The "5S" approach to improve a working environment can reduce waiting time

Findings from hospitals in Northern Tanzania

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Hisahiro Ishijima
Overseas Department, Fujita Planning Co. Ltd, Tokyo, Japan
Eliudi Eliakimu
Health Quality Assurance, Ministry of Health and Social Welfare, Dar es Salaam, United Republic of Tanzania, and
Jonathan Mcharo Mshana
Human Resource for Health Program, National Institute for Medical Research, Dar es Salaam, United Republic of Tanzania

Abstract

Purpose – The purpose of this paper is to assess causal relations between the implementation of the 5S approach and the reduction of patients' waiting time at out patient departments (OPDs) of hospitals in Tanzania.

Design/methodology/approach – Patients' waiting time was measured under the cluster randomized control trial (c-RCT). In all, 16 hospitals were chosen and divided into treatment and control groups using block randomization. Before the intervention, a baseline study was conducted at OPDs in all 16 hospitals. After one year of the intervention, the end-line study was carried out in both the groups. A comparison of the average waiting time reduction and Difference-in-Difference (DID) analysis was carried out to see the effect of the 5S approach on the reduction of patients' waiting time.

Findings – Statistical significance in reduction of patients' waiting time was seen in the medical records sections ($p = 0.002$) and consultation rooms ($p = 0.020$) in the intervention group. The same trend was also seen using DID analysis (−15.66 min in medical record, −41.90 min in consultation rooms).

Research limitations/implications – This study has the following limitations in terms of the data. The data were collected for only three days at the time of baseline survey, and again for three days at the time of the end-line survey from 16 hospitals. Moreover, piloted areas for the implementation of the 5S approach vary from hospital to hospital. There might be a bias in the measurement of a patient's waiting time. Caveats are therefore needed in extrapolating the study results to other settings. Despite these caveats, the findings will provide important insights for implementing quality improvement programs in Tanzania and in other African countries for improvement of time factors.

Originality/value – This study used c-RCT, and has proven the effectiveness of the 5S approach in improving the working environment and reducing patients' waiting time at OPDs in several hospitals at district level in Tanzania.

Keywords Tanzania, c-RCT, District level hospitals, Patient waiting time, The 5S approach
Paper type Research paper

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Introduction

Long waiting times between registration and receiving consultations from clinicians, and when receiving other services such as prescriptions for medications and specimen collection for laboratory testing at out patient departments (OPDs), are problematic in public hospitals in Tanzania (Muhondwa *et al.*, 2008).

Prolongation of waiting time is identified as one of the dissatisfactory factors for patients and users of health facilities in many countries, as reported in different studies (Aldana *et al.*, 2001; Muhondwa *et al.*, 2008; Umar *et al.*, 2011).

Resource shortages are often pointed at as being the cause of the prolongation of waiting time, especially the fluctuation or shortage of human resource for health (Lucas, 2002; World Health Organization, 2006). However, prolongation of waiting time is not only caused by resource shortages, but also by various factors such as poor planning and management, a disorganized workplace, and registration procedures (Abdullah, 2005; Ofili and Ofovwe, 2005; Rauf *et al.*, 2008; Organization for Economic Co-operation and Development, 2013).

The definition of time study used in this paper is "a work measurement technique consisting of careful time measurement of the task with a time measuring instrument, adjusted for any observed variance from normal effort or pace and to allow adequate time for such items as foreign elements, unavoidable or machine delays, rest to overcome fatigue, and personal needs." (Institute of Industrial and System Engineers website).

Some studies identified that patients spent a majority of time at OPDs waiting to receive medical services (Sharma and Chowhan, 2013). The reduction in long waiting times at OPDs and emergency rooms has been studied in many countries (Helbig *et al.*, 2009; Ng *et al.*, 2010; Cao *et al.*, 2011; Dinesh *et al.*, 2013), as it is a very important factor for a patient's satisfaction, and an indicator of health care quality. These studies generated sets of evidences used to design and implement waiting time reduction strategies. One of the methods used for the reduction of patient waiting time is a lean management method, applied to one section or department of a hospital in a developed country, which has shown reduced waiting times (Dinesh *et al.*, 2013; Ng *et al.*, 2010). However, those studies were limited to one hospital hence it is difficult to generalize findings. There has been no study, based on the authors' knowledge, conducted using cluster randomized control trial (c-RCT) to validate the effectiveness of the 5S approach among QI interventions at hospitals in an African context.

The 5S Approach

The 5S approach is a principle and a tool, which is used to organize and manage the workplace for improvement of the working environment. It originated from the Japanese manufacturing sector in the mid-1950s. The approach became famous and it started to be applied by many companies in the 1980s. It has also been applied in the service industry, for example in hotels and hospitals, since the 1990s (Fabrizio and Tapping, 2006).

