

INTEGRATED LEAN SIX SIGMA APPROACH FOR HEALTHCARE SERVICE QUALITY MANAGEMENT

Sourabh Pal^a Santosh Kumar Sharma^b

^aDepartment of Mechanical Engg.

^bHead of Department

Chhatrapati Shivaji Institute of Technology,
Durg (C.G.)

Abstract

The competition among medical industry is becoming fiercely competitive in India. But the management of hospital is imperfect. Hospitals are in need of scientific management thought and analysis methods. Lean Six Sigma (LSS) can improve service process, improve service quality and efficiency and improve customer satisfaction; thereby it could enhance the competitiveness of hospitals. The FMEA-Failure Mode and Defect Analysis is used to prioritize the probable failure modes for action. FMEA is a group based, efficient, proactive, and contemplated based strategy that is utilized to anticipate process and item issues before they happen. It gives a look at what issues could happen as well as at how serious the impacts of the issues could be.

Risk Priority don't solidly manage need as some disappointment modes may warrant quick activity despite the fact that their RPN may not rank among the most noteworthy. Consequently the reasons for disappointment modes for fancied activity/prepare have been assessed utilizing The Analytic Hierarchy Process, it is a successful instrument for managing complex basic leadership, and may help the chief to set needs and settle on the best choice. The AHP considers an arrangement of eval The AHP produces a weight for every assessment standard as indicated by the chief's combine astute correlations of the criteria. The higher the weight, the more vital the relating rule and an arrangement of option choices among which the best choice is to be made.

Keywords: Lean Six Sigma, (LSS), Failure Mode Effect Analysis (FMEA), Analytical Hierarchal Process (AHP), Reliability, Risk Priority Number (RPN), Health Care, Failure mode.

I. INTRODUCTION

Six sigma will be an set about strategies what's more instruments to methodology change. It had been produced by Motorola clinched alongside 1986. A system that gives associations devices will move forward the proficiencies from claiming their business techniques. This build to execution Also diminishing over transform variety prompt deformity decrease What's more change done profits, Worker morale, Furthermore personal satisfaction from claiming results alternately involving entire organization's commitment, particularly from the Top Management. Six sigma activities take after one task methodologies propelled by Deming's PDCA cycle i.e. Plan Do Check and Act.[1]

Benefits:

- Continuous efforts to reduce process variation.
- The system and processes having characteristics that can be analyzed, measured, improved or controlled.
- Achievement of sustained quality improvement.

Lean Concept

Lean concept is a framework of techniques and activities for completing an manufacturing or service operation. Lean refers to systemic strategy for the disposal for waste within a process or services. Those systems and exercises vary as stated by the provision nearby at they bring those same underlying principle: those disposal

about constantly on non-value-adding exercises furthermore waste from the business. Lean execution may be subsequently centred on getting the right things of the right put in the right moment in the correct amount with accomplish impeccable worth of effort flow, same time minimizing waste and being adaptable and fit on progress.

Lean concept goals are:

- Enhance quality: To stay aggressive on today's marketplace, an organization must see all the its customers' needs what's more necessities and plan procedures will help their desires What's more prerequisites.
- Elimination of waste: Waste will be any movement that expends time, resources, alternately space anyway doesn't include whatever esteem of the item alternately administration.

Integration of Lean Six sigma in healthcare industry

A incorporated methodology using those best about Lean and Six Sigma methodologies will increase share value of organisation by executing sensational upgrades clinched alongside client satisfaction, cost, quality, velocity also contributed money. Those organizations working on the coordinated methodology will increase these real benefits:

- Turned into speedier what's more additional responsive with clients strive to six sigma ability level.
- Work at most reduced expenses for poor nature.
Attain more amazing adaptability for those businesses

