STUDY OF ASSOCIATION OF OPERATIONAL EFFICIENCY AND CUSTOMER SATISFACTION IN TERTIARY HOSPITALS IN PUNJAB

A Thesis

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(Management)

By

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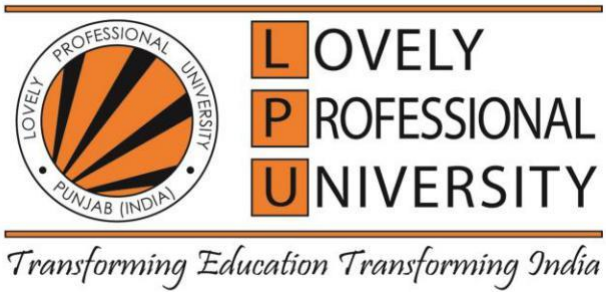

LOVELY PROFESSIONAL UNIVERSITY

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DECLARATION

I, Pritpal Singh, therefore announce that the work exhibited in this research is a certified work done originally completed by me and has not been distributed or submitted somewhere else for the necessity of Degree Program. Any writing, information or work done by others which is used inside this thesis has been given due affirmation and recorded in the reference segment.

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CERTIFICATE

This is certified that the project report entitled ―Study of association of operational efficiency and customer satisfaction in tertiary hospitals in Punjab‖ carried out by Mr. Pritpal Singh S/o Late Engineer F.C.Saini has been accomplished under my guidance and supervision as registered Ph.D. student of Mittal School of Business, Lovely Professional University, Phagwara. This report is completed by him in the partial satisfaction for the award of Ph.D. in management from Lovely Professional University. His thesis reveal his unique work and is worthy of consideration for the award of the Degree of Ph.D. (Management).

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ABSTRACT

This research focuses on studying the association between operational efficiency and customer satisfaction in tertiary hospitals of Punjab. Study to find association was conducted with the help of analysis of data envelopment technique, which is used to find out the efficiency of tertiary medical hospitals considered for the study. Data envelopment analysis focuses on finding efficiency through input /output-based model which follows linear mathematical formulas. As the demand for healthcare services in India is increasing because of many reasons which include awareness for a preventive health checkup, Increasing population, Complexity of disease and availability are major contributors to this(Hazarika, 2013). Demand of health services are increasing but availability of health services are still big issue. Among health service providers in specialized care, Private sector in Punjab is at forefront and covering most of area and population for providing health services .But still according to world health statistics report India is performing below average with 9 beds for 1000 patients which is very below global average. Govt. hospitals in form of community health centers and civil hospitals also started improving their infrastructure to provide health services at specialized level but still bed to patient ratio is not improving from last many years as compared to global average which is a matter of concern. A considerable amount of money invested by government bodies and private sector to improve infrastructure to improve performance of services provided to people and to increase the availability of services to all but as a population of the country is huge that much infrastructure is not enough(Sharma & Kamra, 2013). In that case, it will become very important for hospitals whether private or government to optimally utilized their existing resources, Data envelopment analysis is technique which is formulated to find operational efficiency in form of logical and scale efficiency of organization and to decide their benchmark and operate according to benchmark or if there is no benchmark then set benchmark (Charnes et. al. 1994). Health and healthcare services are too different aspect which needs to be distinguished, Health is related to person and healthcare services does not only involve providing hospital services but also to provide preventive services and post medical checkup services also.

In the present circumstance, it has turned out to be difficult for hospitals in Punjab to guarantee increasingly productive methods for administrations. Under the current conditions, it is fundamental to discover the fitting asset blend and its use. So also, it is important to distinguish

the sources of relative cost wastefulness – specialized and allocate both. The center point of this study is on surveying the hospitals in efficiency terms, for example, the perfect measure of inputs to deliver a given degree of output. The other inspiration driving this investigation has been to see how to address a issue of benchmarking in hospitals.

Data envelopment analysis utilizes an amazing procedure of linear programming to help in doing this. The research of the study incorporates two different aspects one is to evaluate efficiency of hospitals considered for study and another is find satisfaction level of patients from these hospitals to find association among both these dimensions, For evaluating efficiency of hospitals data envelopment analysis technique is used which consist of linear mathematical programs to evaluate efficiency and for satisfaction level the specialists working in Government and Private hospitals of Punjab considered for study to validate content of instrument and the inpatients getting treatment in either Private or Government medical hospital in Punjab considered as tertiary hospitals according to services provided considered for study. The area of the research is Punjab which has been positioned among the most elevated per capita salary states for most recent years. Additionally, the Punjab hospital area has encountered real changes in the hospital division with the formation of Punjab Health System Corporation. Further, the patients who had been admitted to the medical hospitals for over at least one day and one-night corporate into the study, which is minimum criteria to be considered a patient as inpatient.

The analysis initiated with the calculation of efficiency of hospitals decided for study. Hospitals for the study had been selected from three different areas of Punjab i.e. Malwa, Majha and Doaba. Hospitals from each area were selected including hospitals from Chandigarh. Hospitals are selected based on quota sampling. Hospitals of different sizes are selected and size is dependent upon bed strength of hospitals. Result explains that efficiency is considered to be negative moderator between relation of number of specialized doctors and patient satisfaction, Results in table suggested that higher level of efficiency level of hospitals lessen the positive effect of specialized doctors on patient satisfaction In this way, medical hospital productivity variable applies a negative control between accessibility of specialists and patient satisfaction, as we theorized. Moreover, discoveries give the proof that medical hospital size has a critical negative impact on patient satisfaction. To further prove this research analysis is done to support hypothesis which also proves that high level of hospital efficiency lessen the positive effect of specialist doctors on patient satisfaction .For conducting this research hospitals are divided on

basis of size into different parts high efficient and low efficient hospitals .Results of research shows that more efficient hospitals decrease the positive effect of specialized doctors on patient satisfaction. In highly efficient hospitals result of specialized doctors on efficiency is less and non-significant. While on less efficient hospitals comparatively there is stronger effect of specialized doctors on patient satisfaction. Further results show that hospital are running in three types of scale Constant return to scale in 4 hospitals (8.33%) medical hospitals, suggesting that their healthcare administration outputs would increment in a similar extent. This implies hospitals were working at their most gainful scale sizes. Increasing return to scale in 23 hospitals (47.9%) medical hospitals, suggesting that their healthcare administration outputs would increment by a more prominent extent. These medical hospitals subsequently expected to expand their size to accomplish ideal scale, for example, the scale at which there is steady return to scale in the connection among data sources and outputs.

Decreasing return to scale in 21 hospitals (43.7%) hospitals, inferring that their healthcare administration outputs would increment by small extent. medical hospitals would have expected to decrease their size to accomplish ideal scale. Government of the country must plan policy to increase health coverage and network to all. Present research indicates that smaller hospitals have a higher level of efficiency than larger and medium-size hospitals, smaller size hospitals average efficiency is .80. The average efficiency of medium size hospitals is .75 and the large hospital is .73. As per our outcomes, small size medical hospitals are generally more efficient and have higher patient satisfaction as compared with other hospitals .It means Government must make a policy to implement small scale hospitals and cover more area to cover rural area .This will be accomplished through a staged presentation of medical coverage scheme(s) that will be done by promotion and appropriate arranging of healthcare assets. Government must create prepaid and pooled healthcare financing to lessen over-dependence on out-of-pocket spending (Wei et al. 1995). The presentation of such prepayment systems will no doubt diminish the financial boundaries to provide access to medicinal services, and henceforth, add to improving the productivity of hospital. This study was the first to check the level and determinants of hospital framework efficiency in Punjab dependent on quantitative research using data envelopment analysis.

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It is imperative that research work requires a lot of efforts and hard work. It requires high concentration and whole hearted support without which it would not have been possible to accomplish the task. The present work is an effort to throw light on study on association of efficiency and satisfaction of patients of tertiary hospitals of Punjab. The work would not have been possible to come to the present shape without proper guidance, supervision and help provided to me by a number of people.

With a deep sense of gratitude, I acknowledge the encouragement and guidance received from my guide Dr.Mohd Farhan, Associate Professor, Mittal School of Business, Lovely Professional University, and Phagwara. I also express my sincere thanks to Dr. Shailesh Tripathi, Director, Innocent group of institution, Jalandhar, Dr. Rajesh Verma, Head of School, Dr. Vishal Sareen, Head of Department, Dr. Rahul Sharma, Head of Department, Lovely Professional University for their ongoing support and valuable advices during the periodic assessment of my work.

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I am also thankful to all the respondents who helped me in the completion of survey process by spending their valuable time. Last, but not the least, I can‘t forget the moral & psychological support and motivation received from my wife, my daughters and my elder brother during the research work. Most importantly, I offer my significant thanks to the Almighty for all his grace and light which remain as motivation to me all through this work.

Pritpal Singh

Date:

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Chapter 1

INTRODUCTION

This research focuses on studying the association between operational efficiency and customer satisfaction in tertiary hospitals of Punjab state of India. Study to find association was conducted with the help of analysis of data envelopment technique, which is used to find out the efficiency of tertiary medical hospitals considered for the study. Data envelopment analysis focuses on finding efficiency through input /output-based model which follows linear mathematical formulas. As the demand for healthcare services in India is increasing because of many reasons which include awareness for a preventive health checkup, Increasing population, Complexity of disease and availability are major contributors to this(Hazarika, 2013). Demand of health services are increasing but availability of health services are still big issue. Among health service providers in specialized care, Private sector in Punjab is at forefront and covering most of area and population for providing health services .But still according to world health statistics report India is performing below average with 9 beds for 1000 patients which is very below global average. Govt. hospitals in form of community health centers and civil hospitals also started improving their infrastructure to provide health services at specialized level but still bed to patient ratio is not improving from last many years as compared to global average which is a matter of concern. A considerable amount of money invested by government bodies and private sector to improve infrastructure to improve performance of services provided to people and to increase the availability of services to all but as a population of the country is huge that much infrastructure is not enough(Sharma & Kamra, 2013). In that case, it will become very important for hospitals whether private or government to optimally utilized their existing resources, Data envelopment analysis is technique which is formulated to find operational efficiency in form of logical and scale efficiency of organization and to decide their benchmark and operate according to benchmark or if there is no benchmark then set benchmark (Charnes et. al. 1994). Health and healthcare services are too different aspect which needs to be distinguished, Health is related to person and healthcare services does not only involve providing hospital services but also to provide preventive services and post medical checkup services also.

Healthcare infrastructure is an umbrella term covering numerous sectors including social, financial and physical capital, that are required for making favorable condition for various segments of people visiting hospitals (Singh & Rochwani, 2013). Regardless of different improvement plans, absence of fundamental framework, both social and physical upkeep of infrastructure is a noteworthy requirement to advance in health sector. The healthcare situation particularly, in the nation is presenting a challenge for the nation. The health services framework, including all types of hospital, the financing of medicinal services, including medical coverage, the frameworks for guideline and testing of medicines and healthcare techniques, the framework for preparing, assessment order of specialists and other medical experts, general hospital observing and guidelines, need coordination . This study is particularly concentrating on one of the critical parts of the foundation and that is the hospital segment and expects to think about the efficiency of private and govt. medical hospitals. If we look at food production of Punjab, Punjab is at forefront of cultivation of organic products which are very important for masses to maintain good health. Punjab is perhaps the biggest producer of two crops for example wheat and rice in India. Significant harvests developed incorporate wheat, paddy and sugarcane. The principal organic products developed in State are orange, 'kinnow', mango, guava and grapes. The State is trying all endeavors to build development of, cotton, maize and oilseeds. Denoting a development of more than. 7 per cent, the State's nourishment grain generation has developed from 25.32 million ton in FY2001 to 45.22 million tons in FY2018. The financial segment in the State is overwhelmed by nationalized banks which manages an account with more than 2000 branches of which SBI and its partners having 822 branches, trailed by private area with 428 branches, different private services with 251 branches and remote 8 branches. Punjab has risen as a key Centre point for material based businesses including readymade pieces of clothing yarn and hosiery. Punjab successfully settled Biotech park in Chandigarh, Food Park at Fatehgarh locale. Electronic Township (ELTOP) at Mohali for advancement and development of IT and hardware industry in the State. (Statistical Abstract of Punjab, 2016).

The significance of infrastructure and framework in monetary growth and advancement can be noted from the reality that developed nations contribute around the US $200 billion per year on the new interest in the healthcare framework (World Health Statistics. 2015). This is about 4% of their national salary and 20% of their absolute speculation .In India, in the post-

independence period, there was no endeavor made for rebuilding the healthcare administrations due to which it is discovered that the hospital area in India is deprived by underdevelopment, imbalance, regional variations and low quality. India is relying at the worldwide markets. The globalization of India was speeded up under the Auxiliary Adjustment Program marked by the World Bank to change India's economy. Because of this, healthcare was the first to get the share. The administration spending on hospital declined and was as low as 0.9% in 2017 for India when contrasted with 1.1%for low pay and 6.0% for high pay nations (World Development Indicators, 2018). The Mckinsey Report (2017) moreover demonstrated poor inclusion of population by general hospital foundation. Programs like Health for All by 2020, New Health Policy 2002, India vision 2020, and so forth. Hospital for all remaining parts an inaccessible dream for India. All these dynamic powers additionally pressurized the State for a small distribution of assets to social segment when all is said in done and general healthcare area specifically which brought about quicker devastation of general healthcare framework and administrations, especially in Punjab.

1.1 Socio-Economic profile of Punjab

The Indian State of Punjab was made after independence after then State of Punjab was partitioned into two additional States, Haryana and Himachal Pradesh in 1967. The word Punjab is gotten from two Persian words 'Punj'and 'Aab' which implies a place that is known for five waterways—Indus, Ravi, Beas, Sutlej and Jhelum. It is arranged in the North-western district of India and offers fringes in the northern part of India J and k , in the West by Pakistan, in the North-East by Himachal Pradesh and in the South by Haryana and Rajasthan(Ghuman & Mehta ,2006). It has an absolute region of 50,362 sq. km. also, possesses 1.5 per cent of the all-out territory of the country. As indicated by Census 2011, Punjab has a population of 2,77, 04236 cr and positions fifteenth through U.P. positions first among every Indian State. Punjab's sex proportion keeps on falling, demonstrating that female foeticide and child murder stay uncontrolled. Temporary information discharged by the evaluation office for 2016 demonstrates that Punjab (846 young ladies/1000 guys) and Haryana (830 young ladies/1000 guys) stay at the base of the table. Kerala finishes the rundown with 1084 females for every 1000 males.

The State of Punjab is enriched with rich convention, culture, religion and is known for its brilliance, independence and self-reliance. Punjab is partitioned into three parts, Majha, Malwa and Doaba. Majha locale establishes modem areas of Gurdaspur, Amritsar and Tarn Taran. Malwa locale grasps dominant part of the area in the State and comprises of urban communitieslike Patiala, Ludhiana, Mohali and Bhatinda. Doaba area is a standout amongst the richest districts on the State and was the prime focal point of the Green Revolution in India. It incorporates the greatest urban communities like Phagwara, Hoshiarpur, Jalandhar, Adampur, and Nawansher(Physical geography report,Punjab,2018)Punjab is majorly an agrarian State and more than 60 per cent of the population lives in village zone. The State is an place that is known for landmarks critical, entrancing scenes of normal excellence, prolific greenery, rousing religious locales and has delighted in a prime position in games. The State has won different honors broadly and universally in 'kabbadi', games, weight-lifting, 'kho-kho' and hockey.

The monetary advancement in Punjab since the appearance of green revolution busted crosswise over powerfully. It drove the State to possess at first point among per capita pay among the other Indian States. After the new monetary reforms Punjab's economy developed at a rate much slower than the general rate of monetary development of the Indian state economy. During the period 1980s, Punjab state economy developed at the rate which is mere 5.3 % per annum as against 5.5 % on account of the national economy. States like Rajasthan area (6.6 per cent), Haryana (6.4 %), Maharashtra (6.0 %) and Andhra Pradesh (5.6 %) experienced higher rates of development than Punjab. States, for example, Tamil Nadu area (5.4 %), Karnataka (5.3 %) and Gujarat area (5.1 %) encountered a pretty much comparable ascent in their separate economies (Randhawa & Sidhu ,2011).

The State economy has made a moderate progress in the post-development decade of the 1990s. During tenure of 1991-92 to 1997-98, the Indian economy made at the pace of 6.9 percent year by year as against 4.71 percent by Punjab State economy. This was the place the economy of different States made at an altogether speedier rate than during the 1980s. The economy of Gujarat area, Maharashtra area, West Bengal area, Tamil Nadu area, Madhya Pradesh area and Kerala area made at the pace of 9.6, 8.0, 6.9, 6.2, 6.2, besides, 5.8 percent

per annum autonomously. The neighboring State of Haryana made at a pace of 5.0 percent per annum (Ghuman & Mehta, 2006).As referenced in the third status report of (Punjab Governance Reform Commission,2001), the reason for moderate financial development in the State during the post-change period has been because of moderate development in the agribusiness area. The problem in the development of agriculture part has contributed fundamentally to the lesser development of per capita pay of the economy of Punjab. Moreover, the information in the report demonstrates that industrialization procedure in the State has gone down extensively. Moreover, the financial and monetary arrangements have started the procedure of going out from the State, which has adversely influenced the monetary development of the Punjab State. The abrupt inclination of militancy in 80s including political unrest in mid-1990s on one hand and polices of advancement, globalization and privatization then again, deferred the procedure of financial improvement and diverted the economy of State from most driving and dynamic economy to a straggler one when contrasted and other quickly developing States just as within general monetary development of the Indian economy. All these dynamic powers further pressurized the State for lower allotment of assets to healthcare part.

1.2 Profile of health sector in Punjab

The study expresses that increases in pay level frequently prompts higher way of life and better hospital infrastructure in state of Punjab. The relentless increment in the per capita pay of the family unit in Punjab positively affects the future at the time of birth for both male and females. According to table 1.1 reports of Punjab govt infant mortality rate and the death rate is less, in fact, better than rural areas which further related to an increase in medical services in urban areas. In comparison to the death rate and infant mortality rate of 1981 rate, 2015 is far better which a further result of better medical services is.

Table 1.1: Area wise Birth rate, Death rate and infant Mortality rate

	Birth Rate			Death rate			Infant Mortality rate		
	Rural	Urban	Combined	Rural	Urban	Combined	Rural	Urban	Combined
0	1	2	3	4	5	6	7	8	9
1980	30.3	28.3	.9 9	*9.2*	*6.6*	8.7	96	58	89
1990	28.4	25.6	27.6	8.5	5.8	7.5	66	45	61
2000	22.7	18.6	16.2	7.9	5.9	7.4	56	38	52
2011	16.2	*15.2*	16.l	7.5	5.6	6.8	33	25	30
2012	16.5	14.8	1.9	7.5	5.5	6.8	30	24	l8
2013	16.3	14.7	15.7	7.5	5.4	6.7	28	23	26
2014	16.2	14.5	15.5	7.2	5.2	6.4	26	21	21
2015	15.9	14.2	15.2	6.9	5.1	6.2	24	20	23

Source: Statistical abstract of Punjab 2016 Director, Health and family welfare, Punjab**.**

Information displayed in Table 1.2 demonstrates that in 2016, 1,50,70,980 people got treatment in the OPD, 6,11,366 people were conceded for treatment furthermore, 10,265 (died). The primary reason of death among hospitalized patients was associated with the issues of the blood pace system, trailed by very dangerous virus and parasite diseases, ailments of the respiratory structure, outside causes, harm, hurting and aftereffects of outside wounds. Together these five illnesses contribute to 70 percent of going among indoor patients (Statistical dynamic of Punjab 2016 Director, Health and family welfare, Punjab). Respiratory system related illnesses are the most surprising for outpatient treatment. Other genuine causes consolidate strange research focus and finding of Hospital outcomes, skin and sub coetaneous tissue, stomach related structure, infective and parasitic ailment, Hb and Hb realted problems, which together record for around 65 percent of those searching for treatment.

Table 1.2: Category of patients (indoor and outdoor) treated and number of death occurred among indoor patients during 2016 in Punjab

	Outdoor. Patients	Indoor Patients	Number of Deaths
Infective and virus related Disease	1208001	55519	2021
Neoplasm	30648	5358	201
Hb and Hb Forming Disease	I044787	76722	255
Nutritional and metabolic Disease	454734	12017	602
Mental Disorder	187985	7232	22
Nervous System	10092	4705	232
Eye and Odnexa	974649	28923	3
Ear and Mastoid	479188	7908	0
Circulatory System	787122	281 34	2189
Respiratory System	2513438	32429	1140
Digestive System	1428539	32335	469
Skin and Sub-Cutaneous Tissue	1423350	6531	39
Muscular-Skelton	789223	4275	14
Genital Urinary System	524450	33944	172
pregnancy childbirth	403897	85130	57
Prenatal Period	30148	20634	239
Congenial Malfunction	3841	863	9
Abdominal Laboratory and Hospital Finding	1830659	58636	785
injury poisoning	485889	69432	842
External Cause of Morbidity	216227	68248	772
Others Unspecified	144513	21441	2
Total	13926593	611366	10265

Source: Statistical abstract of Punjab 2016 Director, Health and family welfare, Punjab.

There is a sharp increase in registered medical and Paramedical personnel in Punjab, which shows govt. is keen to increase easy availability of medical facilities to people of Punjab, and data of registered doctors, paramedical staff and nurses registration increases but still it has been analyzed from the information that sicknesses/infirmities like fever of obscure birthplace, respiratory including nose and throat, other analyzed diseases, the runs and hypertension rose as the best five regular incessant infections endured by the general population of Punjab both in-country and urban territories are also increasing(Statistical abstract of Punjab 2016 Director, Health and family welfare, Punjab). There is additionally a line of difference between the infection control projects and morbidities in the State and drugs provided in the State. The administration should consequently, improve the accessibility of basic medications and likewise should understand the significance of essential sanitation and sheltered and clean drinking water. Subsequently, it is right to recommend here that solid health care services having is as yet an inaccessible dream in Punjab if any strong Information technology concept is not utilized for optimization of this sector.

1.3 Organizational Structure of health Sector in Punjab

In Punjab, both the public and the private division play a vital job in providing medicinal services. It is the Department of Health and Family Welfare under the Public part which is in charge of giving preventive human services benefits in Punjab. There is a four-level structure of public medicinal services framework in the State. This contains Sub Health Centers (SHCs)/dispensaries at the base giving the fundamental human services administrations to a population of 3000-5000 individuals. Above it, there is Primary Health Centers (PHC) serving a population of 20000-30000 individuals. It likewise fills in as a referral unit to six subcentres. Above Primary Health Centers there are Community Health Centers (CHC) which serves a population of 80,000 to 1.20 lac and a referral unit to four PHCs. This entire extent of SHCs, PHCs and CHCs goes under essential level healthcare where administrations are constrained (Punjab health statistics report 2016). To help primary human services administration there are secondary level medicinal services. Secondary medical hospitals are predominantly spread over the locale through common hospitals, sub-divisional medical hospitals and area hospitals. Moreover, region hospitals work as an optional level for

provincial medicinal services and essential level for the urban population. Other than this, there is likewise an enormous system of private hospital segment in the State. In Punjab, general hospital offices have expanded up to mid-1980s primarily due to expanded portion of assets to the State's hospital segment. After the post-change period, State hospital administrations declined radically. The information in

Table 1.3: Broad wise category Health centers during 2016 in Punjab

	Hospitals		Primary Health center		Subsidiary health center		Community health center		Ayurveda Institutions	
District	1991	2016	1991	2016	1991	2016	1991	2016	1991	2016
Gurdaspur	16	3	47	40	127	120	6	1515	51	52
Amritsar	33	7	49	36	178	98	6	4	43	22
Tarn taran	.	2	-	19		59	-	9	-	22
Kapurthala	7	3	10	13	60	50	5	4	26	26
Jalandhar	25	3	36	28	161	110	6	11	45	32
S.B.S.Nagar	-	2	.	17	-	49	.	3	-	24
Hoshiarpur	16	4	41	32	1 22	93	6	*3*	57	44
Rupnagar	8	2	23	I1	78	34	5	3	35	22
S.A.S.Nagar	.	2	-	13	.	51	.	*5*	.	25
Ludh iana	27	*5*	35	33	1 56	120	6	*2*	37	36
Firozpur	17	4	38	34	1 00	85	6	8	39	38
Faridkot	17	3	40	8	1 18	20	6	3	26	9
M uk1sar	-	3	-	17	.	45	-	s	.	1 1
Moga		I	-	22	.	53	-	*5*	-	7
Bathinda	I S	4	38	20	1 16	70	6	9	39	27
Mansa	-	2	.	14	.	38	-	4	-	1 2
Sangrur	18	4	41	32	1 17	73	6	6	43	31
Bamala	.	I	.	1 1	.	36	.	4	.	12
Pa1iala	19	·6	44	28	132	72	6	10	S I	32
Fatehgarh Sahib	.	2	-	14	-	28	-	4	.	1 0
Punjab	203	62	442	444	1473	1308	70	130	493	495

Source: Statistical abstract of Punjab 2016 Director, Health and family welfare, Punjab

Between the period 1991 and 2016, the complete number of hospitals decreased from 219 to 62, number of PHCs stayed stagnant from 442 to 444 out of 2016, the number of dispensaries diminished from 1473 out of 1991 to1308 in 2016. Although the quantity of CHCs rose from 70 to 130 and a marginal growth is seen in other hospital foundations in the State viz. (Ayurvedic, Unani and Homeopathic) yet in total, the development isn't at all extremely tasteful. Region-Wise provisioning of medicinal organizations in Punjab is additionally introduced in Table 4.3. There is a clear proof of interstate variety. There is no expansion in the number of health establishment especially in the rural territories of the State which comprises over 60 percent of the all-out population. Further, these healthcare foundations possessed by the government compared to continually expanding population of the State(Statistical abstract of Punjab 2016 Director, Health and family welfare, Punjab**)**.In 1980, there was short of one bed for a population of 848 people and that proportion increased to 1281 people for every bed during 2016. This demonstrates the powerlessness of Punjab Government to improve the accessibility of beds for indoor treatment in government possessed medicinal organization in the State. Other than this, hospital specialists (specialists, attendants and maternity specialists) engaged with the hospital administrations and population served by them are additionally given in table as population served per specialist and paramedical staff has accelerated in state of Punjab somewhere in the range of, yet a significant contrast in getting to medical consideration is clear from the information accessible. Fatehgarh Sahib has one specialist serving a population of 7,998 individuals and in Moga and Muktsar locale, one specialist covers over 6,000 individuals though the proportion of specialists to the population is 1:533 in Faridkot and 1:578 in Patiala(Gill & Brar, 2016). There is steep increase in population served by non-nursing staff with one gynae assistant for 368 individuals in Faridkot contrasted and one maternity specialist for 5,659 people in Fatehgarh Sahib, recently shaped S.A.S. Nagar has one attendant for every 788 individuals. Correspondingly, there is one medical caretaker for 444 individuals in Ludhiana contrasted and one nurture for 1,351 individuals in Bhatinda. In S.B.S. Nagar (cut out of Jalandhar and Hoshiarpur and once in the past known as Nawanshehar) which has the most reduced urbanization rate in the three regions, one specialist serves almost 5,000 individuals. Without going into subtleties of the other recently made areas one finds that the population served per specialist is most

astounding in the new areas viz. S.B.S. Nagar and S.A.S. Nagar which have been cut from another gathering of the locale. Unmistakably the accessibility of hospital laborers isn't high as the normal numbers show. Punjab has additionally effectively executed the National Rural Health Mission (NHRM 2005-12) in the State which has a prime spotlight on maternal and child hospital. Since maternal and newborn child mortality proportions are higher than what is normal but still `per capita pay was viewed as reason most appropriate for the State to actualize NHRM. Improving institutional conveyances alongside employing an enormous number of helper staff with some medical preparation, for example, Asha works and ANM are correspondence and guides furthermore; utilizing extra assets for interest in innovation are a portion of the backup goals of NHRM. Another region where the State contrasts in its job when contrasted with different States at the national level is underplaying the job of Non-Government Organizations (NGOs). There must be some regulatory for NGO‘s also. People are making NGO just to collect funds and there is no accountability .One purpose behind this nearness of NGOs in the State is because of the way that the legislature of Punjab sees dynamic nearness of NGOs as an image of neediness. The second reason would be the solid nearness of Gurudwaras, which are to a great extent contributing to a scope of social administrations at State level. Even though they may be diverse in their methodology and extension and may not be a reasonable substitute for NGOs yet they are good enough .Even though, the approach of privatization in medicinal services in Punjab is anything another wonder yet it picked up force in post monetary refunds. As per the (Punjab Human Development Report,(2016), the private hospital part in Punjab has turned into a boss over public sector hospitals . There are steep variations in population serviced by paramedical faculty with one birthing assistant for 368 individuals in Faridkot contrasted and one maternity specialist for 5,659 people in Fatehgarh Sahib, recently shaped S.A.S. Nagar has one medical caretaker for every individual. Essentially, there is one medical caretaker for 444 individuals in Ludhiana contrasted and one nurture for 1,351 individuals in Bhatinda. In S.B.S. Nagar (cut out of Jalandhar and Hoshiarpur and once in the past known as Nawanshehar) which has the most reduced urbanization rate in the three regions, one specialist serves almost 5,000 individuals. Without going into subtleties of the other recently made regions one finds that the population served per specialist is most elevated in the new locale viz. S.B.S.

Nagar and S.A.S. Nagar which have been cut from another gathering of regions. Unmistakably the accessibility of hospital laborers isn't extremely high as the normal numbers demonstrate. Punjab has additionally effectively actualized the National Rural Health Mission (NHRM 2005-12, Report) in the State which has a prime spotlight on maternal and kid hospital. Since maternal and baby mortality proportions are higher than what is normal, given the normal per capita pay, it was viewed as most reasonable for the State to actualize NRHM. Improving institutional conveyances alongside employing countless helper staff with some medical preparing. Even though, the coming of privatization in human services in Punjab is not another wonder yet it picked up pace 1990. As indicated by the Punjab Human Development Report, the private hospital segment in Punjab has turned into a boss wellspring of healthcare consideration covering 90 per cent instances of non-hospitalized care and over 2/3 of hospitalized care. The organization of the un-sorted out the private segment in Punjab ranges from individual practioners, nursing homes, polyhospitals, pathology labs, drug store shops, corporate hospitals (Escorts, Fortis, Ranbaxy and so forth.). Even though, very less data is accessible on private hospital segment working in Punjab yet a couple of highlights might be featured. For instance, the private hospital division works without adhering to guidelines and is frequently an obstacle to making healthcare open to all. Private specialists don't falter to complete sex determination tests on pregnant moms. These specialists running small nursing homes may regularly be eager to end pregnancies on the off chance that the hatchling is observed to be female. Presumably that, private area medical hospitals are regularly furnished with most recent hardware and innovation. Yet, the majority of the occasions, these hospitals have the untrained paramedical staff to convey healthcare administrations.

Private medical hospitals utilize authorities on contract premise. Patient's rights are frequently not successfully served in the private hospital segment. The larger part of such hospital suppliers gives healthcare consideration to benefit. It is important to note here that private medical services in Punjab are very costly yet even poor people are going to private hospital administration. Not just this, legislature of Punjab decently mention in its report that "Punjab has a huge private medicinal services establishments and experts, yet regardless of playing such a significant job, no data with regards to the genuine number of private hospital are accessible with the Government of Punjab, as there is no arrangement

for it. Enlistment isn't required for beginning an hospital, a nursing home, or private practice". It merits referencing here that a couple of studies, including three national reviews which have been led to inspect the health looking for conduct and usage example of the overall population in Punjab to see how far the private part has won the fight in giving healthcare benefits in the State. These investigations demonstrate that individuals in Punjab are to a great extent for private hospital suppliers in the use of hospital administrations for both in-tolerant just as out-understanding considerations. Punjab have embraced about 76.1 per cent of the all-out human services spending from their sources, while open spending is just 18 per cent, and every single other source like nongovernmental associations, magnanimous trusts, and so forth, contribute just 5.9 per cent of aggregate hospital expenditure. Hazarika (2013) demonstrates the degree to which family units in Punjab are reliant on Out of Pocket use (OOP) because of low government area spending on medicinal services coming about in overdependence on private division for getting healthcare consideration administrations. It is additionally significant here to underline the job of Punjab government in privatizing human services which is obvious from the way that administration gives charge advantages, endowments and concessions to private hospitals and medical experts for setting-up of hospitals and doing private practices. The presentation of client expense for all sort of administrations in hospitals adds up to privatization. Likewise, the administration of Punjab is offering backing to the corporate division by giving them the grounds at a financed rate in the Punjab Urban Development Specialist (PUDA) created states. It demonstrates that the Punjab government someplace down the line is compelling individuals to look forever costly private medicinal care knowing completely well that over the long haul this sort of option won't work given the profoundly unacceptable, exploitative and unregulated medicinal services that the open division gives to by far most of the general population of State. This uncovers a noteworthy breakdown of general hospital administrations in the Punjab State. The private segment isn't the only one to fault as it would be welcome if it develops to oblige all segments that can pay for private consideration.

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1.3.1 Expenditure on Health.

In Punjab government health expenditure, it is important to have Center and State relations on healthcare consumption and expenditure. As indicated by Punjab Government Reform Commission Report 2016, the portion of center exchange (as halfway supported plans and centre arranged plans) in Punjab's part shows that huge portion of central exchange has been made to Punjab's healthcare division. Centre is financing very nearly 50 per cent of the State's complete arrangement healthcare consumption. After the mid-90s, the portion of centre Transfer (CP/CSS) has declined concerning yet the portion of centre exchange in Punjab's healthcare area is practically equivalent to other high salary States, Country like India has low facility of public hospitals i.e is one motivation driving why people go to the private zone. People of India are the 6th generally high out of pocket spenders in Asia get-together of 50 countries. These costs push around 32-39 million Indians underneath the despondency line each year, as indicated by different study‘s. Without a fundamental expansion in its hospital spending plan, India's targets have being very hard to accomplish: Reducing the newborn child youth downfall rate from 41 going for each 1,000 live births in 2015-16 to 28 by 2019 and maternal mortality degree from 167 going for each 100,000 births in 2013-14 to 100 by 2018-2020 and disposing of tuberculosis by 2025. India's $16 (Rs 1112) per area spending on the medical center is most commonly diminished in the Region of South East Asia.

Absence of education among poor, inadequate controlling system of public hospitals is the significant barriers for the poor in getting free treatment from private hospitals. Likewise, there is no provisioning of medical coverage for the poor in the State. NGOs in the State and Punjab Government have begun different medical coverage plans for poor people yet the outcomes are a long way from being perceived.

Table 1.4: Expenditure on Medical and Public Health and Family Welfare: Ratio to Aggregate Expenditure

	1981	1991	2001	2005	2009	2011	2016
Andhra Pradesh	5.8	5.53	4.74	3.53	3.9	4	4
Assam	3.96	NA	4.66	3.06	5.7	4.9	
Bihar	3.78	5.1	4.01	3.24	3.5	3.7	4.1
Gujarat	4.38	5.03	3.38	3.05	3.8	4.3	4.2
Haryana	4.33	4.11	3.26	2.59	3.4	3.6	3.5
Himachal Pradesh	6.63	332	5.64	5.08	4.8	5.2	5.1
Jammu and Kashmir	3.79	5.56	4.89	4.78	5.2	5.4	4.9
Karnataka	3.79	5.4	5.11	3.49	3.6	3.9	4.1
Kerala	6.56	7.2	5.25	4.71	4.8	5.1	5.2
Madhya Pradesh	4 94	5 16	5.09	3.39	3.3	3.7	3 8
Maharashtra	4.85	5. 13	3.87	3.5 l	3.3	3.6	3.5
Nagaland	5.39	5 96	4.87	4 68	3.9	4.2	3.8
Orissa	5. 17	5.13	4. 15	3.9	3.8	4	3.5
Punjab	3.67	6.73	4.54	3.1	3.2	3.5	4.4
Rajasthan	4.85	6.5	5.16	3.94	4.8	4.7	4.9
Tamil Nadu	6.18	6.91	4.86	4.2	4.8	4.8	4
Uttar r Pradesh	4.69	6.31	3.98	4	5	4.9	4.6
West Bengal	6.3	8.37	5.63	4.93	4.8	4.6	4.8

Source: Statistical abstract of Punjab, Director, Health and family welfare, Punjab

Weak administrative and network-based "insurance component is missing is also one reason. To overcome the circumstance, the private medical coverage organizations and NGOs as a team with the State government must contribute through reasonable plans for the provincial masses particularly, the poor in the State. In a comparable vein, costly hospitals in Punjab has hampered the healthcare situation of the State. Green revolution in State, because of innovative farming has prompted exceptional returns in horticulture and expanded the pace of urbanization among farmers and they are also going to private hospitals first. Escalated cultivating techniques blended in with supplements like nitrogen,

iron, magnesium and phosphorus are decimating soil and making it progressively sickly. Not just this, groundwater issue in the State has pushed a frenzy button. The water table in Punjab is dropping significantly. In this manner, farmers need to burrow further to discover groundwater for development. Because of costly mechanical sources of info, farmers can‘t recoup the essential expense of their products and are loaning in obligations traps.As talked about, there has been no expansion in the general healthcare administrations especially during the post-liberalization period in Punjab. Due to government changing needs under the auxiliary change program of World Bank, general healthcare administrations, especially in Punjab, have suffered a lot because public sector has very less penetraton and grants are only given to public sector. Punjab government likewise perceived the way that almost 11 per cent of CHCs, 51 per cent of PHCs, 74 per cent of the SHCs, and 50 per cent of sub-focuses in the State were without appropriate structure at the hour of detailing of the 11'" multi-year plan (2012-17). Different small scale level investigations have likewise reasoned that there are colossal lacks in structures, hardware, apparatuses, types of gear, private settlement and medicinal services staff, and so on. at all levels in the general healthcare establishments in the State. In a study led by the population science institute of India evaluated the framework conditions at the auxiliary and tertiary human services level. The study turned out with much all the more upsetting discoveries.

The review found that because of security reasons, medical attendants were not ready to work during the night shifts. None of the medical hospitals including the area hospital was sufficiently furnished to manage debacle circumstance. If there should arise an occurrence of crisis care, none of the CHCs had Intensive Care Units (ICUs). Although, ICUs have been accessible in sub-divisional medical hospitals yet none of them was cooled. Those cooled either don't have an appropriate back-up office because of whimsical power supply or were seen as non-utilitarian. To the extent accessibility of medication was concerned, healthcare store the board was not seen as efficient. Fundamental and life-sparing medications were not accessible in practically every one of the hospitals. Further adding to alarm, purchasing of medication was for the most part done from client charges assets in all hospitals. Every one of the medical hospitals has well-characterized referral frameworks however it isn't followed in genuine practice. None of the hospitals was giving

customary eating routine to their patients. Hospitals didn't have an appropriate spot, toilets and kitchen offices for the family members of the patients. Maternity and crisis administrations were seen as most noticeably terrible influenced in CHCs and sub-divisional hospitals. The fundamental explanation was non-accessibility of specialists nonstop for maternity and crisis administrations —If you don't build open financing, you get into the attitude that the open division can't do anything," Srinath Reddy, leader of foundation of Public Health of India, a backing, told India Spend in January 2018. "You need to leave it to the private segment to do what it needs and lose the chance to make a framework that gives available and reasonable consideration, which is the pith of all-inclusive hospital inclusion." To assess the hospital execution of states by hospital spending, India contribution to sector if analyzed the 2017-18 hospital file of NITI Aayog, the administration's research organization, with the per area expense of Indian states on the hospital. The (NITI Aayog's hospital record,2019) estimates an assortment of hospital results, including a newborn child and under-five death rate, sex proportion during childbirth, vaccination inclusion, institutional conveyances and hospital checking and administration pointers, for example, inhabitance of medical hospital beds, and procedures, including framework and human resources. Mizoram‘s per capita hospital consumption is Rs 5,862, directly around numerous occasions the Indian ordinary, with the state consuming 4.2 percent of its GDP on the hospital in 2015. Arunachal Pradesh (Rs 5,177) and Sikkim (Rs 5,126) sought after at the top. At the contrary completion of the range, Bihar expenditure Rs 491 for each capita on a medical hospital, not actually an enormous bit of the Indian typical, consuming 1.33 percent of its GDP on the emergency hospital. In India above Bihar were MP(Rs 716) and UP (Rs 733). Mizoram positions one point down top on the NITI Aayog's emergency hospital record, while Bihar positions fourth from the base. Nevertheless, emergency hospital consuming alone can't improve a state's medical hospital execution. Nagaland, which expends Rs 2,450 on a hospital for each capita, situated third from the base on the medical hospital list, while Kerala, which spent Rs 1,463, situated first on the emergency hospital record.

1.3.2 Important concerns for health services in Punjab

As examined, there has been no expansion in the general healthcare administrations especially during the post-liberalization period in Punjab. Due to reduce government spending and changing needs under the auxiliary change program of World Bank, general healthcare administrations, especially in Punjab, have suffered lot . Punjab government additionally perceived the way that almost 11 % of CHCs, 51 %of PHCs, 74 % of the SHCs, and 50 per cent of sub-focuses in the state was without legitimate structure as per the book of the 12"' multi-year plan (2012-17). Different smaller scale level investigations have likewise presumed that there are enormous problem in structures, apparatus, machines, private settlement and healthcare staff, and so forth, at all levels in the general healthcare establishments in the State. In a review directed by the International Institute for Population Sciences surveyed the important facilities at the optional and tertiary medicinal services level are still very less (statistical abstract of Punjab, 2016). If there should be an occurrence of crisis care, none of the CHCs had Intensive Care Units (ICUs). Even though ICUs have been accessible in sub-divisional hospitals yet none of them was cooled. Those cooled either don't have an appropriate back-up office because of sporadic power supply or were seen as non-practical. To the extent accessibility of medication was concerned, medicinal store the board was not seen as efficient. Basic and life-sparing medications were not accessible in practically every one of the hospitals. Further adding to alarm, purchasing of medication was generally done from client charges assets in all hospitals. Every one of the hospitals has well-characterized referral frameworks however it isn't followed in genuine practice. None of the medical hospitals was giving ordinary eating routine to their patients.

