Preliminary Assessment – Need and Location identification for setting up of dialysis units under PPP framework in Delhi

A dissertation submitted in partial fulfillment of the requirements
For the award of

Post-Graduate Diploma in Health and Hospital Management

By

Dr. Sourabh Kumar Sinha

International Institute of Health Management Research
New Delhi -110075

May 2010

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Under the guidance of

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New Delhi -110075
May 2010

Certificate of Internship Completion

Date: 12th May, 2010

TO WHOM IT MAY CONCERN

This is to certify that Dr. Sourabh Kumar Sinha has successfully completed his 3 months internship in our organization from February 1, 2010 to April 30, 2010. During this internship he has worked on "Preliminary Assessment –Need and Location identification of dialysis units in Delhi under PPP frame work" under the guidance of me and my team at Feedback Ventures. In this short duration, he has demonstrated the required competence and commitment to perform well in a healthcare consulting role.

We wish him good luck for his future assignments.

Mr. Ravi Shankar Iyer
General Manager – IAD

Certificate of Approval

The following dissertation titled "**Preliminary Assessment – Need and Location identification for setting up of dialysis units under PPP framework in Delhi**" is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post-Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

Name	Signature
_____	_____
_____	_____
_____	_____

Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Sourabh Kumar Sinha**, a participant of the **Post- Graduate Diploma in Health and Hospital Management**, has worked under our guidance and supervision. He is submitting this dissertation titled "**Preliminary Assessment – Need and Location identification for setting up of dialysis units under PPP framework in Delhi**" in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management**.

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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Acknowledgement

I was placed in feedback ventures with anticipation for learning & Hands on Experience. I had a feeling that the office bearers of this company would provide me with immense guidance & support. I felt extremely privileged when I found that all my dreams have come true at Feedback.

At this juncture of time this Report would be incomplete if I forget to thank all people who made my learning a possibility & an unforgettable experience.

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Abstract

Preliminary Assessment – Need and Location identification for setting up of dialysis units under PPP framework in Delhi

By

Dr. Sourabh Kumar Sinha

The National capital Territory of Delhi occupies an area of 1,483 sq km and is second largest metropolitan city next to Mumbai with approximately 1.6 Crore population. Dialysis is found to be one such service, wherein; there is urgent requirement of developing quality dialysis centres across Delhi to ensure easy accessibility and affordable pricing to its users with active private sector participation.The incidence of end stage renal disease (ESRD) in India is estimated to be ~150 per million persons (pmp). In comparison, the prevalence rate across countries varies significantly. This is a factor of varying life expectancies for patients on dialysis given differences across countries in the level of affordability, accessibility to dialysis infrastructure and skill and the availability of universal health coverage.

Problem Statement:

After taking into consideration other factors as services, average life expectancies of dialysis patients, patient share on other RRT (Renal replacement therapy) options and increasing life expectancies, it is estimated that the state needs over 1,100 dialysis machines to meet the demand.

Major findings:

a) Demand for dialysis services : Given Delhi's population of an estimated 17.62 million persons, the state would have an estimated ESRD incidence of over 3,000 patients every year. If we assume that 15% of the patients would continue to opt for other forms of RRT such as peritoneal dialysis and renal transplantation, and given that the average life expectancy of a patient on dialysis is 2 years, the total number of patients requiring dialysis at any given point in time (prevalence of dialysis treatment) is over 6,500 people, this translates to a requirement of ~1,100 dialysis installations in Delhi.

b) Existing Availability of Dialysis Services in Delhi: There are an estimated 500 dialysis machines in the city or ~28 machines per million persons. This supply is significantly higher as compared to the country average of ~5 machines per million persons and second only to Mumbai which has ~800 to 900 dialysis installations. However, given the demand for dialysis services this supply still falls short of meeting the treatment needs of the patients in Delhi.
c) Distribution of Dialysis Infrastructure and Skill in Delhi: Most dialysis infrastructure and skill in the country is concentrated in large private hospitals. Government establishments account for an extremely low share of the available dialysis services.
d) Cost of Hemodialysis Treatment: The price for dialysis session charges across private hospitals in Delhi range from Rs. 1,200 to over Rs. 1,800 per session. This results in a treatment cost of Rs. 12,000 to Rs. 18,000 per month towards dialysis session charges alone. Additional costs include costs of medicine and investigations which may range from Rs. 6,000 to Rs. 10,000 per month.
e) Gap Analysis: Delhi requires ~1,100 dialysis installations to meet the dialysis demand assuming an optimal treatment rate of ~3 sessions per patient per week and efficient machine utilization of ~3 sessions per machine per day. This leads to a requirement of ~600 additional dialysis machines to meet the demand.

Research Design

a) To get through the desired objectives set, a primary research was carried out in Delhi. Primary interactions were done in around 25 Delhi government hospitals to identify the location for functional dialysis units.
b) Primary data collection was done through detailed questionnaire considering hospital as a provider. Quantitative analysis was carried out after data collection has been completed.

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Abbreviations

NCT	National Capital Territory of Delhi
PPP	Public Private Partnership
ESRD	End Stage Renal Disease
PMP	Patients per Million Persons
USRDS	United States Renal Data System
RRT	Renal Replacement Therapy
CGHS	Central Government Health Scheme
ECHS	Ex-Servicemen Contributory Health Scheme
RSBY	Rashtriya Swastha Bima Yojna
PSU	Public Sector Undertaking
GNI	Gross National Income
CAGR	Compounded Annual Growth Rate
SEC	Socio-Economic Classification
MCD	Municipal Corporation of Delhi
LNJP	Lok Nayak Jai Prakash Hospital
AIIMS	All India Institute of Medical Sciences
CNBC	Chacha Nehru Bal Chikitsalaya
GTB	Guru Teg Bahadur Hospital
DDU	Deen Dayal Upadhyay Hospital
CKD	Chronic Kidney Disease
ICU	Intensive Care Unit
OPD	Out Patient Department
OT	Operation Theatre
RO	Reverse Osmosis
SR	Senior Resident
JR	Junior Resident
PD	Peritoneal Dialysis
CAPD	Continuous Ambulatory Peritoneal Dialysis

Part I: Internship Report

1.1. Introduction

Introduction

Internship is an integral part of course of PGDHHM. As a part of the curriculum students are required to undergo 3 months internship in any healthcare related organization. The main purpose is to get an orientation towards healthcare and to complete the assigned task which includes the project and study.

I have done my internship in Feedback Ventures from 1st of February 2010 to 30th of April 2010 under the guidance of Mr. Ravishankar Iyer (General Manager – IAD).

1.2. Organization Profile

Feedback Ventures is India's leading integrated infrastructure Services Company, with a mission of "Making Infrastructure Happen". Totally focused on infrastructure development, Feedback Ventures offers an integrated suite of services across the core and social sectors of infrastructure. Feedback is known for its innovative work and for operationalizing challenging projects in difficult locations. No wonder, 17 of India's 50 biggest listed companies are Feedback's clients. So are the governments of 22 of the 28 Indian states and 4 of India's 7 Union Territories.

Sectors

Feedback Ventures offers a range of services across eleven focused infrastructure sectors. For easier understanding, these sectors have been divided into a total of 32 sub-sectors. For instance, transportation is a sector, but it has highways, railways, MRTS, ports, airports and logistics as sub-sectors. 11 infrastructure sectors are:

Transportation & Logistics, Energy, Housing & Townships, Commercial Infrastructure, Industrial Infrastructure, Water & Sanitation, Retail & Environment, Hospitality, Healthcare, Urban Development , SEZs

Services

Feedback Ventures is uniquely positioned to offer both Strategic Consulting and Project Management services. Feedback's integrated suite of services span across Consulting, Transaction Advisory, Project Development, Planning & Engineering, and Project Management

Healthcare Sector - Introduction

Feedback Ventures is a healthcare consultant to India's leading hospital chains like Max, Fortis, and Wockhardt for developing their business strategies, business plans, improving operational efficiencies, implementing and managing new projects.

The company has an in-depth understanding of the healthcare consultants' space in India, including economics of healthcare delivery and related businesses, critical success factors for new and incumbent players, consumer's healthcare buying behavior, and hospital-consultant dynamics. Over the last few years, Feedback Ventures has built a strong understanding of key healthcare micro markets and has gained insights by interacting with more than 11,000 consumers and 3,500 physicians across major cities.

In the primary healthcare sector, it works to improve the performance of training institutions. As their healthcare consultant in India, Feedback Ventures monitors and evaluates public healthcare programs and provides human resource development for government healthcare agencies.

Today, Feedback is the only healthcare consultant in India that has three out of the four biggest Indian healthcare companies as its clients.

Healthcare – Hospitals

Feedback Ventures is a hospital consultant to India's leading healthcare chains like Max, Fortis, and Wockhardt. It is developing business strategies, business plans, improving operational efficiencies, and implementing as well as managing new projects for many of its healthcare clients.

Developing a hospital building is a complex and challenging task. Feedback's project management experts have decades of experience in developing hospitals. Its teams of hospital consultants in India understand the mechanics of operating hospitals. The company meticulously plans and delivers hospital projects on time, in quality and within stipulated budgets.

No wonder, three out of the four biggest healthcare companies have chosen Feedback Ventures as their hospital consultant in India

Healthcare Services

- Market and industry analysis
- Formulation of business strategies and plans
- Opportunity identification and diversification advisory
- Efficiency / performance improvement
- Project development services
- Project implementation support
- Public-Private Partnership structuring
- Joint ventures and alliances

1.3. A documentation of the process of work, project done, skills acquired and lessons learnt.

During my internship I was absorbed in 2 – 3 different projects like PPP framework formation for Delhi government, Proposal writing & presentation for NCR planning board and formation of growth strategy of a imaging centre in Delhi. All these projects gave me an immense opportunity to understand healthcare from different perspectives.

For formulation of PPP framework our first step was to understand the feasibility of putting up more dialysis units in Delhi. Hence the demand supply study was done by collecting both secondary and primary data. After finding a significant demand the methodology for the referral and satellite centers was formulated by visiting different Delhi government hospitals and getting an information of services provided there. Plus private centers dialysis prices and volumes were found and thereby provision to charge nominal fee was designed so that maximum people can afford the services. This project and a part independently undertaken by me helped me to gain an idea of the on field primary data collection and understanding of patient behavior by primaries with various doctors. Also it helped to improve my data collection as well as data analysis skills.

