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Using an Interprofessional Lens to Analyze Serious Adverse Events in a Teaching Hospital: An Analysis with the TeamSTEPPS® Framework

Katherine Blondon[1,2], Catherine Chenaud[1]

[1]Medical Directorate, University Hospitals of Geneva, Geneva, Switzerland
[2]Faculty of Medicine, University of Geneva, Geneva, Switzerland
Email: Katherine.Blondon@hcuge.ch

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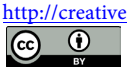

Abstract

This paper explores the contribution of teamwork skills in serious adverse events, using the TeamSTEPPS® framework. Adverse events are the undesirable events that are not due to the natural course of a disease; they are considered serious when they prolong a hospital stay, lead to a physical disability or to death. Failures in teamwork, particularly with interprofessional teams, can lead to potential risks to patient safety. Using a dataset of de-identified reports of serious adverse events in 2016 in a tertiary teaching hospital, we explored the contribution of teamwork skills according to the TeamSTEPPS® framework to these adverse events. We found that 61% of the 41 analyzed events involved failures in teamwork skills, with 80% of these involving communication, 52% in situation monitoring and team structure, 44% in mutual support and 40% in leadership. Sixty-four percent of the events involved more than one teamwork component. Our findings emphasize the need to improve teamwork training in healthcare, focusing not only on communication, but also on other teamwork skills as they often contribute together in adverse events. Future analyses of serious adverse events should include a focus on teamwork competencies, to guide the development of future quality and safety training programs.

Keywords

Team Collaboration, TeamSTEPPS Framework, Incident Analysis, Interprofessional Education

1. Introduction

1.1. Interprofessional Collaboration and the TeamSTEPPS Framework

Interprofessional collaboration and education have rapidly gained interest in the past decade, as an approach to improve patient safety and quality of care. Ever since Julio Frank's report in 2010 [1] calling for changes in healthcare education of professionals, one of the means to improve quality and safety of care as well as to prepare new health professionals to future challenges related to access to care, aging and chronic diseases, is the implementation of interprofessional education (IPE) [2]. Interprofessional education per se has been supported for more than a decade by several health organizations, educators, researchers, and health professionals throughout the American continent as well as in Europe, resulting in identifying and publishing frameworks as well as defining competencies that underlie interprofessional and collaborative practice [3] [4]. TeamSTEPPS® (Team Strategies and Tools to Enhance Performance and Patient Safety) is one of the well-established frameworks for team skills [5].

The rationale for implementing interprofessional education, collaboration and practice lies in the delivery of high-quality and effective patient care through effective health and social care collaboration. Since the end of the 1990s, it has repeatedly been shown that problematic collaboration between health professionals leads to medical errors, mishaps and incidents [6]. Thereafter an increasing volume of publications have reported the negative impact on patient outcomes of deficiencies in communication and collaborative practices between health care professionals [7]. Flawed teamwork and communication issues are major contributors to adverse events and incidents [8].

TeamSTEPPS® was launched in 2006 by the Agency for Healthcare Research and Quality (AHRQ) and has shown its effectiveness in various healthcare settings. Besides improving team skills such as leadership, mutual support, communication and situation monitoring [9], TeamSTEPPS® has also been shown to reduce medical errors related to communication and medication [10].

1.2. Adverse Events

An adverse event is any undesirable experience for the patient that is not due to the natural course of disease or treatment. In our institution, an adverse event is considered as *serious* if it lengthens the hospital stay, leads to death or physical disability [11]. Incidents related to violence (e.g. physical aggression, auto-mutilation) are also considered serious adverse events at our hospital. All collaborators can declare an adverse event, and identification is recommended but optional. It is an institutional requirement, however, for our collaborators to declare *serious* adverse events.

In our institution, all declarations of serious adverse events are reviewed by a cell composed of the chief medical officer, the chief nursing officer, the senior legal officer, the assistant chief executive and the chief human resources officer.

