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Lean healthcare: learning via action research

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Introduction

Manenberg is an impoverished part of Cape Town; colourful characters and criminals live side by side with the ordinary citizens of a dusty, wind-swept sub-economic area. The G.F. Jooste Hospital (GFH) provides 24/7 services, from behind iron-barred security entrances. From 150-200 people per day enter the Accident and Emergency (A&E) unit, many in a very poor way; that translates to 50 000 to 70 000 people per year. In the words of the Head of Department for the A&E Unit at GFJ, 'The Emergency Unit of G.F. Jooste Hospital is a high stress, high intensity unit that is constantly overwhelmed by numbers and severity of illness of patients. The turnover and pressure to perform is unique. The hospital is grossly under resourced for the patient numbers and the capacity is stretched to the limit on a regular basis. The patient flow through the unit is always a major issue with delays in admission times to the wards a major factor in clogging the casualty and occupying staff with an extra patient care load.'

In this paper we describe experiments to apply the Toyota Production System to this demanding and needy situation. The approach was modest. The outcomes were promising.

Toyota Production System

The Toyota Production System, more recently renamed The Toyota Way, or Lean Thinking is variously described. For our purposes we will characterise it as follows:

It is a system for creating thinking people.

It seeks continuous improvement through eliminating waste.

Specific rules and tools include

Value Stream Mapping (Rother and Shook, 1999)

The Toyota Rules-in-Use (Spear, 1999)

All work shall be highly specified

All communications shall be direct and unambiguous.

All improvements will use the scientific method under the guidance of a teacher.

Toyota Production System in Healthcare

The healthcare industry, whether state-run or private, has come under tremendous scrutiny world-wide. As medical science advances are made, costs rise. In developing countries the gap between medical services to the poor and rich continuously widens; the HIV/AIDS pandemic squeezes health budgets and resources become increasingly stretched. The need to eliminate waste becomes more pressing.

The application of the Toyota Production System to healthcare has begun in earnest. In the UK, USA and Australia significant successes are being claimed, albeit on a limited scale. Some examples:

USA (Spear, 2005)

In a pre-surgical nursing unit at the Western Pennsylvania Hospital

Time between signing in and starting registration went from 'up to 2 hours' to zero.

Time spent registering patients went from between 12 and 60 minutes to 3 minutes.

Number of daily unnecessary blood bank reports issued went from between 10 and 11 to zero.

In the Allegheny General Hospital 'the number of patients suffering from central-line (intravenous catheter) infections declined from 37 in one year to 6 in the following year, and associated deaths fell from 19 to 1.'

In the Southside Hospital, Pittsburgh, iterative trials and experiments in the pharmacy resulted in time spent searching for medications falling by 60% and stock-outs falling by 85% - 'with no investment in technology.'

The Shadyside Hospital, Pittsburgh, learnt from Southside but conducted its own iterative trials and experiments (i.e. it learnt to master the problem-solving process rather than borrowing solutions). In the case of nurse-time spent on 'patient-controlled anesthesia pumps' an estimated 2 900 nurse-hours per year were saved. In the same hospital, a patient fall occurred on average every 12 hours; it 'declined dramatically - at one point, the unit went 95 days without one.'

UK (Jones and Mitchell, 2006)

Improvements are reported 'in one small part of one hospital: the pathology department at Bolton. A 70 per cent reduction in the number of steps needed to complete most tasks; a 40 per cent reduction in the floor space needed; up to 90 per cent reductions in the times taken to do its job–all achieved with less, not more, staff and with limited capital investment (mostly building works to knock a few walls down).'

Australia (Jones and Mitchell, 2006)

In 2006, it was reported that 'Two years ago, the emergency department at Flinders Medical Centre in Adelaide, South Australia was bursting at the seams. 50,000 patients were attending Flinders' emergency department every year, some 40 per cent of whom were admitted to hospital, and the complicated triage system it was using just couldn't cope.' Moreover, 'In September 2003 more than 1000 patients waited in the emergency department for more than eight hours before being treated. At times, there were up to 80 patients waiting in the department.'

Improvements were made to the flow, resulting in very quick benefits: 'Average emergency department waiting times fell 25 per cent (with 70 per cent of patients going home within four hours). Also, the numbers leaving the department without seeing a doctor fell by 41 per cent. Staff felt the pressure ease.'

