USE OF FAILURE MODE AND EFFECT ANALYSIS [FMEA] AS A TOOL FOR PROJECT SELECTION IN IMPLEMENTING QUALITY IMPROVEMENT PROGRAMS IN MEDIUM SCALE HOSPITALS

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Abstract

Failure Mode and Effect Analysis (FMEA) is a tool for analyzing the design of a product or service system to identify potential failures, and then taking steps to counteract or at least minimize the risks from those failures. FMEA identifies the risks involved in potential failure modes and prioritizes the actions required to eliminate or minimize the risks. The concept is used to select projects for quality improvement in medium scale hospitals in the service process so that the patient satisfaction is enhanced. The authors conducted a study on patient satisfaction factors and had a survey with patients and medical officers of the medium scale hospitals and calculated Risk Priority Number (RPN) for all factors and prioritized the factors based on the risks and selected projects by brainstorming with the doctors of the hospitals. The segment of hospitals having less than 50 bed availability, promoted & managed by doctors (Nursing Homes & Polyclinics) were considered as medium scale hospitals in the study.

Key words: FMEA, patient satisfaction, RPN, severity, occurrence, detection

Introduction

FMEA identifies the actions that could eliminate or reduce the chance of potential failures. FMEA is a 'before-the-event' action requiring a teamwork that keeps the professionals proactive. This is an inexpensive way to minimize changes in design and production. Design FMEA identifies known and foreseeable failure modes. These failures are ranked according to their relative impact on the product. Based on expected failures and severity of those failures, priorities are set up. As Design FMEA eliminates many potential failure modes in advance, it results in lower development time and cost of manufacturing. Process FMEA identifies the potential process failure modes. Then the failures are ranked according to their relative impact on the customers. Priorities are established based on this. FMEA is one of the most powerful tools available for determining the reliability of the process or product. Continuous improvement requires a careful monitoring and measuring of the reliability of processes. FMEA brings out the potential product/process related failure modes. FMEA uses 'Occurrence', 'Detection Possibility', and 'Severity Index' to arrive at a 'Risk Prioritization Number' for deciding the corrective action requirements.

Literature Review

Process quality is defined as "how" service is delivered. It aims at providing overall satisfaction to the patient in all its dimensions. Examples of process quality include the level of personalization and patient-service provider interaction, the delivery of medication and food to the patient, the efficiency of admission and checkout, and the timeliness and accuracy of hospital bills. Generally, it is easier for patients to assess the level of process quality compared to clinical quality. For example, patients may not be certain of the quality level of their surgery, but they know they were treated well or poorly by the doctors and staff. Current health care delivery systems are highly decentralized,

complicated, comprising layers of processes and handoffs that patients and families find bewildering (Committee on Quality of Health Care in America, 2001, p. 28).

Patient Satisfaction

In review of research literature, we notice the lack of attention to the meaning of the construct "patient satisfaction". Logically, the discussion of conceptual and theoretical issues should come before measurement but the opposite has been the case with patient satisfaction research. Linder- Pelz's definition rests on social-psychological theory showing that the expression of satisfaction is an expression of an attitude, an affective response, which is related to the belief that the care possesses certain attributes (components/dimensions). Patient satisfaction, thus, becomes defined as the individual's positive evaluations distinct dimensions of health care.

Patient satisfaction appears as a continuous variable resulting from emotional reactions and cognitive evaluations of distinct dimensions of the health care provided compared to an individual frame of reference. Thus, Satisfaction is an abstract concept, which cannot be directly observed or measured. Surveying patient satisfaction is the most common method for obtaining patients' views on their hospital stay. Many theories include patients' expectations as the basic concept of satisfaction. A traditional definition of satisfaction is, therefore, the degree of congruence between expectation and accomplishment. Logically, we have to know what patients expect before we ask them about their satisfaction with the care they received. Consequently, the involvement of patients in the development of an instrument to measure satisfaction is very important and must be an integral part of development.

Despite the growing literature devoted to the concept of patient satisfaction, no unified approach has been devised for its meaning and its measurement. Some authors have criticized the notion that patient satisfaction is directly influenced by the discrepancies between expectations and perception.

Stages of FMEA

1. Determining the possibilities of failure with respect to various components, identification of root causes of the problem, estimating the impacts of failure and possibility of preventing the risk.

2. At this stage, numerical evaluation of severity of the impact, frequency of occurrence of such failure and the possibility of detecting the failure before it happens is done.

3. Risk Priority Number RPN is calculated and the high-risk causes are corrected by proper control mechanisms.

4. Recalculation of RPN is carried out at this stage to check the effectiveness of the control mechanisms introduced to avoid the failures.

Methodology

A Questionnaire was prepared and given to the chief doctors of the 12 medium scale hospitals to find out the patient satisfaction and to identify the element which is to be attended on priority if negated. The Risk Priority Number is to be calculated to set priorities on attending issues. RPN constitutes three elements as severity, occurrence and detection. Severity is the assessment of the seriousness of the failure effect, identified on a 10 point scale, 1 to represent no effect and 10 to indicate serious effect. This numerical ranking enables the doctor to prioritize the failures and address the real big issues first.

