



ROLE OF STATISTICAL METHODS AND QC TOOLS IN HOSPITAL MANAGEMENT

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It is the mark of a truly intelligent person to be moved by statistics.

George Bernard Shaw

Universality of Statistical Methods

Statistics has been a modern management decision support tool, it is the science of numbers and as a branch of Mathematical sciences has immense potential and versatility to bring out hidden facts from figures by in-depth expiration and insightful analysis. Statistical Methods help in understanding hidden facts, trends, variations, growth pattern which are inherent and not apparent in our routine operations A large volume of data can be confusing but when it is statistically analyzed, it brings out value added out puts for decision Makers. Similarly The Quality control tools are of immense value to any Manufacturing and services providing organizations such as Hospitals in enhancing productivity & Quality.

In science and Space research statistics has a key role to play> Understanding of the Universe/totality is always trough a sample, such as blood sample which calls for sampling techniques and other statistical tools to understand and interpret.

Statistical Methods & QC have universal applications in any field of operations. In sports including Cricket, race and games of chance, Oil exploration, diagnosis and allied areas of health care are among the vital areas for applications of statistical methods

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and Quality control tools and techniques. Application areas extends but not limited to; production systems, Hospital Management, Marketing Research, Quality control, Analytical Finance. And even in Politics for conducting post pool estimates. Demography, Life insurance, Traffic management depend on statistical methods, Concepts of Probability and Normal Distribution are basic to any repetitive and risk involved operations.

Management process & strategies call for statistical methods for understanding and crtically analyzing the situation. Until anything is measure it is only a opinion and there is no management without measurement, which Managers agree

In Corporate organizations Managers can make effective and efficient decisions only when they use relevant data and information in a systematic manner adopting appropriate statistical methods. The principal aim of statistical methods is to provide decision makers with a set of techniques for collecting, analyzing, interpreting data into actionable recommendations and to take right decisions. Statistical tools can help in Planning, Implemnting, controlling and monitoring process of Management.

Application of statistical methods is wide spread and encompasses all economic, political educational administrative and health care areas.

Managers and Decision makers at all levels dealing with data and information must understand and follow the problem solving process/ methodology: Define , obtain relevant data Analyze,, Monitor & evaluate , measure inherent risks before taking decisions. In all the stages statistical methods play a important & decision support role. It is therefore important that essential aspects of Data collection, sampling Measurement of central values , Variation/ standard deviation, correlation, regression, testing Hypothecs, probability concepts are understood , appreciated and applied in work/ operation areas to get benefit and familiarity with these tools and techniques. Is there any area where Statistical methods have no role to play?

Statistics in Hospital & Health Care systems

It has been observed by many health care experts in their studies that Indian hospitals lack customer focus and orientation and also very few hospitals are adopting QMS & TQM. As such the healthcare industry presents a very dynamic but uncertain environment in which "quality issues" have occupied a central position. Now healthcare organizations are becoming more and more complex, old models of quality assurance, relying on provider-based preset standards are insufficient to solving quality problems. Concepts of total quality management (TQM) and continuous quality improvement (CQI) have taken a central role in healthcare quality management.

Although much has been talked & debated about concerns on health care of the population, total health spending accounted for only 4.0% of GDP in India in 2012, less than half the OECD average of 9.3%. Health spending as a share of GDP among OECD countries is highest in the United States, which spent 16.9% of its GDP on health in 2012. Health expenditure as a share of GDP, India and OECD countries

Health care systems in US and UK and other countries have been adopting Statistical methods, QC and six sigma tools in Manufacturing and services sector including Hospitals have demonstrated dramatic improvement in performance. Understanding and application and implementation of these management tools and techniques where there is immens3e scope, is very marginal. Most medical and health care professionals are averse to statistical mehods and Quantities techniques. The medical professions in general are comfortable with their experience based opinions / hunches rather than data base management systems at large.