In the last month of internship period I was engaged in a project on figuring out the growth strategy of an imaging center in Delhi where the methods of growth and their

feasibility was proposed. Mainly 3 methods were proposed for the growth – through new centers, through new businesses like dental radiology, tele radiology etc and growth in the existing business through efficiency improvement. For each method a detailed study was done to find the feasibility and a complete business plan was developed. This project gave me a wonderful insight on how to practically go about things when you want to grow your business especially in healthcare.

Thereby these different kinds of project gave me an insight of different kinds of healthcare services and an understanding of different geographies and their market behavior. Also it improved my data collection, storage and analytical skills. Also we worked in teams thereby further improving my team working skills which I consider is very important in a professional life. Overall my internship went good and I feel satisfied about my performance and I believe with the support of my colleagues and line manager it would definitely improve in future engagements.

Overall, I had a good learning in the company. Also Feedback is the only healthcare consultant in India that has three out of the four biggest Indian healthcare companies as its clients. To conclude, it can be said that my internship at Feedback Ventures was a wonderful learning experience.

Part II: Dissertation on "Preliminary assessment – Need and Location identification for setting up dialysis units under PPP framework in Delhi"

2.1 Introduction

The National capital Territory of Delhi occupies an area of 1,483 sq km and is second largest metropolitan city next to Mumbai with approximately 1.6 Crore population and with advent of growing population, there is growing demand of accessible and affordable healthcare services in Delhi.

Department of Health & Family Welfare, Government of National Capital Territory of Delhi (GNCTD) is currently working on an ambitious program of providing quality medical services to its citizens. Dialysis is found to be one such service, wherein; there is urgent requirement of developing quality dialysis centres across Delhi to ensure easy accessibility and affordable pricing to its users with active private sector participation.

The incidence of end stage renal disease (ESRD) in India is estimated to be ~150 per million persons (pmp)[1]. This is in line with incidence rates observed in other developed and developing countries with the average incidence across forty-five countries listed in the USRDS at ~153 pmp. In comparison, the prevalence rate across countries varies significantly. This is a factor of varying life expectancies for patients on dialysis given differences across countries in the level of affordability, accessibility to dialysis infrastructure and skill and the availability of universal health coverage.

2.2 The Problem Statement

Delhi is the healthcare hub for a geographically large and populated catchment area comprising of J&K, Punjab, Haryana, UP, Bihar, MP and Rajasthan. Key healthcare institutions in the state receive a significant share of its patients from these catchment areas increasing pressure on limited health infrastructure. Given the state's current population it is estimated that ~3,000 patients are diagnosed with ESRD every year. After taking into consideration other factors as services, average life expectancies of dialysis patients, patient share on other RRT (Renal replacement therapy) options and increasing life expectancies, it is estimated that the state needs over 1,100 dialysis machines to meet the demand[2].

Dialysis services are concentrated in large urban areas and Delhi accounts for over 8% and 10% of the dialysis infrastructure and skill respectively with ~500 dialysis

[1] Source: Research reports; interactions with eminent Nephrologists in the country

[2] At current patient treatment frequency and machine utilization levels

installations and 80-90 Nephrologists in the state. This however is insufficient to meet the demand for dialysis services. What makes the environment even more sensitive is the fact that most supply is concentrated in the private sector with only 24 machines available in hospitals owned and operated by Delhi government and the municipal corporation. Even if we include machines in centrally funded hospitals and centres operated by quasi-government organisations it accounts for only 60-70 machines or 12% to 14% of the total dialysis infrastructure in the city. This means only the high income category can afford treatment in private centres that have high dialysis treatment charges while a large section of the middle and low income population does not have the access or the economic means to avail of dialysis services.

2.3 Literature Review

Dialysis is the process by which the blood is cleansed artificially rather than by the kidneys. The term dialysis is derived from the Greek word meaning to separate. During dialysis, metabolic wastes and excess fluids are separated and removed from the patients blood. There are two types of dialysis:-

- Hemodialysis
- Peritoneal dialysis

Hemodialysis

The first artificial kidney machine was developed in 1943 by Dr.Willem Kolff. Hemodialysis is derived from two words, hemo, meaning blood and dialysis. Today, it has become the most commonly performed type of dialysis. Hemodialysis treatments are required three days per week, and each treatment lasts about four hours.

How it works

During hemodialysis treatment, the patient’s blood is circulated outside of the body into an artificial kidney machine, through a link to the patients circulatory system. The blood flows into the dialysis machine, is cleansed and then returns to the patient’s body. The dialysis process is continual, with new blood and dialysate constantly circulating into the machine and waste products and excess fluids constantly circulating out. The artificial kidney machine contains an internal chamber which is divided by a thin semipermeable membrane. It is called semi permeable because only particles of a certain size will pass through it. On one side of the membrane is a special solution called dialysate. On the

other side is the blood which needs to be cleansed. Since red and white blood cells are relatively large, they will not pass through the pores of the membrane, but waste products (such as creatinine and urea) are very tiny and will pass through the membrane. Waste products are removed from the blood through three chemical processes: diffusion, osmosis and ultrafiltration. Diffusion works on the principle that liquids of different concentrations tend to equalize when placed next to each other. For example, if you take a cellophane bag and fill it with water mixed with food coloring, seal it and place it in a container of clear water, you will find in a short time that the clear water will have food coloring in it. The food coloring has passed through the tiny holes in the cellophane membrane. The water in the bag still has food coloring in it because the process works both ways. Diffusion continues until there are equal amounts of food coloring on both sides of the membrane. This state is called equillibrium. Waste products are found in the patient's blood which is not present in the dialysate. During diffusion the tiny waste particles move out of the blood and into the dialysate until both solutions have reached equilibrium. By constantly introducing clean batches of dialysate the waste products continue to shift towards the waste-free dialysate until a large proportion of waste products have been washed out of the blood. If the patient is low on vital elements, such as calcium or dextrose, they may be added to the dialysate. Just as the waste products shifted to the side where they were lacking, the calcium and dextrose will shift towards the side of the chamber where they are needed, the patients' blood. Osmosis is very similar to diffusion, but rather than removing waste products, excess fluid is removed. To facilitate this process dextrose is added to the dialysate. This works to pull the excess fluid from the blood. Ultrafiltration is the process by which very minute particles are removed from a substance, in this case the blood. In order to speed up the removal of excess fluid, a pump may be used. This pump raises the pressure of the blood flowing through the dialysis machine, thereby forcing excess fluids out of the blood.

Access for Hemodialysis : In order to be dialyzed there must be a way to connect your circulatory system to the artificial kidney machine. This connection is called a vascular access and initially requires minor surgery. The fistula is created by a surgical procedure which attaches a vein to an artery in an arm. This increases the amount of blood that flows through the vein which in turn causes the vein to enlarge. The larger size of the blood vesel allows two needles to be inserted for treatment. Because this may cause discomfort, the skin can be anaesthetised with Novocain. These needles are connected to

tubes which go to and from the artificial kidney machine. A graft also provides access to the patients circulatory system. When a graft is used, synthetic material is inserted to form a connection between an artery and a vein. The advantage of the graft and fistula, which both require minor surgery, is that they are under the skin and therefore less prone to infection than an external shunt. They do require two needle sticks each time dialysis is performed. Sometimes a person must start dialysis before a permanent access can be created. In this case, a catheter may be inserted into a vein in your chest, neck or leg to gain access to the circulatory system. A catheter may also be used if the patient has used up all other possible sites for a fistula or graft. The advantage of a catheter is that no needles need to be inserted. The disadvantages are numerous, including the possibility of infection and clotting.

Peritoneal Dialysis

Peritoneal dialysis is usually self administered. In both hemodialysis and peritoneal dialysis, the blood is cleansed. However, in peritoneal dialysis the process takes place within the patient's own body, in the peritoneal or abdominal cavity, rather than outside the body in a machine. The peritoneum is a thin membrane which covers the instestines and other contents of the abdominal cavity. During dialysis, the dialysate is introduced into the abdominal cavity, allowed to stay in for some time, and then drained out. The peritoneum basically functions the same as the semipermeable membrane used in the artifical kidney machine. Since it contains a whole network of tiny blood vessels called capillaries, the peritoneum is constantly able to provide a new supply of blood to be filtered. As blood flows through the peritoneum, waste products are filtered (through diffusion) and excess fluids are removed (through osmosis). The wastes flow into the dialysate which remains or dwells within the abdominal cavity for a variable period of time. At the end of this period the dialysate is drained from the abdomen and fresh dialysate is introduced. Access for Peritoneal Dialysis: Access for peritoneal dialysis is gained via a flexible hollow tube, called a catheter, which is surgically implanted through the wall of the abdomen into the abdominal cavity. This catheter is usually permanent, but may be replaced as needed. A potential problem with peritoneal dialysis is peritonitis, an infection of the lining membrane of the peritoneal cavity. The exchanges of dialysis fluid must be performed using sterile technique in order to prevent this type of infection.

Depending on the way Peritoneal dialysis is performed it is described in two different ways:

- Continuous Ambulatory Peritoneal Dialysis (CAPD)
- Continuous Cycling Peritoneal Dialysis (CCPD)

Continuous Ambulatory Peritoneal Dialysis: Continuous Ambulatory Peritoneal Dialysis (CAPD) is self administered and machine free. CAPD exchanges are performed in a clean, private location where the patient is comfortable. The process of exchanging the dialysis fluid is repeated every 4 to 6 hours during the day, with each exchange taking approximately 30 minutes (10 minutes to introduce and 20 minutes to drain the dialysate). Each day, the final dialysis is performed right before the patient goes to bed at night. Since the patient is continually dialyzing, there are usually fewer dietary restrictions. CAPD provides mobility for the patient, and thus an improved quality of life. The details of an exchange are as follows: Fluid that has been dwelling in the peritoneal cavity needs to be removed so fresh fluid may be infused and the blood cleansing process can continue. The catheter is attached to a Y SET. This Y set has a drain bag on one end and a fresh bag of dialysate on the other. For outflow, the empty bag is placed on the floor and the used fluid is allowed to drain into it by gravity. When the bag is full, the line is opened clamped and the inflow line is opened. For inflow, the two litre bag of dialysate is raised above the patients shoulder and the fresh, warm dialysate is infused by gravity. When that bag is empty, the inflow line is closed and the Y set and bags are removed and discarded. The patient then resumes normal activity until it is time for another exchange.

