

Full Length Research Paper

Reducing the charging errors in an hospital emergency department: A PDCA approach

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Modern hospitals are highly computerized in managing the routine and operational documentary procedures. One of the best practices in managing with a computerized system was the materials used in a hospital. One of the benefits the computer system may provide to the hospital was to save labor force. Some problems occurred in the emergency department because the healthcare staff failed to communicate with the system properly. This have had adverse effects on the efficiency and effectiveness of the hospital's operation due to incorrect information the computer produced. This project is designed to solve the problem by reducing the charging errors by adopting a PDCA cycle. The project had achieved both tangible and intangible improvements. We have discussed the research findings and compared this with previous studies. Several recommendations were provided for the hospital management and the public policy decision makers.

Key words: Hospital, charging error, emergency department, PDCA, revenue leakage.

INTRODUCTION

Hospitals adopted computer in several ways to reduce waste and error, to upgrade service quality, to facilitate a seamless cross-department communication and cooperation, and ultimately to improve the hospital's operational efficiency. Although some benefits were gained, waste and errors remained. Looking into the entire computer-aided managerial system, the labor force remains the main mediating factor for the system. A computer-aided managerial system requires correct input of sufficient data, the GIGO (garbage in garbage out) occurs when data feed into the system were wrong in quantity and quality (Chang and Henry, 1999). The emergency department (ED) of a hospital is typically characterized with highly restricted time and thus requires speedy treatment, timely decision, and seamless cooperation among healthcare professionals. Life first is certainly the rule number one in this particular context. It is not uncommon to find incorrect data, particularly the material used, under this rush and

sometimes jammed environment. As a result, the complexity in the current emergency treatment process have created various opportunities for revenue leakage, of which may result from personal ignorance to the charging procedure. This called for keen insights into the current operation procedure. Root cause analysis was generally viewed as a capable approach in identifying causes of problems, particularly in the problems that may lead to financial leakage (Racidemann and Sandhu, 2007). Waste and errors in inventory occurs, and then becomes an extra cost to the hospital (Sears, 2006). This project is designed to solve the problem by first identifying the causes step by step by a team from the emergency department (Seid et al., 2007).

The purpose of the project is to correctly charge all kinds of medicine, healthcare materials along with medical treatments, to correctly reflect the costs of each treatment and avoid waste. Accordingly, this in turn increases the hospital's revenue (Sears, 2006).

The members of the team comprise physicians and nurses on duty to the emergency department. Measures to perform were categorized into two directions, one for physicians and the other for nurses to improvement. The former aims to input carefully with correct data, and the

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later aims to double-checking for the correctness of the outcomes.

The project follows the PDCA cycles in the period of June to October 2010. The process includes the following steps in sequential order such as;

Establishing the theme, project planning, defining current problem, targeting, analyzing, alternative evaluating, decisions, results measuring, and standardizing the operation (Pines et al., 2002; Carter and Chochinov, 2007).

PDCA

PDCA refers to a Plan-Do-Check-Act cycle. This famous quality improvement model was generally recognized as one of greatest thoughts of Edward Deming. The concept of PDCA was based on the scientific method that follow the process of "hypothesis" – "experiment" – "evaluation", or "plan" – "do" – "check" (Deming, 1986; Walton, 1986).

Initiated in the 1950s in Japan after the World War II, the PDCA cycle was later adopted by the top Japanese engineers and helped the Japanese industries grow rapidly. It is also known as the Deming circle, Shewhart cycle, Deming cycle, Deming wheel, Control circle or cycle, or Plan-do-study-act (PDSA, Deming prefers to replace "check" with "study" to emphasize the need of control).

Some scholars pay respect to the contribution of PDCA to the quality improvement for both manufacturing and service process, and termed it as the Deming's Management Method (DMM) (Walton, 1986) to make the PDCA more a theoretical approach. The DMM and the associated fourteen points of management perspectives were thought can serve as guidelines for quality management by performing proper organizational behavior and practice (Anderson, 1994). In general, the core to the power of Deming's management method lies in its apparent simplicity (Walton, 1986).

Other than the well-known quality process of PDCA, there are many others that were frequently used as an improvement model. For example, the Six-Sigma is another commonly used improvement model in health care (Hall et al., 2008). This typically adopts a five-phase methodology of Define – Measure – Analyze – Improve – Control (DMAIC) for improving an existing process, or another distinctive yet related sub-model of DMADV (Define – Measure – Analyze – Design - Verify) for designing a new process. The HFMEA (Healthcare Failure Mode Effects Analysis) is one of the famous one that was used in the healthcare process. Based on the failure mode analysis in the air plane accidents, the HFMEA has been adopted by health care industries to analyze a new process or product to detect potential weakness or failure prior to an actual implementation, and later on the patient safety.

