safety-event categories.

Additionally, in order to account for coding discrepancies, a minimal agreement method was used to calculate interrater reliability. For the minimal agreement calculation, each patient-safety-event entry was counted as an agreement if one or more intervention codes assigned by the primary coder matched one or more intervention codes assigned by the reliability coder. The frequency that two independent observers agreed and disagreed was totaled, and a percentage of agreement was calculated. Following calculation of reliability statistics, all entries found to be in minimal disagreement were reviewed by the first author and revised based on consensus with one or more of the data coders.

NEEDS ASSESSMENT RESULTS

Reliability and Intervention Types

A total of 1,231 patient-safety event reports were included in the needs assessment data analyses, with 1,417 intervention codes identified among the event reports reviewed. Initial reliability data indicated 69% overall interrater agreement on 100% ($n = 1{,}417$) of intervention codes. Initial reliability calculations indicated adequate levels of interrater agreement for the three intervention types coded most often across each of the nine most frequently reported patient-safety events (82% of 1,417 interventions coded), including "no intervention" (coded as "0"; agreement = 83%, range = 67%–91%, $n = 595$), individual feedback (coded as "19"; agreement = 77%, range = 39%–92%, $n = 358$), and group feedback (coded as "22"; agreement = 80%, range = 22%–100%, $n = 207$).

Additionally, reliability data indicated 79% minimal agreement on 100% ($n = 1{,}231$) of the follow-up descriptions to patient-safety event reports (see Table 3 for a complete listing of these reliability data, as well as number of each intervention type coded and the number of manager responses reviewed across each patient-safety event category). The intervention codes listed in Table 3 are defined in Table 2.

Reliability data indicated low levels (0%–42%) of interrater agreement on 12 of the other 13 intervention types coded, which were coded 56 times or fewer each, and moderate levels of agreement (65%, $n = 20$) on referral intervention codes. These 13 intervention codes accounted for only 18% ($n = 255$) of the interventions observed and were not reliably coded due to possible overlap with similar intervention codes. For example, in coding a particular follow-up intervention for a patient-safety event the primary coder observed a policy intervention (coded as "3"), while the reliability coder observed a lecture intervention (coded as "1").

Selected examples of language included in managers' descriptions of their corrective actions taken in response to reported patient-safety events, and the intervention codes assigned to these manager responses, are provided in Table 4. Examples include each of the three intervention types coded most often, a manager response that included multiple interventions, as well as an example of an ambiguous description that was difficult to code reliably.

Additionally, complete disagreements of intervention codes per event follow-up description were revised according to consensus. Based on these analyses of reliability and subsequent revisions of interventions coded for event follow-up responses found in complete disagreement ($n = 258$ follow-up descriptions), the data gained from the content analysis were judged to adequately represent managers' responses to patient-safety events.

Intervention targets

Among the nine most-frequently reported categories of patient-safety events, baseline data analyses indicated procedure/treatment variance was reported most often ($n = 303$; see Table 1 for a list of the total number of events reported across each of the nine most frequently reported patient-safety events), and witnessed falls were associated with the least effective management responses. Managers responded to 61% of witnessed fall events with no intervention and never used a group feedback intervention (see Table 5 for a list of overall relative frequencies of feedback vs. no interventions used for each of the nine most frequently reported patient-safety event types). Thus, managers' follow-up responses to these two relatively-frequent error types were identified as potential targets for intervention.