Continuous Cycling Peritoneal Dialysis: Continuous Cycling Peritoneal Dialysis (CCPD) is very similar to CAPD, however, in this case, the exchanges are performed at night while the patient sleeps. To facilitate this process the patient is hooked up to an automatic cycling machine. This machine makes several evenly spaced exchanges during the night and a final one just before the patient gets up in the morning. During the day either one exchange or no exchanges are made. An advantage of CCPD is that the likelihood of infection caused by improper handling of the dialysis equipment is reduced. With only one hook-up per day rather than four or five there is less chance that the patient will introduce some bacteria into the peritoneal cavity; thus the likelihood of peritonitis is reduced. On the other hand, it is necessary for the patient to be attached to a machine during the night hours while the CAPD patient remains totally machine free.

Key issues/concerns limiting penetration of the peritoneal dialysis include –

1) High Cost of Treatment

Currently the cost of peritoneal dialysis is Rs. 18,000 to Rs. 20,000 per month excluding the cost of medicines and investigations. In comparison, the cost of hemodialysis is Rs. 12,000 to Rs. 15,000 per month[3] and in the long term leads to significant cost savings. However, if you take into account the additional indirect costs incurred in travelling to a hemodialysis centre on a regular basis, the difference in treatment cost is reduced. Also, by bulk procurement of CAPD solution there is potential for this cost to be significantly reduced.

2) Higher returns for hospitals and nephrologists in Hemodialysis

In the Indian context, the treating doctor and in this case the Nephrologist is often the key decision maker for the patient given limited awareness on treatment options. The decisions of care givers are often interlinked with the financial return generated on the treatment. There is a significantly higher amount of revenue accrued to both the treating consultant and the hospital in case of a patient on hemodialysis as compared to peritoneal dialysis. There is steady revenue through consultations and dialysis undertaken at the hospital.

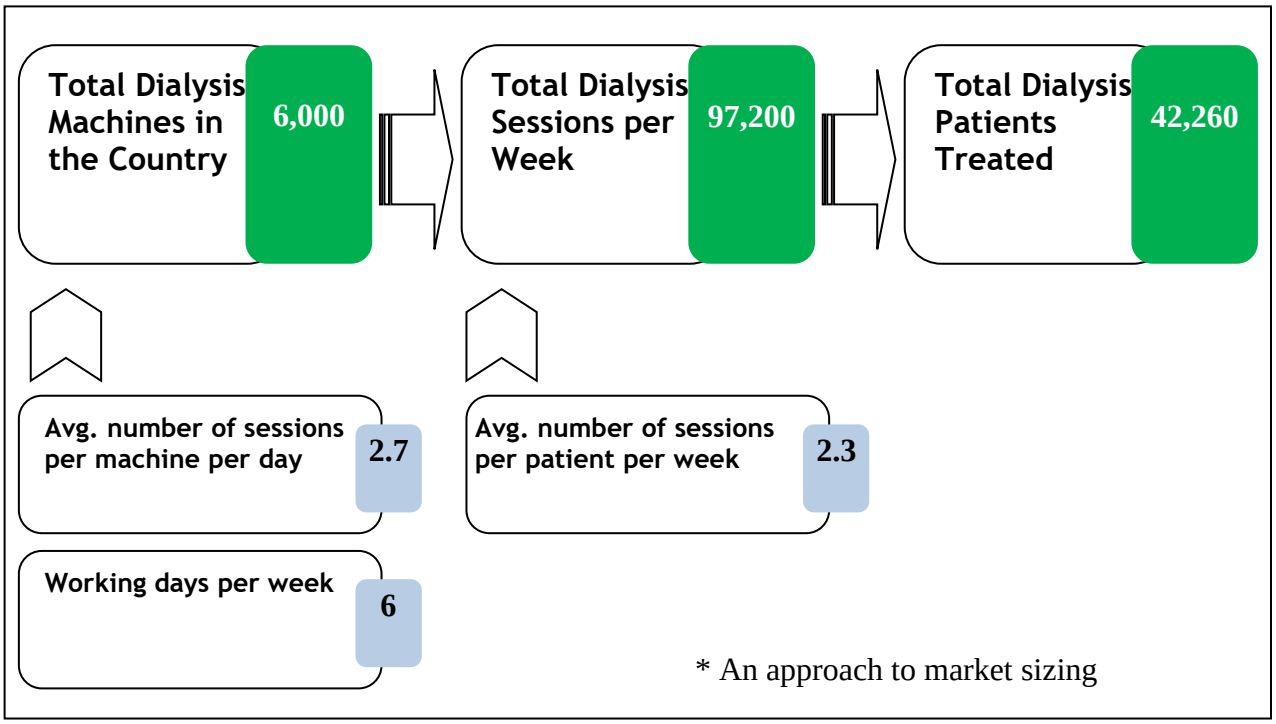
In comparison, a patient on peritoneal dialysis needs to visit the hospital only once in a month and undertakes dialysis himself thereby significantly reducing revenue to the hospital and the treating doctor. The key beneficiaries are the pharma companies who directly supply the consumables to the patient. Given that the patient relies heavily on the doctor for decision making, hemodialysis is more often than not the choice of treatment.

3) Quality of treatment

Peritoneal dialysis is often associated with a higher rate of infections and reduced life expectancies given that treatment is often in a non-sterile environment and adequate precautions might not be taken when the patient is undertaking self-dialysis. This is also driven lack of confidence/experience amongst treating physicians who have had limited exposure to peritoneal dialysis and is only likely to be addressed with greater acceptance of PD and more exposure to treating doctors. However, in the absence of any large scale studies, the truth is ambivalent with nephrologists having differing opinions on the subject. Another reason for reduced life expectancies for PD

[3] At average dialysis session charges of Rs. 1,200 to Rs. 1,500 per session, assuming 2.3 sessions per patient per week

Given the country's current population of one billion plus it is estimated that ~1.5 to 2 lac people are diagnosed with ESRD each year. It is difficult to ascertain the prevalence rate for ESRD in the country given the absence of any renal registry or comprehensive population based studies.



To cater to this demand there are an estimated 6,000 dialysis installations[4] in the country providing maintenance dialysis to approximately 40,000 to 45,000 dialysis patients every year This implies that of the total ESRD patients in the country only ~12% undertake hemodialysis treatment[5]. Peritoneal dialysis accounts for 10% to 12% of the total dialysis patients in the country while an additional 3,000 to 3,500 renal transplants take place in the country each year[6]. Even if we include these modes of treatment/maintenance therapy, only about 15% of the ESRD patients each year have access to any form of renal replacement therapy (RRT).

[4] Source: inputs from manufacturers, suppliers and distributors of dialysis machines and consumables

[5] The average life expectancy for a hemodialysis patient is estimated to be ~2 years. Implying that only ~21,000(=42,000 hemodialysis patients/2 years) of the ~180,000 new ESRD cases each year are given hemodialysis treatment

[6] Limitations of peritoneal dialysis and renal transplants have been discussed in subsequent sections

2.4 Aim of study:

The aim of the study was to assess the requirement of dialysis units in Delhi.

2.5 Objectives:

(a) Analysis of currently existing & proposed dialysis centers in the city, both government and private setups.

(b) Assess the requirement of additional units are required to cater to demand of population of Delhi.

(c) Suggest location for development of dialysis centers, preferably in government hospitals.

2.6 Research Design

(a) To know the deliverables of the study, a discussion on the scope of the study had been done with senior managers in Feedback Ventures.

(b) To get through the desired objectives set, a questionnaire was formulated and approval was taken from senior managers.

(c) A primary research was carried out in Delhi. Primary interactions were done in around 25 Delhi government hospitals to identify the location for functional dialysis units.

(d) Primary data collection was done through detailed questionnaire considering hospital as a provider.

(e) Quantitative analysis was carried out after data collection has been completed.

2.7 Observations:

Demand for Dialysis Services in Delhi

This section provides an overview of the socio-economic and healthcare profile of Delhi and the quantum of demand for dialysis services in the state.

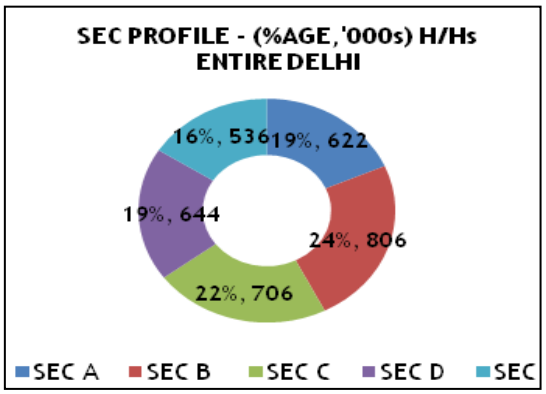
Socio-economic Profile of Delhi

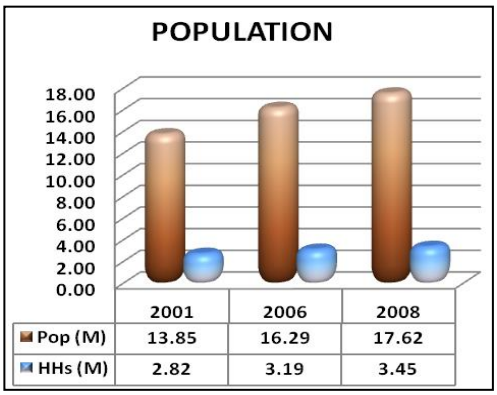
Delhi is well established healthcare hub of North India. While income has grown at ~10% in last 5 years, healthcare costs have outpaced income growth. Therefore a majority of the population is dependent on the Government healthcare facilities. This section discusses the socio – economic and the healthcare profile of Delhi.