Although the recent development of Six-Sigma has

been proven to be able to result in the same purpose for quality improvement, PDCA is a simpler, easy understanding and user-friendly approach. This is also true to the underlying DMAIC. As to the DMADV and HFMEA, they were mainly for checking the potential pitfalls of a new process, and may not be appropriate for the use of the current project (Johnson and Raterink, 2009).

MATERIALS AND METHODS

Materials used in this project are order-related information (Dean, 1996; Srivastava, 2005) in the emergency department of the National Taitung Hospital in Taiwan for a period of June 1st to July 9th in the year 2010. This included all transactional documents related to the physician's orders that are specifically for the individual patient's case during this period.

Methods taken in the procedure followed the FOCUS-PDCA. These processes are finding a process to improve, organizing a team, clarifying the current knowledge, understanding causes, and selecting the process to improve (FOCUS) as the preparation stage of the project. And then in the program stage followed by planning the improvement, doing data collection and analysis jobs, checking the improvement and customer outcomes, and acting to hold and continue the improvement (PDCA) (Redick, 1999).

Charging procedure

The process began with a triage and ends with the patient leave for IPD or discharge. The physician gave orders and supervised treatments, and then performed computer key-in for prescriptions. Nurses hand over the certified documents to the patients. As the current process indicated, errors may occur in any steps of the "area to be improved", as shown in Figure 1, in which the physician can fail to charge correct data with the computer and the nurse may fail to correctly double-check the printout.

Materials

Errors found in the department were used as the material to be investigated. Data before launching the project were collected during the period of June 21st and July 9th, 2010 for further analysis. A total of 342 records were collected, among which 59 errors were found, as shown in Table 1. These errors were brought to the team meeting for further analysis. The errors that occurred in the ED could be categorized into several aspects, as the Find activities in the FOCUS.

Target

The target is established by including several criteria into consideration, and a team was organized to include direct members of ED operation, such as emergency physicians, ED nurses, pharmacists, and medical technicians, as the Organizing of FOCUS proposed. The target is then established as shown in the following equation. The project team attempted to improve the current level from 17.23% of errors to a level of 5.85% by including the estimation of the members' current capability and knowledge at a level of 75% (that is, some capabilities needed for improvement may exceed members' current abilities) (DOH, 2006), as what the Clarify of FOCUS required.

$$\text{Current level} \times \text{Weight of improvement} \times \text{Expected Capability} = \text{Improvement}$$

Table 1. Errors to be improved.

| Descriptions | Errors | % / total | % | % accuracy |
|---|--------|-----------|--------|------------|
| Fail to key-in treatment code | 42 | 12.28 | 71.19 | 71.19 |
| Fail to double-check the prescription | 10 | 2.92 | 16.95 | 88.14 |
| Treatment before charge | 4 | 1.16 | 6.78 | 94.92 |
| Patient discharge against physician order | 2 | 0.58 | 3.39 | 98.31 |
| Ignored a chargeable treatment | 1 | 0.29 | 1.69 | 100.00 |
| Sum | 59 | 17.23 | 100.00 | 100.00 |

Note: 59 errors with 346 cases.

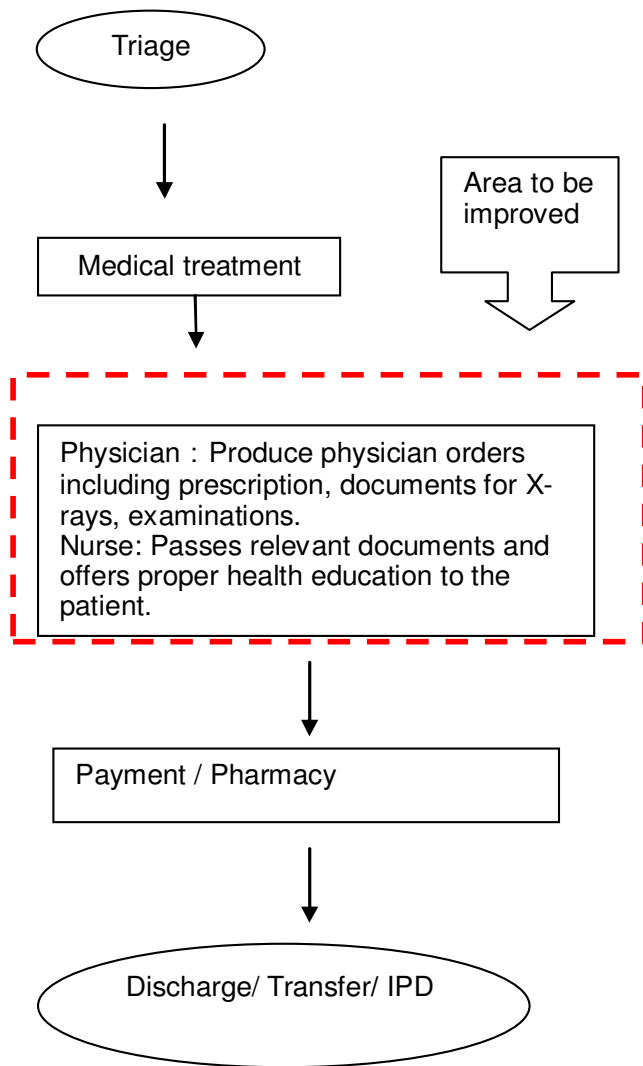


Figure 1. Current procedure for ED charging.