G.F. Jooste A&E Unit – Research hypotheses

GFH is busier than Flinders, and one suspects the pathology among the queuing patients is more dire. We undertook our study in the A&E Unit (floor plan shown in Figure 2) to test the following hypotheses:

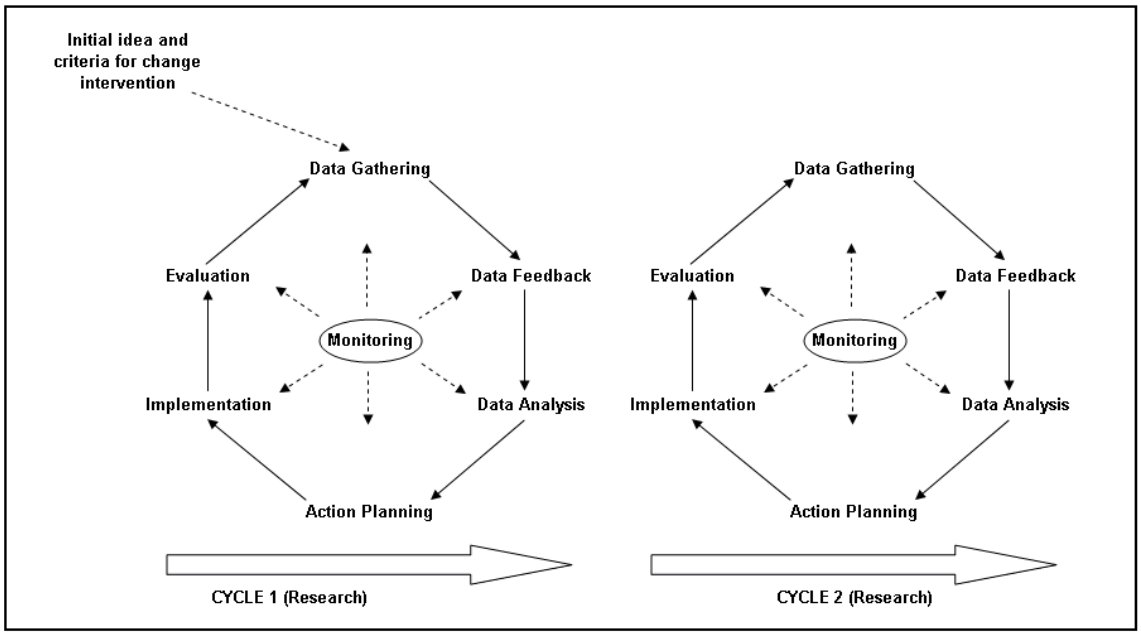
1. Value Stream Mapping (VSM) can be used to describe patient flow within the A&E Unit, and can be used to clarify that flow to the significant role players, namely doctors, nurses and support staff
2. VSM can be used as a tool to assist improvement initiatives in enhanced patient flow and improved patient service level

3. Application of the principles, philosophies and tools of TPS/Lean thinking can contribute to improved patient flow and patient service level, as measured by reduced time in the system
4. Introduction of TPS/Lean thinking in the A&E Unit can result in a positive attitude amongst the significant role players–doctors, nurses and support staff–which could drive sustained performance improvement initiative in the A&E Unit

Research Methodology

The chosen methodology for this research study was Action Research (AR), which is defined as 'an approach to research that aims both at taking action and creating knowledge or theory about that action' (Coughlan & Coghlan, 2002: 220). AR was chosen above alternative methodologies as this it 'relates to describing an unfolding series of actions over time in a given group, community or organisation; understanding as a member of a group how and why their action can change and improve the working of some aspects of a system; and understanding the process of change or improvement in order to learn from it' (Coughlan & Coghlan, 2002: 227). These principles are aligned with the objectives and hypotheses of this research study.

Figure 1: The action research cycles



Source: Coughlan & Coghlan, 2002

In support of the methodology chosen for this research study, Nutt (2002) highlights two approaches to arriving at solutions during the decision-making process dealing with complex problems:

- *Idea imposition*, in which 'an orderly path is seldom followed because decision makers jump to conclusions and then try to implement the solution they stumbled upon' (Nutt, 2002: 49). This process lacks proper reflection and thereby offers sub-optimal solutions. Nutt found that solutions arrived at through idea imposition were 'neither cheaper nor faster.'
- *Discovery, where decision makers 'work their way through a process that stresses claim validation, implementation, and direction setting. A premium is placed on learning through the discovery of decision topics, barriers to taking action, and desired results' (Nutt, 2002: 46). Discovery thus encourages questioning and seeking the best solution, thereby offering superior results*

The researchers, within the permitted time frame, endeavoured to achieve superior outcomes by undertaking the *discovery* process, concurrently seeking to create a learning environment in which participants themselves could develop further knowledge and insight regarding their working environment.

