Waiting Time and Patient Satisfaction in a Subspecialty Eye Hospital in Cameroon Using a Mobile Data Collection Kit: Pre and Post Quality Improvement Intervention

Mathew Mbwogge, Nick Astbury, Henry Nkumbe, Catey Bunce, Covadonga Bascaran

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Mathew Mbwogge[1] MSc; Nick Astbury[1] PhD; Henry Nkumbe[2] MD; Catey Bunce[3] DSc; Covadonga Bascaran[1] MD

[1]Independent London GB
[2]Africa Eye Foundation Cameroon Yaoundé CM
[3]Research Data & Statistics Unit The Royal Marsden NHS Foundation Trust London GB

Corresponding Author:
Mathew Mbwogge MSc
Independent
Alumni Relations, LSHTM
Keppel Street
London
GB

Abstract

Background: Waiting time could considerably increase the cost to both the clinic and the patient, as well as be a major predictor of the satisfaction of eye care users. Efficiently managing waiting time remains a challenge in hospitals. Waiting time management will become even more crucial in the post-pandemic era. A key consideration when improving waiting time is the involvement of eye care users. This study aimed at improving patient waiting time and satisfaction through the use of Plan-Do-Study-Act quality improvement cycles.

Objective: The study's objectives were to (1) determine the waiting time and patient satisfaction, (2) measure the association between waiting time and patient satisfaction, and (3) determine the effectiveness of the Plan-Do-Study-Act model in improving waiting time and satisfaction.

Methods: This was a pre and post-quality improvement study among patients consulting with the Magrabi ICO Cameroon Eye Institute, aged 19-80 years. We made use of Plan-Do-Study-Act (PDSA) cycles to carry out improvement audits of waiting time and satisfaction over 6 weeks. A mobile data collection kit (ODK) was used for real-time tracking of waiting, service, and idling times at each service point. Subjects were also asked whether or not they were satisfied with waiting time at the point of exit. Data from 25 pre-intervention and 24 post-intervention subjects were analyzed in Stata14. An unpaired t-test was used to assess the statistical significance of observed differences in times pre and post-intervention. Logistic regression was used to examine the association between satisfaction and waiting time.

Results: Forty-nine subjects were recruited with mean(SD) age 49(15.7) years. The pre-intervention mean(SD) waiting, service, and idling times were 449.6(96.6) minutes, 111.9(47.0) minutes, and 337.7(98.1) minutes respectively. There was no significant association between patient wait time and satisfaction (Odds Ratio=1.0; 95% CI: 0.99 to 1.0, P=.26; Chi2=.25). The use of Plan-Do-Study-Act led to a 14.5% (65.4/449.6) improvement in waiting time (t=2.0, df=47, P=.05) and a non-significant increase in patient satisfaction from 32% (8/25) to 33.3% (8/24) (z=0.1, P=.9).

Conclusions: The use of PDSA led to a borderline statistically significant reduction of 65.4 minutes in waiting time over 6 weeks and an insignificant improvement in satisfaction, suggesting that quality improvement efforts have to be done over a considerable period to be able to produce significant changes. The study provides a good basis for quality improvement in limited-resource settings making use of block appointment systems, with comprehensive subspecialty eye care services. We recommend shortening the patient pathway and other measures including a phasic appointment system, automated patient time monitor, robust ticketing, patient pathway supervision, standard triaging, task shifting, doctor consultation planning, patient education, and additional registration staff.

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Original Research

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Mathew Mbwogge

Correspondence
Mathew Mbwogge,
Independent, UK
m.mbwoge@gmail.com
Tel: +447424409211,

Abstract

Background: Waiting time could considerably increase the cost to both the clinic and the patient, as well as be a major predictor of the satisfaction of eye care users. Efficiently managing waiting time remains a challenge in hospitals. Waiting time management will become even more crucial in the post-pandemic era. A key consideration when improving waiting time is the involvement of eye care users. This study aimed at improving patient waiting time and satisfaction through the use of Plan-Do-Study-Act quality improvement cycles.
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Methods: This was a pre and post-quality improvement study among patients consulting with the Magrabi ICO Cameroon Eye Institute, aged 19-80 years. We made use of Plan-Do-Study-Act (PDSA) cycles to carry out improvement audits of waiting time and satisfaction over 6 weeks. A data collection app known as Open Data Kit (ODK) was used for real-time tracking of waiting, service, and idling times at each service point. Participants were also asked whether or not they were satisfied with waiting time at the point of exit. Data from 25 pre-intervention and 24 post-intervention participants were analyzed in Stata14 at 0.05 significance level. An unpaired t-test was used to assess the statistical significance of observed differences in times pre and post-intervention. Logistic regression was used to examine the association between satisfaction and waiting time.
Results: Forty-nine participants were recruited with mean(SD) age 49(15.7) years. The pre-intervention mean(SD) waiting, service, and idling times were 449.6(96.6) minutes, 111.9(47.0) minutes, and 337.7(98.1) minutes respectively. There was no significant association between patient wait time and satisfaction (Odds Ratio=1.0; 95% CI: 0.99 to 1.0, *P*=.37; Chi2=.43). The use of Plan-Do-Study-Act led to a 14.5% (65.4/449.6) improvement in waiting time (t=2.0, df=47, *P*=.05) and a non-significant increase in patient satisfaction from 32% (8/25) to 33.3% (8/24) (z=0.1, *P*=.9).
Conclusions: The use of PDSA led to a borderline statistically significant reduction of 65.4 minutes in waiting time over 6 weeks and an insignificant improvement in satisfaction, suggesting that quality improvement efforts at the clinic have to be done over a considerable period to be able to produce significant changes. The study provides a good basis for standardizing the cycle (consultation) time at the clinic. We recommend shortening the patient pathway and other measures including a phasic appointment system, automated patient time monitor, robust ticketing, patient pathway supervision, standard triaging, task shifting, doctor consultation planning, patient education, and additional registration staff.

