

ARAVIND EYE HEALTH CARE OPERATIONS

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INTRODUCTION

Improving efficiency in health care is an acute issue. In the developed world this is due to increases in costs and quality issues (Aptel and Pourjalali, 2001; Spear, 2005); Western Europe currently spends 9% of its GDP on health care, and, if the trend continues, will spend over 20% by the year 2050 (Drouin *et al.*, 2008.) In the developing world on the other hand demand exceed capacity; it was estimated that in 1997 over 12 million people were blind in India from cataracts, while a further 3.8 million new cases are developed each year, and current capacity for surgery is far below this level (Thulasiraj *et al.*, 1997.)

Better health care operations are clearly required to deal with issues of ageing population, increased costs and unmet demand.

One case that provides clues to such means is Aravind, the largest eye care provider in the world, with over 2.5 million operations performed and 20 million patients treated in the last thirty years. An Indian non-for-profit organization in which two thirds of the patients are treated for free, Aravind attends its goals by strict attention to cost optimization.

THE STORY OF DR. V

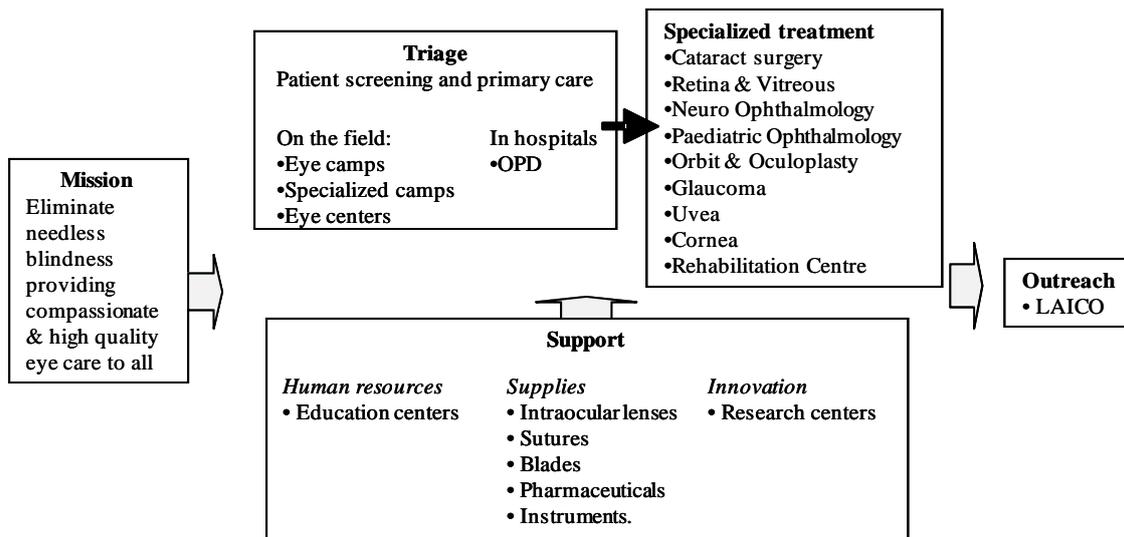
Dr. Govindappa Venkataswamy (known as Dr. V) retired at age 58 from a life in public health as an ophthalmologist in India. He then started, with his sister and brother in law, an 11 room clinic in southern India to treat poor patients who suffered cataracts and other eye diseases. Thirty years after these modest commencements Aravind comprises a network of five regional hospitals that perform over 200,000 cataract operations per year, 70% of them without cost to the patient (Chang, 2007). Aravind is not funded through government grants, aid-agency donations or bank loans. Instead, the model Dr. V chose was that of high operational efficiency: extreme cost reductions that have enable the organization to be supported on an average contribution of \$40 from the third of its patients who can afford it. This obsession with efficiency has prompted some observers to liken this model to McDonald's processes, an analogy happily adopted by Dr. V. (Bulletin of the World Health Organization, 2001)

Aravind provides an entire range of eye care services from primary eye care to the tertiary eye care. This network structure, represented in Figure 1, allows Aravind to reach a large rural population in South East India, who cannot afford transportation to the hospitals, facilitating the creation of scale economies (Thulasiraj, 2007). Triage¹ at the primary care level facilitates a