Actions

Initial communications to explore the possibility of the action research intervention took place through various parties over many months. We researchers, a business school professor of operations management and a full-time MBA student who is also a medical doctor, visited the site together only after receiving an indication of willingness on the part of the doctor in charge of the A&E Unit. We drew the basic floor plan as shown in Figure 1 and began the process of gathering the data for the VSM (Value Stream Map). As the field data gathering became more intense, a workshop was conducted to introduce key role players to the concept of VSM and the potential benefits of VSM as a tool that could assist initiatives to enhance service delivery as measured by patient lead time in the A&E Unit. All attendees indicated that they understood the content of a sample VSM illustrated during the workshop. Furthermore, attendees acknowledged the value of the VSM as a tool that highlighted a broader awareness of all the processes of a particular value stream, and that the VSM could be a tool that aided improvement initiatives. The VSM produced from the fieldwork is shown in Figure 3.

The takt time shown in Figure 2 is based on 150 to 200 patients per 24 hours, i.e. 9.6 to 7.2 minutes per patient. Obviously there are patterns ('seasonality') to the 24 hour cycle

but we ignored them for the initial study; we worked with the peak 24-hour takt time of 7.2 minutes per patient.

Whilst data was collected for the full VSM (Figure 3), it was immediately evident that the first three process steps in the triage section each had similar cycle times: ~~6~~-10 minutes per patient for the triage sister, 5-10 minutes for collecting an existing or making out a new file (medical records), and 10-30 minutes for the triage doctor. We decided to focus on these three steps to create a demonstration effect to engage the attention of the staff by providing 'quick wins.' During the two-day observation for the VSM the queue lengths were counted and timings taken of queuing times. (The times shown on the VSM are derived from queue length and takt time as per VSM practice; see Rother and Shook, 1999.) The findings from the two-day exercise are summarised in Table 1.

Table 1: Key findings noted during the observation of the triage process on 20/21 September

Triage Process	Key Findings
Triage Nurse	• *Pre-Assessment:* o 10-20 patients waiting in queue o 10-45 minute waiting period o Patients wait in Triage Waiting Area (Figure 1) • *Process:* o Triage Nurse measures patient's vital signs, and does additional tests/observations as appropriate o Stable *Cycle Time* 6-10 minutes (*variability in Cycle Time due to number of additional tests/observations required per patient, as appropriate)*
Medical Records	• *Pre-Assessment:* o 10-20 patients waiting in queue o 25-120 minute waiting period o Patients wait in Triage Waiting Area (Figure 1) • *Process:* o Medical Records Clerk issues patients with a folder in which a record of all activities is kept o Stable Cycle Time 5-10 minutes (*variability in Cycle Time due to need to retrieve old folder from archives for patients previously treated at G.F. Jooste)*

Triage Doctor	• *Pre-Assessment:* o 5-10 patients waiting in queue o 30-60 minute waiting period o Patients wait in Triage Waiting Area (Figure 1) • *Process:* o Triage Doctor does medical screening (not treatment) of patients, and decides on further treatment as appropriate o Stable Cycle Time of approximately 10 minutes *(variability in Cycle Time due to non-adherence to Rule 1 of TPS: generally due to Triage Doctor treating patients additionally to screening)*

We counted the number of people queuing at various points, and timed how long individuals waited. However, in the VSM approach one calculates the waiting time based on takt time. Table 2 shows the various figures. Table 3 shows the time patients spend in the triage system; on the takt basis (the way Toyota would do it) only 12% of the time the patient is in the system is 'value' being added.

Table 2: Observed and calculated statistics of the triage process

	Number		Time (minutes)		
	Waiting	Being processed	Being processed	Observed waiting	Takt waiting†
Nurse	10-20	1	6-10	10-45	72-144
Med records	10-20	1	5-10	25-120	72-144
Doctor	5-10	1	10-30	30-60	36-72

†Calculated as (takt)*(observed number waiting), e.g. 7.2 minutes * 10 = 72 minutes

Table 3: Time patients spend in the triage system

	Time in the system (minutes)			
	Observed		Takt-based	
	Min	Max	Min	Max
Waiting for:				
Nurse	10	45	72	144
Med records	25	120	72	144
Doctor	30	60	36	72
Total waiting	65	225	180	410
Being processed	21	50	21	50
Total	86	275	201	410
% Service	24%	18%	12%	12%

The process of engaging the A&E Unit staff was undertaken by the fieldworker (the MBA student and medical doctor) over a succession of workshops and meetings. All the interactions and experiments were logged in a format as shown in the extract at the end of the paper (Exhibit A). The primary result being reported in this paper is that arising from 'Experiments 1 and 2' which involved changes in the triage process.

