EMPOWERING PRIMARY HEALTH CARE SERVICES THROUGH E-GOVERNANCE
A Case Study from Delhi Government

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Abstract: In the field of health care services the responsibility for their delivery is shared by many agencies in the public sector. In addition there are central government ministries each with their own institutions. Each of these agencies provides health care services in Delhi through a variety of outlets like dispensaries and hospitals. These institutions function independently and there is neither proper coordination between the government agencies managing them nor between the institutes themselves at the operational level. This coordination is essential from the point of view of having a structured patient referral system and sharing of resources between institutes in addition to providing feedback to shape government health policies. In this research paper the study focuses on primary health service centres of Delhi Government. The research objectives of this paper are:

- Study the working of Primary health centres including services provided.
- Study the level of IT usage in these dispensaries
- Analyze key problems faced by these dispensaries
- Propose an e Governance model to manage these dispensaries
- Determine obstacles & challenges in implementation of this model.

This research paper uses some technologies that are being used by National health services (NHS) of UK. These technologies include use of call centers for service delivery and Decision support systems (DSS) that are being used in patient interaction.

1   INTRODUCTION

Delhi is an old city and has slowly expanded over the years to acquire its present status of a big metropolis. As per the census of 2001 Delhi with an area of 1483 sq km has a population of 137 lakhs with a population density of 9294 persons per sq km, which is the highest of India. In this population only 7 % are residing in rural areas making it a total urban city. About 35 % of Delhi's population lives in slums. According to the projections of Registrar General of India on 1st march 2005 the population of Delhi was 15.6 million and is expected to reach 25 million by 2020.

The release of land for providing housing and health infrastructure has not matched with the growth of the city. As a result health infrastructure of Delhi is inadequate in respect of actual needs.

In Delhi health care facilities are being provided by both governmental and non governmental organizations. Among the Government organizations the Directorate of health services (DHS) is a major service provider in the health sector. This directorate participates in delivery of health care services, and coordinates with other government and non government organizations to provide health care to Delhi's citizens The DHS also coordinates and monitors various health programs of state and national importance.

The DHS provides health care facilities at primary and secondary level through a chain of health outlets like dispensaries and hospitals. The DHS is providing primary health care services through a chain of 180 allopathic dispensaries. The DHS constantly monitors delivery of its programs by collecting data regularly from its dispensaries. In addition this directorate collects data on public

health and communicable diseases for analysis and required action.

The health centres under DHS are its frontline health outlets capable of providing health promotion, health protection and treatment of various ailments to the community. The vision of DHS is to promote these health outlets as the backbone of health services and overall health development with a view to actively involve these outlets in bottom up planning. The Planning branch of DHS is responsible for planning the development of primary health services including monitoring the functioning of existing centres. The state of Delhi is divided into 8 districts with each district being headed by a Chief District Medical Officer (CDMO). Each district has its own chain of dispensaries.

In the UK, the NHS has used some key technologies like call centers for patient interaction and Decision support systems which are assisting in this. The delivery model proposed also makes use of nursing staff managed call centers and information kiosks. The nurses are assisted by an online Decision support system for patient counseling.

According to the NHS web link:http://www.nhsdirect.com/aboutnhsdirect.html enables a patient to search for the nearest doctor, dentist, optician, pharmacies and hospitals including a map search facility. The NHSDIRECT online is a help line supported by a 24 hour nurse advice and information help line. It can prescribe treatments for common health problems by using a body key and identifying symptoms by asking patients simple queries. It has information on over 700 topics covering tests, illnesses, treatment and operations. A patient can also enquire about something by filling an online form and the query is answered within five days by a qualified professional. It has a searchable database of doctors, hospitals, pharmacies and other health care services.

According to (Kannabiran, 2004) citizen relationship management (CZRM) is about reorienting service operations of government around citizens instead of administrative processes. The core of a new e Government paradigm is to transform customer relationships along with processes and mediums that support them. E Governance efforts need to be backed by end to end process reengineering with citizen centric strategies.