¹ Triage, a process of classification in order of importance, was first applied in the First World War by French doctors as a mean to have a rapid classification of casualties in the field, and has been extensively used and analyzed in Emergency Rooms.

reduction in patient variability at the specialized treatment centres. Cost reductions are facilitated by integrating their own production facilities of supplies, process innovation and specialized human resources, this last critical as there is a large reported turnover of trained medical personal (Shah and Murty, 2004). Finally a foundation allows the diffusion of the Aravind model, contributing to the original mission of the institution.

FIGURE 1
NETWORK OF ARAVIND FACILITIES



Screening Camps: Due to the large population of untreated patients who cannot afford displacement to the main hospitals (Robin et al., 2004), Aravind sets temporary screening camps in villages, typically over the week-end. These primary attention centres perform triage and offer free transportation to hospitals for those patients that require specialized treatment. In 2006, 1,793 such camps were conducted, examining over 2.3 million patients and performing 270 thousand site restoration surgeries (<http://www.aravind.org/community/index.asp>). This initiative has been extended to special areas like school screening camps, refraction camps, diabetic retinopathy detection and awareness camps and primary eye care vision centres, and include the use innovative technology such teleophthalmology (Bai et al., 2007).

Support: to reduce the cost of intraocular cataract lenses Aravind developed in 1992 their own production facility, Aurolab, a non-profit charitable trust, ISO 9002 certified, which manufactures close to 700 thousand lenses per year, export to 90 countries and enjoys a 10% global market share for lenses that cost about eight dollars each, compared to about 150 dollars for similar lenses made in the west (Karlam, 2004; Bulletin of the WHO, 2001). Similar facilities have been developed for the production of sutures, blades, pharmaceuticals and instruments. Aravind also facilitates the production of specialized human resources to offset high turnover rate of medical personal (Shah and Murty, 2004) through training institutes (Aravind Postgraduate Institute of Ophthalmology) and of process innovation through dedicated research institutions (Aravind Medical Research Foundation).

Outreach: a teaching and training institute, the Lions Aravind Institute of Community Ophthalmology, created in 1996 extends the activities of Aravind to other areas and countries through teaching, training, capacity building, research, publications and advocacy to governments and voluntary agencies.

Hospitals: the network of Aravind comprises five eye hospitals with a combined bed capacity of 3,500, serving primarily the southern States of India. To the initial facility at Madurai (1976,

expanded continuously to present capacity of 280 paying and 1100 free patients) followed those of Theni (1985), Tirunelveli (1988), Coimbatore (1997) and Pondicherry (2003). These hospitals provide both primary care and specialized services.

HOSPITAL PROCESSES AT ARAVIND

We now show the processes of the outpatient department (OPD), and of the Operating Room.

Outpatient Department (OPD): Patients enter the hospital through a designated OPD entrance (appendix 1). Some patients are referred from other health service providers, but most come by themselves, dropping in without prior appointment, pulled by the good reputation of the hospital, spread mainly by word-of-mouth as the hospital does not advertise. The eye camps constitute a form of advertising for the free eye care services, which has a spill over effect on the paying segment of patients. Most patients are accompanied through the whole OPD process by 1 to 2 relatives. This means waiting areas in the OPD are occupied by as many patients as relatives.

New patients go to a reception counter, staffed by one receptionist, and fill a card with basic personal information. Then they wait in one of three lines in front of three registration counters, staffed by one receptionist each. On hitting the counter the patient pays 50 INR (about 0.8 Euros) and the receptionist enters the patient data into a proprietary patient management software, which prints out a card with two parts: an OPD patient card on which all stations will write the results of examinations, and a patient tag, which is separated by the receptionist from the card, folded, stamped and put into a plastic cover to serve as a patient passport for consecutive visits. The software automatically assigns the patient to one of the three OPD Units, balancing out the patient flow between the three units.