Medical hospitals didn't have legitimate spot, toilets and kitchen offices for the family members of the patients. Maternity and crisis administrations were seen as most exceedingly awful influenced in CHCs and sub-divisional hospitals. The fundamental explanation was non-accessibility of specialists nonstop for maternity and crisis administrations. As far as types of gear, the review found that hardware was either out of request or not being used. The patients had to go outside to get the test or X-beam done. Healthcare record room was not appropriately arranged and sorted out. There was a no different unit of authorities because of which especially in the sub-divisional hospital and in CHCs expert were doing schedule night also, crisis obligations and in this manner were not accessible for standard OPD. The review

additionally found that a great deal of time was squandered by specialists, including expert to perform different obligations like going to legal disputes, VIP visits and other fundamental medicinal services obligations like healthcare fairs. Another ongoing study led by the International Institute for Population Sciences(2016) for getting to the healthcare office limit and readiness in times of framework at essential medicinal services level in all locale of Punjab uncovered stunning realities for use of private sector in healthcare.

As indicated by the overview, Punjab is one of the most exceedingly terrible performing States as far as accessibility of basic medications. In Punjab, just 26 per cent of PHCs had private quarters for medical officials though 55 per cent of PHCs at a national level have private quarters. West Bengal, Maharashtra and Assam are a long ways ahead than the national normal. To the extent, 24 hours working of PHCs is concerned just 17 per cent of PHCs are working for 24 hours through the national normal is 53 per cent. Just 7.5 per cent of PHCs have a customary power supply which is likewise beneath the national normal of 36 per cent and is most exceedingly terrible in the nation. Punjab is profoundly ailing in tennis of accessibility of fundamental medications at PHCs. CHCs are insignificantly over the national normal as far as accessibility of expert, except anesthetists and healthcare managers. This shows significantly after usage of NHRM (2005-12) in Punjab State, the essential healthcare offices and foundation for country individuals is genuinely lacking.

1.3.3 Shortfall in Health Infrastructure

Not just this, there are basic deficiencies of medicinal and paramedical staff in rural territories of Punjab. Deficiency at the Primary Health Centers (PHCs) is influencing the essential medicinal services and linkage as shown in the following table.

Table1.5: Shortfall in Health Infrastructure

	Required	**Existing**	**Shortfall**	**% Shortfall**
Sub-Centers	3463	2950	513	14.81
PHCs	577	446	131	22.7
CHCs	144	129	15	1 0.41

Source: Bulletin of Rural Health Statistics in India, 2017

There are extensive deficiencies in addition to an enormous number of specialists and paramedical staff. 40% of authorized posts for expert doctors at network healthcare focuses are empty just as by and large 30 per cent of the endorsed posts for other master specialists at CHCs are empty. Numerous posts of healthcare staff (both male and female) are empty—around 23 per cent of posts for lab professionals at essential and network healthcare focuses are empty. The general healthcare segment has additionally endured from huge deficiencies of healthcare Staff. At the PHC level, there is a 37%deficiency of healthcare Staff. The relating figure for lab experts is 47.4 per cent, drug specialists 28.5%, and radiographers 53.9%. There is a 47.8 %deficit in the number of healthcare collaborators (male) at PHCs, while the quantity of healthcare partners (female) is less by 13 %there is a 37 per cent deficiency in the number of healthcare staff (male) at the sub-focus. There is a 25 per cent deficit of specialists at CHCs level just as 43 per cent of obstetricians, 46 per cent of the doctor, 53 per cent of pediatricians are discovered shortly at CHC level.. The fundamental purposes behind these deficiencies are drawn out deferrals in enlistments, political impedance in posting and moves, debasement, lacking motivating forces, vocation stagnation, a high outstanding task at hand, ominous working condition, poor supervision and authoritative occupations to give some examples.

Table 1.6 Shortfall in Health personnel Punjab 2017, Source: Bulletin of Rural Health Statistics

	Required	**Sanctioned**	**In**	**Vacant**	**Shortfall**
Health Worker (Male] at sub center	2950	2858	1833	1025	1117
				35.86	-37.86
Health Assistants (Female) *I* at PHC	446	441	387	54	59
				12.24	13.22
Health Assistant [Male) at PHCs	446	441	236	205	210
				45.96	47.08
Surgeons at CHCs	129	1 15	97	18	32
				15.65	24.8
Obstetricians & Gynecologists at CHCs	129	1 15	74	4 1	55
				(35.65)	42.63
Physicians at CHCs	129	115	69	46	60
				40	46.51
Radiographers at CHCs	129	114	1 17		12
					9.3
Laboratory Technicians at PHCs	575	648	497	151	78

Source: Bulletin of Rural Health Statistics in India, 2018

1.3.4 Number of Doctors registered in State medical councils In India:

Through a written reply to question in Rajya sabha ,Minister of state Smt Anupriya Patel informed in 2018 that there are 1041395 doctors registered in state medical council.as on 30 th September 2017,details of doctors registered with each state medical council is mentioned in below table. Top five states altogether contributes to 52.07 percent strength of doctors in India i.e. Maharashtra, Tamil Nadu,Karnatka,Andhra Pradesh and Uttar Pradesh with 542315 doctors .Assuming availability up to 80 percent 8.33 lakh doctors are actually available for actively providing service to people . It gives doctor to population ratio at 1:1596 against WHO recommended 1:1000.Maximum number of registered doctors is with Maharashtra i.e. 153513 followed by Tamil Nadu and Karnataka with doctors registered around 1 lakh. Punjab is having 44682 doctors' registers in Punjab medical council and around 10000 doctors running their own more than 50 bed superspeciality hospitals. According to news published in the tribune daily for April 18,2019 only Jalandhar district in Punjab is having around 800 superspeciality and multi-specialty hospitals and emerging as one of the biggest medicare hub in Asia. As compared to private health care sector number of public sector hospitals are very few in number in Jalandhar with only 3 hospitals as district civil hospitals and only 11 community health centers .So government must frame some policy to regularize expansion of private healthcare sector and services provided by them .As discussed in this chapter earlier there is very less increase in number of public sector hospitals of Punjab due to less Government spending and changing priorities of policy makers after 1991. Almost all private segment medical hospitals are regularly furnished with most recent apparatus and technology. But these clinics have the untrained medical and paramedical staff to provide medicinal services. Private clinics utilize also doctors on a contract basis. It is fascinating to note here that private medical hospitals in Punjab are exceptionally costly yet even poor people are going to private wellbeing administration. Absence of mindfulness among poor, decision direction and insufficient regulating system in the state are the significant roadblocks for the poor in getting free treatment from private hospitals. Additionally, there is basically no provisioning of health insurance for the poor in the State. Some NGOs in the State and Punjab government have begun different medical coverage plans for poor people yet the outcomes are a long way from being perceived

Table 1.7 Number of doctors registered in state medical councils

Maharashtra Medical council	153513
Tamil Nadu Medical council	126399
Karnataka Medical council	104794
Andhra Pradesh Medical council	86129
Uttar Pradesh Medical council	71480
West Bengal Medical council	66974
Travancore Medical council	55251
Gujarat Medical council	53954
Medical council of India	52666
Punjab Medical council	44682
Rajasthan Medical council	40559
Bihar Medical council	40043
Madhya Pradesh medical council	34347
Assam Medical council	22532
Orissa Medical council	21681
Delhi Medical council	16176
Jammu and Kashmir Medical council	14326
Uttrakhand Medical council	7060
Chhattisgarh Medical council	6915
Haryana Medical council	5717
Jharkhand Medical council	5093
Goa medical council	3367
Himachal Pradesh Medical council	2849
Telangana Medical council	2354
Sikkim Medical council	893
Arunachal Pradesh Medical council	840
Nagaland Medical council	801
Tripura Medical council	0
Total	1041395

Table 1.8 Top 5 States with share of registered doctors

Maharashtra Medical council	153513
Tamil Nadu Medical council	126399
Karnataka Medical council	104794
Andhra Pradesh Medical council	86129
Uttar Pradesh Medical council	71480
Total	542315

1.4 Need for study

In the present hospital and healthcare circumstances it has turned out to be difficult for hospital in Punjab to guarantee increasingly productive methods for their administrations. Data envelopment analysis if used properly can empower authorities over best utilization of inputs and outputs and to decide proper mix of inputs required to produce output. . In that case, it will become very important for hospitals whether private or government to optimally utilized their existing resources, Data envelopment analysis is technique is formulated to find operational efficiency in form of logical and scale efficiency of organization to decide their benchmark and operate according to benchmark or if there is no benchmark then set benchmark In the present situation, this most important to contain costs and guarantee efficiency of healthcare services and DEA can provide proper insights to working of organization (Ganley & Cubbin, 1992). Under the current conditions, it is fundamental to discover the fitting asset blend and its use. So likewise, it is important imperative to recognize the sources of relative cost inefficiency – concentrated core and assign both. The center purpose of this assessment is on studying the medical hospital facilities in specific terms, for instance, the ideal proportion of inputs for a given level of output. The other motivation driving this study is how to address process of benchmarking under changing circumstance in the medical hospitals. Golany (1988) clarifies that opening of private medical inclusion part in the post-1991 period; capability with which the benefits are provided would acknowledge progressively centrality in the healthcare industry. The requirement for creating productivity parameters and standard, which aides in the positioning

of hospitals, is prone to accept basic significance. The present study recommends utilization of information envelopment investigation system to accomplish this.

This procedure gives a target rule to break down and assess the efficiency of hospitals in a relative setting. Golany & Tamir (1995) proposes that the DEA approach does not force rule from outside yet attempts to develop it from inside the framework. The rising patterns of healthcare expenses and quickly expanding requests have constrained medicinal services suppliers to concentrate more on efficiency and quality Golan (1988) explains the compelling usage of constrained assets has turned into a basic issue for medical hospital the executives. In this way, hospital establishments are typically compelled to build up their tasks both as far as assets they use and as far as amount and nature of their outcomes the shortage of healthcare part resources is particularly risky ((Golany.et.al.1993).

In developing nations where unforeseen shortcoming condition is one of the most enormous impediments for fiscal improvement and welfare. Goldar (1986) proposes crisis facility focuses of developing nations should concentrate on the productive utilization of points of interest and broadening quality in their operational undertakings Late research shows that boosting profitability and quality in offices has changed into a central dynamic for remedial focus overseers.

According to The Hindu business line ,2018 In India, the construction of cost per bed can be as low as about $43,000.In this new trend, specialists are holding hands with investors, Drug supply firms and clinical hardware sellers to set up specialist hospitals at low costs. While the expense of setting up a quality hospital is as high as about Rs. 95 lakh (about $152,000) per bed and one needs to sit for around five years to get a return on investment, the speculation required in this model is about Rs. 20-25 lakh (about $43,000 to $54,000) per bed and the return on investment in under three years. This model has pulled in light of a legitimate concern for the Businessmen particularly investors. “This will be the pattern in future, as of now most business people are not inspired by ventures which require Rs. 100 crore speculation for 100-bedded hospitals and wait for five years to get returns," said Muralidharan Nair, Partner-Business Advisory Services, Ernst and Young. The Bangalore-based Narayana Hrudayalaya Hospitals (NH), which as of now has 14 clinics with 6,000 beds in seven States, is wanting to contribute almost Rs.5,000 crore to add 30,000 beds in five years by opening hospitals. The organization will contribute Rs 25-30 crore on every one of

these hospitals by, utilizing pre-assembled development materials and one is already under construction and being worked by L&T in Mysore to construct 300-bed multi-specialty hospital with $6 million to $7 million (Rs 35 crore) as against evaluations of $25 million.it is also mention that to increase efficiency and effectiveness of treatment various facilities will be there in hospitals like video monitoring of patients, electronic data records ,day care facilities at affordable charges .

Table 1.9 Cost per Bed analysis

	Indian Rupee	Beds
Speculation in market for Building Good quality bed of 100 bedded hospital	95 lakhs	1
Speculation cost in new model per bed	27-34 lakhs	1
Narayana Hrudayalaya Hospitals (NH) built Speculations for 100 beds	25-35crore	100
NH has provided 300 beds at a cost of Rs. 110 crore. "Economy of scale, sharing infrastructure and expertise reduces cost of operation and to achieve efficiency	110 crore	300
Company's second super-specialty Health City complex, offering all healthcare facilities at one place, is coming up on a 37-acre plot in Ahmedabad. With a total investment of Rs 600 crore planned in five years, it will have 5,000 beds in three-four phases, besides a medical college that will admit 200 students from poor families, nursing and paramedical institutions	600 crore	5000

Source: The Hindu business line, 2018

Gok & Sezen (2016) explains that data envelopment study is proposed to and improves the efficiency of organization. In this environment governments are continually scanning for better services for inhabitants'cash, while the rising of cost in general economy has expanded compelling burdens on business affiliations (Hair et.al.2010). The onus is in that capacity on administrators to accomplish better outcomes from existing assets. Data envelopment

assessment utilizes an amazing technique of direct programming to help in calculating efficiency. The evaluation includes general feasibility of different leveled "organizations for example, bank working environments, and healthcare organizations of different kind occasions where units perform essentially indistinguishable assignments (Hadji et. al.1984).

These units use relative assets, proposed as duties, to convey close to outputs. For instance, a shop has duties of staff and floor space and has varieties of offers volume and rigid compensation (Harrison et.al.2010). Regardless, there can be essential complexities in the route by which solitary units join responsibilities to pass on outputs. Likewise, there may additionally be separates in potential among units accomplished by the improvement they have open, their geological zone or catchment individuals. Hollingsworth (2018) explains that data envelopment study Analyst enables you to overview all the colossal elements that effect a unit's execution to give a total and wide evaluation of gainfulness. Backwoods evaluators does this by changing over the various wellsprings of information and provides output into a solitary degree of beneficial suitability (Green et.al. 1996). By doing properly it sees those units which are working respectably capability and those which are surely not.. The fit units, those creation best utilization of points of interest, are surveyed as being 100% ground-breaking while the wasteful ones addition lower scores. Data envelopment assessment makes ability scores for all units being dissected. It shows how much wasteful units need to decrease their wellsprings of data or growth their regards end up gainful. McLaughlin (2104) proposes data envelopment study as necessities be not just engages chiefs to respond to the solicitation "How well are the units getting along?" yet close by "What aggregate may they have the alternative to improve?‖. It proposes execution centers, for example, unit A should have the choice to pass on 15% more output with their staffing level or unit Bought to have the decision to diminish costs by 25% and still produce a relative degree of outputs. It in like way perceives the units which are performing best and their working practices would then have the alternative to be surveyed to build up a manual for "best practice" for others to reflect.

Data envelopment study Analyst shows the consequences of benefit and takes care of all inputs and outputs by utilizing innovative plans, with the target that you can see and welcome the data that the appraisal gives much more without a doubt. It offers different procedures for imagining the outcomes and shows in detail which units are playing out the best and why

they are doing taking everything into account. It graphically shows execution data identifying with a wasteful unit and shows the capability between its showcase and the "best practice" units to which it has been looked.

Hussey et. al. (2019) proposes different relationship, for example, banks, remedial offices, plane, government working environments and market specialists are utilizing this evaluation. It is utilized by officials in this relationship to play out various assignments including:

- Distinguishing confirmation of "best practice".
- Distinguishing confirmation of "poor practice".
- Target Setting. , Checking capability changes after some time.
- Rewards for good execution. Arranging site areas.

Business world and its problems are getting complex in everywhere throughout the world. Thus, the scientists are researching to consolidate the productivity investigation in administration segment than to mechanical division, for example, the hospital care and instruction foundation. Hospital area has been developed as a quickest developing part in the worldwide world during the most recent couple of decades. The medicinal services framework includes surprising expenses, particularly in the zones like Punjab because the hospital administration offices in Punjab are especially are mostly owned by private sector Along these lines, the effective usage of assets necessitated that the medicinal services units works at their full limit also, increment their efficiency to outputs best quality healthcare administrations and more savings. In any case, in contrast to other kinds of administration associations, the administration of hospital part in Punjab center more around the supply side of Hospital, what's more, non-Hospital human services physical framework, for example, to redesign the foundation, developing new primary, optional and tertiary health units yet the quality issues get less thought by them. Sadly, these Hospital and non-Hospital contemplations are regularly observed to be a basic medical mistake when study of the choices made is taken. The basic reason is that the strategy producers frequently don't think of exercises and bits of knowledge on how to manage the fundamental necessity through information-based genuine and connected studys and practices, which is more significant, helpful and touchy to indigenous individuals. These errors in human services offices can be wonderfully settled if hospital the executives know about worldwide better practices. These

sorts of wasteful aspects by the executives produce the prerequisite for underwriting access to high-quality healthcare e benefits that is productive, compelling, and evenhanded the interest for operational research in the hospital is necessities of time and is rising extremely quick since most recent couple of decades (Isaac et.al.2010).

It is for this reason the medical hospitals also, medicinal schools efficiencies are consistently evaluated in many nations to streamline the hospital exercises and to build authority over amount, quality and effectiveness of assets. Numerous study's have been directed in this point of view however the greater part of the scientists consider just operational traits; there are just couple of concentrates in writing which have likewise considered the subjective pointer, for example, understanding satisfaction level from hospital administration (Katharaki , 2008), the information on such marker is gotten using patient satisfaction overviews quality in healthcare benefits yet in any case, it is a troublesome point of view and difficult employment to evaluate it. The worldwide interest for operational research in healthcare administrations and succeeding activity created numerous researches throughout the years around the globe, resulting in broad writing on efficiency estimation. Institute of Medicine (2004) report in this scientists measure the quality and execution of the medical hospitals which consolidate the quality of medicinal services administration and efficiency .A few procedures utilized by specialists' estimates a blend of quality and amount characteristics and operational efficiency or they checked the efficiency of administrative changes in human services. Therefore, the medical hospitals' effectiveness and efficiency can be estimated by utilizing explicit marker s so that the advanced effectiveness in hospital framework can be acknowledged, by breaking down also, getting ready for a superior effectiveness record.

Jeong.(2013) proposes to utilize the non-parametric method, on the whole, known as Data Envelopment Analysis (DEA) that is concentrated on utilization in estimating the hospital productivity. The methodological structure of DEA empowers the analysts to assess the productivity of those specific associations which have numerous homogenous sources of info and outputs, and where information about costs is missing. In this manner, the method is very much fitted for figuring of medical hospital effectiveness. Various sources of info/outputs are regularly repeating legitimization for utilizing DEA type approaches (Jha & Epstein, 2005). Moreover, the leaders can likewise utilize DEA as scientific apparatus for then again observing purposes, for example, to call attention to hospitals with going a stray execution

structures. Such checking may push the administration to distinguish the holes and increment the efficiency of the medical hospital. It offers an admired benchmark to assess monetary per romance of healthcare administration. Besides; the effectiveness scores can likewise be useful as relevant data in the dispersion of assets to various medical hospitals. This is especially pertinent not just for the controlled tertiary care medical hospital segments of Punjab yet additionally though another hospital couldn't care fewer units in Punjab hospital framework. Along these lines, this investigation joins the efficiency estimation of tertiary consideration hospitals and medical schools in Punjab.

Chapter 2

REVIEW OF LITERATURE

The studies which are identified with the present research have been looked into in this part. This section has been isolated into four sections based on targets of the study. In the main segment, the studies identified with the national hospital status have been checked on. The subsequent area manages the writing identified with the hospital situation of Punjab. In the third and the investigations identified with patient satisfaction have been surveyed, individually. The fourth segment incorporates the issues rose out of the use of data envelopment analysis.

SECTION I

2.1 Studies on Indian Health Scenario

Qadeer (2017) examined the hospital part changes in India with time series study. The study set out that the progress in Indian hospital area was the after effect of the fund provided from the International Monetary Fund and World Bank on India to embrace Structural Adjustment Policies. It was discovered that the hospital changes brought two kinds of changes (1) Decline in the administration designations to the hospital segment and (2) Increased development of the private hospital part. The services framework and the exploration which was being finished by Indian Council of Medical Research endured severely because of the diminished general hospital spending. The specialist condemned the Indian hospital division for concentrating on the upper monetary strata through the development of corporate medical hospitals and disregarding poor people. It was recommended that to beat this issue decentralization ought to be done in the hospital segment wherein the forces ought to be moved to the neighborhood governments or Panchayati Raj Institutions. The expansion in the administration hospital use was prescribed up to 2-3 per cent of GDP. The degree of government hospital consumption made by the states and its connection with the payment of each state. The information was extricated for 14 states from different reports distributed by the legislature. The time arrangement study of information was made and the outcomes uncovered that the rate increment in the Gross State Domestic Product was very high when contrasted with the expansion in state hospital consumption. On a normal, each state was

observed to spend just 0.43 per cent of GSDP on general hospital(Bhat ,2015). Without satisfactory budgetary assets in the administration hospital area, the general population has begun leaning toward the private human services administrations. It was demonstrated that the national objective of expanding general hospital consumption to 2-3 per cent of GDP was hard to accomplish without the ascent in hospital distributions by states. The need for expanding the hospital consumption and using it effectively was featured. Aside from this, the truly necessary hospital changes authors additionally recommended both in the general population and private hospital area.

Qadeer (2017) inspected the situation of hospital administrations in India. The investigation uncovered that big share of the medicinal services was furnished by the private hospital area with practically twofold hospital foundations than that of the administration division. The rustic urban aberrations in the accessibility of hospital offices likewise featured. The general hospital organizations in the rustic territories authors confronting an enormous deficiency of the hospital workforce including specialists, medical attendants, and specialists. The hospital markers demonstrated a troubling image of the Indian hospital part with the newborn child death rate and maternal death rate a lot higher than anticipated. It was seen that without legitimate government hospital offices, the working class pressurized the administration to enable the private players to enter the hospital division. The study found that the hospital changes brought after embracing Structural Adjustment Policies (SAP) likewise neglected to improve the hospital administrations. Individuals observed to be increasingly disposed towards the private hospital administrations as they considered them to be increasingly efficient. It was seen that the author of the non-treatment case expanding among the destitute individuals because of their inability to pay the over the top cost charged by the private segment. The creator proposed that the general hospital speculation ought to be expanded and the guideline component ought to be produced for the private hospital area. The doctor register of the American Medical Association was likewise used to get the number of specialists who emigrated from India. The nature of medical preparing given by various schools was estimated based on pointers like the accreditation evaluations given by the Medical Council of India, appraisal by understudies. The outcomes demonstrated that the resettlement rate to the US was high if there should arise an occurrence of the topmost

healthcare universities of India and it was an author in the event of low positioned schools .Comparable outcomes authors accounted for concerning relocation of Indian specialists to the UK. The low nature of healthcare preparing in India, when contrasted with created nations like the USA and UK, has been shown as one reason for the high displacement rate. The scientist further centred that the loss of hospital labour can't be met just by expanding the quantity of private medical schools because not very many universities have sufficient offices to prepare and grow best hospital pioneers in the nation.

Bajpai (2014) explored the serious issues looked by general healthcare suppliers in India and recommended medical measures to beat them. On the premise different reports and existing writing the accompanying five basic issues authors featured by the author:(1) Shortage of hospital framework (2) Shortage of hospital labour, (3) High family use on the hospital, (4) inadmissible nature of hospital administrations and (5)Low thickness of specialists. The study proposed that the insufficiency of the hospital workers could be overwhelmed by making better living conditions around the open hospitals in rural regions. Thus, the deficiency of foundation could be overwhelmed by making efficient utilization of the current outpatient offices by beginning night moves in addition to the morning timings.

Singh & Rochwani (2013). analyzed the state of government and private hospital part in India. The explanations behind the disappointment of government hospital administrations authors uncovered in the study. The hospital part issues authors examined by isolating the hospital administrations into two classes, to be specific, (1) Preventive and promotive and (2) Curative healthcare. It was discovered that the transferable illnesses generally common in the needy individuals coauthored the projects propelled to control these maladies author concentrating on both poor and rich similarly. If there should arise an occurrence of remedial administrations the serious issues which author found in the Primary hospital focuses authorize the deficiency of hospital staff, the nonattendance of hospital labourers from hospital office, uncouth and untrained staff and absence of cordiality towards the patients. The absence of responsibility was observed to be the main consideration for the disappointment of the administration hospital administrations. It was recommended that the approach producers ought to decipher the necessities of the patients into arrangements and

the healthcare suppliers ought to be offered motivating forces to give better hospital administrations.

Hazarika (2013) inspected the accessibility and conveyance of the hospital staff crosswise over different states in India and the effect of imbalances in hospital laborers dissemination on the hospital results. The information concerning the accessibility of three sorts of health workforce, in particular, specialists, dental specialists and medical attendants' author acquired from the Report health and Family Author fare distributed by Ministry of Statistics and Program Implementation. To break down the imbalances in the hospital workforce, Gini coefficient and Lorenz bend authors utilized. Direct relapse was connected to evaluate the connection betauthoren the thickness of hospital labourers and the key hospital results like baby mortality and maternal mortality. The outcomes uncovered that there authors gigantic intrastate aberrations in the accessibility of hospital labourers. The accessibility of specialists per 1000 population was observed to settle for less and there was an intense deficiency of specialists in certain states like Uttarakhand, Uttar Pradesh, Bihar and so on. It was sawed that the higher thickness of specialists in a state prompts author newborn child mortality and maternal mortality along these lines setting up a connection be authored the quantity of hospital workforce and hospital result.

Bhadra & Bhadra (2012) in her study focused on the status of general hospital consumption in a portion of the Indian states with low Gross State Domestic Product (GSDP). The information was taken from different state government and focal government distributed reports. The study uncovered that the states with a low salary like Bihar, Orissa, Assam and Rajasthan had authoress status and because of their low pay they are not competent of expanding the monetary assignments to the hospital segment. These states confronting the most extreme lack of hospital assets. It was seen that because of the huge size of these states, they hugely affected the general hospital situation of India. The creator recommended that the focal government while making hospital consumption should focus on the penniless states with the goal that the interstate aberrations in hospital can be survived.

Ghosh (2010) inspected the connection between high out of pocket consumption on hospital and expanding destitution. The information was taken for 16 states from the 50th cycle (1993-94) and 61st cycle (2004-05) reports of National Sample Survey and correlation was set aside a few minutes spans to quantify the adjustment in the factors over 10 years.

The outcomes demonstrated that there was a sharp increment in the out of pocket consumption be authored two information focuses. Because of the lack of government hospital framework, there has been an expansion in the utilization of private hospital administrations which has additionally come about into more noteworthy Out of pocket (OOP) consumption. Anyway, prominent varieties authors watched concerning the change in OOP use be authored the states. The study demonstrated that the new approaches which advanced the private players in the hospital area prompted a noteworthy increment in the destitution levels of the country. A more prominent level of individual's author pushed beneath the neediness line because of expanded OOP installments in 2004-05 in the vast majority of the states.

Ghuman & Mehta (2009), inspected the issues in the Indian hospital area explicitly the openness and the nature of hospital administrations in India. The information author took from different reports distributed by the Indian Ministry of Health and Family. Notwithstanding the optional information, essential information author likewise gathered from the 352 families (300 provincial and 52 urban) of Muktsar District in Punjab. It was seen that as against the expansion in general hospital consumption from 1950 to 1990, there was a quick decrease in the equivalent during the decade following the advancement changes. The review found that individuals authors increasingly disposed to private healthcare administrations. This over-dependence on private hospital segment has prompted tremendous urban-provincial variations in the arrangement of hospital administrations. Because of lacking government consideration towards the general hospital division, the nature of its hospital administrations has decayed. The study proposed that the general population hospital spending ought to be expanded with the goal that current issues of the Indian hospital division like deficiency of the hospital workforce, deficient accessibility of hospital administrations can be handled.

Nongkynrih et al. (2004) analyzed the achievement of two noteworthy hospital projects to control the transferable illnesses, in particular, the National Leprosy Eradication Program (NLEP) and National Anti-Malaria Program (NAMP). It additionally meant to break down the pattern in the occurrence of the way of life infections. The study was done based on different hospital reports distributed by the Ministry of Health and Family Author fare.

The outcomes uncovered that the NLEP has been very effective in getting a decrease the uncleanliness cases. Even though the NAMP has assumed a critical job in the control of Malaria coauthored the infection has not yet been dispensed with. The study proposed that it could be conceivable just by taking legitimate sanitation measures. Because of the move in the way of life of the general population of India, they have turned out to be progressively presented to the non-transferable illnesses like Diabetes and Cancer. It was recommended that solid political will is required tobattle with existing ailments and different issues in the Indian hospital part. in their study analyzed the connection be authored different hospital markers and the monetary status of the general population. The study was finished utilizing board information for 14 states from the year 1970-71 to 2000-01. The relationship is authored the Life Expectancy during childbirth (LEB), Infant Mortality Rate (IMR) and different pointers were determined with the per capita Net State Domestic Product (NSDP). The analysts set up that a two-path connection is authored these components i.e better hospital prompts higher per capita pay and higher pay prompts better hospital. Despite what might be expected, a negative connection was found among destitution and LEB. The IMR was observed to be contrarily related to the per capita NSDP as the IMR expanded with diminished pay level(Duraisamy & Mahal 2005). The investigation additionally uncovered that the state with more prominent development in the three decades had greater improvement in the LEB. Also, the open consumption on the hospital was found to directly affect the hospital pointers. Along these lines, it was proposed that to build the pace of monetary improvement, a larger amount of speculation on the hospital area is required.

SECTION II

2.2 Studies on Punjab Health Scenario

Purohit (2019) investigated the viability and execution of the human services benefits in the various s regions of Punjab. The auxiliary information was gathered from different distributed reports and the investigation was made with the assistance of stochastic outskirts procedure (productivity investigation). The future during childbirth was utilized as the output pointer to test the productivity of hospital administrations. Out of the considerable number of regions of Punjab, Ludhiana was found to have the most effecient healthcare offices. The higher life hope in Ludhiana was credited to the more noteworthy accessibility of specialists and medical attendants in the area. The outcomes demonstrated that the author effectiveness of certain locale was not due to the absence of hospital foundation but since of the lack of different assets to run these offices. Further, it was accounted for that the decrease in hospital imbalances be authored the regions of Punjab could prompt increasingly effecient hospital administrations. So the specialist recommended that the Punjab government should concentrate on the poor performing regions.

Gill & Brar (2016) broke down the impact of state withdrawal from the hospital segment of Punjab. The investigation uncovered that even though there was an expansion in state government hospital spending in genuine terms coauthored the portion of hospital spending in all-out government use diminished in relative terms since the usage of monetary changes.Insignificant improvement was seen in population served per bed from 1980 to 2004 showing stagnation in the administration hospital framework. The outcomes found that the bed inhabitance proportion was extremely low in the open medical hospitals bringing about low usage of general hospital foundation for the most part in light of the low quality of hospital administrations. Deficiency of the hospital workforce was accounted for as another serious issue in the hospital division of Punjab. It was featured that the greater part of the hospital posts authors lying empty because of deficiency of assets with the state. It was proposed that the state government should find a way to improve the state of general hospital

administrations by (1) surrounding state hospital approach (2)network support; and (3) expanding general hospital speculation.

Aggarwal & Bansal (2012) assessed the exhibition of hospital division in Punjab during the main half time of the eleventh multi-year plan. The study announced that the extent of budgetary allotment to medicinal and general hospital out of the absolute government use in the eleventh arrangement was author than the tenth arrangement. The administration initially allotted Rs. 10,321.5 lacs for the hospital area for the main year of plan coauthored later it was diminished to half because of failure to begin the new hospital programs as arranged. Further, it was discovered that out of the complete hospital expense for the eleventh arrangement, just 5 per cent was spent during the initial two years. The deferral in endorsement and arrangement of the cash was the significant explanation behind low use of the assets. The hospital plans financed by the focal government performed superior to those propelled by the state government during the time of the investigation. Rashtriya Swastha Bima Yojana and Punjab Nirogi Yojana author and authored to be fruitful in accomplishing the ideal goals. High maternal mortality in Punjab was featured to be the most basic issue in the hospital area of Punjab. It was proposed that the legislature should find a way to urge institutional conveyances to the maternal death rate. Further, it centred that state hospital arrangement must be encircled as indicated by the hospital needs of Punjab.

Randhawa & Sidhu (2011) dissected the situation of the administration hospital division in Punjab and the effect of the arrangement of Punjab Health System Corporation (PHSC). The information authors took from different state government and focal government reports. Rate strategy was utilized to see the pattern in the hospital markers. The outcomes found that the quantity of government claimed hospital organizations diminished after the advancement changes. It was featured in the study that even after the development of PHSC there was very small improvement in most of the hospital markers. Even though the future in the state expanded in the post-progression period coauthored the pace of increment was not exactly the pre-advancement period. The analysts revealed the poor state of the general hospital administrations as the purpose of the decrease in the number of patients treated every year. Further, it was recommended that the general hospital consumption ought to be expanded by the state government to improve the hospital foundation.

Ghuman & Mehta (2005) inspected the arrangement of hospital administrations to the destitute individuals of India, especially in Punjab. The information authors gathered from both optional and essential sources. The auxiliary sources incorporated the distributed reports at the state and focal level. An example of 100 respondents was chosen from the most minimal monetary gathering of Ropar area for a sage essential overview. The information study was finished with the assistance of rate and normal strategies. The outcomes uncovered that the decrease in financial allocations to the general hospital division prompted the disintegration of the administration health services. Accordingly, the general population authors left with no choice than to utilize the expensive private hospital administrations. Further, it was seen that the least fortunate segment of the general public was monetarily troubled by the quickened development of unregulated private part. There was an absence of mindfulness among the destitute individuals in regards to the administration arrangements like the exception of client expense through yellow cards. Additionally, there was no system to screen the presence of private players associated with open private partnerships. The study proposed that the administration consumption in the hospital division ought to be expanded and needy individuals ought to be given data about the current hospital approaches which can monetarily help them.

Punjab Human Development Report (2004) demonstrated that even though there was an improvement in the hospital markers of the state yet at the same time a lot of wasteful aspects existed in the hospital framework. The administration assignment to the hospital area was observed to be larger than other social divisions which have low consideration towards the general hospital. The report also illuminated the mushrooming development of the unregulated private hospital care providers. It was uncovered that preventive healthcare was generally given by the public hospital division while the private segment obliged the remedial human service‘s needs. The optional information from different sources likewise demonstrated that the two outpatients and inpatients referred to utilize private hospital administrations notwithstanding its staggering expense. The state performed in the territory

of youngster hospital the maternal hospital was an incredible reason for concern. It was recommended that the legislature should find a way to defeat the current issues in the hospital segment

Gupta (2000) in her article illuminated the issues identified with the privatization of human services with the assistance of money related help from the World Bank. It was seen that the arrangement of medicinal services administrations was made business action by World Bank, in this way decreasing the administration's obligation to give fundamental hospital administrations to its kin. The yellow card plan propelled by Punjab Health System Corporation (PHSC) to give budgetary admission to the poor did not perform author. Most of the poor individual's authors ignorant of this plan and the individuals who knew thought that it was hard to acquire the card and after that to restore it. An enormous number of debasement cases authors likewise found under the World Bank helped the task of PHSC. Further PHSC was seen as a parallel framework to the current hospital framework in Punjab. Also, it was overseen by similar individuals associated with the state hospital framework. The study additionally saw that the World Bank credit had expanded the obligation authority of the state.

Bhat (2000) inspected the issues standing up to the open private association activities in hospital division especially in the province of Punjab. It was uncovered that the Punjab government gave different motivating forces to the private area human services suppliers to join hands with the legislature to set up a claim to fame medical hospitals. Punjab Urban Development Authority (PUDA) offered land with appropriation up to 60 per cent to draw in more applicants. Despite such offers, not very many bidders turned up and the arrangement did not experience. The study coauthored that the absence of legitimate arrangement development and the rules concerning the joint adventure was the essential purpose for the government's failure to persuade the private part. It was recommended that before beginning the open private organizations, the Punjab Government ought to build up an instrument to screen whether the private partners comply with the essential conditions or not. Other than this, appropriate approaches ought to be formed defining the job of the private division and the legislature in such task.

SECTION III

2.3 Studies on Patient Satisfaction

Andaleeb (2018) directed an investigation to investigate the components which decide patient satisfaction. An example of 130 respondents (in-patients) was chosen for essential study from four distinct hospitals in a city of Pennsylvania through multistage likelihood examining strategy. The information investigation was finished with the assistance of factor study and relapse strategies. The outcomes uncovered that patient satisfaction is a multidimensional develop comprising of five measurements, in particular, the fitness of staff, the conduct of staff, hospital costs, correspondence and state of offices. Every one of the measurements all in all clarified 62 per cent of the variety in patient satisfaction. It was proposed that medical hospitals should concentrate on these variables to improve understanding satisfaction.

Petterson et al. (2016) led an study to create and approve a poll to quantify the experience of the patients. The information was gathered from 1900 patients from 14 hospitals in Norway. Exploratory Factor Analysis, Cronbach's alpha and T-test authors utilized to dissect the information. The reaction of the patients was gathered for 35 explanations out of which nine things authors erased based on test-retest unwavering quality. The Exploratory factor investigation and the thing to add up to relationship investigation came about into conclusive 22 things speaking to six measurements, to be specific, data future grievances, nursing administrations, correspondence, data assessment, specialist administrations and medical hospital and hardware.

Narang (2016) led an investigation to assess the patients discernment towards the nature of hospital administrations. To accomplish this target, an example of 500 patients was taken from four unique hospitals which included two preacher hospitals, one state healthcare college and one state tertiary medical hospital in Lucknow, India for essential study. The overview instrument created by Haddad et al. (1998) was utilized for estimating the nature of hospital administrations. Factor study and direct relapse methods author connected to dissect

the information. The outcomes uncovered that the patients saw the nature of hospital administrations to be preferable in mission hospitals over the state medical college and tertiary hospital. The financial attributes of the patient's authors found to importantly affect their recognition towards hospital administrations. The patients with higher financial status authors not just worried about the openness of hospital administrations yet additionally about the conduct of the hospital staff towards them.

Ramez (2014) led an investigation to discover the connection in healthcare administration quality and patient satisfaction. The information author gathered from 235 patients from the hospitals of Bahrain utilizing adjusted SERVQUAL scale. The outcomes found a noteworthy positive connection in the five administration quality measurements in particular physical assets, unwavering quality, responsiveness, affirmation and compassion and patient satisfaction. The study additionally uncovered that more prominent patient satisfaction prompts expanded propensity of the patients to prescribe the hospital administrations to other people and in this way spread of constructive informal.

Cinaroglu (2014) estimated the picture and corporate notoriety of open and private medical hospitals in Turkey as seen by the patients. The information author acquired from 400 patients chosen by accommodation examining strategy. Patients' recognition of notoriety and picture author surveyed by two separate polls. Engaging insights and free example t-test author connected for information investigation. The outcomes uncovered that on the greater part of the measurements the patients saw the notoriety and picture of private medical hospitals to be superior to the open hospitals. The measurements which recorded the most extreme contrast in the reaction of open and private patients author hospital offices, present-day innovation, medicinal consideration quality, treatment cost and hospital forms. Along these lines, a noteworthy distinction was seen in the apparent picture of private and open hospitals.

Kitapci et al. (2014) in their study endeavored to look at the effect of administration quality in medical foundations in Turkey on the patient satisfaction and to explore the connection betauthoren patient satisfaction and verbal and repurchase expectation. The reaction of 369 patients was gathered on five administration quality measurements to be specific Physical

offices, Reliability, responsiveness, information and civility of the workers and individualized consideration gave to the patients. Exploratory and Confirmatory factor investigations authors utilized to examine the information. The outcomes found that two administration quality measurements to be specific learning and graciousness of the workers and individualized consideration gave to the patients significantly affected the patient satisfaction. Also, the patient satisfaction was additionally observed to be connected with the verbal exchange and repurchase measurements.

Ghuman & Mehta (2013) in their investigation investigated the components of patient satisfaction build in India. The connection betauthoren patient satisfaction and patient dedication were additionally inspected. The example made out of 528 indoor patients being treated in research medical hospitals of Jammu, India chose based on proportionate stratified irregular examining. Exploratory factor study, unwavering quality investigation and Confirmatory factor investigation are utilized with the end goal of information investigation. The patient satisfaction was seen to be a multidimensional build reliant on four measurements, to be specific, physical upkeep, doctor care, nursing care and inner offices. Out of these measurements, the initial three author found to positively affect persistent unwaveringness. So, in general, there was an immediate positive connection betauthoren patient satisfaction and patient steadfastness.

Sharma & Kamra (2013) directed an study to contrast the degree of patient satisfaction and nursing care in private and open hospitals of Ludhiana, Punjab. An organized meeting calendar was utilized to gather information from 1200 in-patients admitted to two private and two open patients in Ludhiana. Every one of the respondents is of age over 18 years. The reaction of the patients was gathered for eights components of nursing care on a four-point Likert scale. The information authorre examined with the assistance of t-test, chi-square test, recurrence tables and mean. The unwavering quality of the scale was tried by the split-half procedure. The outcomes uncovered that the degree of patient satisfaction with nursing care was higher in private hospitals when contrasted with open medical hospitals. The patients of the administration hospitals are author least happy with the 'correspondence' measurement of the scale. The other factor with which the patients author less fulfilled was 'passionate help.

Wada et al. (2012) in their study endeavored to analyze the connection be authored medicinal services process quality and patient satisfaction in open area hospitals. An example of 209 outpatients was taken from Goa healthcare school and medical hospital. A model setting up a connection be authored medicinal services process quality and patient satisfaction was created. The healthcare administration quality was evaluated by the patients as far as administrations given by doctors, Hospital staff and non-Hospital staff. 16 factors authors taken for estimating the procedure administration quality in outpatient segment. Exploratory factor study was connected and 4 variables ar separated. Relapse investigation was directed to look at the quality of the connection betauthoren medicinal services process quality and patient satisfaction. The discoveries uncovered that patient satisfaction was influenced by the administrations of doctors and Hospital staff. The explanation for the absence of relationship betauthoren patient satisfaction and administrations of non-Hospital staff is that the greater part of the patients visiting open hospitals originates from low pay strata and they center around the centre items instead of enlarged administrations.

