Lean processes mapping of diabetic patient flow in primary healthcare centres in Kuwait highlights opportunities for fewer patient visits

Hisham Kelendar (1)
Muhammad Faisal (2)
Mohammed A Mohammed (3)

(1) Bradford Institute for Health Research, Faculty of Health Studies, University of Bradford, Bradford, UK
(2) Senior Research Fellow in Biostatistics, Bradford Institute for Health Research, Faculty of Health Studies, University of Bradford, Bradford, UK
(3) Professor of Healthcare Quality & Effectiveness, The Strategy Unit, NHS Midlands and Lancashire Commissioning Support Unit, Faculty of Health Studies, University of Bradford, Bradford, UK

Corresponding author:
Hisham Kelendar
Faculty of Health Studies, University of Bradford, Bradford, UK
Email: dr.hisham81@gmail.com

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Abstract

Background: Healthcare systems are facing the ever-present challenges of increasing demand and limited resources. To address these concerns, some healthcare systems have adopted lean methodology specifically to enhance patient flow by eliminating waste in hospital settings. Little is known about the use of lean in the primary care setting: a setting that consumes considerable resources and increasingly handles chronic diseases such as diabetes.

Aim: To map the flow of patients with type 2 diabetes (PWT2D) without any complications in primary care, identify potential waste and make recommendations for improvement.

Methodology: We used a descriptive exploratory approach in the modality of a case study through semi-structured interviews with thirteen staff involved in the care of PWT2D in four Kuwaiti primary healthcare centres.

Result: PWT2D typically visit their General Practitioner (GP) at least every two months for a review appointment. When a blood test is required to monitor blood sugar levels, three more visits are required, involving the blood test, collection of test results by the patient and a review of these results with the GP. Staff acknowledged waste as non-standardised clinical practice, delays, waiting times and unnecessary patient visits. Four potential improvements were identified which could be consolidated into a single visit: using point of care testing, the posting of laboratory results to GP computer systems, the introduction of guidelines that standardise the practice for the patient's visit and permitting the GP to prescribe four months of medication.

Conclusion: The process map of PWT2D has highlighted waste and improvement suggestions that may reduce workload, enhance patient satisfaction, avoid unnecessary visits, enhance the timeliness of laboratory testing, improve communication between and across departments and minimise use of resources without undermining the quality of care. These suggestions need to be implemented and rigorously evaluated.

Key words: Lean, process mapping, patient flow, value stream mapping, efficiency, hospital, healthcare

Background

Healthcare systems are facing the challenges of rising demand and limited resources [1]. This increase is due to an ageing population, sedentary lifestyle and increased non-communicable disease burden [1, 2]. Healthcare organisations are looking to make better use of available resources and avoid waste. A wide range of waste types with distinct characteristics and classifications have been highlighted in healthcare [3]. To address these challenges, several methods have been advocated [4, 5] including lean methodology [5].

Lean is a widely-used method that originates from Toyota, a Japanese car manufacturer and was first introduced to the public domain by the book, The Machine that Changed the World [6]. The central insight of lean is to understand how we can maximise our resource efficiency [7]. It consists of a series of structured problem-solving tools [8]. Process mapping, also known as value stream mapping (VSM), is one of the most common lean tools applied in healthcare, aiming to visualise all activities of patient flow [9]. Fillingham mentions that in most processes, non-added value (NAV) steps account for nine times more effort than AV steps [10]. Typically, lean begins with mapping the patient flow in order to identify delays, repeated visits, waiting times, inappropriate procedures and errors [11]. Poor patient flow leads to increased healthcare costs, an increase in the likelihood of errors, reduces healthcare service efficiency and results in both patient and staff dissatisfaction [7]. Process maps can be used to redesign the patient's journey [12] by eliminating, combining, rearranging and simplifying (ECRS) the stages of patient flow [13]. Using VSM across different healthcare systems and among a variety of specialties shows encouraging results and benefits [14-16]. Much of the reported use of lean in healthcare has focused on patient flow in hospitals in developed countries [17]. Less is known about the potential of lean in developing countries [18], especially primary care settings [19, 20]. Additionally, a systematic review of the use of lean in healthcare concluded that lean interventions have a positive yet inconsistent benefit on patient flow that calls for more research [21]. In this paper we focus on the use of lean process mapping to describe the flow of patients with type 2 diabetes (PWT2D) in Primary Healthcare Centres (PHCs) in Kuwait.