Integration of Lean Six Sigma- a powerful union

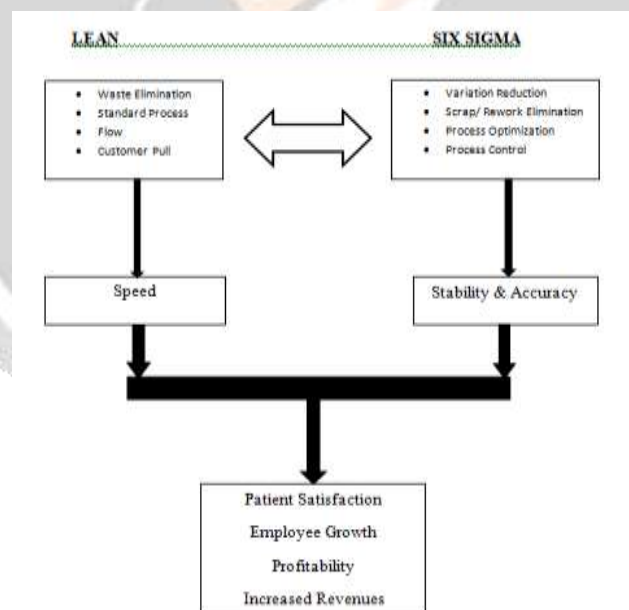


Figure-1 Integration of Lean & Six Sigma

Implementation of Lean Six Sigma in Healthcare Industry

A synergised approach making the best of out of Lean Strategies and Six Sigma shall enhance shareholder regard by achieving breathtaking changes in buyer devotion, quality, speed , cost and contributed capital. The associations sharpening the fused approach will expand below vital favourable circumstances:

- Become speedier and more open to customers gain ground toward Six Sigma capacity level
- Operate in any event costs of low quality
- Achieve more noticeable flexibility all through the business.

Six Sigma Approach to Healthcare Industry

The test for social protection industry to benefit by the use of Six Sigma is foremost. Calm care inside and out incorporates human segment when stood out from machine components, in which the variability is honest and to a great degree difficult to assess. In this way, challenge in grasping Six Sigma approach to manage restorative administrations is to make sense of how to utilize the information from Six Sigma to drive human direct. Accomplishment will come exactly when the Six Sigma specific system is joined with a social philosophy for change expanding speed and a sound operational segment.

There are by and large four estimations (pointers) that can be used by independently or in blend to describe level of execution of a human administrations affiliation. These measurements are advantage level, advantage cost, purchaser dedication, and clinical enormity. While these measurements are relevant in social protection affiliations, they are in like manner incredibly difficult to apply in restorative administrations setting. Despite the troubles in using Six Sigma in the social insurance industry, various specialists' offices inside the human administrations industry is beginning to use Six Sigma way to deal with improve patients' satisfaction. [15]

Failure Mode and Effects Analysis

Failure mode and effects analysis is a procedure for change of system and processes with a view to enhance security. It is a team based, think, proactive, and mulled over based system that is used to thwart process and thing issues before they happen. It focuses on what issues could happen as well as at how serious the impacts of the issues could be. FMEA expect that regardless of how learned or cautious individuals are, disappointments will happen in a few circumstances and could even probably happen. The emphasis is on what could enable the inability to happen. In a perfect world, FMEA can be utilized to help keep disappointments from happening. Notwithstanding, if a specific disappointment can't be anticipated, FMEA at that point concentrates on assurances that can be set up to keep the disappointment from contacting the individual accepting consideration, treatment, or administrations, or, in the most pessimistic scenario, alleviate its belongings if the disappointment can cause hurt.

Reliability

Reliability principles are used adequately in organizations, for instance to help gather, survey, figure, and upgrade the general unflinching nature of complex structures. Unwavering quality standards, used to blueprint systems that make up for the limits of human limit, can upgrade prosperity and the rate at which a structure dependably conveys fancied outcomes.

Unwavering quality is measured as the backwards of the framework's disappointment rate. Accordingly, a framework that has an imperfection rate of one in ten, or 10 percent, performs at a level of 10-1.

The Analytical Hierarchy Process (AHP)

The Analytic Hierarchy Process, envisaged by Thomas Saaty in 1980, is a strong device for overseeing complex fundamental initiative, and may facilitate the boss to predefined needs and settle on best decision. By decreasing complex decisions to a movement of combine savvy relationships, and a while later coordinating the results, the AHP gets both comprehensive and target parts of the made choice. Additionally, it merges supportive strategy for evaluating the consistency of the chief's appraisals, consequently lessening the inclination in the fundamental authority get ready.