Keywords: Waiting time; waiting list; patient satisfaction; quality improvement; clinical audit; ophthalmology; patient-centered care

Introduction

Long waits can significantly increase costs and can also be a major determinant of the satisfaction of those seeking healthcare services[5]. Patient experience and satisfaction are closely linked to the quality of care users attribute to healthcare[6,7]. Although quality of care does not necessarily translate into patient satisfaction, it can be a major predictor[8]. Patient experience and satisfaction can also be dependent on the time patients spend in clinics during their consultation[9]. The reduction of waiting time has been a key concern, especially for ambulatory hospitals, due to increasing outpatient demands[10]. Efficiently managing the patient flow in hospitals ensures high quality of care[11]. It is reported that patient flow management as part of a hospital quality improvement strategy warrants continuous attention and should involve all staff[11]. Evidence suggests that there is a strong negative correlation between waiting time and patient satisfaction[12,13]. User dissatisfaction has been strongly linked to waiting times, with users spending more time waiting than being attended to[14]. It is believed that the routine task of healthcare staff is to perform their work and improve it[15]. However, the ability to reduce waits and improve services may be limited by service capacity[16].

In ophthalmology, long waits and the dissatisfaction of those seeking eye care have been made worse by the COVID-19 pandemic[17]. Apart from affecting patient satisfaction, system delays affect healthcare program delivery[18]. Waiting time has been identified as one of the major challenges in managing workflow in eye hospitals as a result of the growing number of those in need of eye care[19].

Between 2010 and 2019, the number of people with blindness increased by 10.8% (95% UI: 8.9%-12.4%) and moderate to severe visual impairment increased by 31.5% (95% UI: 30.0%-33.1%)[20]. Sub-Saharan Africa faces severe limitations in well-trained eye care personnel[21]. In Cameroon, it is estimated that 250,000 persons are blind and 600,000 visually impaired. The prevalence of blindness in Cameroon is one of the highest in the world, and there is no government health budget allocation specific to eye health[22].

The concept of waiting time presents different meanings in different contexts. In countries with a regularized appointment system like the United Kingdom, it is the time spent from booking an appointment to when the person attends the appointment[23]. In underdeveloped economies like Cameroon, waiting time is the time a patient spends at the clinic to get a complete health check[24].

Hospital waiting time is a major concern in Cameroon like in many other countries[1]. The current evidence regarding quality improvement specific to waiting time in hospitals in Cameroon is lacking[2]. The problem of long waiting in clinics in Cameroon could primarily be attributed to poor management[3] and there is strong evidence that waiting time in Cameroonian hospitals is the main point of dissatisfaction when accessing healthcare[4]. Its understanding will help in defining the measures of change needed for its improvement. The problem of long waits at the Magrabi ICO Cameroon Eye Institute (MICEI) escalated due to the increase in patient volume. Conscious of the need to deliver high-quality eye care services, the eye institute capped its daily patient visits, in part to deal with the overwhelming number of patient complaints about waiting time. Following this, MICEI management sought to investigate the time patients spend at the clinic and propose measures of improvement.

Our choice of Cameroon stems from the fact that apart from the lack of any prior study that primarily sought to improve waiting time and satisfaction in Cameroon, waiting time was found to be the main reason for patient complaints at the newly established eye hospital (MICEI) in Cameroon. The study was the first of its kind that was specific to ophthalmology in Cameroon. However, we found quality improvement interventions undertaken in other health areas[2,25,26]. One sought to improve waiting

time by means of hospital-wide quality improvement, using the Strengthening Laboratory Management Toward Accreditation (SLMTA) model[2], another sought to improve early infant diagnoses coverage, timely return of HIV test results, and the initiation of antiretroviral treatment using the Quality Improvement Collaborative approach[25], while another sought to improve the adherence and cure of patients with tuberculosis by use of SMS reminders[26]. We also found two studies[3,4] that aimed at investigating patients' satisfaction with the quality of health services[3] and the undertaking of antiretroviral treatment[4]

This study was based on the model of Plan, Do, Study, Act (PDSA)[27]. This four-stage model was proposed by Deming as a simple way to undertake quality improvement interventions in health care. It involves making continuous cyclical improvements geared towards achieving what works best for care users.

