Tackling Patient Wait-Times at LVPEI with Systems Thinking

Ali Kamil, SDM’12, HKS’14
Dmitriy Lyan, SDM’11, Sr. Product Manager, Amazon
Agenda

• About LVPEI
• Opportunity, motivation, and challenges
• Approach
• General observations
• Analysis and recommendations
• Next steps
• Appendix
LVPEI is a non-profit organization focused on the delivery of eye care to patients at all levels of the economic pyramid.

**Services offered:**
- Comprehensive patient care
- Clinical research
- Sight enhancement and rehabilitation
- Community eye health
- Education
- Product development

**Centre of Excellence:**
- Provides outpatient services to 200,000 people
- Performs 25,000 surgeries
- Trains 250 professionals at all levels of eye care
- Provides low vision services to 3,000 people
Our team was engaged to identify bottlenecks and causes of high patient service time in the LVPEI outpatient department (OPD).

<table>
<thead>
<tr>
<th>Challenges</th>
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<tbody>
<tr>
<td>• Unpredictable demand patterns in a given day</td>
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<tr>
<td>• No established uniform process within the hospital.</td>
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<tr>
<td>• High and varying patient service times*</td>
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<tr>
<td>• High provider fatigue due to high patient volume and extended hour of service</td>
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<td>• High turnover of doctors and staff</td>
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<table>
<thead>
<tr>
<th>Motivation and Opportunities</th>
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<tbody>
<tr>
<td>• Identify bottlenecks in the system. Causes of unpredictable wait times</td>
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<tr>
<td>• Propose a policy to reduce service times and achieve uniformity</td>
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<tr>
<td>• Must not compromise LVPEI’s high standard of quality care and cannot turn away patients</td>
</tr>
<tr>
<td>• Can we increase capacity to handle more patients?</td>
</tr>
<tr>
<td>• How can we effectively handle walk-in patients?</td>
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*service time = total time spent by patient in the hospital*
Approach: Team conducted the project in three phases over 5 months

<table>
<thead>
<tr>
<th>Pre-trip (January to March)</th>
<th>On-site (March 1 – 20)</th>
<th>Post-trip (April to May)</th>
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<tbody>
<tr>
<td>• Engaged LVPEI Head of Operations to discuss current challenges</td>
<td>• Conducted time and motion studies in two cornea and two retina OPD clinics, collecting timestamps on the flow of patient folders, and noting management practices</td>
<td>• Ran statistical analyses to quantitatively identify relationships between different variables and patient service times</td>
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<td>• Interviewed key personnel at hospitals in the Boston area, including operations leaders at Massachusetts General Hospital (MGH) and practitioners at Massachusetts Eye and Ear Infirmary (MEEI) and Mount Auburn Hospital</td>
<td>• Interviewed faculty ophthalmologists and optometrists, and OPD scheduling administrator</td>
<td>• Compared findings to our interviews and observations of management practices</td>
</tr>
<tr>
<td>• Interviewed key stakeholders at the LVPEI hospital</td>
<td>• Conducted patient surveys at the walk-in counter</td>
<td>• Derived recommendations for addressing systemic causes of increases in patient service times in the OPD</td>
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GENERAL OBSERVATIONS
Patient pathways varied significantly depending on the clinic, and on the type of patient and appointment.

Investigations units are subject to their own process flow management practices.
Additionally, several combinations of factors impact patient service time.

### Hospital-Specific Factors
- Commitment to training medical staff
- Patient volume vs. hospital capacity

### Scheduling-Specific Factors
- Doctor-specified appointment and walk-in templates
- Administrator's adherence to doctor-specified appointment templates
- Real-time prioritization of patients

### Clinic-Specific Factors
- Management of patient folders and staff
- # of Fellows, Optometrists, and Facilitators
- Skill levels of staff
- Size and layout of clinics
- Anticipated vs. actual patient volume
- Types and variety of patients that can be seen
- Need for diagnostics

### Patient-Specific Factors
- Lack of awareness of appointment-based system
- Bias for early morning arrival
- High volume of late arrivals and no shows
There is little discrepancy in patient service time between non-paying (NP) and general (G) patients, but high variability ranging from two to four hours.

<table>
<thead>
<tr>
<th>Priority Level</th>
<th>Patient Count</th>
<th>Clinic 1</th>
<th>Clinic 2</th>
<th>Clinic 3</th>
<th>Clinic 4</th>
<th>Average Service Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>182</td>
<td>2:44</td>
<td>4:08</td>
<td>2:17</td>
<td>3:26</td>
<td>3:12</td>
</tr>
<tr>
<td>NP</td>
<td>56</td>
<td>2:55</td>
<td>3:35</td>
<td>2:51</td>
<td>4:01</td>
<td>3:29</td>
</tr>
</tbody>
</table>

Average patient service times for general and non-paying patients differed by only 17 minutes.