Patients then sit down in the waiting area. Patient cards are collected by a receptionist who will guide them to the OPD. As soon as 6 patients have been registered the entrance guide calls the six patients through a microphone and guides the batch of patients via the first station (vision test) to the OPD Unit, where she hands the patient batch over to the OPD nurses. The typical batch is 6 patients, but can range from 1 to 6 according to patient load/flow. The expressed goal of the registration department is to move patients as quickly as possible to the OPD or the speciality clinics, to reduce crowding in the limited waiting space of the registration area. Paediatric patients (age 1 to 15) are moved directly from the registration area to the paediatric speciality clinic. The patient files are never handled by the patients themselves, but are carried by receptionists and nurses from station to station. Patients, who are referred to speciality clinic after having passed through the OPD, make a second registration at the respective speciality clinic, where they have to pay an additional 50 INR and where their OPD card is stuck into a folder of a colour specific to the speciality clinic. In the occasional case of a patient visiting several speciality clinics on the same day he/she pays the 50 INR registration only once and the colour of the file is defined by the first speciality clinic visited (which is usually the one associated with the main diagnosis).

At the end of the OPD or speciality clinic visit the patient card / file is retained by the nurses in the respective department to be collected by the receptionists during one of several collection rounds in the course of the day, to be brought back to the reception area, where the diagnosis is entered into the IT system. After that the file is filed in two filing rooms in the registration area. Old files are kept in additional rooms in the basement and 5th floor, which are connected with the IT system. In the case of returning patients the receptionists locate the files through codes in the computer system, retrieve it from their own filing area, or request them through the computer system from the other two filing stations. The Patient Card issued during the registration of new patients is valid for three months and allows for three visits without the need to pay repeat registration fees. Patients coming for these repeat visits are called recurring patients and register at a separate registration counter, which has a similar set-up and work routine as the previously described registration area. The main differences are that the patient does not pay a registration fee, he/she already has a Patient Passport, the receptionists will retrieve the file of the patient from the filing room, and the patient skips the vision test and is accompanied directly to the speciality clinic (incl. Unit III, which

after 11 am serves as the speciality clinic for cataract patients) where he/she has an appointment. The receptionists locate the files through codes in the computer system and can request old files through the computer system from the other two filing stations. Last year the hospital started a trial to decrease patient burden at the registration department by registering recurring patients of retina and specialized clinics directly at the speciality clinic. These clinics can request old files through the computer system from any of the filing stations.

New patients now go through a vision test. The entrance guide accompanies the batch of patients to the vision test waiting area and asks two patients to take a seat in the vision test room. If patient load is high, two nurses will perform the vision test simultaneously on the two patients seated side by side. If patient load is low one nurse will perform the test in sequence. As soon as all patients from the batch have done the test the entrance guide accompanies them to the OPD area, where she asks them to sit down in the waiting area and hands the six files over to an OPD nurse.

In Unit I and II the names, numbers and in-time of the batch are registered on paper and the files moved to the nurse's cubicle. The allocation to the next exam stations depends on the patient load and is handled flexibly. The standard routine would be first Refraction, exam by Junior Doctor, exam by senior Doctor, discharge from OPD and move to speciality clinic, medical shop or optical shop. Additional procedures are required for patients over 40 years of age (blood pressure, ocular tension, urine sugar), for special tests (dilatation, A-test, blood tests) or for counselling (in cases of diabetes, recurring patients after cataract operation, etc.)

Each Unit has a Nurse in Charge responsible to manage patient flows. She can alter the sequence of the procedures for any patient in order to minimize bottlenecks developing at certain stations. Refraction is the longest procedure and therefore the most common bottleneck. Hence the Nurse in Charge may send patients to the junior doctor's exam first. However, the last two steps (exam by the Senior Doctor and counselling) will always be last. The waiting areas in the OPD serve as the buffer for all processes. Patients are usually asked to wait on the chairs adjacent to the next exam station, but could wait anywhere, since they are called loudly for each next step (remember that the order of the files determines the order of patients and files are kept with the nurses, i.e. no patient can get lost or be forgotten, because he/she sits somewhere in a corner).