In the manufacturing sector, the 5S approach has been found to be useful in setting out a clear, simple route toward achieving a total quality, equitable, environment where well controlled process and operation produce high quality goods and services (O'hEocha, 2000). The 5S could be incorporated with some management system practices as an approach for integrated management system so as to improve productivity, quality delivery of services and safety (Jamian *et al.*, 2012).

O'hEocha's (2000) study reported that 5S approach is effective in improving environmental performance related primarily to the measured reductions in waste of resources. Pheng's (2001) study has shown that 5S principles are useful in ensuring high productivity and achievement of quality standards in organizations in manufacturing sector. The 5S principles also can complement well with other quality improvement and quality assurance approaches such as the ISO standards in ensuring cleanliness and safety of working environment and hence building a good foundation toward total quality management (TQM). Ho's (2010) study provided some evidence on usefulness of 5S in improving productivity and competitiveness in organizations and companies across various sectors including security systems manufacturer, textile industry, communication enterprise, railway, construction, and others. The importance of the 5S principles is health sector in developing countries like Tanzania is even more than ever given the dwindling resources particularly financial resources.

The 5S's refer to five abbreviations of Japanese words, all with the initial letter "s". These are Seiri; Seiton; Seisou; Seiketsu; and Shitsuke. These words have also been translated into English and Kiswahili words starting with "s" to make them familiar to Tanzanian health workers as shown in Table I (MoHSW, Tanzania, 2013; Hasegawa and Karandagoda, 2013).

The 5S approach used for improvement of productivity in a health facility

The 5S (Sort-Set-Shine-Standardize-Sustain) approach can improve the arrangement of items in the workplace using a "Can see, Can take out, Can return" philosophy, so that particular items and particular numbers are kept and organized, supported by some tools such as labeling, numbering, color coding and so on. This way of arrangement in the workplace is effective in reducing time spent searching for needed items for provision of services. For example, medical records sections keep thousands of patients' files for years and years. Unfortunately, many hospitals in Africa do not keep patients' files in an appropriate manner as

	Japanese	English	Kiswahili	Meanings
S1	Seiri	Sort	Sasambua	Remove unused items from your workplace. This step will also help to identify what is missing from your workplace
S2	Seiton	Set	Seti	Organize everything needed in proper order for easier work. This step is based on finding efficient and effective storage of necessary items. Setting of necessary items can save time and energy when looking for something
S3	Seiso	Shine	Safisha	Maintain a high standard of cleanliness of the workplace, tools and equipment. This step will create ownership of infrastructure, equipment and tools, and enable identification of any abnormality of infrastructure, equipment or tools
S4	Seiketsu	Standardize	Sanifisha	Maintain an environment where S1 to S3 are implemented in the same manner throughout the organization
S5	Shitsuke	Sustain	Shikilia	Maintain S1-S4 through discipline, commitment and empowerment. This step focusses on defining a new mindset and standard in the workplace

Table I.
Explanation of the 5S approach

shown in Plate 1. However, removing unused files or expired files from shelves, and properly categorizing active files by numbering and labeling them, makes retrieving a patient's files easy, quicker and opens up more space. This leads to an improvement in staff movement and a reduction in waiting time when getting a patients' file at OPD.

As mentioned above, operational efficiency can be improved by practicing the 5S approach. The improvement in operational efficiency through the 5S approach is expected to bring various positive effects to the workplace. Patients' waiting time is one indicator, which commonly reflects the results of efforts in a cross-sectorial manner. Therefore, in this study we studied the effect on the patients' waiting time as a result of the 5S approach.

Operational research (OR)

This OR was jointly conducted by the Ministry of Health and Social Welfare (MoHSW), the Japan International Cooperation Agency, and 16 district and designated district hospitals in the Kilimanjaro and Manyara regions in Tanzania between June 2011 and August 2012.

The OR aimed to assess the effect of the 5S-KAIZEN-TQM approaches on quality of care and other areas in the context of health care facilities in Tanzania using c-RCT methods, as described in Figure 1. This paper is focussed on patient waiting time, measured through direct observation at four selected sections of OPDs in all 16 hospitals. Ethical clearance of the research was obtained from the National Health Research Ethics Review Committee (NatHREC:Ref.NIMR/HQ/R.8a/Vol.IX/1257) in Tanzania.

Methods

Study design

Findings of this paper were obtained from c-RCT conducted at selected hospitals in Manyara and Kilimanjaro regions in Tanzania. The broad objective of the study was to examine the effectiveness of the 5S approach on the reduction of patients' waiting time at different service points in OPDs. We hypothesized that hospitals in the treatment group that would practice 5S activities would improve productivity and minimize process time for service provision through improving the working environment as described in Figure 2. Due to the reduction in process time, sections that would practice the 5S approach could reduce patients' waiting time for provision of health services.