Table 4 shows the approach to Experiment 1.

Table 4: Guidelines for Experiment 1

Problem	Hypothesis	Expected Outcome	Type of Waste	TPS/Lean Principle/Philosophy
Waiting time *(10-45 minutes between Triage Nurse & Medical Records, and 30-60 minutes between Medical Records and triage Doctor)* between the Triage processes retards patient throughput in the system, thereby contributing to sub-optimal service delivery	By reducing waiting time between the various Triage processes patient *lead time* can be significantly reduced, thereby enhancing service delivery	Improved patient *lead time* in Triage *(targeted 10% improvement on range of lead time)* will enhance service delivery to patients	• Waiting • Excessive Inventory *(patients waiting between steps is equated to Inventory)*	• Make Value flow (*Flow* principle) • Specify value from a customer perspective • Involve & empower employees

The target of a 10% improvement on the lead time through the various triage processes was set and exceeded in the experiments. This is illustrated by comparison of the VSM

for the Triage section of the A&E Unit at baseline on 20/21 September 2006 with that achieved during Experiment 1 on 16 October 2006 (Figure 8). It was conducted over 90 minutes. These outcomes are summarized in Table 5, with the ranges of patient times given:

Table 5: Comparison of patient throughput in Triage after Experiment 1

Date Of VSM	**Triage Nurse**	***Waiting Time***	**Medical Records**	***Waiting Time***	**Triage Doctor**	**Throughput TIME**
21/10/2006	6-10 min.	*25-120 min*	5-10 min.	*30-60 min.*	10-30 min.	**76-230 min.**
16/11/2006	5-10min.	*0min.*	5-8 min.	*0-10 min.*	5-11 min.	**15-39 min.**

A decision was taken to extend the trial of achieving enhanced service delivery as measured by patient lead time. However, during the Evaluation stage of AR cycle 1 (Coughlan & Coghlan, 2002), certain areas of concern were raised during the Revision of change intervention between AR cycles (Thornhill et al, 2000):

- Although patient flow through Triage had been enhanced, the problem of patients cluttering the Triage waiting area impacted on service delivery and needed to be addressed in keeping with the *5S process*
- It became evident that there were two value streams by patient category. (The hospital uses a categorisation of patients within the A&E Unit into four distinctive colour groups–Green, Yellow, Orange and Red–indicating the level of urgency of a particular patient's presenting symptoms and vital signs–blood pressure, heart rate, respiratory rate, temperature and mobility. Patients categorised as Green and Yellow are recognised as being clinically stable enough to wait for medical treatment as Orange and Red category patients are deemed as clinically too unstable to wait. Treatment of Orange and Red patients is therefore prioritised

above treatment of Green and Yellow category patients.) It was recognised that the volume of Green and Yellow patient categories approximated 80% of the patients seen in the A&E Unit, whilst Orange and Red patient categories approximated 20%.

- The Four Rules of TPS (Spear, 1999), in particular Rules 2&3, needed to be addressed with subsequent AR cycles, i.e. a direct, unambiguous links needed to be established between the various customer-supplier processes, and a simple, direct pathway created for patient flow

Experiment 2: (Conducted on 01/02 November 2006)

The outline of guidelines of Experiment 2 is tabulated below:

Problem	**Hypothesis**	**Expected Outcome**	**Type of Waste**	**TPS/Lean Principle/Philosophy**
Create *"pull" flow* (as per Experiment 1) for *Green* & *Yellow* category patients in Triage (*80/20 rule*), whilst concurrently addressing the *Four Rules of TPS*	By applying the *Four Rules of TPS* and principles & philosophies of TPS/Lean, patient service delivery as measured by reduced *lead time* in Triage could be sustainably improved	Reduced patient *lead time* in Triage *(set target time of 120-150 minutes lead time)* will enhance service delivery to patients	• Waiting • Excessive Inventory *(patients waiting between steps is equated to Inventory)* • Transporting	• Make Value flow (*Flow* principle) • Specify value from a customer perspective • Involve & empower employees • Apply *Four Rules of TPS* • *Just-In-Time* & *Jidoka*