There are five cubicles in each Unit for refraction tests. The nurses place two files into a pouch outside each cubicle. The refractionist takes the two files from the pouch and calls the two patients from the waiting area, one of whom she places besides herself at her desk for the examination and the other one she places on a chair to wait at the far side of the cubicle. After finishing the first patient she asks him/her to return to the OPD waiting area. In the meantime the nurses have placed two new files in the pouch, thus making sure that the pouch is always filled with two new files. After finishing the second patient the refractionist puts the two finished files back into the pouch, makes the two new files, calls the two new patients and starts the examinations again. The benefit of handling a batch of two patients in this process is that it saves the refractionist time to call patients from the waiting area.

Operating room process: Productivity at Aravind is very high. Seventy-odd doctors handle over 1.3 million patients and over 200,000 cataract operations per year. An Aravind doctor performs about 2000 cataract surgeries per year (between 30 and 40 in a 5-6 hours surgical session), while an average ophthalmologist in India performs about 400 cataract surgeries per year. Two factors contribute to this elevated productivity. The first is the utilization of simple versions of cataract operations, mainly one known as the manual, sutureless small incision cataract surgery, or SICS (Chang 2007), which in spite of allowing high productivity with up to 18 operations per hour per surgeon, does not compromise quality, reportedly as high as with other procedures (Venkatesh et al. 2005). The second factor is a production line approach to the actual operation. As described in Figure 6 there are two main sub-processes in series, preparation and the actual operation.

For the actual operation each theatre has four operating tables. Two doctors serve these tables, working simultaneously on two them. Patients are offset in such a way as to allow the doctor to operate continuously, moving from table to table with very little time lost. Although operating

theatres usually do not allow simultaneous operations to take place due to the risk of infection, no such infection has been reported at Aravind (Manikutti and Vohra, 2004).

QUESTIONS

- 1.- Familiarize yourself with Aravind watching the videos in the multimedia portion of the case.
- 2.- Follow a patient through the OPD (multimedia case, Madurai Hospital, first floor), and draw your own process map.
- 3.- Identify bottlenecks in the simplified version of the OPD process (in the multimedia case - process analysis). Real times measured in the field are in appendix 2, for your reference.
- 4.- Run the simulation in the multimedia portion of the case. How does variability affect the process? What could be done to control it?
- 5.- Analyze the OPD process using Value Stream Maps. See appendix 4 for an example of the VSM of the OT department
- 6.- The mission of Aravind is "Eliminate needless blindness, providing compassionate & high quality eye care to all". However, providing health care for all can be expensive: in Europe represents 9% of the GDP and could rise to 20% in a few years. As the alternatives are worsening the quality of health care, or improving it efficiency, please identify the operational keys to cost efficiency at Aravind, and discuss how these can be applied to other health care providers.
- 7.- Aravind is non-for-profit organization. Could a for-profit approach be more effective in contributing to Aravind' mission?

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APPENDIX 1
 OPD PATIENT FLOW

Welcome to Aravind Hospital, the largest eye care provider in the world. We are here to look after you, if you have any questions please don't hesitate to speak to a staff member, we are happy to help.

Step By Step Guide To Your Visit

There are many different eye conditions, you will need to have a detailed eye examination which could take up to 2 hours, depending on the complexity of tests required. The times indicated below are an average.



- 1. Registration (5 mins)**
 On arrival you will be asked to fill in a registration card, please give your complete permanent address with telephone number. You will be asked to take a seat until our receptionist accompanies you to your vision test. If the patient is under 15 years you will be taken direct to the Paediatric Ophthalmology.
- 2. Vision Test (10 mins)**
 Every patient has a simple test to check your level of vision from an eye chart.
- 3. Refraction Check (10 mins)**
 A refractometer will place a series of lens in front of your eyes and will ask which looks clearest. This test determines your exact eye power and determines your level of sight.
- 4. Preliminary Examination (20 mins)**
 An eye doctor will carry out an initial examination of your eyes, please advise the doctor of any previous medical history.

5. Blood Pressure/Eye Tension/Sugar Test (30 mins)
 This is only for patients aged 40+, we will check your blood pressure, intraocular pressure and a urine test for diabetes. Stages 3-5 may happen in any order depending on the number of patients.