The concept of Decision support systems(DSS) along with its role and benefits in the practice of General practitioners in UK has been discussed by (Thornett, 2001). A rule based Decision support system is being used in NHS Direct service,

launched in 1998, which is a 24 hour medical telephone helpline, staffed by nurses. It provides health care advice in out hours and saves the cost of employing doctors in running its day to day services. The sharing of information on Decision support systems between General practitioners of NHS is expected to improve the quality of health care in primary health care services of the NHS in UK.

2 RESEARCH METHODOLOGY

A random sample size of 32 was selected out of 180 dispensaries by random sampling. A physical survey was undertaken in each dispensary to count average daily attendance and number of patients with access to internet and telephone. A team of 4 surveyors studied this count spending 5 days in each dispensary with one day's duration equal to 6 hours. The entire survey was completed in 2 months by this team in the year 2006. Also the functioning of dispensaries was observed by study visits to all 32 dispensaries. The web site of Delhi government was also studied for analysis and determining the on line presence for dispensaries. In the same survey the level of IT usage in each dispensary was determined. The access of 56 doctors in these 32 dispensaries to internet and mobile phones was also determined.

3 RESULTS AND DISCUSSION

3.1 Statistical Analysis

According to the annual report of (Directorate of Health services, Government of Delhi, 2004-05), the statistics for dispensaries for the last 7 years are given in the table below:

Table 1: OPD attendance data in dispensaries.

YEARS(x)	OPD ATTENDANCE(y)	NO OF DISPENSARIES(z)
1998-99	3682813	139
1999-2000	3823689	139
2000-01	6381712	155
2001-02	7032010	167
2002-03	7347775	171
2003-04	8550673	173
2004-05	9784722	179

Performing correlation between years(x) and annual OPD attendance(y), we obtain the correlation coefficient as $r(x,y) = 0.976$

Table 2: Data showing IT usage in dispensaries.

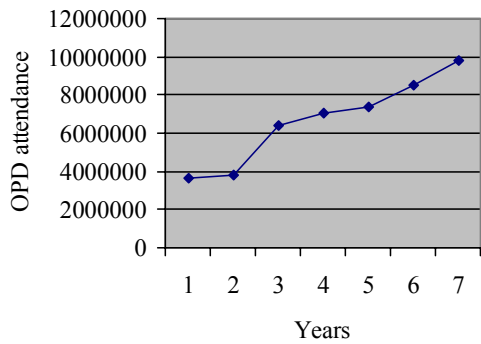| Dispensaries	Telecom facility	No of telephones	No of computers	Internet facility	Technical staff	Website
32	nil	32	nil	nil	Nil	Nil

Figure 1: Graph between years and OPD attendance.

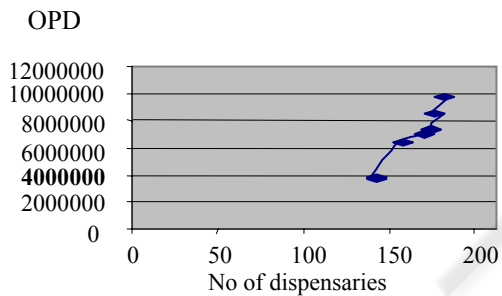Figure 2: Graph between OPD attendance and number of dispensaries.

Figure 3: Internet access in patients.

Figure 4: Telephone access in patients.

The Figure 1 between OPD attendance and years along with the Figure 2 between OPD attendance and number of dispensaries are shown above.

Now, performing regression analysis between OPD attendance(y) and number of dispensaries (z), the following regression equation is obtained:

$$z = 113.61 + 0.7032\ y \qquad (1)$$

Applying this equation, we obtain:

If $y = 110$, $z = 191$.
If $z = 200$, then $y = 122.85$(in units of 100,000).
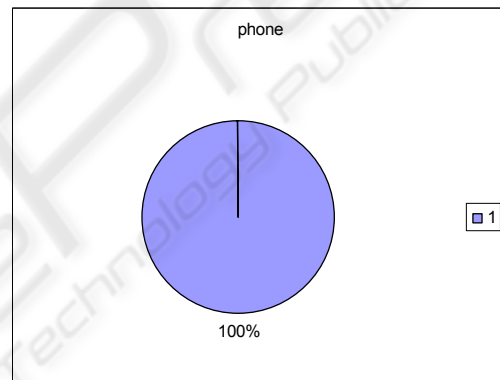
In the above figures it can be seen that out of a total of 6800 patients surveyed in 32 dispensaries, only 287 have access to internet either at home or in a public cyber café while all 6800 surveyed have access to a telephone either self, mobile, or a public phone, which means that just over 4 % have access to internet while 100 % have access to a telephone. This is an important result for determining the most effective medium for delivery of health care services in dispensaries.