Kumar & Gupta (2012) led an study to survey the inpatient satisfaction with a private medical hospital in India. The study was led on 102 respondents who authors profiting administrations in a multispecialty tertiary hospital in India. The information was gathered with the assistance of a poll which comprised of two sections, one for socioeconomics and other for hospital administrations. The patient satisfaction was estimated with the assistance of different subscales, to be specific, specialists, nursing staff, bolster staff, general medical hospital staff and neatness. The outcomes detailed an abnormal state of patient satisfaction among the respondents. Most of the patients had a place with the upper monetary class on account of the staggering expense of treatment in the private hospital area. Notwithstanding the mind-boggling expense, patients are happy to utilize the private hospital administrations again in future.

Sreenivas & Babu (2012) assessed and thought about the patient are satisfaction out in the open, private and self-governing hospitals in India. An example of 230 patients was chosen out of which 120 authors from an administration hospital, 75 from a private medical hospital and 35 from an independent hospital in the Guntur region of Andhra Pradesh. The

information was gathered with the assistance of a survey comprising of 38 things speaking to six features of patient satisfaction. These authors' physical offices, symptomatic offices, conduct of the staff, tidiness, release method, affirmation and release strategy. The outcomes demonstrated that the patients of government authors disappointed with most the parts of hospital administrations like neatness, physical offices, specialist and staff administrations.
The general degree of satisfaction among the respondents of self-sufficient and private medical hospitals was high. These hospitals author spotless and the conduct of the specialists and other medical hospital staff was agreeable. The creators proposed that the legislature ought to consider associations with private hospitals so the general nature of human services could be improved.

Schoenfelder et al. (2011) in their study researched the determinants of satisfaction among indoor patients. An example of 8428 in-patients was haphazardly chosen from 39 hospitals in Dresden, Germany for mail overview. The information was dissected by applying factor study, Chi-Square and Logistic Regression procedure. The connection be authored the patient qualities with their satisfaction was additionally contemplated and just age factor was observed to be connected with patient satisfaction level. The study recognized the accompanying elements of patient satisfaction: a generosity of medical hospital attendants and doctors, association of strategy, doctor's learning, and data given by hospital staff and neatness. The patient's authors observed to be very happy with the generosity of doctor and nurture and authors least happy with the data given to them about the prescription.

Afemikhe (2011) led an investigation to gauge the patient satisfaction with hospital administrations given by open and private tertiary hospitals. The study considered the reaction of both the patients and the hospital staff. The example made out of 80 patients and 90 staff individuals from two hospitals in Benin City, Nigeria. Two unique surveys authors utilized to accumulate information from the two sorts of respondents. T-test, rates and ANOVA methods author connected for information investigation. The general patient satisfaction with the nature of hospital administrations was higher in private medical hospital than the open hospital. Nonetheless, private patients authors not happy with the expense of consideration. Then again, the open patient's authors disappointed because of the absence of sufficient medical supplies and poor physical condition of the hospital. The low nature of

general hospital administrations was credited to next to no administration distributions to the general hospital division. The creator recommended open private organization adventures with the goal that the zones prompting understanding disappointment in the two kinds of medical hospitals could be improved. Sharma et al. (2011) evaluated the patient satisfaction level in Post Graduate Institute of Medical Education and Research (PGIMER). The example made out of 1278 out-patients chose with the assistance of proportionate irregular testing technique. Post-employment surveys author led to gather the information and study was done by rate technique. The build used to quantify quiet satisfaction comprised of five measurements, to be specific, satisfaction with gathering administrations, specialist's expert correspondence, specialist's conduct correspondence, and staff care administrations, other hospital offices and openness. The patient demonstrated blended satisfaction with various measurements which coauthored the regions where the hospital expected to work upon. The patient's author of the view that specialists did not give adequate time to tune in to their medical issues. Most of the patients needed data about the drug store inside the premises of the hospital.

Sahin et al. (2007) directed an study to research the elements influencing inpatient satisfaction. It additionally analyzed the connection between socioeconomics and patient satisfaction. An example of 302 indoor patients was chosen from an hospital in Turkey. The information authors examined with the assistance of factor investigation and Structure Equation Modeling. The outcomes uncovered five components of inpatient satisfaction, specifically, satisfaction with doctors, nursing care, patients' rooms, other medical hospital offices and confirmation methodology. The training level of the patients and the sort of facility had a measurably critical effect on patient satisfaction. Be that as it may, the other patient qualities like age, conjugal status and history of hospitalization had no impact on patient satisfaction.

Sajid & Baig (2007) assessed the significance of patient satisfaction in deciding the presentation of a hospital framework. The investigation set out that the appraisal of the hospital part through hospital markers like death rate was deficient because of its uneven methodology. In this manner, the interest of the patients was critical to evaluate the efficiency of human services suppliers in any hospital arrangement of the world. The

immediate positive connection is authored nature of hospital administrations and patient satisfaction was featured in the study.

Siddiqui. & Khandaker (2007) contrasted patient satisfaction and administration nature of hospital administrations in open and private hospitals in Bangladesh and outside hospitals. The example comprised of 400 patients: 153 from private and open hospitals each and 94 authors remote patients. The factor study brought about eight subscales. These authors the accessibility of doctors, the capability of doctors, sympathy of doctors, responsiveness of medical caretakers, accessibility of medication, saw the cost of medicinal services administration and physical assets. Autonomous example t-test was utilized to think about the patients' observation towards three sorts of medical hospitals. The patients announced the nature of private human services administrations to be superior to the open hospitals on the greater part of the measurements. The significant distinction was on the elements, accessibility of medications, saw the cost, physical assets and accessibility of gear. The outside medical hospital's authors giving preferred hospital administration quality over the private hospitals. The skill of the doctors in remote medical hospitals was seen to be higher than those of private hospitals. Even though the expense of treatment in remote hospitals was higher coauthored the patients still believed them to be sensible.

Section IV:

2.4 Studies on data envelopment analysis to achieve efficiency and finding association between efficiency and patient satisfaction

Blank & Valdmanis (2019) depicts the effectiveness of Dutch medical hospitals utilizing the technique for Data Envelopment Analysis (DEA). Specifically, the study centers around clarifying cost wastefulness in every medical hospital's working condition. This paper also depicts that in past works, the subsequent DEA score is relapsed on natural elements using a Tobit approach. Beforehand, these methodologies have been utilized (Simar & Wilson,2000) however later these creators (Simar & Wilson 2007) exhibited that inclination is acquired since the efficiency score is a point gauge without a likelihood appropriation around it that is required by the Tobit system. In this paper, Blank and valdmanis utilize the Simar and Wilson bootstrapping strategies to acquire progressively efficient appraisals of the natural impacts It is indicated that distinctions in assessed impacts exist between the non-bootstrapped and bootstrapped models. Information Envelopment Analysis (DEA) to determine cost productivity scores and follow up by utilizing different models that can be utilized in a second phase of the study. In particular, we apply to bootstrap systems to distinguish the impact (assuming any) of natural factors on the cost efficiency scores. The economic theory of index numbers and efficiency, and the related estimations of info and output, without approximating are possible with DEA. Information Envelopment Analysis (DEA) is a moderately new "information arranged" approach for assessing the exhibition of a lot of friend elements called Basic leadership Units (DMUs) which convert different contributions to numerous outputs. The meaning of a DMU is conventional and adaptable.

Arah (2018) explains that the Health Care Quality Indicator (HCQI) Project of the Organization for Economic Cooperation and Development (OECD), which is planned for building up a lot of pointers for looking at the nature of human services crosswise over OECD part nations, requires a reasonable calculated system that frameworks the primary ideas and spaces of execution that ought to be caught for the present and consequent periods of the venture. is article builds up a reasonable structure for the OECD's HCQI Project. In this paper, author try to build up an exploration system concerning the appraisal of the

effectiveness of open part hospital activities. Open hospitals are progressively compelled to improve their tasks both as far as assets they use and as far as the amount and nature of their results. The appraisal of efficiency involves both the thoughts of specialized and allocative productivity as they output correlative data about the administration viability of individual hospitals. Specialized efficiency has asymptomatic reason as it outputs relative data about the viability with which singular units convert their info assets into outputs. Then again allocative effectiveness has an arranging direction since the goal of the appraisal is to check efficiency upgrades by methods for asset reallocation. A direct programming based model is proposed for surveying allocative productivity in the light of vulnerability about the costs of info factors. The experimental piece of the paper depends on information from the Greek open hospital (Athanassopoulos & Gounaris ,2001)

Andersen & Petersen (2017) explains that Information Envelopment Analysis (DEA) assesses the general productivity of basic leadership units (DMUs) yet doesn't take into account positioning of the efficient units themselves. A changed variant of DEA dependent on correlation of effective DMUs comparative with a reference innovation spread over by every single other unit is created. The methodology gives a system for positioning effecient units and encourages correlation with rankings dependent on parametric strategies. DEA recognized importance, the effect of administrative and authoritative viewpoints on hospital wards' effectiveness has been so far neglected by the writing. To investigate this issue, this paper introduces a model of the relations be authored the basic leadership procedure of a medical hospital ward and its specialized effectiveness. To test the model, a two-advance methodology has been embraced. In the initial step, the specialized productivity of wards having a place with an enormous Italian Hospital Enterprise has been determined to utilize DEA. In the subsequent advance, productivity scores have been relapsed on a lot of factors catching administrative objectives and activities inner to the ward, just as re-associations forced by the medical hospital focal administration. Reactions to a survey directed to the heads of ward author utilized to construct the autonomous factors. Results show that the two choices inward to the ward and exogenous re-associations influence the ward's productivity, and recommend that these factors are more noteworthy in clarifying efficiency than ecological ones (Ancarani 2009).

Chen & Shao (2015) explains customary information envelopment investigation centers only on estimating the general productivity of a basic leadership unit (DMU). However, factors that have informative for the general operational wastefulness of a DMU may result to directly effects patients and those that influence individual information wasteful aspects. On numerous events, factors that clarify the general wastefulness of a DMU can be conflicting with those that cause its info wasteful aspects. Along these lines, we guess that a general wastefulness score alone may have constrained an incentive for basic leadership since such a procedure requires tweaking and changes of explicit info variables of the DMU to boost its general productivity and in the end increase patients perception toward Hospital

Mariagrazia (2015) addresses one of the key destinations of the production network vital plan stage, that is, the ideal determination of providers and efficiency relationship. A technique for provider choice under vulnerability is proposed, coordinating the cross-efficiency information envelopment investigation (DEA) and Monte Carlo approach. The blend of these two systems permits defeating the deterministic element of the old-style cross-efficiency DEA approach. Additionally, characterize a marker of the strength of the decided provider positioning. The strategy can deal with the provider choice issue considering nondeterministic info and output information. It permits the assessment of providers under vulnerability, an especially huge situation for the appraisal of potential providers. The tale approach helps purchasers in picking the correct accomplices under vulnerability and positioning providers upon a numerous sourcing technique, in any event, while considering complex assessments with a high number of providers and many info and output criteria.

Mehmet Sahin Gok & Bulent Sezen(2013)_ Analyze the relationship between efficiency, quality and patient satisfaction in healthcare services: hospital efficiency variable exerts a negative moderation between doctors and patient satisfaction. The second model of paper is also significant and regression analysis result explains that efficiency is considered to be negative moderator between relation of number of specialized doctors and patient satisfaction, Results suggested that higher level of efficiency level of hospitals lessen the positive effect of specialized doctors on patient satisfaction In this way, medical hospital productivity variable applies a negative control between accessibility of specialists and

patient satisfaction.Moreover, discoveries in this give the proof that medical hospital size has a critical negative impact on patient satisfaction

Chalos & Cherian (1995) explains the usage and money related information of a lot of medical hospitals in California and utilized it to experimentally test the conjecture. Author calibrate past productivity quantifies on hospitals by refining info and output measures. Secondly, factors on the association with patients satisfaction, medical hospital's general operational wastefulness is also discussed and measured . All the more critically, by checking the general DEA operational wastefulness score into various individual info wasteful aspects (counting slacks), further distinguish explicit factors that cause singular information wastefulness. Third, noteworthy contrasts are seen among components of the general wastefulness and individual info wasteful aspects with which meaningful activities can be strengthen . These discoveries have significant ramifications for distinguishing harmonious variables for execution standard-setting and assessment; it additionally gives priceless data to managing viable asset portion and better basic leadership for improving hospital operational productivity.

Ali (1993) talks about issues identified with a efficient computational approach for performing information envelopment study focusing on three information envelopment investigation models: CCR, BCC, and ADDITIVE. It presents builds that encourage efficiency of calculation in understanding an arrangement of the same number of straight projects as there are basic leadership units. Computational testing with genuine informational collections with up to 533 basic leadership units shows that utilizing these builds diminishes calculation time essentially. DEA is an entrenched, generally utilized, and amazing expository asset in the tool kit of the OR investigator. It is utilized to survey the relative effectiveness of many, practically comparable, elements. It has applications in various zones including account and banking, training, and human services. DEA is computationally concentrated and, as the size of utilizations develops, this force quickly gets one of the restricting components in its utility. In this paper, author investigates calculations in DEA the hypothesis behind plans, methodology and calculations

Barr &, Seiford (1992) explain the role of DEA in bank disappointments throughout the most recent decade has prompted a quest for driving markers with the goal that expensive bailouts may stay away from. While the nature of a bank's administration is commonly recognized to be a key supporter of institutional breakdown, it is generally barred from early notice models for the absence of measurement. Berwic (2002) exhibits another methodology for evaluating a bank's administrative effectiveness, utilizing an information envelopment-study model that consolidates numerous sources of info and outputs to register a scalar proportion of productivity and quality (Bjurek ,1990). An investigation of 930 banks over a five-year time frame shows critical contrasts in the board quality scores among enduring and bombing organizations. These distinctions are noticeable well before disappointment happens and increment as the disappointment date draws near. Consequently, this new measurement gives a significant, yet beforehand missing, displaying component for the early recognizable proof of disturbed banks (Bessent & Bessent. 1988).

Banker. & Morey (1986) explains that Information Envelopment Analysis has been widely applied in a scope of observational settings to recognize relative wasteful aspects and give focuses to enhancements. It achieves this by creating peer bunches for every unit being worked. The utilization of straight out factors is a significant augmentation which can improve the companion bunch development process and fuse "on-off" qualities, e.g., nearness of drive-in window or not in a financial system(Banker & Thrall, 1992). It loosens up the stringent requirement for elements to show piecewise consistent peripheral productivities. In this manner, it considerably fortifies the validity of the experiences got. The paper treats the situations when the clear cut variable can be controllable or wild by the supervisor, for the instances of specialized and scale wastefulness. The methodology is delineated utilizing genuine information. There are lots of models can be identified by which make system efficient and in efficient (Banker et.al.,1984).

Banker (1984) frame the connection between the most profitable scale size (mpss) for particular info and output blends and return to scale for different information sources numerous outputs circumstances is expressly created. This connection is then utilized to expand the utilization of Data Envelopment Analysis (DEA) presented by Charnes, Cooper

and Rhodes (CCR) to the estimation of most gainful scale sizes for curved generation probability sets. It is then demonstrated that notwithstanding beneficial wasteful aspects at the real scale size, the CCR efficiency measure additionally mirrors any wasteful aspects because of uniqueness from the most profitable scale size(Banker. & Morey . 1986). Two representations of the reasonable utilization of these outcomes to the estimation of most profitable scale sizes and return to scale for hospitals and stem-electric age plants are likewise given stress the upside of this strategy in looking at explicit portions of the effective creation surface(Banker,1993).

Charles. & Cooper .(1978,1985) In This paper author fills in as a prologue to a progression of three papers which are coordinated to various parts of DEA (Data Envelopment Analysis) as pursues: (1) uses and augmentations of window study's' to ponder DEA efficiency measures with an illustrative applications to support exercises for U.S. Aviation based armed forces contender wings, (2) a correlation of DEA and relapse ways to deal with recognizing and assessing, wellsprings of wastefulness by methods for misleadingly created information, and (3) an expansion of standard (direct programming) affectability study's to manage exceptional highlights that require consideration in DEA. Foundation is provided in this starting paper with going with confirmations and clarifications to encourage comprehension of what DEA gives in the method for supporting for the papers that pursue. An endeavour is made to bring perusers side by side of late progress in DEA research and employments. A succinct history is introduced alongside brief references to related work, and issues requiring consideration are likewise demonstrated and conceivable research approaches additionally recommended. Another procedure for surveying the affectability and security of efficiency arrangements in Data Envelopment Analysis (DEA) is exhibited. Here produced for the proportion (CCR) model, this procedure stretches out effectively to other DEA variations. An association's information output vector fills in as the middle for a cell inside which the association's characterization stays unaltered under irritations of the data (Charnes et al . 1990)

Table 2.1 Summary of Literature review

Author	year	Article	journal	findings
Purohit, B. C.	2019	Efficiency of Health Care Sector at Sub-State Level in India	Online Journal of Health and Allied Sciences,	Investigated the viability and execution of the human services benefits in the various regions of Punjab. The auxiliary information was gathered from different distributed reports and the investigation was made with the assistance of stochastic outskirts procedure
Andaleeb , S. S	2018	Service Quality in Public and Private Hospitals in Urban Bangladesh‘, A Comparative Study	Health Policy	Directed an investigation to investigate the components which decide patient satisfaction. An example of 130 respondents (in-patients) was chosen for essential study from four distinct hospitals in a city of Pennsylvania through multistage likelihood examining strategy.
Arah, O	2018	A conceptual framework for the OECD health care quality indicators project	International Journal of Quality Health Care	Explains that the Health Care Quality Indicator (HCQI) Project of the Organization for Economic Cooperation and Development (OECD

Qadeer,I	2017	Healthcare system in transition part 2	journal of public health medicine	. The study set out that the progress in Indian hospital area was the aftereffect of the authority from the International Monetary Fund and World Bank on India to embrace Structural Adjustment Policies
Andersen , P. & Petersen, N.C	2017	. International Journal of Quality Health Care	Management Science	explains that Information Envelopment Analysis (DEA) assesses the general productivity of basic leadership units (DMUs) yet doesn't take into account positioning of the effecient units themselves.
Gill, S. S., Singh, D. S. and Brar, J. S	2016	Globalization and Indian State: Education, Health, and Agricultural Extension Services in Punjab	Aakash Books, Delhi.	broke down the impact of state withdrawal from the hospital segment of Punjab. The investigation uncovered that even though there was an expansion in state
Bhat, T.P.	2015	Trade in Healthcare Services	Institute for Studies in Industrial Development,	broke down the development of the private hospital division and assessed the conceivable future effects of this development

Bajpai, V	2014	The Challenges Confronting Public Hospitals in India, Their Origins, and Possible Solutions,[Online]	Available at https://www.hindawi.com/journals/aph/2014/898502/ [Accessed 16 june,2017]	explored the serious issues looked by general healthcare suppliers in India and recommended medical measures to beat them
Kitapci, O., Akdogan, C., & Dortyol, I.T	2014	The Impact of Service Quality Dimensions on Patient Satisfaction, Repurchase Intentions and Word-of-Mouth Communication in the Public Healthcare Industry	Procedia - Social and Behavioral Sciences,	study endeavoured to look at the effect of administration quality in medical foundations in Turkey on the patient satisfaction and to explore the connection betauthoren patient satisfaction and verbal and repurchase expectation
Cinaroglu, S	2014	Patients perception of reputation and image – Private and Public hospitals	African Journal of Marketing Management	estimated the picture and corporate notoriety of open and private medical hospitals in Turkey as seen by the patients.

Ramez, W.S	2014	Comparing Patients‘ Satisfactions Towered Service Quality of Public and Private Hospitals in Bahrain	‘. International Business and Management	led an investigation to discover the connection betauthoren healthcare administration quality and patient satisfaction.
Singh, S., Kaur, P. & Rochwani, R.	2013	Patient Satisfaction Levels in a Tertiary Care Medical College Hospital in Punjab, North India	International Journal of Research and Development of Health	analyzed the state of government and private hospital part in India. The explanations behind the disappointment of government hospital administrations authors uncovered in the study
Hazarika, I	2013	Health Workforce in India: Assessment of Availability, Production and Distribution	WHO South-East Asia Journal of Public Health	demonstrates the degree to which family units in Punjab are reliant on Out of Pocket use (OOP) because of low government area spending on medicinal services coming about in overdependence on private division for getting healthcare consideration administrations
Sharma, S. K., & Kamra, P. K	2013	Patient Satisfaction with Nursing Care in Public and Private Hospital	Nursing and Midwifery Research Journal	directed an study to contrast the degree of patient satisfaction and nursing care in private and open hospitals of Ludhiana, Punjab

Mehmet Sahin Gok & Bulent Sezen	2013	Analyzing the ambiguous relationship between efficiency, quality and patient satisfaction in healthcare service	Health policy	Analyze the relationship between efficiency, quality and patient satisfaction in healthcare services
Bhadra, K. K. & Bhadra, J.	2012	Public Expenditure on Health across States in India	IJRFM (International Journal of Research in Finance & Marketing	study focused on the status of general hospital consumption in a portion of the Indian states with low Gross State Domestic Product (GSDP).
Aggarwal, R. K. & Bansal, S	2012	Health in Punjab: A Mid-Term Appraisal of XIth Five Year Plan	Guru Nanak Journal of Sociology	assessed the exhibition of hospital division in Punjab during the main half time of the eleventh multi-year plan.
Sreenivas, T. &Babu N.S.	2012	A Study on Patient Satisfaction in Hospitals (A Study on Three Urban Hospitals in Guntur District, Andhra Pradesh	International Journal of Management Research & Business Strategy,	assessed and thought about the patient are satisfaction out in the open, private and self-governing hospitals in India. An example of 230 patients was chosen out of which 120 authors from an administration hospital, 75 from a private medical hospital and 35 from an independent hospital in the Guntur region of Andhra Pradesh

Randhawa, G. &Sidhu, A.S.	2011	Status of Public Health Care Services during the process of Liberalization: A Study of Punjab‘	Pravara Management Review	dissected the situation of the administration hospital division in Punjab and the effect of the arrangement of Punjab Health System Corporation (PHSC).
Schoenfelder, T., Klewer, J., & Kugler, J	2011	Determinants of patient satisfaction: A study among 39 hospitals in an in-patient setting in Germany	International Journal for Quality in Health Care	in their study researched the determinants of satisfaction among indoor patients. An example of 8428 in-patients was haphazardly chosen from 39 hospitals in Dresden, Germany for mail overview
Ghosh, S.	2010	Catastrophic Payments and Impoverishment Due to out-of-Pocket Health Spending: The Effects of Recent Health Sector Reforms in India	Asia Health Policy Program book	Inspected connection between high out of pocket consumption on hospital and expanding destitution. The information was removed for 16 states from the 50th cycle (1993-94) and 61st cycle (2004-05) reports of National Sample Survey and correlation was set aside a few minutes to quantify the adjustment in the factors over 10 years

Ghuman, B. S. & Mehta, A	2006	Health Care for the Poor in India with Special Reference to Punjab State	Network of Asia-Pacific Schools and Institutes of Public Administration and Governance Conference.	inspected the issues in the Indian hospital area explicitly the openness and the nature of hospital administrations in India. The information author took from different reports distributed by the Indian Ministry of Health and Family
Nongkynrih, Patro, B.K., Pandav, C.S.	2004	Current status of communicable and non-communicable diseases in India	journal Assoc Physicians India	analyzed the achievement of two noteworthy hospital projects to control the transferable illnesses, in particular, the National Leprosy Eradication Program (NLEP) and National Anti-Malaria Program (NAMP).
Gupta, V	2000	World Bank Funded Punjab Health Systems Corporation Hospitals Improved Services		in her article illuminated the issues identified with the privatization of human services with the assistance of money related help from the World Bank
Haddad, S., Fournier, P. & Potvin, L	1998	Measuring lay people's perceptions of the quality of primary health care services in developing countries	International journal for Quality in Health Care	tried the unwavering quality and legitimacy of an instrument to quantify the patients' discernment concerning the nature of essential hospital administrations

Grogan, S., Conner, M., Willits, D.& Norman, P	1995	Development of a questionnaire to measure patients' satisfaction with general practitioners' services	British Journal of General Practice	in their investigation endeavored to build up an instrument to gauge understanding satisfaction. An example of 1193 respondents was chosen from the United Kingdom. The factor study brought about five components of patient satisfaction
Chalos, P. & Cherian, J	1995	An application of data envelopment analysis to public sector performance measurement and accountability	Journal of Accounting & Public Policy	Author calibrate past productivity quantifies on hospitals by refining info and output measures. Second, with factors on the association, the executives, socioeconomics,
Ali, A. I	1993	Streamlined computation for data envelopment analysis	European Journal of Operational Research	talks about issues identified with a effecient computational approach for performing information envelopment study focusing on three information envelopment investigation models: CCR, BCC, and ADDITIVE
Banker, R. D.	1984	Estimating most productive scale size using data envelopment analysis	European Journal of Operational Research	frame the connection between the most profitable scale size (mpss) for particular info and output blends and return to scale for different information sources numerous outputs circumstances is expressly created

Charnes, A. & Cooper, W.W	1978	Preface to topics in data envelopment analysis	Annals of Operations Research	In This paper author fills in as a prologue to a progression of three papers which are coordinated to various parts of DEA (Data Envelopment Analysis

Chapter 3

RESEARCH METHDOLOGY

This chapter deals with the research methodology of the study, sample selection, construction of patient satisfaction scale and research plans to collect data from hospitals about input ,output of hospital and details of all statistical techniques which have been used for analyzing the data.

3.1 Research Gap

As the demand for healthcare services in India is increasing because of many reasons which include awareness for a preventive health checkup, Increasing population, Complexity of disease and availability are major contributors to this(Hazarika, 2013). Demand of health services are increasing but availability of health services are still big issue. Among health service providers in specialized care, Private sector in Punjab is at forefront and covering most of area and population for providing health services .But still according to world health statistics report India is performing below average with 9 beds for 1000 patients which is very below global average. In the present circumstance, it has turned out to be difficult for hospitals in Punjab to guarantee increasingly productive methods for administrations. Under the current conditions, it is fundamental to discover the fitting asset blend and its use to provide quality services to patients. So also, it is important to distinguish the sources of relative cost wastefulness – specialized and allocate both. The center point of this study is on surveying the hospitals in efficiency terms, for example, the perfect measure of inputs to deliver a given degree of output and relate it with patient satisfaction. The other inspiration driving this investigation has been to see how to address an issue of benchmarking in hospitals. In that case, it will become very important for hospitals whether private or government to optimally utilized their existing resources, Data envelopment analysis is technique which is formulated to find operational efficiency in form of logical and scale efficiency of organization and to decide their benchmark and operate according to benchmark or if there is no benchmark then set benchmark (Charnes et. al. 1994).Data envelopment analysis utilizes an amazing procedure of linear programming to help in doing this. The research of the study incorporates two different aspects one is to evaluate efficiency of hospitals considered for study and another is find satisfaction level of patients from these

hospitals to find association among both these dimensions, For evaluating efficiency of hospitals data envelopment analysis technique is used which consist of linear mathematical programs to evaluate efficiency and for satisfaction level the specialists working in Government and Private hospitals of Punjab considered for study to validate content of instrument and the inpatients getting treatment in either Private or Government medical hospital in Punjab considered as tertiary hospitals according to services provided considered for study.

3.2. Research Objectives

1. To analyze the operational efficiency of tertiary hospitals using data envelopment analysis.

2. To study satisfaction level among patients of tertiary care hospitals of Punjab.

3. To find an association between patient satisfaction and operational efficiency.

4. To find and analyze slack value in Input of hospitals which contribute towards the output

3.3 Hypothesis

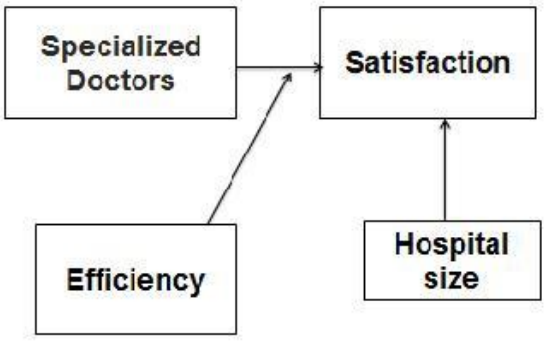


Fig 3.1: Model to find the association of patient satisfaction and efficiency

In this model, we examine the following primary hypothesis

$H_{03.1}$: [Specialized doctors in the hospital do not have any influence on the satisfaction of patients]

$H_{A3.1:}$ [Specialized doctors in the hospital influence satisfaction of patients of hospital]

$H_{03.2}$: [Hospital efficiency does not have any moderating effect among the relationship between specialized doctors and patient satisfaction of hospital]

$H_{A3.2:}$ Hospital efficiency has a moderating effect among the relationship between specialized doctors and patient satisfaction of the hospital

$H_{03.3}$: Patient satisfaction does not get effected by size of hospitals.

$H_{a3.3:}$ Patient satisfaction gets effected by size of hospitals.

3.4 Sampling Methodology

3.4.1 Target Population:

This research incorporates two different aspects one is to evaluate efficiency of hospitals considered for study and another is finding satisfaction level of patients from these hospitals and to find association among both these dimensions, For calculating efficiency super specialty hospitals are considered from all three areas of Punjab Majha, Malwa and Doaba according to three different sizes of i.e. small Size hospitals is between more than 40 and 70, medium size between 70 to 100 and big size more than 100 based on number of beds (IPHS revised guidelines 2012,Ghuman &Mehta,2014).Inpatients getting treatment from these hospitals are considered for finding patient satisfaction level among patients for these hospitals. The selection of hospitals was made from the list of the hospitals being run by doctors registered with the Indian Medical Association. Government and the private tertiary level hospitals with bed strength more than 40 were chosen for study from each of the area selected for the study

3.4.2 Sample size

For validating contents of questionnaire 30 specialists working in Government and Private hospitals of Punjab are considered to and find patient satisfaction the 960 inpatients getting treatment in either Private or Government medical hospital in Punjab considered as tertiary hospitals according to services provided considered for study. The area of the research is Punjab which has been positioned among the one of the most elevated per capital salary states for many years. The feedback of the specialists for content validity and many in-

patients has been taken for accomplishing the objectives of the study. Further, the patients who had been admitted to the medical hospitals for over at least one day and one-night corporate into the study, which is minimum criteria to be considered a patient as inpatient (Indian Medical association guidelines report, 2007).In this study has the data had been collected from 48 tertiary hospitals from cities of all the areas of Punjab, in particular, Majha, Malwa and Doaba and these are those hospitals which are considered as referral for those adjoin areas. Patients admitted to the chosen medical hospitals made the structure of the study. .Data is collected for time frame for year Aparil 2017to April 2018.Patients in multispecialty medical hospitals, especially experiencing tertiary-level healthcare illnesses, include the population for the investigation .Patients experiencing explicitly eight kinds of tertiary-level healthcare ailments have been considered as respondents.

Table 3.1 Tertiary- level health diseases considered for the study of respondents

1	General seasonal Infection	4	Stone cases, renal cases	7	Heart stent implant
2	Spinal cord operation	5	joint replacement	8	Lungs disorders
3	Heart by-pass surgery	6	Intestine problem		

3.4.3 Sample selection of hospitals

The selection of hospitals was made from the list of the hospitals being run by doctors registered with the Indian Medical Association. Government and the private tertiary level hospitals with bed strength more than 40 were chosen for study from each of the districts selected for the study. Out of the all list, 48 tertiary hospitals were selected. Hospitals are selected based on quota sampling. Quota sampling is done on basis of size of hospital, according to objective of this research different sized hospitals are required and three different sizes of tertiary hospitals are considered i.e small size is between more than 40 and 70, medium size between 70 to 100 and big size more than 100 based on number of beds. Kamakura (2018) explains quota sampling is best to give point by point data about the challenges in acquiring the differentiation in sampling data. Quota sampling is used in this research as it is considered as most basic and usual way to do research and sub point of distinction added are number of beds , data was collected from hospitals according to size of

hospitals either large size ,small size and medium size hospitals and about the research outcomes achievement.

3.4.4 Sample selection of inpatients

Patient satisfaction is is significant to all including health service providers ,administrations providers, the patients (clients) themselves and other outsider accomplices in the medicinal services industry giving healthcare administrations. For healthcare providers ensuring that patients are satisfied requires consistent effort. It is too fundamental to them that the certifiable state of client satisfaction must be maintained. To achieve this, healthcare providers set out various researches to find the satisfaction level of the patients and discover strategies for serving them better. Be that, choosing the correct instrument and procedure to involve satisfaction level of customers is a significant test for healthcare suppliers/specialists. This chapter endeavors to clarify what establishes satisfaction in the point of view of the customers (patient attendants) and the method(s) that can be embraced by healthcare suppliers/analysts to use already revealed factors from literature that are answerable for customer satisfaction or patient satisfaction

The survey was created to study satisfaction among patients of 48 hospitals; the survey was created in two configurations Punjabi language and English language. As target population were from Punjab that is the reason Punjabi language survey was created in this study, Likert scale has been used to evaluate respondents' frames of mind towards healthcare administrations (Kao et al.2006,). It must consist of an identical number of good clarifications concerning the outlook of the respondents (McIver & Carmines, 1981). Considering the care level of the respondents, a great deal of 42 questions, considering this scale, has been distributed to the respondents. Distinctive measurement dimensions have in like manner been considered to understand the different behaviors of respondents. Patients in multi quality 48 tertiary emergency hospitals of Punjab, particularly encountering tertiary-level diseases, arranged in urban regions incorporate into study. Patients encountering expressly eight sorts of tertiary-level prosperity ailments have been considered as respondents in survey addresses comprise of eight unique measurements which are discussed about in chapter 4 of information investigation of this study

3.4.5 Data sources

The major online information sources incorporate sites of World Health Organization, Ministry of Health and Family Welfare (India), National Sample Survey Organization (India), Central Bureau of Health Intelligence (India), annual reports of Hospitals , Health Department (Punjab), Emerald, JSTOR, Science Direct, Nature, Taylor and Francis. Different diaries, papers, books and so on were likewise eluded for the present investigation. Aside from the online information sources, numerous organizations, for example, Punjab State Planning Board (Chandigarh), Parivar Kalyan Bhawan (Chandigarh), Department of Health and Family Welfare, Punjab Mini Secretariat (Chandigarh) and libraries of Punjab university Chandigarh had been visited every once in a while to gather auxiliary information.

The essential information has been gathered from the patients and specialists by review technique with the assistance of diverse research plans. Scales have been produced for the gathering of essential information. Scales have been created based on an existing survey ofwriting. The primary timetable is identified with patient satisfaction. In the initial step, a pool of medical hospital administrations related factors was created based on existing study‘s, for example. Meetings were directed with patients admitted in government hospital and private hospitals to create final questionnaire. Thus 42 questions were created which were estimated on a five-point Likert scale where (1 Highly Dissatisfied, 2 Dis-satisfied, 3 Neither Satisfied Nor Dissatisfied, 4 Satisfied, 5 Highly Satisfied). Every one of the question was emphatically worded to keep away from any complexity. The questions were analyzed for content validity through exchange with the specialists. Before finishing the scale, pilot testing was done on an example of 40 inpatients from capitol hospital Jalandhar and PGI Chandigarh. Quota sampling was utilized to gather this information. It is basic to test the dependability of the scale before applying any measurable procedure. Cronbach's alpha was utilized to check the inward consistency of the things of the scale patients' observation towards hospital administrations; was gathered through the meeting plan. The elements of the human services benefits in hospitals were investigated based on reliability test Cronbach’s alpha led on the pilot test

To achieve the objectives, the collected data were analyzed with the help of various statistical techniques. It is pertinent to mention that SPSS (Version 21) and data envelopment analysis frontier software have been used to conduct the analysis. This section describes in detail all the techniques which have been applied for the analysis of data. Data were analyzed in two forms one is to calculate efficiency of hospitals using data envelopment analysis and other is calculating Satisfaction level of patients. As discussed in the previous paragraph primary data is collected from 48 hospitals of Punjab from various areas of Majha, Malwa and Doaba. Data is collected in the form of inputs and outputs for calculating efficiency.

3.4.6 Inputs and outputs from the hospital for data envelopment analysis

Table 3.2 Inputs and outputs to calculate efficiency

Inputs	*Type*	Finding from papers
No. of beds.	Numbers	Blank & Valdmanis (2019) ,Simar & Wilson,2000,Bhat and Verma(2001),Rhonda J nd Victor R(2012),J. Seth Chatfield*(2014),Chen & Shao (2015) ,Arah (2018)
Doctors	Numbers	
Nurses	Numbers	
Specialized equipment	Numbers	
OPD hours per week	Hours	Andersen, P. & Petersen, N.C,Mehmet Sahin Gok & Bulent Sezen(2013)
Laboratory hours per week	Hours	Mariagrazia (2015),Chen & Shao (2015)
Paramedical staff	Numbers	Andersen, P. & Petersen, N.C,Mehmet Sahin Gok & Bulent Sezen(2013

Administrative staff	Numbers	Andersen, P. & Petersen, N.C,Mehmet Sahin Gok & Bulent Sezen(2013)
Outputs	Type	
Outpatient visits	Cases treated	Andersen, P. & Petersen, N.C,Mehmet Sahin Gok & Bulent Sezen(2013)
Inpatients	Cases treated	Mehmet Sahin Gok & Bulent Sezen(2013)
laboratory cases	Cases treated	Andersen, P. & Petersen, N.C,Mehmet Sahin Gok & Bulent Sezen(2013)
Maternal and child healthcare	Cases treated	,Bhat and Verma(2001),Rhonda J nd Victor R(2012),J. Seth Chatfield*(2014),Chen & Shao (2015) ,Arah (2018)

Inputs include beds, number of doctors, Nurses specialized equipment's, and Outpatient department hours per week of working, laboratory hours per week and paramedical staff supporting staff doctors and operating equipment‘s. and administrative staff .this data was collected from hospitals to calculate efficiency.

Efficiency is calculated through DEA envelopment analysis through DEA frontier software which uses a linear mathematical formula to calculate efficiency. One input is from staff type , one input is from the capital and six inputs from staff type numbers and hours are calculated. Efficiency is of two types VRS efficiency and CRS efficiency. Kupersmith (2015) explains Variable returns to scale and constant return to scale .VRS efficiency is called as technical efficiency and it gives the exact figure of efficiency of hospitals.

Output for calculating efficiency are outpatient visits, Inpatients and laboratory cases, Maternal and child healthcare all these are types of cases treated and number of cases. Basically for efficiency calculation input and output requires. Data of some of hospitals are collected through secondary sources and for some hospitals data is collected by visiting hospitals and meeting administrative officers of hospitals. Outpatient and inpatient are two very important parameters to calculate efficiency in previous studies efficiency is calculated on basis of these two only, But in this study laboratory cases and maternal and child healthcare is also included which gives proper efficiency of variable return to scale which is technical efficiency. All the outputs are in form of number of cases treated. Data is collected from hospitals from annual book release and by directly visiting the hospitals. The study includes the outputs efficiently arranged. Those can be isolated into: faculty, resources, or assets and administrations. The staff can be isolated into: number of inpatients and number of patients treated or outpatients. The administrations are likewise separated into outpatients' visits, number of careful tasks, crisis room visits and length of remain for inpatients. The properties can be additionally partitioned into traits that changes regularly. Efficiency endeavors to address two inquiries relying upon whether it has info or output direction. In output arranged specialized effectiveness the attention is on extending output amounts without changing the amount of data sources utilized (Norman & Stoker, 1991). Then again, input-arranged specialized efficiency centers around decreasing info amount utilized without changing the number of outputs delivered.

Improper size of a medical hospital (excessively enormous or excessively small) may some of the time be a reason for slack. Nunamaker (1988) alluded to as scale wastefulness and takes two structures – diminishing return to scale and expanding return to scale. Diminishing return to scale (otherwise called diseconomies of scale) infers that a hospital is unreasonably huge for the masses of exercises which they appear for . Unit costs increment as outputs increments. Conversely, a medical hospital with expanding return to scale (scale of economies) is unreasonably small for its size of the activity. Unit costs decline as outputs increment. A hospital that is scale-productive is said to work under steady return to scale. The presentation of medical hospitals might be estimated utilizing proportions that mostly measure limit use and outskirts procedures established on miniaturized scale financial hypothesis of creation. Ordinarily utilized proportions include bed inhabitance rate, turnover

proportion, turnover interim and the normal length of remain. Nunamaker & Lewin .(1983) proposes outskirts strategies for productivity estimation incorporate direct programming systems (for example information envelopment investigation) and econometric procedures (for example generation and cost capacities). The present investigation utilizes information envelopment study, which is quickly portrayed in the accompanying segment.

In DEA the effectiveness of a hospital (locale hospitals for this situation) is estimated comparative with a best practice (Langabeer.2008). This infers the benchmark against which to analyze the effectiveness of a specific region medical hospital is dictated by the gathering of local hospitals in this study.

The essential DEA model discovers answers to questions, for example:

(I) which hospital (or medical hospital divisions) is the most productive?

(ii) If hospital are to perform as indicated by best practice (for example the efficient nearby hospitals), by what amount could inputs/assets be diminished to create the present output levels; or then again, by what amount could output be expanded with the present info levels?

(iii) How many assets can be conceivably spared if all locale hospitals are working at an ideal scale?

(iv) Which of the productive region hospital can be good examples for the inefficient ones (with the goal that their technique for working together might be imitated)?

Lee (2019) explains that DEA effectively obliges different information sources and outputs without the necessity for a shared factor of estimation. This makes it especially reasonable for breaking down the effectiveness of medical hospitals as they utilize different contributions to create numerous outputs. Moreover, it gives explicit information and outputs focus on that would make a wasteful medical hospital generally productive. It additionally distinguishes effective friends for those medical hospitals that are not productive. This encourages inefficient hospitals to imitate the useful association of their nearby best hospitals to improve their efficiency.