The use of pre and post-quasi-experimental designs[28,29] and the Plan, Do, Study Act model in healthcare[30] in general and in ophthalmology[31] in particular has been widely reported. A similar study was undertaken in Ethiopia using an appointment system[24]. Also, there is evidence of usage of the online data kit (ODK) in health care projects in Cameroon[32].

This study's objective was threefold, (1) determine the waiting time and satisfaction (2) measure the association of waiting time and satisfaction, (3) measure the effectiveness of the Plan-Do-Study-Act model in improving waiting times and satisfaction.

Methods

Study Setting

This study was undertaken at the Magrabi ICO Cameroon Eye Institute (MICEI) from June 15, 2018 to July 28, 2018. MICEI is a subspecialty eye hospital and training center, with an average of 300 daily outpatient visits[33]. The center is the only tertiary eye institute in Cameroon, with a 72-bed capacity, 8 ophthalmologists, 8 ophthalmic nurses, and about 70 full-time staff.

Contextual Factors

Study feasibility was carefully examined by assessing some contextual factors likely to affect success[34]. The study was made context-specific by making use of the Model for Understanding Success in Quality (MUSIQ)[35]. We calculated the MUSIQ score using an excel template developed by East London NHS Foundation Trust[36], as can be seen in Table S1 of Multimedia Appendix 1.

The eye care center is sub-urban, 25km away from the city center of the country's capital. The Center Region is host to 8 other eye clinics delivering general ophthalmology services in public and private hospitals. Enabling factors include a motivated executive towards quality improvement, a well-structured microsystem with state-of-the-art equipment, the institute's aim to become a center of excellence, and high donor expectations. Additionally, MICEI runs a patient-based and tiered pricing model similar to that of Aravind Eye Care System in India which is different from the disintegrated hospital-based eye care delivery within Cameroon. Other positive factors were the availability of stationery and printing of study materials at the hospital and the hospitality of the staff.

PDSA Plan and Do Phase: Intervention

This intervention was a two-step person-centered quality improvement using the PDSA model. The first step involved a situation analysis of waiting time and mapping of the patient flow. Based on this, best-fit measures were introduced to offset delays in waiting time. Figure 1 is an adapted PDSA conceptual framework of the intervention[37].