Diabetes is at the top of the list of non-communicable chronic diseases in Kuwait. Diabetes effects 24% of the Kuwaiti population which is considered to hold the sixth-highest prevalence of diabetes in the world [22]. As a result, diabetes is the principal or secondary diagnosis in 40.6% of hospitalisations in Kuwait [23]. The majority of PWT2D in Kuwait were registered at a PHC [24]. The efficient use of primary care resources to manage diabetes is an important challenge.

Method

This is a descriptive exploratory qualitative study carried out via interviews attempting to capture the current process map and elicit potential improvements.

1-Setting

The Kuwait healthcare system is highly centralised with the Ministry of Health (MOH) being the national body that oversees the system across the country [25]. In 2015, the MOH had 94 PHC covering six healthcare regions [24]. This case study is based in the Hawalli region, which has the highest primary healthcare population per primary healthcare centre (PHC) (n = 62,652) [24, 26]. The Hawalli population accounts for almost one million people, where the annual number of visits to diabetic clinics is 200,044. Both numbers represent 20% of their totals for Kuwait [24, 26]. A convenience sample of four PHCs was selected on a voluntary basis.

2- Participants

The interviews included at least one staff member from each department involved in the flow of PWT2D without complications or comorbidities, including physicians, nurses, pharmacists, lab technicians and workers in different administrative positions. The selection of participants was done through consultation with the PHC director. The heads of departments were also interviewed. All participants consented to participate but did not consent to audio recording of the interview.

3- Date collection process

The interviews took place at the PHC (in the office or a meeting room) in the form of 'one-to-one', 'face-to-face' for a maximum of one hour. To understand the current process map for PWT2D, the researcher asked the healthcare workers (HCWs) to describe how patient services are provided in practice, the personnel involved at each step and the estimated time needed for completion. Furthermore, attention was also given to waiting times, waste, problems within the steps and ideas for eliminating or reducing these issues. The following fifteen questions were used in the semi-structured interview:

Questions to understand the current process map for PWT2D

1. How many steps are there in the flow of PWT2D from one appointment to another appointment?
2. How many times is the patient passed from one person to another (hand-off)?
3. What is the approximate time taken for each step (task time)?
4. What is the approximate time between each step (wait time)?
5. What is the approximate time between the first and the last step?
6. Does the patient join a queue or is put on a waiting list?
7. Are there any delays which occur on a regular basis?
8. How many steps add no value for the patient? Adopted from [29]

Questions to identify proposed corrective action
1. Where are there main problems for patients or staff?
2. Is there anything that will hinder the process?
3. Is the patient getting the most appropriate care from the appropriate person?
4. Is the care being given at the most appropriate time and in the ideal place?
5. Are there procedures that could be done in the same visit?
6. Could the patient have several investigations at the same visit?
7. Could patients carry their own records? Adopted from [29]

During the interview, the researcher took extensive notes by hand and at the conclusion of the interview, read them back to the participant to review and clarify any inaccurate statements or missing information. Aside from interviews, the researcher also reviewed the existing design artefacts (such as layouts and drawings), relevant process statistics (such as activity volume and frequency, the number of PWT2D visits annually and other relevant statistics when available) and observed/followed a patient process map.

3- Data analysis
For qualitative data analysis of the answers obtained, all information was transcribed and categorised. The impact of the proposed changes was evaluated using different measures including turnover time, the length of the patient journey, number of visits per year, the total number of steps and patient satisfaction.

4- Drawing the process map of PWT2D
In order to capture an accurate representation of the process as opposed to the assumed occurrences, the current process was mapped. Based on interviews, all the steps and processes required for providing the services for PWT2D were mapped out. The final version of the process map was presented to the participants for waste identification and potential improvement suggestions. The ECRS framework was used to guide the process of creating corrective actions, thoughts and ideas.

5- Lean principles and tools used throughout the case study
Table 1 shows the lean principles and tools used throughout this case study.