II. LITERATURE REVIEW

The purpose of Lean Thinking in healthcare is to create an environment for improving flow and eliminating waste. Six Sigma on the other hand, helps to identify and quantify problems that are related to variation in processes. Both are powerful strategies to focus efforts in the areas that offer the most potential improvement. Despite their disparate roots, it is quite clear that Lean and Six Sigma encompass many common features such

as an emphasis on customer satisfaction, a culture of continuous improvement, comprehensive employee involvement and search for root causes. Lean always asks the question, "Why does this process exist at all? What is the value and the value stream?" Six Sigma starts with "How can we improve this process?" It does not ask "Why does it exist at all? (Antony and Banuelas, 2001) (5)

According to George (2002), Six Sigma does not directly address process speed and so the lack of improvement in lead time in companies applying Six Sigma methods alone is understandable. These companies also generally achieve modest improvement in Work in Process (WIP) and finished goods inventory turns. In a similar manner, those companies engaged in Lean methodology alone show limited improvements across the organization due to the absence of Six Sigma organizational infrastructure. In essence, an integrated approach utilizing the best of Six Sigma and Lean Strategies will maximize shareholder value by accomplishing dramatic improvements in customer satisfaction, cost, quality, speed and invested capital. The companies practicing the integrated approach will gain four major benefits (George, 2002): Become faster and more responsive to customers; strive for Six Sigma capability level; operate at lowest costs of poor quality; and achieve greater flexibility throughout the business.[6]

Six Sigma is deployed by carrying out improvement projects. Project selection is usually based on a translation of the company strategy into operational goals (Pyzdek, 2004). Six Sigma provides an organizational structure of project leaders and project owners. Project leaders are called Black Belts (BBs) and Green Belts (GBs). Members of upper management play the role of project owners, or Champions

Rausand, M. (2004) FMEA is especially efficient if applied in the analysis of elements which cause the whole system failure. However, it can be very complicated in the case of complex systems (such as vehicles), which have multiple functions and are comprised of a number of components, since a variety of information on the system has to be considered [22]

III. PROBLEM IDENTIFICATION

Presently, the execution and uses of medicinal services frameworks have moved to the concentration of social and political consideration in the propelled nations. In the globalizing scene, ever less of these economies can bear to fund the operation of their welfare frameworks in an indistinguishable route from some time recently

Know Problems :

- High cost and so forth drug store costs in addition to expenses of work .
- None settled expenses as nursing, unit, secretary, night managers and pharmacy.
- Lack of viable administrative prerequisite
- Incomplete opiate medicine and conveyance and reaction documentation
- Inadequate documentation of patient parameters with basic drugs
- Failure to get all telephone orders marked by MD with 48% hours

IV. RESEARCH METHODOLOGY

Failure mode and effect analysis is an expository strategy (a paper test) that joins innovation and experience of individuals in recognizing likely disappointment method of item or process and getting ready for its annulment. FMEA is a "preceding the-occasion" activity requiring a collaboration to effortlessly and economically reduce changes in outline and generation.

FMEA can be clarified as a gathering of occasions anticipated to :

1. Perceive and assess the potential disappointment of an item or process and its belongings.
2. Recognize activities that could kill or diminish the possibility of potential disappointments.
3. Archive the procedure.

FMEA can be utilized as an individual venture instrument. Be that as it may, it is emphatically prescribed that utilization to create restorative activity in a procedure change extend. A FMEA is not a trifling device rather it requires huge exertion from a different teams. FMEA technique use at :-

- Formation of the item idea, for checking whether all prospects of the client are incorporated into this idea.
- Define the item, keeping in mind the end goal to check whether ventures, benefit, supplies are fitting and controlled in the correct time.
- Process of generation, so as to check whether documentation prepared by architects is completely done.
- Assembly, to check whether the procedure of the gathering is good with documentation.
- Organization of the administration, keeping in mind the end goal to check whether the item or the administration is lovely with perceived criteria.

RECORD PROCEDURE FOR FMEA

A. Items and its purpose

Including the environment in which the targeted item has to operate, specify all its roles and functions.

B. Potential Failure Mode

- Evaluating past failures, establish reports, brainstorming.
- Illustrate in technical terms and not as clients will see.
- For example: split, distorted, extricated, short-circuited, cracked, releasing, staying, oxidized and so on.

C. Potential Effects of Failure

- Customers' perception of failure (inward/end client).
- For example: unpredictable functioning, poor aspects, clamour, impeded capacities, decay and so forth.