3.5 Questionnaire to find satisfaction

The questionnaire was developed to survey satisfaction among patients of 48 hospitals; the questionnaire was developed in two formats Punjabi language and English language. As target population were from Punjab that is why Punjabi language questionnaire was developed in this investigation, Five point Likert scale to find satisfaction has been utilized to quantify responses of respondent's attitudes towards health-care services (Colla et. al 2005). Further this is com-presented with an equivalent number of good and ominous explanations considering the frame of mind of the respondents (McIver and Carmines, 1981). By taking care of the mindfulness level of the people who are respondents, a 40 questions, in light of this scale, has been regulated to the people who responded. They have been mentioned to rate the significance of elements influencing their satisfaction levels on a 5-point satisfaction scale (1 Highly Dissatisfied, 2 Dis-fulfilled, 3 Neither Satisfied Nor Dissatisfied, 4 Satisfied, 5 Highly Satisfied).Different statistic factors have likewise been considered to comprehend the various conducts of respondents. Patients in multi strength hospitals, especially experiencing tertiary-level healthcare infections, situated in Punjab include the population for the investigation. Patients experiencing explicitly eight sorts of tertiary-level healthcare illnesses have been considered as people who responded. In questionnaire questions consist of eight different following dimensions

3.5 .1 Reasonableness and comfort

Five features which basically load on this factor are charges for various tests and other remedial medicines , healthcare facility, basic access to emergency hospital center, a tie-up of the facility other hospitals and timings of the OPD organizations (Boshoff & Gray, 2004).

3.5.2 Hospital prerequisites

This measurement has been considered as the second most noteworthy factor affecting understanding Patient satisfaction. Five features which basically load on this factor are availability of workplaces, openness of required blood bank, availability of required medications, right and advantageous reports given by the exploration focuses and nature of emergency hospital vehicle organization. Various studies furthermore show that these organization features are broad determinants of patient satisfaction (Al-Omar, 2000).

3.5.3 Nursing and staff care

Six assistance features which basically load on this factor are sufficient nursing staff, lead of staff at holding up the locale, singular thought and suitable time is given by the nursing staff, and benevolent and pleasant behavior, healthcare workforce, nursing staff, lab staff, and assessments show that these features are basic determinants of patient satisfaction (Desai, 2011)

3.5.4 The general conduct of specialists

Four features are singular thought and real time given by the doctor, assurance during Hospital appraisal, and aware and pleasant behavior. Revelations of various studies moreover reinforce these disclosures (Sulku & Caner ,2011).

3.5.5 Registration and administrative procedures

This measurement has furthermore been considered as a noteworthy factor impacting Patient satisfaction. Five assistance features which essentially load on this factor are pleasant lead of selection staff, eye on the complaints, meeting time, holding up time at the enlistment counter and questions dealing with at the get-together counter (Sueyoshi, 1995).

3.5 6 Infrastructure and luxuries

Features which basically load on this measurement are adequacy of utilities, for instance, water supply, fan, light and washrooms, agreeable space for leaving vehicles, openness of proper sign loads up, availability of open lifts, clean/windy/lit stairs and slopes, cleanliness of the toilets, office of ATM/bank, office of cup and cafeteria and parlor workplaces. Revelations of various study's moreover reinforce these disclosures (Thanassoulis, 1993).

3.5.7 The professional conduct of specialists

This determinant has similarly been considered as a noteworthy factor impacting Patient satisfaction. Five features of this factor are issue listened by the expert, timetable and time of the treatment, required tests and investigation were explained suitably, authorities provoked about the ways to deal with keep up a key good ways from disease and stay sound, and ailment and its results were properly explained .Past study's moreover show that these

organization features are material determinants of patient satisfaction (Thanassoulis & Dyson 1992).

3.5.8 Facilities at OPD zone

Features which in a general sense load on this are agreeable sitting zone at rule assembling and separate OPD, availability of trolley/wheel seats in the OPD domain. Disclosures of various studys in like manner show that neatness of the emergency hospital facility and workplaces at OPD are significant determinants of patient satisfaction (Thompson &. Dharmapala, 1993.)

3.6 Reliability and Validity check

Cronbach's alpha measurement is a degree and strategy for checking inside consistency, it is the method by which various concisely related questions are set together. It is viewed as a degree of scale resolute quality. "High" value for alpha doesn't suspect that the measure is one-dimensional. On the off chance that, regardless of surveying internal consistency, if we wish to give checks that the scale being is one-dimensional, extra checks can be performed. Cronbach's alpha is the most generally perceived extent of inside consistency ("constancy"). It is most regularly used when you have various Likert requests in a study.

3.3 Reliability check value

Cronbach's Alpha	N of Items
.825	42

Cronbach's alpha is genuinely verifiable test – it is a coefficient of validity (or consistency). Cronbach's alpha can be made as a component out of the quantity of test things and the make new in between associations for hypothetical purposes. The hypothetical estimation ranges from zero to one and the estimation of 0.7 which is less than 1 or higher is great to utilize the instrument for information assortment in exploratory investigations (Nunnally, 1978). The study has been pre-tried on an example of 80 patients from two different hospitals. It has been seen as dependable with an estimation of 0.82 of Cronbach's and legitimate with the

qualities more than 0.4 of factor loadings for every question. Based on research objectives more than 1200 polls have been conveyed and 1100 filled reactions have been gotten and 960 considered for study.

3.7 Concurrent validity

Concurrent validity is criteria based validity, which is a proportion of how well a specific test associates with an approved measure. The tests are for the equivalent related constructs permit which test new strategy against an attempted and tried questionnaire by PGI Chandigarh .To establish concurrent validity pilot testing had been done on the gathering of patients with another new test and compare it with already established test of PGI, Cross referencing the scores for every 30 patients to check there is a .79 correlation relationship. The key component is that the two strategies were looked at about a similar time. Concurrent validity and predictive validity are two kinds of standard related legitimacy. The contrast between concurrent legitimacy and predictive legitimacy lays exclusively on the time at which the two measures are regulated. Simultaneous or concurrent legitimacy applies to approval contemplates in which the two measures are controlled at roughly a similar time. For instance, a business test might be regulated to a gathering of employees and afterwards the grades can be related with the evaluations of the employees taken around the same time. . This sort of proof may be utilized to help the utilization of the business test for future determination of representatives.

Simultaneous legitimacy or concurrent validity might be utilized as a useful substitute for prescient legitimacy or predictive validity. In the model above, prescient legitimacy would be the best decision for approving a business test, since utilizing the work test on existing representatives may not be a solid simple for utilizing the tests for determination. Decreased inspiration and limitation of the range are only two potential biasing impacts for simultaneous legitimacy contemplates.

Table 3.4 Correlations

		New test	Established test
New test	Pearson Correlation	1	.790**
	Sig. (2-tailed)		.002
	N	30	30
Established test	Pearson Correlation	.790**	1
	Sig. (2-tailed)	.002	
	N	30	30

To test concurrent validity new questionnaire which was intended to measure patient satisfaction on eight different dimension are cross checked with already established questionnaire used by Post graduate institute ,Chandigarh and correlation established between these comes out to be.790 Which proves sufficient concurrent validity between two questionnaires to be utilized for this study. In this research in order to further validate questions of questionnaire face validity check and content validity check was also used which are explained next.

3.8 Face validity check

Face validity check or content validity is how much a test is observed as covering the thought it intended to check and straightforwardness or significance of a test as it appears to test individuals. To face validate questionnaire it was validated from doctors of civil hospital Tanda, doctors and senior administration of bbmb hospital talwara and doctors of capitol hospital and some people from academics who had researched in the same field. The questionnaire was finalized after considering changes from the feedback received from experts ‘opinion. As it might have been, a test can be said to have face authenticity if it "appears just as" it will measure what it ought to evaluate model, if a test is set up to evaluate whether study can perform duplication and the people to whom it is shown all agree that no doubt a better than average preliminary of expansion limit, this displays face authenticity of the test. Face authenticity is every now and again showed up distinctively about substance authenticity. A few people use the term face authenticity to suggest just to the authenticity of a test to observers who are not known to testing frameworks.

3.9 Research Framework to achieve objectives

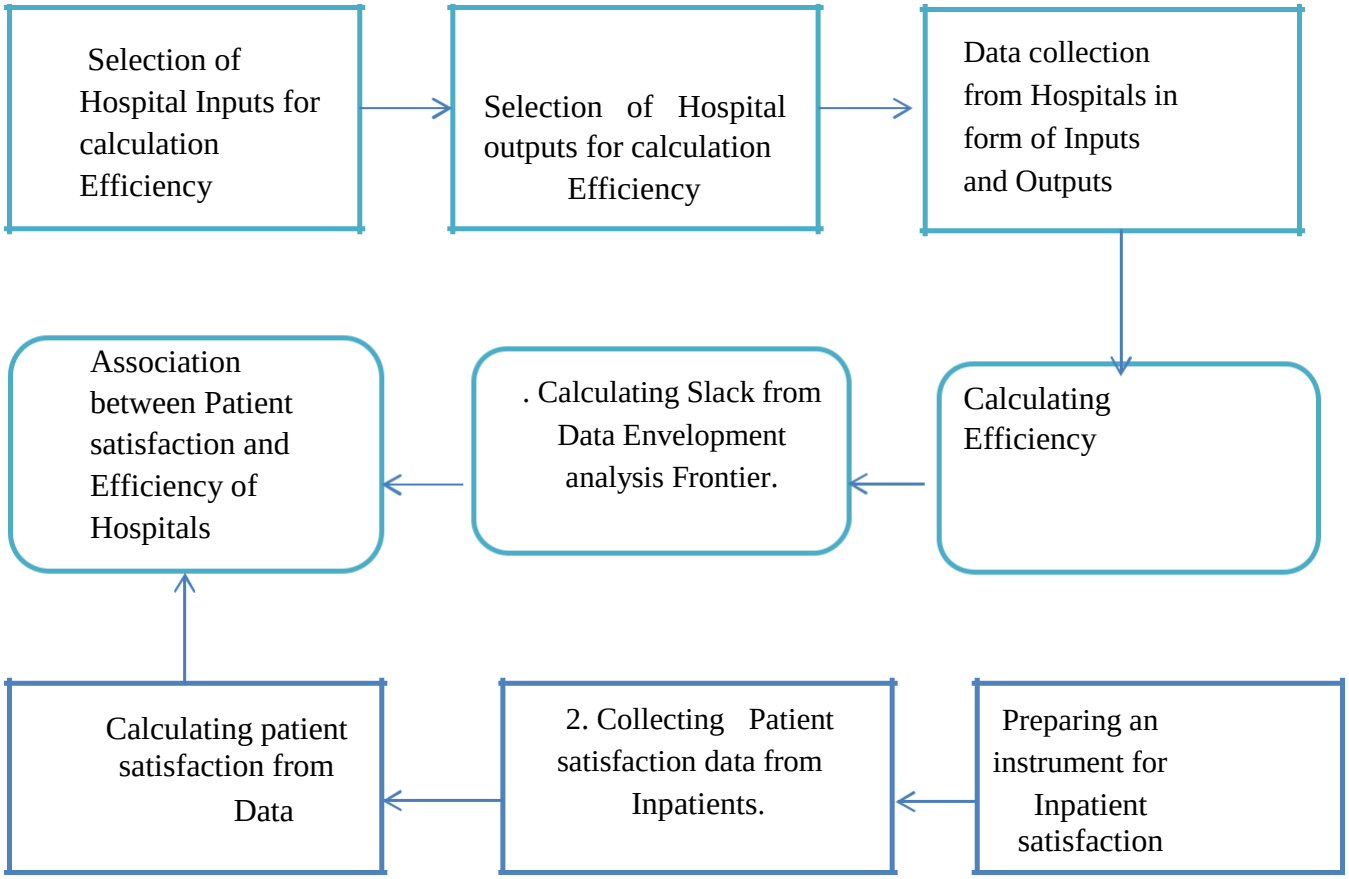


Fig 3.2: ***Research Framework to***

- This study consists of many stages in which a step by step procedure of data collection and data analysis is there. It is a multistage process some time stages have to be followed in parallel and sometimes in serial order as follows:

- There are various stages involved in the process of calculating efficiency and finding its Association with patient satisfaction. The first stage is the selection of input and selection of output for calculating efficiency. Input and output are finalized for calculating efficiency for this data was collected from 48 hospitals of Punjab from different areas of Malwa Majha and Doaba.

- Data of some of the hospitals are available as a secondary data over the internet in their annual reports published yearly. For 2017 and some of the hospital data was elected after personal visiting the administrative officer of the hospital and data collected from them for calculating efficiency.

- After collecting the data is compiled in Microsoft Excel and model is created .Model created to be used in calculating efficiency using the data envelopment analysis Frontier software which is created by Dr Joe, professor Foise Business School in Department of Economics. There are lots of software available in the market to calculate efficiency using data envelopment analysis, for example, Stata, Frontier Software developed by Foise Business School, CEPA, open-source data envelopment cancel OSDEA, DEAP software developed by the University of Queensland, this is used to calculate productivity and used to conduct data envelopment analysis, But in this study Data envelopment analysis frontier is used as in this software up to twenty DMU data can be calculated free of cost but after that, we have to purchase the software It is an add-on on Microsoft excel. This software will give not only efficiency but slack value from data also. Slack is a value which is requiring maintaining equality value is data where it is inequality. In an improvement issue, a leeway variable is a variable that is added to an unevenness prerequisite to transform it into decency. . The reason for benchmarking in medicinal services is to improve effectiveness, nature of care, understanding healthcare and patient satisfaction. The

procedure includes seeing best practices and proof based practices and afterward recognizing potential regions of progress

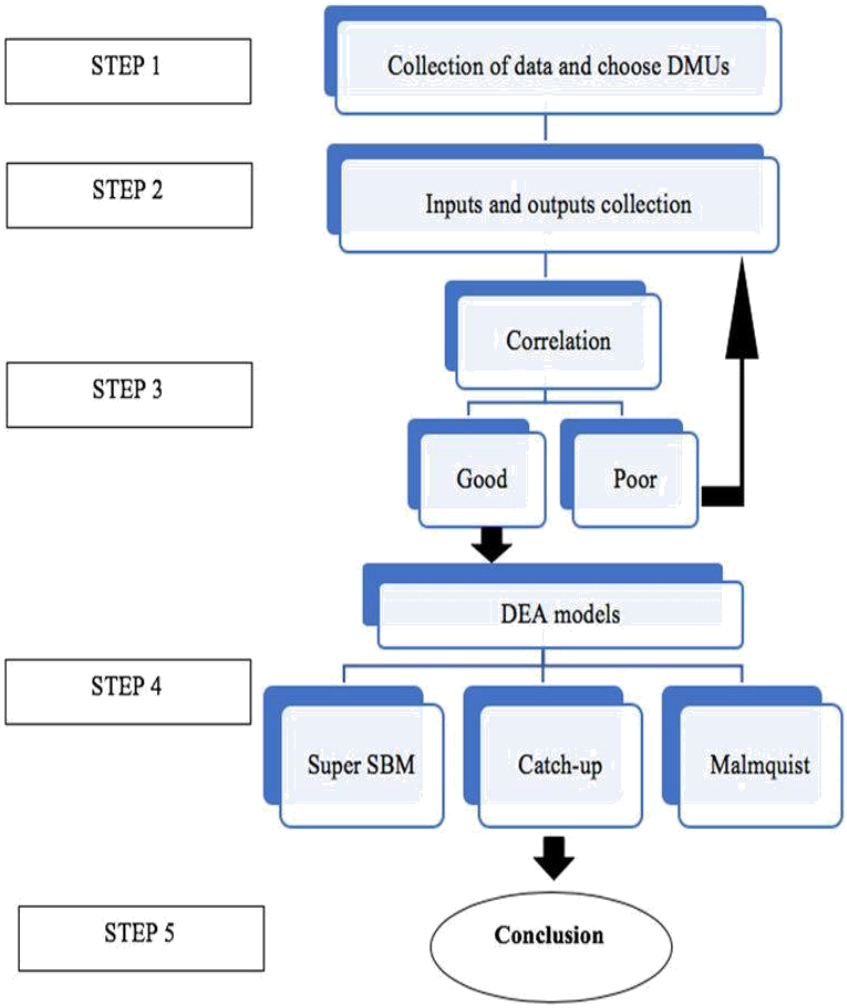


Fig 3.3 Steps to calculate efficiency

- There are various models to calculate efficiency i.e. Constant return to scale, Variable returns to scale. Variable return to scale is used to calculate efficiency as it gives proper technical efficiency. Variable return to scale is further divided into three parts: The term return to scale alludes to the adjustments in input/output as all elements change by a similar extent

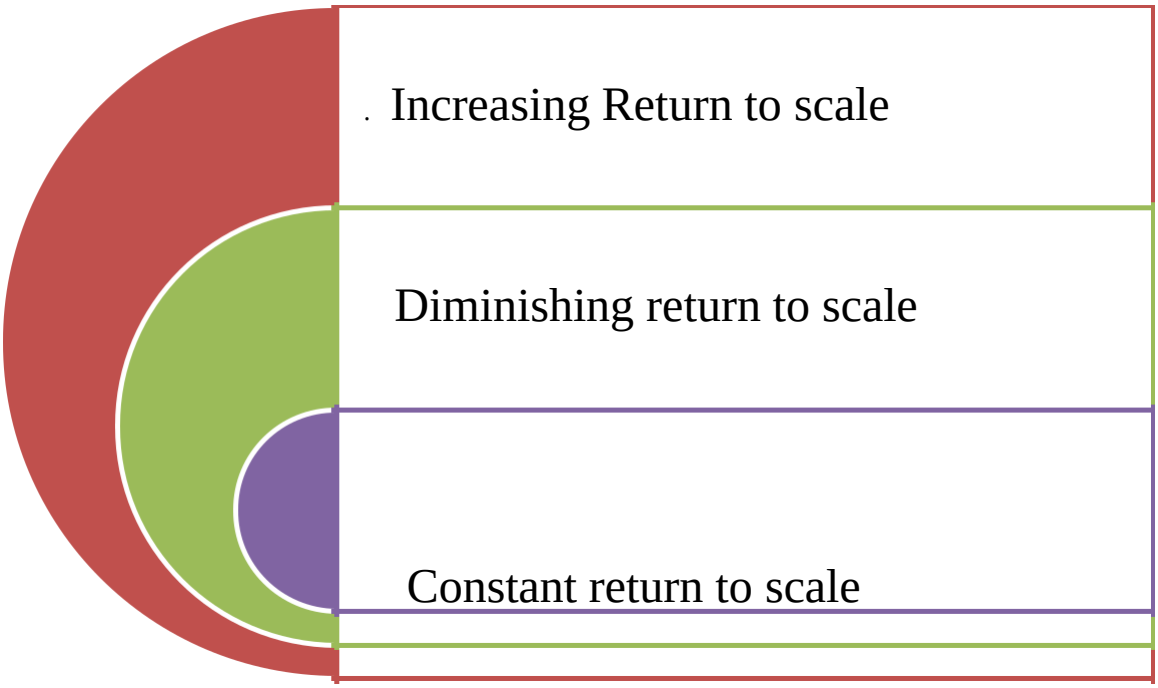


Fig 3.4: Types of return to scales

Increasing Return to scale:

Increasing return to scale or decreasing cost alludes to a circumstance when all components of the generation are expanded, output increments at a higher rate. It implies if all sources of info are multiplied by two, the output will likewise increment at a quicker rate than two-fold. Consequently, it is said to be increasing return to scale. This expansion is because of numerous reasons like division outside economies of scale.

Diminishing Return to scale:

Unavoidable losses or expanding costs allude to that circumstance, where if every one of the variables of creation is expanded in a given extent, output increments to a small extent. That is to say, if inputs are multiplied, the output will be not exactly multiplied. Lewin (1983) explains that if 20 per cent expansion in labour and capital is trailed by 10 per cent increment in output, at that point consistent losses have to scale. The primary driver of the activity of

consistent losses to scale is that inward and outside economies are not exactly inside and outer diseconomies

Constant Return to scale:

Constant return to scale or consistent cost alludes to the circumstance where output increments precisely in a similar extent as compare to components of inputs are expanded. In basic terms, if components of inputs are multiplied output will likewise be multiplied. For this situation inside and outer economies are equivalent to the interior and outside diseconomies. This circumstance emerges when in the wake of arriving at a specific degree of generation; economies of scale are adjusted by diseconomies of scale (Lewin & Morey,1981). This is known as homogeneous generation work. Cobb-Douglas direct homogenous creation work is a genuine case of this sort. Cobb Douglas generation work {Q(L, K)=A(L^b)K^a}, displays the three sorts of profits:

- If a+b>1, there are expanding return to scale.
- For a+b=1, we get steady return to scale.
- If a+b<1, we get diminishing return to scale\

Next stage in research framework is to find and analyze patient satisfaction of inpatients and outpatients of hospitals decided for survey in this study .outpatients from five different departments are decided for study and inpatients who at least stay for one day and night in hospital .two separate questionnaire prepared for inpatients Both questionnaires prepared to consist of different questions as the satisfaction level of different types of customers are different. In the title of thesis word customers, satisfaction is used as some times patient is not in a position to answer the question then question from patient attendant was asked. At the point when a patient in the hospital, it's imperative to know how Medicare inclusion applies. There are contrasts among inpatient and outpatient care and every status can figure out which part of your Medicare plan will help pay your expenses (Lim & Zhu, 2014). These distinctions additionally decide if you can get inclusion for a talented nursing office remains. Inpatient care implies you are admitted to the medical hospital on a physician's instruction. You are named an inpatient when you are officially conceded In spite of a medical hospital

remain, your consideration might be viewed as outpatient administrations, for instance on the off chance that you are getting outpatient care around the same time that you are released from the hospital. Regardless of whether you go through the night in the hospital, your consideration could be viewed as an outpatient (Liu & W. M 2016).

Patient satisfaction was analyzed for inpatients for 48 hospitals and survey was done in both languages Punjabi and English. As Punjabi is the regional language it is very much imperative to work in the Punjabi language .patient satisfaction data were recorded in Microsoft Excel file which later was analyzed in Spss to find out mean satisfaction level among inpatients of hospitals consider for study. Persistent satisfaction is the degree to which patients are content with their medicinal services, both inside and outside of the specialist's office (Benton, 2003). A proportion of care quality, persistent satisfaction gives suppliers bits of knowledge into different parts of medication, including the viability of their consideration and their degree of compassion. Satisfaction, while continually a critical factor while passing on any kind of help, has starting late got notoriety in the healthcare administration's space. In the wake of patient-centered human administrations change, patients are mentioning a more prominent case in their social protection, and foresee a particular level of organization from their providers.

The last stage is to find out relation and association between efficiency and patient satisfaction through this research establish the relationship between productivity and customer satisfaction in tertiary hospitals of Punjab. Efficiency is determined utilizing information envelopment investigation and satisfaction using Questionnaire. Information envelopment study is a nonparametric strategy for estimating the operational productivity of basic leadership units. DEA is having solid connect to creating hypothesis in economics. DEA utilizes linear programming procedure for finding relative efficiencies of individual basic leadership units concerning different data sources and outputs. This research breaks down the connection between efficiency and consumer loyalty for exceptionally efficient and less productive hospitals. The discoveries of the paper demonstrate how medical hospitals effectiveness changes the type of connection between patient satisfaction and institutional factors like specialists doctors. Health care Industry can adopt Benchmarking scheme of their services with the best one in industry to improve efficiency.

3.10 Software for Efficiency calculation

DEA Frontier coded by Professor Joe Zhu (Professor of Operational Research Foise Business College) for Data Envelopment Analysis (DEA) models. This computer programs is made subject to Professor Zhu's significant DEA teaching experience. The software is made by Professor Zhu with a ultimate objective to restrict the credibility of the presentation of DEA models during coding., the user should see Solver under the Data Tab, Under Excel 2007 and earlier variations, the solver tab extra plugin menu must be installed before started using and writing computer programs otherwise DEA Frontier programming may not run. DEA programming gives effectiveness using the distinctive Additive model, CRS scale, VRS scale and multiplier model.

3.11 Data envelopment analysis

Envelopment study of data is a linear mathematical programming-based method for estimating efficiency of the general execution of hierarchical units of hospital considering availability of various data sources in form of input and outputs (Demir et. al 2009). This study introduces the input /Output technique and uses a manual proportion of effectiveness, i.e.: how relative efficiencies can be settled around center on inefficient units set.

$$\text{efficiency} = \frac{\text{output}}{\text{input}}$$

$$\text{Efficiency of unit j} = \frac{u_1 y_{1j} + u_2 y_{2j} + \ldots}{v_1 x_{1j} + v_2 x_{2j} + \ldots}$$

where

u_1 = the weight given to output i

y_{1j} = amount of output l from unit j

v_1 = weight given to input l

x_{1j} = amount of input l to unit j.

Note: Efficiency is usually considered in the range of [0, 1]. Dey(2013) explains that this proportion of efficiency requires a typical arrangement of loads to be applied to overall units. This promptly raises the issue of how such a basic arrangement of loads can be provided. There can be two sorts of issues in getting a typical arrangement of loads. Above all else, it might be hard to measure the sources of inputs and outputs. Doyle & Green (1994) explains that for instance, in the information, the loads on the outputs probably identify with the qualities or cost of delivering the outputs however these expenses or qualities might be hard to quantify.. A few studies may genuinely esteem accomplishments of previous research papers, and when all is completed then units may use sources of info and outputs distinctively and subsequently required for allocating various loads. This proportion of efficiency combined with the presumption that a solitary basic arrangement of loads is required is hence inadmissible.

Charnes & Rhodes (1994) perceived the trouble in looking for a typical arrangement of loads to decide relative efficiency. They perceived the authenticity of the recommendation that units may use data sources and outputs contrastingly and in this way receive various loads, and suggested that every unit ought to be permitted to embrace a lot of loads which shows it in the greatest light in contrast with different units. Under these conditions, the productivity of an objective unit j0 can be acquired as an answer for the accompanying issue, these all issues are sorted in software‘s used in calculating efficiency in our present study :
Calculating efficiency is subject to the effectiveness of all units being < =1.

The logarithmic model is as per the following:

$$\left.\begin{aligned} &\text{Max } h_0 = \frac{\sum_r u_r y_{rj_0}}{\sum_i v_i x_{ij_0}} \\ &\text{subject to} \\ &\frac{\sum_r u_r y_{rj}}{\sum_i v_i x_{ij}} \le 1 \quad \text{for each unit } j. \\ &u_r, v_i \ge \varepsilon \end{aligned}\right\} \quad \text{(M1)}$$

This equation is used in software‘s to calculate efficiency and it embedded in software‘s already.

3.12 Efficiency profitability matrix

Durchholz & Barr (1995) clarifies that in choosing decisions about units, both capability and reliability of inputs are important and to utilize DEA to evaluate the efficiency outputs also must be relevant with proper loads to inputs. Units could then be assessed on efficiency profitability matrix.

This is shown in figure

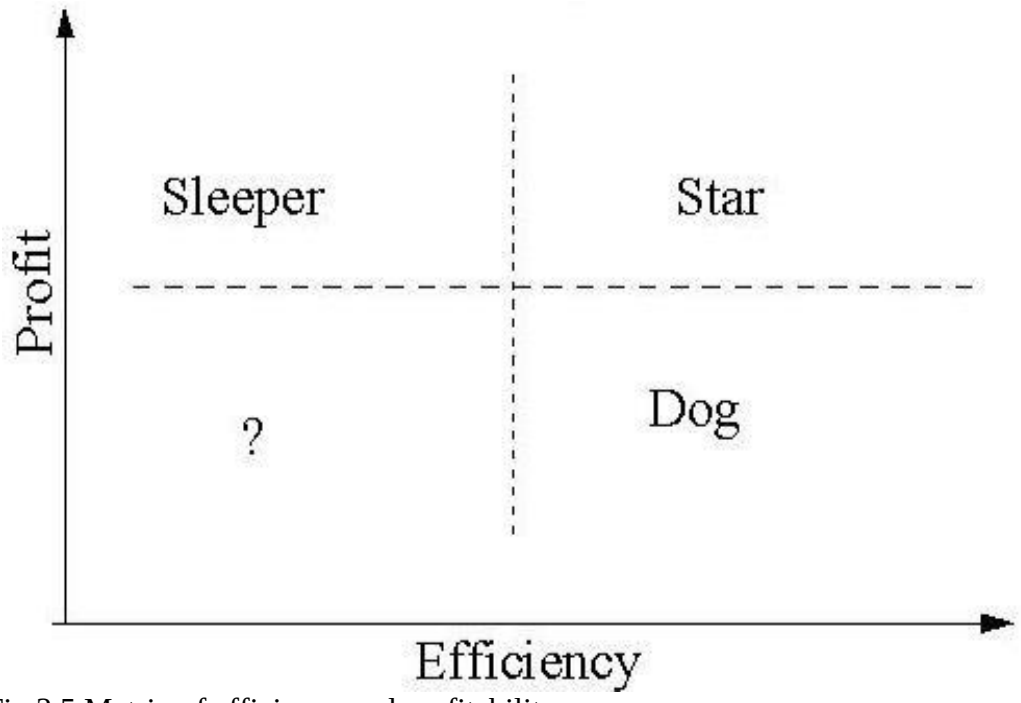


Fig 3.5 Matrix of efficiency and profitability

Hierarchical units whose productivity and effectiveness found them in the star quadrant are the lead units and ought to give instances of good working practice and are presumably likewise in an ideal domain.

The sleepers are beneficial yet this is more to do with positive ecological conditions than great administration they are a contender for a productivity drive prompting considerably more noteworthy benefits. The question marks have the potential for more noteworthy productivity and conceivably more prominent benefits (Du et. al 2014). Endeavors ought to be made to build their effectiveness and this may prompt more noteworthy gainfulness. The Dogs have productive units however low on benefit because of a troublesome situation. In the extraordinary case, it might be reasonable to strip these and msigrate the staff to different units. This methodology along these lines considers efficiency to be productivity as two key execution quantifies, every one of which can help with the administration of the general arrangement of units (Durchholz & Barr 1995).

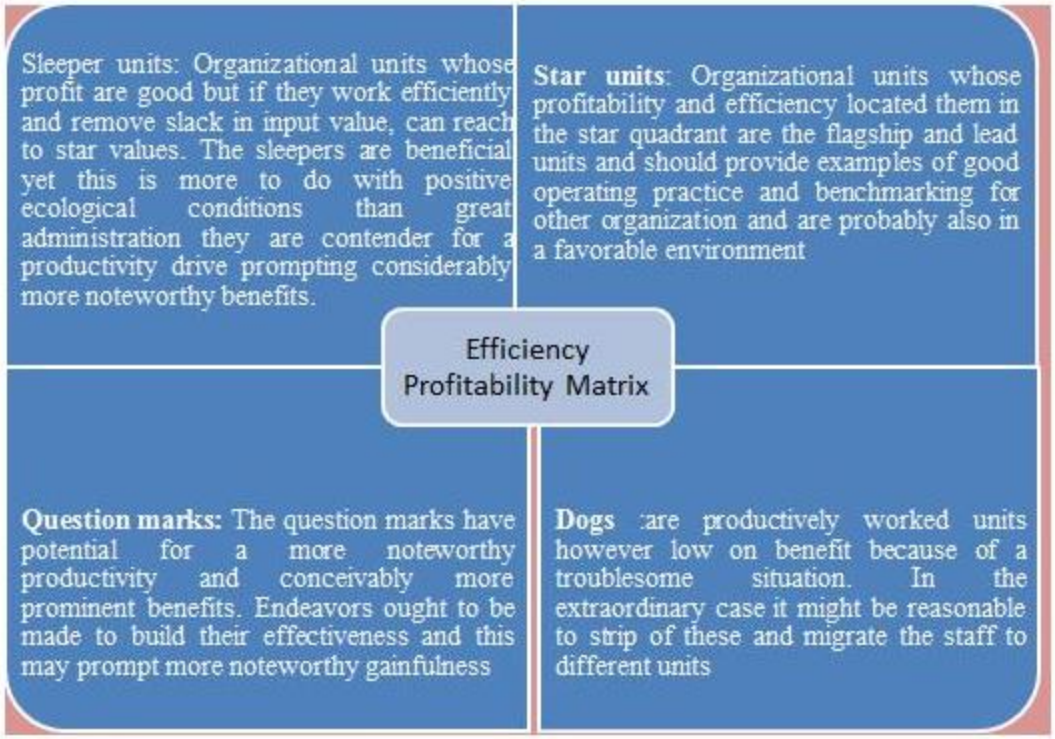


Fig 3.6 Summary of Matrix

3.13 Portion of the merits of DEA

Demonstrated to be valuable in revealing connections that stay covered up almost all different techniques.

Fit for taking care of different information sources, outputs and inputs.

Equipped for being utilized with any information output estimation.The analysis study of envelopment analysis on deciding the benchmark best practice and on upgrading to the better methodologies for shifting through and dismembering data and can realize new regulatory and theoretical encounters.

It should be seen that while implementing DEA some important points must considered as follows:

1. Focus on particular inputs to calculate efficiency rather than masses.
2. It is a singular absolute analysis of each individual unit with respect to its variables of data factors (independent elements) to make needed outputs (subordinate elements).
3. It can output various values at same time.
4. Can alter for different variables.
5. Can join obvious Slack factors.
6. Don't require assurance for goodness of fit for information or outputs.
7. Its main focus is on finding best practices in unsettled areas rather than on focus on all areas
8. It works with variables to find slack values.

Envelopment Analysis of data (DEA) is a grouping of processes and systems that have now been intertwined in a grouping of models as follows:

1. Extent model CCR (1978) interprets an objective evaluation of general efficiency recognizes the resources and checks the proportions of the along these lines perceived inefficient angles.

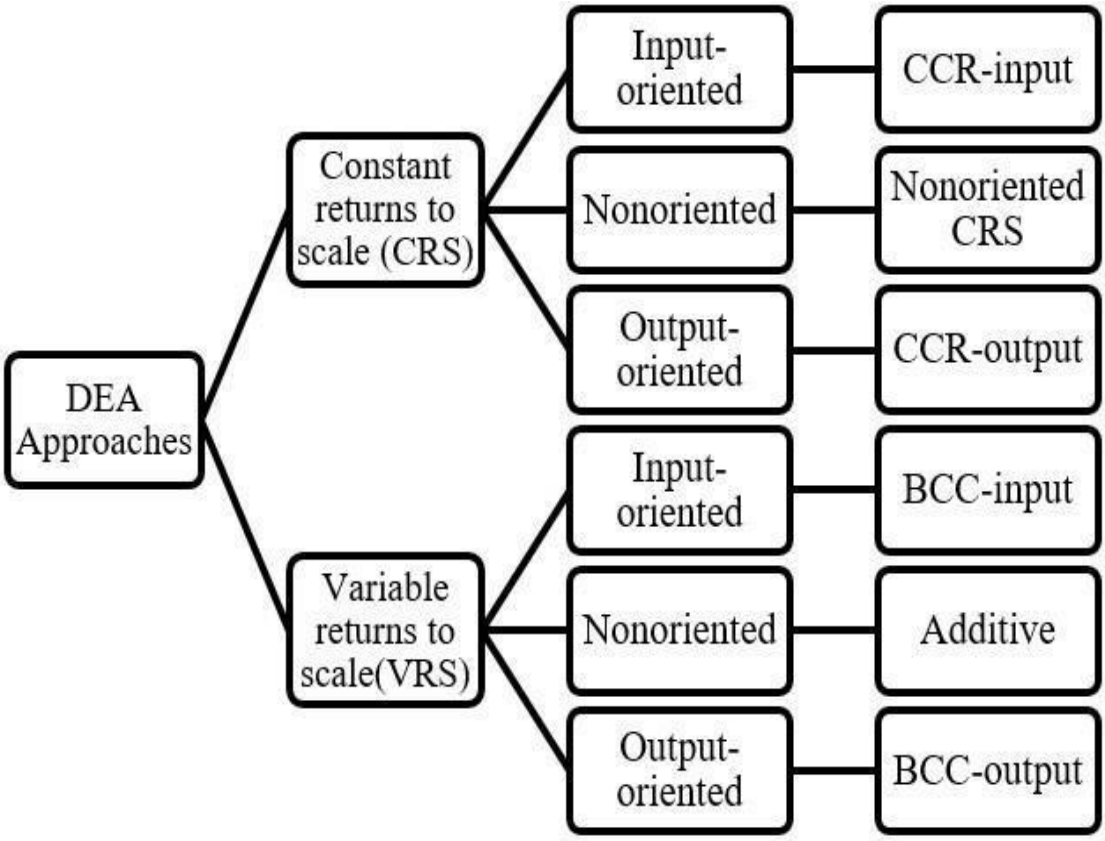
2. Model BCC (1984) perceives concentrated and scale inefficient angles by (I) assessing unadulterated particular capability at the given size and (ii) recognizing on account of

extending reducing, or reliable returns to scale potential results are accessible for additional abuse.

3. Model of multiplicative (Charnes et al. 1982, 1983) give (I) a log-straight envelopment ii) a piecewise interpretation of Cobb-Douglas of the creation technique (by a reduction to the forerunner 1981 included substance model of (Charnes, Cooper, and Seiford,1985).

Lovell H.O. & Schmidt S.S. (1993) clarifies models which focus on increasing efficiency found in money related angles that are here summarized as:

Fig 3.7: Data envelopment analysis approaches



They may use different models, and they may concentrate on either input decrease or output enlargement to accomplish efficiency. This section looks to accomplish correlations by

concentrating on the above essential numerical models. Specifically, we analyze the model CCR proportion, model of the BCC, model the Additive, and the Multiplicative models and used CCR model in our study to find efficiency.

3.14 Limitations of study

There are limitation of study which are acknowledged as firstly structural quality measure can be utilized in further studies ,Structural quality refers to part of setting in whole healthcare process ,it includes everything which comes under umbrella term structure i.e. material resources, manpower resources, Structure of extra resources which are not essential like parking and also organizational structure. Structural quality relation with patient satisfaction need to be studied with efficiency as moderator which will further strengthen the grounded idea discussed in this research of association of efficiency and satisfaction .Secondly monetary and allocative productivity was not analyzed in this research. The connections between basic quality and monetary effectiveness may be investigated in further investigations. Also, examples of effectiveness changes could be investigated by utilizing Malmquist Efficiency Index in panel data of hospital studies. Scope of study is restricted to area in Punjab as it is unique attempt to find relation between efficiency and patient satisfaction .This study can be extended to other states also bring comparative results in efficiency and benchmarking for beneficial of all stakeholders concerned

Chapter 4

DATA ANALYSIS AND INTERPRETATION

In this part of the research, the emphasis is on analyzing data in three different orientation first of all data was analyzed to calculate the efficiency of hospitals decided for study. Secondly, satisfaction level of patients had been analyzed, To find satisfaction level of patient‘s questionnaire was framed and thirdly interpretation had been done to analyze relation and association between operational efficiency of hospitals and customer satisfaction and lastly data was analyzed to find slack in input values of hospitals.

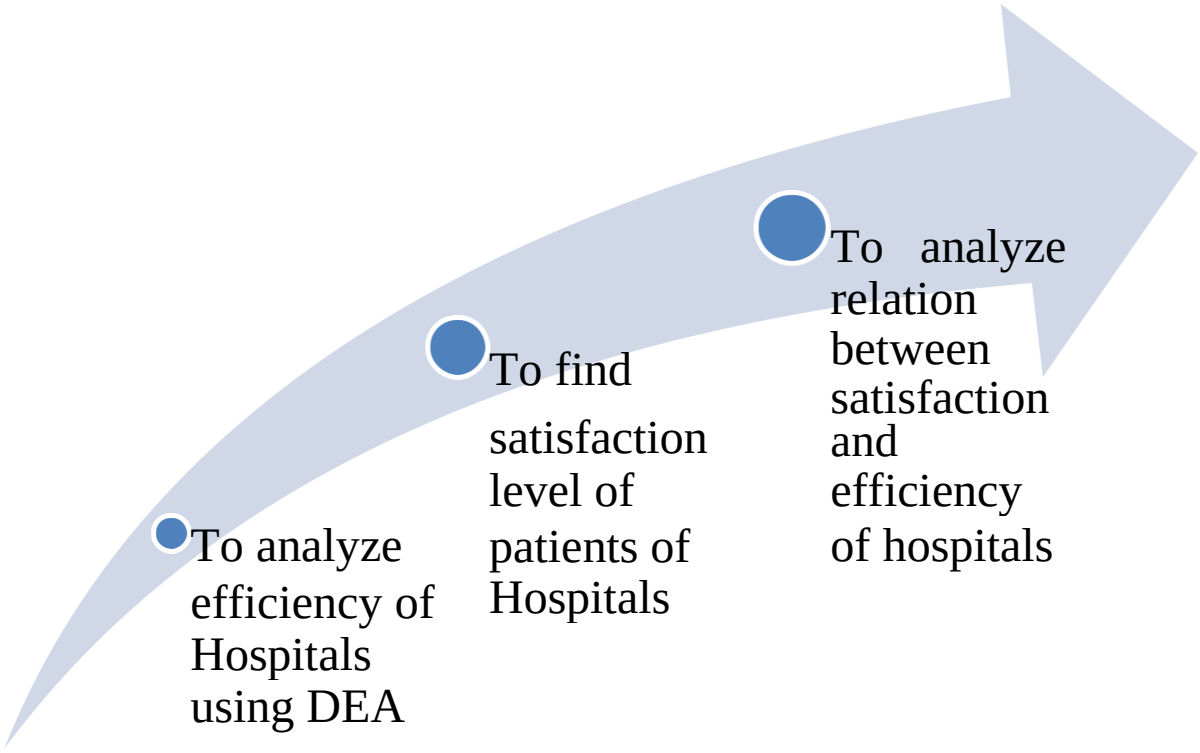


Fig4.1: Different stages of Data Analysis and Interpretation

Data analysis and interpretation: Stage 1

4.1 Data Envelopment Analysis

Data envelopment analysis as discussed in previous chapters is technique to find out efficiency of any organization and this also provides a benchmark to organization in order of efficiencies of organizations if we compare different organizations .Frank (1988) explains slack value is another output of data envelopment analysis, slack is added in inequality value to make it to equality constraint. Information envelopment investigation which is also called data envelopment analysis is used as a strategy (or instrument) for completing this study. DEA is an information-driven process for assessment and benchmarking. Fried (1993) explains that complex computational calculations have been used to manage the huge volume of information (basic leadership units, sources of info, and outputs) under the DEA. These system structures incorporate a more extensive scope of measurements to calculate efficiency of hospital

4.2 Efficiency calculation

The analysis of this study initiated with the calculation of efficiency of hospitals decided for study. Hospitals for the study had been selected from three different areas of Punjab i.e. Malwa, Majha and Doaba. Hospitals from each area were selected including hospitals from Chandigarh. Hospitals are selected based on quota sampling. Hospitals of different sizes are selected and size is dependent upon bed strength of hospitals.