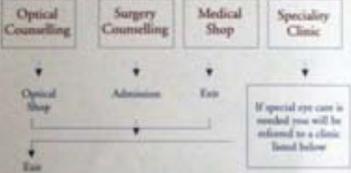
6. Dilatation (30 mins)
 The doctor in some cases may ask the refractometer to instil eye drops in the eye. This is to make the pupils bigger in order to get a better view of the inside of the eye. It may take 30 minutes for dilatation, you will be asked to wait in the waiting room during this time, you will experience blurred vision for 2-3 hours following dilatation.

Optical
Counselling

Surgery
Counselling

Medical
Shop

Speciality
Clinic



- 7. Final Examination & Diagnosis (5 mins)**
 After all the tests have been carried out the doctor will carry out a final examination and depending on the results you will be guided to one of the following areas:
 Our Speciality Clinics (room numbers)



Ground Floor

Information centre: Reimbursement section- claims will be received and processed here.

Cataract (7) : Treatment of cataract.

1st Floor : - Out Patient Block

Glaucoma (11) : Treatment of disease caused by increased pressure in the eye.

Paediatrics (12) : Ophthalmology services for children under 15 years & squint patients of any age.

Cornea (14) : Infections/trauma to the eye.

LASIK (105) : LASIK, ZYOPTIX laser assisted surgery for correction of refractive errors.

Oculoplasty (15) : Artificial eye implantation.

2nd Floor

Retina (21) : Treatment of any retina disorders.

Low Vision (22) : Vision rehabilitation centre.

Neuro (23) : Treats neurological diseases associated with the eye.

Uvea (24) : Treats inflammation to the eye.

Aravind - A Partnership for Life
 Let us protect your sight

It is important to take care of your sight, our ophthalmologists recommend:

- Annual eye check for any adult who wears glasses or contacts.
- If you are over 40 years, your eyes should be examined every year to check for common age-related problems such as cataracts, glaucoma or refractive errors.
- Any injury to the eye, consult an ophthalmologist immediately.
- If you have a child at home and are doubtful of their visual status or showing signs of a squint, do not delay in consulting an ophthalmologist.

Don't wait until it is too late, some eye conditions are without symptoms, and cause irreparable loss of vision.