6- Ethical Approval
This study was ethically approved by the Kuwait MOH ethics committee. Approval was also granted by the Chair of the Humanities, Social and Health Sciences Research Ethics Panel at the University of Bradford. Verbal consent was obtained from all participants throughout the research and their identities will remain anonymous. Participation was optional.

Results

Across four PHC sites in Kuwait, thirteen staff members were interviewed. The minimum number of annual visits to the general practitioner (GP) for PWT2D was considered. Furthermore, only the typical process map for PWT2D from one appointment (undergoing a lab test which usually includes a HbA1C test) to the next appointment was drawn up.

1-Annual visits to the GP for a patient with controlled diabetes
The minimum number of annual visits to the GP for a PWT2D were six visits (Figure 1).

The reason for the results in Figure 1 is the limitation set out by Kuwait MOH instructions, only permitting GPs to prescribe two months' worth of medication for PWT2D at a time. The patient is required to see the GP every second month in order to review and renew their medication.

Table 1: Lean principles and tools used throughout the case study

LEAN PRINCIPLES AND TOOLS USED THROUGHOUT THE CASE STUDY
Just in time production
ECRS
Standardised work
Gemba walk (direct observation of the workplace)
Waste elimination
A3
Flow improvement
VSM
Current situation analysis
Employee involvement
Lead time reduction
Patient involvement

2-Current process map

The patient journey started with arrival at the PHC, before proceeding to sign-in at the reception where the patient received a number. They took the random finger prick blood sugar test with the nurse and then waited in the waiting area to be seen by the GP who saw the patient and wrote the prescription and the lab request. The patient would then go to the pharmacy to collect medications and to the lab to give a blood sample. Once the lab results were available (usually a few days/weeks later), the patient would receive them and bring them to the next GP consultation visit. In a typical follow-up consultation for PWT2D, the GP reviewed the patient's lab results, specifically the HbA1c test and recommended an adjustment in medication accordingly. This simple service provided by the healthcare sector travels through multiple steps where different flows are branched onto different stream paths. Based on the interviews, the researcher drew up the current process map for PWT2D (Figure 2).

When the practitioner requested a lab test, excess time was spent by the patient on transport, testing, waiting, collecting and consulting the GP for the lab results. Based on the current process map, the delay is directly apparent. Patients were required to do blood tests in a separate location and wait for the results. Once the results became available, the patient was required to collect them and bring them to the next appointment. Within this process is a sample flow map that is beyond the scope of this case study. Due to the lack of networking and inter-department communication, additional steps and pathways are necessary to transfer lab information. Several paths were identified within the four PHCs, but only the common path for a patient with a lab request was considered.

3-System deficiencies and the proposed corrective actions

Most of the interviewed HCWs across the four PHCs reported that the practice of lean principles empowered them to identify the obstacles within the healthcare system and explore improvement opportunities. Based on the observation phase and with the help of interviewer feedback on the current process map, multiple improvement opportunities were determined.

One of the findings was the lack of a formal standardised process for different steps within the flow of PWT2D. For example, when GPs were asked about the guidelines for the number of times PWT2D should be seen annually and the frequency of required lab investigations, varying responses were received. One participant said that their response depended upon the patient's condition and whether the patient was 'controlled' or 'uncontrolled'. Another GP mentioned that the patient is seen once the lab result finished. After reviewing the existing records, it was determined that

Figure 1: The minimum number of annual visits to the GP for a patient with controlled diabetes