TABLE 3 Reliability Indices for Each Managers' Response Coded by Intervention Type for Each Patient-Safety Event Category

	Manager responses to patient-safety events									
Int. code	Procedure or treatment variance	Patient fall witnessed	Patient fall unwitnessed	Med. omission	Med. (other)	Med. woring dose	Patient identification	Policy or practice (other)	Policy or practice documentation	Total
0	0.80 (153)	0.91 (54)	0.85 (104)	0.90 (59)	0.80 (85)	0.67 (21)	0.83 (18)	0.83 (82)	0.89 (19)	0.83 (595)
1	0.00 (7)	—	—	0.00 (1)	0.00 (2)	1.00 (1)	0.00 (2)	0.00 (6)	0.00 (1)	0.05 (20)
2	1.00 (1)	—	—	—	0.00 (3)	—	—	0.00 (1)	—	0.02 (5)
3	0.33 (3)	0.00 (7)	0.04 (26)	0.00 (1)	0.63 (8)	—	0.13 (8)	0.66 (3)	—	0.18 (56)
4	0.00 (1)	—	—	—		1.00 (1)	0.00 (2)	—	—	0.25 (4)
5	0.0 (16)	—	0.00 (3)	0.00 (2)	0.00 (6)	0.00 (2)	0.00 (4)	0.00 (5)	0.00 (2)	0.00 (40)
7	0.00 (2)	—		0.20 (5)	0.00 (3)	—	0.00 (7)	0.00 (1)	—	0.06 (18)
8	0.00 (22)	—	0.00 (2)	—	0.00 (7)	0.00 (1)	0.00 (2)	0.00 (2)	—	0.00 (36)
14	0.00 (1)	—	—	—		—	—	0.00 (1)	—	0.00 (2)
15	—	—	—	—	0.00 (1)	—	—	—	—	0.00 (1)
19	0.76 (80)	0.71 (21)	0.80 (59)	0.90 (61)	0.71 (42)	0.92 (37)	0.39 (23)	0.65 (31)	0.75 (4)	0.77 (358)
20	0.00 (1)	—	—	—	—	—	—	—	—	0.00 (1)
21	0.00 (1)	—	—	—	—	—	—	—	—	0.00 (1)
22	0.92 (39)	1.00 (1)	0.23 (13)	0.65 (23)	0.86 (37)	0.22 (9)	0.97 (38)	0.73 (11)	0.89 (36)	0.80 (207)
25	0.33 (3)	0.60 (5)	0.30 (30)	—	0.33 (6)	1.00 (2)	—	0.57 (7)	—	0.42 (53)
26	0.56 (9)	—	1.00 (2)	—	—	—	0.75 (4)	0.50 (4)	—	0.65 (20)
Total	0.67 (339)	0.77 (88)	0.63 (239)	0.81 (152)	0.69 (200)	0.73 (74)	0.60 (108)	0.68 (154)	0.84 (63)	0.69 (1417)
Minimal agreement*	0.74 (303)	0.81 (86)	0.76 (198)	0.88 (135)	0.76 (177)	0.80 (66)	0.89 (70)	0.78 (133)	0.84 (63)	0.79 (1231)

Note. The *n* for interventions coded by the primary data collector are indicated in parentheses. *n* Values across the bottom row for minimal agreement calculations represent the total number of manager responses to patient-safety events reviewed, which is less than the number of interventions coded for all except one category of manager response to patient-safety events (Policy or Practice Documentation).

*At least one intervention technique was identified by two independent coders across each event report.

TABLE 4 Managers' Responses to Patient-Safety Events and Associated Intervention Types

Manager response description	Intervention type(s) coded
Single intervention coded	
"... manager signed report."	No intervention (0)
"... notified staff member involved of the event ..."	Individual feedback (19)
"... made unit staff aware of the event."	Group feedback (22)
Multiple interventions coded	
"... spoke with staff member involved and assured will not happen again."	Individual feedback (19) and commitment (4)
"... made staff member involved aware of the event and discussed event at unit staff meeting."	Individual feedback (19), discussion/consensus (5), and group feedback (22)
Intervention(s) not reliably coded	
"... reminded unit staff of the policy regarding [the procedure] at unit meeting."	Lecture (1) or policy (3)

Note. Intervention codes are indicated in parentheses.

