Effect of human errors on patient safety - a case study in Singapore hospital

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ABSTRACT

Objective: This study aims to build a human factors problem reporting system which can identify potential risks in hospitals and proactively remove them beforehand in order to achieve a sustainable improvement on the patient safety and quality of care by continuous enhancement. Background: One of the most prevalent methods for preventing adverse event caused by human errors is a root cause analysis on the reported adverse events to identify the weak point of the system. However, the root cause analysis after an incident has a problem of hindsight bias and limitation on proactive prevention of adverse events. Prevention of adverse event caused by human error should have a form of continuous improvement in order to ensure sustainable enhancement. Method: Human factors problem reporting system was devised and exercised as a pilot study for 3 months in a tertiary hospital in Singapore. The reporting system has a structured survey form covering major areas of human factors related problems identified in healthcare. Results: Total number of 917 reports collected from 20 different wards in the hospital effectively captured both common problems across different wards and unique problems specific to each department. Conclusion: The proposed human factors problem reporting system showed enough potential to detect latent problems typically not captured by the mandatory adverse event reporting system. Although the causality of the identified human factors issues with the adverse events was not secured, it showed a good chance of opportunity to be used as a preventive intervention for potential errors. Application: Human factors problem reporting system can be combined with the continuous efforts of improving the healthcare quality and ensure patient safety together.

Keywords: Human error, healthcare, reporting system

1. Introduction

Adverse events in healthcare and root cause analyses on occurrences of human or system errors have been a subject of much scrutiny over the past 10 years. Human errors have been noted as most frequent source of problems causing adverse event in medicine. Following the publication of the report entitled “To Err is Human” by the Institute of Medicine in 1999, patient safety has received increased attention in medical literature and in the eye of the public. It was extrapolated that at least 44,000 to 98,000 in-patients die each year from preventable medical errors in the United States (Millman 1993; Kohn, Corrigan et al. 1999), exceeding the number attributable to even the combined figures of road-accidents, air-crashes, suicides, falls, poisonings and drowning in the United States annually (Baker, O'Neill et al. 1992).

However, it was noted that human errors should be approached in a holistic manner since accusing a person who committed error cannot ensure that the same thing will not happen again in the future (Woods, Johannesen et al. 1994; Einav, Gopher and Donchin 2005). In this sense, it is crucial to study on how human interact with its environment in the context of the tasks. Human Factor Engineering, the application of this science, had been
utilized by many industries to remove preventable errors, and to provide high quality services and products. In the aviation industry, for example, pilot errors had been analyzed, and improvement made to create the current flight safety we enjoy today (Baker, Qiang et al. 2008). In the medical industry, this science is also being applied gradually.

One of the applications is in the investigation of incidents or events that had occurred, which is mandatory in several countries, including the United States and Singapore. When an adverse event happens, thorough investigation is performed to identify the root cause of the incidents. This type of root cause analysis is meaningful in a sense that (1) it increases the awareness of the public and the professional community and (2) it helps to establish an inspection and supervisory loop that makes healthcare professionals more aware of their tasks and responsibilities. However, there are some limitations on the type of data that can be obtained during a retrospective analysis because same accidents can be caused through totally different paths.

Further, the prevention of errors should not require the errors to be manifested first before intervening. Although incident reporting system is an effective tool to identify weak links in the system and increases the awareness of the problems, it has limitations in the quality and completeness of the information, incapability to capture all the details in the whole system (Gopher 2004).

“Being blessed with both uninvolvement and hindsight, it is a great temptation for retrospective observers to slip into a frame of mind and wonder at how these people could have been so blind, stupid, arrogant, ignorant or reckless” (Reason 1990) pp. 214

Among these limitations, hindsight bias is one of the most serious issues as was indicated by Reason (1990). Hindsight bias is referring to the tendency of evaluation the process based on the known outcome and overestimating the realized outcome more probable than other equally probable outcomes (Fischhoff, 1975). In terms of the human error analysis, hindsight bias induces a tendency that actions or decisions related with negative outcome can be judged more harshly compared to the cases resulted in neutral or positive outcome. Similarly, judges tend to believe a person committed a mistake knew more about the situation when he or she performed an action, which is known after the outcome of failure has identified. This tendency oversimplifies situations and hides the details of the processes affecting practitioner behavior before an incident happens, which, in turn, reduces further systematic analysis about the factors on human performance. (Woods, Johanesen et al. 1994; Woods & Cook, 1999)

In order to overcome the limitations of the post-accident analysis and reliability oriented safety scheme, resilience engineering concept was proposed as a preventive intervention (Hollnagel, Woods, and Levenson, 2006)

The viewpoint of resilience engineering is looking at the failure as the downside of the adaptations necessary to deal with the dynamics and complexity of the real world problems. Failure of the adaptation is considered as the absence of the ability of organizations or individuals to anticipate the changing shape of risk before failures happens. Thus, the proactive intervention needs to be the form of continuous improvement ensuring sustainable enhancement of the safety of the whole system rather than following incidents and patching on superficial problems.