3.2 IT Usage in Dispensaries

We can infer from the above table 2 that none of the 32 dispensaries surveyed is computerized nor do they have any technical staff. No dispensary surveyed has internet facility.

Among the doctors surveyed in these 32 dispensaries it is found that out of a total of 56 doctors working in these 32 dispensaries, 34 doctors

are active users of internet and use it for professional development even though no dispensary is having any provision for internet facility. Thus about 60 % of the doctors surveyed were familiar with internet usage. Also all 56 doctors were having their own mobile phone or 100 % of doctors surveyed had access to their own mobile phones. This result can be used while developing a model for delivery of health care services in the next section of this paper.

However despite the lack of computerization the web site of the health department of the Delhi government at http://health.delhigovt.nic.in gives a listing of dispensaries under DHS. This listing can be obtained district wise also. It gives the address and phone number of each dispensary. However the map search facility in which one can open the profile of each dispensary in a district does not function. The resources in these health outlets like number of doctors and diagnostic services provided are not displayed for any dispensary. Even these details are meaningless for more than 90 % of patients as they lack access to internet and are unable to view this information. In fact in our study over 32 dispensaries only 4 % of patients were having internet access. Therefore an alternative delivery mechanism needs to be constructed.

3.3 Other Findings

These findings were obtained through personal study visits to these 32 dispensaries in which their functioning was studied. They can now be tabulated as follows:

1. OPD timings: All dispensaries opened between 8 am and 2 pm. Thus there was no off hours support for patients.
2. There was a need for specialist doctors visits to dispensaries on a regular basis as these are managed by only General practitioners.
3. Referral of patients is unidirectional and no track of referred patients is kept. A record of referred patients is kept in the dispensary only for government employees and not for general patients.
4. No contact between dispensary and secondary hospital at point of referral.
5. A patient does not know which ailments can be treated at the dispensary level. Even for common ailments they are reaching hospitals instead of first visiting the local dispensary.
6. There is no medical records department in these dispensaries and monthly reports are compiled manually and carried by hand by a Nursing orderly(NO) to the district CDMO office. As a result previous year's statistics are not properly maintained at the dispensary level.
7. The notification of infectious diseases is done by the Dispensary MO by telephone or through written document which is again carried manually to the District CDMO office.
8. The process of consultation with other doctors by doctors from the dispensary is done through their personal mobile phones / land phones and there is no official facilitation for this process.
9. No separate space/ counter for OPD registration exists in dispensaries and is being done in the open space leaving patients exposed to infectious threats like TB from such patients who also visit these dispensaries.
10. The dispensaries offer only basic lab tests like urine, stool, and blood sugar, because of lack of equipment like auto analyzer .A patient who has to be tested for more tests is referred to hospitals.
11. The present working strength of staff in a dispensary indicates a shortage of manpower like doctors, pharmacists and the lab technician. As an example a dispensary with one doctor faces a problem if this doctor is on leave. Similarly in a dispensary with 2 doctors if one doctor is absent full patient load comes on the single doctor. The same reasoning applies to the working of pharmacists (2 in a dispensary) and the single lab technician. Thus there is no manpower back up to deal with these situations.
12. The referral of patients from a dispensary is occurring because of lack of more diagnostic facilities in the pathology lab, lack of X RAY machine, absence of specialist doctors visits, lack of ultrasound facilities, and ECG machine.