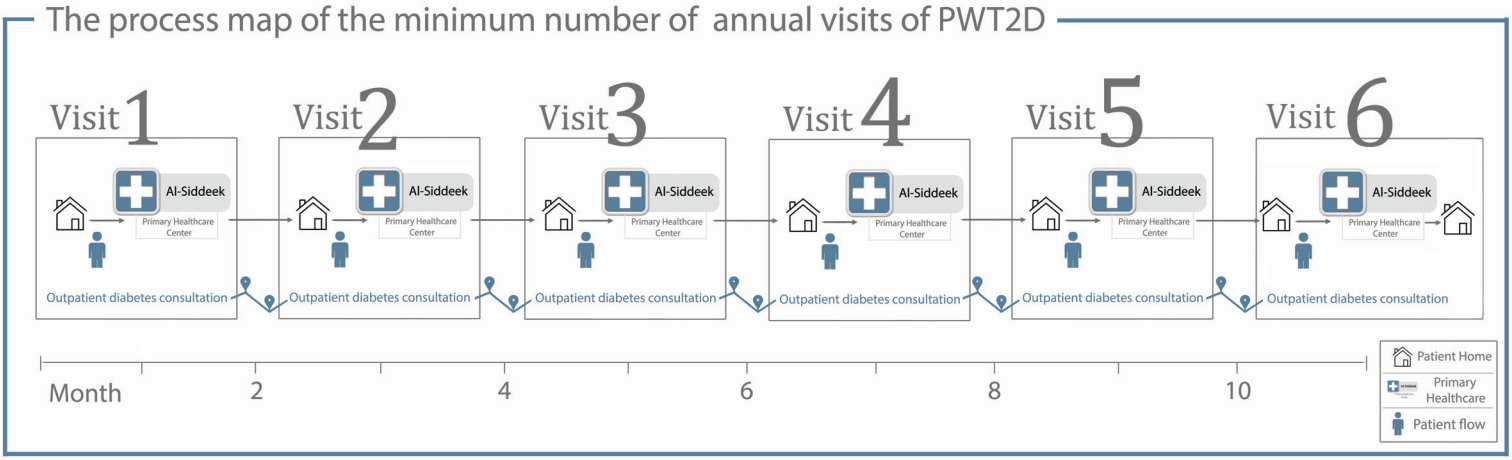

Figure 2: The typical process map for PWT2D detailing the steps from one appointment (undergoing a lab test which usually includes a HbA1C test) to the next appointment.

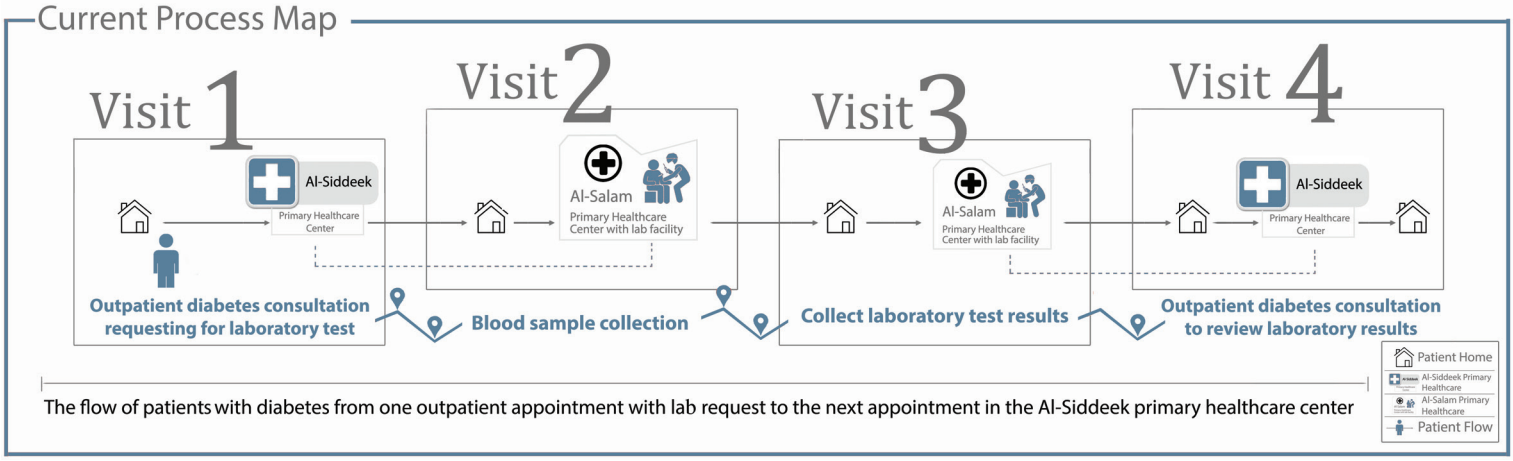

Table 2: Suggestions for improving the flow of PWT2D with the expected benefits for the patient and organisation