Before 5S activities | After 5S activities

Plate 1. Example of the 5S activities at medical records in a public hospital here

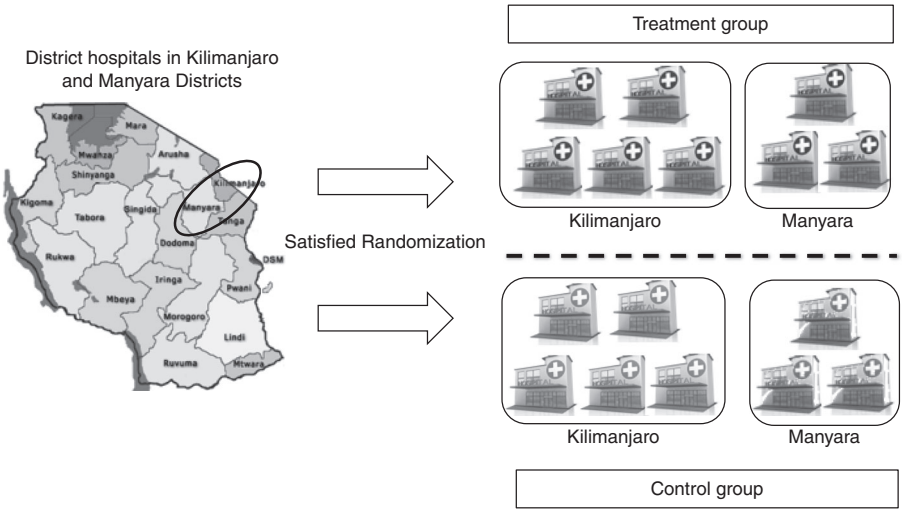

Figure 1.
Design of cluster randomized control trial

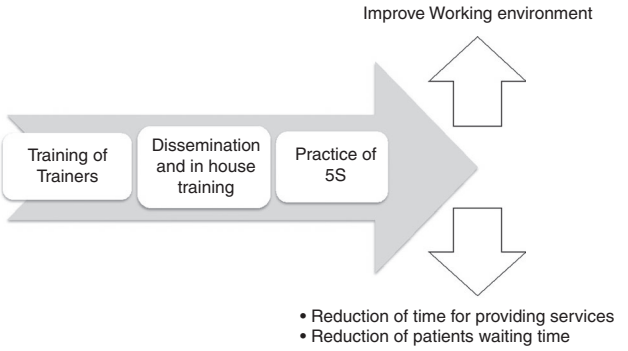

Figure 2.
Hypothesized model for waiting time reduction through 5S approach

This study team listed 16 district level hospitals from two regions in the northern part of Tanzania based on the following characteristics: hospitals at district level; average number of outpatients per day; bed capacity; number of staff; no other QI intervention; and no conflict with other QI intervention in hospital.

Randomized block design (Bhattacherjee, 2012) was used to select the hospitals for the study. Subjects were assigned to blocks, based on regions (Kilimanjaro and Manyara regions) (Table II). Then, within each block, subjects were randomly assigned to either the treatment group or the control group (Table II). 11 districts (seven districts in Kilimanjaro and four districts in the Manyara region) were taken in this block randomization.

Series of intervention activities to intervention group

Intervention activities that were conducted in eight hospitals in the treatment group are shown in Figure 3. Before the first intervention, a baseline survey was conducted in all 16 hospitals with both the intervention and control group. After the baseline survey,

	1	2	3	4	5	6	7
Manyara	B	A	B	A			
	Babati District	Kiteto District	Hanang District	Mbulu District			
Kilimanjaro	A	B	A	B	B	A	A
	Siha District	Same District	Mwanga District	Rombo District	Hai District	Moshi Rural Council	Moshi Urban Council
Regions	Treatment (A)			Control (B)			
Manyara	Hospital F, G, and H			Hospital N, O, and P			
Kilimanjaro	Hospital A, B, C, D, and E			Hospital I, J, K, L, and M			