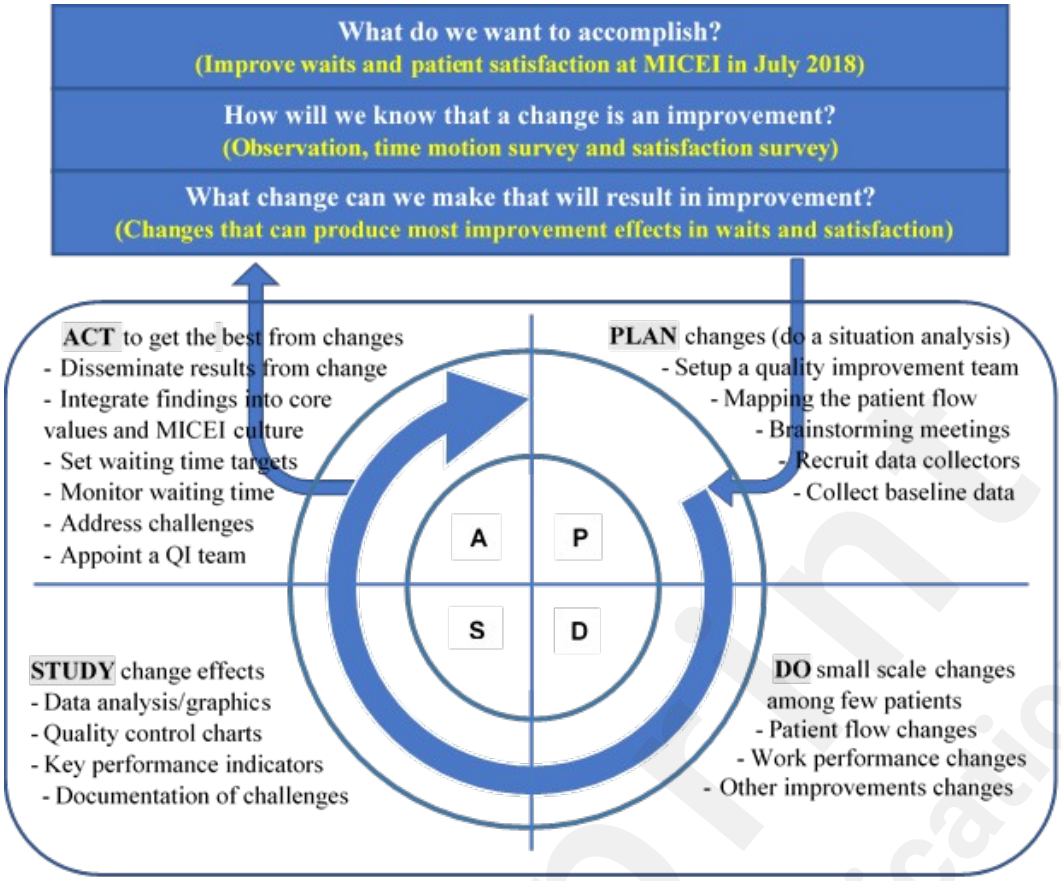

Figure 1: PDSA conceptual framework. Licensed under the Open Government License

Recruitment of Participants

Study participants were recruited from patients consulting with the Magrabi ICO Cameroon Eye Institute in June through July 2018, using non-probabilistic sampling[38]. Participants were randomly approached at the point of entry by 2 trained data collectors, introduced to the study if they met the inclusion criteria and only those that voluntarily consented got enrolled. The inclusion criteria were: aged 18 to 80 years, seeking ophthalmic consultation, and able to understand and speak either English or French language. The exclusion criteria were: incapacity to provide consent, surgical and post-operative appointments, and patients not following the normal flow, fast track, and VIP patients.

Data management

Data collection was done using the Open Data Kit (ODK)[39]. A data form was built using Microsoft Excel 2010 and validated online using XLSForm Online v1.2.0. The Excel data form was then converted to a version (xml) compatible with the server (ODK backend) using the downloadable ODK-XLSForm-Offline-v1.6.0 and uploaded to ODK Aggregate server (open-source java server) with a personalized user id and password. Since this study took place in a predominantly French-speaking region, all data forms and patient information materials were translated into the French language to suit participants.

HUAWEI Media Pad T2 10.0 Pro and SAMSUNG Galaxy Note 10.1 android tablets with installed ODK Collect application (open source) for requesting data forms from the sever, were used to collect real-time data on waiting time and patient satisfaction.

To check for completeness, two dry runs were performed and the data form was modified prior to the start of the intervention. Data collection was automated thereby reducing errors. The data form was built so that each question must be answered before proceeding to the next. All filled data forms were verified by the principal investigator for completeness before submitting to the server.

The latest version of ODK Briefcase downloaded and installed in Windows 10 was used to pull the dataset from the Aggregate server. This was then exported as a csv file and loaded into Stata 14 for analysis.

Quality Improvement Team

A quality improvement (QI) team was set up, including the principal investigator, the pediatric ophthalmologist, medical records officer, outpatient senior nurse, head of investigations, nurse assistant, optical technician, and facility manager. The team met once every week on less busy days at 7-8 am, to give feedback on daily challenges and propose solutions. The team set out to reduce waiting time by 25%.

Data Collectors

Two data collectors (an advanced level holder and a university student) purposely recruited for the study were trained using a standard operating procedures manual developed for the study.

Dry-run and testing

After 2-day training, a dry run was performed on 2 consenting patient volunteers. Based on the challenges, the data form was modified to account for inter-unit counter referrals (due to forth and back movements), and to include the option “other” to some of the questions to make answers more flexible. The questionnaire was finalized after a second dry-run, converted, and resubmitted to the server.

Changes Proposed

The patient flow was mapped and all consultation rooms were identified according to room numbers. Patient flow bottlenecks were identified through brainstorming and direct observations. Based on an interim analysis of data collected from 25 participants, the following measures to potentially reduce waiting time were proposed;

1. A time monitor sheet to fill the start and finish times at each service point.
2. Introduce a second receptionist for the separate handling of reviews.
3. Introduce a numbering system for all patients (reviews and new patients alike).
4. Regularly supervise the patient flow for on-the-spot handling of bottlenecks.
5. Appoint an experienced ophthalmic nurse for effective triaging of patient files.
6. Educate patients on patient flow, for orientation and reduction of turnaround time.
7. Standardize waiting time by defining the duration for a full consultation.
8. A phasic appointment system which includes associating a nurse assistant to each ophthalmologist, to take notes and book appointments, and the proactive sorting of patient files a day befor booked appointments Each day is divided into slots corresponding to the maximum number of patients a doctor is able to handle.
9. Grant ophthalmic nurses’ permission to discharge less complicated cases.
10. Color zoning of the general ophthalmology to know who is waiting for whom.

PDSA: Study of the Intervention Phase

Approach to Impact Assessment

A PDSA-led pre and post-quasi-experimental design was used to measure the effectiveness of the intervention, from June 18, through July 27, 2018. This method was particularly important because we wanted to address two key aspects of quality: the clinical effectiveness through waiting time and patient experience through patient satisfaction[40]. We used the before and after design[29] to keep the intervention as close to reality as possible. Besides, it was not ethical to undertake a pre-post

study with control group since this was a single center study[29]. Also, evidence in the use of PDSA in quality improvement interventions has been well documented[41–43]

Attributing Results to the Intervention

A total of 49 participants from randomly arriving patients at the eye institute were invited to take part in a time-motion and satisfaction survey at two-time points (25 participants before and 24 participants after the intervention). Data collectors randomly approached participants at the point of entry, explained the study to them and only enrolled those who gave voluntary consent. Through a process of shadowing, data collectors recorded the time spent at each service point from entry through exit. At the exit, patients were asked whether or not they were satisfied and the reasons for their dissatisfaction if relevant. We determined that the results were due to the intervention by assessing and comparing the waiting time and patient satisfaction of the two samples.