	The Process	Current Situation	Target Situation	Proposed Corrective Action	Potential benefits to the Organisation	Potential benefits to the Patient
PWT2D annual visits						
1	Reduce the annual visits to the GP for PWT2D	Minimum six visits annually	Three visits annually	A new policy allows GP to prescribe medications for 4 months or provide to patients necessitating GP visit	Appointment slots will be freed up and total annual visits could be reduced by 50%	Greater satisfaction due to elimination of unnecessary visits as average total visits per patient could reach three per year
2	Reduces the interval between patient visits	No informative guidance for patient visits	Informative approach guiding patient visit	Introduce guidelines that standardise the practice	Clearer and more informative practice	Patient satisfaction is increased due to removing unnecessary visits
PWT2D from one appointment (with lab test which usually includes HbA1C test) to the next appointment						
1	HbA1c test process time reduction	10 days	30 minutes	Point of care testing	Lowers workload and frees up appointment slots	Patient satisfaction increases due to minimising visits from 4 to 1
2	Reduces patient waiting time for next appointment	14 days	On the same visit	Point of care testing	Combine two appointments together	Patient satisfaction increases due to reduced waiting time
3	Reduces the time between blood sample and result availability	7 days	3 days	Lab and doctor electronic system connection	Minimise waste, errors and delays	Patient satisfaction increase due to not needing to travel for results

PWT2D are required to visit the GP at least once every two months due to the limitations of the medication prescription that must be renewed every two months.

The other finding was that no automated process exists to obtain the lab results. As a result, the patient is required to conduct further visits to various locations for both the providing of blood samples and the collection of results. (This is the case in those PHCs that do not have lab facilities). When one patient was asked for her thoughts on the process, she revealed she was frustrated at being required to travel to another location to provide a blood sample and then being asked to return later for the results. She questioned why it was not possible for the results to be sent directly to her file. She also mentioned that one of her relatives on follow up in another PHC was not required to do all these steps as this second PHC had the lab facilities required. It is worth noting that an electronic system is available and is used by the GPs, but that this system is not connected to the lab department. Moreover, there were several complaints from GPs about the current electronic systems that, if resolved, would result in significant time-savings for GPs to spend on the patient without interruption. Another solution that has the potential to improve this situation is a establishing a point of care testing (POT) for the HbA1c. POT combine the process steps by having the follow-up investigations carried out on the same visits where the results are available immediately and can be easily reviewed by the GPs. Based on participants interviews, Table 2 summarises some of the preliminary suggestions for improving the flow of PWT2D with the expected benefits for the patient and the organisation.

All the proposed corrective actions aim to enhance the patient visit flow and target improving the healthcare system efficiency, which will lead to better access, higher quality of care and reduced costs.

Discussion

The results of this study show that lean management can play a significant role in optimising the flow of PWT2D (without complications) in PHCs in Kuwait where a number of improvement opportunities were discovered. To the best of the authors' knowledge, this is the first process map describing the flow of PWT2D within PHCs from one appointment to another. Discussing the flow of PWT2D through the current process map enhanced HCWs' learning, especially in the identification of waste and inefficiencies and suggesting priorities for changes. Several opportunities for improvement were identified to mitigate waste and inefficiencies in the flow of PWT2D.
One opportunity for improvement is providing lab results as soon as possible. This could be achieved by using an IT-based system instead of a paper-based system, with the lab computer system connecting directly to GP computers, removing the need for the patient to collect their results and bring them for their next visit. The integrated computer health information system could help improve user management and increase patient flow efficiency. This is reflected in the delay in management plans, patient frustration and waste of resources. Moreover, each additional step in the process provides further opportunity for the introduction of errors, leading to safety concerns. Arguably, a better solution is providing a POT that will include the lab work and results in the patient's original appointment. A POT will improve the timeliness and accuracy of the result, reduce HbA1c test process from 10 days to 30 minutes, condense patient waiting time for next appointment from 14 days to the same visit and consequently reduce the annual number of patient visits.