Notes: A – Treatment group; B – Control group

Table II. Result of block randomization

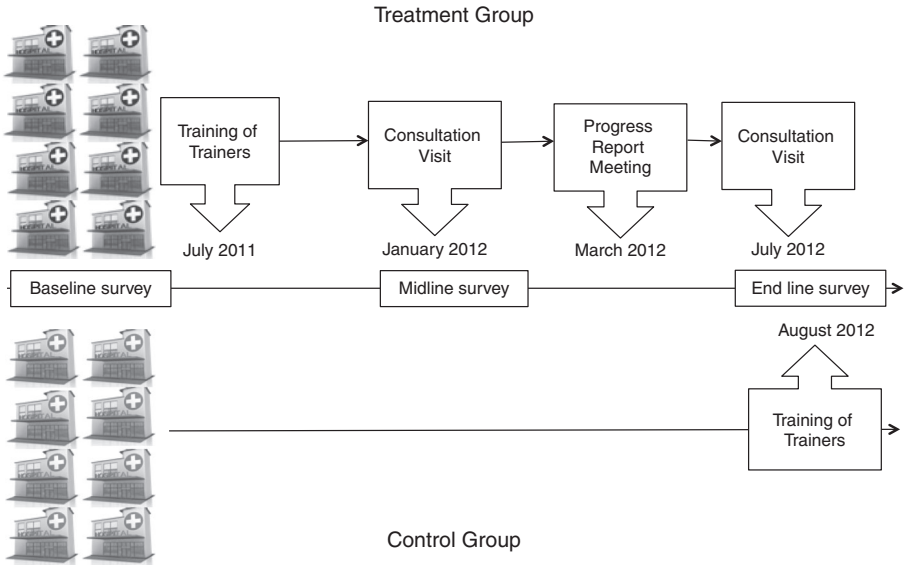

Figure 3. Series of interventions to treatment group

the first intervention, training of trainers (ToT) on the 5S approach, was conducted in July 2011 to the eight hospitals in the intervention group. Six months after ToT, consultation visits (CVs) were conducted by MoHSW CV team to monitor and evaluate the progress of the 5S implementation in the eight hospitals. During the visit, technical advice was given to Hospital Management Teams and Quality Improvement Teams of the hospitals. Around the same time of CVs, a midline survey was conducted. Three months after the CVs, all eight hospitals were invited to participate in a Progress Report Meeting (PRM) to present their self-evaluation results of 5S activities, and to receive comments, suggestions, and advice from other participating hospitals. Three months after the PRM, a second CV was conducted, and an end-line survey was also conducted in August 2012. During the ToT, hospitals in the treatment group were instructed to select pilot areas to practice the 5S approach. The selection of pilot areas was the decision of each hospital in the treatment group.

5S activities implemented by the hospitals in the treatment group

Six months after the baseline survey, the study team visited the hospitals in the treatment group, and obtained information on pilot areas for the 5S implementation. When the pilot areas were identified same as the observation points, the study team obtained information on the 5S activities that had been practiced in those areas.

Based on the assessment at hospitals in the treatment group, the study team obtained information on 5S activities conducted in the four areas selected for measuring waiting time as shown in the Table III. Hospital "A", "B", "C", "D" and "G" selected the medical records section as one of the pilot areas for the 5S approach. Removing old files, proper numbering of patients' files and arrangement of files are found as common interventions in the medical records section. Hospital "A" and "E" selected consultation rooms as one of the pilot areas for the 5S approach. Sorting items in the consultation room and arranging patients' files for smooth serving are found to be common interventions in consultation rooms. Hospital "A", "B", "C" and "G" selected the laboratory as one of the pilot areas for the 5S approach. Sorting items in the laboratory, and changing specimen collection and arrangement are found to be common interventions in laboratories. Hospital "B", "C", "D", "E" and "G" selected the pharmacy as one of the pilot areas for the 5S approach. Removing unwanted items and labeling of shelves are found to be common interventions in pharmacies. Hospital "F" and Hospital "H" did not select any of the sections where waiting time could be measured.

Sample size

Based on the c-RCT sampling strategy, previous studies were reviewed to calculate the sample size of this study. However, no similar studies were found based on the authors' knowledge. Therefore, the authors agreed to use the following settings to calculate sample size: power = 0.8, significance = 0.05, effect size = 0.4, interclass correlation coefficient = 0.05, number of clusters = 15. Based on the settings, the sample size per cluster was calculated, and it was indicated that a minimum of 65 observations per cluster were needed for this study. Therefore, to ensure accuracy, it was agreed to collect 75 observations per cluster. However, some hospitals had a smaller number of patients on the day of data collection, and could not observe 75 per cluster, as shown in Table IV.

Data collection

Data on patient waiting time was collected at four sections, namely, registry; waiting area of the consultation room; laboratory reception; and pharmacy dispensing area in the OPD of the 16 hospitals. Two surveyors were allocated per hospital at each section to observe and directly measure time spent by patients before receiving services.

The surveyors prepared 50 pieces of paper and wrote, "Participant" on 25 pieces of the paper, and "Not a participant" on the other pieces of paper. Then, these papers were put in a box, and patients who came to the data collection points were asked to pick a piece of paper from the box. Whoever picked the paper with "participant" was requested to participate in the survey. The surveyors continued to measure time spent waiting for services. During the baseline and the end-line surveys, the flow of patients was observed for three consecutive days, from Monday to Wednesday, from 8 a.m. to 2 p.m. in the same week at the four sections of the 16 hospitals. These days were selected based on the fact that many outpatients usually visit hospital on Mondays, Tuesdays and Wednesdays, and so it was possible to obtain enough data during surveys (Table V).