Measures

Processes and Outcomes

The duration for a full consultation day was investigated using waiting time as the primary outcome variable. Waiting time was defined as the time spent in the microsystem, from entry to exit[24]. It was a continuous variable made up of (1) service time which is the time the patient is being served and in contact with staff, and (2) idling time which is the time the patient spends in between service points waiting to be served. The secondary outcome variable was patient satisfaction defined as the patient-reported satisfaction with waiting time and service. This was used to establish whether waiting time was a good determinant of patients' satisfaction. Other variables included participants' socio-demographic variables.

Assessment of Contextual Factors

Direct observations, quality improvement meeting sessions, and interim analysis, including the use of data visualization technics (scatter and box plots), were used to determine any unusual data points that could be attributed to contextual factors. Abnormal data points were identified by calculating the lower [Q1-1.5(Q3-Q1)] and upper [Q3+1.5(Q3-Q1)] fences. Any data points that fell out of these limits were investigated further.

Data analysis

Waiting Time and Satisfaction

All statistical analysis were performed in Stata 14 at 0.05 significance level. Based on our sample size, the Shapiro Wilk test for the pre-test sample (z=1.0; P=.1) and the post-test sample (z=-0.98; P=.8) showed that both samples were assumed to be drawn from a normal distribution [44]. Also, the skewness and kurtosis test for the first sample (skewness: P=.3; kurtosis: P=.9) and the second sample (skewness: P=.5; kurtosis: P=.8) fulfilled the normality hypothesis. Following the above, we used the parametric approach in our data analysis. The mean waiting, service, and idling times were calculated. Patients' satisfaction was analyzed using frequencies. Box plots were used to compare waiting times between males and females by type of patient. A difference in means plot was also used to visually inspect and compare the means between categorical variables including sex, age group, arrivals, diagnosis, and residence.

Association of Waiting time and Satisfaction

Logistic regression[45] with reported odds ratios was performed to establish the existence of any association between waiting time and patient satisfaction. Participants satisfaction was modelled with waiting time, age and sex using a logistic regression and odds ratios with 95% CI calculated.

Effectiveness of PDSA

The independent sample t-test[46] was used to compare the waiting time and satisfaction of the pre and post-groups. Box plots and pie charts were used to visually examine the pre-post intervention effect on waiting and patient satisfaction respectively, by sex and type of patient.

Ethics

In line with the Helsinki Declaration of 1975, a protocol was developed and approved by the Ethics Committee of the London School of Hygiene and Tropical Medicine (Ref: 15444). Ethics approval was also obtained from the Institutional Review Board of MICEI (Ref: 0003/L/DG/DM/PA/KBG). All participants provided written informed consent. All data forms submitted to the server were encrypted, using a pair of public keys. Participants received reimbursement of their consultation fees.

Results:

The study findings were reported in accordance with the revised Standards for Quality Improvement Reporting Excellence (SQUIRE v2.0) guidelines[47].

Participant Demographics

A total of 49 participants 30.6% (15/49) of whom were reviews, took part in the study with a mean age(SD) of 49(15.7) years ranging from 19 to 80 years (25 women). Participants were recruited into two consecutive samples (pre and post-intervention) matched for age and gender. The mean(SD) age for the pre-intervention arm (n=25; 13 women) was 49.3(14.6) years and that for the post-intervention arm (n=24; 12 women) was 49.6(17.0) years. Most patients arrived between 6 and 9 am (n=38) for their consultation. Table 1 presents the socio-demographic characteristics of study participants.

Table 1: Socio-demographic characteristics

	Category	**Pre-intervention participants**		**Post-intervention participants**	
		n	**%**	**n**	**%**
		25	**51.0**	**24**	**49.0**
Age (years)					
	15–24	1	4.0	3	12.0
	25–54	14	56.0	10	42.0
	55–64	5	20.0	7	29.0
	65–80	5	20.0	4	17.0
Gender					
	Men	12	48.0	12	50.0
	Women	13	52.0	12	50.0
Patient type					
	New	18	72.0	16	67.0
	Review	7	28.0	8	33.0
Marital status					
	Married/Cohabiting	17	68.0	14	58.3
	Single	6	24.0	7	29.0
	Divorced/Widow	2	8.0	3	13.0
Residence					
	Littoral	0	0.0	2	8.3
	Far North	1	4.0	1	4.2
	Center	20	84.0	20	83.3