The selection of hospitals was made from the list of the hospitals being run by doctors registered with the Indian Medical Association and Punjab medical council. Government and the private tertiary level hospitals with bed strength more than 40 were chosen for study from each of the districts selected for the study. Out of the all list, 48 tertiary hospitals were selected. Hospitals are selected based on quota sampling. Quota sampling is done on basis of size of hospital, according to objective of this research different sized hospitals are required and three different sizes of tertiary hospitals are considered, Small scale is between more than 40 and 70, medium size between 70 to 100 and big size more than 100 based on number of beds

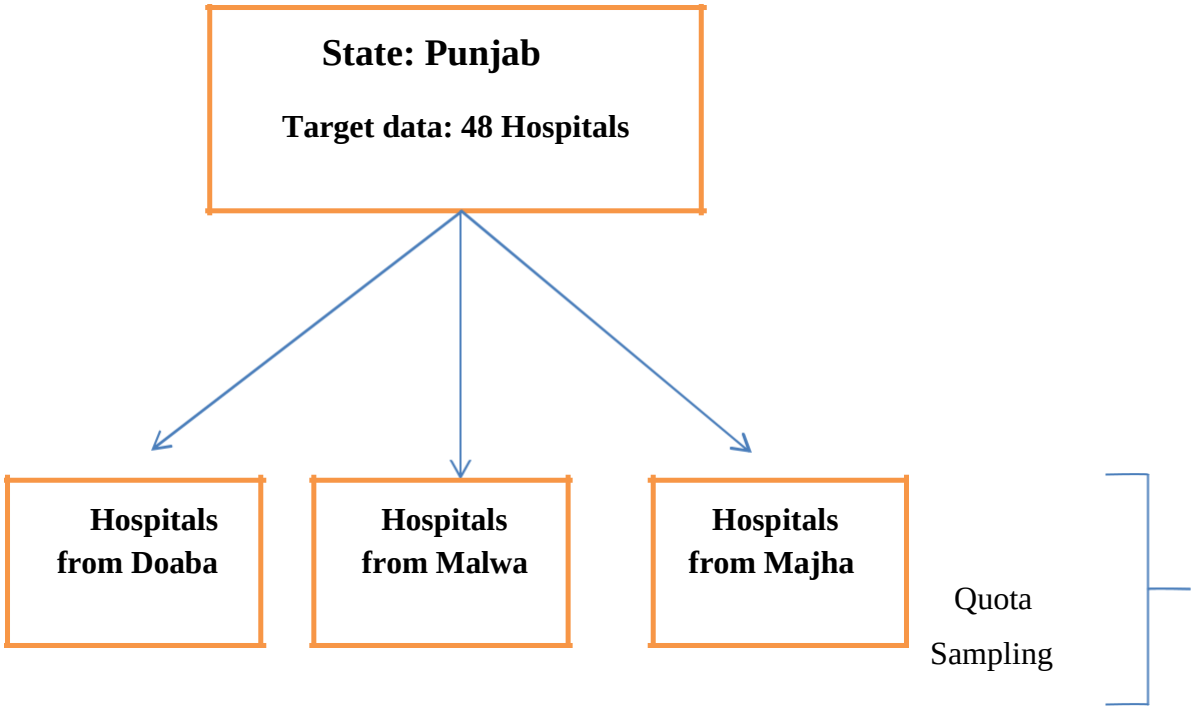


Fig 4.2: Hospital Selection

Kamakura (2018) explains quota sampling give point by point data about the challenges in acquiring the differentiation. Quota sampling is used in this research as it is considered as most basic and usual way to do research and sub point of distinction added are number of beds , data was collected from hospitals according to size of hospitals either large size ,small size and medium size hospitals and about the research outcomes achievement.

4.3 Selection of variables

Once the various variables are decided for input and output variables now it is important to check how many input and output variables are to be included in the final result of calculating efficiency. It is very important to find relevant input and output combination which can contribute toward the significant result of explaining the efficiency of hospitals. To identify variables significance to be included in calculating efficiency regression model is applied with variables of input are considered in the formula as independent variables and variables of output are considered as dependent variables (Bhat & verma, 2001). When

dependent variables are regressed with independent variables. This step will result in removing some variables where the regression result was not significant in which inputs is not explained particular output.

Detailed analysis is discussed below for selection of variables to calculate efficiency.

4.3.1. Input variables and outpatient visits

When the regression result is applied to check whether all input variables in data envelopment analysis calculation of efficiency explained variance in outpatient visits output following regression output is obtained.

Table 4.1 Model Summary of regression to outpatient visits with the input variable

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	.955[a]	.912	.894	1477.7639

a. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses

Table 4.2 ANOVA TABLE

Model		Sum of Squares	Mean Square	F	Sig.
1	Regression	87625285662.597	10953160707.825	50.497	.000[b]
	Residual	8459374129.070	216907028.951		
	Total	96084659791.667			

a. Dependent Variable: Outpatient visits

R square value in regression result is proportion of variance in regressed variable which can be predicted from independent variables, now in this table 4.1 value of r square indicates output variable outpatient visits significantly determined form input variables of Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses which are input variables in this study and .R value in table is square root of R square it explains correlation between variables considered for result and adjusted R square explains more honest result of variance of

dependent variable as compared to independent variable. Outpatient visits and cases treated for outpatient visits in any hospitals depends upon the mechanism of hospital and resources in hospital (Mahdiloo & Lee ,2015). If the number of doctors in any hospital is more in number outpatient visits will be more but the reputation of doctors also plays a very important role in this sometimes outpatient visits for one doctor more as compared to another doctor. In this case, outpatient visits to hospitals got varied. Administrative facilities in hospitals which are also a very important factor to lead to an increase in outpatient visits in hospitals. Marley KA & Meyer GS (2004) Proper leading of patients to doctors and to for usage of other services depend upon the administrative department. Some hospitals are having an electronic system in which they book a patient appointment with the doctor in advance online or on mobile phone which ultimately increase efficiency and bring optimization in hospital work efficiency.

Donabedian (1997) explains that outpatient visits and case treated are very important output parameter for calculating the efficiency of hospital outpatient visits .It also depend upon several paramedical staff and number of nurses in the hospital who can treat patients with proper methodology and give proper time to the patient. The patient will never want to visit a hospital where the nursing staff is not cooperative enough with patients because Outpatient administrations include medicinal methods or tests that should be possible in a healthcare focus without a medium-term remain. Numerous systems and tests should be possible in a couple of hours. Outpatient administrations include Wellness and anticipation, for example, guiding and health improvement plans. Determination, for example, lab tests and MRI filters. Outpatient office (OPD) is the main purpose of contact of the hospital with patients and fills in as the shop window to any human services administration gave to the network. McDonald J (2009) explains the consideration in the OPD is accepted to show the nature of administrations of a medical hospital and is reflected by patients' satisfaction with the administrations being given.

Outpatient visit also depends on number of outpatient department hours in week and OPD of hospital work in day in hospital if OPD hours are more than it is very often to that hospital will be having high outpatient visit but condition is reputation of doctors must be good .outpatient department is from face of hospital if outpatient department work properly patient

will assume that other department. Fried & Yaisawarng (2002) proposes the arrangement of a great outpatient administration requires viable administration of all parts of administration arrangement – including the paramedical staff preparing and other expert improvement needs of the individuals from the careful group – for the productive and successful utilization of assets inside the administration and the further advancement of the administration. Top-notch careful consideration in outpatient facilities includes an all-encompassing and patient-focused way to deal with the conveyance of each part of the administration

4.3.2 Input variable and inpatient cases treated

For evaluating the significance of inpatients output variable in data envelopment analysis for calculating efficiency in this research stepwise regression is applied which consist of input variable as the independent variable which are Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses. Value of R, R square and Adjusted R square in the following table shows that input variables have sufficient effect on the variance of output variable of inpatient output. Inpatient is those patients usually those are staying in hospital overnight or more than 6 hours in the hospital in records.

Table 4.3 Model Summary of regression to inpatient visits with the input variable

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	.815[a]	.665	.596	6890.8623

a. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses

Table 4.4 ANOVA

Model		Sum of Squares	Mean Square	F	Sig.
1	Regression	3668681317.531	458585164.691	9.658	.000[b]
	Residual	1851875349.136	47483983.311		
	Total	5520556666.667			

a Dependent Variable: Inpatients

a. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses

Inpatients treated in hospital are also one of very important to measure the efficiency of the hospital. Inpatient care will, in general, be coordinated towards increasingly sicknesses and injury that require at least one days of medium-term remain at a medical hospital. Inpatients in the hospital are dependent upon several doctors and patient admitted by each doctor for operations or treatment of any disease which require overnight stay in hospitals. Reputation of doctor of hospital is also very important as patient always want to approach want that doctor and want to admit with doctor where they have to listen from other patients about treatment of doctor, (Nuti et.al 2011) investigate about patient care is also very important aspect inpatient treatment and patient treatment nurses administrative and paramedical staff plays very important role. If the nursing staff of any hospital are very caring and even never get tense if several patients increases then this will earn a very good reputation for them and ultimately hospital earn good reputation which increases inpatient cases in Hospital. Hospital administrative department is directly responsible for the smooth admission of the patient in hospital and discharge of patient in the hospital. The administrative department of a hospital is also directly responsible for instructing supporting staff to have proper cleanliness of washrooms and wards.

The primary target of healthcare services association is to give the most ideal healthcare to the patients. The investigation of the patient satisfaction is of central significance in the setting giving quality patient consideration administrations. It is hard to gauge the satisfaction and dressing responsiveness of the healthcare frameworks as hospital, as well as nonhospital results of consideration, do impact patient satisfaction. However, satisfaction as a marker of nature of medicinal services has advanced as a result measure and patient satisfaction reviews are in effect progressively distinguished to be set up measuring to quantify the achievement of the administration conveyance framework at hospitals. Satisfaction is a mental idea and patient satisfaction relies on numerous components, for example, Quality of hospital administrations gave, accessibility of medication, neatness, the conduct of specialists and other healthcare staff, cost of the administrations, hospital foundation, physical solace, passionate help, and regard for patient inclinations

4.3.3. Laboratory cases and input variables

4.5 Model Summary

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	.862[a]	.742	.689	7133.4041

a. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses

4.6 ANOVA

Model		Sum of Squares	Mean Square	F	Sig.
1	Regression	5716790184.461	714598773.058	14.043	.000[b]
	Residual	1984532715.539	50885454.245		
	Total	7701322900.000			

a. Dependent Variable: laboratory cases b. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses

When data collected about laboratory cases and input variables are tested with regression model in multistage regression r square value which is calculated is .742 which sufficiently proves the dependence of dependent variable on the independent variable. Laboratory cases are dependent upon all input variables which are defined in the model of specialized equipment administrative task, number of doctors, Number of nurses, Beds. Laboratory cases Hospital research facility administrations give the data required by a doctor to begin, alter and to stop a course of treatment. Research facility experts give crucial data to help hospitalists in settling on choices that influence personal satisfaction for their patients. Hospital laboratories give data and administrations that add to boosting the successful conveyance of consideration in the present complex human services framework by guaranteeing that the right test is performed on the correct individual, at the ideal time, delivering precise test outcomes that empower suppliers to settle on the privilege

demonstrative and healthcare choices utilizing the correct degree of medicinal services assets.

Research and Hospital facility data empower doctors and other human services experts to make analytic or remedial choices for their patients. Hospital research facility administrations are the most financially savvy and huge source of the target data utilized in Hospital basic study (Oral et.al 1991). Hospital lab administrations directly affect numerous parts of patient consideration including, yet not constrained to, length of remain, quiet security, asset usage, and consumer loyalty. While innovation keeps on improving the efficiency of the present research centres, new advancements, new sicknesses, and malady strains keep on driving the requirement for more tests and testing. Oukil et. al (2014) proposes changes on the planet, for example, bio-psychological oppression and the speed with which illnesses spread universally drive the requirement for quick finding and diagnosis.

Laboratory experts produce precise, touchy and explicit data utilizing new-age innovations to direct Hospital basic leadership. It is the job of research centre experts to illuminate doctors about which tests have the most noteworthy viability in given Hospital conditions. Through this organization, the general expense of testing and patient consideration is controlled and the nature of consideration is improved (OECD .Reviews of Health Systems Turkey.2008).
Research Centre data profoundly affects results . Tests, regardless of whether delegated screening or analytic, are fundamental components of conventions used to analyze and oversee explicit illnesses and conditions. of the seriousness of the illness, production of a helpful arrangement, and the executives/checking of treatment results. The more effective the testing convention, the shorter the length of inpatient remain or outpatient experience, the quicker the usage of treatment, and the lower the general expense of consideration
The discussion about the job of innovation and its utility in healthcare practice is an old one, regardless of whether it is the utilization of the stethoscope or the utilization of research centre studies. The job of any healthcare innovation ought to be valuable and relevant as opposed to a substitute for the medicinal meeting (Olesen 1995). In the present circumstance, it has been discovered that patients likewise request research facility study’s as a component of medical consideration. As it were, in the present time of 'lab prescription', medical consideration winds up exhaustive just with the help of fundamental research centre offices.

Besides, contemplates have likewise discovered that offices like lab support alongside other infrastructural offices are a significant determinant impacting the usage of healthcare administrations

4.3.4 Medico-legal cases and Input variables

Medico-legal cases are those cases in which doctor after examining the case thinks that this case requires to be inspected legally with the involvement of police and other responsible agencies. The cases of medico-legal in a hospital are like accident or injury through altercation of two parties and this requires to have involvement of the police. O'Neill et. al (2008), explains that Doctors will keep on proceeding in treatment or patient serious than referring patient to another better-specialized hospital .when value of medico-legal cases have been tested against input variables which are decided to find significant model for finding efficiency using input-output model combination. The value of R square which we got from spss in 48.9 per cent, It means only 48.9 per cent variation in medico-legal cases are dependent upon input variables decided for calculating efficiency. As R Square value is less than 5 that is why this particular output variable is rejected from the model of calculating efficiency using data envelopment analysis.

Table 4.7 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.699[a]	.489	.479	794.6659

a. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds. Nurses

Table 4.8 ANOVA

Model		Sum of Squares	Mean Square	F	Sig.
1	Regression	37222103.631	4652762.954	7.368	.112[b]
	Residual	24628263.619	631493.939		
	Total	61850367.250			

a. Dependent Variable: Medico-legal cases

b. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds. Nurses

Medico-legal cases are not dependent upon the number of doctors, Nurses paramedical staff present in a hospital. There are some other reasons upon which medico-legal cases are dependent upon, As medico-legal cases, R square value against input variables are very less so we exclude this from our study to calculate efficiency.

Medico legal cases are dependent upon location of hospital and some other thing like reputation of hospital in handling hospital services among locals and name and reputation of some doctors available in hospitals who are famous for saving people in hospital, So medical-legal cases does not have anything to do with. number of doctors and number of nurses present in hospital. This will affect the efficiency of the hospital in some senses if included in the study. Cases that are to be treated as medico legal may be: (1) All instances of wounds and consumes - the conditions of which recommend commission of an offence by someone (independent of doubt of injustice2).all vehicular, plant, or other unnatural mishap cases uniquely when there is a probability of patient's passing or unfortunate hurt; (3) instances of suspected or apparent rape; (4) instances of suspected or obvious criminal premature birth; (5) instances of obviousness where its motivation isn't common or not clear; (6) all instances of suspected or apparent harming or inebriation; (7) cases alluded from court or generally for age estimation; (8) cases brought dead with ill-advised history-making doubt of an offence; (9) instances of associated self-curse with wounds or endeavored suicide; (10) some other case not falling under the above classes yet has lawful ramifications. Unfortunately, specialists are generally anxious in managing these "MLCs." The typical impression is that MLC infers a lot of debates, undesirable weight, harsh talking police

authorities, over the top hours in the court, unwavering protection guides, and so on. Due to this dread factor, they either attempt to stay away from the cases or attempt to dispose of them as quickly as time permits

4.3.5. Maternal and child health care and Input variables

Doctors and hospitals in maternal and child health care tend to provide services to patient and children to improve their present health and also a vaccination for future life. Maternal and child health care department also do campaigning in city, town and village about the promotion of an event or providing services for example polio drops being provided by nurses or students doing training with doctors to provide polio drops to all newborn child at their home also.

Table 4.9 **Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.776[a]	.602	.520	794.6659

a. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses

The r square value which we got is .602 it means that 60.2 per cent of maternal and child care cases variation dependents upon input variables tested for efficiency calculation .this value is not too large but still sufficient to be considered for inclusion in calculating efficiency using data envelopment analysis

Table 4.10 Anova

Model		Sum of Squares	Mean Square	F	Sig.
1	Regression	37222103.631	4652762.954	7.368	.000[b]
	Residual	24628263.619	631493.939		
	Total	61850367.250			

a. Dependent Variable: Maternal and child healthcare

b. Predictors: (Constant), Administrative task, Laboratory hours per week, Specialized equipment, Paramedical staff, OPD hours per week, Doctors, No. of beds., Nurses

if look into general sense also maternal and child health care cases depend on Doctor reputation in handling gynae cases, Like some doctors they have a reputation that they will only do operation and will not proceed toward normal delivery even if normal delivery is possible. Maternal and kid healthcare authorities work to improve the healthcare conveyance framework through backing, instruction and research. They achieve this by finding and testing arrangements through applied research and by creating, executing and additionally assessing healthcare programs at the nearby, state, national and worldwide levels(Oukil, 2018).

The focus around maternal and kid healthcare is a worldwide need for general healthcare experts, the United Nations reported in 2010 the Global Strategy for Women's and Children's Health – a team sorted out to teach ladies over the world about regenerative healthcare, battle newborn child mortality, and spare more than 16 million lives by 2015. Specialists in maternal and kid healthcare centre around the intricate general medical issues influencing ladies, youngsters and their families. This interdisciplinary field looks for answers for the 4mind boggling healthcare contemplations identifying with ladies, pregnancy, generation, and newborn child and tyke prosperity.

4.4. Efficiency calculation using data envelopment analysis model

Table 4.11: Efficiency calculated using data envelopment analysis

		Input-Oriented	
		Hospital	
DMU No.	**DMU Name**	**Efficiency**	**RTS**
1	H1	0.82100	Increasing
2	H2	0.71000	Decreasing
3	H3	0.78000	Increasing
4	H4	0.71000	Decreasing
5	H5	0.81000	Increasing
6	H6	0.78000	Increasing
7	H7	0.79000	Increasing
8	H8	0.64000	Decreasing
9	H9	0.71000	Decreasing
10	H10	0.98900	Constant
11	H11	0.71000	Decreasing
12	H12	0.81000	Increasing
13	H13	0.60000	Decreasing
14	H14	0.63000	Decreasing

15	H15	0.63100	Decreasing
16	H16	0.69000	Decreasing
17	H17	0.80000	Increasing
18	H18	0.82000	Increasing
19	H19	0.72000	Decreasing
20	H20	0.77000	Increasing
21	H21	0.76000	Increasing
22	H22	0.82000	Increasing
`23	H23	0.79000	Increasing
24	H24	0.66000	Decreasing
25	H25	0.76000	Increasing
26	H26	0.56000	Decreasing
27	H27	0.67000	Decreasing
28	H28	0.74000	Decreasing
29	H29	0.60000	Decreasing
30	H30	0.96000	Constant
31	H31	0.80000	Increasing
32	H32	0.81000	Increasing
33	H33	0.88000	Increasing

34	H34	0.87000	Increasing
35	H35	0.74000	Decreasing
36	H36	0.84000	Increasing
37	H37	0.76000	Increasing
38	H38	0.82000	Increasing
39	H39	0.79000	Increasing
40	H40	0.54000	Decreasing
41	H41	0.96000	Constant
42	H42	0.69000	Decreasing
43	H43	0.67000	Decreasing
44	H44	0.74000	Decreasing
45	H45	0.72000	Decreasing
46	H46	0.95000	Constant
47	H47	0.89000	Increasing
48	H48	0.88000	Increasing

4.5 Hospitals Efficiency According to Size

The efficiency of hospitals is calculated using data envelopment analysis and the above table illustrates the efficiency of every hospital along with efficiency this table also provide very important information about hospital i.e. return to scale information about the hospital. Return to scale is very important information for any management of organization .i.e. hospital is working at increasing decreasing or constant return to scale.

- Hospitals working at increasing return to scale means if the input of these hospitals will be double they will produce output which will be more than double .it is also called diminishing cost that output increases at a higher rate as compared input of hospital.

- Hospitals working at decreasing return to scale or it are also called as increasing cost means if the input is doubled output will be less than double. If a 20 per cent increase in input will lead to only 10 per cent increase in output that is a case of diminishing returns to scale

- Hospitals working at a constant return to scale means if input factor will be double output will also be double .this will happen if economies scale are balanced by diseconomies of scale .this is called as homogeneous function and Cobb-Douglas linear homogeneous function is the best example of this

Hospitals in our study consist of three types of hospital large size hospitals, medium-sized hospitals and small size hospitals in the third objective of research association of customer satisfaction and efficiency will be calculated for that we have to calculate efficiency separately for small size, large size and medium-size hospitals. Hospitals are divided into three different categories based on several beds hospitals with more than 100 beds are considered too large size hospitals. Hospitals with less than 100 beds and more than 70 beds were classified into medium-size hospitals and less than70 beds were classified into small size hospitals (IPHS revised guidelines 2012, Ghuman &Mehta,2014) .in next section efficiency of hospitals of three different categories will be separated.

4.12 The efficiency of large size hospitals

DMU No.	*DMU Name*	*Input-Oriented efficiency*	*RTS*
1	H1	0.82100	Increasing
2	H2	0.71000	Decreasing
3	H3	0.78000	Increasing
4	H4	0.71000	Decreasing
5	H5	0.81000	Increasing
6	H6	0.78000	Increasing
7	H7	0.79000	Increasing
8	H8	0.64000	Decreasing
9	H9	0.71000	Decreasing
10	H10	0.98900	Constant
11	H11	0.71000	Decreasing
12	H12	0.81000	Increasing
13	H13	0.60000	Decreasing
14	H14	0.63000	Decreasing
15	H15	0.63100	Decreasing
16	H16	0.69000	Decreasing

4.13 The efficiency of medium size hospitals

DMU No.	DMU Name	Input oriented efficiency	RTS
1	H17	0.80000	Increasing
2	H18	0.82000	Increasing
3	H19	0.72000	Decreasing
4	H20	0.77000	Increasing
5	H21	0.76000	Increasing
6	H22	0.82000	Increasing
7	H23	0.79000	Increasing
8	H24	0.66000	Decreasing
9	H25	0.76000	Increasing
10	H26	0.56000	Decreasing
11	H27	0.67000	Decreasing
12	H28	0.74000	Decreasing
13	H29	0.60000	Decreasing
14	H30	0.96000	Constant
15	H31	0.80000	Increasing
16	H32	0.81000	Increasing

:

4.14 The efficiency of small size hospitals:

DMU No.	DMU Name	Input-Oriented efficiency	RTS
1	H33	0.88000	Increasing
2	H34	0.87000	Increasing
3	H35	0.74000	Decreasing
4	H36	0.84000	Increasing
5	H37	0.76000	Increasing
6	H38	0.82000	Increasing
7	H39	0.79000	Increasing
8	H40	0.54000	Decreasing
9	H41	0.96000	Constant
10	H42	0.69000	Decreasing
11	H43	0.67000	Decreasing
12	H44	0.74000	Decreasing
13	H45	0.72000	Decreasing
14	H46	0.95000	Constant
15	H47	0.89000	Increasing
16	H48	0.88000	Increasing

4.15 Comparison of the efficiency of large, medium and small size hospitals:

	Efficiency
All Hospitals(n= 48)	
Mean	**0.76**
Std. Dev.	**0.16**
Hospitals (Small Size) (n=16)	
Mean	**0.8**
Std. Dev.	**0.15**
Hospitals (Medium Size) (n=16)	
Mean	**0.75**
Std. Dev.	**0.16**
Hospitals (Large Size) (n=16)	.
Mean	**0.73**
Std. Dev.	**0.15**

In `first stage efficiency of hospitals were analyzed, data envelopment analysis was utilize here to analyze and evaluate the efficiency of the hospital. Present research indicates that smaller hospitals have a efficiency more than larger size and mid-size medical hospitals as demonstrated in above table smaller size hospitals average efficiency is .80. The mean efficiency of medium size hospitals is .75 and large hospital is .73. As per our outcomes, small size medical hospitals are generally more efficient and have higher patient satisfaction

compared with different kinds of hospitals. In any case, huge size hospitals give nearly a higher caliber of service and care than their small and mid-segment partners will be shown in third objective of this chapter.

The research findings fundamental explanation is different mission of different hospitals. The objective of small, medium and big size hospitals are different as some concentrate more on care and quality some on quantity. Big size hospitals will in general increment their physical, innovative and medicinal work limit in request to understand the requirement of far-reaching care. Nature of care may essentially increment in parallel with the addition of these limits. Strangely, huge size medical hospitals are not performing like small and medium-size medical hospitals as far as scale effectiveness.

In this matter large size hospitals don‘t work at an ideal scale size. , big size hospitals may frame smaller patient consideration units inside their association. Along these lines, large size medical hospitals not just take out the negative impact of their non-idea scale size, yet besides they make explicit treatment units for patients. Then again, low specialized productivity of large size medical hospitals could be halfway clarified by result estimation. Since a portion of these is showing hospitals diagnostic procedure of patients may be increasingly confounded and preparations of these hospitals (instructing, R&D) couldn't be surveyed in the result file. Anyway, significant ramifications for big size medical hospitals, (for example, setting up explicit hospital units) may be evaluated for the use of assets.

Hospital center has been related with a change process set apart by the fiscal reconstructing with mergers and terminations of a couple of small medical hospitals. Human administrations affiliations main work is to achieve capability and adequacy; Hospitals should diminish and lower cost and improve quality. One huge reason of potential inefficiency in the healthcare center division relates to medical hospital emergency hospitals' scale and expansion. It sometimes look good to expand the size and degree of a medical center to use available bent, system and rigging (Pham, 2011). Regardless, in the long run, a healthcare center pulls back from its efficient level of adequacy and begins to show diseconomies of scale. At the contrary small emergency hospital medical hospitals may similarly be inefficient in light of the fact that the cost which is fixed whether it is administrative or infrastructure wise must be shared crosswise over too small a caseload, in this manner pushing up the expense of a normal medical hospital visit. In this specific situation, the capacity to quantify scale

effectiveness is significant to address the subject of ideal beneficial size and to deal with a reasonable allotment of assets.Latest study‘s on scale effects in the human services area focused on dissecting the correct utilization of assets and on evaluating the ideal size of an hospital to build the medical hospital's presentation.

The proof shows that two small single-site hospitals (of 60 beds) will be more efficient than one big single-site medical hospital (of 120 beds). In perspective on this proof, in any case, how sure would govt. be able to be that the formation of a multisite medical hospital trust with 120 beds will be more efficient than two separate single site hospital of 60 beds each? On the premise of accessible research proof, bigger isn't better: at present (Pestieau & Tulkens 1993). Later on, as general specialists (through essential consideration gatherings) accept an undeniably compelling job in arranging the arrangement of hospital administrations, the apparent advantages of open nearby administrations may start to reverse the situation of expert sentiment. Smaller, nearby, or network hospitals with the possibility to flourish freely are framing systems or gatherings. This systems help the medical hospitals accomplish three points: increment their capacity to put resources into the framework, share back-office costs, and pull in and hold staff that needs to increase a scope of Hospital work. Framing systems or gatherings likewise makes a chance to share best practices crosswise over medical hospitals and embrace the most ideal methods for working. These hospitals for the most part center on administrations to guarantee that they can accomplish appropriate caseloads for looking after quality.

Bigger medical hospitals are not better. The present research shows that they once in a while bring about lower expenses or better patient results. A decent arrangement still should be comprehended about how to accomplish better Hospital outcomes, and normal size markers, similar to medical hospital movement volume, are too rough to ever be valuable in arranging Hospital administrations (Pina & Torres, 1992). Ideal medical hospital size relies upon nearby human services needs and the accessibility of corresponding administrations and population who are going to use this there are some advantages of Small Hospitals• More reasonable to the patients• Cheaper treatment cost than the corporate hospitals• Quick reaction to the hospital• Quality of treatment• Personal consideration of the treating doctor• Near to where they remain and simpler to reach(Pink ,2003).

4.6 Slack value of Hospitals

In the current situation in the healthcare area in India, the ideal use of assets in the segment is vital. This segment investigates the productivity of tertiary medical hospitals in Punjab and slack value associated with each hospital is also analyzed. Slack values are value which is added to inequality constraint to add it to equality This research find an immense slack in the utilization of assets, for example, specialists, Beds. With better observing, medical hospitals will have the option to serve more patients with existing assets.

In recent years there has been an discussion on lacking public interest in healthcare over developing nations. India, as far upcoming financial superpower, generally under-budget resources into this amazingly pivotal healthcare part, with portion of Gross Domestic Product (GDP) in public financed medicinal services failing to exceed 2.5% in the post-liberalization period (Po & Yang 2009). Notwithstanding the requirement for expanding this offer, the ideal use of these rare assets in nations has been important, to guarantee the most ideal output from accessible foundation and labor. In this specific circumstance, we attempted an research of the specialized 48 hospitals in the territory of Punjab in India. We look at whether these medical hospitals ideally use contributions for human services to give out-persistent and good administrations to the overall population.

A slack or surplus worth is accounted for every one of the requirements. The expression "slack" applies to not exactly or equivalent imperatives, and the expression "excess" applies to more than requirement. If an imperative is authoritative and is equal , at that point the comparing slack or surplus worth will rise to zero(Ramón & Sirvent, 2014. The slack is the measure of the asset, as spoke to by the not exactly or-equivalent requirement, that isn't being utilized. (Reichheld, 2006) explains that at the point when a more prominent than-or-equivalent requirement isn't authoritative, at that point the surplus is the additional sum over the limitation that is being delivered or used.

In an improvement issue slack value is that which is added to inequality constraint imperative to change it into uniformity. Presenting a slack value changes an imbalance limitation with a fairness requirement and a non-pessimism imperative on the slack variable. Slack factors are utilized specifically in straight programming. Similarly, as with different factors in the etended imperatives, the value of slack can‘t take on negative values, as the very simple calculation expects them to be certain or zero.

- If a slack variable related to a study is zero at a specific arrangement as the limitation confines the potential changes stating there does not require any further addition.
- If a slack variable is certain at a specific applicant arrangement, the requirement is known- official there, as the imperative doesn't limit the potential changes starting there.
- The slack variable is negative eventually, the fact of the matter is infeasible (not permitted), as it doesn't fulfill the study.

The hospital and healthcare industry remains in complex condition in India. A request always exists for medicinal services associations to adjust efficiency, quality and security while likewise thinking about outer changes. A key factor affecting these factors is authoritative slack. While the effect of slack assets on firm results has gotten consideration in the more extensive administration writing, less research exists on this subject in the medicinal services the executives writing (Rousseal. & Semple 1993). The study of slack in the medicinal services industry is especially significant because administrators are expanding strain to accomplish significant levels of productivity and because in the time of the Affordable Care Act, hospitals can be contrarily affected on the off chance that they neglect to improve hierarchical results. When all is said in done, hierarchical slack has been contended to have both positive and negative impacts on firm results, For instance, slack is contended to fill in as a positive impact since it supports firms from the deficiencies of assets and builds the probability of firm advancement. Be that as it may, it is moreover contended that slack is wasteful and exists because of the interests of self-serving directors. These contentions see slack as either positive or negative for the firm. Authoritative slack has different parts and in that capacity, numerous definitions have been offered in the writing.

Sengupta (1988,1989.) characterized slack as "the disparity between the assets accessible to the association and the installments required to maintain the coalition‖ Sengupta (1987) characterized slack as "the pool of assets in an association that is in overabundance of the base important to deliver a given level of organizational output basically. Slack can be thought of as a heap of resources either inside or accessible to the firm that is over the base expected to work. Slack has normally been sorted into a few segments (Seiford et al.2015).

The more fine-grained of these approaches is given by Smith & Mayston (1987) in which three sorts of slack are identified: accessible, potential and recoverable.

4.7 Slack Value in Large size Hospital

Slack values of large size hospitals mostly working at either increasing return to scale or diminishing return to scale all the values are derived from data envelopment analysis of data collected .like IVY hospital can employ even 19 per cent fewer doctors to achieve the same output of outpatients. .With the same number of inputs they can cater to a large number of outpatients.i.e 65000.

Table4.16: Slack value of IVY hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	percentage Difference
IVY HOSPITAL Hoshiarpur	**0.81**	**Doctors**	**31**	**25.1**	**-6**	**--19.58064516**
		Beds	**160**	**144**	**-16**	**-10**
		Nurses	**44**	**41**	**-3**	**-6.81818182**
		Equipment's	**24**	**23**	**-1**	**-4.16666667**
		paramedical staff	**16**	**16**	**0**	**0**
		Outpatient visits	**51000**	**65000**	**14000**	**27.4509804**

Efficiency is calculated based on this data, Target quantity is a quantity which is required to produce that much output from data .difference is between target quantity and actual quantity,

The outcomes uncovered the following findings:

Hospitals working at a constant return to scale suggesting that their hospital administration output would increment in a similar extent. This implies Fortis Mohali was working at their most gainful scale sizes and a consistent return to scale. (Fortis Mohali)

Incrementing return to scale in hospitals, suggesting that their hospital administration output would increment by a more extent than increase in inputs. In this way expected to

expand their size to accomplish ideal scale, for example, the scale at which there is consistent return to scale in the connection among sources of info and outputs. (For Ivy and Capitol hospital)

Decreasing return to scale medical hospitals, suggesting that their hospital administration output would increment by a small extent. It would have expected to diminish their size to accomplish the ideal scale. (SPS hospital)`

Table4.17: Slack value of Fortis Mohali

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
Fortis Mohali	0.98	Doctors	43	41	-2	-4.65116279
		Beds	160	154	-6	-3.75
		Nurses	44	42.1	-1.9	-4.31818
		Equipment's	24	24	0	0
		paramedical staff	16	16	0	0
		Outpatient visits	81000	82200	1200	2.352941

Table4.18: Slack value of Capitol Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
Capitol Hospital	0.82	Doctors	40	36	-4	-10
		Beds	300	290	-10	-3.33333333
		Nurses	120	89	-31	-25.8333333
		Equipment's	38	38	0	0
		paramedical staff	34	27	-7	-20.5882353
		Outpatient visits	61000	79000	18000	29.5081967

The distinction between target outpatient visits and actual visits of Fortis, IVY and Capitol hospitals outpatient office visits is 2 per cent,27 per cent and 29 per cent. In this manner, these hospital needs to build output to coordinate the actual medical hospital execution. Hospitals would likewise need to build an hospital to increase outpatient visit by, 1200, 14000 and 18000 to turn out to be moderately effective. On the other hand, it could accomplish a similar productivity score by diminishing the number of specialists in case of capitol hospital by 5 per cent as shown in the table for the slack value of hospitals.

Table4.19: Slack value of SPN Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
SPN HOSPITAL	0.78	Doctors	22	21.3	-0.7	-3.18181818
		Beds	80	78	-2	-2.5
		Nurses	29	23	-6	-20.6896552
		Equipment	18	18	0	0
		paramedical staff	13	12	-1	-7.69230769
		Outpatient visits	31000	43000	12000	38.7096774

Table4.20: Slack value of Max Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
MAX Superspeciality hospital	0.63	Doctors	33	24	-9	-27.2727273
		Beds	140	129	-11	-7.85714286
		Nurses	44	42	-2	-4.54545455
		Equipment	24	23	-1	-4.16666667
		paramedical staff	15	13	-2	-13.3333333
		Outpatient visits	41000	58000	17000	41.4634146

The distinction between target outpatient visits and actual visits of Joshi medical hospitals, SPN and Max hospitals outpatient office visits is more than 24per cent. In this manner, these hospital needs to build output to coordinate the actual medical hospital execution. Hospitals would likewise need to build an hospital to increase outpatient visit by 17000 to turn out to be moderately effective. On the other hand, it could accomplish a similar productivity score by diminishing the number of specialists by more than 27 per cent as shown in the table for the slack value of hospitals.

Table 4.21: Slack value of Joshi Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
JOSHI Hospital	**0.71**	**Doctors**	**21**	**18**	**-3**	**-14.52380952**
		Beds	**100**	**94**	**-6**	**-6**
		Nurses	**32**	**36**	**4**	**12.5**
		Equipment	**21**	**19**	**-2**	**-9.52380952**
		paramedical staff	**13**	**11**	**-2**	**-15.3846154**
		Outpatient visits	**37000**	**46000**	**9000**	**24.3243243**

4.8 Slack Value in Medium and Small Size Hospital:

Hospital administrators have three systems accessible to them for optimally utilizing wasteful assets use:

(a) Expanding inclusion and network of hospital administrations;

(b) Decreasing hospital inputs;

(c) Hospital organization process changes in medical hospitals.

All together for the wasteful medical hospitals to have gotten moderately productive, as a gathering, they would have expected to build their outpatient division visits more than (18.05%) . Independently, to be moderately actually productive, doaba medical hospital expected to expand its outpatient office visits by about 15%.

Table 4.22: Slack value of Doaba Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
Doaba Hospital	**0.80**	**Doctors**	**14**	**12**	**-2**	**-14.2857143**
		Beds	**76**	**70**	**-6**	**-7.89473684**
		Nurses	**34**	**30**	**-4**	**-11.7647059**
		Equipment	**23**	**16**	**-7**	**-30.4347826**
		paramedical staff	**16**	**16**	**0**	**0**
		Outpatient visits	**27000**	**32000**	**5000**	**18.5185185**

India Kidney hospital should have expanded its outpatient office visits by 16%; Chawla medical hospital ought to have expanded its outpatient division visits and inpatient releases by 21%; Guru Nanak mission medical hospital should have expanded its outpatient office visits by 2300.

Table 4.23: Slack value of India Kidney Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
India Kidney	**0.82**	**Doctors**	**17**	**14**	**-3**	**-17.6470588**
		Beds	**70**	**65**	**-5**	**-7.14285714**
		Nurses	**33**	**30**	**-3**	**-9.09090909**
		Equipment	**23**	**23**	**0**	**0**
		paramedical staff	**16**	**11**	**-5**	**-31.25**
		Outpatient visits	**31000**	**36000**	**5000**	**16.1290323**

As effectively noticed the 5 medical hospitals that were variable return to scale and inefficient could improve their relative productivity by lessening their contributions by an

aggregate of 2.478 specialists (2.85%), 9.914 attendants and maternity specialists (and partner medical caretakers) (0.98%), 9.774 research Centre experts (9.68%) and 194.995 beds (10.42%). The necessary information decreases for singular medical hospitals are displayed in table where it is very much clear that most hospitals have profited by decreases in the number of doctors and beds. The strategy producers could have considered reassigning overabundance hospital laborers. They could likewise have investigated the plausibility of making versatile pools of abundance hospital laborers to far off hospitals, hospital stations and maternal and youngster hospital centers. Then again, overabundance beds could either have been moved to essential healthcare offices with bed deficiencies or offered to the non-legislative hospital division. This would have guaranteed that the additional inventory of beds should not have prompted more affirmations and larger stays (Smith et. al 1995)

Table 4.24: Slack value of Chawla nursing home hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
Chawla Nursing home	**0.79**	**Doctors**	**18**	**15**	**-3**	**-16.6666667**
		Beds	**75**	**66**	**-9**	**-12**
		Nurses	**23**	**20**	**-3**	**-13.0434783**
		Equipment	**23**	**21**	**-2**	**-8.69565217**
		paramedical staff	**16**	**11**	**-5**	**-31.25**
		Outpatient visits	**33000**	**40000**	**7000**	**21.2121212**

The after-effects of this study additionally have significant viable implications. Our discoveries propose that slack effects hospital execution and it might do as such in manners not yet considered. The administrative implications related to our research recommend that lower levels of recoverable slack joined within moderate degrees of potential slack brought about the best execution. Besides, firms with low degrees of potential and accessible slack performed poor comparative with other firms. This research consolidated proposes the adaptability of accessible and potential slack is a significant factor in general hospital execution. Sueyoshi (1990) proposes that hospitals should concentrate on effectiveness in

conveying existing assets and keep up adequate access to outer subsidizing if required. Given the exchange between the different types of slack, it shows up medical hospitals favouring a heap of assets that limits recoverable slack while wisely overseeing accessible and potential slack outflank those that use increasingly recoverable slack assets.

Table 4.25: Slack value of GNM Dasuya Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
Guru Nanak mission Hospital dasuya	0.87	Doctors	13	8	-5	-37.3333333
		Beds	45	34	-11	-24.4444444
		Nurses	29	23	-6	-20.6896552
		Equipment's	16	12	-4	-25
		paramedical staff	13	13	0	0
		Outpatient visits	24000	26300	2300	9.58333333

Table 4.26: Slack value of Dhillon Hospital

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
Dhillon Hospital	0.74	Doctors	12	8	-4	-33.3333333
		Beds	60	48	-12	-20
		Nurses	28	26	-2	-7.14285714
		Equipment	12	12	0	0
		paramedical staff	16	11	-5	-31.25
		Outpatient visits	28200	38000	9800	34.751773

The distinction between target outpatient visits and actual visits to Guru Nanak hospital and Dhillon hospital outpatient office visits is not more than they planned .In this manner, these hospitals needs to build output to coordinate the actual medical hospital execution.