Three possible outcomes result from on this review: 1) the event is analyzed and managed by the cell, 2) the event requires an in-depth analysis according to the London protocol [12], and delegates this task to a trained institutional team, and 3) in a minority of cases, the event is reclassified as a non-serious incident, and is subsequently delegated to a departmental team for management. The London protocol includes a team factors component presented as "verbal and written communication, supervision and seeking help, team structure".

To highlight the IP competencies that should be emphasized in future training of health professionals at our institution, our aim was to conduct a qualitative analysis of the in-depth analyses of serious adverse events that occurred in the University Hospitals of Geneva during 2016 based on the TeamSTEPPS 2.0® framework [5]. We will use an adverse event example to help illustrate the process.

1.3. Example of a Serious Adverse Event

A 54-year-old man undergoes an uneventful surgical excision of a para-anal mass, and the histological analysis reveals an invasive squamous cell carcinoma. Five days later, a colonoscopy is performed with resection of several polyps.

On Day 8 at 3 am, the patient presents an episode of hematochezia (rectal bleed): his hemoglobin is then at 111 g/l. At 6 am, another rectal bleed occurs, in large quantity (full chamber pot): his hemoglobin level is at 102 g/l.

At 8 pm on Day 9, Nurse 1 discovers massive anal bleeding during the nursing rounds, with blood dripping continuously down the legs, and a fully soaked diaper with blood clots. Nurse 1 immediately pages the ward resident, before measuring the patient's vital signs. The resident asks for the vital signs, and informs Nurse 1 that she is receiving a handoff of a busy day (three patients presenting lower GI bleeds), and cannot come to see the patient. The resident asks Nurse 1 to use a hemostatic tampon. Nurse 1 replies that she does not have this type of tampon in the ward, and that in any case this is a procedure for physicians. The resident reports asking Nurse 1 to apply rolled-up compresses in the intergluteal fold, and to help the patient sit up. Nurse 1 applied the compresses and takes the vitals, which are considered stable at this point (pulse of 96 bpm). She draws blood to test for hemoglobin and blood group, according to protocol. She also inserts a second catheter and starts an IV saline drip.

At 8:15 pm on Day 9, Nurse 1 reports the patient's vitals to the resident, and adds that he is feeling faint. The resident replies that the patient is bleeding and that she is still busy with handoffs. She enquires about the hemoglobin result (still pending). The patient's pulse is at 104 bpm by 8:30 pm. The other nurses in the ward see the patient's increasing tachycardia and continued bleeding, and offer to help. Nurse 1 is very concerned about the patient, and feels impotent in this situation.

At 8:30 pm, Nurse 2 calls the resident for the 3rd time and suggests that she call her supervisor. The resident responds that the supervisor has been informed,

and that he is with her, receiving handoffs from the day teams. She explains: "If I get called all the time, I can't finish the handoffs, and I won't get around to seeing the patient." As soon as the handoffs are completed, the floor resident, the operating room (OR) resident and supervisor go see a patient in the ICU.

The patient's pulse increases to 110 bpm at 8:40 pm, then 126 bpm at 8:45 pm, with a blood pressure of 111/60. The residents and the supervisor arrive in the patient's room and see the massive bleeding. The supervisor increases the output of the IV drip, performs a rectoscopy and decides to immediate operate on the patient. The OR resident tells the nurse that the patient should have been sitting up. The nurse did not recall hearing this order prior to this moment: since the patient had been complaining of feeling dizzy, she had asked him to lie down to help prevent him from going into shock.

At 9:27 pm, the intervention begins and is successfully completed an hour later. The patient receives 3 pouches of blood. The rest of the stay is uneventful, and he is discharged on Day 13.

2. Methods

After obtaining approval for the study from the local ethics committee, we acquired the dataset of all de-identified systems analyses reports of serious adverse events that occurred between January 1, 2016 and December 31, 2016 in our institution. Two investigators (KB and EVG) independently conducted a qualitative thematic analysis based on the TeamSTEPPS® framework. The five TeamSTEPPS® components (team structure, communication, leadership, situation monitoring and mutual support) were used as themes. For each event, we coded the defaults in the components, which contributed to the adverse event. We report the interrater agreement (kappa) between the two coders. The third investigator (CC) was involved in the initial systems analyses, and helped provide additional information or context about the events when required.