	Category	Pre-intervention participants		Post-intervention participants	
	West	2	8.0	0	0.0
	North West	0	0.0	1	4.2
	South	1	4.0	0	0.0
Origin					
	Littoral	0	0.0	1	4.2
	Center	14	56.0	8	33.3
	West	9	36.0	14	58.3
	North West	1	4.0	0	0.0
	North	0	0.0	1	4.2
	South	1	4.0	0	0.0
Work status					
	Formal	9	36.0	6	25.0
	Informal	8	32.0	13	54.2
	Others	8	32.0	5	20.8
Education					
	None	1	4.0	1	4.2
	Elementary	3	12.0	1	4.2
	GCE1 Ordinary Level	6	24.0	11	46.0
	GCE Advance Level	3	12.0	2	8.3
	University	4	16.0	7	29.0
	Doctorate	8	32.0	2	8.3
Travel time					
	< 1 hour	18	72.0	19	79.2
	A few hours	5	20.0	4	16.7
	Half a day	1	4.0	0	0
	1 – 2 days	1	4.0	1	4.2
Transport means					
	Private	6	24.0	6	25.0
	Public	18	72.0	18	75.0
	Motorbike	1	4.0	0	0
Arrival time					
	5 – 7 am	14	56.0	5	20.8
	7 – 9 am	7	28.0	14	58.3
	9 – 11 am	4	16.0	5	20.8

1GCE=General certificate of education

Patient Pathway (Patient Flow)

The patient flow chart starts at the gate where patients are handed a number upon arrival. Medical record files are initiated at the reception by calling on patients based on numbers. Patients are also advised on the consultation fee based on the consultation option chosen (VIP, fast track, or standard). Care users are created at the medical records upon presentation of a cash receipt of the consultation fee. If patients are on a repeat visit, their medical record file will have to be retrieved by the medical records officer in order to proceed to the next service point. In the general ophthalmology unit, visual acuity, blood pressure, and intraocular pressure are taken by assistant ophthalmic nurses. The visual acuity determines whether or not patients should be refracted. Patients are prescreened by an ophthalmic nurse with the help of a slit lamp prior to seeing the general ophthalmologist. The general (outpatient) ophthalmologist may request for mydriatic eye drops to be instilled should that be necessary. He then refers patients to subspecialty units based on his anterior and posterior chamber assessment (using a slit lamp). The flow is such that there might be back and forth movements due to

counter referrals. At the end of the intervention, a total of 47 participants had visited the general ophthalmology. Altogether, 49% (24/49) have been to the cataract and glaucoma unit and 30.6% (15/49) have been to the cornea and refractive errors unit. There was no marked difference in service point visits by gender and sample. Figure 2 presents the patient flow at the clinic.