Service Time Variability (All Days)

Mean (μ) – 3h 15m
SD (σ) – 1h 37m
Walk-in patients have higher variability in service times compared to patients with appointments.

<table>
<thead>
<tr>
<th>Clinic 1</th>
<th>Clinic 2</th>
<th>Clinic 3</th>
<th>Clinic 4</th>
<th>Average Service Time</th>
<th>Total Patient Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:21</td>
<td>5:01</td>
<td>4:38</td>
<td>5:04</td>
<td>5:04</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>28</td>
<td>8</td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Walk-in patient service time is higher than apt-based patients.

86% of walk-ins arrive before 12pm.

Walk-in Patient Service Time Variability (all days)

Mean ($\mu$) – 5h 4m
SD ($\sigma$) – 2h 3m
ANALYSIS & RECOMMENDATIONS
Key Observations

- Only **28%** of all apt. based patients arrived on time
- Clinics adhering to apt. based system achieved shorter service times
- Clinics 1 and 3 adhered to apt. based system and penalized patients for early (<30m) or late arrivals (>30m)
- Clinics 2 and 4 did not actively adhere to apt. system and had significantly higher service times for on-time patients

Service Times for On-time Patients

<table>
<thead>
<tr>
<th></th>
<th>Clinic 1</th>
<th>Clinic 2</th>
<th>Clinic 3</th>
<th>Clinic 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg.</td>
<td>2h 22m</td>
<td>3h 58m</td>
<td>2h 4m</td>
<td>3h 38m</td>
</tr>
<tr>
<td>St. Dev</td>
<td>1h 17m</td>
<td>1h 33m</td>
<td>1h 22m</td>
<td>1h 23m</td>
</tr>
</tbody>
</table>

Recommendations

- Require doctors to adhere to apt. based system
- Prioritize patients based on their appointment times and not check-in times
- Educate patients about apt. based system and encourage adherence
Encourage the use of appointment system, while simultaneously employing strategies to better manage walk-in patients.

**Walk-in Survey Results Summary**

- **40 patients surveyed in total**
  - **41%** of patients had tried unsuccessfully to make an appointment; **50%** of these were because the requested appointment time was unavailable
  - **80%** of patients who did not make appointments were unaware of the option

**Survey Findings**

- In general, awareness of the appointment option is low
- Patients choose the walk-in option because the next available appointment is too far away
- The majority of walk-in patients are new to LVPEI

**Interview Findings**

- Doctor scheduling for walk-in patients by time and type is often not adhered to due to over demand and incorrect triage
- Unexpected walk-ins are disruptive to the patient flow, but doctors have no choice but to accommodate
- Incorrect triage results in re-routing patients to other clinics and increased service time
- Walk-in patients often have primary care concerns that do not require specialized attention, or ask to see a specific doctor unnecessarily

**Ideas to Consider**

- Better promote appointment system, especially among new patients
- Designate general doctors for walk-in clinic to reduce specialist time on general cases
- Require referral letters for new patients asking to see a specific doctor
- Enforce ophthalmologist-set guidelines for appointment booking at the walk-in counter
Identify factors contributing to decreasing service times in the late afternoon.

**Key Observations**
- Average service time decreases with time of day
- Appointment-based patients arrival time has normal distribution

**Potential Factors to Consider**
- Providers work more efficiently towards the end of the day
- Patients that do not require diagnostics are stacked later in the day
- Reduced number of walk-ins in the latter half of the day

**Ideas to Consider**
Closely observe the behavioral patterns of providers during the later half of the day. If positive behavior is identified, this practice should be replicated during the rest of the day.
Monitor practitioner fatigue in latter half of workday, as high pressure to serve customers can lead to increased errors and reduced service quality.

**Interview Findings**
- Error rate of providers rises throughout the day for both optometrists and ophthalmologists
- After 4:00PM, doctors begin to observe fatigue in their teams
- After 4:00PM, doctors begin to observe work being completed in a hurry

**Key Observations**
- Patients who arrive later in the day and patients who arrive significantly late for their appointments tend to experience lower service times.
- Average service time decreases with time of day
- With time of day, providers and staff tend to get fatigue and are prone to mistakes/errors

**Ideas to Consider**
- Closely observe the error rate that is created at any given time
- Closely observe the frequency of re-work over a given time period
- Determine the cause of the decline in service times during latter half of the day
Monitor practitioner fatigue in latter half of workday, as high pressure to serve customers can lead to increased errors and reduced service quality.

**Insights**

- Workday is scheduled for 8am – 5:30pm. Providers observed working until 7/8pm to service all patients.
- High patient backlog increases pressure on LVPEI providers to service all patients in a given day.
- Latter part of the day has been observed (via interviews) to increased fatigue and errors in service.
- High pressure situation coupled with long workdays will lead to high turnover of staff.