D. Severity

Severity is the evaluation of the reality of the impact of the potential failure mode. In this we need to decide all failure modes in light of the practical prerequisites and their belongings. A case for severity rating is given in taking after table:

SEVERITY RATINGS	
Critical: Can cause hazard/health issue	9-10
Major : Requires necessary attention	7-8
Minor : Requires attention in the near	5-6
System is degraded but operation continued.	3-4
Insignificant: Causing no immediate effect on performance.	1-2

E. Class

Grouping of any exceptional item qualities requiring extra process control.

F. Potential Cause /Mechanism of Failure

Each cause/component must be recorded briefly.

Examples are mistaken life supposition, poor natural assurance, incorrect material, over stressing, lacking oil, weariness, fatigue, inadequate design, consumption, yield, crawl etc.

G. Occurrence

Occurrence is the shot that one of the specific cause/part will happen. In this movement, it is critical to look at the explanation behind a mistake and how frequently it happens. Taking a look at comparative items or forms and the disappointments that have been reported for them can do this. A failure cause is looked upon as a plan shortcoming. A case for event rating is given in taking after table:

Probability of Occurrence	
Unlikely	1

Low (few)	2-3
Moderate (occasional)	4-6
High (repeated)	7-8
Very high (consistent failure)	9-10

H. Detection

Probability of detection/control	
Outstanding : Control mechanisms are fully effective.	9-10
High : unlikely cause or failure will go undetected.	7-8
Medium: Effective with specific conditions.	5-6
Low: Failures rarely to be detected.	3-4
Ineffective: Failures certainly not detected.	1-2

4.3 FMEA Worksheet

For the most part FMEA table will have a noteworthy part for each segment. As these parts may have different disappointment modes, the significant column is here and there partitions into sub-lines where each sub-line outlines a particular disappointment mode . The table is composed into the accompanying structures:-

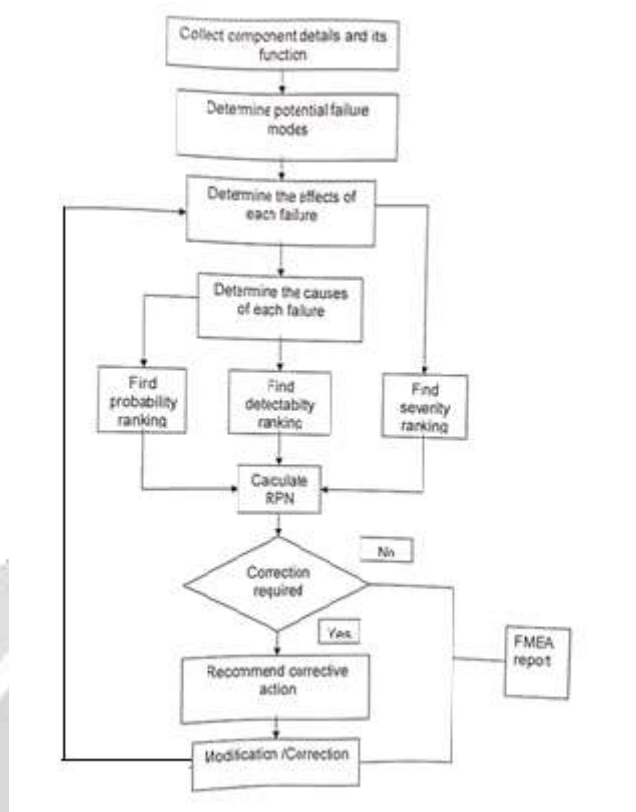
1. Phase:- It consists of factor according to which it will affect the working environment in the hospitals. These Factors are Tangibility, Reliability, Responsiveness, Assurance, & Courtesy.
2. Activity:- the activities which are performed under these factors are being categorise here. These are operation, admission, cleanliness, medicines supply, etc
3. Failure Modes:- the possible failure modes which could be detected under the the activities which is being performed are being analysed
4. Effects:- What are the possible effects which could be caused due to the failure modes are analysed
5. Control Measures:- The way in which failure can be stopped are investigated.
6. Detection
7. Severity
8. Occurrence
9. Risk Priority Number

FAILURE MODE AND EFFECT ANALYSIS (FMEA) WORKSHEET

Phase	Activity	Failure modes	Effects	Control measures	S	O	D	RPN
1	1.1	1.1.1						
		1.1.2						
		1.1.3						
		1.1.4						
	1.2	1.2.1						
		1.2.2						

This worksheet was used to record information during the FMEA sessions, for writing and allocating a number to each process phase, activity and possible failure modes, their effects, and safeguards in place to avoid failure (control measures). A severity score (S) was assigned to failure effects, whereas occurrence (O) and detection (D) scores were given to failure modes. The risk probability number (RPN) was calculated by multiplying the 3 scores.