Events that were not due to any collaborative teamwork issues were then removed from the final analysis with descriptive statistics. Results of the thematic analysis were compared and contrasted, and discordant analyses were discussed to reach a consensus for the final results. We report the number of events with issues in each of the five themes, as well as the total number of themes involved in each event.

3. Results

Table 1 presents the types of adverse event overall and in our sample. Out of a total of 259 declared serious adverse events in 2016, 132 (51%) were related to bullying and physical aggression, 32 (12%) were related to auto-mutilation or suicide. Forty (15%) incidents concerned patient care other than medication, whereas 11 (4%) events were related to medication processes. Thirteen (5%) events concerned the healthcare provider's behavior.

In our sample of events, which were selected by the cell and that were analyzed

Table 1. Summary of the adverse event types overall and in the sample of in-depth analyses.

Type of adverse event	N (%) (total N = 259)	In-depth analyses (n = 41)
Physical aggression, bullying	132 (52%)	7 (5%)
Auto-mutilation, suicide	32 (12%)	2 (6%)
Care processes other than medication	40 (15%)	15 (38%)
Medication	11 (4%)	9 (82%)
Organization of care	27 (10%)	8 (39%)
Healthcare providers' behaviors	13 (5%)	0
Other	4 (2%)	0

in depth (n = 41), there was a higher proportion of events related to care processes (medication or not) and organization of care, and less emphasis on individual behaviors or violence.

TeamSTEPPS Components

Concordance between coders was present for all TeamSTEPPS® components in 31 of the cases (out of the 41 total), with a kappa of 0.91. A full consensus was easily reached after discussion for the remaining events. Among the serious adverse events, 16 events (39%) were considered unrelated to collaborative teamwork issues and were thus excluded. Examples of excluded events include incidents due to a single human factor issue (*i.e.*, error during drug administration), or physical aggression that was uniquely due to a patient's state or disease.

Among the 25 reports with teamwork issues, communication failure was the most frequent TeamSTEPPS® component involved. Communication failures were present in 20 events (80% of the serious adverse events with teamwork issues). Defaults in situation monitoring and in team structure were present in more than half the events (13 events, 52%), whereas lack of mutual support or leadership were only identified in 44% and 40% respectively (Table 2).

Most serious events involved more than one TeamSTEPPS® component. Figure 1 illustrates the frequency of the total TeamSTEPPS® components present per serious adverse event. Although there is a predominance of events related to a single component (n = 9), the next most frequent number of components involved per event was 4 (n = 6). Among the nine adverse events with only one TeamSTEPPS® component involved, five concerned communication issues.

In our example of a serious adverse event, we found room for improvement in all five of the TeamSTEPPS components.

- ***Team organization*** includes the knowledge of roles and competencies of each profession and was deficient in this report; for example, the resident asks the nurse to administer a hemostatic tampon, without considering that this is beyond the scope of nursing competences. In this situation, the nurse speaks up to inform the doctor of this.

Table 2. Number of serious adverse events per TeamSTEPPS component, among events with teamwork issues (n = 25).

TeamSTEPPS component	Nb of serious adverse events	%
Communication	20	80.0%
Situation monitoring	13	52.0%
Team structure	13	52.0%
Mutual support	11	44.0%
Leadership	10	40.0%