Table 10: Outline of Guidelines for Experiment 2

Preparation:

Following on Data Analysis and Data Feedback from Experiment 1, certain key decisions in the planning for Experiment 2 were made during the Action Planning stage of AR cycle 2. These decisions include the following:

- The focus for subsequent experiments would be placed on Green and Yellow category patients. Orange and Red category patients therefore were not included during the Implementation of Experiment 2
- The problem of patient clutter within Triage (in keeping with the 5S process) needed to be addressed to enhance the potential for continuous improvement in service delivery. The decision was made to re-locate the waiting area for Green and Yellow category patients in Triage from Area 'A' to Area 'B' (Figure 4) as a countermeasure to clutter
- An additional step, namely 'Meet-and-Greet' would be added to existing Triage processes during Experiment 2. The Meet-and-Greet Nurse would be located in the existing space, Area 'C' (Figure 4) occupied by the security officer at the entrance to the hospital, as this was deemed a safe location. To facilitate optimal functioning of this step a security window panel through which communication could occur, would be inserted prior to commencement of Experiment 2. The intended functions of the Meet-and-Greet Nurse were:
    - Regulation of patient *flow* into the A&E Unit to reduce the impact of clutter on service delivery

    - Identification of patients suitable to participate in the experiment on the basis of patient category, and also to have a direct line of vision of those patients included in the trial whilst seated in the waiting area
    - Communication with patients of the various steps that they would encounter during their visit to the Triage section of the A&E Unit
- The sequence of processes undergone by patients in Triage would be re-arranged in an attempt to enhance flow in accordance with Rules 2 & 3 of the Four Rules. Furthermore, certain processes would need to be re-located to facilitate flow in accordance with Rules 2 & 3. Decision-making included:
    - Interchanging the sequence of assessment by the Triage Nurse and processing of a folder with the Medical Records Clerk. Patients would now first have a folder processed at Medical Records prior to assessment by the Triage Nurse. Following this step, patients would then be assessed by the Triage Doctor
    - The Triage Nurse would be re-located from the current Triage Assessment Area, Area "G" to the vacant Information Desk, Area "E" (Figure 4) in accordance with Rules 2 & 3 of TPS
    - The Triage Doctor would be re-located from the current Triage Assessment Area, Area "G" to the Porters' Room, Area "F" (Figure 4) in accordance with Rules 2 & 3 of TPS
- The concept of "pull" flow (as opposed to "push" flow) was explained to the role players. In this regard, Liker & Meier (2006: 94) note that there are three elements that distinguish "pull" flow from "push" flow. These are:

    - Defined: There is agreement between supplier-customer processes on limits of volume, mix and sequence of product
    - Dedicated: Items shared between supplier-customer processes are guided by the takt time as a common reference
    - Controlled: There are simple, visual controls that maintain the agreement between supplier-customer processes
- Role players were instructed to adhere to the Four Rules to optimise service delivery
- Prior to undertaking the experiment, role players were advised that they should expect to encounter problems during the conduction of the experiment, and that in keeping with the principle of Jidoka the experiment may need to be temporarily stopped to determine the root cause of such problems through Five-Why reviews in order to facilitate enhanced service delivery in the longer term.

Findings:

On each of the two days during which the trial was conducted, similar outcomes with regard patient throughput were achieved. The experiment was conducted over a period of approximately 2.5 hours (150 minutes) on each of the two days (between 10am and 1pm on both days), and included 15 patients on each of these days. Takt time for the experiment conducted on 02 November 2006 was calculated at 10 minutes based on the throughput of 15 patients during the 150 minute period over which the experiment was conducted on 01 November 2006.

The average patient throughput time in Triage for the experiment conducted on 02 November 2006 was 89 minutes, which exceeded the target times of 120-150 minutes throughput. The throughput times ranged from 28-140 minutes, with none of the patients included in the experiment exceeding throughput time of 150 minutes. The 89 minute average exceeded the lower target limit average of 120 minutes by 25%.