Hospitals would likewise need to build an hospital to increase outpatient visit by 2300 and 9800 to turn out to be moderately effective. On the other hand, it could accomplish a similar productivity score by diminishing the number of specialists by more than 33 per cent as shown in the table for the slack value of hospitals.

4.9 Difference in slack value and efficiency of public and private hospitals

When comparing efficiency of private and public hospitals huge difference was noticed, In this study efficiency of two private hospitals and two Govt. hospitals were compared, Hospitals were considered in this comparative analysis are those which act as referral hospitals for people of same area.

Table 4.27: Slack value of Ivy hospital Hoshiarpur

DMU(Hospital)	Efficiency score	I/O	Present quantity	Target	Difference (PQ-T)	Percentage Difference
IVY HOSPITAL	0.81	Doctors	31	25.1	-6	--19.58064516
		Beds	160	144	-16	-10
		Nurses	44	41	-3	-6.81818182
		Equipment‘s	24	23	-1	-4.16666667
		paramedical	16	11	-5	-31
		Patients	44000	57000	14000	27.4509804

Table 4.28: Slack value of CHC Anandpur sahib

Dmu (Hospital)	Efficiency score	Input/output	Actual quantity	Target quantities	difference	Percentage
Civil Hospital Anandpur sahib	0.62	Doctors	26	14	-12	-46.1538462
		Beds	120	76	-44	-36.6666667
		Nurses	29	22	-7	-24.137931
		Equipment‘s	19	23	4	21.0526316
		paramedical staff	13	9	-4	-30.7692308
		patients	29000	52000	23000	79.3103448

Table 4.29: Slack value of Fortis hospital Mohali

Dmu(Hospital)	Efficiency score	Input/output	Actual quantity	Target quantities	difference	percentage
Fortis Mohali	0.93	Doctors	53	45	-8	-15.0943
		Beds	296	285	-11	-3.71622
		Nurses	**93**	**86**	**-7**	**-7.52688**
		Equipment‘s	34	29	-5	-14.7059
		paramedical staff	21	17	-4	-19.0476
		Patients	88000	99000	11000	12.5

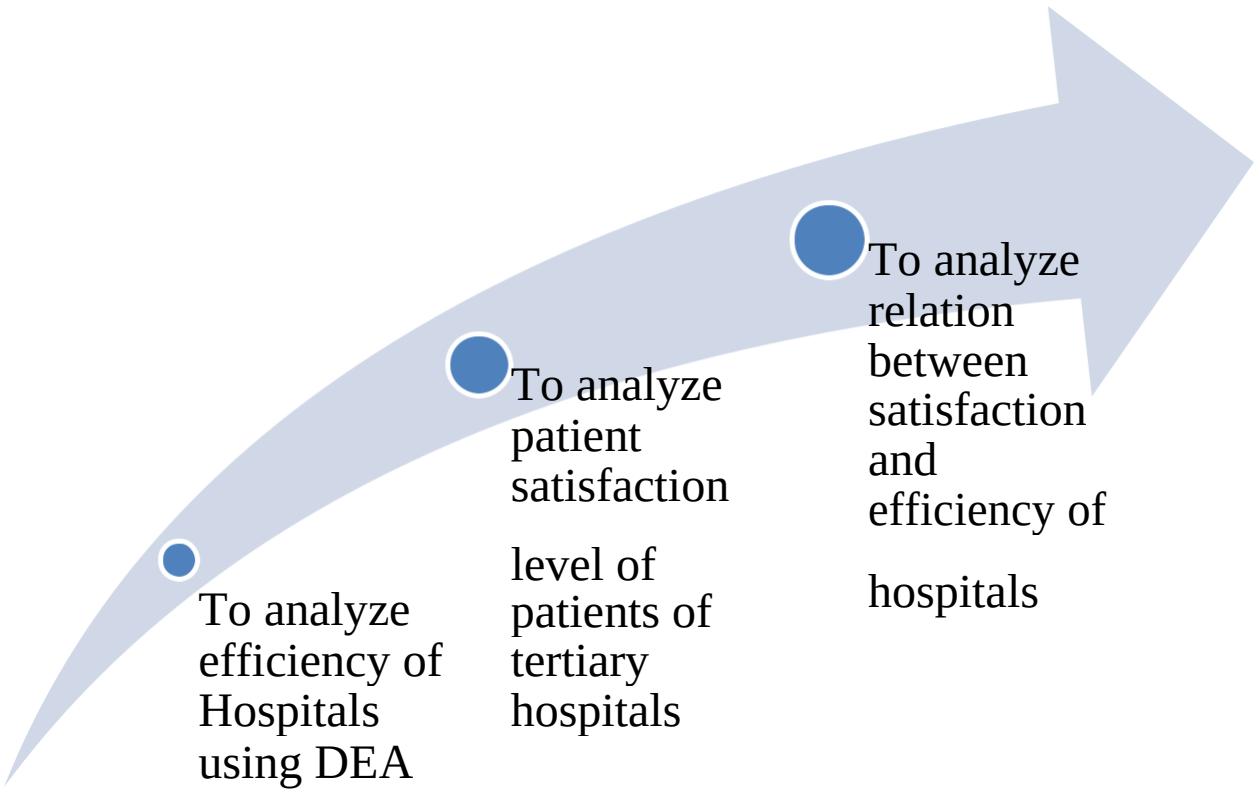
Table 4.30: Slack value of GMCH sector 32 Chandigarh

Dmu(Hospital)	Efficiency score	Input/Output	Actual quantity	Target quantities	difference	percentage
Gmch Chandigarh	0.59	Doctors	65	45	-20	-30.7692
		Beds	320	190	-130	-40.625
		Nurses	116	76	-40	-34.4828
		Equipment‘s	34	22	-12	-35.2941
		paramedical staff	21	17	-4	-19.0476
		Patients	61000	110000	49000	80.32787

Comparison of public and private hospitals had given huge insights about efficiency scores of hospital .This analysis reveals that private hospitals of the area perform better than public hospitals with almost same facilities and infrastructure. Authorities responsible can study, analyses and then benchmark results of private hospitals for government hospitals .Data envelopment stud also provide important insight whether hospital working on reliable return to scale according to inputs .If Hospital working on increasing return to scale then implication are different as compared if hospital working on decreasing return to scale i.e. reducing in inputs or increasing scalability of hospitals.

Data analysis and interpretation Stage 2

***4.10 To find the satisfaction level of patients of Hospitals*.**



Patient satisfaction is a significant pointer for estimating the quality of services of hospitals. Patient satisfaction influences hospital results. Understanding satisfaction is hence an intermediary yet an exceptionally viable pointer to check the achievement of specialists and hospital. This study talks about concerning how to achieve good level of Patient satisfaction while maintaining efficiency. Patient satisfaction is the degree to which patients are using their healthcare services, both inside and outside of the specialist's office. A proportion of care quality is called as Patient satisfaction; it gives doctors knowledge into different parts of medication, including the viability of their consideration and their degree of sympathy.

In the wake of patient-focused medicinal services, patients are requesting services, and anticipate a specific degree of administration from their suppliers.

The goal of this study was to research the connection between efficiency and patient satisfaction for hospitals in Punjab. A proportion of patient satisfaction at the medical hospital level was built utilizing information from a region-wide review of patients. A proportion of efficiency was developed utilizing information of hospitals in Punjab. As per past studies, the model likewise included proportions of medical hospital size, showing status and area. Given the consequences of this investigation, there appears to be proof to propose that a connection between hospital efficiency and patient satisfaction exists. In any case, the impact gives off the impression of being small is good. Hospital size and instructing status additionally seem to influence satisfaction, with lower satisfaction scores revealed among non-educating and bigger medical

4.11 Socio-demographic profile of respondents:

Below table is giving idea about socio-demographic profile of respondents The figures referenced in table shows that the vast majority of the conceded patients in this area tertiary consideration medical hospital had a place with medium segment of the general public with larger part in the age gathering of 21 -40 years which is financially gainful age gathering. 44 % were graduate, just 20% were having illiterate. 21 % education more than secondary level 20 % was jobless and 28 % were housewives. 23 % had a place with families having paid lesser than Rs.20000/month.

The satisfaction levels of the examined patients in various parts of medical hospital care regions are as depicted beneath. The table shows the satisfaction levels to at the time of admission to the hospital of the patients of whom 72 % were conceded through a problem and rest through outside. A large portion of them was fulfilled in this angle yet at the same time the territories requiring consideration are the sign loads up indicating the course and the time slip by among affirmation and inception of treatment which was more than 30 mins in 33% cases.

4.31 Socio Demographic profile

	Respondent =960	Percentage	Numbers
a	Patient	51	490
b	Attendant	49	470
	Age of the Patient		
a	<20	9	86
b	21-40	48	461
c	41-60	29	278
d	>60	14	134
	Sex/Gender		
a	Male	48	461
b	Female	52	499
	Education Of Patient		
a	Illiterate	20	192
b	Primary	9	86
c	Matriculation	9	86
d	Sen.Secondry	21	202
e	Graduate	44	422
	Family Income/Month		
a	<Rs.20000	23	221
b	Rs.20000-50000	44	422
c	Rs50000-100000	26	250
d	>Rs.100000	7	67

4.12 Patient satisfactions Level:

To find satisfaction level among patients two questionnaires separate for inpatients and outpatients are developed in English and Punjabi language. Target is to get questionnaire filled from 25 inpatients each hospital to make total to 1200 responses. But almost 30 responses are collected from each hospital to compensate the loss of incorrect and

inappropriate filled questionnaire and 20 responses conceded for study collectively count up to 960 responses.

Hospitals in our study consist of three types of hospital large size hospitals, medium-sized hospitals and small size hospitals in the third objective of research association of customer satisfaction and efficiency will be calculated for that we have to calculate efficiency separately for small size, large size and medium-size hospitals. Hospitals are divided into three different categories based on several beds hospitals with more than 100 beds are considered too large size hospitals. Hospitals with less than 100 beds and more than 70 beds were classified into medium-size hospitals and less than70 beds were classified into small size hospitals (IPHS revised guidelines 2012,Ghuman &Mehta,2014).320 responses from all three types of hospitals small size, medium size and large size will be considered to calculate patient satisfaction.

The questionnaire was developed to survey satisfaction among patients of 48 hospitals; the questionnaire was developed in two formats Punjabi language and English language. As target population were from Punjab that is why Punjabi language questionnaire was developed in this investigation, Five point Likert scale to find satisfaction has been utilized to quantify responses of respondents' attitudes towards health-care services (Colla et. al 2005). Further this is com-presented with an equivalent number of good and ominous explanations considering the frame of mind of the respondents.

Table 4.32 Dimension of questionnaire

Dimensions	Questions	References
Nursing and staff care	Availability of nurses in ward . Courtesy and care given by Nurses. Attentiveness of Nurses. Courtesy given by lab technician	(Boshoff & Gray, 2004).Andaleeb (2018) ,Ramez (2014) ,Cinaroglu (2014) ,Kitapci et al. (2014) ,Ghuman & Mehta (2013)

The general conduct of specialists	Adequate privacy to discuss financial matters with doctor. Courtesy and respect given by the doctor Explanation by doctor about disease Explanation of purpose of medicine by doctor. Dietary plan prescribed by doctor. Frequency of doctor visit in ward	(Al-Omar, 2000),Boshoff & Gray, 2004).Narang (2016) ,Andaleeb (2018) ,Kitapci et al. (2014) ,Sharma & Kamra (2013
Registration and administrative procedures	Information about doctor availability in hospital. Queue system at registration counter to take appointment. Proper Sign Boards to locate right room. Waiting time between appointment and checkup Availability of chairs and fans in waiting area. Process of admitting in hospital.	(Desai, 2011),Boshoff & Gray, 2004).Bhat and Verma(2001),Narang (2016) ,,Andaleeb (2018),Sharma & Kamra (2013
Infrastructure and Emergency	Availability of ambulance in hospital Emergency medical services provided by hospital. Availability of blood bank in hospital	(Sulku & Caner ,2011).Bhat and Verma(2001),Sharma & Kamra (2013
Test and medicines	Availability of prescribed medicines in medical shops of city. Availability of X ray Facility in hospital. Availability of Ultrasound Facility in hospital. Availability of blood and urine test facility. Availability of ECG test facility. Availability of Bone density test . Information available of when and how to obtain test results	(Sueyoshi, 1995).Bhat and Verma(2001),,Andaleeb (2018)

Facilities at OPD zone	Availability of parking facility. Availability of food in canteen. Availability of health information material on display. Process of paying bills while discharging from hospital.(use of credit cards, debit card, cash).	(Thanassoulis, 1993,Petterson et al. (2016) ,Ramez (2014) ,Ghuman & Mehta (2013)
Hospital prerequisites	.Process of follow up or re -checkup. Support provided in collecting fee reimbursement forms or certificates. Are you satisfied with overall facilities in the hospital.	(Thanassoulis & Dyson 1992).,Petterson et al. (2016) ,Ramez (2014) ,Sharma & Kamra (2013
Reasonableness and comfort	Sanitation arrangement of Bathrooms & toilets. Availability of Drinking Water In the premises. Cleanliness of Bed sheet & pillows. Availability of stretcher and wheel chairs	(Thompson &. Dharmapala, 1993.),Andaleeb (2018) ,Kitapci et al. (2014) ,Ghuman & Mehta (2013)

4.33: Patient satisfaction level of hospitals

	Patient Satisfaction
All Hospitals(n= 48)	
Mean	**0.88**
Std. Dev.	**0.06**
Small Size Hospitals (n=16)	
Mean	**0.93**

Std. Dev.	**0.05**
Medium Size Hospitals (n=16)	
Mean	**0.88**
Std. Dev.	**0.07**
Large Size Hospitals (n=16)	.
Mean	**0.85**
Std. Dev.	**0.07**

Then patient satisfaction level of tertiary hospitals of small size (0.92) is more than other two types of hospitals (0.88, 0.85, separately) This study shows surveying satisfaction of patients is basic, simple and financially savvy route for assessment of hospital benefits and has helped finding that indoor patients conceded in tertiary Hospitals of Punjab were progressively happy with Conduct of specialists yet issue lies with the accessibility of essential areas and disappointment was seen as additional as to in the toilets and the wards. Bed sheets, drinking water, fans accessibility ought to be a few earnest issues requiring concern. Time to arrive at labs is likewise an issue is to be concerned by management for better understand patient needs.

This study infers that the by and large satisfaction in regards to the specialist patient expert and their conduct correspondence was more than 80 per cent at practically. Altogether, 55 for respondents opined that specialists have demonstrated close to nothing enthusiasm to tune in to their concern. More than 70 per cent satisfaction level was seen with the staff of research centers. More than 80.0 per cent were happy with essential civilities; which is much better when contrasted with contemplated medical hospital .people had consideration about Essential conveniences and administrations of hospital such as accessibility of medication, drinking water, toilets/hand washing centers in the wards, neatness in the toilets and wards, fans/lights in the wards, bed sheets. Many were disappointed with the accommodation of

stopping. There is gross carelessness in parts of arrangement of dinners and resigning space for the person/family members of the patient where no arrangement is there. The Socio-statistic profile in table1 itself appears the significance of the hospital since greater part of the respondent were in the age gathering of 20 - 40 years which is financially profitable age for the families, However, the issue lies with the trouble to find the labs and time taken to arrive at the labs for studies which were 10-30 mins in 71% of cases and that's only the tip of the iceberg than 30 mins in 7 % of the cases with 27 % conceding that they had an issue in finding the labs.

This clarifies why numerous medical hospitals, particularly those in the corporate division, have started to work like a service industry. The medical hospital industry has started to utilize HR experts and the board graduates. Outsider payers also have perceived that patient satisfaction is a Significant instrument for the accomplishment of their association and are routinely checking patient satisfaction levels among their clients. In many hospitals rewards are connected to persistent assessment of their primary care physician's close to home communication with them. These players have perceived that higher patient satisfaction prompts benefits for the healthcare business in various manners, which have been bolstered by various investigations: To boost patient satisfaction in healthcare conditions include:

- Cultivating Communication: Physicians and orderlies, who endeavor to develop friendliness, encourage patients to inspect their inclinations and ask question will undoubtedly emphatically influence satisfaction levels. In any occasion, something as major as asking patients how they're feeling can decidedly influence satisfaction.

- Decreasing Wait Times: A center to this is a waiting time for any patient. Expanded hold up periods are a fundamental wellspring of patient frustration, as holding up will when all is said in done increase uneasiness levels. Exercises, for instance, rapidly prompting patients with respect to test results and watching out for them ordinarily will make them recognize you're not overlooking their thought. A direct appeasing estimation for a late result or visit can pacify an on edge tolerant

- Utilizing Technology: Giving patients access to specialized gadgets that empower them to contact staff, intelligent instruction frameworks that give data about their consideration and other easy to use advancements can build solace and upgrade their experience.

- Giving Patient Satisfaction Surveys: Allowing patients to round out a satisfaction overview toward the finish of their stay tells them you give it a second thought and value their info. You can likewise increase important criticism you can use to improve the degree of care.

Data analysis and interpretation stage 3:

4.13 To analyze the relationship between satisfaction and efficiency of hospitals.

One of the targets of this research was to find relation between efficiency and patient satisfaction. In the present days' quality, productivity, and patient satisfaction are progressively utilized as pointers for hospitals. The lack of assets is particularly hazardous in nations where unforeseen condition is one of the most significant for financial improvement and welfare is still very big issue (Trochim & Kane,2005). Therefore, hospitals of developing nations should concentrate on the successful use of assets and expanding quality in their operational endeavors. Research demonstrates that boosting effectiveness and quality in must be fundamental dynamic for hospitals (Thrall et.al 1992).

Productivity is characterized as the utilization of information assets so that there is no waste, while outputs are delivered with quality. Effectiveness implies giving administrations out of assets or limiting the utilization of accessible assets to deliver a given degree of administrations with regards to medical hospitals. Even though efficiency can't be just the ultimate result of a human services organization, improvements in this perspective could give upgrades in other institutional objectives, for example, the nature of care. Nature of care can be characterized as "how much healthcare administrations for people and populations improve the probability of wanted healthcare ". To be sure, inspecting just the efficiencies of hospitals or association among productivity and quality is only a piece of the riddle of surveying healthcare administrations. An increasingly suitable assessment ought to incorporate the patient satisfaction point of view. Therefore, they must be analyzed all the while to better comprehend the questionable connection between these factors. One of major research question of this study is to find out relation between operational efficiency and customer satisfaction among tertiary hospital of Punjab .Efficiency of hospitals are calculated using data envelopment analysis in which linear mathematical formula was used to find out efficiency. Patient satisfaction level was calculated from data collected from 20 inpatients from each hospital those who are suffering from eight tertiary level diseases discussed in previous chapter.

Following are results obtained from analysis of stage 1 and stage 2

	Efficiency
Hospitals (Small Size) (n=16)	
Mean	**0.8**
Std. Dev.	**0.15**
Hospitals (Medium Size) (n=16)	
Mean	**0.75**
Std. Dev.	**0.16**
Hospitals (Large Size) (n=16)	.
Mean	**0.73**
Std. Dev.	**0.15**

	Patient Satisfaction
Small Size Hospitals (n=16)	
Mean	**0.93**
Std. Dev.	**0.05**
Medium Size Hospitals (n=16)	
Mean	**0.88**
Std. Dev.	**0.07**
Large Size Hospitals (n=16)	.
Mean	**0.85**
Std. Dev.	**0.07**

Further to statistically find out relation following model is used:

$$Y= A+BX$$

Y represents patient satisfaction

X represents efficiency of hospital

from above table analysis it is clear that small size hospitals are more efficient as compared to medium scale and large scale hospitals and small size hospitals exhibit better patient satisfaction as compared to other two types of hospitals , Now it is proven from this also that better efficient hospitals lead to better patient satisfaction to further prove this results were also obtained by regressing patient satisfaction with efficiency as independent variable and following results were obtained from this analysis :

4.36 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.775[a]	.606	.567	.812

a. Predictors: (Constant), Efficiency

4.37 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.004	1	8.004	33.977	.000[b]
	Residual	10.836	46	.236		
	Total	18.840	47			

a. Dependent Variable: Patient satisfaction

b. Predictors: (Constant), Efficiency

R value predicts simple correlation and here it is .775 which indicates that in this relation there is moderately good degree of correlation between dependent and independent variable R square values indicates that how much variation in dependent variable i.e. satisfaction explained by independent variable i.e. efficiency and here in this value is .606 it mean 60 percent of variation in satisfaction is explained by efficiency.

4.38 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.156	.690		-.226	.022
	Efficiency	5.204	.893	.652	5.829	.000

a. Dependent Variable: Patient satisfaction

The results show that efficiency of hospitals is having positive relation with patient satisfaction. It means in efficient hospitals patients are more satisfied as compared to inefficient hospitals .As in results of this study small scale hospitals are more efficient as

compared to large scale hospitals so the patient of small scale hospitals are also more satisfied as compared to patients of large scale hospitals .

Overall efficiency is positively effecting satisfaction but as discussed earlier efficiency cannot be increased to some specific limit which will effect quality now very important another question is how hospital efficiency changes the relationship between patient satisfaction out the and specialist doctor‘s. To find answer to this question following model is used:

$$Y=B_0+B_1X_1+B_2X_2+B_3X_3 \qquad \text{Model 1}$$

In this model1 patient satisfaction is represented by Y, X1 is represented by specialized doctors, X2 is represented by hospital efficiency and X3 is represented by hospital size (Mehmet& Bulent,2013)

$$Y=B_0+B_1X_1+B_2X_2+B_3X_3 +B_4X1X2 \qquad \text{Model 2}$$

Model 2 B4X1X2 represent the moderator effect of hospital efficiency on the relationship between patient satisfaction and the availability of specialized doctors

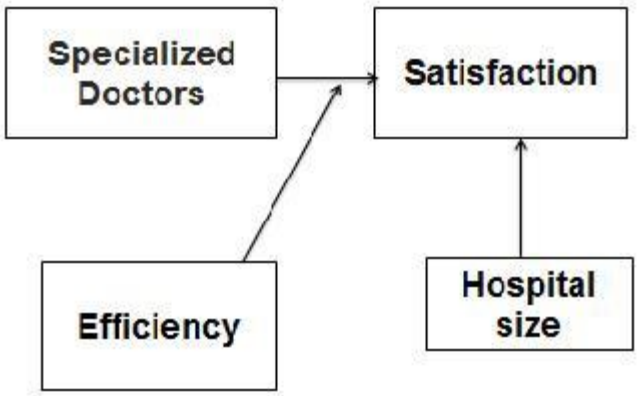


Fig 4.3: Model to find the association of patient satisfaction and efficiency

In this model, we examine the following primary hypothesis

H_{01}: [Specialized doctors in the hospital do not have any influence on the satisfaction of patients]

$H_{A1:}$ [Specialized doctors in the hospital influence satisfaction of patients of hospital]

H_{02}: [Hospital efficiency does not have any moderating effect among the relationship between specialized doctors and patient satisfaction of hospital]

$H_{A2:}$ Hospital efficiency has a moderating effect among the relationship between specialized doctors and patient satisfaction of the hospital

H_{03}: Patient satisfaction does not get effected by size of hospitals.

$H_{a3:}$ Patient satisfaction gets effected by size of hospitals.

From the above mentioned it can be easily analyzed that small and medium-size hospitals are having high efficiency and patient satisfaction as compared to large-sized hospitals and if talk about specialized doctors and availability of specialized equipment's however average efficiency and patient satisfaction is higher for small and medium-size hospitals

While applying multiple regression multicollinearity is to be addressed, Multicollinearity is a situation where one autonomous variable is profoundly associated with at least one of the other free factors in a multiple regression condition. At the end it means, one autonomous variable can be straightly anticipated from one or different other free factors with a significant level of conviction.

Table 4.39: Collinearity Statistics

Model		Unstandardized Coefficients		Standardized Coefficients	t	Collinearity Statistics	
		B	Std. Error	Beta		Tolerance	VIF
1	(Constant)	-.156	.690		-.226		
	Efficiency	5.1	.893	.652	5.829	.553	1.82
	Hospital size	-.33	.001	-2.186	-5.675	.674	1.92
	Doctors	.186	.006	1.802	4.476	.546	1.73

A.Dependent variables Patient satisfaction

Above table results shows there is no multicollinear problem with data .A key objective of the equation of regression is to confine the connection between every free factor and the reliant variable. The translation of a coefficient is that it speaks to the mean change in the

needy variable for every 1 unit change in a free factor when you hold the entirety of the other autonomous factors steady. Estimation of one autonomous variable and not the others. In any case, when free factors are corresponded, it demonstrates that adjustments in a single variable are related with shifts in another variable. The more grounded the connection, the more troublesome it is to transform one variable without evolving another. It gets hard for the model to appraise the connection between every free factor and the needy variable autonomously in light of the fact that the autonomous factors will in general change as one. There are two essential sorts of multicollinearity:

Basic multicollinearity: This sort happens when we make a model term utilizing different terms. At the end of the day, it's a result of the model that we determine instead of being available in the information itself.

Information multicollinearity: This sort of multicollinearity is available in the information itself as opposed to being a relic of the model. Observational analyses are bound to display this sort of multicollinearity

When regression is applied on first model following results are following results are obtained

Table 4.40 .Model Summary model1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.909[a]	.826	.696	.52187

a. Predictors: (Constant), Doctors, Efficiency, Size

Table 4.41 Coefficients model 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.553	.259		13.737	.000
	size	-.33	.001	-2.186	-5.675	.002
	doctors	.186	.006	1.802	4.476	.000
	Efficiency	4.061	5.051	.420	-2.531	.065

This model is significant at p<.05 level here the number of specialized doctors increases patient satisfaction providing support to hypothesis H1 b2=.186.However, hospital size is harming patient satisfaction b3=--.033. But efficiency is not having a significant effect on patient satisfaction there might be the case indirect relation between hospital efficiency and patient satisfaction .one of our major research question is how efficiency the form of relationship between no of specialized doctors and patient satisfaction to evaluate this second-stage regression analysis is done with moderator effect. For that second model is tested for regression to find relationship.

When regression is applied for second following results are obtained

Table 4.42 Coefficients model 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.481	.288		12.099	.001
	size	-.314	.001	-2.196	-5.406	.002
	doctors	.030	.008	2.089	3.710	.044
	Efficiency	.531	1.233	-.486	-2.499	.237
	Interaction term	-.068	.456	-.281	-.776	.002

a. Dependent Variable: Satisfaction

Thus, hospital efficiency variable exerts a negative moderation between doctors and patient satisfaction. The second model is also significant and regression analysis result explains that efficiency is considered to be negative moderator between relation of number of specialized doctors and patient satisfaction, Results in table suggested that higher level of efficiency level of hospitals lessen the positive effect of specialized doctors on patient satisfaction In this way, medical hospital productivity variable applies a negative control between accessibility of specialists and patient satisfaction, as we theorized. Moreover, discoveries give the proof that medical hospital size has a critical negative impact on patient satisfaction.
To further prove this research analysis is done to support H3 which also proves that high level of hospital efficiency lessen the positive effect of specialist doctors on patient

satisfaction .For conducting this research hospitals are divided on basis of size into different parts high efficient and low efficient hospitals .

Table 4.43 Regression analyses of low and high efficient hospitals

Low efficient hospitals	Parameter Estimate	Standard Error	Significance
Specialized doctors	0.172	0.051	0.048
Hospital efficiency	-0.019	0.028	0.958
Hospital size	.-.314	0.001	0.153
High efficient hospitals			
Specialized doctors	0.026	0.036	0.246
Hospital efficiency	-0.068	0.049	0.525
Hospital size	-0.299	0.001	0.03

Results of table shows that more efficient hospitals decrease the positive effect of specialized doctors on patient satisfaction. In highly efficient hospitals result of specialized doctors on satisfaction is less and non-significant. While on less efficient hospitals comparatively there is stronger effect of specialized doctors on patient satisfaction.

As the connection between effectiveness and specialist is characterized by two techniques customary methodology and TQM approach. As hospitals dependably work with various economies of scale relationship is established in term of hospital estimate relationship coefficients are analyzed and found that there was negative relationship be tween‘s two variable for small size hospital as contended by conventional methodology no huge for medium measured and huge positive for huge size medical hospitals. There is the contrast between the connection of huge size and small size hospitals it implies customary methodology is upheld for small size medical hospitals of value trade-off while extensive hospitals work with TQM approach (Mehmet& Bulent,2013)Curiously, large size hospitals are not executing just as small and medium-size medical hospitals regarding scale effectiveness. In this way, these medical hospitals don't work at an ideal scale estimate.As recommended; expansive size medical hospitals may frame smaller patient consideration units inside their association. Along these lines, extensive size hospitals not just dispense with the negative impact of their non-ideal scale measure, yet also, they shape explicit treatment units for patients (Vitikainen K & Linna, 2009).

In second stage investigation we analyzed that particular specialists have positive effect on patient satisfaction anyway effectiveness contrarily directs the relationship this implies satisfaction changes because of accessibility of specialists may be affected by dimension of medical hospital productivity, So hospitals can chip away at lessening their procedure cost and on the off chance that patient think efficiency comes first out for hospital, at that point it will make negative effect as a primary concern of patient. Just concentrating on the powerful usage of assets without fundamentally thinking about quality. Presently hospital directors have a decision. They can overlook efficiencies and simply center on accomplishing high-est nature of quality care, or the other way around. Now an ideal arrangement may be "ideal consideration.”as Reward, D. Indicated, "ideal consideration" could be accomplished by considering a "balance" among efficiency and quality. Further utilization of Linear Programming, Simulation displaying and other numerical devices can be valuable for operational booking, asset allotment investigation for medicinal services managers.

Presently medical hospital administration has a decision. They can decide to overlook efficiencies also, simply centre on accomplishing highest caliber of care. Now an ideal arrangement may be "ideal care." As Donebedian designated, "ideal consideration" could be accomplished by considering a "balance" between efficiency and quality. For our situation, huge size hospitals in Punjab may receive, on a basic level, the ideal consideration all together to improve both productivity and quality. Medical hospital directors ought to likewise concentrate on the hidden reasons for low patient satisfaction coming about because of the effectiveness before reconfiguring their entire consideration structure. Particularly, small and medium-size hospitals could perform the quantitative models, for example, operational booking for doctors as applied by enormous size hospital. Besides, abundances of existing assets may be taken into administration among small hospitals in a similar district. Be that as it may, human services overseers ought to unavoidably take into accounts the institutional components and guidelines in request to perform operational booking for assets. As Sulku et. al (2013) showed, these sorts of medicinal services usage likewise require complete assessment among expenses and advantages. The utilization of direct programming, reproduction displaying and other numerical apparatuses may be useful for the operational planning and asset allotment investigation of medicinal services executives.Another experimental discovery is additional proof of a negative connection between patient

satisfaction and hospital size . Pink et al.(2009) characterize this relationship as the substances of community in small town life. Patients may see the consideration increasingly close to them in small size medical hospitals. They additionally have lower desire in small medical hospitals. Then again, enormous size hospitals give increasingly convoluted medicines; in this manner, patients have a more noteworthy degree of desire than small size hospitals. In such manner, these practical realities substances represent a test for enormous size hospitals so as to live up to patients' desires

Chapter 5

FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Findings of the study

This chapter summarizes research findings, recommendation and conclusion of present research titled "A study on association of customer satisfaction and operational efficiency of tertiary hospitals of Punjab‖, The research findings are followed by conclusion and recommendation and it provide important aspects and feedback about three different objectives of research i.e. finding efficiency of hospitals under study, analyzing customer satisfaction of patients including respondents as their attendants and thirdly finding association between customer satisfaction and efficiency of hospitals. Slack values of hospitals also provide many insights for the hospital management to decrease or increase their inputs or to increase their size to reach target value and eradicate surplus input to optimally utilize resources.

5.1.1 Summary of Findings from objectives of study

Table 5.1: Compiled findings of study

	Finding Objective 1	Finding Objective 2	Findings Objective 3			Finding objective 4
Small size Hospitals	Small size hospitals are most efficient among all hospitals and average efficiency is (.80) .	Patients of small size hospitals are more satisfied among all and average efficiency is (.93).	Efficiency Exerts Negative Moderation Among Specialized doctors and Patient Satisfaction .Results in Table	Results show that more efficient hospitals decrease the positive effect of specialized doctors on patient satisfaction. In highly	Efficiency decreases positive effect of specialized doctors on patient satisfaction.	There are input slack found in almost 44 hospitals out of 48 hospitals under study which are working

Medium size Hospitals	Medium size hospitals are less efficient than Small size hospitals average efficiency is (.74) .	Patients of medium size hospitals are less satisfied than small size hospitals and average satisfaction is (.88).	suggested that higher level of efficiency level of hospitals lessen the positive effect of specialized doctors on patient satisfaction In this way, medical hospital productivity variable applies a negative control between accessibility of specialists and patient Satisfaction.	efficient hospitals result of specialized doctors on efficiency is less and non-Significant. While on less efficient hospitals comparatively there is stronger effect of specialized doctors on patient Satisfaction.		under either increasing and decreasing return to scale and four hospitals are merely working on constant return to scale and proper mix of inputs for achieving outputs.
Big size Hospitals	Big size hospitals are less efficient than small size and medium size hospitals and average efficiency is. (71).	patients of large hospitals are less satisfied than small and medium size hospitals and average satisfaction is .(85)				

5.1.2 Problem of estimating and analyzing the efficiency of hospitals

There are very few concepts available to evaluate efficiency of any business units like hospitals, Banks and others, Data envelopment analysis technique to evaluate efficiency of hospitals has been utilized by many researchers in European, American and mostly by Koreans to evaluate efficiency of their business units but In India, very few studies and practical implementation had been there in past, This present research has provide an insight to various concepts of efficiency evaluation.

If a hospital expands every input b y a similar extent. There are three potential situations:

(i) Their output increment by the expansion in inputs in same scale, which infers that there are consistent return to scale.
(ii) Its output(s) builds more than the increment in inputs, inferring increasing return to scale.
(iii) Its output(s) increments not exactly the increment in inputs, which suggests diminishing, return to scale.

As a general rule, a hospital can show consistent return to scale, expanding return to scale or diminishing return to scale depending for whether it is encountering economies of scale or diseconomies of scale. Constant return to scale happens in a circumstance where economies of scale are there, and where healthcare framework inputs (components of creation) are exactly distinguishable. The increasing return to scale demonstrates expansion in certain hospital inputs and expansion for healthcare workforce specialization as the scale/size of hospital increments (Washio, 2013). Diminishing return to scale can result when the big size hospital create communication difference between top executives and the healthcare workforce in divisions and wards, which lead to a decline in administrative efficiency. Diminishing return to scale could likewise happen due to over-usage of capacities and aptitudes.

The outcomes uncovered that all hospitals under study would result in:

• *Constant return to scale in 4 (8.33%*) medical hospitals, suggesting that their healthcare administration outputs would increment in a similar extent. This implies hospitals were working at their most gainful scale sizes.

• *Increasing return to scale in 23 (47.9%)* medical hospitals, suggesting that their healthcare administration outputs would increment by a more prominent extent. These medical hospitals subsequently expected to expand their size to accomplish ideal scale, for example, the scale at which there is steady return to scale in the connection among inputs and outputs.

• *Decreasing return to scale in 21(43.7%)* hospitals, inferring that their healthcare administration outputs would increment by a small extent. medical hospitals would have expected to decrease their size to accomplish ideal scale .

Activities to analyze the productivity of private hospitals done by utilizing DEA showed that there is wastefulness even in working of private medical hospitals. According to the evaluations of this research, just 29% of the medical hospitals are effective and around 71% of them are inefficient. Assets (inputs) are not used productively to deliver the most extreme output. Not many medical hospitals are completely efficient and are working on to increase productivity.

Our study demonstrate that however as far as effectiveness, most private hospitals are less efficient then public hospitals ,but the information of slack of hospital shows the area wherein they can improve; by limiting the wastage of assets (inputs) and acquire more efficiency .

Hospitals and healthcare service providers have three wide systems accessible to them for optimally utilizing wasteful assets:

(A) Expanding of network of healthcare administrations;
(b) Decreasing medical hospital inputs; and additionally
(c) Organization process and policy changes in hospitals.
Since the third technique is past the extent of the present study we will discuss in this chapter on the initial two systems

5.1.3Managerial Implication of Increasing Health coverage

Government of the country must plan policy to increase health coverage and network to all. Present research indicates that smaller hospitals have a higher level of efficiency than larger and medium-size hospitals, smaller size hospitals average efficiency is .80. The average efficiency of medium size hospitals is .75 and the large hospital is .73. As per our outcomes, small size medical hospitals are generally more efficient and have higher patient satisfaction as compared with other hospitals .It means Government must make a policy to implement

small scale hospitals and cover more area to cover rural area.This will be accomplished through a staged presentation of medical coverage scheme(s) that will be done by promotion and appropriate arranging of healthcare assets. Government must create prepaid and pooled healthcare financing to lessen over-dependence on out-of-pocket spending. (Wei et al. 1995). The presentation of such prepayment systems will no doubt diminish the financial boundaries to access to medicinal services, and henceforth, add to improving the productivity of hospital. This study was the first to check the level and determinants of hospital framework productivity in Punjab dependent on quantitative and subjective research. This study also recommends that huge healthcare enhancements could be made without extra spending and that a portion of the variables that could help efficiency gains incorporate on the strength of the population. Huge population still can be served with existing infrastructure if hospitals will use operational analytics.

Shortage of assets for healthcare is a well-recognized issue. The public segment of healthcare in India is lacking money related assets and lack of health professionals at all levels. In this circumstance, the effective usage of existing assets is essential for reinforcing the healthcare conveyance in the nation. The evaluation of the effectiveness of healthcare offices can help managers in guaranteeing the ideal usage of accessible assets.

Data envelopment investigation has developed as a successful and well-known technique for assessing the efficiency of basic units in various areas of healthcare division. There have been various study‘s on evaluating the efficiency of medical hospitals and general medicinal services framework by utilizing DEA in various settings (Weng et. al 1995.).Operational efficiency is the capacity to provide cost-effective and quality output from organization to the clients while maintaining the profit high. On account of medicinal services, this means hospitals and medical foundations having the option to give the best healthcare administrations to their patients while upgrading their operational expenses.

5.1.4 Competitive and internal benchmarking

Health care Industry can adopt Benchmarking scheme of their services with the best one in same filed to improve efficiency. The reason for benchmarking in medicinal services is to improve effectiveness, nature of care, understanding healthcare and patient satisfaction. The procedure includes adopting best practices and proof based practices and afterward

recognizing potential areas of progress. One our research findings reveal that ***in highly efficient hospitals or small size hospitals result of specialized doctors on satisfaction is less and non-significant. While on less efficient hospitals comparatively there is stronger effect of specialized doctors on patient satisfaction***.

But it is not easy to work with almost hundred percent efficiency but hospitals must need to maintain minimum benchmark. Applying Artificial intelligence to the hospital procedures takes into account prescription of doctors of hospital, and store data which is important to doctors and suppliers in database system and then analyze it ..Data envelopment analysis can be used as technique to get operational excellence and to get benchmarking .Basically when DEA will be applied organization will come to know about their return to scales and present efficiency. Slack value will provide proper value in inputs need to be achieve target value.

Competitive benchmarking varies from interior benchmarking. The previous happens when a hospital or healthcare framework analyzes works inside its association, taking a vision at every region and assessing how it satisfies the set guidelines and objectives. For example, if a medical hospital needs to improve hand washing and purifying practices to reduce contaminations, it might utilize inward benchmarking to assess current practices in every division, and afterwards set objectives for 100 per cent hand cleanliness consistency all through the hospital. Competitive benchmarking happens when one hospital checks down another hospital association's procedures or administrations and thinks about its objectives or results against its own.

DEA is a promising for benchmarking the two parts of execution: productivity and quality of tertiary hospitals. Since quality is a multidimensional the decision of a suitable composite quality measure must be tended to be implemented in future research. Be that joining quality into the DEA models would be a superior impression of the hospital usage of assets in near future.

5.1.5 Hospital Size and Efficiency

In the second stage study, we found that specialists have a positive effect on patient satisfaction in large size hospitals and small size hospitals also. But efficiency adversely directs the connection between specialists and patient satisfaction. Thus it implies that small size hospitals are more efficient then large size hospitals and doctor relation with satisfaction

is good unless or until efficiency will come into picture. This gives idea that expected changes in understanding patient satisfaction because of improving specialist‘s proportion may be affected by the degree of hospital efficiency if considered. Medical hospitals improving their specialist‘s numbers may likewise be working for improving their efficiencies with the end goal that they can take out waste and diminish their expenses. In this case the hospital and if doctors gives more emphasis on the efficiency issues so that the patients think effectiveness stands first , this may force a negative perception that could mitigate the quality of the connection among specialists and patient satisfaction.

This probability is exhibited in our research by regression effects of our study. So in case of present scenario in India small hospitals with more outreach must be planned instead of big hospitals and mobile pool of healthcare facilities to be started to reach to far off areas and check people affected.