Hospital		Medical record		Consultation room	Laboratory		Pharmacy
A	P	Remove old files Prepare enough boxes and put number on boxes according to year, and arrange the boxes on the shelves according to year	P	Sort consultation room Put box to keep patient files in so that the first to come will be served first Put labels on items and arrange	P	Sort laboratory Put restrictions on patients entering the laboratory, specimens taken at reception and labeled. Put waste bin both at reception and in the laboratory	
B	P	Remove old files Install shelves and arrange active files Number files properly			P	Sort laboratory Put labels on machines and other things Put number on the fridge and write what is inside Arrange specimens and label	P Remove unwanted things like expired medicines and destroy them Install shelves and arrange medicines Put labels on shelves
C	P	Remove old files Arrange active files Number files properly			P	Sort laboratory Remove unwanted things like old machines Put labels on the machines and other things	P Sort pharmacy Arrange medicines on the shelves so that first in will be first out and label
D	P	Remove old files Arrange active files Number files properly					P Remove unwanted things like boxes Put medicines on shelves and label
E			P	Sort consultation room Arrange patient files in order so that the first to come will be served first Arrange things in an orderly fashion so it is easy to find them and return them			P Remove unwanted things like boxes Put medicines on shelves and label
F							
G	P	Remove old files Arrange active files Number files properly			P	Sort laboratory Put labels on the machines and other things Arrange specimens so that the first to come will be the first to be served	P Remove unwanted things like boxes and destroy those which are not in use, like expired medicines Arrange medicine on shelves and label
H							

Note: P, Pilot areas for 5S activities

Table III.
5S activities implemented by the hospitals in the treatment group

	Registry/Medical record		Consultation room		Laboratory		Pharmacy	
	BL	EL	BL	EL	BL	EL	BL	EL
Intervention hospitals								
A	75	75	75	75	75	75	75	75
B	75	75	75	75	70	75	75	75
C	75	75	75	75	75	75	75	75
D	75	75	75	75	75	75	75	75
E	75	75	75	75	75	75	75	75
F	75	75	74	75	0	52	75	75
G	75	75	75	75	75	75	75	75
H	62	75	70	75	70	75	56	75
Control hospitals								
I	24	48	59	55	16	28	35	31
J	75	75	75	75	75	75	75	75
K	75	75	75	75	72	75	75	75
L	75	75	75	75	59	75	75	75
M	75	75	75	74	75	74	75	75
N	75	75	72	75	65	73	75	75
O	75	75	75	75	75	75	75	75
P	75	75	75	75	75	75	75	75
Total	1,136	1,173	1,175	1,179	1,027	1,127	1,141	1,156

Table IV.
Sample size per hospital and data collection points

Surveyed points	Time measured
1 Registry	Patient's waiting time for completion of her/his registration at registry
2 Consultation room	Patient's waiting time from arrival at consultation room bench/seat until he/she enters the consultation room
3 Laboratory	Patient's waiting time from arrival at laboratory until submission/provision of specimen for examination
4 Pharmacy	Waiting time of patients at pharmacy from presentation of drug prescription until drugs are obtained from pharmacy staff

Table V.
Surveyed points and purpose of time measured at the points

Data analysis

To avoid bias from baseline imbalance, Difference-in-Differences (DID) analysis was used to see the effect of the 5S approach on patients' waiting time at four-observation points of the hospitals in the treatment group. As mentioned in the data collection section of this paper, repeated cross-section data was used for the analysis of this study. Since c-RCT was used for this study, a parallel trend assumption is fulfilled for the purpose of this analysis.

Findings

Differences between the treatment group and the control group

The overall average of patient waiting time reduction was observed in all four-observation points. Statistical significances were observed at the medical records section ($p = 0.002$ in piloted hospitals) and at the consultation room ($p = 0.020$ in piloted hospitals). At the end of the c-RCT, mean patient waiting time at the medical record section was reduced from overall average of 12.9 minutes (95 percent confidence interval 11.3-13.3) to 4.6 minutes (95 percent confidence interval 4.5-4.8). Mean patient

waiting time at the consultation room was reduced from overall average of 35.0 minutes (95 percent confidence interval 33.0-37.0) to 22.5 minutes (95 percent confidence interval 21.3-23.7) (Table VI).