Problems encountered:

Despite the significant improvement in average patient lead time in Triage during the experiment, certain problems were elicited during the Implementation stage of AR cycle 2. Role players had been warned that certain problems were expected to arise, in this draining the lake exercise. During both the Implementation and Evaluation stages the problems encountered were addressed. Table 12

Principle or Philosophy of TPS/Lean	**Problem(s) Encountered**	**Root Cause(s)**	**Counter-Measure(s)**
Rule 1: All work shall be highly specified as to content, sequence, timing and outcome	• Delays in treatment of subsequent patients due to inhibition of *flow*	• Deviation from specification of role by Triage Doctor (*with Patients # 2 and # 6 as no longer screening, but also treating patients*) and by Triage Nurse (*with Patient # 9 by pre-empting referral for X-Rays*)	• Triage Doctor should adhere to role specification, namely sorting, and not treatment, of patients. Triage Nurse also to adhere to role specification
Rule 2: Every customer-supplier connection must be direct and unambiguous	• Disconnected processes (by direct vision) prior to undertaking experiment	• Layout and positioning of processes not conducive to direct supplier-customer processes and unambiguous communication	• Re-arrange sequence and positioning of certain processes to establish direct supplier-customer relationships (Figure 4)

Rule 3: The pathway for every product must be simple and direct	• Complicated pathway for patients between various processes leads to formation of queues	• Pathway between various processes is indirect	• Re-arrange sequence and re-positioning of certain processes to establish direct, simple pathway for patient flow (Figure 4)
Rule 4: Any improvement must be made in accordance with the scientific method, under the guidance of a teacher	• Prior to Experiment 2 hospital administration undertook to introduce *flow* unsupervised. *Outcome:* queues still formed	• 'Push' flow instead of *"pull" flow* was introduced, thereby contributing to the formation of queues	• Analogy of 'push' and *"pull" flow* made with string, and characteristics of *"pull" flow* explained to role players • TPS/Lean principles and philosophies on *"pull" flow* applied under supervision

Table 12: Problems encountered during Experiment 2

Conclusion:

The experiment was deemed a success based upon the following outcomes:

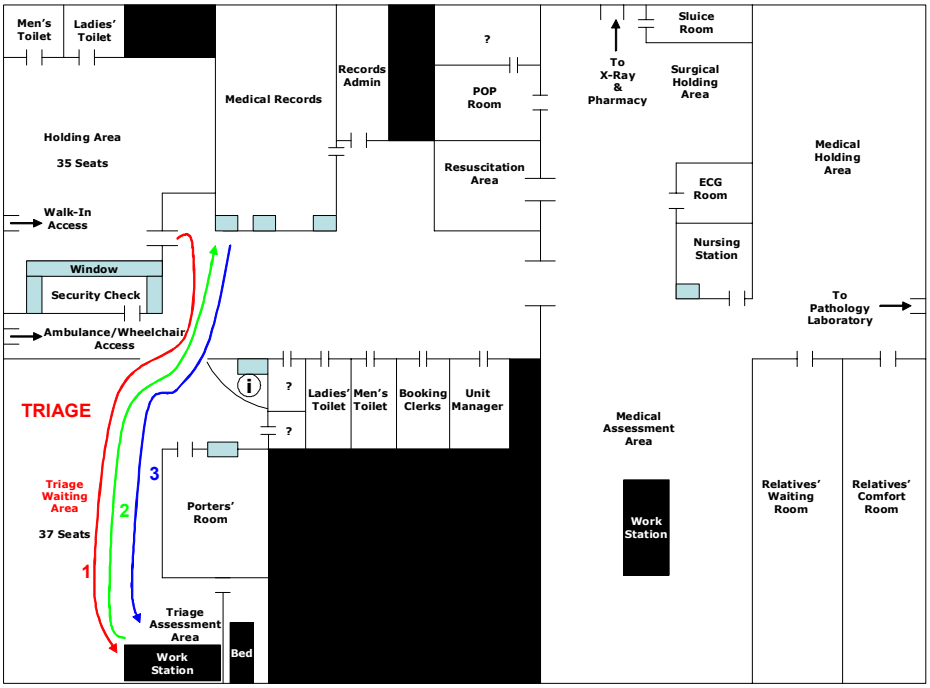
- Average patient *lead time* in Triage exceeded the pre-experiment 10% target reduction in *lead time*
- Service delivery, in the opinion of the patients included in the experiment, was satisfactory. 100% of patients included in the experiment indicated their satisfaction with the level of service delivery
- All staff members who participated in the experiment indicated that they were satisfied with the outcome in terms of patient *lead time* in Triage, as the achieved

average *lead time* of 89 minutes exceeded the target range of 120-150 minutes *lead time*.

It is clear that the principles and philosophies of TPS/Lean proved useful in terms of improved service delivery in the Triage section of the A&E Unit. This is evidenced by the finding that adherence to the Four Rules of TPS provided a basis for improved patient throughput times, and that through conducting Five-Why reviews effective countermeasures to problems could be developed and implemented to sustain efforts toward continuous improvement.