Another improvement opportunity is providing standardised clinical, policy and procedure practices. In lean, standardised processes are an important aspect in achieving a highly efficient system [27]. Lack of practice standardisation is a common finding of process maps in various services[28]. In this study, asking different physicians about the guidelines for the average number of times PWT2D were required to be seen annually and the frequency of necessary lab investigations returned a variety of responses. For example, in response to the question on the frequency of HbA1c measuring, two answers were every three months, another answer was depending on the case and one GP simply said, 'I am following the NICE guideline'. As a consequence, it is highly recommended to have a guideline appropriately implemented. Another important finding was that the patient was required to visit the GP once every two months for renewal of medication regardless of whether the patient's diabetes was classified as controlled or not. This could be improved if the administrative policy allowed GPs to prescribe the medication for four months or for patients to obtain the medication without necessitating a GP visit.

The findings regarding the direct time spent with the patient are consistent with previous studies. O'Leary et al. found in their research that hospitals spent most of their time on NAV activity for the patient [29]. As time spent on communication is significant, developing a system that maintains an efficient method of communication is a must. The lag in communicating lab results, inefficient patient-doctor communication and inherently fragmented systems are all potential contributors to delays, medical errors and poor quality of service. This aggravates the frustration patients will face during the journey of receiving healthcare services, as they often have to wait at each stage of the process and go through numerous steps. Reflecting on the previous recommendations with the consideration of the total diabetic outpatient visits, total annual visits could be reduced by 50% where average total of visits per patient could reach three per year. As a consequence of reducing the total number of visits, appointment slots will be freed up to allow more patients and reduce waiting lists, and provide the opportunity for GPs to spend more time with their patients.

The authors observed that by adapting VSM, employees receive guidance on how their work contributes to the flow of PWT2D, which increases understanding of the work of other professional groups and leads to greater application

of knowledge. This observation was also mentioned by Drotez and Poksinska [30] and by Rossum et al. [31]. Interviewed participants were also introduced to diverse lean strategies in order to maximise value and minimise waste. These included performing root cause analysis to identify waste, redesigning processes through the VSM tool, reducing variation in practice through the use of standard work and simplifying organisation operations to streamline patient flow. Another revelation from this research was the necessity of HCW engagement in the research project and the improvement initiative. Melanson et al. highlight the importance of teamwork as a critical factor for the successful implementation of lean [32].

This research provides several significant lessons to those interested in process mapping. Process mapping considers an innovative approach in Kuwait's PHCs that allows HCWs from different specialties to improve the patient flow and in doing so, the system efficiency. It offers leaders strategic recommendations that have the potential to improve the flow of PWT2D. It led to an understanding of the current processes, identifying areas for improvement and suggesting necessary changes. The full potential of the lean method can be achieved if it is implemented holistically, where lean becomes embedded within daily healthcare activities.

Conclusion

This case study contributes a practical example of how a lean-inspired approach using VSM or process mapping can be utilised in Kuwait PHC. It was carried out with the participation of HCWs to draw the process map of PWT2D. This facilitated the identification of the gaps in the system (different kinds of wastes), proposed solutions and measured the anticipated effect. The improvement could be achieved by eliminating immediately, where possible, NAV steps or combining multiple steps into one, mainly when steps cannot be eliminated. Additionally, processes could be rearranged and simplified where time, effort and cost could be saved. VSM is a promising instrument for PHCs in Kuwait, but the extent to which suggested changes can be successfully implemented remains to be seen.

Proposals for further research

A shortage of examples of lean application in PHC is noted. Therefore, this study is presented as one of the few examples of this theme; it should be considered a good contribution to the continuity of the research. To be able to draw more generalising conclusions, the majority of studies of this kind should be carried out in other departments within healthcare systems. In lean, the patient is at the centre of healthcare, so the HCWs should aim to understand value from the patient's perspective. Further research on in-depth patient involvement is recommended. In terms of method, further research should be carried out by supplementing interviews with observations or with a quantitative method.

Limitations

Our study was limited to PHCs from one healthcare area. Even though other PHCs in different healthcare areas have the same setting with similar processes and procedures, we cannot be sure that other PHCs face similar challenges. Another limitation was that interviews were conducted with a limited number of people based on availability. Thus, generalisations cannot be made for other groups based on the single group that has been investigated. However, this study allows understanding of the operational process of how one lean-inspired project can be implemented to improve system efficiency. Finally, the suggestions for improvement described in the context of this research work have not been tested.

Conflicts of interest

The authors declare no conflicts of interest.

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