The population of Delhi, currently at 17.62 million, has grown at a CAGR of 4% over the last 2 years, against a CAGR of 3.3% during 2001-2006. The per capita income of Delhi at Rs. 76,070 is amongst the highest in India. As compared to a population growth rate of 4%, the per capita income has grown at a CAGR of 13.5% during the last 2 years as against an average of 8% for 2001-2006 period.

Delhi has almost uniform distribution of population across various segments. 19% of the households belong to Sec-A 24% of the households belong to Sec-B followed by 22% in Sec-C. Sec-D & Sec-E combined together is almost 35% and this segment is entirely dependent on the public healthcare facilities for primary, secondary as well as tertiary care, being provided by Delhi and central government. A significant part of the Sec-C population also depends on the public facilities for tertiary care. It becomes important for the government to create quality infrastructure to cater to the needs of ~ 60% of the total population.

Fig 6: Population and Household Trends, and the Socio-Economic Profile of Delhi[7]





[7] Indicus Report, 2006

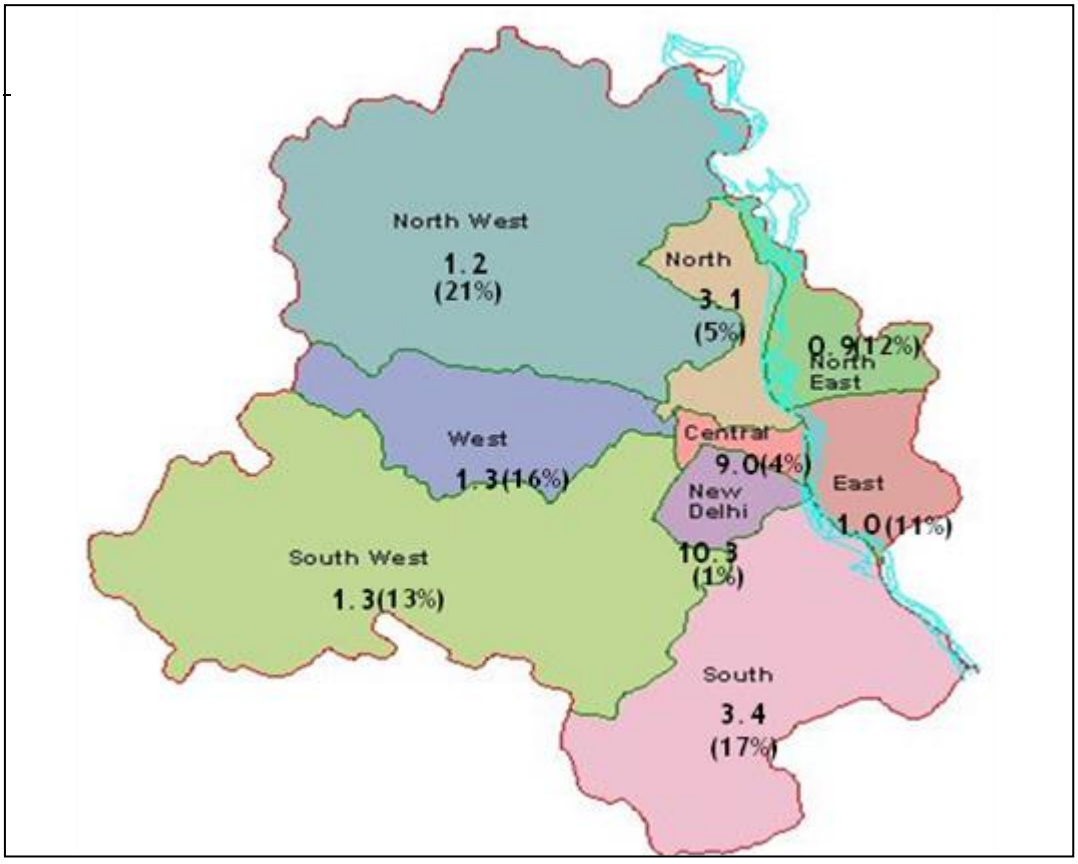
Healthcare Profile of Delhi

Delhi is a well established healthcare hub of North India with a high influx of patients from adjoining areas like Haryana, Punjab, Northern Rajasthan, Ghaziabad and Meerut; 25% of the patients are from outside the city. The city is home to 36,889 beds, has a bed to population ratio of 2.1 beds/1000 population; thus effective bed to population ratio for the city's population is 1.57 beds / 1000.

The supply of beds is dominated by government hospitals as well as small nursing homes. 57% of the beds in Delhi are in the government sector which is significantly higher than the country average of ~40% beds in the government sector. However the quality of these beds is not satisfactory in many cases.

Within Delhi, the bed to population ratio is skewed with glaring shortage in bed supply in West and East Delhi. Central and New Delhi have high bed/population figures of 9.0 and 10.3 respectively primarily because of the presence of large government hospitals.

Fig 7: Bed to Population Ratio and Population distribution of Delhi



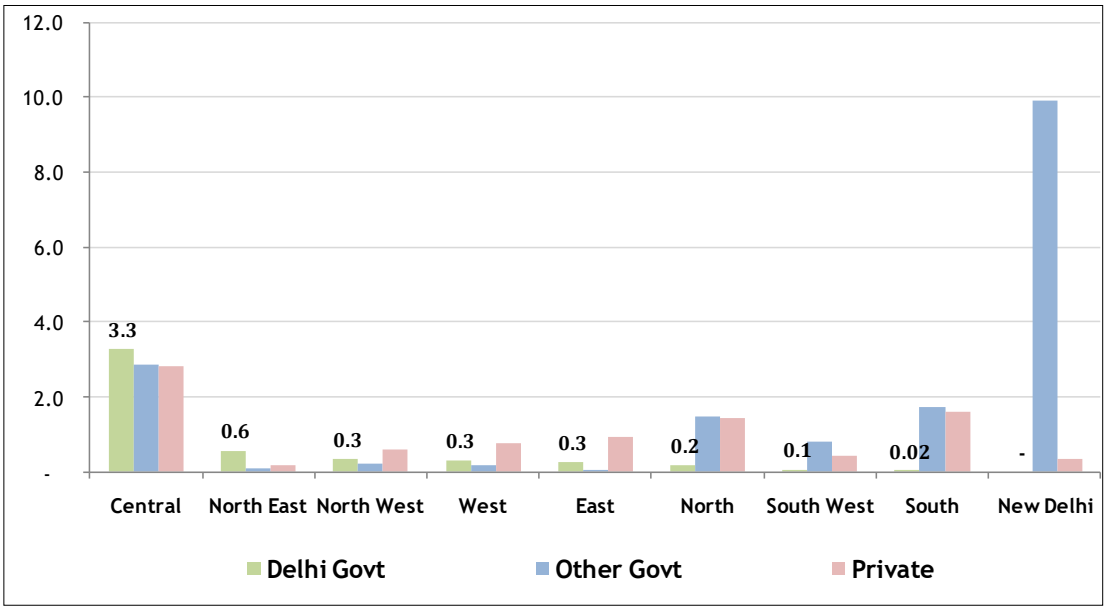


Fig 8: Region wise supply of beds/1,000 population in Delhi

Central, North, South and New Delhi have fair quantum of the overall government as well as private facilities with associated diagnostic and clinical infrastructure. However, East (E/NE) and West Delhi (NW, W, SW) lack adequate presence of hospitals and associated facilities.

Also, the distribution of supply of beds through the Delhi government hospitals is also skewed heavily in favour of the central and northern half of the state (central, north west and north east) which comprise of almost all key facilities under the Delhi government including, LNJP, G B Pant, GTB, Baba Saheb Ambedkar and Sanjay Gandhi Memorial which are all 200+ bedded hospitals. North, south west and south Delhi are deficient in Delhi government facilities which also limits the number of sites for potential development of dialysis infrastructure.

The Demand for Dialysis Services

Given Delhi's population of an estimated 17.62 Mn persons, the state would have an estimated ESRD incidence of over 3,000 patients every year[8]. Also, ~20% of patients

[8] Research Reports, interactions with key opinion leaders / researchers / consultants (nephrologists) and suppliers – incidence of ESRD in Indian ranges from 150 – 200 persons per million population (pmp)

undertaking dialysis in Delhi are from outside the state (patient inflow)[9]. If we assume that 15% of the patients would continue to opt for other forms of RRT such as peritoneal dialysis and renal transplantation, and given that the average life expectancy of a patient on dialysis is 2 years, the total number of patients requiring dialysis at any given point in time (prevalence of dialysis treatment) is over 6,500 people.

At optimum treatment and machine utilization levels[10] this translates to a requirement of ~1,100 dialysis installations in Delhi. However, it would not be prudent to assume that the entire population of Delhi would be able to afford dialysis services at the existing cost of treatment or even at highly subsidized treatment costs. This share would depend entirely on the level to which the prices can be reduced or government subsidy provided.

Table 2: Demand for Dialysis Services in Delhi

	Population (Mn Persons)	ESRD patients / year	Prevalence of ESRD[11]	Patients requiring Hemodialysis[12]	Machines Required
Total Delhi	17.62 Mn	3,100	6,200	6,500	1,100
SEC A, B & C	11.45 Mn	2,000	4,000	4,250	710

Even at current treatment levels and machine utilization rates, ~930 machines are required to treat patients requiring hemodialysis.

SEC D and E account for ~35% of the state's population. If we assume that this segment of the population will not be able to afford dialysis treatment even at discounted prices, until and unless the government provides for significant subsidies, the state still needs to

[9] Based on Research – interactions with multiple nephrologists and government and private hospitals and dialysis centres ~20% of the dialysis patients are from outside Delhi. This share is higher in key referral hospitals as AIIMS, LNJP, and Apollo Indraprastha etc.

[10] A dialysis patient ideally requires 3 sessions per week in hemodialysis. Also, efficient dialysis centres undertake an average of 3 sessions per machine per day (6 working days)

[11] If all ESRD patients dialysis treatment resulting in the an average life expectancy of ~2 years for ESRD patients

[12] Assuming ~15% of the ESRD patients opt for other modes of RRT as peritoneal dialysis and renal transplantation; ~20% of the dialysis patients are from outside Delhi

provide for over 700 dialysis installations[13] to meet the demand from SEC A, B and C categories.