Effect of 5S approach on waiting time

At the end of the c-RCT, significant reduction of patient waiting time was observed at the medical records section. The waiting time reduction was minus 15.66 minutes in piloted hospitals, and minus 1.76 minutes in non-piloted hospitals. Significant reduction of patient waiting time was also observed at the consultation room. The waiting time reduction was minus 41.90 minutes in piloted hospitals, and minus 10.40 minutes in non-piloted hospitals. Slight waiting time reduction was observed at the laboratory in treatment group in hospitals that piloted 5S activities at laboratory. However, there was no statistical significance. The waiting time reduction at the pharmacy showed no statistical significance between treatment group and control group even at the pharmacy in hospitals that piloted 5S activities as shown in Table VII and Figure 4.

Discussion

This study was conducted to find the field effectiveness of the 5S approach, which has been applied practically in many public hospitals in Tanzania. The MoHSW adopted the 5S approach to improve the working environments of public hospitals, through the improved physical changes and cleanliness that the 5S approach brings. However, the actual improvement of productivities and time reduction was not measured. Therefore, the field effectiveness of the 5S approach was checked through patients' waiting time.

Based on the analysis between the treatment group and the control group, we found that implementation of the 5S approach was useful in reducing the waiting time at different service points of the hospitals. For hospitals in the treatment group, a significant gap between before and after intervention with the 5S activities was observed at the medical records section and at the consultation room. However, the waiting time at the laboratory and pharmacy showed less difference.

From the industrial engineering point of view, a time study is often conducted in the following situations: during repetitive work cycles of short to long duration; when a wide variety of dissimilar work is practiced; or when process control elements constitute a part of the cycle (Salvendy, 2001; Tak *et al.*, 2013). Based on the results of our study, through improving the working environment with the 5S activities, it is easy to reduce patient waiting time during the repetitive work cycles practiced in sections, such as at the medical records section (the repetitive work cycle at the medical records section involves receiving patients at reception, finding the patients' files, and registering the patients) and at the consultation room (the repetitive work cycle at the consultation room involves receiving patients at reception, arranging files in order of first arrival, checking and recording vital signs of patients, and calling patients into the consultation room).

The majority of hospitals in the treatment group chose the medical records section and consultation room as start up implementation areas for showcases to other work areas. Activities, which were implemented, are shown in Table III. Removing old files, proper numbering and coding of shelves and rearrangement of active files are common activities found at the medical records section. Arrangement of the consultation room, improvements in the flow of patients and arrangement of patient files are common activities found at the consultation room. It is indicated that these kinds of simple activities can improve efficiency at the workplace, leading to a reduction in patients waiting time.

Table VI.
Summary statistics of outcome variables

	Hospital No.	Patient No.	Mean	SD	CI range	95% CI[a]	Hospital No.	Patient No.	Mean	SD	CI range	95% CI	*p*-value
	Baseline survey						End-line survey						
Medical record													
All	8	587	12.3	12.9	1.0	(11.3-13.3)	8	600	4.6	2.1	0.2	(4.4-4.8)	0.008***
Pilot	5	375	17.3	14.0	1.4	(15.8-18.7)	5	375	4.4	1.7	0.2	(4.2-4.6)	0.002***
Non-Pilot	3	212	3.9	2.4	0.3	(3.6-4.2)	3	225	4.9	2.5	0.3	(4.6-5.2)	0.376
Control	8	549	7.4	7.3	0.6	(6.8-8.0)	8	573	10.2	9.0	0.7	(9.5-10.9)	0.193
Consultation room													
All	8	594	35.0	25.0	2.0	(33.0-37.0)	8	600	22.5	15.6	1.2	(21.3-23.7)	0.051*
Pilot	2	150	50.5	28.1	4.5	(46.0-55.0)	2	150	14.4	7.7	1.2	(13.2-15.6)	0.020**
Non-Pilot	6	444	29.9	21.5	2.0	(27.9-31.9)	6	450	25.3	16.5	1.5	(23.8-26.8)	0.510
Control	8	581	29.3	17.9	1.5	(27.8-30.8)	8	579	35.1	27.0	2.2	(32.9-37.3)	0.380
Laboratory													
All	7	515	12.7	12.7	1.1	(11.6-13.8)	8	577	7.9	6.5	0.5	(7.4-8.4)	0.178
Pilot	4	295	12.4	8.7	1.0	(11.4-13.4)	4	300	11.0	8.0	0.9	(10.1-11.9)	0.705
Non-Pilot	3	220	13.0	16.6	2.2	(10.8-15.2)	4	300	4.9	2.8	0.3	(4.6-5.2)	0.191
Control	8	512	9.6	7.6	0.7	(8.9-10.3)	8	550	10.6	6.0	0.5	(10.1-11.1)	0.948
Pharmacy													
All	8	581	4.7	2.5	0.2	(4.5-4.9)	8	600	4.7	3.0	0.2	(4.5-5.0)	0.968
Pilot	5	375	4.7	2.4	0.2	(4.5-5.0)	5	375	4.5	2.1	0.2	(4.2-4.7)	0.746
Non-Pilot	3	206	4.7	2.7	0.4	(4.3-5.1)	3	225	5.2	4.0	0.5	(4.7-5.7)	0.748
Control	8	561	6.2	4.3	0.4	(5.8-6.6)	8	556	6.2	3.5	0.3	(5.9-6.5)	0.945