Occurrence can be identified from the satisfaction indices found in the patient satisfaction survey and is the possibility of

failure given on a 10 point scale in the order 1 for least possibility and 10 for the highest. Detection is the possibility of identifying the failure on a 10 point scale in the order 1 for certainty of detection and 10 for the absolute uncertainty. The Doctors were also asked to rate for Severity and Detection considering the statements given are negated in the context of nursing care, appointment, facilities and other access. RPN is used to prioritize items that require additional quality planning or action.

The project selection for improvement is prioritized by patient satisfaction indices and the element of importance to the factors from the medical officer's point of view is obtained by questionnaire and included in the risk priority number.

The findings of principal component analysis done are presented in the following Table-1.

Table-1 Findings of Principal Component Analysis

Sl. No.	Factors	Severity	Occurrence	Detection	RPN
Factors related to Doctors					
1	DR1	5.5	2.24	2.92	35.9
2	DR2	6.42	3.42	6.33	138.9
3	DR3	5.58	3.26	5.42	98.59
4	DR4	5.75	2.24	3.08	35.97
5	DR5	3.75	2.58	5.83	56.41
6	DR6	6.17	3.14	4	77.5
7	DR7	4.08	3.1	4.17	52.74
8	DR8	5.42	3.4	5.33	98.22
9	DR9	3	2.98	2.92	26.1
10	DR10	2.83	2.5	4.17	29.5
11	DR11	5	3.04	3.58	54.42
12	DR12	3.25	3	5.92	57.72
13	DR13	3.75	2.82	3.58	37.86
14	DR14	6.67	2.46	6	98.45
15	DR15	6.42	2.84	4.58	83.51
16	DR16	3.67	2.56	2.83	26.59
17	DR17	4.25	2.2	3.92	36.65
18	DR18	2.33	2.9	3	20.27
19	DR19	1.92	2.48	5.67	27
20	DR20	3.08	2.52	3.92	30.43
21	DR21	2.08	2.62	2.25	12.26
22	DR22	6	3.7	2.58	57.28
23	DR23	4.58	2.38	6.5	70.85
24	DR24	1.83	2.3	2.5	10.52
25	DR25	2.33	3.1	3.25	23.47
Factors related to Access					
1	ACC1	3.92	4.6	3.17	57.16
2	ACC2	4.08	5.68	1.92	44.49
3	ACC3	5.58	2.58	2.33	33.54
4	ACC4	4.92	2.96	2.75	40.05
5	ACC5	5.67	2.24	3.58	35.97
6	ACC6	5.17	3.02	2.5	39.03
7	ACC7	5	4.74	4.25	100.7
8	ACC8	3.75	4.98	5.42	101.2
Factors related to Nursing care					
1	NUR1	4.92	3.36	4.33	71.58
2	NUR2	5.08	3.7	6.17	115.9
3	NUR3	2.42	3.34	5	40.41
4	NUR4	4.67	3.64	4.92	83.63
Factors related to Appointments					
1	APP1	4.83	3	2	28.9
2	APP2	4.92	2.76	3.08	41.8
3	APP3	6	3.14	3.58	67.45
4	APP4	6.17	2.72	2.58	43.3
5	APP5	6.58	4.14	3.25	88.5
Factors related to Facilities					
1	FAC1	2.33	4.18	2.25	21.91
2	FAC2	3.83	4.4	5.25	88.47
3	FAC3	2.58	4.3	2.42	26.85
4	FAC4	3.5	4.92	2.5	43.05
5	FAC5	4	3.98	2.17	34.55
6	FAC6	5.5	4.42	5.75	139.7
Factors related to General Satisfaction					
1	GS1	5.5	3.46	6.92	131.6
2	GS2	5	3.2	6.17	98.72
3	GS3	7.33	2.24	6.75	35.97
4	GS4	6.42	3.12	7	140.2
5	GS5	4.42	3.16	6.58	91.9
6	GS6	5.83	3.46	6.42	129.5
7	GS7	3	3	6.33	56.97

Findings

Based on the doctors and patients perceptional views of the severity, occurrence, and detection components of RPN, the RPN for all variables are calculated. Here the researcher has selected RPNs above 100. They are listed below.

1. The doctor not doing enough tests to find out what is wrong.-139
2. The receptionist does not explain things clearly to patients.-101
3. Patient cannot speak to a receptionist privately.-101
4. The nurses not listening carefully when patient is talking about his/her problem.-116
5. The hospital is not having everything needed to provide medical care.-140
6. Patients are not receiving the best care from the staff working in the hospital.-132
7. Patients are not happy about the treatment given by the hospital.-140
8. The medical care patients received is not just perfect.-130
9. To formulate improvement activities (projects) a brainstorming session with the doctors was conducted.

The possible actions identified are as given in the Table-2.