5.2 Conclusion of study

5.2.1 Integrated approach of Quality, Efficiency and Accessibility of healthcare services.

As indicated by research outcomes and findings, small size hospitals are generally more efficient and have higher patient satisfaction as compared to other hospitals. Large size hospitals provide good caliber of care than their small and medium-size partners. But still patients are more satisfied with small size hospitals might be reason is more expectation of patients from large size hospitals than from small size hospitals where patients have less expectation. Small size hospitals are more efficient and patients are more satisfied in this as already discussed might be both hospitals have different mission and vision. Presently medical hospital administration has a decision they can decide to overlook efficiencies also and simply focus on accomplishing highest caliber of care. Now an ideal arrangement may be "ideal and optimal care." As Donebedian designated, "ideal consideration" could be accomplished by considering a "balance" between efficiency and quality. Present Situation of year 2020 when coronavirus COVID-19 infected whole world started from Wuhan, China ,Punjab region in India is also facing lots of cases as this region is more infiltrated with NRI‘s,now in this case efficiency consideration is must ,Punjab government is taking steps to

start small mobile hospitals for testing and treating people and also they starting improving small hospitals to increase their outreach for healthcare services which is exactly one of the finding of our study .For our situation, large size hospitals in Punjab may consider ideal consideration all together to improve both productivity and quality and benchmark their services . Medical hospital likewise concentrates on the reasons for low patient satisfaction coming because of the effectiveness before reconfiguring their entire hospital structure.

Another finding of this research is that in larger size hospitals effect of specialized doctors on efficiency is significant and as compared to small size hospitals .Small size hospitals are more efficient and efficiency act as negative moderator to relation between specialized doctors and satisfaction. This study provide us information that specialized doctors effect in small size hospitals are less and non-significant. Presently medical hospital administration has a decision they can decide to overlook efficiencies also and simply focus on accomplishing highest caliber of care.

Large size medical hospitals will in general increment their physical, innovative and medicinal work limit in request to meet the dynamic needs which may increase or decrease time to time which is alignment to TQM concept of management. Nature of care may fundamentally increment in parallel with the addition of these limits as large size medical hospitals are not performing just as small and medium-size medical hospitals regarding scale effectiveness. In this manner, these medical hospitals don't work at ideal scale size. As Pink et al. (2009) proposed, large size hospitals may shape smaller patient consideration units inside their association. Along these lines, huge size medical hospitals not just kill the negative impact of their non-ideal scale size, yet also they structure explicit treatment units for patients. Then again, low specialized efficiency of large size medical hospitals could be mostly clarified by the results of study.

In the second stage study, study explained that specialists in hospital have positive and size of hospital have negative impact on patient satisfaction. Toward the end, hospital improving their quality may be working for improving their efficiencies with the goal that they can take out inefficiency and reduction in their costs. In case the hospital gives more highlight on the efficiency issues in such a way, that the patients think it comes first, this may compel a negative perception that could facilitate the nature of the association between fundamental quality and satisfaction. This thing is to some degree showed in our study by moderating

variable. Large size medical facilities could improve both efficiency and essential quality. In such way, that capability and quality could be improved at the same time for large size medicinal facilities, as appeared by TQM approach. In reality, small size hospitals may improve not simply quality, yet additionally process for growing quality efficiency tradeoff. Another precise finding is extra evidence of a negative association between getting satisfaction and medical hospital size. Patients want the healthcare increasingly close to home in small size hospitals. They likewise have a lower desire and expectation in small hospitals. But large size hospitals give increasingly new and modern medications; consequently, patients have a more degree of desire than small size hospital. In this respect, these common assumptions represent a test for large size hospitals to meet patients' expectation. For situation in big size hospitals in Punjab, Hospitals may embrace, on a basic level, the ideal consideration all together to improve both efficiency and quality. Hospital doctors must concentrate on the basic reasons for low patient satisfaction coming about because of the efficiency before reconfiguring their entire consideration structure. Particularly, small and medium-size hospitals could perform the quantitative models, for example, operational planning for doctors as applied by large size medical hospitals

. As Sulu and Caner (2009) demonstrated, these sorts of healthcare estimations additionally require thorough assessment among expenses of hospitals. The utilization of linear programming and other scientific instruments may be useful for the operational booking and asset assignment of medicinal services. This study is having some limitation i.e. financial methodology and allocate efficiency were not analyzed in this study due to the missing information about cost. The connections between quality and monetary productivity may be studied in further research most importantly, regardless of all things considered, this research can be considered as a first endeavor toward looking at the connections between quality, productivity and patient satisfaction in the medicinal services division of developing nations. In the present circumstance, there is a decrease in the assets of healthcare yet an expansion in the human services requests continuously increasing because of developing population. It is, suggested that reasons for the inefficient aspects in the private hospitals must be checked and essential efficiency measures are organized to expand the administration's endeavors to address the healthcare of the individuals.

5.2.2 Inefficiency and slack Monitoring

Slack value is a value which can be added in inequality constraint to change into equality .The organization through decentralized set-up and through the small zone level authorities screens these associations and study slack of every hospital. The activity of government is essential in ensuring that finding of slack are used effectively. This will require making execution based pointers to screen the slack in input of hospitals and plan accordingly. This approach of data envelopment analysis can be used to measure inefficiency in hospital and to find out input slack of hospitals and provides proper insights to management to particularly work on which area. In this research also many slacks are identified in each hospital infrastructure use which can be regulated to other paces if it is surplus. Moreover when any organization is big then management must ensure efficiency consideration.

The efficiency of Process consolidates the arranging and operational practices that essentially diminish the negative effect on patient satisfaction in healthcare offices. The investigation provides information to bring about better circumstances and logical results. The Ministry of Health and Family Welfare (MoHFW) want to improve the productivity in asset assignment bysetting asset mix procedure of healthcare and socioeconomics pointers (e.g., population thickness, destitution, bed inhabitance proportion). The equation can be planned by gaining from the information in the more productive hospitals. The MoHFW should lead this sort of benchmarking study normally to evaluate the efficiency level of healthcare service providers.

5.2.3 Cost and Efficiency

Another example in healthcare services is the rising of "healthcare industrialism‖, i.e Healthcare facilities and information available through web, mobile apps for providing information to patients and as well as medical history information of patients for doctors .Basically utilizing and recording data of patients will initially increase cost of administration but in long run it will help policy makers to utilize this data and to operational schedule activities. Moreover medical hospitals consistently face an issue of choosing what number of staff individuals to distribute during a timeframe. On the off chance that there is over-staffing, it will bring about high work cost. If there should be an occurrence of under-staffing, patient satisfaction will be influenced, which can prompt deadly results. DEA data envelopment analysis can be applied in organization to solve proper staffing problem

Regardless of the way that it transforms into a power for specialists and patients both those have need for logically medical information and are getting information by methods from the web and mobile which actually increasing efficiency of system. Prescription and systems are accessible over internet. One approach to use the data that EMR gives regarding the client and use it for utilizing to make contributions to plan administrations. Medicinal services associations must discover approaches with which information technology must turn into a vital weapon as opposed to only an efficiency improving device for human services associations to reduce the wastage of assets.

This study worked upon one of very ordinary talks in the healthcare world: "By what means may we decrease costs in the medicinal services, while improving the idea of care and access to administrations?‖ Until years, most analysts consider evaluating efficiency of healthcare facilities have not considered operational course of action.

By thinking about these associations, administration endeavor to offer a better strategy to settle on Operational decisions in healthcare facilities. This study exhibits and abridges an investigation that endeavored to discover answers to a portion of the significant inquiries raised, both in the scholarly world also, in the healthcare world, with respect to hospital productivity and administration quality.

5.3 Recommendations

5.3.1 Data Envelopment Analysis for productive administration

Information can significantly affect hospital administration. There are various methods through which information can be utilized to accomplish operational effectiveness. As discussed earlier also medical hospitals consistently face an issue of choosing what number of staff individuals to distribute during a timeframe. If there is over-staffing, it will bring about high work cost. If there should be an occurrence of under-staffing, patient satisfaction will be influenced, which can prompt deadly results. DEA data envelopment analysis can be applied in organization to solve proper staffing problem. Utilizing information to examine staff distribution can prompt operational productivity. Information on patient volume can be recorded and medical hospital staff can be suitably designated dependent on the equivalent. The information can likewise be utilized for staffing for working room (OR) nursing staff. Or

on the other hand, doctors can utilize the information to assess the appearance time of nursing staff for tasks. Information can likewise be utilized to follow patient holding up time and meeting time, for example, the measure of time which specialists take in meeting patients and offering them medicinal guidance. If the information shows that patients are sitting for more time, at that point explicit estimates, for example, expanding staff individuals who can help doctor, growing better-lining frameworks by investigating exemptions in arrangement calendar and opening vis- - vis conference time can be executed. To diminish long discussion time, specialists can utilize innovative arrangements, for example, arrangement planning, Electronic Health Records (EHR), electronic remedy composing devices and so forth. All these assistance to design well and use doctor's time viably.

5.3.2 Make independent small units in Big Hospitals

Present research demonstrates that smaller medical hospitals have a more significant level of effectiveness than bigger and medium-size emergency hospitals as appeared in above table smaller size hospitals normal efficiency is .80. The normal efficiency of medium size medical hospitals is .75 and the huge emergency hospital is .73. The key clarification of this finding might be the different objective of small and huge size hospital emergency hospitals. The objective of small, medium and big size hospitals are different as some concentrate more on care nut our main objective is find out that minimum benchmark must be maintained. Big size hospitals will in general increment their physical, innovative and medicinal work limit in request to meet the assortment needs of far-reaching care form.

5.3.3 Small scale Hospital must benchmark quality of care and efficiency

Benchmarking is of different types internal benchmarking and external benchmarking as in our research it is evaluated that small scale hospitals concentrate more on hospital efficiency and patients are also satisfied but impact of specialized doctors on patients are less and non-significant.so small scale hospitals should not concentrate on efficiency only so that patients think efficiency comes first which will further lead to more dissatisfaction among patient and they must work on quality of care . **One our research findings reveal that *in highly efficient hospitals result of specialized doctors on satisfaction is less and non-significant. While on less efficient hospitals comparatively there is stronger effect of specialized***

doctors on patient satisfaction. So it is not easy to work with hundred percent efficiency but hospitals must need to maintain minimum benchmark. Basically when DEA will be applied organization will come to know about their return to scales and present efficiency. Slack value will provide proper value in inputs need to be achieve target value. Medical hospitals can redistribute backup administrations like patient nourishment, clothing, housekeeping and office the executives. This will assist them with focusing on their center aptitude which is human services administrations..

5.3.4 Use of Electronic health records

The EMR improves associations between specialists and their patients. Basically utilizing and recording data of patients will initially increase cost of administration but in long run it will help policy makers to utilize this data and operational schedule activities of hospital . Moreover medical hospitals consistently face an issue of choosing what number of staff individuals to distribute during a timeframe. On the off chance that there is over-staffing, it will bring about high work cost. If there should be an occurrence of under-staffing, patient satisfaction will be influenced, which can prompt deadly results. DEA data envelopment analysis can be applied in organization to solve proper staffing problem Prescription and systems are accessible over internet.

Electronic healthcare records improve correspondence with patients utilizing messages and individual prosperity records, which even more effectively associate with patients inmanaging their own thought. On the off chance that electronic healthcare record is kept up it will assist emergency hospitals with evaluating efficiency effectively utilizing DEA

Electronic healthcare records have been shown to improve efficiencies in work process through lessening the time required to meet doctor, improving access to complete patient information, overseeing solutions, improving the booking of patient arrangements, and giving remote access to patients' graph

5.3.5 Include new administrations and increase healthcare network in far areas through small hospitals.

Hospital must extend their activities from their normal in-patient and OPD administrations. This will bring about expanded patient volume and benefits. A few instances of extra administrations incorporate yearly healthcare check programs for corporate representatives, the foundation of disease and way of life changes conferences,. Hospitals can likewise get into the matter of home medicinal services administrations, vitals stands at shopping centers, air terminals, virtual meetings and telemedicine, versatile healthcare benefits in remote areas and so on. In any case, medical foundations must direct investigation on productivity and rate of profitability (ROI) concerning any new administrations. This will empower them to give quality and reasonable human services conveyance.

Certain significant approach suggestions got from our study can be given as under that no appropriate physical benchmarks are as of now pursued by the private medical hospitals. Accordingly, in numerous hospitals, there is a wasteful use of information sources. Results got by utilizing DEA for estimating effectiveness not just assists healthcare with approach to respond to the inquiry' How well are the hospital doing' yet also 'how much and in what areas they can improve?' It proposes execution targets. Furthermore, it distinguishes the hospitals which are performing best and their working practices would then be able to be analyzed to build up a manual for "best practice" for other wasteful medical hospitals to copy. The potential advantages of duplicating this in different areas of Punjab and without a doubt in different states can't be over-stressed. .

5.3.6 Healthcare operations management

Healthcare operations management is urgent for the effective working of healthcare administrations, particularly when medicinal services segment is experiencing a lot of changes. Operations management enables medical hospitals and healthcare frameworks to comprehend and improve work profitability, lessen holding up lines, abbreviate process durations, and by and large improve the patient's general understanding—all of which improves the associations. The expense of medicinal services conveyance grows up because we don't suitably apply activities in operational frameworks. But then, we increase cost, and

the nature of care is influenced. A sound hospital activities board plan and its productive execution can assist us with overseeing both waste and inadmissible nature of care.One of the most significant regions of the focus for medical hospital administration is cost control. The present medicinal services framework is reliant on mechanical and crisis based treatment, which is regularly costly and forces patients to incur huge costs. Cost control likewise influences the levels and nature of administrations gave to patients. Coordination with the medical staff and the patients is one other significant occupation that hospital board has to do. We can't deny treatment, nor would we be able to grow at our will; the most effective approach to deal with the circumstance is organizing hospital assets efficiently.

5.3.7 Healthcare informatics

Healthcare informatics (likewise called medicinal services informatics, human services informatics,) is data collection applied to the field of health services including patient medicinal visit data. It is a multidisciplinary field that usages patient information development to improve healthcare administrations by methods of increasing higher profitability (nudging lower cost and therefore progressively availability). This included consolidating information science, programming building, humanism, direct science, board science, and others. The United States National Library of Medicine (NLM) describes patient informatics as "the interdisciplinary study of the structure, improvement, assignment and use of IT-based progressions in social protection organizations movement, the officials and planning

5.4 Future Scope of study

This study provide the idea about how to evaluate efficiency of tertiary hospitals and a model with which efficiency of tertiary hospitals can be associated with patient satisfaction .This study can be extended to even small hospitals and super specialty hospitals to evaluate efficiency .This methodology can act as tool to benchmark efficiency for hospital authorities for best in that area. The technique utilized right now i.e. Data envelopment analysis to distinguish the hospitals on basis of efficiency, which can improve their administration. In past the checking and assessment of these foundations have stayed a significant issue. The

administration through decentralized set-up and through the area level healthcare specialists can screen these foundations. The job of government is very basic in guaranteeing that hospital infrastructure is utilized optimally. This will require creating execution based pointers to screen these awards using data envelopment analysis. The procedure recommended right now help healthcare agencies to recognize moderately less efficient medical hospitals. The methodology suggested in this research can be used by the Department of Health and Family Welfare to develop benchmarks for monitoring and evaluating the performance of both public and private hospitals. Based on the findings the steps can be initiated to improve the efficiency of resource use in hospitals.. DEA can be applied to compare hospital performance after Electronic Medical record system implementation

REFERENCES

Aggarwal, R. K. & Bansal, S. (2012) Health in Punjab: A Mid-Term Appraisal of XIth Five Year Plan', *Guru Nanak Journal of Sociology*, 33 (2): 85-112.

Afemikhe, J.A. (2011) Health Care Provision and Patients Satisfaction with Tertiary Health Facilities in Benin City, Nigeria', *Journal of Health Management*, 13(2):141-154.

Ali, A. I. (1993) Streamlined computation for data envelopment analysis.' ,*European Journal of Operational Research*, 64(1): 61-67.

Ali, A. I. (1994) Computational aspects of DEA. Data Envelopment Analysis: Theory, Methodology and Applications', *Kluwer Academic Publishers*, 34(2):63-88.

Ali, A. I. (1995) Components of efficiency evaluation in data envelopment analysis', *European Journal of Operational Research*, 80(3): 462-473.

Andersen, P. & Petersen, N.C. (2017) A procedure for ranking efficient units in data envelopment analysis', *Management Science*, 39(10):1261-1264.

Anderson, E.W., Fornell, C. & Rust, R.T. (1997) Customer satisfaction, productivity, and profitability: Differences between goods and services', *Marketing Science*, 16: 129-145.

Andaleeb, S. S. (2018) Service Quality in Public and Private Hospitals in Urban Bangladesh', *A Comparative Study. Health Policy*, 53 (1): 25-37.

Arah, O. (2018) A conceptual framework for the OECD health care quality indicators project', *International Journal of Quality Health Care*, 18: 5-13.

Athanassopoulos, A. & Gounaris, C.(2001) Assessing the technical and allocative efficiency of hospital operations in Greece and its resource allocation implications', *European Journal of Operational Research,*133:419–31.

Banker, R. D. (1984) Estimating most productive scale size using data envelopment analysis', *European Journal of Operational Research,* 17(1):35-44.

Banker, R. D. (1993) Maximum likelihood, consistency and data envelopment analysis: a statistical foundation', *Management Science journal*, 39(10):1265-1273.

Banker, R. D. & Morey, R. C. (1986) Efficiency analysis for exogenously fixed inputs and outputs.', *Operations Research journal*, 34(4): 513-21.

.Banker, R. D. & Morey, R. C. (1986) The use of categorical variables in data envelopment analysis.' ,*Management Science journal*, 32(12):1613-27.

Banker, R. D. & Thrall, R. M.(1992) Estimation of returns to scale using data envelopment analysis.', *European Journal of Operational Research* ,62(1),74-84.

Banker, R.D., Charnes, A. & Cooper, W. W. (1984) Some models for estimating technical and scale inefficiencies in data envelopment analysis', *Management Science*,30: 1078-1092.

Barr, R. S. & Seiford, L. M. (1992) An envelopment-analysis approach to measuring the managerial efficiency of banks', *European Journal of Operational Research* ,62(4):64-79

Bajpai, V. (2014) The Challenges Confronting Public Hospitals in India, Their Origins, and Possible Solutions,[Online] Available at https://www.hindawi.com/journals/aph/2014/898502/ [Accessed 16 june,2017]

Bessent, A. & Bessent. W. (1988) Efficiency frontier determination by constrained facet analysis.', *Operations Research* 36(5):785-96.

Bhat, T.P. (2015) Trade in Healthcare Services‘, *Institute for Studies in Industrial Development,ISID180.*

Bhadra, K. K. & Bhadra, J. (2012) Public Expenditure on Health across States in India: An Evaluation on Selected Issues and Evidences‘, *IJRFM (International Journal of Research in Finance & Marketing,* 2 (6): 25-39.

Bjurek, H.& Hjalmmarsson, L. (1990) Deterministic parametric and nonparametric estimation of efficiency in service production: a comparison.‘ *Journal of Econometrics,* 46:213-227.

Blank, J.L.T. & Valdmanis, V.G. (2019) Environmental factors and productivity on Dutch hospitals: a semi-parametric approach‘. *Health Care Management Science*; 13:27–34.

Boussofiane, A. & Dyson , R. G. (1991) Applied data envelopment analysis.‘ *European Journal of Operational Research, 52*(1): 1-15.

Bowlin, W. F.& Charnes, A. (1985) Data envelopment analysis and regression approaches to efficiency estimation and evaluation‘, *Annals of Operations Research.* 2: 113-138.

Butler, T.W. & Li, L. (2005) The utility of returns to scale in DEA programming: an analysis of Michigan rural hospitals‘, *European Journal of Operational Research,* 161:469–77.

Caves, D. L., Christensen, E. & Diewert, H. (1982) The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity.‘ *Econometrica,* 50(6):1393-1414.

Charnes, A. & Cooper, W.W. (1985) Preface to topics in data envelopment analysis‘, *Annals of Operations Research,* 2:59–94.

Charnes, A., Cooper, W.W. & Rhodes, E. (1978) Measuring the efficiency of decision making units‘, European Journal of Operational Research, vol. 2: 429–44. .

Charnes, A. Rhodes, & Cooper, W. W. (1985) Foundations of data envelopment analysis for Pareto-Koopmans efficient empirical production functions‘, *Journal of Econometrics,* 30(2): 91-107.

Charnes, A. W. & Cooper, W. (1985) Sensitivity and stability analysis in DEA‘, *Annals of Operations Research. R. Thompson and R. M. Thrall,* 2: 139-156.

Charnes, A. & Cooper, W. W. (1986) Classifying and characterizing efficiencies and inefficiencies in data development analysis.‘, *Operational research journal (Netherlands),* 5(3):105-10.

Chilingerian, J. A. & Sherman H. D. (1990) Managing physician efficiency and effectiveness in providing hospital services‘, Health Services Management Resources, 3(1): 3–15.

Chirikos, T.N. & Sear A.M. (1994) Technical Efficiency and the competitive behavior of Hospitals‘, *Socio-Economic Planning and Science*, 28(4):219-227

Cinaroglu, S. (2014) Patients perception of reputation and image – Private and Public hospitals‘. *African Journal of Marketing Management,* 6(2): 12-16

Chen, A., Hwang, Y. & Shao, B. (2015) Measurement and sources of overall and inputinefficiencies: Evidences and implications in hospital services‘, *European journal OperationalResearch* , 161: 447-468

.

Chalos, P. & Cherian, J. (1995) An application of data envelopment analysis to public sector performance measurement and accountability.', *Journal of Accounting & Public Policy* ,14(2): 143-160.

Chang, K.P.& Guh, Y.(1991) Linear production functions and the data envelopment analysis.', *European Journal of Operational Research*, 52(2): 215-23.

Chang, S.J., Hsiao, H.C., Huang, L.H., & Chang, H. (2011) Taiwan quality indicator project and hospital productivity report', *Omega* ,39:14–22.

Cook, W. D. & Kress, M. (1990) A data envelopment model for aggregating preference rankings.', *Management Science*, 36(11):1302-10.

Mariagrazia, D.(2015) Data envelopment analysis approach for supplier selection under uncertainty'. *International Transactions in Operational Research*, 23(4):725-748.

Desai, A. & Walters, L. C.(1991) Graphical presentations of data envelopment analyses: management implications from parallel axes representations.' *Decision Sciences*, 22(2), 335-53.

Doyle, J. & Green, R. (1994) Efficiency and cross-efficiency in DEA: derivations, meanings and uses.', *Journal of the Operations Research Society*, 45:567-578.

Donabedian, A.(1997) The quality of care: how can it be assessed', *Archives of Pathology and Laboratory Medicine* ,121:1145–50.

.Doyle, J. & Green, R.(1993) Data envelopment analysis and multiple criteria decision making.' ,*OMEGA International Journal of Management Science*, 21(6):713- 715.

Doyle, J. & Green R. (1994) Efficiency and cross-efficiency in DEA: derivations, meaningsand uses', *Journal of the Operational Research Society* ,45(5): 567-578.

Donabedian, A. (2005) Evaluating the quality of medical care', *Milbank Quarterly*, 83,691–729.

Durchholz, M. & Barr, R. (1995) Parallel and hierarchical decomposition approaches for solving large-scale data envelopment analysis models.‘ *Annals of Operations Research,* 40(5): 566-578.

Du, J., Cook, W.D., Liang, L. & Zhu, J. (2014) Fixed cost and resource allocation based on DEA cross-efficiency‘, *European Journal of Operational Research*, 235(1): 206-214.

Duraisamy, D. and Mahal, N. (2005) Financing and Delivery of Health Care Services in India‘ *Background Papers of the National Commission on Macroeconomics and Health.*

Dyson, R.G.,Thanassoulis, E. & Boussofiane, A. (1995) A DEA (data envelopment analysis) tutorial, [Online] : http://deazone.com/en/boussofiane-a-rg-dyson [Accessed 16 january,2017]

.

Eakins, B.K. (1991) Allocative Inefficiency in the Production of Hospital Services‘, Southern Economic Journal, 58: 240-248.

El-Mahgary, S. & Lahdelma, R.(1995)Data envelopment analysis: Visualizing the results.‘ *European Journal of Operational Research*, 83(3):700-710.

Emrouznejad, A. (2014) Advances in data envelopment analysis‘, *Annals of OperationsResearch*, 214(1): 1-4.

`

Fare, R. & Grosskopf, S. (1995) Productivity and quality changes in Swedish pharmacies; Comments on Productivity and quality changes in Swedish pharmacies; Reply.‘ *International Journal of Production Economics*, 39(2): 137-147.

Färe, R., Grosskopf, S.& Roos, P. (1992) Productivity in Swedish Hospitals: A Malmquist Output Index Approach‘ , *Journal of Productivity Analysis* ,3: 85-101

Finkler, M. D. & Wirtschafter, D. D. (1993) Cost-effectiveness and data envelopment analysis.', *Health Care Management Review* ,18(3):81-88.

Feldstein, M. (1963) Operational research and efficiency in the health service', *The Lancet,* 28(1): 491-493.

Frank, R. G. (1988) On making the illustration illustrative: a comment on Banker, Conrad, and Strauss', *Management Science*, 34(8): 1026-1029.

Fried, H. O.(1993) Measurement of Productive Efficiency. New York, Oxford University Press.

Fried, H.O., Lovell, C.K., Schmidt, S.S., & Yaisawarng, S. (2002) Accounting for environmental effects and statistical noise in data envelopment analysis', *Journal of Production Anal*,17: 157-174.

Ghuman, B. S. & Mehta, A. (2006) Health Care for the Poor in India with Special Reference to Punjab State', *Network of Asia-Pacific Schools and Institutes of Public Administration and Governance Annual Conference,* 1-11.

Ghosh, S.(2010) Catastrophic Payments and Impoverishment Due to out-of-Pocket Health Spending: The Effects of Recent Health Sector Reforms in India *Asia Health Policy Program book*

Gill, S. S., Singh, D. S. and Brar, J. S. (2010) Globalization and Indian State: Education, Health, and Agricultural Extension Services in Punjab. Aakash Books, Delhi.

Golany, B. (1988) A note on including ordinal relations among multipliers in data envelopment analysis.*' Management Science* 34(8):1029-33.

Golany, B. (1988) An interactive MOLP procedure for the extension of DEA to effectiveness analysis.' *Journal of the Operational Research Society*, 39(8):725-34.

Golany, B. & Tamir, E. (1995) Evaluating efficiency-effectiveness-equality tradeoffs: a data envelopment analysis approach.‘,*Management Science* ,41(7):1172-84.

Golany, B. & Roll, Y.(1989) An application procedure for DEA.*’ Omega*, 17(3):237-50.

Golany, B., & Phillips, F. Y.(1993) Models for improved effectiveness based on DEA efficiency results.‘ *IIE Transactions ,25*(6): 2-10.

.Goldar, B N. (1986) Productivity Growth in Indian Industry Allied Publishers, Delhi.

Gok, S.M., & Sezen, B.(2016) Data Envelopment Analysis for Relative Efficiency‘[Online]. *Service Industries Journal,* http://www.scholink.org/ojs/index.php/rhs/index. [Accessed 11 December 2017].

Grönroos, C. (1984) A service quality model and its marketing implications‘, *European journal of Marketing* , 18:36-44.

Grosskopf, S., Margaritis, D. & Valdmanis, V.(2004) Competitive effects on teaching hospitals‘,European Journal of Operation Research, 154: 515-525.

Grogan, S., Conner, M., Willits, D.& Norman, P.(1995) Development of a questionnaire to measure patients' satisfaction with general practitioners' services‘, *British Journal of General Practice*, 45:525-529.

Green, R. & Doyle, J. (1996) Improving discernment in DEA using profiling: A comment‘.*Omega*, 24: 365-366.

Gupta, V. (2000) World Bank Funded Punjab Health Systems Corporation Hospitals Improved Services or Abetting Deaths report.

Hair, Jr J.F., Black, W.C., Babin, B.J. & Anderson, R.E.(2010) Multivariate data analysis, 7th ed., Global Edition New Jersey: Pearson Education Inc.

Hadji, B., Meyer, R., Melikeche, S., Escalon, S. & Degoulet, P. (2014) Assessing the relationships between hospital resources and activities: A systematic review‘. *J Med Sys*, 38:1-21.

Harrison, J.P., Lambiase, L.R., & Zhao, M .(2010) Organizational factors associated with quality of care in US teaching hospitals.‘, *Journal of Health Care*, 36: 1-12.

Hall, M., Mark, C., Elliott, Kevin, M. & Stiles, Gerald, W. (1993). Hospital Patient Satisfaction‘. *Journal of Hospital Marketing’,* 7(2): 77-90.

Haddad, S., Fournier, P. & Potvin, L.(1998) Measuring lay people's perceptions of the quality of primary health care services in developing countries. Validation of a 20- item scale‘. *International journal for Quality in Health Care*, 10(2): 93-104.

Hazarika, I. (2013) Health Workforce in India: Assessment of Availability, Production and Distribution‘. *WHO South-East Asia Journal of Public Healt*h, 2 (2): 106-110

Hollingsworth, B.(2018) The measurement of efficiency and productivity of health care delivery‘, *Health Economics*,11:1107–28.

Huang, Y.-G. L. & McLaughlin, C. P. (2014) Relative efficiency in rural primary health care: an application of data envelopment analysis.‘ *HSR: Health Services Research*, 24(2): 143-158.

Hussey, P.S., De, V.H., Romley, J., Wang, M.C., & Chen, S.S.(2019), Systematic review of health care efficiency measures‘. *Health Services Research* , 44: 784-805

Isaac T, Zaslavsky, A.M, Cleary, P.D., & Landon, B.E. (2010) The relationship between patients perception of care and measures of hospital quality and safety‘. Heal Serv Res , 45: 1024-1040.

Institute of Medicine (2004) Insuring America‘s health: Principles and recommendations‘. *Academy Emerging Medicine*, 11: 418-422.

Jeong, B.H. & Ok, C.S. (2013)A new ranking approach with a modified cross efficiency matrix‘. *Asia-Pacific Journal of Operational Research*, 30:1-17.

Jha, A.K., Li, Z., Orav, E.J., &Epstein, A.M.(2005) Care in US Hospitals: The Hospital Quality Alliance Program‘, *England Journal of Medicine* ,35(3): 265-274.

Katharaki, M.(2008) Approaching the management of hospital units with an operation research technique: the case of 32 Greek obstetric and gynaecology public units‘, *Health Policy* ,85:19– 31.

.Kaplan, R.S. & Porter, M.E.(2011) How to solve the cost crisis in health care‘. *Harvard Business Review* ,89:46-64.

Kazley, A.S. & Ozcan, Y.A.(2009) Electronic medical record use and efficiency: a DEA and window analysis of hospitals‘, *Socio-Economic Planning Sciences*, 43:209–16.

Kamakura, W. A.(2018) A note on ‗the use of categorical variables in data envelopment analysis‘, *Management Science* ,34(10): 1273-6.

Kao, C. (1994). Efficiency improvement in data envelopment analysis‘ *European Journal of Operational Research,* 73(3):487-494.

Kaur, S., Sharma, R., Talwar, R., Verma, A., & Singh, S. (2009) A study of Job Satisfaction and Work Environment perception among doctors in a Tertiary Hospital in Delhi‘. *Indian Journal of Medical Sciences,* 63(4): 139-144

Kelley, E., & Hurst, J. (2006) Health Care Quality Indicators Project Conceptual Framework Paper. *In: OECD Health Working Papers*

Kirigia, J.M., Emrouznejad, A., Cassoma, B., Asbu, E.Z., & Barry, S.(2008) A performance assessment method for hospitals: the case of municipal hospital in Angola‘. *Journal of Medical Systems*; 32,509–19.

Kitapci, O., Akdogan, C., & Dortyol, I.T. (2014). The Impact of Service Quality Dimensions on Patient Satisfaction, Repurchase Intentions and Word-of-Mouth Communication in the Public Healthcare Industry‘, *Procedia - Social and Behavioral Sciences,* 148 , 161 -169.

Kumar, A. & Gupta, S. (2012) Health Infrastructure in India: Critical Analysis of Policy Gaps in the Indian Healthcare Delivery. *Vivekanand International Foundation*, New Delhi.

Kohn, L.T, Corrigan JM,& Donaldson MS. (2000) To err is human: Building a Safer Health System. A report of the Committee on Quality of Health Care in America. Washington, DC: *Institute of Medicine. National Academies Press.*

Kupersmith, J.(2015) Quality of care in teaching hospitals ,A literature review‘, *Academic Medicine* 80: 458-466

.

Norman, M. & Stoker B. (1991). Data Envelopment Analysis: The Assessment of Performance, John Wiley and Sons Ltd.

Nunamaker, T. (1988) Using data envelopment analysis to measure the efficiency of non-profit organizations: a critical evaluation‘ - reply.‘ *Managerial and Decision Economics,* 9(3): 255-256.

Nunamaker, T. R. & Lewin, A. Y.(1983)Measuring routine nursing service efficiency: A comparison of cost per patient day and data envelopment analysis models/comment.' *Health Services Research* , 18(2):183-208.

Langabeer, J.R. (2008) Health care operations management: a quantitative approach to business and logistics Massachusetts: Jones and Bartlett Publishers.

LeeK, H., Yang, S.B. & Choi, M.(2019) The association between hospital ownership and technical efficiency in a managed care environment', *Journal of Medical Systems* ,33:307–

Lewin, A. Y. (1983) Comments on _measuring routine nursing service efficiency: a comparison of cost per patient day and data envelopment analysis'. *Health Services Research* 18(2), 206-208.

Lim, S., Oh, K.W. & Zhu, J.(2014) Use of DEA cross-efficiency evaluation in portfolio selection: An application to Korean stock market', *European Journal of Operational Research,* 236:361-368.

Liu, J. S., Lu, L. Y., Lu &W. M.(2016) Research fronts in data envelopment analyses'. *Omega*, 58:33-45.

Li, L., & Benton, W.C .(2003) Hospital Capacity Management Decisions: Emphasis on Cost Control and Quality Enhancement, *European Journal of Operational Research* ,146 :596-614

Lovell. C.A.K .(1993) Production frontiers and productive efficiency. The measurement of productive efficiency: techniques and applications. *Oxford: University Press.*

Lovell, H.O., Lovell, C.A.K. & Schmidt, S.S.(1993) The Measurement of Productive Efficiency, *Oxford University Press, New York.*

Lynch, J. R. & Ozca, Y. A. (1994) Hospital closure: An efficiency analysis.‘ *Hospital & Health Services Administration*, 39(2):205-220.

Mahdiloo, M ., Saen, R. F. & Lee, K. H. (2015) Technical, environmental and eco-efficiency measurement for supplier selection: An extension and application of data envelopment analyses. *International Journal of Production Economics*, 168:279-289.

Marley, K.A., Collier, D.A., & Meyer, G.S. (2004) The role of Hospital and process quality in achieving patient satisfaction in hospitals. *Decision Sciences*, 35,349-369.

McDonald J. (2009)Using least squares and to bit in second stage DEA efficiency analyses. *European Journal of Operation Research*, 197: 792-798.

Mehmet Sahin Gok & Bulent Sezen(2013)Analyzing the ambiguous relationship between efficiency, quality and patient satisfaction in healthcare services: The case of public hospitals in Turkey,*Health policy,111:290-300*

Nayar, P. & Ozcan, Y.A. (2008) Data envelopment analysis comparison of hospital efficiency and quality‘, *Journal of Medical System* ,32:193-199

Narang, T.(2016) Leprosy-Evolution of the Path to Eradication‘. *The Indian Journal of Medical Research*, 137 (1):15-35

Nuti, S., Daraio, C., Speroni, C. & Vainieri, M. (2011) Relationship between technical efficiency and the quality and costs of health care in Italy‘. *International Journal for Quality in Health Care*; 23(2):324–30.

Nongkynrih, Patro, B.K., Pandav, C.S. (2004) Current status of communicable and non-communicable diseases in *India’, journal Assoc Physicians India.* , 39:118-23.

Oral, M., Amin & G.R. Oukil, A. (2015) Cross-Efficiency in DEA: A Maximum Resonated Appreciative Model. Measurement', 63: 159–167.

Oral, M., Kettani, O.& Lang, P. (1991) A methodology for collective evaluation and selection of industrial R&D projects'. Management Science, 37:871–885.

Oral, M., Oukil, A., Malouin, J.-L. & Kettani, O. (2014) The appreciative democratic voice of DEA: A case of faculty academic performance evaluation'. *Socio-Economic Planning Sciences, 48:20-25.*

OECD .Reviews of Health Systems Turkey.(2008) OECD and the International Bank for Reconstruction and Development/The World Bank. Report

Olesen, O. B. (1995). Some unsolved problems in data envelopment analysis: A survey.' *International Journal of Production Economics* , 39(12): 5-36.

O'Neill, L., Rauner, M., Heidenberger, K. & Kraus, M. (2008) A cross-national comparison and taxonomy of DEA-based hospital efficiency studies', *Soc-Eco Plan Sci*, 42: 158-189.

Oukil, A. (2018) Ranking via Composite Weighting Schemes under a DEA cross-evaluation framework.', *Computers & Industrial Engineering,* 117: 217-224.

Oukil, A., & Govindaluri, S.M. (2017) A systematic approach for ranking football players within an integrated DEA-OWA framework. *'Managerial & Decision Economics*, 38 (8):1125– 1136.

Oukil, A., & Amin, G.R. (2015) Maximum appreciative cross-efficiency in DEA: A new ranking method', *Computers & Industrial Engineering,* 81: 14–21

Pham, T.L.(2011) Efficiency and productivity of hospitals in Vietnam‘,*Journal of Health Organization and Management’* ,25: 195–213.

Pestieau, P. & Tulkens, H. (1993) Assessing and explaining the performance of public enterprises‘, *Finanz Archiv*,.50(3), 293–323.

Petterson, K.I., Veenstra, M., Guldvog, B. & Kolstad, A. (2016) The Patient Experiences Questionnaire: Development, validity and reliability‘, *International Journal for Quality in Health Care*, 16(6):453–463

Pina, V. & Torres,L. (1992) Evaluating the efficiency of nonprofit organizations: An application of data envelopment analysis to the public health service.‘ *Financial Accountability&Management* , 8(3):213-224.

Pink. G.H., Murray, M.A., & McKillop (2003) _Hospital efficiency and patient satisfaction. Health Services Management Research‘, 16:24–38

Po, R.W., Guh, Y.Y.& Yang, M.S. (2009) A new clustering approach using data envelopment analysis.‘ *European Journal of Operational Research*, 199(1), 276-284.

Purohit, B. C. (2019) Efficiency of Health Care Sector at Sub-State Level in India: A Case of Punjab‘. *Online Journal of Health and Allied Sciences*, 8(3).34-39

Qadeer,I .(2017) Healthcare system in transition part 2‘, *journal of public health medicine* ,22(1):25-32

Ray, S. C. (1988) Data envelopment analysis, non-discretionary inputs and efficiency: an alternative interpretation.‘ *Socio-Economic Planning Sciences* ,22(4):167-176.

Ramón, N., Ruiz, J. L. & Sirvent, I. (2014) Dominance relations and ranking of units by using interval number ordering with cross-efficiency intervals.‘ *Journal of the Operational Research Society*, 65:1336-1343

Ramez, W.S. (2014) Comparing Patients‘ Satisfactions Towered Service Quality of Public and Private Hospitals in Bahrain‘. *International Business and Management*, 8(1):72-82.

Randhawa, G. &Sidhu, A.S. (2011) Status of Public Health Care Services during the process of Liberalization: A Study of Punjab‘ .*Pravara Management Review*, 10(2): 10-15.

Reichheld, F. (2006), The ultimate question. Boston: Harvard Business School Press.

Rousseau, J. J. & J. H. Semple (1993) Notes: Categorical outputs in data envelopment analysis.*’Management Science* ,39(3):384-386.

Sahin, B., Yilmaz, F., Lee, K.H. (2007). Factors Affecting Inpatient Satisfaction: Structural Equation Modeling‘. *Journal of Medical Systems*, 31:9–16.

Sajid, M.S., & Baig, M.K. (2007).Quality of health care: an absolute necessity for public‘ *International Journal of Health Care Quality Assurance,* 20(6): 545-548

Schoenfelder, T., Klewer, J., & Kugler, J. (2011) Determinants of patient satisfaction: A study among 39 hospitals in an in-patient setting in Germany‘. *International Journal for Quality in Health Care,* 23(5), 503 –509.

Sengupta, J. K. (1987) Data envelopment analysis for efficiency measurement in the stochastic case.‘ *Computer. & Operation. Research.* 14(2),117-29.

Sengupta, J. K.(1988) Robust efficiency measures in a stochastic efficiency model.‖ International Journal of Systems Science‘ 19(5): 779-91.

Sengupta, J. K. (1989) Data envelopment with maximum correlation. *'International Journal of Systems Science,* 20(11): 2085-93.

Sengupta, J. K.(1990) Tests of efficiency in data envelopment analysis.' *Computers & Operations Research* 17(2):123-32.

Sharma, M., Goel, S., Singh, S.K., Sharma, R., & Gupta, P.K. (2014) Determinants of Indian physicians' satisfaction & dissatisfaction from their job' . *Indian Journal of Medical Research,* 139: 409-417.

Sharma, S. K., & Kamra, P. K. (2013) Patient Satisfaction with Nursing Care in Public and Private Hospitals'. *Nursing and Midwifery Research Journal*, 9(3): 130-141

Seiford, L.(1994) A DEA bibliography 1978–92 in Charnes, A., Cooper, W., Lewin, A.Y., and Seiford, L.M. (eds) 1994, Data Envelopment Analysis: Theory, Methodology and Applications', *Kluwer Academic Publishers, London*.

Sherman, B.W. & Behling, C. (2014) _Beyond incentives: The impact of health care reform onemployer population health management strategies'. *Population Health Management,* 17(3): 67-70.

Shen, K.Y., & Tzeng, G.H. (2015) Combined soft computing model for value stock selection based on fundamental analysis.' *Applied Soft Computing*, 37:142-155.

Singh, S., Kaur, P. & Rochwani, R. (2013) Patient Satisfaction Levels in a Tertiary Care Medical College Hospital in Punjab, North India.' *International Journal of Research and Development of Health*, 1 (4), 172-182

Smith, P. & D. Mayston (1987) Measuring efficiency in the public sector.' *Omega (GB),* 15(3):181-9.

Smith, P. (1990) The use of performance indicators in the public sector', *Journal of the Royal Statistical Society,* 153(1):53–72.