**Ideas to Consider**

- Adherence to apt. based system and reducing number of walk-in patients.
- Consider provider/staff rotation between high-pressure clinics and regular clinics.
- Identify rework and errors created by time of day.

**Modeling Next Steps**

- Consider long term impact to quality of service and reputation due to high service times and errors/rework.
- Identify impacts to staffing and turnover due to high pressure environment.
- Consider competitor/alternate emergence scenario.
Identify and encourage best cross-consultation management practices

Relevant Clinic Observations

- Cross-consultation cases comprise a non-negligible percentage in each clinic: **10 to 15%**
- **3 out of 4** clinics employed practices to manage and integrate cross-consultation cases into existing patient flow
- Management of cross-consultation cases differed across clinics
- Passive cross-consultation management was disruptive to regular patient flow

Sample Cross-Consultation Management Practices

- **Fixed time allocation:** 15 minutes every 2 hours for cross-consultations and short follow-ups
- **Real-time prioritization:** integration and prioritization of cross-consultations with existing patients
- **Prioritization by check-in:** prioritization of cross-consultation patients according to check-in time

Ideas to Consider

- Conscious management of cross-consultation patients in each clinic
- Identification of good cross-consultation management practices
- Closer observation of the decision-making process behind the need for cross-consultation
- Guidelines for providers on the necessity for cross-consultation
Remove annual post-surgery follow-up requirement and divert patients to comprehensive clinic for ongoing long follow-ups

Observations

- 60-70% of doctor's appointment templates are dedicated to seeing new patients
- 20% of all patients seen across the four days of study are new patients.
- Providers perform over 500 surgeries a year
- All patients are requested to come back for follow-ups at least once a year regardless of the need.

Insights

- Continuing with the policy of requiring patients to come back for simple follow-ups exhausts LVPEI doctors' capacity to serve new patients.
- Dedicating more of providers' time to follow-up patients reduces opportunities to learn from diverse and complex cases.
- Ongoing reduction in time available to see new patients limits LVPEI's ability to realize its vision to reach all those in need.

Ideas to Consider

- Removing the requirement for all patients to come in for yearly follow-ups post-surgery
- Transitioning fully recovered patients to comprehensive clinic for ongoing long follow-ups
SYSTEM DYNAMICS BASED MODELING OF LVPEI
Used System Dynamics based modeling tools to simulate LVPEI operations.
Used System Dynamics based modeling tools to simulate LVPEI operations

- Simulated the operations for the ideal scenario observed during time and motion studies of the
- Current system accumulates as more and more patients show up.
- Workup time and Investigation times per patient drop to the minimum established requirement
Used System Dynamics based modeling tools to simulate LVPEI operations

- Standard workday (9 hours) quickly devolves into workdays lasting 12-13 hours.

- Complaints of burnout and fatigue during interviews confirmed the simulation results.

- Increase in patient volumes at the investigation rooms tends to correlate with increase in cross-consultations or referrals.

- Implies ophthalmologists tend to increase referrals and cross consultation in patient buildup.
Used System Dynamics based modeling tools to simulate LVPEI operations

- System Dynamics model of LVPEI provided quantitative evidence to observations made during the time and motion studies

- Enables LVPEI to identify potential policies proven through the model to improve their processes
  - Adherence to apt-based system
  - Building a reputation of rewarding on-time arrivals
  - Increase in headcount to avoid burnout and fatigue

- Additional work required to take into account exogenous factors such as provider’s reputation, experience level of staff, bulk arrival vs. trickling arrival rate
NEXT STEPS
Additional studies and modeling exercises will build a comprehensive understanding of the factors contributing to patient service time in the OPD.

**Future Studies**

- Time and motion studies that include cross consultation patients
- Time and motion studies on cornea diagnostics
- Patient flow of walk-in patients
- Triage process at walk-in counter
- Check-in process
- Patients returning to LVPEI due to incorrect diagnosis
- Effectiveness of short-term recommendations

**Simulation Models**

- LVPEI’s patient flow system for cornea and retina clinics
Acknowledgements

• Anjali Sastry – Senior Lecturer MIT Sloan School of Management
• Janet Wilkinson - Senior Lecturer MIT Sloan School of Management
• Elli Suzuki – COO, Global Minimum Inc.
• Nicole Yap – Jacaranda Health, Kenya
Thank you
QUESTIONS?
APPENDIX
Overall Patient Average Service Time

- Clinic 1: 4:48
- Clinic 2: 3:36
- Clinic 3: 2:48
- Clinic 4: 2:24

Graph showing service time for appointments, walk-ins, new patients, and follow-ups at Clinic 1, Clinic 2, Clinic 3, and Clinic 4.
Overall Patient Check-in to Dilation Average Service Time