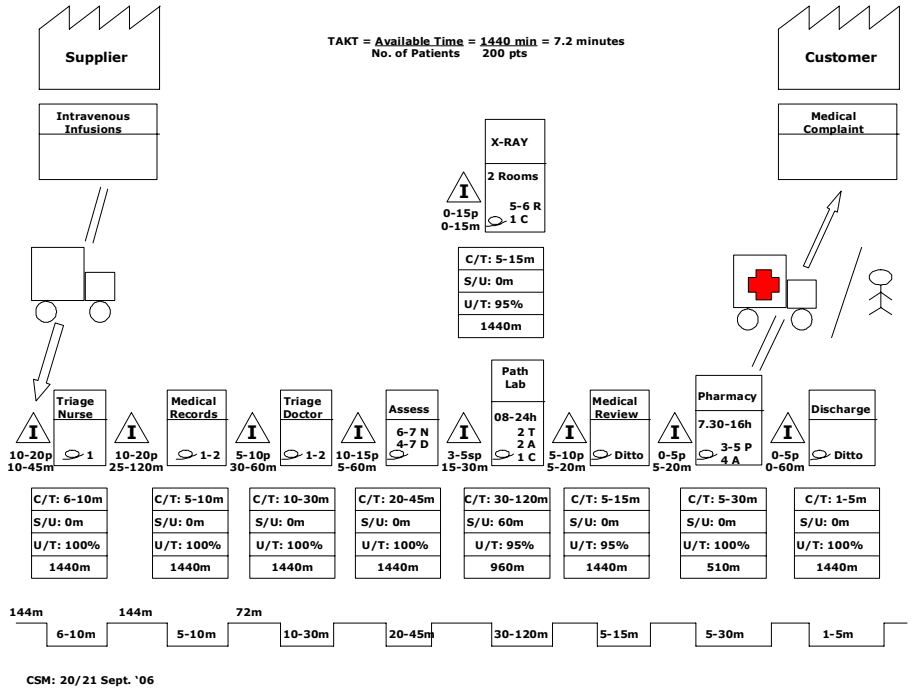
Figure 2: Accident and Emergency Unit layout pre-trial

Street-side



Key to patient routes: 1 = to triage nurse; 2 = to medical records; 3 = to triage doctor

Figure 3: Value Stream Map of Accident and Emergency Unit pre-trial



Key: I = Inventory p = patients m = minutes C/T = Cycle Time S/U = Set-Up Time U/T = Up-Time
N = Nurse D = Doctor T = Technologist A = Assistant C = Clerk P = Pharmacist
Other symbols used are as shown in "Learning to See" by Rother & Shook (2003)