However, the life expectancy of dialysis patients is expected to increase once extensive dialysis services are initiated on a PPP basis given better economic and geographic accessibility. This will lead to an increase in the average life expectancies of dialysis patients through increased access and frequency of treatment.

The table below highlights the demand for dialysis services given increasing life expectancies –

Table 3: Demand for Dialysis Services given Increasing Life Expectancy

Ave Life Expectancy	Prevalence of ESRD	Patients requiring Hemodialysis	Machines Required (Optimum)	Machines Required (Current)	For SEC A, B and C only
2.0	6,200	6,500	1,100	930	610
2.5	7,700	8,200	1,360	1,160	760
3.0	9,250	9,800	1,650	1,400	900
4.0	12,300	13,100	2,200	1,860	1,210
5.0	15,500	16,400	2,750	2,330	1,510

Even with a slight increase in average life expectancies of dialysis patients to 2.5 years the total number of machines required to optimally treat dialysis patients, and assuming efficient machine utilization, are over 1,300 machines. However, it is unlikely that optimal treatment requirements would be met as a significant majority of patients would still not be able to afford treatment 3 times a week. Even at current treatment rates, 1,100 hundred dialysis installations would be required in Delhi to meet the total demand in Delhi. Over 750 machines are required to meet the demand from the SEC A, B and C category population at current treatment rates.

Life expectancies for dialysis patients are significantly higher in other developed nations as the USA, UK, Australia and New Zealand all of whom have an average life

[13] At current dialysis treatment frequency (2.3 sessions per patient per week) and machine utilization (2.7 sessions per machine per day); ~600 dialysis installations are required to meet demand from SEC A, B and C categories only

expectancy of dialysis patients of over 5 years. Even developing nations such as Argentina and Turkey have life expectancies of over 4 years and 3 years respectively. The demand for dialysis services would therefore increase given increasing number of patients on dialysis.

Existing Availability of Dialysis Services in Delhi

This section provides a supply-side overview of dialysis services and skill in Delhi, split of supply in government and private sector, patient profile and treatment cost. It shall lead to assessing the overall gap in the provision of dialysis services and key issues

There are an estimated 500 dialysis machines in the city or ~28 machines per million persons. This supply is significantly higher as compared to the country average of ~5 machines per million persons and second only to Mumbai which has ~800 to 900 dialysis installations. However, given the demand for dialysis services this supply still falls short of meeting the treatment needs of the patients in Delhi.

Also, there are a total of 850-900 Nephrologists in the country of which about 90 to 100 are in Delhi. For provision of quality dialysis services the supply of skill also needs to be significantly augmented either through sharing of nephrologists under the PPP framework or creation of skill through the provision of adequate training to physicians and consultants in Internal Medicine.

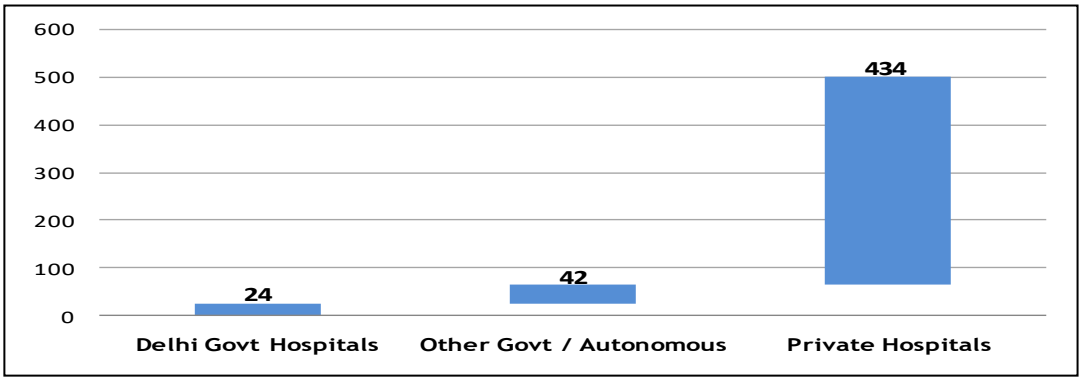
The following sections discuss the profile of supply of dialysis services in Delhi –

Distribution of Dialysis Infrastructure and Skill in Delhi

Most dialysis infrastructure and skill in the country is concentrated in large private hospitals. Government establishments account for an extremely low share of the available dialysis services.

The figure below depicts the distribution of supply across type of hospitals in Delhi –

Fig 9: Distribution of Dialysis Machines in Delhi by Ownership Type[14]



As evident from the figure above, hospitals under the Delhi government account for only 5% of the total dialysis infrastructure in Delhi. There are an additional 40 to 45 dialysis machines available in other government and autonomous hospitals in the state. Together the entire government and autonomous hospitals account for only ~12% to 13% of the dialysis infrastructure in the state. Given that almost the entire SEC D and E population amounting to 35% of the population and a section of the SEC C population depends almost entirely on government health infrastructure, the supply of dialysis services through the government set-up is inadequate.

In comparison almost 85% of the supply is concentrated in large government hospitals. Large hospitals such as Indraprastha Apollo with 22 machines and Sir Gangaram Hospital with 24 machines individually account for a supply almost equivalent to all Delhi government hospitals.

The private sector also accounts for a majority (80% to 85%) of Nephrologists practicing in the city. There are only 5 qualified nephrologists working in Delhi government hospitals – 3 in Lok Nayak Hospital and 2 in Guru Teg Bahadur Hospital. Dialysis centres at Baba sahib Ambedkar Hospital and Deen Dayal Upadhyay Hospital are managed by internal medicine consultants with training on Nephrology/dialysis. In comparison nephrology departments in large private hospitals have equal to or more than the total number of qualified nephrologists in Delhi government hospitals with Apollo having 6, SGRH 7 nephrologists and PSRI with 5 nephrologists. The availability of

[14] Other Govt / Autonomous hospitals include hospitals funded by the Govt of India, MCD Hospitals and other autonomous hospitals as ESI, Railways, Armed Forces etc.

support staff is also heavily skewed with a complete absence of qualified dialysis technicians. Support work regarding machine handling and managing of dialysis process is undertaken by Operation Theatre (OT) and Laboratory technicians trained to handle dialysis process.

Given the profile of current availability of dialysis services in Delhi Government hospitals, a significant investment in skill is required apart from the augmentation of quantitative supply to enable provision of quality dialysis services.

Utilization of Dialysis Infrastructure

On an average dialysis machines undertake 2.7 sessions per machine per day. There is however, a huge variation depending on ownership of the centre and patient volumes handled. A typical private centre undertakes an average of 3 sessions per machine per day as compared to government hospitals that undertake between 1 to 2 sessions per. This significantly reduces the available capacity in government hospitals which already have a short supply of dialysis infrastructure. The low utilization of machines in government hospitals are a factor of limited availability of human resources and rigid work hours.

Cost of Hemodialysis Treatment

The price for dialysis session charges across private hospitals in Delhi range from Rs. 1,200 to over Rs. 1,800 per session[15]. This results in a treatment cost of Rs. 12,000 to Rs. 18,000 per month towards dialysis session charges alone. Additional costs include costs of medicine and investigations which may range from Rs. 6,000 to Rs. 10,000 per month.

In comparison, treatment at the Delhi government hospitals is highly subsidized. Most of the dialysis capacity in the government hospitals is focussed towards meeting the requirements of the acute / emergency patients and maintenance hemodialysis is only entertained when additional capacity is available. The cost towards dialysis session, consumables, medicines and investigations in the Delhi government hospitals is borne by the hospital/government with the patient availing treatment free of costs.

The costs associated with the provision of hemodialysis services are significant. It is estimated that the cost of provision of a single session of dialysis in an efficient set-up

[15] This is a broad indicative range and some premium hospitals are priced higher than the average range; also patients on single-use dialyzers may incur higher session charges than indicated

amounts to ~Rs. 1,000. Avenues will need to be identified under the PPP framework to further reduce costs to enable a significant majority of the population to be able to avail dialysis services.

Dialysis Catchment Area

Delhi forms the healthcare hub for the entire north Indian region. Over 30% of the patients in key super-specialties are from outside the state including Haryana, Punjab, Rajasthan, MP, Uttar Pradesh, Uttaranchal and Bihar. This share is even higher and may go up to 50% in large referral hospitals as AIIMS, Apollo and Sir Gangaram Hospital.

However, given the nature of maintenance dialysis treatment requiring regular travel to the medical centre for maintenance dialysis this share is lower. Still ~20% of the maintenance hemodialysis patients across hospitals in Delhi are from outside the state from peripheral areas as Haryana, Uttar Pradesh etc. The share is higher in referral hospitals as LNJP and AIIMS given that they largely entertain emergency dialysis patients (as compared to maintenance dialysis) and receive referrals volumes from across the north Indian hinterland.

Gap Analysis

This section deals with the quantum of supply required to meets the demands of dialysis services in Delhi and the need for skill enhancement

As discussed earlier Delhi requires ~1,100 dialysis installations to meet the dialysis demand assuming an optimal treatment rate of ~3 sessions per patient per week and efficient machine utilization of ~3 sessions per machine per day. This leads to a requirement of ~600 additional dialysis machines to meet the demand. However, it would be unreasonable to expect that all dialysis patients meet optimum treatment criteria or even afford initial treatment even at a reduced pricing. It would be more practical to understand the demand from the segment that is most likely to afford treatment at reduced pricing and factor in increase in demand through increasing prevalence.

A total of ~760 to 900 machines are required to meet the demand from the SEC A, B and C category persons given an increase in life expectancy from 2 to 2.5 - 3 years. This leads to a gap of 260 to 400 machines in the provision of dialysis services. This gap would however increase significantly if dialysis services are provided free of cost to extremely poor / BPL category patients as then it significantly increases economic accessibility to dialysis services for people belonging to the SEC D & E category.

In the first-phase however, the government should look at the provision of 250 to 300 additional dialysis beds to augment existing supply of services.