Notes: [a]Not cluster adjusted. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

	Medical record	Consultation room	Laboratory	Pharmacy
Panel A: single difference				
Pilot	−5.80 (2.788)	−20.70 (16.41)	0.40 (3.173)	−1.70 (1.381)
Non-Pilot	5.30 (3.081)	9.80 (8.414)	5.70 (1.957)	1.00 (2.166)
Panel B: difference in differences				
Pilot	−15.66 (6.012)	−41.90 (10.57)	−2.40 (4.666)	−0.20 (1.670)
Non-Pilot	−1.76 (4.732)	−10.40 (11.65)	−9.10 (5.905)	0.5 (1.682)
Region dummy	Yes	Yes	Yes	Yes
Sample size	2,309	2,354	2,154	2,298
Number of hospitals	16	16	16	16
Intraclass correlation	0.168	0.139	0.151	0.159

Table VII. Effect of 5S approach on waiting time in four different sections

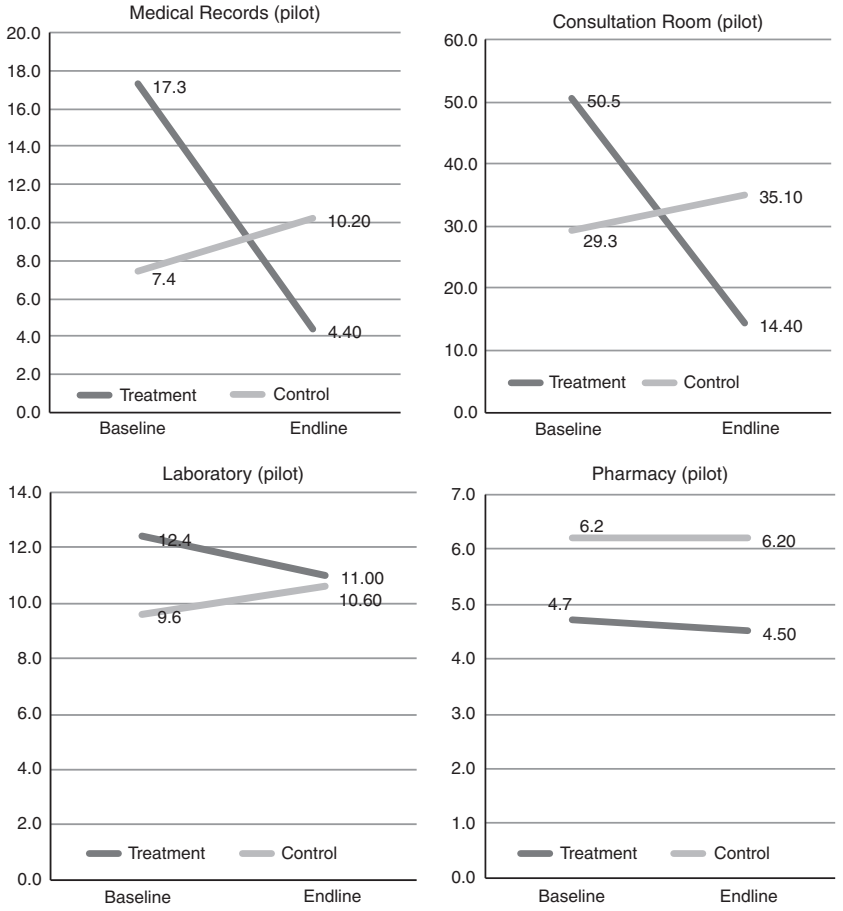

Figure 4. DID analysis of four observation points (pilot)

On the other hand, it seems to be difficult to reduce patient waiting times in sections such as the laboratory or pharmacy with simple actions. Receiving test orders at the laboratory reception is repetitive work; however, specimen sample collection varies from test to test. Receiving a prescription for medication at the pharmacy dispensing area is repetitive work, however, medication and its volume varies from patient to patient. The majority of hospitals in the treatment group that chose the laboratory and pharmacy section as pilot areas for the 5S approach took sorting and setting activities. Those activities are concerned with removing unnecessary items, rearrangement of items and labeling items. Those activities may not be enough to improve efficiency of work, as workflow and staff movement were not well considered. In such work areas, patient flow analysis to identify bottlenecks, the process for dispensing medicines, counseling of side effects and adherence need to be considered.