$$(17.23\% \times 88.14\% \times 75\% = 11.38\%)$$

Current level - Improvement level = Targeted improvement

$$(17.23\% - 11.38\% = 5.85\%)$$

Alternatives evaluation

Several alternatives were then raised, discussed, and then evaluated by the team members, as the understanding of FOCUS assumed. Members discussed and evaluated each alternative by giving one (poor) to five (excellent) points on criteria of feasibility, economy, and effectiveness.

The alternatives that received 96 points were implemented with PDCA, as the selection action in the FOCUS, shown in Table 2. The team then decided to take the quality improvement (QI) processes, mainly the root-cause analysis (RCA). Other tools included in this project by the members include flowcharts, check sheets, Pareto diagrams, cause and effect diagrams, histograms, scatter diagrams, and control charts (Hughes, 2008; Langley et al., 1996) to solve this problem, as the Plan in the PDCA.

RESULTS AND ANALYSES

The team member adopted the plan in the cases of the emergency department in the period between July 15th and August 20th, 2010 with substantial supervisions of nursing group leaders, as the Do action in PDCA. Major difficulties in this stage were found in the inter-personal communication in passing the orders. This problem had come back to the team meeting again, and then a modified procedure was established. In the Check process of PDCA, the project achieved several improvements. Materially, the project sharply reduced the errors from 17.23% for a 29 day period to the fractional 3.9% of a 54 day period. This result is far better than the expected target, at 5.85%. This improvement had brought visible and tangible benefits to the hospital in terms of revenue increasing and cost reduction, as shown in Table 3 and Figure 2, as the Check process of PDCA.

Noteworthy, the factor of “fail to key-in treatment code” gained a notably improvement, from 12.28% to a very low level at 2.34%, as shown in Table 3. This is particularly important to a hospital management since errors of this kind were conventionally occurred with an emergency physician, and were always one of the major barriers to a hospital improvement project.

One of the most important challenges to the PDCA management process was to hold or maintain the results as a standard, and to encourage the members on a continuous improvement. In the Act stage of PDCA, the team established several guidelines for the standardized charging process in the forms of “wall posters” (point by

Table 2. Alternatives evaluations.

| Problem | Causes | Alternatives | Evaluations | | | Points | Decisions |
|-----------------|--------------------------------------|--|-------------|---------|-----------|--------|-----------|
| | | | Feasibility | Economy | Effective | | |
| ED Mis-charging | Under- staffed nursing labor | Add nursing labors | 8 | 10 | 28 | 46 | |
| | Fail to double-checking prescription | Double-checking before approval | 34 | 18 | 32 | 84 | |
| | Fail to key-in treatment code | Physician established a common code for checking purpose | 40 | 32 | 30 | 102 | ● |
| | Code unknown | Posters: (Around computer desk) 1. Frequent used code 2. Mis-charging reminder | 38 | 24 | 24 | 96 | ● |
| | Code absent | Filing frequent used codes | 36 | 24 | 36 | 96 | ● |

Notes: Actions to be taken are those scored 96 points or more; marked with an ●

Table 3. Improvement summaries.

| Items | Before (06/21- 07/09) | | Process (08/09-08/20) | | After (08/30-09/10) | |
|---|--------------------------|-------|--------------------------|-------|------------------------|------|
| | n | % | n | % | n | % |
| Fail to key-in treatment code | 42 | 12.28 | 30 | 8.77 | 8 | 2.34 |
| Fail to double-check the prescription | 10 | 2.92 | 6 | 1.75 | 3 | 0.87 |
| Treatment before charge | 4 | 1.16 | 1 | 2.92 | 1 | 0.29 |
| Patient discharge against physician order | 2 | 0.58 | 2 | 5.84 | 1 | 0.29 |
| Ignored a chargeable treatment | 1 | 0.29 | 0 | 0.00 | 0 | 0.00 |
| Sum | 59 | 17.23 | 39 | 19.28 | 13 | 3.79 |

point) and pamphlet. A concise process of the standard process is also illustrated in a simple chart, and to be added as a notice in shift-rotating checklist. This action helps keeping the charging errors low.