Figure 4: Key changes undertaken in Experiment 2 with respect to layout

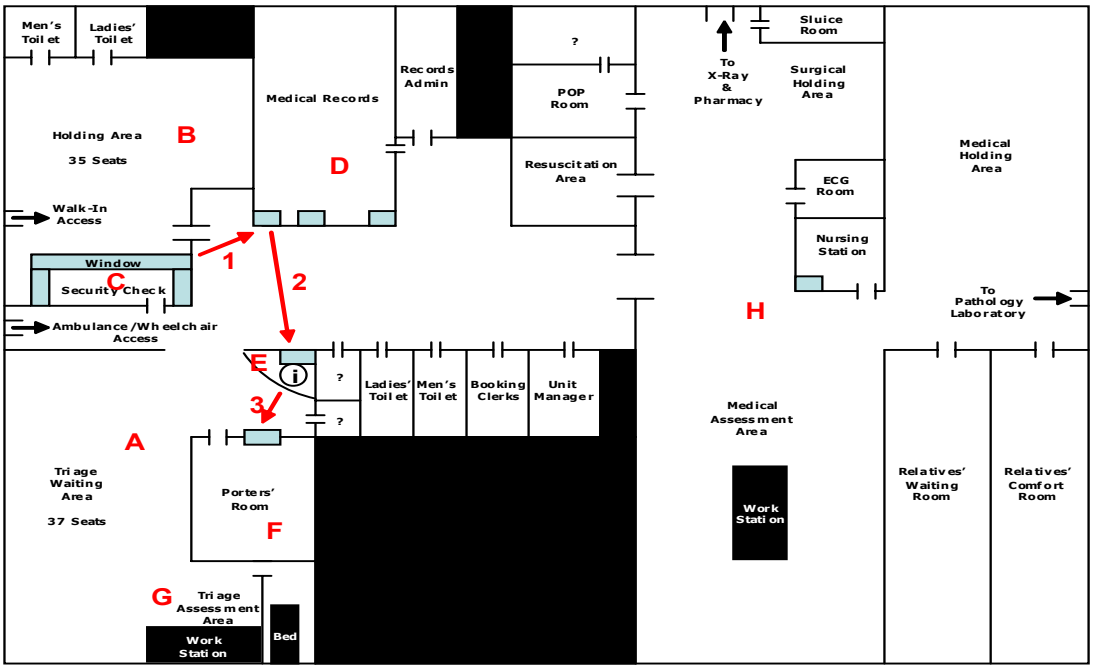


Exhibit A: Selection of research log entries

Date	Attendees	Location	Type	Objectives	Outcomes
20/09/2006	NS, MS, MP, JF, FG	GFJ (A&E)	Workshop on VSM & current state VSM *Data Gathering*	• Formal introduction to concept of Value Stream Mapping (VSM) to role players and explanation of value as a Lean tool • Obtain permission to undertake VSM of A&E Unit • VSM of A&E unit subject to approval	• Role players introduced to concept and value of VSM as a Lean tool – all attendees indicated understanding of VSM as explained • Permission obtained from NS to undertake VSM of A&E • VSM of A&E unit undertaken on 20/21`September 2006
16/10/2006	NS, MP, FG, AvS, VK, CR	GFJ (A&E)	Workshop and Conduction of Experiment 1	• Re-introduce key role players to the concept of VSM and principles & philosophies of TPS/Lean thinking • Complete a trial of TPS/Lean in action within healthcare environment to test validity of research hypotheses	• Key role players introduced to VSM and TPS/Lean thinking. Initial reaction of validity, but tempered by skepticism • Trial of TPS/Lean undertaken in Triage environment over a 90 minute period. Validity of all hypotheses held true, and decision taken to undertake extended trial in Triage environment

Date	Attendees	Location	Type	Objectives	Outcomes
19/10/2006	GP, NS, JV, MP, JF, MR, JQ, CE, CR	GFJ (Boardroom)	Presentation	• Introduce a broader audience, including senior hospital management, to objectives of research study • Provide *Data Feedback* and facilitate *Data Analysis* according to AR methodology on outcomes of Experiment 1 in Triage environment • Facilitate *Action Planning* of AR methodology and agree on date of *Implementation* of subsequent AR trial (Experiment 2)	• Attendees understood concepts of VSM and TPS/Lean, and acknowledged that these may be applied in A&E • Initial skepticism somewhat overcome following feedback on positive outcomes of enhanced patient flow achieved during Experiment 1. Agreed that trial warrants further attention • *Action Planning* agreed on addition of additional step of Triage "Meet-and-Greet" to regulate pull flow of patients for Experiment 2. Preliminary *Implementation* date for Experiment 2 set for 25/10/2006 subject to structural changes to house "Meet-and-Greet" nurse

01/11/2005	MP, FG, AvS, NSo	GFJ (A&E Triage)	Experiment 2 set-up and conduction	• Clear instruction to participating staff on principles and philosophies of TPS/Lean, their specific roles (*Rule 1*) and objectives of Experiment 2 of enhanced patient flow in Triage • *Implementation* of Experiment 2 within Triage environment over 2-3 hour period • *Evaluation* of Experiment 2 through feedback of role players – participating staff and patients	• Participating staff clearly understood the principles and philosophies of TPS/Lean, objectives of the experiment and their defined roles in achieving these outcomes • Experiment 2 implemented within Triage over 2.5 hours. (Detailed outcomes described in text) • *Evaluation* of Experiment 2 done through feedback of role players. (Detailed outcomes described in text)
02/11/2005	MP, FG, AvS, NSo, NS, CR, CE	GFJ (A&E Triage)	Experiment 2 repeated/Meeting	• Repeat *Implementation* of Experiment 2 to test if repeatable and attempt at enhancement of service delivery • *Evaluation* of Experiment 2 with	• Experiment 2 proven to be repeatable with regard enhanced service delivery • *Evaluation* done with broader audience.

				broader audience with intention to discuss longer-term feasibility of implementation of recommendations	Detailed outcomes described in text
03/11/2005	GP, UM, MS	GFJ (Superintendent's Office)	Meeting	• *Evaluation* of Experiment 2 outcomes at higher management level	• *Evaluation* of Experiment 2 done. (Details of outcomes discussed in text)

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