TABLE 5 Overall Relative Frequencies of Feedback Versus No Interventions Used

Manager responses to patient-safety events	Individual feedback	Group feedback	No intervention
Procedure or treatment variance	25%	14%	47%
Witnessed falls	25%	0%	61%
Unwitnessed falls	26%	6%	53%
Medication omission	50%	19%	35%
Medication (other)	27%	23%	42%
Medication wrong dose	56%	10%	31%
Patient identification	32%	51%	24%
Policy or practice (other)	22%	9%	61%
Policy or practice documentation	10%	50%	32%

DISCUSSION

The evaluation of the needs assessment focused on providing answers to the following questions: Was at least one or more targets identified with a strong potential for intervention impact? Were intervention targets identified using multiple data sources? Do the priorities for medical-error prevention resemble published epidemiological data?

In fact, several types of patient-safety events were identified as potential intervention targets. Additionally, the targeting of managers' follow-up responses to medical errors is supported by the patient-safety culture survey data, which indicated nonpunitive follow-up to errors and the nonreporting of patient-safety events were areas in need of improvement. Clearly, more effective manager follow-up communications would address these needs. Furthermore, several of the identified potential intervention targets are among the types of medical errors determined to be the most problematic in other studies, including preventable technical complications of surgery (included among procedure/treatment variance events in this study) and errors in the use of a medication (Leape, Lawthers, Brennan, & Johnson, 1993), as well as errors related to specific national patient-safety goals, including patient falls and patient identification (Joint Commission, 2008).

From Assessment to Intervention

The results of the needs assessment were communicated in meetings with hospital personnel, and an action plan for intervening on managers' responses to reported procedure/treatment variance and witnessed fall events was approved. The next step was to implement an intervention with hospital managers, which included providing hospital managers with feedback on their current application of OBM intervention techniques and education regarding more effective intervention techniques to use in response to specific types of errors identified as intervention targets. The recommended intervention was to respond to these two error types as soon as possible with active communication, including combinations of individual and group feedback for specifying corrective actions. Additionally, managers were instructed to use positive recognition strategies for supporting behavior that prevented harm, including the reporting of events. Intervention results indicated initial increases in reporting the targeted event types, increased use of individual and group feedback interventions along with decreased occurrences of events with no follow-ups, as well as positive perceptions of the intervention techniques used and related outcomes among participants targeted by the intervention (Cunningham & Geller, 2011).

This patient-safety needs assessment resulted in a clear plan for applying OBM methodology to decrease events that put patients at risk for injury. Although the initial plan was to identify critical behaviors among HCWs that directly influence patient safety, this was not possible. However, the results of this assessment provided an opportunity for interventions to be identified and applied at the management level and thus have a hospital-wide benefit to patient safety. That is, the critical behaviors identified in this particular assessment for patient-safety improvement were those of the managers responsible for taking corrective action in response to reports of patient-safety events. Most published OBM research has focused on front-line employees and has given limited attention to management behavior (Hyten, 2009; Nolan, Jarema, & Austin, 1999). The current research may serve to stimulate more focus on this gap in OBM literature.

Behavior-change interventions are already included in the patient-safety efforts of most hospitals. Errors are reported, and managers usually respond to these error reports by taking some kind of action to improve relevant behaviors. For example, errors are reported and managers tell the employees involved what happened, ask employees what they think caused the

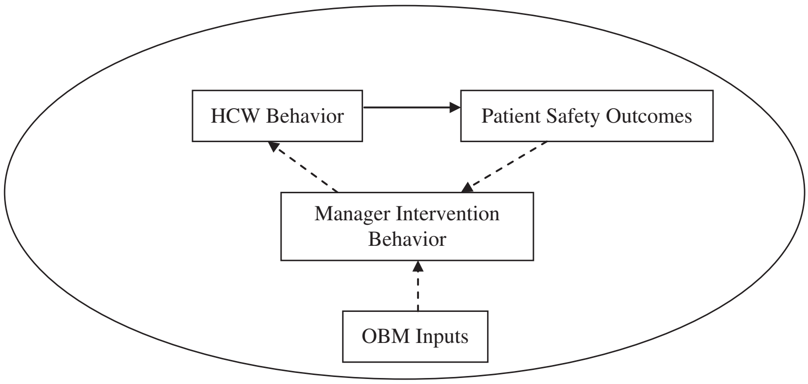

FIGURE 1 A model of existing behavioral influences on patient-safety outcomes. OBM inputs are added to influence hospital managers' responses to medical errors.