FMEA Flow Chart



Implementation of the AHP

The AHP can be executed in three straightforward back to back strides:

- 1) Computing the vector of criteria weights.
- 2) Computing the matrix of option scores.
- 3) Ranking the options.
- 4) Checking the consistency.

Each progression will be depicted in detail in the accompanying. It is expected that m assessment criteria are considered, and n alternatives are to be assessed. A helpful procedure for checking the dependability of the outcomes will be additionally presented.

1. Computing the vector of criteria weights

In order to compute the weights for the different criteria, the AHP starts creating a pair wise comparison matrix A . The matrix A is a $m \times m$ real matrix, where m is the number of evaluation criteria considered. Each entry a_{jk} of the matrix A represents 1 the importance of the j th criterion relative to the k th criterion. If $a_{jk} > 1$, then the j th criterion is more important than the k th criterion, while if $a_{jk} < 1$, then the j th criterion is less important than the k th criterion. If two criteria have the same importance, then the entry a_{jk} is 1. The entries a_{jk} and a_{kj} satisfy the following constraint: $(1) \cdot = 1$. $a_{jk}a_{kj}$ Obviously, $a_{jj} = 1$ for all j . The relative importance between two criteria is measured according to a numerical scale from 1 to 9, as shown in Table 1, where it is assumed that the j th criterion is equally or more important than the k th criterion. The phrases in the "Interpretation" column of Table 1 are only suggestive, and may be used to translate the decision maker's qualitative evaluations of the relative importance between two criteria into numbers.

<i>Value of a_{jk}</i>	<i>Interpretation</i>
1	<i>j and k are equally important</i>
3	<i>j is slightly more important than k</i>
5	<i>j is more important than k</i>
7	<i>j is strongly more important than k</i>
9	<i>j is absolutely more important than k</i>

Table-1 Relative Scores

Once the matrix A is built, it is possible to derive from A the normalized pair wise comparison matrix A_{norm} by making equal to 1 the sum of the entries on each column, i.e. each entry a_{ij} of the matrix A_{norm} is computed as

$$\bar{a}_{jk} = \frac{a_{jk}}{\sum_{l=1}^m a_{lk}}$$

Finally, the criteria weight vector w (that is an m -dimensional column vector) is built by averaging the entries on each row of A_{norm} , i.e.

$$w_j = \frac{\sum_{l=1}^m \bar{a}_{jl}}{m}$$

2. Computing the matrix of option scores

The matrix of option scores is a $n \times m$ real matrix S . Each entry s_{ij} of S represents the score of the i th option with respect to the j th criterion. In order to derive such scores, a pairwise comparison matrix $B^{(j)}$ is first built for each of the m criteria, $j=1, \dots, m$. The matrix $B^{(j)}$ is a $n \times n$ real matrix, where n is the number of options evaluated. Each entry of the matrix represents the evaluation of the i th option compared to the h th option with respect to the j th criterion. If $b_{ih}^j > 1$, then the i th option is better than the h th option, while if $b_{ih}^j < 1$, then the i th option is worse than the h th option. If two options are evaluated as equivalent with respect to the j th criterion, then the entry is 1. The entries and satisfy the following constraint:

$$b_{ih}^{(j)} \cdot b_{hi}^{(j)} = 1$$

And $b_{ii}^j = 1$ for all i . An evaluation scale similar to the one introduced in Table 1 may be used to translate the decision maker's pair wise evaluations into numbers.

Second, the AHP applies to each matrix $B^{(j)}$, the same two-step procedure described for the pair wise comparison matrix A , i.e. it divides each entry by the sum of the entries in the same column, and then it averages the entries on each row, thus obtaining the score vectors s^j , $j=1, \dots, m$. The vector s^j contains the scores of the evaluated options with respect to the j th criterion. Finally, the score matrix S is obtained as

$$S = [s^{(1)} \dots s^{(m)}]$$

i.e. the jth column of S corresponds to s^j

3. Ranking the options

Once the weight vector w and the score matrix S have been computed, the AHP obtains a vector v of global scores by multiplying S and w, i.e.

$$v = S \times w$$

The ith entry v_i of v represents the global score assigned by the AHP to the ith option. As the final step, the option ranking is accomplished by ordering the global scores in decreasing order.