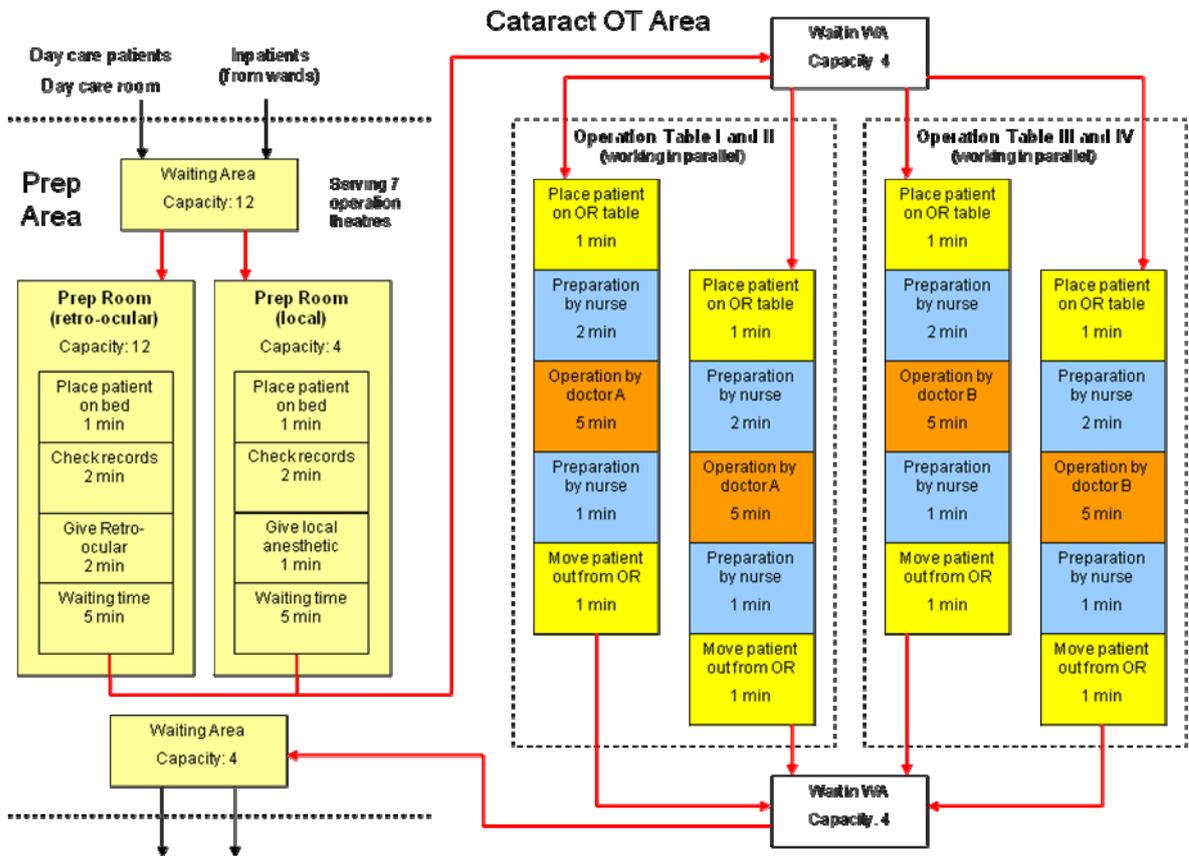
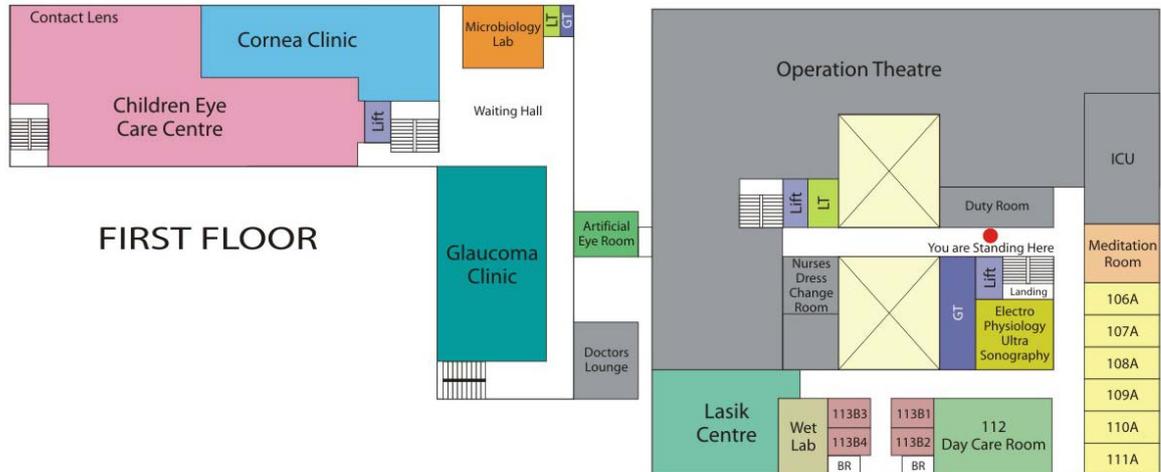
APPENDIX 2