error, and then tell them how to handle similar situations in the future. In this process, employees' subsequent behaviors are potentially influenced by managers' intervention behaviors, and managers' intervention behaviors are influenced by patient-safety outcomes. Figure 1 depicts a basic model of these current behavioral influences on patient-safety outcomes. Inputs from OBM are added to influence hospital managers' responses to medical errors and potentially improve the impact of managers' intervention behaviors on patient safety.

Behavior analysts are not specifically trained to select behaviors to target for patient-safety intervention, but they are informed on how to deliver corrective and supportive feedback for behavioral improvement. While hospital managers know the behaviors necessary to deliver safe and effective medical care, they are not experts at interpersonal intervention for behavior change. Thus, a large-scale collaboration between behavior analysts and hospital managers could have dramatic beneficial impact on patient safety. By intervening with several managers to make slight changes in their intervention approaches, hospital-wide improvements in patient safety can be achieved, with benefits measured by data from patient-safety reporting systems and data on changes in HCW perceptions of patient-safety culture.

Hospital managers are the natural behavior-change agents in the traditional hospital hierarchy, and therefore implementing interventions with internal management personnel would likely have optimal long-term benefits to patient safety. Furthermore, intervention procedures should be integrated into existing administrative procedures as much as possible. This may not only reduce financial costs, but also increase social validity and durability. Thus, hospital managers are key informants for identifying behaviors to target for intervention, as well as those with the greatest potential influence on the safety-related behaviors of HCWs. Therefore, OBM interventions with this group will have greater large-scale impact than focusing on insular behaviors of HCWs.

The method used here was aimed at identifying patient-safety targets from a broad view, and while a plan of action with potential to demonstrate clear improvements was generated, there were limitations to this approach. First, there was no objective evidence linking the patient-safety events identified as potential targets with actual adverse events occurring for the patients involved. While this information could be useful for prioritizing patient-safety targets, the actual number of patient-safety events that cause significant injury or death is so low in a single hospital that this information could result in an overly narrow focus of assessment. This is why comparing the patient-safety targets identified in this application with nationally-identified areas of concern was a valuable component of the assessment.

Second, the broad approach to assessing intervention targets at the organizational level also limits this assessment by not including a detailed analysis of more department-specific patient-safety information sources. For example, infection control continues to be a significant challenge in most hospitals. However, these concerns are typically addressed within specific departments or units, such as surgery and postsurgical care, and intensive care units (Pronovost et al., 2006; Pronovost, Miller, & Wachter, 2006). The infection-control data from the selected hospital in this study were certainly informative for identifying specific behaviors that could improve infection-control efforts, but this information was not deemed as useful as the patient-safety event reports for encompassing trends across the entire organization.

Additionally, the primary data source used for the content analysis is limited as it consists entirely of written accounts of past behavior. That is, its content validity cannot be demonstrated without verification from concurrent observational data. This raises a point for future investigation into the accuracy of managers' reports of corrective actions taken in response to hospital errors.

A method of assessment similar to that used here should be incorporated into OBM methods of problem identification, as it guides practitioners to take a larger-scale perspective than is often used in applied settings. However, there is clearly room for improvement with this assessment method. More sources of data should be considered to capture information related to patient-safety outcomes, including actual harm and associated costs, as well as additional levels of analysis (e.g., specific hospital departments and employee demographics).

Methodological Contributions

Analyzing the content of managers' written descriptions of their corrective actions in response to safety-related errors enabled quantification of behavior from what could otherwise be viewed as only qualitative data. That is, what managers elected to write in their descriptions of follow-up actions to reported patient-safety events was highly variable, with no criteria or specific standards for information reporting. Thus, data coders were forced to make subjective judgments in identifying features of OBM interventions from written accounts of managers' actions. While this approach is not new within the content-analysis discipline, it is new to OBM.