Unfortunately understanding, Appreciation and application of statistical methods in Medical systems has not been adequate. Manufacturing systems have adopting Statistical methods and QC tools have shown dramatic performance with higher productivity, better quality, cost and waste control.

Healthcare industry is considered as one of the biggest and fastest-growing sector globally. The domain of this industry covers different types of hospitals, nursing home, medicinal clinics, and institutions which provides primary, secondary, and tertiary levels of patient care. Healthcare industry consumes over 10 percent of Gross Domestic Product (GDP) of most developed nations and contributes enormous part of a country's economy

Health care & hospital Management have taken a major policy making role in the Indian economy and public system. In these health care services providing Industry there is immense scope and opportunity for adopting Management principles and quantitative, statistical methods and QC tools and techniques. Statistical methods, six sigma management approaches are entering health care industry in a big way

In recent years, there has increasing interest in the healthcare industry to apply total quality management (TQM) principles and practices to improve customers quality of service and care. The most influencing reason behind this is increased competitive market, advancement of medical technology, high quality healthcare service at reasonable costs, and proactive consumer culture. Therefore, the healthcare managers begin to find new ways to provide services to meet customers' requirement and TQM best fits to them as this concept had success in other service industries also

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Final

The mass available patient, Treatment data, feedback data, lab analysis data have tremendous value for operating and strategic decision making in various functional areas of Hospital management. There is scope for adopting Optimization tools and techniques in managing inventory of equipments, materials medicine besides minimizing waiting time, Blood Bank, usage of ambulance vans and supporting systems and referrals using statistical data pertaining to these vital areas of hospital operations.

Unfortunately these tools and techniques are not being adequately deployed in Indian Hospital environment.

This paper aims to convey the role and importance of statistical methods, QC tools and Optimization techniques among medical Professional/ Administrators and demonstrates the scope and sample areas having potential for applications with case based examples.

Vast volumes of following aspects of hospital data are available but seldom statistically analyzed:

- In patients flow
- Out patient admissions
- Beds utilization
- Departments performance Vs Capacity utilization-
- Lab test results
- Efficacy of drugs * Treatments,
- Waiting Time,
- Customer feed back
- Suggestions & Recommendations
- Treatment Effects
- Patients' Historical Records
- Referrals
- House keeping
- Canteen
- Parking

The data on the above can be statistically analyzed for estimation/ projection, Testing hypothesis, Visual/ Graphical Presentations and empower Medical /Hospital decision makers to Manage resources in an effective and efficient manner.

The following data pertaining to Inpatient flow during three year period at a renowned hospital is taken for statistical analysis as a demo.

Case study -!

STATEMENT OF SHOWING IPD STATISTICS at a corporate hospital of 1500 beds in Bagalkot

JANUARY TO DECEMBER -2012 -2014

MONTH	Med	Surgery	Ortho	Optho	ENT	OBG	Total	
Jan	530	370	234	297	157	478	2066	
Feb	559	362	232	307	146	504	2110	
Mar	499	365	222	238	139	458	1921	
Apr	456	348	219	255	144	449	1871	
May	524	395	225	251	147	452	1994	
Jun	488	349	235	237	130	431	1870	
Jul	500	357	227	229	152	422	1887	
Aug	547	363	237	242	157	425	1971	
Sep	546	315	212	222	139	392	1826	
Oct	551	335	219	233	148	418	1904	
Nov	487	315	229	213	154	433	1831	
Dec	476	286	225	221	149	500	1857	
Jan	581	302	253	230	156	465	1987	
Feb	511	328	228	264	129	409	1869	
Mar	476	255	186	230	87	385	1619	
Apr	513	329	207	268	144	535	1996	