<table>
<thead>
<tr>
<th>Clinic</th>
<th>Appointments</th>
<th>Walk Ins</th>
<th>New</th>
<th>Follow Ups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic 1</td>
<td>1:26</td>
<td>2:24</td>
<td>1:55</td>
<td>2:48</td>
</tr>
<tr>
<td>Clinic 2</td>
<td>2:24</td>
<td>3:21</td>
<td>3:50</td>
<td>4:19</td>
</tr>
<tr>
<td>Clinic 3</td>
<td>3:50</td>
<td>4:19</td>
<td>4:48</td>
<td>5:26</td>
</tr>
<tr>
<td>Clinic 4</td>
<td>4:48</td>
<td>5:26</td>
<td>6:05</td>
<td>6:48</td>
</tr>
</tbody>
</table>

Legend:
- Blue: Appointments
- Red: Walk Ins
- Green: New
- Purple: Follow Ups
Overall Patient Arrival Rates

- Clinic 1
- Clinic 2
- Clinic 3
- Clinic 4
Appointment-based Patient
Patient Type (G, NP, S, SS) & Service Time

Service Time

Number of Patients

G  182
NP  56
S   31
SS  5

Patient Types
Service Times
Appointment-based Patient Distribution Early/Late/On-Time Arrivals

Arrivals (Total)

- Early Arrivals: 46%
- Late Arrivals: 26%
- On-Time Arrivals: 28%
- NA: 0%

Clinic 1
- Early Arrivals: 55%
- Late Arrivals: 23%
- On-Time: 19%
- NA: 0%

Clinic 2
- Early Arrivals: 35%
- Late Arrivals: 30%
- On-Time: 30%
- NA: 0%

Clinic 3
- Early Arrivals: 40%
- Late Arrivals: 25%
- On-Time: 25%
- NA: 0%

Clinic 4
- Early Arrivals: 39%
- Late Arrivals: 36%
- On-Time: 25%
- NA: 0%
Appointment-based Patient Arrival & Service Time (Clinic 2)
Appointment-based Patient Arrival & Service Time (Clinic 3)
Appointment-based Patient Arrival & Service Time (Clinic 4)
Walk-in Patient Arrival & Service Time

- Walkin Arrival Time vs Srvc Time
- Service Time

Histogram showing patient service times and arrival times grouped by time of day.
Appointment-based Patient Arrival vs Appointment Time Variability

Early

Late

Day 1  Day 2  Day 3  Day 4

LV Prasad Eye Institute
Appointment-based Patient Service Time Variability for On-Time (Clinic 1)

Service Time (h:mm)

0:00 1:12 2:24 3:36 4:48 6:00

Appointment-based Patient Service Time Variability for On-Time (Clinic 2)
Appointment-based Patient Service Time Variability for On-Time (Clinic 3)
Appointment-based Patient Service Time Variability for On-Time (Clinic 4)
Team Profiles

Ali Kamil is a graduate student at the MIT System Design and Management program and an M.P.A. candidate at the Harvard Kennedy School of Government. His research interests lie in employing big data, social computing, and system dynamics-based simulation tools to identify patterns in human behavior, connectivity, and activities in low-resource settings—specifically in developing and emerging markets. He is a member of the MIT Media Lab’s Human Dynamics group directed by Professor Alex “Sandy” Pentland. He holds a bachelor’s degree in computer science and economics from the Georgia Institute of Technology.

Dmitriy Lyan has professional experience in both software development and investment management. While at SDM, his research focused on identifying critical performance factors and developing simulation models to tackle management challenges faced by organizations in healthcare and education. He is currently a senior product manager at Amazon Web Services. In addition to holding a master’s degree in engineering and management from MIT, he has an M.S. in financial engineering from the Peter F. Drucker and Masatoshi Ito School of Management at Claremont Graduate University and a B.S. in computer engineering from the University of California, San Diego.

Elli Suzuki is a COO of Global Minimum Inc., a non-profit organization that is focused on inspiring and enabling youth in developing markets to create and implement their own solutions to most critical issues they face. Prior to MIT, Elli spent 5 years in the financial service industry, marketing multi-asset investment solutions to institutional clients. Elli holds an M.S. in Management Studies from MIT Sloan School of Management. After graduation, Elli employs her management skills to disseminate innovative and affordable interventions designed to empower marginalized individuals in sub-Saharan Africa.

Nicole Yap holds an M.S. in Management Studies from MIT Sloan Scool of Management. She has two years of consulting experience, advising large private and public sector clients on their Customer Relationship Management (CRM) strategies. Nicole focuses on the development of market-based policies and approaches that organizations can apply to sustainably reach developing markets. Nicole plans to apply her management consulting background to the development of sustainable global health strategy upon graduation in 2013.