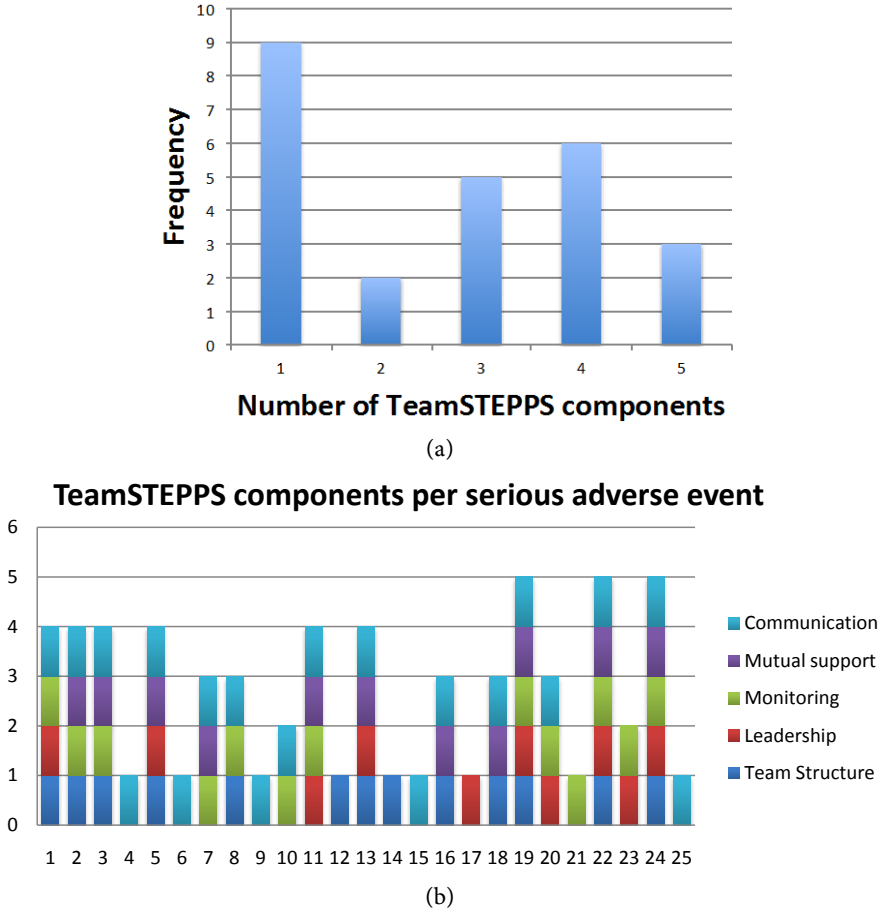

Figure 1. (a) Total number of TeamSTEPPS® components per serious adverse event (n = 25 events); (b) Distribution of number of TeamSTEPPS® components by event.

- There was a lack of ***leadership*** on behalf of the doctors, and Nurse 1 takes the lead by applying the protocol. She did not consider calling the head nurse to report her difficult situation, however, which involved both the leader's use of resources and the organization of people that should be involved in this situation.
- Although there was support from the other ward nurses, there was also a lack of ***mutual support*** between the doctors and the nurses in this situation, with different objectives (completing handoffs vs managing a bleeding patient).

Nurse 1 applied the 2-challenge rule, calling the resident twice to ensure that the resident had grasped the urgency of the situation.

- After the two first initial bleeding episodes, the need for monitoring was low, but during the acute phase of the situation, there was no ***monitoring*** by the doctors, who were focused on completing their handoffs.
- Finally, ***communication*** was deficient throughout the event: at the end of the first call between Nurse 1 and the resident, the resident reports asking Nurse 1 to sit the patient up. Nurse 1 does not recall hearing this, and therefore did not follow the instructions. Checking back about this order would have helped improve patient management. Another example of communication issue is the resident's complaint about iterative nursing calls, which signify that the degree of urgency was not clearly understood or conveyed.

4. Discussion

The findings from our analysis emphasize the importance of teamwork in adverse events. In our institution, nearly two thirds of the serious adverse events of 2016 were related to failures in teamwork competencies, in particular for communication. Our findings from the adverse events reflect the results of the systems analyses of *preventable* adverse events conducted by the Joint Commission [13]. This approach to the analysis of serious adverse events provides further insight into how to improve the quality of care that we provide in our institution. Besides improving communication, all the other four TeamSTEPPS® components also need to be addressed in future team training. Furthermore, it suggests that this approach could be considered as a way to monitor teamwork competencies in the future.

Findings from this study underline the need to continue implementing teamwork-training skills in our institution. Simulation-based teamwork training with the TeamSTEPPS® framework is provided in several divisions or departments such as internal medicine, emergency and obstetrics in our institution. At the undergraduate level, medical students and other health professional students all receive simulation-based training for teamwork competencies. We have also recently begun to provide teamwork training for the newly promoted supervisors in all areas of the institution, even for the non-clinical staff. Training plays an important role for improvement, as do assessments in the field. In the near future, we plan to implement teamwork assessments as part of the internal quality audits that are conducted in the wards throughout the year.