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May	570	390	271	267	146	526	2170
Jun	586	412	236	293	136	507	2170
Jul	551	476	251	258	152	522	2210
Aug	549	405	248	200	132	452	1986
Sep	585	414	233	280	141	543	2196
Oct	567	437	262	245	143	535	2189
Nov	515	358	242	257	146	257	1775
Dec	538	366	226	221	145	529	2025
Jan	580	428	264	288	160	528	2248
Feb	720	488	288	299	168	485	2448
Mar	704	473	257	260	169	522	2385
Apr	773	454	260	300	168	544	2499
May	803	491	318	408	133	566	2719
Jun	730	434	281	354	157	525	2481
Jul	649	409	266	344	167	555	2390
Aug	666	447	255	267	151	565	2351
Sep	924	594	323	344	154	558	2897
Oct	786	516	261	245	145	557	2510
Nov	839	580	294	334	157	592	2796
Dec	858	549	309	294	168	582	2760
	21737	14495	8935	9695	5316	17606	77784

IP data for 36 months

MED analysis



The above data contains inpatient data for 3 years (36 Months) for six Departments.

The Analysis reveals that on an average 2160 patients /month with a standa deviation of 320.We can expect arrivals between 1500 and 2800 with 95% probability and resources can be planned accordingly. Since the skewness is positive higher turnover is more likely

This Analysis can be done for each of the six departments.

Total IP trends



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Trends for Med



AS an illustration the overall Inpatient data and Med data have been statistically analyzed. We could carry on similar statistical Analysis for other data also

We can compute monthly average, variations in the inflow of patients for each of the six Departments. This will help Hospital Management to understand the relative contribution and variations from each department and to take corrective actions for abnormal variations. Further we can display the data in histograms and Spread diagram to visually see the out layers and abnormalities for actions. The Departments also will understand their contribution, variability for action. We could fit a regression line for each of the six categories to estimate the flow for next period and arrange/ reallocate resources

As an illustration Regression analysis for the total IPD for six Departments have been made .The regression summary results follows:

SUMMARY OUTPUT

Regression Statistics					
Multiple R	0.790075				
R Square	0.624218				
Adjusted R Square	0.613165				
Standard Error	198.8623				
Observations	36				

ANOVA

					Significance
	df	SS	MS	F	F
Regression	1	2233490	2233490	56.47795	1.01E-08
Residual	34	1344572	39546.23		
Total	35	3578062			

		Standard				Upper	Lower	Upper
	Coefficients	Error	t Stat	P-value	Lower 95%	95%	95.0%	95.0%
Intercept	1717.09	67.69299	25.36585	1.13E-23	1579.522	1854.659	1579.522	1854.659
X Variable 1	23.97709	3.190488	7.515181	1.01E-08	17.49324	30.46094	17.49324	30.46094

A similar data on the Waiting time can be analyzed for taking action for abnormal variations

Such Statistical Analysis would be helpful for better understanding the situation and making Decisions

Based on Total IP the Regression Analysis is Y=1717.09 + 23.998X where Y represents the total IP arrivals per month and X the month itself. To estimate the Ip arrivals for the next month based on the trend we have to substitute X=42, which is the 42 nd month in the data set

Similarly for Med

The Regression is Y=427.78+1.78X Based on this we can estimate the ip flow for the subsequent months by substituting for 42,43,...

To measure mean arrivals and variability in each case we could compute Descriptive statistics adopting Excel

Column1					
Mean	603.8056				
Standard Error	20.6052				
Median	555				
Mode	551				
Standard					
Deviation	123.6312				
Sample Variance	15284.68				
Kurtosis	0.174117				
Skewness	1.099176				
Range	468				
Minimum	456				
Maximum	924				
Sum	21737				
Count	36				

The Analysis reveals that average flow of IP per month has been 604 with a high variation (SD) 0f 124. The positive skewness indicates significant growth

Thse are illustrative examples of adopting statistical methods for Hospital data. There are many more advanced tools/and techniques and testing methods such as Correlation,T,F,Z, tests,ANOVA etc

We could correlate the variations for internal and external factors by collecting data .Examine the cause and effect/ root cause Analysis for timely actions

These Statistical Analysis can be easily carried on a continuing basis by concerned Hospital staff with training on Statistical Methods. User friendly built in Excel software. There are such numerous statistical Applications which can be adopted for hospital data base for improving decision making

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