STANDARD TIMES OF THE OPD MEASURED IN THE FIELD

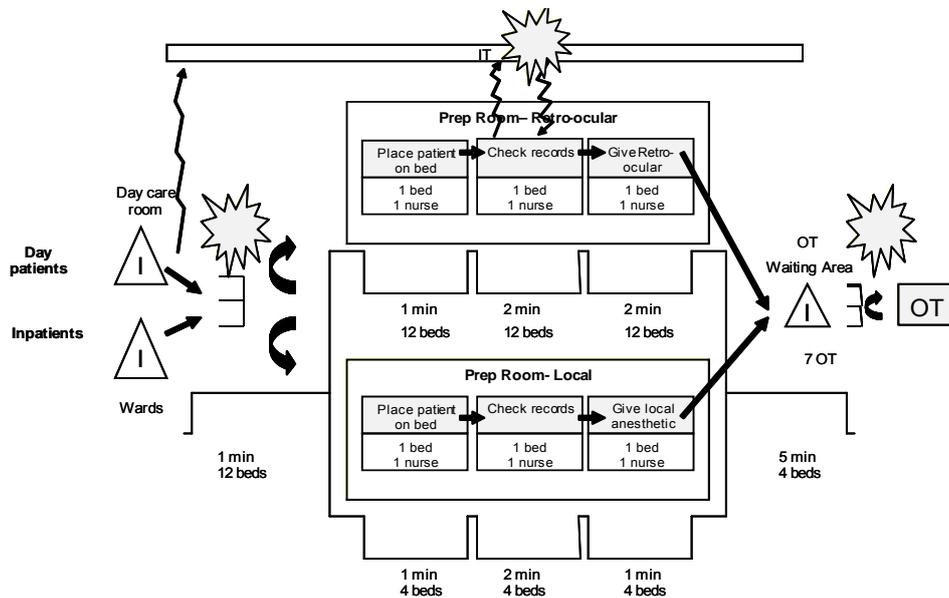
| Process | Measured time | | | | | | | Estimated time | | | | |
|--------------------------------|---------------|------|------|----------|-----|-----|-----|----------------|------------|--------------------------------|------------------------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Average | | Typical Cataract Patient | Complicated Patient | |
| | | | | | | | | Sec | Min | minimum time | minimum time | |
| Registration | | | | | | | | | | | | |
| get card and fill it in | 156 | 150 | 95 | 76 | 164 | 174 | 230 | 149 | 2.5 | 2.5 | 2.5 | |
| wait in line | | | | variable | | | | | | 9.8 | 9.8 | |
| register | 80 | 70 | 97 | 93 | 118 | 123 | 105 | 98 | 1.6 | 1.6 | 1.6 | |
| wait in waiting area | | | | variable | | | | | | 5.3 | 5.3 | |
| move to next station | 55 | 45 | 62 | 52 | 80 | 50 | 55 | 57 | 1.0 | 1.0 | 1.0 | |
| Total time | | | | | | | | | 5.1 | 20.1 | 20.1 | |
| Vision Test | | | | | | | | | | | | |
| wait in waiting area | | | | variable | | | | | | 3.4 | 3.4 | |
| vision test | 60 | 60 | 97 | 65 | 62 | 72 | 58 | 68 | 1.1 | 1.1 | 1.1 | |
| wait in waiting area | | | | variable | | | | | | 2.3 | 2.3 | |
| move to next station | 60 | 55 | 53 | 56 | 58 | 64 | 50 | 57 | 0.9 | 0.9 | 0.9 | |
| Total time | | | | | | | | | 2.1 | 7.7 | 7.7 | |
| OPD Unit I, II, III | | | | | | | | | | | | |
| Refraction test | 345 | 375 | 348 | 354 | 341 | 340 | 352 | 351 | 5.8 | 5.8 | 5.8 | |
| Blood pressure | 37 | 78 | 70 | 40 | 67 | 46 | 56 | 56 | 0.9 | 0.9 | 0.9 | |
| Ocular pressure | 56 | 59 | 53 | 64 | 61 | 50 | 67 | 59 | 1.0 | 1.0 | 1.0 | |
| Urine blood sugar | | | | | | | | | | 3.0 | 3.0 | |
| Preliminary doctor's exam | 80 | 150 | 156 | 165 | 53 | 74 | 168 | 121 | 2.0 | 2.0 | 2.0 | |
| Dilatation | | | | | | | | | | | | |
| procedure | 12 | 15 | 10 | | | | | 12 | 0.2 | | 0.2 | |
| waiting time | 1080 | 1020 | 1140 | | | | | 1,080 | 18.0 | | 18.0 | |
| Blood test | 120 | 134 | | | | | | 127 | 2.1 | | 2.1 | |
| A Scan | 17 | 36 | 24 | 18 | 21 | | | 23 | 0.4 | 0.4 | 0.4 | |
| Final doctor's exam | 120 | 262 | 140 | 196 | 132 | 156 | 245 | 179 | 3.0 | 3.0 | 3.0 | |
| Diabetic counselling | | | | | | | | | | | 3.0 | |
| Cataract counselling | 231 | 212 | 134 | 167 | 132 | 154 | 182 | 173 | 2.9 | | | |
| Optic Counselling | 276 | 120 | 165 | 285 | 321 | 127 | | 185 | 3.1 | | 3.1 | |
| Surgical Counselling | 189 | 346 | 550 | 392 | 654 | 750 | 245 | 447 | 7.4 | 7.4 | 7.4 | |
| combined moving / waiting time | | | | variable | | | | | | 8.0 | 12.0 | |
| move to next station | | | | | | | | | | 1.0 | 1.0 | |
| Total time | | | | | | | | | | 32.6 | 63.0 | |
| Overall total time | | | | | | | | | | 60.4 | 90.8 | |