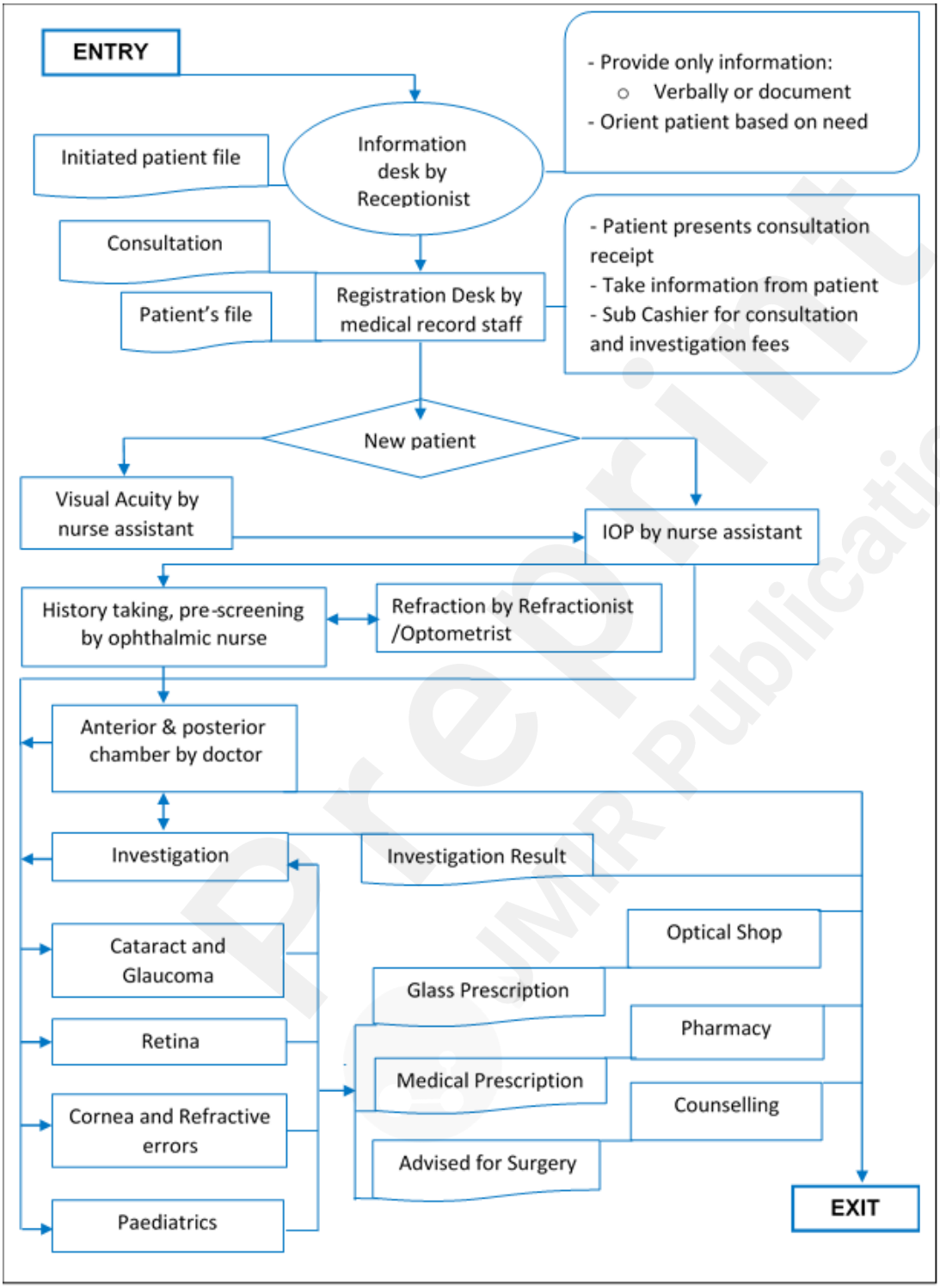

Figure 2: Authors' conception: Patient pathway protocol

Intervention Timeline

In the pre-intervention phase, 25 participants took part in a time-motion and satisfaction survey. Based on the interim analysis, changes were implemented. The second group of 24 participants was

recruited into the time-motion survey after the changes and the two groups were compared.
The first seven changes were implemented, including : (1) a time monitor sheet to fill the start and finish times at each service point, (2) introduction of a second receptionist for the separate handling of review patients, (3) expansion of the numbering system to include all patients, (4) patient flow supervision for on-the-spot handling of bottlenecks, (5) triaging of patient files led by assistant nurses at the general ophthalmology, (6) proactive sorting of patient files at the medical records, (7) regular patient education by a medical record staff. These changes were implemented simultaneously as a package.
Given the 10 originally proposed changes 3 could not be implemented due to cost and time constrain, including the standardization of waiting time by defining the duration for a full consultation, granting ophthalmic nurses the permission to discharge less complicated cases, and color zoning of the general ophthalmology. For instance, the color zoning of the outpatient waiting area required a formal contract award procedure. Three measures, including a phasic appointment system, effective triaging, and patient education could not be fully implemented due to staff shortage, lack of qualified nurse and audiovisual materials, respectively.

Figure 3 displays the waiting time series with the intervention effect.

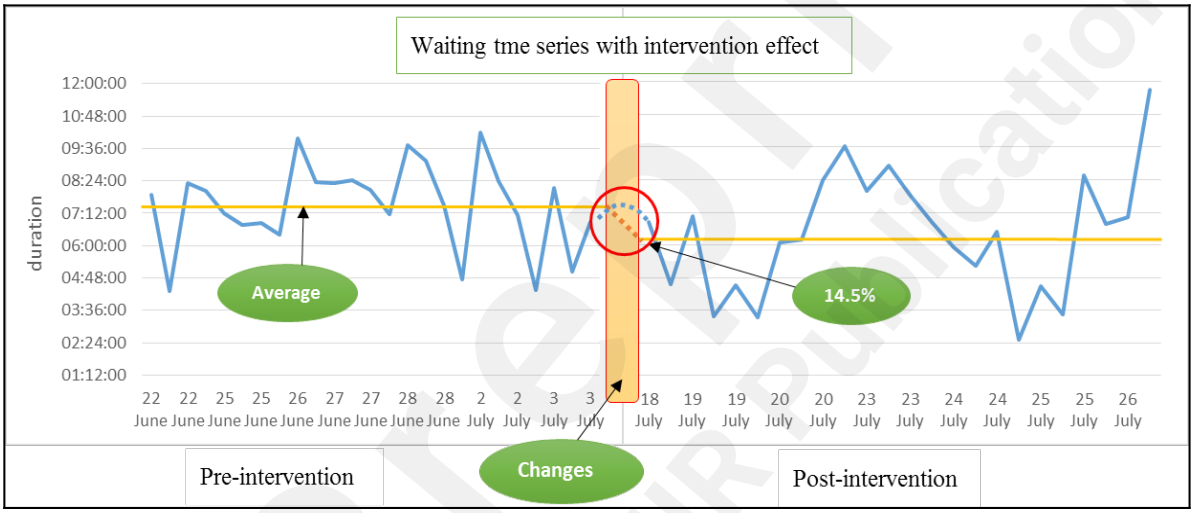

Figure 3: Timeline of time motion and satisfaction survey

Waiting Time and Patient Satisfaction

At baseline, the mean waiting time (service plus idle times) for a comprehensive eye exam at the MICEI was found to be 449.6(96.6) minutes. The mean service time was 111.9(47.0) minutes and the mean idling time was 337.7(98.1) minutes. The amount of idle time patients spent was three times (337.7/111.9) more than that being served. The service points with high mean waiting times at baseline included Room 15 with 203.8(86.1) minutes, Room 20 with 203(141.4) minutes, Room 13 with 185.3(46.1) minutes, Room 18 with 160.8(63.5) minutes, and Room 16 with 99(97.4) minutes. At baseline, the highest proportion of idling was among patients going through Room 15 (96%; 195.7/203.8), Room 20 (95%; 192.5/203), Room 13 (90.3%; 167.3/185.3), Room 18 (87.1%; 140/160.8) and Room 16 (85%; 84.5/99).
The mean waiting time for men was 472.2(86.5) minutes and that for women was 428.8(104.1) minutes. Male patients spent 77% (361.8/472.2) of the time idling while females spent 73.5% (315.4/428.8). Table S1 of Multimedia Appendix 2 shows detailed waiting, service, and idling times by service point and by sex.
The mean waiting time for new patients was 485(67.0) minutes, and that for reviews was

358.6(105.8) minutes. Both new patients and reviews spent 75% of the waiting time idling (364.3/485 and 269.3/358.6 respectively). Figure 4 shows the baseline waiting, service, and idling times of new and review patients by sex.