4. Checking the Consistency

At the point when many combine insightful correlations are played out, a few irregularities may normally emerge. One case is the accompanying. Expect that 3 criteria are considered, and the chief assesses that the primary standard is somewhat more vital than the second measure, while the second foundation is marginally more essential than the third basis. An apparent irregularity emerges if the chief assesses by slip-up that the third basis is similarly or more essential than the principal rule. Then again, a slight irregularity emerges if the leader assesses that the principal paradigm is likewise somewhat more vital than the third model.

A reliable assessment would be, for example, that the main standard is more essential than the third rule. The AHP joins a successful system for checking the consistency of the assessments settled on by the leader when constructing each of the pair wise correlation grids required all the while building each of the pair wise comparison matrices involved in the process, namely the matrix A and the matrices B^j . The technique relies on the computation of a suitable consistency index, and will be described only for the matrix A. It is straightforward to adapt it to the case of the matrices B^j by replacing A with B^j , w with s^j , and m with n. The Consistency Index (CI) is obtained by first computing the scalar x as the average of the elements of the vector whose jth element is the ratio of the jth element of the vector $A \cdot w$ to the corresponding element of the vector w. Then,

$$CI = \frac{x - m}{m - 1}$$

A perfectly consistent decision maker should always obtain $CI=0$, but small values of inconsistency may be tolerated. In particular, if

$$\frac{CI}{RI} < 0.1$$

the inconsistencies are tolerable, and a reliable result may be expected from the AHP. In (8) RI is the Random Index, i.e. the consistency index when the entries of A are completely random. The values of RI for small problems ($m \leq 10$) are shown in Table

m	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

Table-2 Values of the Random Index (RI) for small problems.

V. RESULTS AND DISCUSSIONS

QUESTIONNAIRE						
Factors	Cause	Effect	S	O	D	RPN
Tangibility:	CAUSE 1	i. Is that equipment and technology up to date?	9	2	10	180
	CAUSE 2	ii. What is the condition of physical facility in hospitals?	7	4	8	224
	CAUSE 3	iii. Washrooms & toilets are properly clean or not?	6	3	6	108
	CAUSE 4	iv. Rooms/ Wards hygienic condition?	8	2	7	112
	CAUSE 5	v. The meals provided are nutritious or not?	8	4	8	256
	CAUSE 6	vi. Are foods being served hot& fresh?	7	3	6	126
	CAUSE 7	vii. How is the nurses behaviour towards patients?	6	5	7	210
	CAUSE 8	viii.Are rooms/ wards being crowded & noisy?	7	3	6	126
	CAUSE 9	ix. Parking conditions are proper or not?	4	7	3	84

Reliability:	CAUSE 10	i. Is food delivered ontime?	6	3	6	108
	CAUSE 11	ii. Staff's responses in emergency are prompt or not?	9	1	8	72
	CAUSE 12	iii. Patient's records/data readily available or not?	8	2	7	112
	CAUSE 13	iv. Is that hospital charges arefluctating /inappropriate?	6	3	6	108
	CAUSE 14	v. Staff's services are efficient or not ?	7	2	8	112

Responsiveness:	CAUSE 15	i. Is there any delay in services provided to patient while discharging?	6	4	6	144
	CAUSE 16	ii. How is the patient-nurse interaction when the patients need them?	7	2	8	112
	CAUSE 17	iii. Admission procedure is easy or complex?	9	3	9	243
	CAUSE 18	iv. How is the administrative staff's attitude towards the patient and their family?	6	4	5	120
	CAUSE 19	v. Does chemist of the hospital explain instructions appropriately?	9	1	8	72
	CAUSE 20	vi. Do doctors explain patient's queries transparently about any procedure?	8	2	9	144
	CAUSE 21	vii. How the treatment process explained to the patient?	7	3	7	147
	CAUSE 22	viii. How the discharge process is explained to patient's family?	6	4	6	144

Assurance:	CAUSE 23	i. Do the customers trust nurses of the hospital?	6	4	6	144
	CAUSE 24	ii. Do patient's feel assured that he/she will be recover well before they will be discharged?	8	1	9	72
	CAUSE 25	iii. Billing of the service by the institution is proper or not?	7	2	6	84
	CAUSE 26	iv. Is that transactions are safer with the institution's employees?	3	4	5	60
	CAUSE 27	v. Is that the patients feel safe with the knowledge and skill of the nurses?	5	3	7	105