Assessment of Facilities in Delhi Government Hospitals

This section provides an overview of the current availability of dialysis infrastructure and skill, support services, location, patient profile and catchment areas and referral characteristics of Delhi Government Hospitals. The objective is to identify the potential sites that can be developed to provide dialysis services under the PPP framework

A list of 25 hospitals owned and operated by the Delhi Government was provided by the Department of Health and Family Welfare (DoHFW). These hospitals were evaluated to understand the potential of these sites for development of dialysis services under a PPP framework[16]. Key elements of analysis included potential to generate dialysis volumes, availability of support infrastructure as critical care and casualty, geographic distribution of hospitals to enable even distribution of dialysis machines and the availability of space. Based on the evaluation of these hospitals along these parameters the hospitals have been clubbed into four (4) categories –

Table 4: Segmentation of Delhi Government Hospitals based on Potential for Dialysis

S.No.	Segment	Hospitals
1	Non-focus Specialty Hospitals	C N B C Hospital (Paediatric) N C Joshi Memorial Hospital Dada Dev Maitri Avam Shishu Chikitsalya Maternity-cum-health centre
2	Hospitals with a lack of support infrastructure	Satyawadi Raja Harishchandra Acharya Bhikshu Hospital Guru Govind Singh Government Hospital Rao Tula Ram Hospital Sardar Vallabh Bhai Patel Hospital Pt. Madan Mohan Malviya Hospital

[16] The Super-specialty hospital at Janakpuri and Rajiv Gandhi Super-specialty hospital at Tahirpur have not been included given that these hospitals are meant to be operated on a PPP basis

3	Hospitals with basic support infrastructure	G B Pant Hospital Sanjay Gandhi Memorial Hospital Bhagvan Mahavir Hospital Hedgewar Arogya Sansthan Jag Pravesh Chand Hospital Maharishi Balmiki Hospital Babu Jagjivan Ram Hospital Lal Bahadur Shashtri Hospital Arun Asaf Ali Hospital
4	Hospitals with existing dialysis services	Lok Nayak Hospital (LNJP) Guru Teg Bahadur Hospital (GTB) Deen Dayal Upadhyay Hospital (DDU) Baba Saheb Ambedkar Hospital

Segment I: Non-focus Specialty and/or Extremely Small Hospitals

These hospitals have the least potential for development of dialysis services given either a very small size or focus on specialties that have limited relevance for dialysis. N C Joshi Memorial Hospital is extremely small in size with 30 beds and the other hospitals in the group are focussed on obstetrics and gynaecology or paediatrics. While the potential of nephrology volumes from these specialties is in itself limited, these hospitals are also not tuned to provide ideal support services that a dialysis patient may require – intensive care and specialized medical treatment.

While internal/general medicine specialty is available in the segments discussed below, the ability to effectively diagnose and refer patients with chronic renal disease (CKD) or nephrology patients in general is varied across hospitals. This is due to a significant difference in the quantitative and qualitative employment of human resources in general medicine, availability of diagnostic services and critical care infrastructure. The hospitals have therefore been classified on the basis of critical care infrastructure as support infrastructure, also denoting that these hospitals are better suited to provide a higher level of care within general medicine.

Segment II: Hospitals Lacking Support Infrastructure

The hospitals in this category are those that have a strong internal medicine practice but are characterized by an absence of any critical care facility. These hospitals depend on the larger referral hospitals for intensive care treatment and channel critical care patients to these referral centres. Given that patients on dialysis are prone to emergencies as cardiac arrest, strokes and other medical eventualities requiring urgent care; it is advisable to have an in-house intensive care facility. These should be considered for development of dialysis services only if centres in the segment III and IV cannot be developed due to space or other constraints and/or to ensure a better distribution of dialysis services across the geographic spread of Delhi.

Variation also exists in hospitals within the segment. While most hospitals have planned for, or even applied for, the provision of critical care infrastructure the development of some is at an advanced stage.

The ICU at Hegdewar Arogya Sansthan is under construction and will most likely be commissioned next quarter which will increase the attractiveness of the hospital. On the other hand, the medical configuration at Rao Tula Ram Hospital is very basic with a significant shortage of qualified manpower and diagnostic services. The internal medicine department is serviced by junior residents in the absence of a full-time consultant. The hospital also does not have any ambulance in the emergency department at present and has requisitioned for 2 ambulances. The basic nature of infrastructure and services at the hospital inhibits the hospitals ability to effectively diagnose and channel relevant patients for dialysis or provide efficient emergency and/or intensive care services.

If these sites are to be developed for the development of dialysis services, given constraints in other centres, sufficient emergency infrastructure would need to be created within the dialysis set-up to ensure adequate treatment to the patient before being shifted to a referral centre critical care facility. It will also need to be ensured that good quality emergency and urgent care services are available at the hospital level to transfer the patient.

Segment III: Hospitals with Basic Support Infrastructure

Hospitals in this segment provide for the basic support services as critical care and emergency services. These centres also act as the referral centres at a local scale receiving critical care patients from other government hospitals in the vicinity not having such infrastructure. They have a catchment area larger than the other hospitals; have the skill, experience and infrastructure for providing a higher level of care and a public perception as a referral centre. Each local catchment in itself has a few centres that provide, and more importantly are known to provide, a level care that is higher than the other general hospitals thus increasing their attractiveness as potential sites.

Profile of hospitals in this segment is discussed below –

Sanjay Gandhi Memorial Hospital

This 276-bedded general hospital is located in *Mangolpuri* area of north-west Delhi. It provides outpatient consultations to over 6.3 lac persons annually including over 1.5 consultations in the general medicine unit. A majority of the patients at the hospital are from the immediate catchment area with less than 5% of the patients from outside the state. The hospital currently has a 4-bedded critical care unit operating at over 100% occupancy. The hospital administration is looking to increase the capacity of the ICU with the addition of 6 more critical care beds.

The hospital is also in close proximity to Baba Saheb Ambedkar Hospital at Rohini and Bhagvan Mahavir Hospital at Pitampura. Most nephro patients requiring dialysis are referred to Baba Saheb Ambedkar Hospital given its proximity. However, more complex cases or cases requiring references across super-specialties are referred to LNJP.

Bhagvan Mahavir Hospital

Is a new 160-bedded hospital located in Pitampura, Northwest Delhi. It provides outpatient consultations to over almost 4.9 lac persons annually including over 1.7 lac OPD patients in general medicine. The hospital has a 10-bedded critical care unit operating at 60% to 70% occupancy.

Availability of adequate space at the hospital should not be an issue given that it is a new hospital and is operating at occupancies lower than those witnessed at other hospitals.

Maharishi Balmiki Hospital

Maharishi Balmiki Hospital is located on *Pooth Khurd / Bawana* area on the outskirts of Delhi. Given its location, the catchment area of the hospital largely comprises of neighbouring villages in the state and the neighbouring state of Haryana which accounts for 30% to 40% of the patients at the hospital. The hospital provides OPD consultations to ~3.25 lac persons annually and is also the referral centre for other hospitals as Satyawadi Raja Harishchandra Hospital that do not have a critical care unit

The hospital currently has a 4-bedded critical care unit at 100% occupancy and is looking to provide an additional 2 beds in the critical care unit.

Babu Jagjivan Ram Hospital

This 100-bedded hospital is located in *Jahangirpuri*, northwest Delhi. The hospital provides OPD consultations to ~5.7 lac persons annually most from the local catchment comprising of Jahangiripuri, Azadpur and villages in the periphery of the city. The hospital currently has a small 2-bedded critical care unit operating at complete occupancy. The hospital is planning to undertake feasibility for the addition of 4 more critical care beds.

Aruna Asaf Ali Hospital

This is the only relevant category hospital located in North Delhi. Aruna Asaf Ali if a 160-bedded general hospital catering to over 3.6 lac outpatients annually, including ~1.2 lac OPD patients in the general medicine department. For super-specialty services, the patients are referred to either LNJP or GB Pant hospital based of medical requirement of the patient. The hospital has a 5-bedded critical care facility.

Lal Bahadur Shashtri Hospital

Lal Bahadur Shashtri Hospital is a 100-bedded general hospital located in Northeast Delhi. The hospital has a 6-bedded critical care facility. However, most serious cases or

those requiring super-specialty treatment including nephrology/dialysis treatment are referred to G T B Hospital which provides super-specialty care and dialysis services.

Hedgewar Arogya Sansthan

Located in *Karkardooma*, Northeast Delhi, this 200-bedded general hospital provides OPD consultation to over 6.2 lac persons annually including 1.7 lac persons in internal medicine. The hospital also has a 4-bedded critical care facility and refers tertiary care patients to GTB and LNJP hospitals. The hospital administration believes that additional space can be created on 2nd and the 3rd floor through re-modification to accommodate a dialysis facility in the hospital.

Jag Pravesh Chandra Hospital

It is a 200-bedded general hospital located in *Shashtri Park*, Northeast Delhi. The hospital also has a 10-bedded critical care unit but the availability of space for expansion in the existing building structure may be a concern.

G B Pant Hospital

G B Pant is a 601-bedded hospital located at *Dilli Gate*, Central Delhi and adjacent to LNJP Hospital. It provides for super-specialty services in Gastro, neurosciences and cardiac care and has excellent critical care infrastructure. The hospital does not however provide for nephrology services or dialysis treatment which is available at LNJP in the adjacent campus. For inpatients requiring nephrologist consultation doctors are called in from LNJP.

Given its proximity to LNJP which already has a robust dialysis infrastructure the attractiveness of G B Pant is somewhat reduced given that it may not be viable to have two large centres in such close proximity. However, in isolation, G B Pant provides good quality support infrastructure and has a central location for development of dialysis services. One of these two hospitals should ideally be developed for the provision of dialysis services through PPP framework.

Segment IV: Hospitals with Existing Dialysis Services

There are four hospitals owned and operated by the Delhi government that provide for dialysis and renal care services. While these hospitals are geographically spread across the state, the quantum of hemodialysis capacity available across these centres varies significantly.

Baba Saheb Ambedkar Hospital

Baba Saheb Ambedkar is a 335-bedded hospital located in *Rohini*, Northwest Delhi. At present the hospital conducts a weekly nephrology OPD and has a relatively new, 4-bedded dialysis unit. It is managed by an internal medicine (MD) consultant trained in Nephrology while the dialysis centre is supported by 2 OT technicians who have been trained to operate dialysis machines.