4 THE PROPOSED E-GOVERNANCE MODEL

The present administrative hierarchy in dispensaries is as follows:

DHS

↓

DISTRICT CDMO

↓

MO (DISPENSARY IN CHARGE)
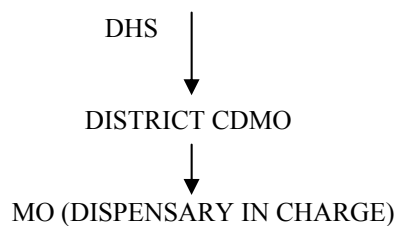
Accordingly to support this structure the ICT infrastructure for each district can now be designed. This infrastructure will support the proposed e Governance model.

In effect this categorization produces a hub and spoke model in each district at the primary level. This model can be used in:

- Load balancing: Redirection of patient flow to balance patient loads within a district.
- Manpower planning: Plan deployment of medical staff for Hub and for spokes.

- Equipment planning: Plan deployment of medical equipment like x ray machines in hub and spokes.

As an example we can show how load balancing can be achieved.

We assume a OPD slot of 6 hours per day and 5 minutes per patient per doctor. Therefore a dispensary with 1 doctor has a capacity of 12 patients per hour or 72 patients per day for a slot of 6 hours. Excess load for a dispensary is Present load – Capacity. Then total excess load in the network can be calculated as 724.

The Hub is selected to absorb all excess load transferred from the spokes while by design the spokes are constrained to their capacity. The Hub is selected according to load(volume) . So the center with the highest load i.e. dispensary e is the hub.
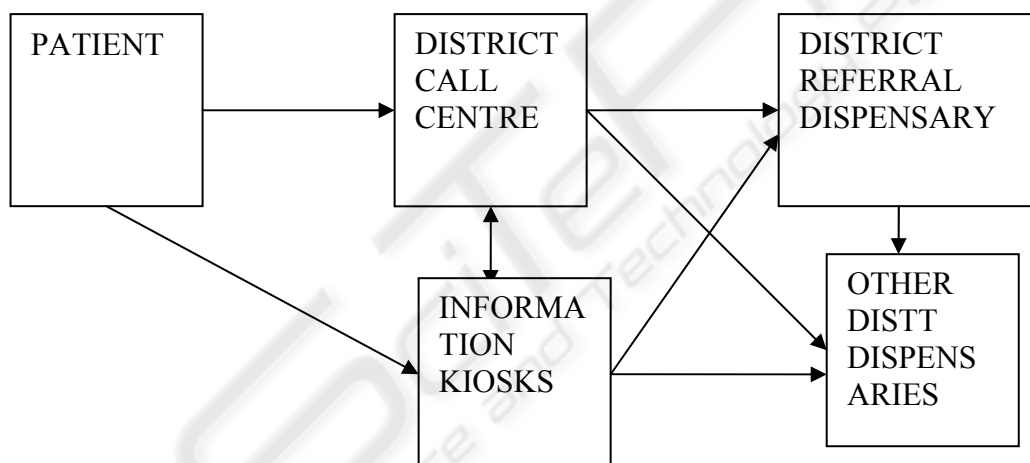

Figure 5: The proposed e Governance model.

Table 3: Hub and Spoke model input.

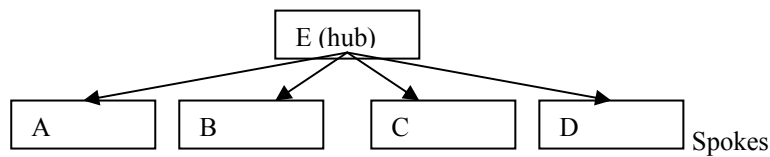| Name of dispensary	No of Doctors	Present load/day	Capacity of dispensary	Excess load
A	2	200	144	56
B	1	150	72	78
C	2	250	144	106
D	1	300	72	228
E	2	400	144	256

Figure 6: Generation of Hub and Spokes.

This results in a hub and spoke model.
The new load distribution can now be calculated as follows:

Table 4: New load distribution using hub and spoke model.