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	CAUSE 25	iii. Billing of the service by the institution is proper or not?	7	2	6	84
	CAUSE 26	iv. Is that transactions are safer with the institution's employees?	3	4	5	60
	CAUSE 27	v. Is that the patients feel safe with the knowledge and skill of the nurses?	5	3	7	105
Courtesy:	CAUSE 28	i. How is staff's behaviour during admission procedure?	5	2	8	80
	CAUSE 29	ii. How is staff's behaviour during housekeeping process?	5	4	6	120
	CAUSE 30	iii. Is nurse's behaviour empathetic towards patients?	6	1	8	48
	CAUSE 31	iv. Do staff greet the patients?	3	3	7	63
	CAUSE 32	v. How is the behavior with the visitors?	2	5	5	50

Table 5.1: Priority evaluation for severity failure

Service Factor	Cause of Failure	Severity	
		Score	Priority
Tangibility	1	9	0.429
	2	7	0.37
	3	6	0.4
	4	8	0.47

	5	8	0.4
	6	7	0.4
	7	6	0.44
	8	7	0.33
	9	4	0.286
Reliability	10	6	0.4
	11	9	0.5
	12	8	0.47
	13	6	0.4
	14	7	0.41
Responsiveness	15	6	0.37
	16	7	0.41
	17	9	0.43
	18	6	0.4
	19	9	0.5
	20	8	0.42
	21	7	0.41
	22	6	0.37
Assurance	23	6	0.37
	24	8	0.44
	25	7	0.47
	26	3	0.25
	27	5	0.33
Courtesy	28	5	0.333
	29	5	0.33
	30	6	0.4
	31	3	0.23
	32	2	0.166

Table 5.2: Criteria priority for occurrence failure

Service Factor	Cause of Failure	Occurrence	
		Score	Priority
Tangibility	1	2	0.095
	2	4	0.21
	3	3	0.2
	4	2	0.12
	5	4	0.2
	6	3	0.18
	7	5	0.28
	8	3	0.18
	9	7	0.5
Reliability	10	3	0.2
	11	1	0.06
	12	2	0.12

	13	3	0.2
	14	2	0.12
Responsiveness	15	4	0.25
	16	2	0.12
	17	3	0.14
	18	4	0.27
	19	1	0.6
	20	2	0.11
	21	3	0.18
	22	4	0.25
	Assurance	23	6
24		8	0.06
25		7	0.13
26		3	0.33
27		5	0.2
Courtesy	28	5	0.133
	29	5	0.27
	30	6	0.07
	31	3	0.23
	32	2	0.417

Table 5.3: Criteria Priority for detection failure

Service Factor	Cause of Failure	Detection	
		Score	Priority
Tangibility	1	10	0.476
	2	8	0.42
	3	6	0.4
	4	7	0.41
	5	8	0.4
	6	6	0.38
	7	7	0.39
	8	6	0.38
	9	3	0.214
Reliability	10	6	0.4
	11	8	0.044
	12	7	0.41
	13	6	0.4
	14	8	0.47
Responsiveness	15	6	0.37
	16	8	0.47
	17	9	0.43
	18	5	0.33
	19	8	0.44
	20	9	47

	21	7	0.41
	22	6	0.37
Assurance	23	6	0.37
	24	9	0.5
	25	6	0.4
	26	5	0.42
	27	7	0.47
Courtesy	28	8	0.534
	29	6	0.4
	30	8	0.53
	31	7	0.54
	32	5	0.417

Criteria Priorities and Inconsistency ratio Evaluation

A pair wise correlation at the principal level of the chain of importance is executed with a specific end goal to get esteem judgements. Table reports the combine shrewd examination given by the hospital staff as far as the five criteria proposed for the assessment of disappointment cause.

Table: Criteria priorities

	Severity	Occurrence	Detection
Severity	1	1.7	0.710
Occurrence	0.6	1	0.43
Detection	1.4	2.33	1

$$CI = \frac{3.001805-3}{3-1}$$

$$CI = 0.000902$$

$$I_r = \frac{0.000902}{0.58} = 0.001556$$

Inconsistency ratio = 0.001556 < 0.1, hence acceptable.