The dialysis unit works from 9 AM to 4 PM and is therefore able to accommodate only 1 session per day leading to a total 3-4 sessions per day across the entire dialysis unit. Given the limited capacity at the hospital, only emergency/acute patients are entertained and sometimes a maintenance dialysis may be provided if capacity is available. Most maintenance dialysis patients are informed about the available treatment / hospital options. However, a significant number do come back to the hospital as they do not undertake given the cost considerations and then provided dialysis on an emergency basis.

Medicines and consumables are provided free of cost to dialysis patients and patients are required to buy from outside when it is not available in the pharmacy. Also since the dialysis unit is located within the critical care complex, emergencies can be handled well.

The hospital also lies in close proximity to two other large hospitals namely the Sanjay Gandhi Memorial Hospital in Mangolpuri and Bhagvan Mahavir Hospital in Pitampura and provides a central location, therefore making it an ideal location for the development of dialysis services.

Deen Dayal Upadhyay Hospital

This 640-bedded hospital in west Delhi has a dialysis unit of 2 beds with limited space availability for the dialysis unit. One of the patients has to undergo dialysis in a stretcher given limited space availability.

The configuration of the unit is very similar to Baba Saheb Ambedkar with this unit also located in close proximity to the critical care unit. The unit is staffed with 1 OT technician trained on dialysis and 2 nurses apart from 2 consultants who manage nephrology / dialysis requirements at the hospital. The unit undertakes 1.5 to 2 sessions per machine per day or a total of 3-4 sessions daily, largely for emergency dialysis requirements. Maintenance dialysis is only provided for when capacity is available and in such a scenario the patient has to procure his own dialyzer. Medicines and consumables for emergency dialysis cases are provided free of cost from the hospital pharmacy.

The hospital acts as the referral centre in the west Delhi and receives patients requiring a higher level of care and nephrology/dialysis referrals from hospitals as Rao Tula Ram, Guru Govind Singh, Acharya Bhikshu and Sardar Vallabh Bhai Patel hospitals in West and Southwest Delhi.

Lok Nayak Jai Prakash Hospital (LNJP)

LNJP is a 1,676 bedded tertiary care hospital located in Central Delhi. It provides OPD consultation to 9 lac persons and inpatient services to over 72,000 persons annually. It is also one of Delhi's leading referral centres in the government sector receiving patients for critical care and tertiary services from most government hospitals across Delhi.

The hospital also has the largest dialysis unit across Delhi government hospitals with 11 dialysis machines. The hospital is planning to add an additional 6 machines in the unit. Of the 3 nephrologists in the hospital one is dedicated to managing the dialysis unit. He is supported by 5 technicians from varied specializations who have been trained on dialysis. The utilization of the dialysis infrastructure at the hospital is also significantly better than the other centres with machines being utilized for 3 sessions per machine per day. The focus here is also on providing emergency dialysis, and only 1 shift is reserved for the

maintenance dialysis patients who procure their own medicines and consumables. For emergency cases the consumables and medicines are provide free of any charge.

Given the central location of LNJP hospital and its reputation as one of the leading referral hospitals under the Delhi government makes it an ideal site for development/expansion of dialysis services under PPP.

Guru Teg Bahadur Hospital (GTB)

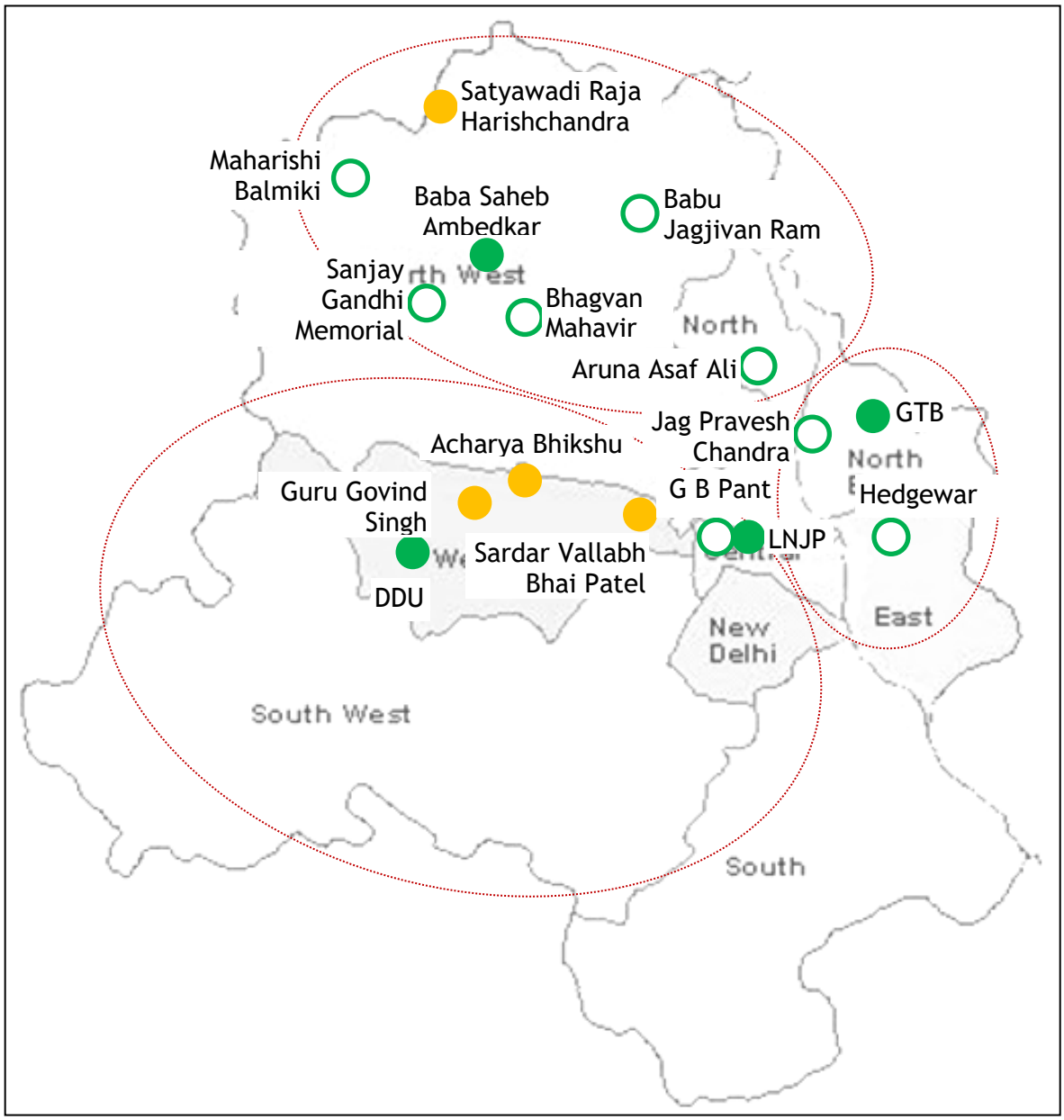
This 1,000-bedded tertiary care hospital located in northeast Delhi is the key government referral centre in the region providing services to almost 14 lac persons per annum.

The hospital also has a 7-bedded dialysis session undertaking 2 sessions per machine per day. At times the utilization may increase to 3 sessions per machine given the work-load and emergency requirements. Given the workload only emergency patients are entertained for hemodialysis while a large volume of patients requiring maintenance hemodialysis are turned away from the hospital. Medicines and consumables are provided free of cost at the hospital. The dialysis centre at the hospital is managed by 2 nephrologists, a senior resident and support staff comprising of 2 technicians from other units trained on dialysis and 2 technicians. The availability of quality support staff is a key constraint in increasing the utilization of the existing infrastructure.

While GTB is an ideal location for a large dialysis centre given a high-population catchment area and perception of GTB as a tertiary care referral centre, availability of area for dialysis may be a constraint.

The figure below provides a geographic distribution of Delhi government hospitals and potential sites for the development of dialysis services –

Fig 10: Distribution of Potential Dialysis Sites across Delhi



2.8 Recommendations

1. Need for setting up more machines in Delhi

In the first-phase however, the government should look at the provision of 250 to 300 additional dialysis beds to augment existing supply of services.

2. Initial Recommendations on Potential Locations

This section lists out the key Delhi government hospitals that provide potential for the development of dialysis facility under a PPP framework based on profile of the hospital, current availability of dialysis services, availability of support infrastructure, location and catchment area / referral flows.

Segments IV and III have been considered the most suitable for the development of dialysis services. While the former already has dialysis infrastructure of varying scales and the relevant support infrastructure required, segment III while not having any dialysis services has better support infrastructure than other general hospitals under the Delhi government. While availability of critical care infrastructure has been taken as the key defining criteria it also reflects better quality human resources to handle acute care and urgent care cases and enhanced public perception on ability to provide higher level of care increasing the catchment area for the hospital. The final distribution of machines would however also depend on a uniform distribution of machines across the state to ensure geographic accessibility. In such case hospitals in Segment II will also be considered with additional mechanisms to handle and transport emergency cases to the nearest critical care facility.

The ideal size of a unit has been taken to be 20 to 30 units spread across 10 centres/hospitals so as to ensure economic viability for the provider and enable a uniform distribution of machines across the state.