Sample of observed times. OPD, 10 to 12 am, 28-11-2007

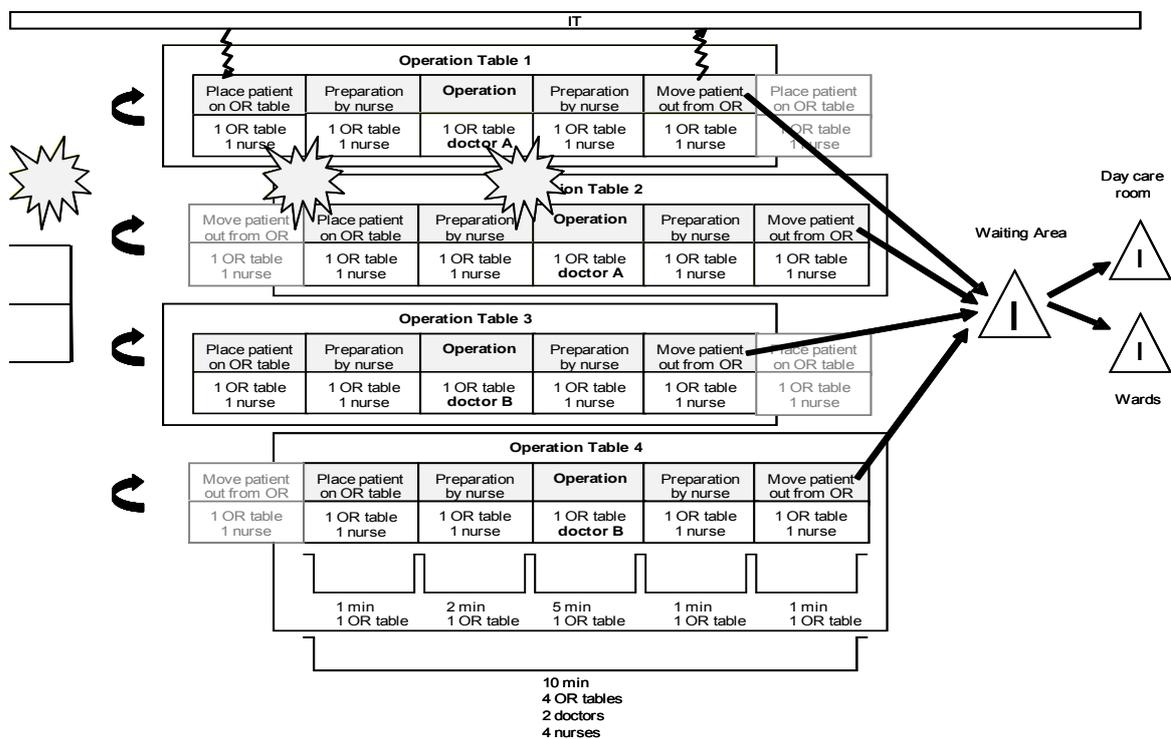
APPENDIX 3.
 FLOOR PLAN OF THE OPERATIONS THEATRE (OT) AREA



APPENDIX 4
 VSM OF THE OPERATIONS THEATRE (OT) PROCESS



Value Stream Map of the pre-operation process



Value Stream Map of the Operation Process