Name of dispensary	New loads on dispensary	Number of Doctors
A	144	2
B	72	1
C	144	2
D	72	1
E	724+144= 868	12

The number of Doctors needed in Hub (E) is therefore 12. The health care managers can also choose 2 hubs for a district, in which case the dispensary with second highest load i.e. D (300) becomes the second hub. In this case both hubs share the total excess load transferred from the spokes equally. The hubs can also be chosen according to the distances between the dispensaries. The Decision support system is thus model driven and must have the capability of performing this load balancing analysis along with manpower and equipment planning using the same hub and spoke model. The Hub and spoke model facilitates the following:

- Decentralization of health care services by forming hub and spoke models in the districts.
- Regionalization of health care services: This is done by directing patients to the nearest region (district).
- Minimizing referral to secondary care services in the district: This is done by strengthening the hubs by providing more manpower and equipment at the hubs.

Once a hub and spoke model is created , further requests for patient servicing can be satisfied by : The present hub or its spokes(if they have free capacity). However if the present network is full, the requests for patient servicing must be redirected to the nearest hub and spoke network. Again search is performed in that network to verify if the request can be satisfied by the hub or by its spokes.

This model proposes to set up a District Call centre in each of the eight districts of Delhi. This call centre will be linked to a network of information kiosks. The delivery of health care services in a district will now be routed through this ICT infrastructure. In addition, one out of the dispensaries in a district will be designated as DISTRICT REFERRAL DISPENSARY. This dispensary will be provided with equipment and services that are currently lacking in a dispensary. In particular this dispensary will be equipped with X RAY machines, ECG machines, ultrasound facility, and Auto analyzer for advanced pathological testing. This dispensary will be equipped with Telemedicine links to other dispensaries and to hospitals in the district which will facilitate consultation between General practitioners managing a dispensary and specialist doctors working in hospitals in the district. This will benefit such patients visiting a dispensary. This removes the need to employ specialist doctors for the referral dispensary as also for the other district dispensaries.

The call centre in a District will be manned not by ordinary call centre employees but with nurses. This will be a 24hours help line. This will support patients through the day. The nurses are supported by an Online Decision support system which will help them provide on line counseling to calling patients for common ailments as well as for other queries about the health system .It will help maintain an online database of patients so that those patients visiting dispensaries can be supported in off hours through medication advice and counseling. This ICT infrastructure will provide the following services:

- E Registration: online registration of OPD patients visiting the dispensary.
- E pharmacy: The information kiosks become mini pharmacies and dispense medicines to repeat patients.
- The information kiosks and call centre regionalize health care services in a district by advising patients to visit the nearest dispensary in the district.
- The District Referral dispensary becomes the telemedicine hub for districts and links to hospitals in the district.

- The Dispensary must be made the first point of contact for all patients except emergency patients. This will prevent patients with common ailments from directly visiting hospitals.
- All district dispensaries can have a common website putting details of resources on line.
- Dispatch of all monthly reports by dispensaries can be made online.
- Notification of infectious diseases is made online.
- Online consultation groups for doctors working in dispensaries. Computerization of dispensaries should proceed in parallel with this ICT infrastructure.
- Since 100 % doctors possess mobile phones, they can use them to access the call centre and this facility can be provided to patients too.
- In order to monitor working of a dispensary hospital managers must have access to an Online DSS which can make predictions about different resources required based on the number of patients visiting the dispensary. This will facilitate online decision making and help health planners in planning for new dispensaries.

5 CONCLUSIONS

- There is no computerization existing in dispensaries
- Dispensaries lack resources of manpower and equipment.
- Dispensaries can be empowered through e Governance and a supporting ICT infrastructure.
- Telemedicine can be used to avoid employing specialist doctors in dispensaries.
- Call centers and information kiosks broaden access to patients as 100 % patients have access to a telephone.
- A purely web based model is inadequate to provide health care services to citizens. It has to be a mix of Web, call centers, information kiosks, radio and television.
- A separate department of IT needs to be set up in the health department to make long term plans and ensure coordination between different stake holders. The department is presently dependent on external IT vendors which reduces its capacity to sustain the technology.

- The process of patient referral needs to be made structured and bi directional between hospitals and dispensaries.
- The District referral dispensary will reduce patient load on hospitals while reducing referrals from dispensaries. By using Telemedicine links it gives access to specialist doctors to those patients who need their services but are remotely located from them.
- The ICT infrastructure further reduces load on dispensaries by distributing services like OPD registration and pharmacy.

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