2. Method

In order to build proactive prevention of the adverse events caused by human errors, a reporting system was devised in collaboration with Technion, Isael that proactively examines the daily work challenges faced by the staff, in view to identify and remove hazards or obstacles that contribute to medical errors. The reporting scheme was refined and customized to meet the context of healthcare systems in Singapore. In June 2010, the Patient Safety Committee (PSC) of a government restructured hospital in Singapore conducted a ‘Human Factors survey’ of the wards using their human factors reporting form covering “work procedure and structure”, “physical space and layout”, “medication administration”, “instrument and equipment” and “data recording and retrieval”. Each survey form has three sections of categorization of the problems, details of the problems, and proposed solutions. The proposed solution is not mandatory, but highly
recommended to fill out the potential solutions from the participants. The survey form was distributed to the healthcare professionals, mainly nurses from 20 different wards including medical and surgical intensive care units (ICU). The participation was totally voluntary and multiple responses from one participant were allowed to encourage reporting of the problems. The collected responses were analyzed through a multiple step analysis. For the first step, the reported forms were screened in order to filter out irrelevant problems. The selection process of reports was based whether it falls on the pre-identified area and whether it is human-factors related. Then, the identified problem was evaluated based on its severity and difficulty for the amendment by a team of human factors engineer and clinicians. After prioritizing the reported problems, the short-term and long-term intervention based on the availability of the resources and the long term strategic plans which are already in place.

The advantage of conducting structured questionnaire survey is pinpoint the problems which was sometimes ambiguous to be depicted when intermixed with other problems. One other advantage of the proposed reporting scheme is the involvement of a human factors engineer, clinicians and operating staffs in the hospitals. The different aspects of expertise and experience can provide the richness of the analysis, knowledge to evaluate, and correct the common human factor problems faced on the ground. Expected outcome includes the better quality care for the patient, better welfare for the healthcare professionals, and finally achieving the sustainable improvement on the healthcare system.

3. Results

In all a wealth of information on common problem areas was collected from the 914 received from the 20 different wards. Initial analysis of the submitted report showed that the Human Factors problem reporting system successfully reflects the problems that each ward is facing. It is evident from the feedback received, that there is further work to be done in improving the situation. The hypothesis is that if the problems reported were to be solved or mitigated, the patient safety outcome will correspondingly improve.

3.1 Overall problems reported

Among the 914 responses, 197 reports were from the work procedures and structures, 195 reports were regarding the physical spaces and layout. Similar number of problems was reported in the category of medication administration (193) and the highest frequency was found in the category of instruments and equipments. The last category of data recording and retrieval was least reported (119) among the five. (Figure 1).

The frequency of reporting is proportional to the size of the wards in general, which means more reports were gathered if the number of staff is bigger than other wards. No significant difference was found between the senior and junior staffs.

However, the characteristics of wards were reflected in the composition of reports. For example, the communication and patient transfer was found to be the most significant problems in an orthopedic ward since the patients needs to travel for clinical test and imaging. On the other hand, common problems were found all across wards (e.g. lack of equipment, such as, bladder scan), which was found to be the common problems in the hospital.

Figure 1. Problems reported in each category. Category A: work procedure and structure, Category B: physical space and layout, Category C: medication administration, Category D: instrument and equipment, Category E: data recording and retrieval
4. Conclusion

In the course of exercising the human factors reporting system, the effectiveness of the reporting system will be validated by the following three methods: (1) measuring the changes of the safety cultures in the hospital, (2) evaluating the perceived workload of the healthcare professionals, (3) comparing the perceived portion of time spend on the core activities of taking care of patients.

Since safety should be infused as a part of culture in medicine considering the challenges that healthcare is facing, the exercising of Human Factors problem reporting system will contribute to the overall enhancement on the healthcare system.

4.1 Future Works

On the other hand, the collected Human Factors problem will be compared with the root cause of incidents happened in the hospital. Since the analysis of incidents was not conducted in the form that can be directly compared with the Human Factors problem reports, retrospective analysis will be conducted to make a symmetric comparison of incident report and human factors problem report. Then, the validity of the human factors problem reporting system in terms of preventive measure will be tested by investigating the correlation between the two reporting systems.

References


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Areas of interest: HCI, Human Error, Affective Design, Social Robot