Direct observation of managers' interaction with staff members would have provided more empirical indication of managers' actual intervention strategies. However, use of the existing reporting system allowed the analysis of significantly more cases of manager interventions than would be possible with direct observation methods and allowed several months of data to be reviewed in a shorter time frame (approximately one month). Although direct observation would provide more valid data, the reduced time needed to review several months of patient-safety event reports would likely be much less costly for hospitals. However, no actual cost data were collected for the current study. Additionally, the reporting practices which produced the event-report data used in this analysis could be specifically targeted with OBM interventions to improve the utility of these data.

A Simplified Taxonomy of Intervention Techniques

The taxonomy of intervention techniques used for identifying and improving healthcare managers' responses to reported patient-safety events also presents some noteworthy contributions. The original taxonomy includes 24 distinct definitions of behavior-change techniques, and two additional techniques were added based on initial revisions of the coding process. The content analysis conducted here revealed only 15 distinct techniques that were identified in the current application, with the most frequent and reliably-coded interventions being individual feedback, group feedback, or no intervention.

Several of the techniques included in the original taxonomy were never coded, or coded very rarely and unreliably. Certain techniques were more difficult to identify, or may have been misidentified due to overlap with definitions of similar techniques. For example, the content analysis could not differentiate between (a) a policy intervention, (b) an oral activator where individuals are reminded of the existing policy, and/or (c) a lecture where individuals are told to follow a procedure as stated in a particular policy. Reviews of self-reported interventions in response to reported patient-safety events may not require fine-grain discrimination of various behavior-change techniques for managers or change agents. Thus, the provision of feedback to managers about their corrective-action performance could be simplified substantially. A taxonomy with fewer intervention categories would be better suited for adoption by administrators of healthcare facilities.

Future Implications

Findings from this study suggest the potential benefit of simplifying the taxonomy of behavior-change techniques to be used by hospital personnel. Rather than focusing on identifying an intervention as either an antecedent or a consequence, managers could be taught to recognize the differences between an intervention that includes feedback vs. a nonfeedback intervention and whether the feedback is behavior-based. This distinction can be as simple as identifying whether or not the information presented in the intervention includes specific information about past behavior or events as it relates to increasing the frequency of desired performance.

Additionally, the taxonomy could be simplified to identify whether the intervention communication was active vs. passive. This means the intervention communication could consist of only the manager delivering information to the HCW, or it could include active, or two-way, communication in which the HCW provides input on the specified intervention plan. Finally, the distinction between individual versus group communications could be useful, as there may be a cumulative impact gained when an intervention is received by relevant personnel.

This revised taxonomy could be conceptualized as a hierarchical matrix of intervention characteristics, with group-level intervention, feedback, and active communication all being components that may provide added intervention impact. Future studies could evaluate the integration of this model of intervention impact by providing healthcare managers with a checklist for both prompting and documenting their own follow-up instructions to a reported error. This could enable OBM researchers to benefit from the recent attention checklists for improved medical practice have received, most notably in *The Checklist Manifesto* (Gawande, 2010). Follow-up research could also identify the necessary and sufficient components of a follow-up corrective action communication.

In Conclusion

Once a comprehensive assessment has been conducted to identify intervention targets with robust potential for error prevention, the evidence-based interventions used in OBM research can be applied to realize large-scale and durable improvements in patient safety. It may be useful to map a taxonomy of behavior-change strategies onto an existing event-reporting and management system in order to maximize the beneficial outcome of behavioral interventions targeting critical patient-safety behaviors. That is, rather than reinventing the process by which hospital managers currently take corrective action in response to errors, the potential for improvement with adoption of OBM intervention technology may be realized by showing managers how they are already using OBM techniques and offering ways to build upon them.

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