4.1. Communication

In our study, the most common TeamSTEPPS® component involved in these events was communication, which was present in 80% of serious adverse events in our final sample. Again, this is similar to the findings of the Joint Commission for preventable adverse events [13]. Several aspects of communication are important for teamwork, and is in particular closely connected to other compo-

nents, such as mutual support and leadership.

Handoff communication has been associated with reductions in errors and preventable adverse events [14] [15], and therefore needs to be a strong focus in our teamwork training programs. A multicentric study with a handoff training bundle (including supervised handoffs with feedback, workshops and software programs) have shown a 23% decrease in medical errors [14]. Curricular changes for undergraduate medical students include a handoff tool, as well as the development of skills to summarize patient cases. Currently, nurses are implementing the use of structured handoffs, which are moving to the bedside [16].

4.2. Situation Monitoring and Team Structure

Monitoring and team structure were the next two TeamSTEPPS® components that could be improved in the adverse events [17]. A strong focus is placed in healthcare on how to manage a patient at a point in time, with less attention placed on ways to continuously monitor the situation [18]. One of the difficulties in the monitoring process is that it is an activity that can be conducted by different health professionals. For example, both physicians and nurses *can* monitor a patient's blood pressure during a resuscitation, but one of them needs to think of it, and either carry it out or request that the other do it. If each person considers that the other is also competent to perform this monitoring, they may be more likely to expect the other to act. This has been described as the bystander effect [19]. Another area of improvement was the low use of cross-monitoring among health professionals. Cross-monitoring can be seen as a positive way to improve each other's actions, but can also be perceived as a negative, judgmental approach for collaboration. This yet another case where communication and team attitudes play an important role in adoption constructive teamwork behaviors.

Team structure has also been a focus in prior research in interprofessional care. It includes having a clear understanding of each professional's roles and competencies, and having corresponding representations of expectations from each type of profession [20]. With frequently changing teams (e.g., physician rotations, new collaborators), health professionals often collaborate with unfamiliar people, who may have trained or worked in different places. In our dataset, false assumptions about roles or competencies led to delays in patient management.

4.3. Leadership and Mutual Support

Leadership and mutual support were less frequently involved in the analyzed events. Although leadership skills can be observed in both nurses and physicians in collaborative processes, the leadership issues encountered were mainly engendered when different teams were involved in a patient's care. Unrecognized leadership or divergent approaches, in particular between physicians, were more frequently observed in the results. Mutual support issues were more often in the

lack of shared mental models, or in the lack of support (*i.e.*, volunteering to help) among health professionals, often from different teams. Team cohesion was generally adequate in these analyses within a team, but got more complicated when different teams were involved (e.g., patient transfers).

4.4. Strengths and Limitations

The main strengths and limitations to our study are related to the secondary retrospective analysis of serious adverse event reports, using the TeamSTEPPS® framework. The strength of using the TeamSTEPPS® toolkit lies both in its elaboration of collaboration concepts, as well as in its tools and approach for subsequent teamwork training. The limitation of our analysis is the small sample size, its mono-centric data set, and the fact that the exploration of team factors may not have been extensive, as it was based on the systems analyses according to the London Protocol. Future investigations of adverse events could consider more detailed teamwork elements (e.g., situation monitoring, huddle, use of checkback) during the initial analysis.

4.5. Conclusion

Applying a teamwork lens to the analysis of the serious adverse events in our institution revealed the presence of many defects in teamwork competencies, in particular for communication, thus confirming the results found in prior analyses of preventable adverse events. Since the completion of this study, our institution has integrated TeamSTEPPS® training institution-wide, in clinical and non-clinical departments, with the aim to improve collaboration and communication, with a focus on handoffs. Investigators of serious adverse events are now TeamSTEPPS® Mastertrainers, and use this framework for the team factor analysis of the London protocol systems analysis.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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