Table-2 Possible Actions Identified

Sl. No.	Variable	Actions required to improve	Projects
1	The hospital is having everything needed to provide medical care	In the existing hospitals where access by transport is difficult to improve the medical facilities available in the hospital. For proposal of new hospitals the location decision is very important based on the access by road/rail transport.	1. Any road which can be formed from the main road/railway station can be thought off. 2. Augmenting sophisticated machines/processes in the specialties hospital is having
2	Patients are happy about the treatment given by the hospital	Improve the quality of curative processes and control the duration of the particular illness of the patient to the maximum extent.	Prepare a checklist of activities for different curative processes and standardize and follow in the correct sequence
3	The doctor doing enough tests to find out what is wrong	Explain the use of these tests for accuracy in diagnosis to the patient.	Make brochures related to tests for diagnosis explaining the pros and cons of test and use in accuracy of diagnosis in relative to symptoms, in your specialty.
4	Patients are receiving the best care from the staff working in the hospital	Training all hospital staff in interpersonal skills specific to managing patients.	1. List the expectations of the patients when they come to your hospital and explore how each one can be satisfied. 2. Disseminate this knowledge to all concerned.

Sl. No.	Variable	Actions required to improve	Projects
5	The medical care patients receive is just perfect	Have a standardized procedure in handling patients from time in to time out.	1. Prepare a clear cut procedure with a focus on the maximum comfort, lesser waiting time and lesser movement for the health care service to the patients coming in the hospitals. 2. Follow without violations. 3. Explain this through reception staff to all patients coming in.
6	The nurses listen carefully when patient is talking about his/her problem.	Giving training to nurses to communicate properly with the patients.	1. List the keywords which will not hurt a patient in the process of nursing care and the right gestures they can use with patients. 2. Train the nurses to implement the same.
7	The receptionist does explain things clearly to patients	Answering politely to patients over phone and give training to receptionists on interpersonal skills.	Design a training program to other staff (excluding doctors & nurses) on handling the patients & implement.
8.	Patient can speak to a receptionist privately	Train the reception staff to communicate properly with the patient as required.	Details provided by the patient must be kept confidential and they may have to speak this with receptionist for further procedure to be followed in the hospital. Provide a private office for the receptionist so that the conversation with patient is not made in public.

Conclusion

The RPN of different elements indicate how to prioritize the improvement programs by the hospitals by giving an indication of potential failures and its impact. The RPN of the above factors indicates that by improving the processes responsible for these factors, hospitals can ensure higher patient satisfaction.

These can be identified by interviewing the doctors and employees of hospital and necessary modifications have to be done in the processes and implemented.

References

1. Committee on Quality of Health Care in America, 2001, p.28.
2. The Basics Of FMEA, CRC Press, 2nd edition, 2009, 90 pages.
3. Failure Mode and Effect Analysis, 2nd edition by D. H. Stamatis, ASQ Quality Press, Milwaukee, WI, 2003.
4. FMEA-4 Potential Failure Mode and Effects Analysis, 2008, Automotive Industry Action Group (AIAG), phone 1-810-358-3003, 151 pages.
5. Potential Failure Mode and Effects Analysis in Design (Design FMEA) and Potential Failure Mode and Effects Analysis in Manufacturing and Assembly

Processes (Process FMEA) and Effects Analysis for Machinery (Machinery FMEA)

6. MIL-STD-1629A, Procedures for Performing A Failure Mode, Effects and Criticality Analysis.

7. Gerlinde Berghofer, Ph.D., Andrea Lang, Ph.D., Helga Henkel, M.A., Friedrich Schmidl, Ph.D., Stephan Rudas, M.D. and Margot Schmitz, M.D." Satisfaction of Inpatients and Outpatients With Staff, Environment, and Other Patients" Psychiatric Services 60:1053-1058, 2009.

8. Benjamin G. Druss, M.D., M.P.H., Robert A. Rosenheck, M.D. and Marilyn Stolar, M.A. Patient Satisfaction and Administrative Measures as Indicators of the Quality of Mental Health Care. New England Journal of Medicine 405:1060-1063, 2006.

9. Sitzia Jand N. Wood, "Patient satisfaction: a review of issues and concepts", Social Science & Medicine, vol. 45, no. 12, pp. 1829-1843, 1997.

10. Vuori H, "Patient satisfaction—does it matter?", Quality Assurance Health Care, vol. 3, pp. 183–189, 1991.

11. Bostan, T. Acuner and G. Yilmaz, "Patient (customer) expectations in hospitals", Health Policy, vol. 82, pp.62-70, 2007.

QUOTABLE QUOTES

1. It is not wrong to be happy. A person who is serious all the time, has missed half of life.
2. Opportunities are like sunrises. If you wait too long, you miss them.
3. Remember, if your problems are as big as ship, your opportunities are as big as ocean.
4. We may not achieve everything that we dream, but we will not achieve anything unless we dream.
5. Hope sees the invisible, feels the intangible and achieves the impossible.
6. Dark is not the opposite of light, it's just the absence of light. Problem is not opposite of solution, it's just the absence of an idea.
7. A step backward doesn't mean you are giving up, it's just your only way of regaining your balance and be able to move two steps forward.
8. When unexpected situations come in front of you, what does it mean? It means that you are moving ahead faster than others.
9. If you are a good listener you are likely to be reckoned as a good communicator, much more a good person.

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