CLUSTER 1	
1	Baba Saheb Ambedkar
2	Bhagvan Mahavir
3	Aruna Asaf Ali

CLUSTER 2	
1	LNJP / G B Pant
2	DDU[17]
3	Acharya Bhikshu
4	Madan Mohan Malviya[18]

CLUSTER 3	
1	GTB
2	Hedgewar
3	Lal Bahadur Shashtri

[17] Given the limited number of potential sites in west and southwest Delhi it may be feasible to increase the capacity of the dialysis centre in DDU

[18] Is the only hospital located in south Delhi, development of critical care infrastructure in progress

2.9 Conclusion:

Given Delhi's population of an estimated 17.62 Mn persons, the state would have an estimated ESRD incidence of over 3,000 patients every year. Also, ~20% of patients undertaking dialysis in Delhi are from outside the state (patient inflow). If we assume that 15% of the patients would continue to opt for other forms of RRT such as peritoneal dialysis and renal transplantation, and given that the average life expectancy of a patient on dialysis is 2 years, the total number of patients requiring dialysis at any given point in time (prevalence of dialysis treatment) is over 6,500 people. This translates to a requirement of ~1,100 dialysis installations in Delhi. There are an estimated 500 dialysis machines in the city or ~28 machines per million persons. A total of ~760 to 900 machines are required to meet the demand. Thus to address the need for setting up more machines in Delhi , in the first-phase however, the government should look at the provision of 250 to 300 additional dialysis beds to augment existing supply of services. The ideal size of a unit suggested to be 20 to 30 units spread across 10 centres/hospitals so as to ensure economic viability for the provider and enable a uniform distribution of machines across the state (as shown in cluster diagram).

References:

S. No.	Source
1	Indicus report – 2006
2	Indian journal of nephrology; Economics of dialysis in India
3	Indian journal of nephrology; Hemodialysis
4	Indian journal of nephrology; Peritoneal dialysis
5	Association for Advancement of Medical Instrumentation, USA; European Renal Association and European Dialysis and Transplant Association

Annexures

Annexure 1: Hospital and City-wise cost of Treatment for Hemodialysis

S.No.	City	Hospital / Medical Centre	Dialysis Cost/Session[19]
1	Delhi	Indraprastha Apollo Hospital	2,300
2	Delhi	Pushpawati Singhania (PSRI)	1,600
3	Delhi	Batra Hospital	2,050
4	Delhi	Jaipur Golden Hospital	1,725
5	Ghaziabad	Yashoda Hospital	1,600
6	Dehradun	HIHT	1,400
7	Bareilly	Gangasheel Hospital	1,160
8	Jaipur	Monilek Hospital	1,250
9	Lucknow	Vivekanand Hospital	850
10	Ludhiana	SPS Apollo Hospital	1,760
11	Bhubaneswar	Kalinga Hospital	1,700
12	Guwahati	International Hospital	1,725
13	Kolkata	Apollo Gleneagles	2,460
14	Kolkata	Peerless Hospital	1,550
15	Ranchi	Raj Hospital	1,200
16	Bangalore	Apollo Hospital	1,600
17	Bangalore	Manipal Hospital	1,300
18	Chennai	MIOT Hospital	1,400
19	Chennai	Apollo Hospital	2,500
20	Cochin	Lakeshore Hospital	1,150
21	Cochin	Ernakulam Medical Centre (EMC)	1,200
22	Coimbatore	Kovai	950
23	Mysore	Vikram Hospital	1,170

[19] Dialysis session charges are inclusive of cost of consumables as dialyzer and tubing and have been adjusted for the reuse of such consumables

24	Ahmedabad	Sterling Hospital	1,310
25	Goa	Vrundavan Hospital	1,100
26	Kolhapur	Lotus Hospital	1,230
27	Mumbai	Hinduja Hospital	1,450
28	Mumbai	Lilawati Hospital	1,120
29	Mumbai	Wockhardt Hospital	900
30	Nasik	Life Line Hospital (Sahyadhari)	930

Annexure 2: Incidence and Prevalence of ESRD (pmp) and Average Life Expectancy

Country	Incidence	Prevalence	Life Expectancy
Argentina	141	598	4
Australia	115	778	7
Austria	158	912	6
France	140	957	7
Germany	213	1,114	5
Greece	196	984	5
Hong Kong	140	994	7
Hungary	159	699	4
Israel	203	657	3
Jalisco (Mexico)	346	929	3
Japan	275	1,956	7
Luxembourg	224	522	2
Malaysia	119	615	5
Netherlands	112	772	7
New Zealand	117	779	7
Norway	100	753	8
Shanghai	282	447	2
Spain	132	991	8
Taiwan	418	2,226	5
Thailand	139	286	2
Turkey	192	589	3
U.K., England, Wales & N Ireland	103	659	6
United States	363	1,641	5

Annexure 3: Size of Dialysis Units in Key Hospitals in Delhi

Hospital	Type	Number of Dialysis Machines
All India Institute of Medical Sciences (AIIMS)	Central Govt	10
Ram Manohar Lohia Hospital	Central Govt	6
Railway Hospital	Indian Railways	5
Lok Nayak Hospital (LNJP)	Govt of NCT of Delhi	11
Guru Teg Bahadur Hospital (GTB)	Govt of NCT of Delhi	7
Baba Saheb Ambedkar Hospital (BSA)	Govt of NCT of Delhi	4
Deen Dayal Upadhyay Hospital (DDU)	Govt of NCT of Delhi	2
Hindu Rao Hospital	MCD	3
Indraprastha Apollo Hospital	Private	22
Batra Hospital	Private	14
St. Stephens Hospital	Private	11
Fortis Hospital (Vasant Kunj)	Private	10
Sir Gangaram Hospital	Private	24
Pushpawati Singhania Research Inst. (PSRI)	Private	16

Annexure 4: Size, Volumes and Critical Care Infra in Delhi Govt Hospitals

Hospital	Total Beds	Focus Area	Internal Medicine OPD (2008-09)	Critical Care Beds
C N B C Hospital Chikitsalya	216	Pediatrics	N/A	N/A
N C Joshi Memorial Hospital	30	General	N/A	N/A
Dada Dev Maitri Avam Shishu	64	Pediatrics	N/A	N/A
Maternity-cum-health centre	0	ObGyn	N/A	N/A
Satyawadi Raja Harishchandra	200	General	137,605	0
Guru Govind Singh Hospital	100	General	131,056	0
Acharya Bhikshu Hospital	100	General	163,149	0
Rao Tula Ram Hospital	100	General	93,165	0
Pt. Madan Mohan Malviya Hospital	65	General	139,367	0
Sardar Vallabh Bhai Patel Hospital	50	General	99,680	0
G B Pant Hospital	601	Super-specialty	N/A	146
Sanjay Gandhi Memorial Hospital	276	General	150,121	4
Bhagvan Mahavir Hospital	160	General	173,169	10
Hedgewar Arogya Sansthan	200	General	170,765	4
Jag Pravesh Chand Hospital	200	General	161,483	10
Maharishi Balmiki Hospital	150	General	84,391	4
Babu Jagjivan Ram Hospital	100	General	134,699	2
Lal Bahadur Shashtri Hospital	100	General	237,579	6
Arun Asaf Ali Hospital	160	General	118,462	5
Lok Nayak Hospital (LNJP)	1,676	Super-specialty	292,895	Dialysis Available
Guru Teg Bahadur Hospital (GTB)	1,000	Super-specialty	299,063	Dialysis Available
Deen Dayal Upadhyay Hospital (DDU)	640	Super-specialty	236,222	Dialysis Available

Baba Saheb Ambedkar Hospital	335	General	240,963	Dialysis Available

Annexure 5: Interview guide – Delhi government hospitals

Availability of Dialysis Infrastructure and Services
Human Resource Employment - Dialysis
Demand-supply Scenario at Hospital Level
Potential to Develop Site for Dialysis Services

Availability of Dialysis Infrastructure and Services

1. Key specialties (available)
2. Does the hospital have facilities for provision of dialysis services _____
3. If yes, Dialysis infrastructure available at the hospital
    a. Area occupied by the dialysis centre: _____ (sq ft/mtr)
    b. Total Dialysis beds/machine installations: _____
        i. Age of machines: _____ (years)
        ii. Make/brand of dialysis machines: _____
    c. Number of dialysis machines working: _____
    d. Configuration/process of emergency back-up available in the dialysis centre (if any)

        _____

        _____

        _____
4. Pricing
    a. Dialysis session charges: _____ (Rs/session)
    b. Consumables:
        i. Charges for key consumables (dialyzer + tubing): _____
        ii. How many times is the dialyzer re-used: _____
        iii. What share of patients is on single-use dialyzers: _____
    c. Pharmacy:
        i. Do the patients on dialysis have to pay for medicines?

            _____
        ii. Are medicines available at subsidized/discounted prices?

            _____
        iii. Ave expenditure/month on medicines for dialysis patient?

            _____

Human Resource Employment – Dialysis

5. Human resources employed in the dialysis set-up
    a. Doctors (Nephrologists): _____
    b. Resident doctors: _____
    c. Dialysis technicians: _____
    d. Nursing staff: _____

Demand-supply Scenario at Hospital Level

6. Patient volumes (OPD and IPD) by key specialties (available)
7. Number of people diagnosed with renal failure per month

    _____

    (*Nephrology and/or the general/internal medicine department; some volumes may also be referred from allied specialties as cardiology etc.*)
8. For hospitals not having dialysis facilities:
    a. How many patients are referred outside per month for dialysis?

    _____
    b. What are the key referral centres? _____, _____,

    _____
    c. What happens in case of existing inpatients requiring dialysis?

    _____

    _____

    _____
        i. Are there a large number of such cases? _____ (% of total inpatients)
9. For hospitals currently having dialysis facilities:
    a. Number of sessions per machine per day: _____
    b. Number of working days: _____
    c. Number of patients on peritoneal dialysis: _____
    d. Number of patients referred to other facilities due to capacity constraints:

    _____
    e. Which are the key referral centres for dialysis: _____,

    _____
    f. What % of dialysis patients have medical coverage for dialysis:

    _____

Potential to Develop Site for Dialysis Services

10. Location of the hospital
11. Is space available for setting up/expanding the dialysis centre

    _____

    a. Total area/space available?

       _____

12. Possibility of setting-up an exclusive RO plant for dialysis

    _____

    _____

    _____

13. Qualitative description of available space:

    _____

    _____

    _____

14. Support services available at the hospital
    a. Number of critical care/ICU beds in the hospital

       _____

    b. Occupancy of critical care facilities

       _____

    c. Configuration of the emergency department
        i. Human resources: Doctors_____; paramedics_____; nursing staff_____
        ii. Volume of emergencies:
            _____ (patients/day)
    d. Does the hospital have a pharmacy?

       _____

        i. Is it well-equipped to service dialysis patients?

           _____

           _____

        ii. Are medicines available regularly?

            _____