DISCUSSION

This project involved several physicians and nurses that were assigned to the emergency department for a mis-charging problem. This

project was successful by not only substantially reducing the charging errors from 17.28 to 3.79%, and accordingly reflected true operational costs and increase revenue, but also provided a communication opportunity for team members to

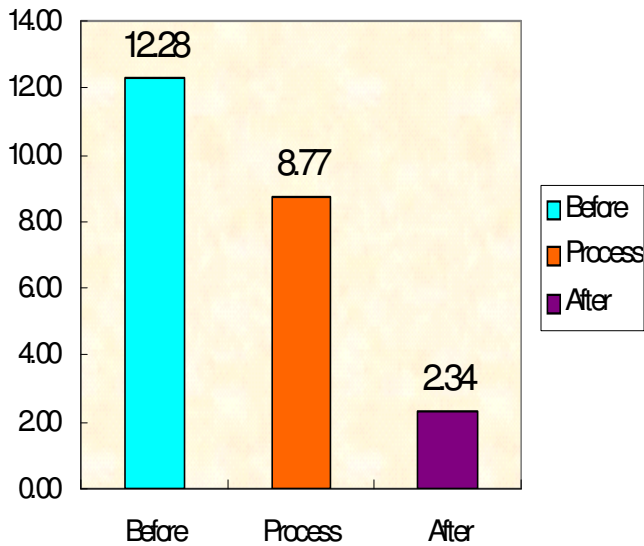


Figure 2. Substantial improvements (fail to key-in).

gain consensus on the process of charging procedure. Important of note is the cooperative manner provided by the medical department, which was hardly expected in normal cases. Compared to the improvement level suggested by DOH (DOH, 2006) that to count the member's capability at 75% and to reduce the rate to 5.85%, this project had achieved a better performance than the suggested standard by reducing this rate to 3.79%. As a matter of fact, the major component of the project achievement was contributed by the emergency physicians. Other than the top management support, one of the major reasons behind a full cooperation from the medicine department may originate from the simplicity and easy understanding of a PDCA cycle. This further provides evidence on the applicability and the usefulness of PDCA cycle due to its simplicity (Walton, 1986).

Take this project as an example, hospitals must provide a consistent, easy-to-use and simplistic interface for correct information exchange in order to enable the visibility of a process. A combination of order-to-invoice quality and collections automation technologies may be worthy to adopt to fill up possible sources of profit leaking (Srivastava, 2005). Members of the team then received varied forms of awards and incentives. However, the more important implication to the success of this project was to deliver a clear message that a possibility of improvement was always there for the team to identify and gain further advancement (Judith, 1997). There were plenty of blind spots that were ignored by inertia. This team has decided to exploit this experience to improve the correctness of patient identification.

Barriers to the success of an improvement pro-gram may stem from both structure and process (Johnson and Raterink, 2009). Whilst the process problem could be overcome by close supervision and quality control training, the former was typically out of the control of a

project team, thus require a support of the management of an organization. To gain and hold the success constant of any improvement, support from the organization is essential (Seid et al., 2007; Sadeghian, 2010). Project initiated by the emergency department has gained multiple supports from the hospital management. The director of the hospital clearly declared full support by announcing the project with spiritual speech in the hospital-wide meeting, and offered incentive promises to the team. This acts as an important moderator for the success of the project, which was consistent with the studies of Parker et al. (1999); Seid et al. (2007) and Sadeghian (2010).

Since maintaining a healthy status is part of the primary rights of a human being, the hospital industry shall align its operation policy with the national's health concern. This means the healthcare industry, including hospital, and it does not matter if was private- or state-owned, shall be viewed as part of a public service. A quality improvement gained in a hospital department will not be of benefit to the hospital by reducing cost or waste, but also increasing the service quality (Deming, 1986). It is recommended that the government shall establish an accessible incentive program to encourage hospital industry continuously conducting the quality improvement projects, among which the PDCA would be one of the best alternative approaches for its simplicity.

Conclusions

A simple yet effective approach to solve problems in a hospital emergency department is possible. A strategy that integrates team members' effort to create a consensus toward a well-defined problem is the critical success factor (Stone, 1998).

This charging error reduction project had gained good results and will benefit multiple parties without additional costs or safety sacrifice. Correct recording in the process of emergency treatment avoids wastes in healthcare material and time. It accordingly creates more room for healthcare professionals to care for the patients (Carter and Chochinov, 2007), which in turn will increase family satisfaction (Zimmermann et al., 2008). The hospital gained additional revenue by filling the leakage, polished its managerial system with correct and timely information; the patients are charged with users' expenses under a correct record that would be used as important information for future diagnosis; the team was cheered with the performance (material and psychological) from the project. Team member realized the existence of a personal blind spot, and gained confidence from the project activities (Stone, 1998; Sears, 2006). It is a win-win outcome.

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