Hospitals may lose trust from the community regarding accessibility to health services, due to long waiting times (Abdullah, 2005; Muhondwa *et al.*, 2008; Ashrafun and Uddin, 2011). Prolongation of patient waiting time is associated with the reduction of patient satisfaction and a risk of the patient leaving the hospital without consultation and treatment, which leads to poor health outcomes (Rauf *et al.*, 2008).

A poor and disorganized working environment is one of the factors, which hinders smooth provision of health services. Anderson *et al.* studied the effectiveness of work environment interventions, and found positive effects resulting from work environment improvements (Anderson and Westgaard, 2013). A reduction in waiting time for access to working tools and equipment was reported and it is indicated that performance of workers also improved (Anderson and Westgaard, 2013). Thus, improvement of the working environment is a very important factor for lead-time reduction in service provision.

Long working hours, time pressure or lead-time for procedures is one of the factors influencing job satisfaction of health workers (Kekana *et al.*, 2007; Pillay, 2009). Prolongation of time to provide services indicates that the process of work is complicated and makes workers tired. Malik's study identified that poor working and hygiene conditions and long working hours are some of the most frequent demotivating factors among physicians (Malik *et al.*, 2010). Therefore, a method of reducing the time needed for the provision of service is a very important factor that could lead to increased staff and patient satisfaction.

Long waiting time for patients at a point of service delivery is one of the causes of overcrowding at a health facility. The World Health Organization warns that overcrowding in health facilities increases the risk of hospital-associated infections. Hence decreasing overcrowding by providing extra facilities and proper organization of the sites or services in healthcare facilities is a priority (Hussein, *et al.*, 2011, Patient, WHO (2011b); Raka, 2010). Improvement of the working environment and reducing waiting time also contributes to a decrease in overcrowding of patient waiting areas, which leads a decreased risk of hospital acquired infection.

In order to improve internal and external clients' satisfaction, and to reduce other problems caused by long waiting times and overcrowding of OPD, lean management or KAIZEN practices including the 5S activities, can be applied (Ng *et al.*, 2010; Kaluarachchi, 2009).

Findings of this study also coincide with prior studies, and we are of the opinion that practicing the 5S activities and creating a good working environment will help hospital managers who are facing HRH shortages with demotivated staff to increase permanence through reduction of lead-time and patient waiting time.

This study has the following limitations in terms of the data. The data was collected for only three days at the time of baseline survey, and again for three days at the time of the end-line survey from 16 hospitals.

Moreover, piloted areas for the implementation of the 5S approach vary from hospital to hospital. There might be a bias in the measurement of a patient's waiting time. Caveats are therefore needed in extrapolating the study results to other settings. Despite these caveats, the findings will provide important insights for implementing quality improvement programs in Tanzania and in other African countries for improvement of time factors.

Conclusion

The findings of our study indicate that practicing the 5S approach has a positive influence on reducing patients' waiting time at health facilities which provide health services at different sections in an OPD, especially where their work process is done in a repetitive manner, at district level hospitals in Tanzania. Many studies that applied a lean management approach to reduce waiting times at hospitals in under developed country settings concluded that the reduction of waiting time increases patients' satisfaction. In this study, the results suggested that the 5S approach could reduce waiting time. There is a possibility to apply this 5S approach at district level hospitals in Africa. Also, our study demonstrated that the 5S approach could reduce lead-time of health services provision. Due to the insufficient human resource for health, workload per a health worker is getting significantly high, and work procedures are more complicated than before. This situation has been one of the causes of demotivation of health workers. Different studies proven that lean management, including the 5S approach can improve workflow and minimize wasteful practices. Therefore, practicing the 5S approach, and reducing lead-time of health services provision leads to an improvement in job satisfaction among health workers.

Satisfaction of clients for both patients and health workers is an important outcome of a quality improvement approach. Currently, data analysis of the satisfaction survey is ongoing and will be published separately. From the overall satisfaction of patients, statistical significance was observed in the question of: how to evaluate the services; how do patients feel about time spent for consultation"; and how do patients feel about time spent for waiting services at the OPD, in treatment group. From the satisfaction of health workers at hospitals, statistical significance was observed in the job satisfaction score and motivation score in treatment group. It is necessary to carry out further analysis in the currently on gong analysis of satisfaction survey data. However, we affirm the connection between actual reduction of patient waiting time and patients' satisfaction. We will continue to study implementation of the 5S approach at African hospitals, and the improvement of quality care and satisfaction of clients.

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Corresponding author
Hisahiro Ishijima can be contacted at: hisahiro.ishijima@gmail.com