Table: Criteria Priorities evaluation

	Score	Priority (weight)
Severity	5	0.33
Occurrence	3	0.20
Detection	7	0.47

The prioritization step is repeated for the second various level. The need that each reason for disappointment has as for alternate reasons for disappointment as far as each foundation must be assessed.

Discussions

FMEA, patients’ documentation is updated and made easily available, and nephrological examinations are regularly performed as planned.

- Plotting failure modes on a matrix that also takes into account the weight of the control measures is a peculiarity of the FMEA model we employed, so that it is easy to identify priorities. We believe these results in quicker evaluations because the priority selection is simplified -and thus it reduces action times.
- We have observed that team selection, motivation and training have great significance, because this analysis is subjective and depends on every member’s abilities and open-minded attitude. The first application of FMEA actively involved all of the team, and it required some work, but it was fulfilled in quite a short time (6 months).

- We have applied the acquired know-how to 2 other processes (peritoneal dialysis and haemodialysis patient dressing): the resulting work was faster and easier. In all of the FMEA we performed, the reduction of total RPN resulted in a great improvement in the service to patients we provide.
- FMEA will be coupled with incident reporting and clinical audits in the Aosta Valley Health Care Organisation, to verify control measures and their effectiveness.
- i. Informed consent: We state that the manuscript does not report the results of experimental investigations on human subjects.
- ii. Financial support: We state that we have not received any grants or funds in support of this study.
- iii. Conflict of interest statement: None of the authors has any conflict of interest.

VI. CONCLUSION & FUTURE SCOPE

Conclusion

FMEA helped with AHP gives off an impression of being an intense apparatus for playing out a total basically investigation on organizing disappointments recognized in an unwavering quality examination for restorative activities. It seems, by all accounts, to be a capable apparatus for playing out a total activity. It makes it conceivable to get a positioning of disappointment causes which incorporates a few sort of data (disappointment rate, non-recognition, seriousness, expected cost for each blame). Specifically, the utilization of an AHP-based approach for the multi-quality investigation furnishes a structure with intriguing attributes for the choice procedure of the most basic reason for disappointment.

The AHP strategy causes a creator to work in a precise and expository way, tending to thus every part of the disappointment in the pecking order. Subjective and subjective judgements including various individuals can be incorporated into the need setting process. Truth be told by utilizing a progression of combine shrewd judgements, AHP can deal with the issue gotten from "direct" (quantitative) assessment of immaterial (subjective) criteria, conquering the issue to allocate a score in light of tables announcing unclear and inconsistent semantic assessments. Notwithstanding, one can take note of that if solid quantitative judgements are accessible for a few criteria, they can undoubtedly be incorporated into AHP.

In synopsis, the AHP makes it workable for officials to acclimatize every one of the actualities, measures, re-assess and impart their choice. Once an underlying choice is made, it is not yet last; even a solid willed chief is subjected to outer weight from particular vested parties, for example, support individual, providers, clients, workers, exchange unions or lawmakers. Slowly, needs are changed until another reshaped choice rises. Without a choice model review trails are lost and administrators think that its difficult to deliberately survey or follow the means and sub-choices settled on in the choice procedure. The trouble of directing an appropriate survey builds increments exponentially with the quantity of destinations. Constant change is regularly a less demanding beginning way. By inspecting how an association at present settles on choice or performs assessment and soliciting how the subtle elements from the present procedure reasonable in respect to the basic leadership ideas encapsulated in AHP, one can see numerous open doors for simple, yet huge enhancements.

All in all, the utilization of AHP with FMEA can give a successful method for measuring and positioning basic disappointments. The proposed approach frames a reason for a nonstop procedure of item/process dependability and progressive systems and the needs of the components can be effortlessly altered and refreshed.

Future Scope

Employments of Lean and Six Sigma have been constrained in neighbourliness; the accomplishments in accommodation have happened in one office extends that can be typically gone for taking care of one issue.

Investigate proposes that Lean and Six Sigma procedures can be useful in enhancing numerous offices inside a healing center and its administrations. The absence of usage and hesitance towards Lean and Six Sigma is because of the overwhelming errand of changing the way of life of the association and the asset costs related with preparing and setting up framework. Accordingly, Lean and Six Sigma execution might be more powerful at a littler association, comprising of less properties..

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