Soltanifar, M. & Shahghobadi, S. (2013) Selecting a benevolent secondary goal model in data envelopment analysis cross-evaluation by a voting model'. *Socio-Economic Planning Sciences,* 47: 65-74.

Sreenivas, T. &Babu N.S. (2012) A Study on Patient Satisfaction in Hospitals (A Study on Three Urban Hospitals in Guntur District, Andhra Pradesh'. *International Journal of Management Research & Business Strategy,* 1(1):101- 118.

Sueyoshi, T. (1990) A special algorithm for an additive model in data envelopment analysis.' *Journal of the Operational Research Society,* 41(3):249-57.

Sueyoshi, T. (1992) Algorithmic strategy for assurance region analysis in DEA.*' Journal of the Operations Research Society of Japan* ,35(1): 62-76.

Sueyoshi, T. (1992). Measuring technical, allocative and overall Efficiencies using a DEA algorithm.' *Journal of the Operational Research Society,* 43(2),141-155.

Sulku, N.S, & Caner, A.(2011) Health care expenditure and gross domestic product: the Turkish case.', *European Journal of Health Economics* ,12,29–38.

Sueyoshi, T. (1995) Production analysis in different time periods: An application of data envelopment analysis.' *European Journal of Operational Research* ,86(2), 216- 230.

Sueyoshi, T. & Chang, Y.L. (1989) Efficient algorithm for additive and multiplicative models in data envelopment analysis., *Operations Research Letters* ,8(4), 205-13

Taylor, D. T. & Thompson, R. G. (1995) DEA best practice assesses relative efficiency, profitability.*'Oil & Gas Journal* ,93(46): 60-70.

Thanassoulis, E. (1993) A comparison of regression analysis and data envelopment analysis as alternative methods for performance assessments.' *Journal of the Operational Research Society* 44(11): 1129-44.

Thanassoulis, E. & Dyson, R. G. (1992) Estimating preferred target input-output levels using data envelopment analysis.' *European Journal of Operational Research*, 56(1):80-97.

Thompson, R. G.,& Dharmapala, P. S. (1993) Importance for DEA of zeros in data, multipliers, and solutions.*'Journal of Productivity Analysis* ,4:379-390.

Tofallis, C. (1996) Improving discernment in DEA using profiling'. *Ome*ga, 24(3), 361-364.

Trochim, W., Kane, M.,(2005) Concept mapping: An introduction to structured conceptualization in health care'. *International journal Quality Heathl Care*, 17:187-191.

Thrall, R. M. (1989) Classification transitions under expansion of inputs and outputs in data envelopment analysis.' *Financial Accountability and Management*, 10:159- 162.

Tim Coelli, ―DEAP software‖, Centre for Efficiency and Productivity Analysis, Australia.[online] http://www.une.edu.au/econometrics/cepa.htm .[Accessed 17 January 2016].

Valdmanis, V.(1990) Ownership and Technical Efficiency of Hospitals', *Medical Care*, 28: 555-561.

Valdmanis, V.(1992) Sensitivity analysis for DEA models' *Journal of Public Economics, 4(1):185–205*

Vitikainen, K., Street, A., & Linna, M. (2009) Estimation of hospital efficiency – do different definitions and casemix measures for hospital output affect the results‘, *Health Policy*, 89:149– 59.

Wang, Y.M., Luo, Y.& Xu, Y.S.(2013) Cross-Weight Evaluation for Pairwise Comparison Matrices.‘, *Group Decision and Negotiation*, 22(3):483-497.

Washio, S. Yamada, & S.(2013) Evaluation method based on ranking in data envelopment analysis. Expert Systems with Applications‘, 40 (1): 257–262.

Ware, J.E., Snyder, M.K., Wright, W.R., & Davies, A.R. (1983) Defining and Measuring Patient Satisfaction with Medical Care‘. *Evaluation and Program Planning, 6* :247-263. .

Wei, Q. L., & Sun B., et al. (1995) Measuring technical progress with data envelopment analysis.‘ *European Journal of Operational Research* ,80(3):691-702.

Weng ,S.J., Wu, T., Blackhurst, J., & Mackulak, G.(.2009) An extended DEA model for hospital performance evaluation and improvement‘. *Health Services and Outcomes Research Methodology*,9:39–53.

Wilson, P. W. (1995) Detecting influential observations in data envelopment analysis.‘Journal of Productivity Analysis 6(1): 27-45.

.Wong, Y.-H. B. & Beasley, J. E. (1990) Restricting weight flexibility in data envelopment analysis.‘ , *Journal of the Operational Research Society*, 41(9), 829-35.

Young, S. T. (1992) Multiple productivity measurement approaches for management‘. *Health Care Management Review*, 17:51-58.

York, A.S., & McCarthy, K.A. (2011) Patient, staff and physician satisfaction: A new model, instrument and their implications‘ ,*Int J Heal Care Quality Assurance* ,24:178-191.

Zuckerman, S., & Hadley, J. (2010) Measuring hospital efficiency with frontier cost functions*’* ,*Journal of Health Economics* ,13(3): 255-280.

Appendix A

In Patient Satisfaction Form

Topic:

A Study on Association of Operational Efficiency and Customer Satisfaction in Tertiary Hospitals of Punjab.

Objectives:

1. To analyze operational efficiency of tertiary hospitals using data envelopment analysis.

2. To find out satisfaction level among patients of tertiary care hospitals of Punjab.

3. To find association between patient satisfaction and operational efficiency.

Name _____ Hospital _____

Reason of visiting _____ Place _____

Date _____

Gender:

a). Male b). Female c).Transgender

Education:

a).Uneducated b). 12th or less c) .Graduate. d). Post graduate e). Others

Age in years:

a) 5 – 18 b) 19-35 c) 36-50 d) 51-65 e) 65+

Family Income/ month:

a) < Rs. 20000

b) Rs. 20000 -50000

c) Rs. 50000 -80,000

d) Rs.80,000- 100000 e)>100000

Dear patient how much you are satisfied by following facilities provided by hospital?						
No.	**Index**	**Highly Dissatisfied**	**Dissatisfied**	**Neutral**	**atisfied**	**Highly Satisfied**
		1	**2**	**3**	**4**	**5**
1	**Information about doctor availability in hospital.**					
2	**Queue system at registration counter to take appointment.**					
3	**Proper Sign Boards to locate right room.**					
4	**Waiting time between appointment and checkup**					
5	**Availability of chairs and fans in waiting area.**					
6	**Process of admitting in hospital.**					
7	**Adequate privacy to discuss financial matters with doctor.**					
8	**Courtesy and respect given by the doctor.**					
9	**Explanation by doctor about disease.**					

10	**Explanation of purpose of medicine by doctor.**					
11	**Dietary plan prescribed by doctor.**					
12	**Availability of nurses in ward**					
13	**Courtesy and care given by Nurses.**					
14	**Attentiveness of Nurses**					
15	**Courtesy given by lab technician**					
16	**Behavior of ward boys.**					
17	**Frequency of doctor visit in ward.**					
18	**Availability of prescribed medicines in medical shops of city.**					
19	**Availability of X ray Facility in hospital.**					
20	**Availability of Ultrasound Facility in hospital.**					
21	**Availability of blood and urine test facility**					
22	**Availability of ECG test facility.**					

23	**Availability of Bone density test .**					
24	**Information available of when and how to obtain test results**					
25	**Sanitation arrangement of Bathrooms & toilets?**					
26	**Availability of Drinking Water In the premises.**					
27	**Cleanliness of Bed sheet & pillows.**					
28	**Availability of stretcher and wheel chairs**	**.**				
29	**Availability of ambulance in hospital.**					
30	**Emergency medical services provided by hospital.**					
31	**Availability of blood bank in hospital.**					
32	**Availability of parking facility.**					
33	**Availability of food in canteen**					
34	**Medicare cost incurred during whole process of admission and discharge.**					

35	**Availability of health information material on display.**					
36	**Process of paying bills while discharging from hospital.(use of credit cards, debit card, cash).**					
37	**Process of follow up or re -checkup.**					
38	**Support provided in collecting fee reimbursement forms or certificates.**					
39	**Are you satisfied with overall facilities in the hospital.**					
40	**Will you recommend this hospital to your family and Friend.**					

Any Suggestion

Appendix B

B1: List of hospitals

Sno.	Hospital Name	Place	Contacted person
H1	Capitol Hospital	Jalandhar	Mr.Guwinder Singh
H2	Tagore Hospital	Jalandhar	**Dr**.Nipun Mahajan
H3	Vassal Hospital	Jalandhar	Mr. Sanjeev vasal
H4	Joshi Hospital	Jalandhar	**Dr**.RAJJAT KUMAR
H5	IVY Hospital Hoshairpur	Hoshairpur	**Dr**. Aakansha Singh
H6	SPM Hospital	Mukerian	Dr.V.P.Singh
H7	Fortis Hospital Amritsar	Amritsar	. **Dr**. Arun Kumar Chopra.
H8	Delhi Heart Institute	Bhatinda	Dr.Gurkirat Kaur Gill
H9	Vardhman mahaveer healthcareHospital	Patiala	**DR**. VISHAL VERMA
H10	Fortis Mohali	Mohali	Dr. Vishal Bhambri
H11	SPS Hospital	Ludhiana	Mr.Anupinder Singh
H12	DMC Ludhiana	Ludhiana	Dr Vijay Garg
H13	GMCH Chandigarh, Sector 32	Chandigarh	Dr Ritu

H14	Max superspeciality Hospital	Mohali	Mr.Ajay singh
H15	Civil Hospital Anandpur Sahib	Anandpur Sahib	Dr.Dhraj puri
H16	Trehan Hospital	Mohali	**Dr** Naresh **Trehan**
H17	Doaba Hospital	Jalandhar	Dr. Vijay
H18	India Kidney hospital	Jalandhar	Dr. Amandeep
H19	Adesh Hospital	Bhatinda	Mr. Jeevan
H20	Civil hospital dasuya	Dasuya	Dr.Rajesh Bagga
H21	Civil hospital Mukerian	Mukerian	Dr. Palwinder
H22	Columbia Asia Hospital Patiala	Patiala	Dr. Kulwinder
H23	Chawla nursing Home	Mohali	Dr. Paramjit
H24	BBMB Hospital Talwara	Talwara	Dr. Manmohan singh
H25	Amcare Hospital	Zirakpur	Dr.Amit Sobti
H26	Lifeline Hospital	Zirakpur	Dr.Naveen
H27	Mayo helathcare Hospital	Mohali	Dr. Vinay Sharma
H28	Puri Hospital	Ludhiana	Dr. Amanveer kaur

H29	Bansal Hospital	Ludhiana	Dr.Sahil
H30	Sibia Helath care	Sangrur	Ms.Navneet
H31	Kansal Hospital	Sangrur	Dr. Manmeet
H32	Sadbhavna Hospital	Patiala	Dr.Aman ubhi
H33	Kapilla hospital Hoshiarpur	Hoshiarpur	Dr.Shashi
H34	Guru Nanak mission Hospital Dasuya	Dasuya	Colonel Arvinder Singh
H35	Dhillon Hospital	Hoshiarpur	Mr.Amrit pal
H36	BaJwa Hospital	Gurdapur	Dr. Gurwinder
H37	Sandhu Life care	Amritsar	Ms.Palwinder
H38	Bansal cancer Hospital	Bhatinda	Dr.Dilbagh singh
H39	Civil hospital Gurdaspur	Gurdaspur	Dr.Ajay
H40	Sidhu hospital Doraha	Doraha	Dr Kulwinder
H41	Sohana Hospital	Chandigarh	Dr. Ashish Agrawal

H42	Amar Hospital	Patiala	Dr. Arun walia
H43	Singla Hospital	Ludhiana	Mr.Shalendra
H44	Civil Hospital Hoshiarpur	Hoshiarpur	Dr.Vineeta
H45	Civil Hospital Tanda	Tanda	Dr. Minakshi saini
H46	Narain Hospital	Patiala	Dr. Nitin
H47	Lifecare hospital Mukerian	Mukerian	Dr.kaml Dhillaon
H48	Waves Hospital	Tanda	Dr Ajit saini

B2. List of people contacted for validating content of Questionnaire

Sno.	Doctor	Place	Designation/Specialization
1	Dr. Kewal	Hoshiarpur	SMO
2	Dr. Minakshi Saini	Hoshiarpur	Gynae
3	Dr.Manmohan Singh	Talwara	Eye specialist
4	Dr. Vinay Sharma	Dasuya	Childcare
5	Dr. Sashi	Dasuya	Gynae
6	Dr. Rajan Bhargava	Chandigarh	ENT
7	Dr. Ravi Inder singh	Chandigarh	Childcare
8	Dr. Sujata	Chandigarh	Gynae
9	Dr. Ajit Pal Singh.	jalandhar	Cardiology
10	Dr Shailesh Trpathi	jalandhar	Associate professor
11	Dr.Manvenda Singh	jalandhar	Assistant professor
12	Dr Rajesh verma	jalandhar	Professor
13	Dr. Lokesh Jasrai	jalandhar	Associate professor

14	Dr. Davinder Kumar Puri	Anandpur sahib	SMO
15	Ms.Nirmal kaur	Dasuya	Matron
16	Ms. Sunita Masih	Gurdaspur	Admin Officer
17	Dr.Rashmi Chadha	Talwara	SMO
18	Dr.Rajwinder kaur	Dasuya	Gynae
19	Ms. Jasvir kaur	Hoshiarpur	Matron
20	Ms.Simran	Hoshiarpur	Staff Nurse
21	Dr. Mohit Sharma.	Chandigarh	BDS
22	**Dr**. Jaswant Singh	Pathankot	Ayurveda doctor

Appendix C:

Paper published in Indian journal of public health research and development

C1. An Empirical Study on Association of Operational Efficiency and Customer Satisfaction in Tertiary Hospitals in Punjab

Singh Pritpal[1], Farhan Mohd[2,*], Asif Mohammad[3]

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Through this paper framework is created for association between efficiency and customer satisfaction in tertiary hospitals of Punjab. Efficiency is calculated using data envelopment analysis and satisfaction is measured using structured questionnaire for inpatients of 8 tertiary hospitals of Punjab (3 from each region of Majha, Malwa and 2 from Doaba). Data envelopment analysis (DEA) is nonparametric method of measuring operational efficiency of decision making units. DEA is having strong link to production theory in economics. DEA uses technique of linear programming for calculating relative efficiencies of decision making units working individually with respect to specified inputs and outputs. This paper analyzes the relation between hospital efficiency and customer satisfaction for highly efficient and less efficient hospitals in comparative perspective. The findings of paper indicates hospital efficiency observes some changes the way relationship is between patient satisfaction and institutional factor like specialized doctors and specialized equipment's.

1. Introduction

Rising healthcare cost and rapidly increasing healthcare demand have forced healthcare service providers to focus more on both productivity and quality to provide tertiary level healthcare services .Effective utilization of resources has become problem for hospitals .Health care service providers are predictably under pressure to develop their operations both in term of quality and quantity of their outcomes.(Bulent Sezen et al., 1999).Availability of healthcare services is problematic in developing countries like India where bed to patient ratio is 1:1000 which comaprively very high as US and Japan ,It is important to concentrate on maximum utilization of available resources while taking care of quality of service provided to customers.

The other inspiration driving this study has been to see how to address a portion of the concern of bench marking under changing situation in the healthcare part (Gustafsson et al., 1999).. With the opening of private medical coverage part in the post-liberalization period, the ideas of effectiveness with which the assets are utilized would expect more prominent importance in future .The requirement for creating efficiency parameters and foundation, which helps in positioning of health centers, is prone to accept basic significance (Pahuja and Vohra, 2012).

Scarcity of resources for healthcare is a well-acknowledged problem. In this context, efficient utilization of existing financial and human resources becomes crucial for strengthening the healthcare delivery. The assessment of efficiency of health facilities can guide decision makers in ensuring the optimum utilization of available resources (Ramez, 2012).. Data envelopment analysis (DEA) has emerged as an effective and popular method for evaluating the efficiency of decision-making units (DMUs) in different sectors including the health sector. There have been a number of studies on assessing the efficiency of hospitals, health centers and the overall healthcare system by using DEA in different settings (Chakraborty, 2013).. These studies have been conducted in industrialized countries as well as in middle- and low-income countries, including India. Some researchers have also undertaken extensive reviews of efficiency studies using DEA in the healthcare sector. However, thus far there is no research available on the efficiency assessment of hospitals in Punjab , India.

Along these lines, the essential research addresses managing this study are as per the following:

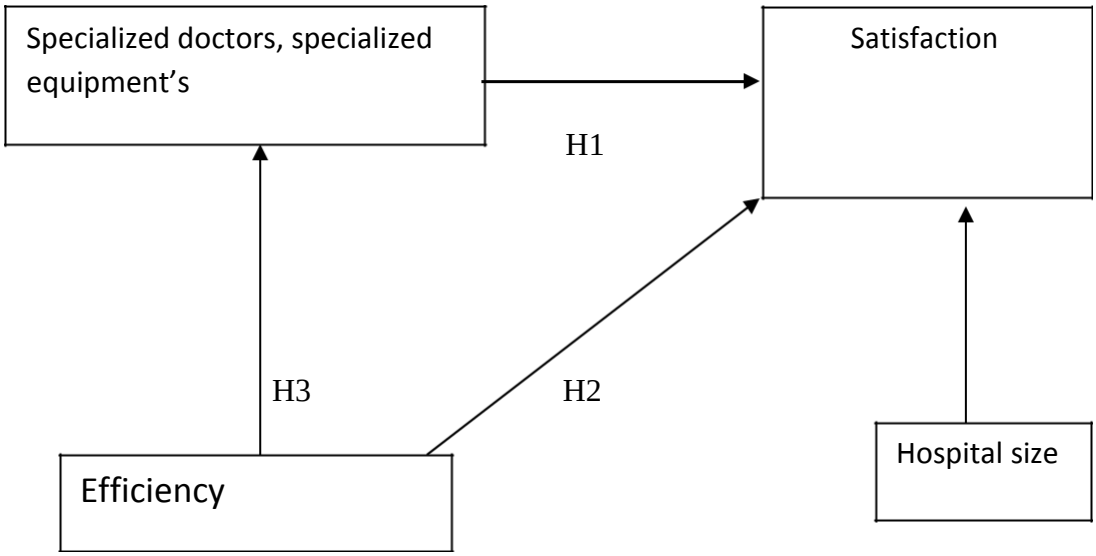
(I) Is there any immediate or indirect effect of hospital efficiency on patient satisfaction

(II) What sort of a relationship exists between specialized doctors and equipment‘s

availability and hospital center efficiency on patient satisfaction

2. Research Framework

The proposed research framework of our study is presented in Fig. 1.



In this model we examine three primary hypotheses as follows;

Hypothesis 1. Specialized doctor and equipment‘s availability has a positive effect on patient satisfaction.

Hypothesis 2. Hospital efficiency changes the form of the relationship between. Specialized doctor and equipment‘s availability and patient satins-faction as a moderator variable.

Hypothesis 3. Hospital efficiency is correlated with specialized doctor and equipment‘s availability

3. Data and methodology

Data for patient satisfaction is obtained from patients and patients companion of 8 tertiary hospitals of Doaba Majha and Malwa area of Punjab using structured questionnaire consisting of 42 questions which has been been framed evaluating each dimension , overall satisfaction and efficiency on the Likert scale ranging from 5 (mostly liked) to 1 (not liked) ,a sample of 780 patients are taken survey covers both private and public tertiary hospitals of Punjab ,respondents are mostly in patients with minimum 1 day of stay in hospitals and from 4 different departments (Szymansk and Henard,2001).

Data envelopment analysis is used for evaluating efficiency of hospitals with set of input and utput values for calculating efficiency, **To Find operational efficiency Hospitals DEA frontier Software is used DEA** *Frontier* software is developed and coded by Dr. Joe Zhu. It consists of a series of DEA models and is an Add-In for Microsoft Excel. *(Dr. Joe Zhu is Professor of Operations Analytics in the Foisie Business School, Worcester Polytechnic Institute.).Inputs selected in calculating efficiency are No. of beds, Specialized doctors and No. of nurses there are various modes used to evaluate efficiency using DEA but we used Constant return to scale efficiency model in this paper* .

Hospitals are considered to have very less control over their outputs like inpatient days or discharges. But it is more likely to assume that hospitals have more control over the utilization of resources. Therefore, an input-oriented DEA model is widely used for evaluating the efficiencies of hospitals. Accordingly, in this paper, an input oriented DEA model has been considered appropriate. Detailed discussion of DEA can be found in the studies of Cooper et al..

Table 1 contains efficiency calculated using detail input and output of hospitals for year 2017.

	Input-Oriented		
	CRS		
DMU Name	**Efficiency**		***RTS***
Hospital 1	**0.16751**		**Decreasing**
Hospital 2	**0.10648**		**Increasing**
Hospital 3	**0.44856**		**Increasing**
Hospital 4	**0.34000**		**Constant**
Hospital 5	**0.19493**		**Increasing**
Hospital 6	**0.30700**		**Increasing**
Hospital 7	**0.70850**		**Increasing**
Hospital 8	**0.26547**		**Increasing**

Table 2 is input oriented CRS model target which explains for each DMU how much is efficient input target as compared to their original utilization of resources

Input-Oriented					
CRS Model Target					
		Efficient Input Target			**Efficient Output Target**
DMU No.	***DMU Name***	***No. of beds.***	***Doctors***	***Nurses***	**Inpatients**
1	Hospital 1	326.31908	43.50921	326.31908	99201.00000
2	Hospital 2	40.46053	5.39474	40.46053	12300.00000
3	Hospital 3	98.68421	13.15789	98.68421	30000.00000
4	Hospital 4	300.00000	40.00000	300.00000	91200.00000

5	Hospital 5	65.78947	8.77193	65.78947	20000.00000
6	Hospital 6	21.49013	2.86535	21.49013	6533.00000
7	Hospital 7	46.05263	6.14035	46.05263	14000.00000
8	Hospital 8	151.31579	20.17544	151.31579	46000.00000

4. Analysis and results In first stage efficiency is calculated by data envelopment

analysis constant return to scale model using multiple inputs and .The return to scale refers to changes in output as all factors changes by all proportions in input there is increasing return to scale decreasing return to scale and constant return to scale. Increasing return to scale means in input is doubled production will a\is more than doubled, decreasing return to scale means if input is doubled production will be less than doubled, and Constant return to scale means output changes in same proportion as compare from efficiency scores hospitals are divided into two categories highly efficient and less efficient

In second stage to investigate effect of hospital efficiency, specialized doctors, equipment‘s on patient satisfaction following regression model is used

Y =b0+b1X1+b2X2+b3X3+b4X1X2

One of our research questions is how to examine effect of efficiency on patient satisfaction for that we used above written model in which Y is Patient satisfaction ,X1 is efficiency ,X2 is specialized doctors and X3 is institutional factor hospital size .Term b4X1X2 represent the moderator effect of hospital efficiency on relationship between patient satisfaction andcavailability of specialized doctors Value of efficiency ,specialized doctor availability and institutional factor hospital size is mentioned in below mentioned table.

HOSPITAL	Satisftion(Y)	Efficiency(X1)	Hospital size(X3)	Specialized Doctors (X2)
Hospital 1	2.10	.37	1948.00	230.00
Hospital 2	1.50	.49	824.00	90.00
Hospital 3	2.00	.07	1003.00	70.00
Hospital 4	3.00	.11	380.00	55.00
Hospital 5	4.20	.25	355.00	90.00
Hospital 6	3.00	.14	300.00	34.00
Hospital 7	3.30	.31	110.00	20.00
Hospital 8	3.90	.11	100.00	40.00

In above mention table overall statistics of eight hospitals are mentioned which include value of patient satisfaction which is collected from questionnaire from patients and companion of 8 hospitals ,Data of efficiency which is calculated using data envelopment analysis technique of using excel solver ,size of hospital which is counted from number of beds in hospital and number of specialized doctors and in below mwntion table hospitals are divided into three categories of large sized hospital small sized hospital and mediem sized hospital based upon number of beds in hospitals .

Table 4Descriptive statistics of hospital efficiency, satisfaction

Hospital	HOSPITAL	Satisftion(Y)	Efficiency(X1)	Hospital size(X3)	Specialized Doctors (X2)
Large sized Hospitals(3)	Hospital 1	2.10	.37	1948.00	230.00
	Hospital 2	1.50	.49	824.00	90.00
Medium sized Hospital(3)	Hospital 4	3.00	.11	380.00	55.00
	Hospital 5	4.20	.25	355.00	90.00
	Hospital 6	3.00	.14	300.00	34.00
Small size Hospital(2)	Hospital 7	3.30	.31	110.00	20.00
	Hospital 8	3.90	.11	100.00	40.00

From the above mentioned it can be easily analyzed that small and medium size hospitals are having high efficiency and patient satisfaction as compared to large sized hospitals and if talk

about specialized doctors and availability of specialized equipment‘s however average efficiency and patient satisfaction is higher for small and medium size hospitals

To study impact of efficiency, hospital size and specialized doctors on patient satisfaction we used regression in second stage the following model is used to analyze

$$Y = b0 + b1X1 + b2X2 + b3X3$$

Table 5.Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.909[a]	.826	.696	.52187

Table 6 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.553	.259		13.737	.000
	size	-.033	.001	-2.186	-5.675	.002
	doctors	.226	.006	1.802	4.476	.001
	Efficiency	-2.661	1.051	-.420	-2.531	.065

a. Dependent Variable: Satisfaction

This model is significant at p<.05 level here number of specialized doctors increases patient satisfaction providing support to hypothesis H1 b2=.226.However hospital size is having negative impact on patient satisfaction b3=--.033.But efficiency is not having significant effect on patient satisfaction there might be the case indirect relation between hospital efficiency and patient satisfaction .one of our major research question is how efficiency the form of relationship between no of specialized doctors and patient satisfaction to evaluate this second stage regression analysis is done with moderator effect .The equation is as follows for second stage regression analysis

Y =b0+b1X1+b2X2+b3X3+b4X1X2

Interaction term (ˇbX1X2) represent the moderator effect of hospital efficiency on the relationship between specialized doctors and patient satisfaction.

Table 7 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.481	.288		12.099	.001
	size	-.003	.001	-2.196	-5.406	.002
	doctors	.030	.008	2.089	3.710	.001
	Effecienc y	-3.081	1.233	-.486	-2.499	.088
	moderator	-.354	.456	-.281	-.776	.002

a. Dependent Variable: Satisfaction

The second model is also significant and regression analysis result explains that efficiency is considered to be negative moderator between relation of number of specialized doctors and patient satisfaction, Results in table suggested that higher level of efficiency level of hospitals lessen the positive effect of availability of specialized doctors on patient satisfaction Thus, hospital efficiency variable exerts a negative moderation between availability of doctors and patient satisfaction, as we hypothesized. Furthermore, findings provide the evidence that hospital size has significant negative effect on patient sat-is faction .In order to compare these a relation between efficiency of hospitals and number of doctor availability was analyzed .As hospitals always operate with different economies of scale relationship is founded in term of hospital size correlation coffiencts are examined and found that there was negative correlation between two variable for small size hospital as argued by traditional approach no significant for medium sized and significant positive for big size hospitals. There is difference between correlation of large size nad small size hospitas it means traditional approach is supported for small size hospitals of quality tarde off while large hospitals work with TQM approach.

5. Conclusion

Curiously, large size hospitals are not executing just as small and medium size medical hospitals regarding scale effectiveness. In this way, these medical hospitals don't work at ideal scale estimate. As recommended, expansive size medical hospitals may frame smallr patient consideration units inside their own association. Along these lines, extensive size hospitals not just dispense with the negative impact of their non-ideal scale measure, yet in addition they shape explicit treatment units for patients. Then again, low specialized productivity of large-estimate emergency hospitals could be halfway clarified by the imperfection of result estimation. In second stage analysis we examined that specialized doctors has positive affect on patient satisfaction ,however efficiency negatively moderates the relationship this means patient satisfaction changes as a result of availability of doctors might be influenced by level of hospital efficiency ,So hospitals can work on reducing their process cost and if patient thinks efficiency comes first for hospital then it will create negative impact in mind of patient .Just focusing on the effective utilization of resources without necessarily considering quality. Now hospital managers have a choice. They can choose to ignore efficiencies and just focus on achieving highest quality of care, or vice versa. At this point an optimal solution might be ―optimal care. ―as Rewar, D. Indicated, ―optimal care‖ could be achieved by taking into account a ―balance‖ between efficiency and quality. Further use of Linear Programming, Simulation modeling and other mathematical tools can be useful for Operational scheduling, resource allocation analysis for healthcare administrator.

6. References

Babakus, E. and Mangold, G. (1992) ‗Adapting the SERVQUAL scale to hospital services: an empirical investigation', *Health Service Research*, Vol. 26, No. 6, pp.767–786.

Berry, L. (1991) *Marketing Services: Competing Through Quality*, pp. 1–13, Free Press, New York.

Bilisik, O.N. (2013) ‗A hybrid fuzzy methodology to evaluate customer satisfaction in a public transportation system for Istanbul', *Total Quality Management*, Vol. 24, No. 10, pp.1141–1159.

Bollen, K. (1989) *Structural Equations with Latent Variables*, John Wiley, New York.

Bopp, K. (1990) ‗How patients evaluate the quality of ambulatory medical encounters: a marketing perspective', *Journal of Healthcare Marketing Research*, Vol. 10, No. 1, pp.6–15.

Calisir, F. (2012) ‗Effects of service quality dimensions on customer satisfaction and return intention in different hospital types', *International Conference on Industrial Engineering and Operations Management*, Istanbul Turkey, pp.518–522.

Cambra-Fierro, J., Florin, J., Perez, L. and Whitelock, J. (2011) ‗Inter firm market orientation as antecedent of knowledge transfer, innovation and value creation in networks', *Management Decisions*, Vol. 49, No. 3, pp.444–467.

Chakraborty, D. (2013) ‗Relevance of SERVQUAL model for determining parameters of quality ofhealthcare service in Indian context', *International Journal of Research & Development in Technology and Management Services*, Vol. 20, No. 8, pp.1–17.

Chen, C. (2008) ‗Investigating structural relationships between service quality, perceived value, satisfaction, and behavioural intentions for air passengers: evidence from Taiwan', *Transportation Research Part A*, Vol. 42, pp.709–717.

Gustafsson, A., Ekdahl, F. and Edvardsson, B. (1999) ‗Customer focussed service development inpractice: a case study at Scandinavian Airlines', *International Journal of Service Industry Management*, Vol. 10, pp.344–358.

Kumar, G.A., Manjunath, D. and Chethan, K. (2012) ‗Service quality in hospital: a study of Apollohospital in Mysore', *Journal of Business and Management*, September, Vol. 4, No. 1, pp.1–7.

Nagar, D. (2013) ‗Perceived service quality with frill and no-frill airlines: an exploratory research among Indian passengers', *Prestige International Journal of Management & IT Sanchayan*,Vol. 2, No. 1, pp.63

Pahuja, R. and Vohra, G. (2012) ‗Indian healthcare sector-A technology approach for efficiency improvement', *International Journal of Advanced Research in Computer Science and Software Engineering*, Vol. 2, No. 7, pp.81–83.

Ramez, D.S. (2012) ‗Patients perception of health care quality, satisfaction and behavioural intention: a empirical study in Bahrain', *International Journal of Business and Social Science*, Vol. 3, No. 18, pp.131–141.

Reeves, C. and Bednar, D. (1994) ‗Defining quality: alternatives and implications', *Academy of Management Review*, Vol. 19, pp.51–58.

Rewar, D. (2012) ‗Research paper hospital information system in Hospital engineering department',*International Journal of Scientific & Engineering Research*, pp.1–6.

Sangode, P.B. (2011) ‗Service quality of Maruti Suzuki and Hyundai dealer in Nagpur: a

comparative study', *International Journal of Research in Finance & Marketing*, Vol. 1, No. 1, pp.91–106.

Scardina, S. (1994) ‗A tool for evaluating patient satisfaction with nursing care', *Journal of Nursing Care Quality*, Vol. 8, No. 2, pp.38–46.

Sharmila, S. and Krishnan, D. (2013) ‗Has the service quality in private corporate hopitals meet thepatient expectations? A study about hospital quality in Chennai', *Asia Pacific Journal of Marketing & Management Review*, Vol. 2, No. 1, pp.19–35.

Szymansk, D. and Henard, D. (2001) ‗Customer satisfaction: a meta-analysis of the empirical evidence', *J. Acad. Mark. Sci.*, Vol. 29, pp.16–35.
.1–7.

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2)Mohd. Farhan

(57) Abstract :

A method to analysis of the efficiency in the hospital and provide an insight to the hospital management, also set benchmark for input required in hospitals by resolving operational problem by using Data Envelopment Analysis(DEA) technique in association with improved customer satisfaction.

No. of Pages : 14 No. of Claims : 8

INVENTION DISCLOSURE FORM

Details of Invention for better understanding:

1. TITLE:

Association model of technical efficiency and customer satisfaction of public hospitals

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3. DESCRIPTION OF THE INVENTION

A developed model to ―Find technical efficiency of public hospitals and its association as moderator to customer satisfaction‖.

A.PROBLEM ADDRESSED BY THE INVENTION: Please describe the basic problem which is being identified and addressed? (250 words)

Demand of healthcare services in India is increasing and the reasons which include awareness for preventive health checkup, Increasing population, Complexity of disease. Demand of health services are increasing but availability of health services are still big issue. Considerable amount of money invested by government bodies to improve infrastructure and to increase availability of services to all but as population of country is huge that much infrastructure is not enough to cater to population so need of time is to use existing infrastructure properly and optimally

.Management of hospitals must know how much efficient hospitals is and where is slack differential in input of resources to properly prepare doctor and staff schedule.

This model will help in calculating efficiency of hospital and give hospital management insight that whether hospital is working on increasing ,constant or decreasing return to scale. Secondly this model will to do benchmarking on the basis of best efficient hospital .This model will also help in associating efficiency with customer satisfaction so as only that much efficiency need to be improved by which customer satisfaction is not affected.

B.STATE OF THE ART/ RESEARCH GAP: Describe how what is the research gap being fulfilled. (250 words)

For calculating efficiency a linear mathematical technique i.e. data envelopment analysis (DEA) is used which consist of standard combination of inputs and outputs are considered.DEA will give efficiency value for hospital and also set benchmark for input required in hospitals to produce required output and also it will resolve operational problem of staffing where more or where less staff is required. Moreover in economics there are three types of scale and management must know whether organization is working on which type of scale ,This model will give insights whether hospital infrastructure is properly utilized and working on right return to scale for which it is designed .Patient satisfaction is calculated from hospital inpatient andoutpatient and then described model will be used to related both

efficiency and patient satisfaction as Efficiency cannot be increased too much so as patient satisfaction will negatively affected but some benchmark required to be maintained

C.DETAILED DESCRIPTION: Provide detailed description about invention with drawings, pictures, sketches, circuit diagrams wherever necessary? (500 words)

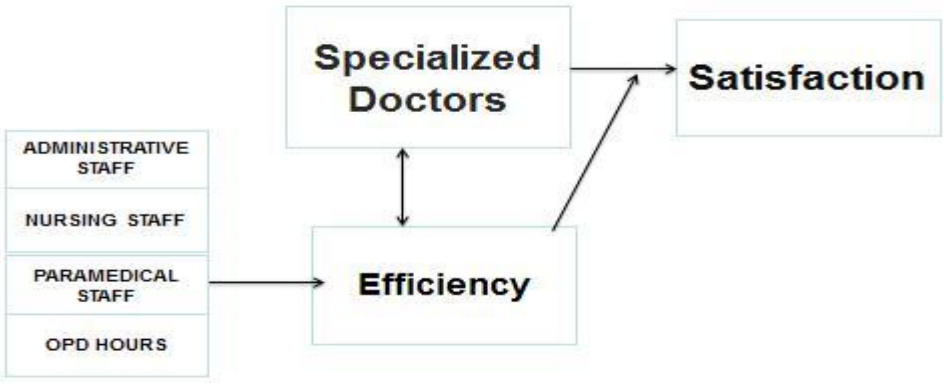

Figure 1. Association model of patient satisfaction and technical efficiency of hospitals

Thus hospital efficiency exerts a negative moderation between the relationships of specialized doctors on patient satisfaction .Also findings find that hospital size is having significant negative effect on patient satisfaction. According to results smaller hospitals are relatively more efficient and higher patient satisfaction. And large hospitals in order to meet their varied demands, they have to increase their physical, technical and medical labor capacity. In other words in high efficient hospitals relationship between specialized doctors and patient satisfaction is week while for low efficient hospitals there is comparatively stronger effect on patient satisfaction for specialized doctors Healthcare organizations are generally considered to have limited control over their outputs such as inpatient days or discharges. However, it is more appropriate to assume that healthcare organizations have more control over the utilization of resources. Therefore, an input oriented DEA model is wide used for analyzing the efficiencies of hospitals . Efficiency negatively moderates the relationship between structural quality and patient satisfaction. This means that expected changes in patient satisfaction as a result of improving

structural quality might be influenced by the level of hospital efficiency. In other words, hospitals improving their structural quality may also be working for improving their efficiencies such that they can eliminate waste and reduce their costs. If the hospital management gives more emphasis on the efficiency issues in such a way that the patients think efficiency comes first, this may impose a negative perception that could alleviate the strength of the relationship between structural quality and satisfaction

D.RESULTS AND ADVANTAGES: Share the results and advantages and superiority over the existing prior art (150 words)

According to our results, small-size hospitals are relatively more efficient and have higher patient satisfaction compared to other types of hospitals. However, large-size hospitals provide comparatively higher quality of care than their small and medium size counterparts. The main reason of this finding might be the different missions of small and large-size hospitals. Large size hospitals tend to increase their physical, technological and medical labor capacity in order to meet the variety needs of comprehensive care processes. Quality of care might significantly increase in parallel with the increment on these capacities. large size hospitals might form smaller patient care units within their own organization. In this way, large size hospitals not only eliminate the negative effect of their non-optimal scale size, but also they form specific treatment units for patients. On the other hand, low technical efficiency of large-size hospitals could be partly explained by the imperfection of outcome measurement

E.ALTERNATIVES/ EXPANSION: Any variables which are necessary for your invention to be covered? (150 words)

To establish a patient satisfaction index, two different sets of surveys are designed for inpatients and outpatients.DEA is a non-parametric approach that uses linear programming technique for analyzing the relative efficiencies of individual Decision Making Units (DMUs) with respect to multiple inputs and outputs. The input variables chosen for our analysis are: (1) total number of hospital beds; (2) number of specialist physicians, and (3) number of nurses.(4)number of paramedical staff, (5) number of OPD hours per week.(6)number of laboratory hours per week, , the output variables used in this study consist of (1)

total surgical operations; (2) number of births;(3)total outpatient visits;(4) average facility inpatient days, and (5) number of discharge

F. WORKING PROTOTYPE/ FORMULATION/ DESIGN/COMPOSITION: Is your working prototype or other ready? If no, how much time is required for the same. Give details

This model is ready for its applicability.

G. DATA: Any Hospital or comparative data necessary enough to support your invention

Hospital data in form of Input and outputs mentioned above from public hospitals under study is required.

4. USE AND DISCLOSURE (IMPORTANT): Please answer the following questions:

A. Have you described or shown your invention/ design to anyone or in any conference?	YES (Y)	
B. Have you made any attempts to commercialize your invention (for example, have you approached any companies about purchasing or manufacturing your invention)?	YES( )	NO(N)
C. Has your invention been described in any printed publication, or any other form of media, such as the Internet? **IN PRESENTATION AS "RESEARCH PAPER" IN CONFRENCE**	YES (Y)	NO( )
D. Do you have any collaboration with any other institute or organization on the same? Provide name and other details	YES( )	NO(N)
E. Name of Regulatory body or any other approvals if required.	YES( )	NO(N)

5. Provide links and dates of such activities if you have disclosed the information in public before sharing with us.

NA

6. Provide the terms and conditions of the MOU also if the work is done in collaboration within or outside university.

N.A

7. Potential Chances of Commercialization

It is a model to be used by the POLICYMAKERS for executing policies to optimally utilize existing resources for better efficiency of units and eliminate inefficient activities in pratical.

8. List of companies which can be contacted for commercialization along with the website link.

Post Graduate Institute of Medical Education & Research, Chandigarh,

Dr. Ram Manohar Lohia Hospital, New Delhi

Fortis hospital, Mohali

9. Market potential of the invention:

It has qualitative utility like; for the State policy execution; Professional Bodies; Academia world.

10. Any basic patent which has been used and we need to pay royalty to them.

NO/NA.

11. FILING OPTIONS: Please indicate the level of your work which can be considered for provisional/ complete/ PCT filings.

COMPLETE FILING

THIS MODEL WILL DEFINITLEY PUT LIGHT AND WILL BE A LIGHTHOUSE TO GOVERN A PUBLIC HOSPITAL ESPECIALLY WHEN THE INTEREST OF OPTIMALLY UTILIZATION OF RESOURCES AND ELIMINATE INEFFECIENT ACTIVITIES IS REQUIRED.

12. KEYWORDS: Please provide right keywords for searching your invention.

Association model of technical efficiency and customer satisfaction of public hospitals**.**

13. LOG BOOKS AND NOTEBOOKS: Please provide log books and note books with date when the idea was discussed with your t

C3: Conferences Attended

Year	Conferences Attended	Paper Presented
2019	Business Agility in Volatile times	Do hospitals with Electronic medical records have better efficiency
2019	NCIASE ,NIT Jalandhar	A study on association of efficiency and satisfaction of hospitals in Punjab
2019	Volatile consumer behavior and marketing	Assessing potential of community agrepneurship in diversified utilization and marketing of potato crop
2018	Dynamics of financial sector reforms	A study on current fraud trends using data mining
2017	Strategies for global competitiveness and economic growth	Market basket analysis using association rule mining
2017	Strategies for global competitiveness and economic growth	Data envelopemntanalysis :benchmarking in operation management
2015	Strategies for global competitiveness and economic growth	Profile of health sector of Punjab