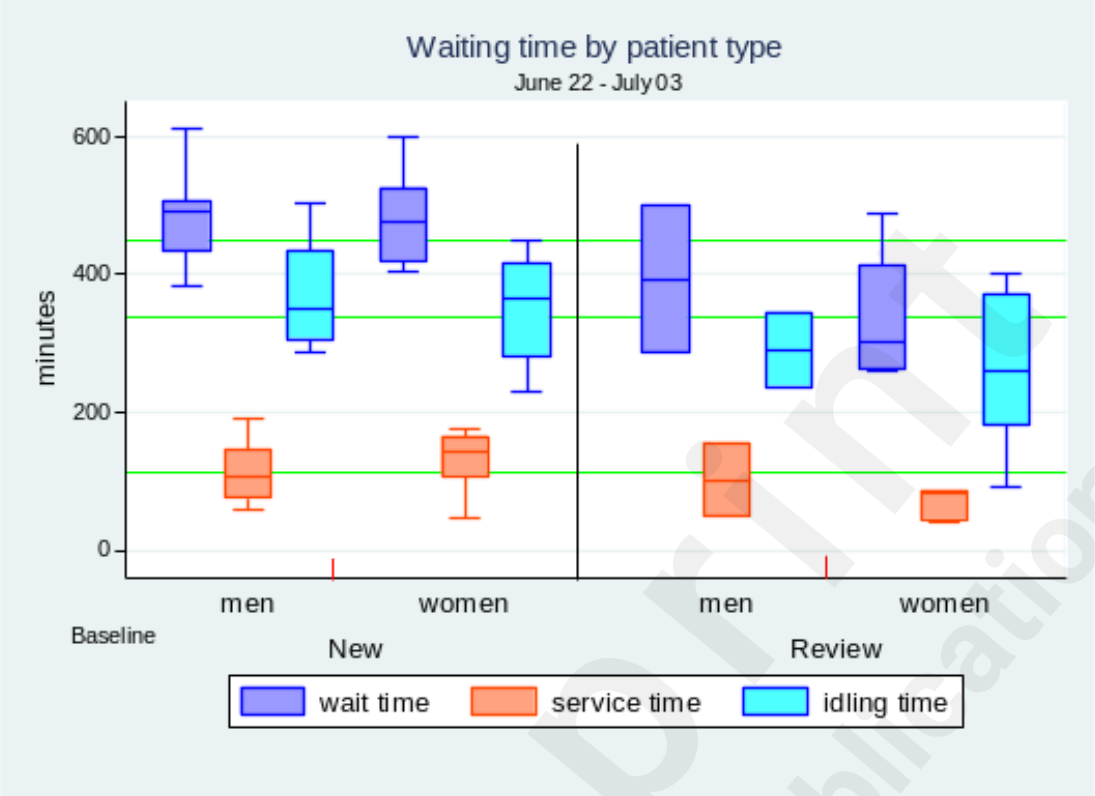

Figure 4: Baseline waiting time of new and review patients by sex

Of the 25 participants who took part in the baseline survey, 32% (8/25) reported that they were satisfied with waiting time, 62.5% (5/8) of whom were women and 75% (6/8) were new patients. Among the participants who reported to be dissatisfied, 76.5% (13/17) complained of long waiting time as the main reason for dissatisfaction, while 23.5% (4/17) complained of queue jumping.
At baseline, 28% (7/25) of the pre-intervention sample were reviews. All 7 reviews reported that they were dissatisfied with their first visit to the clinic. Of these, 43% (3/7) agreed they were satisfied with the current visit.

Association of Waiting Time and Satisfaction

We performed a binary outcome logistic regression since satisfaction was a binary outcome. Waiting time was not a good predictor of satisfaction as the negative association (z=-0.9) was not statistically significant (odds ratio=1.0; 95% CI: 0.99-1.0, *P*=.37; Chi2=.43). Further investigation by sex and age group did not show any significant difference.

Effectiveness of PDSA

An independent sample t-test showed that the mean wait time reduction from 449.6 (95% CI: 409.7-489.5) minutes at baseline to 384.2 (95% CI: 327.8-440.6) minutes post-intervention was not statistically significant, with a 14.5% (65.4/449.6) reduction in mean waiting time (t=2.0, df=47, *P*=.05). The mean service time significantly reduced from 111.9 (95% CI: 92.5-131.3) minutes to 84.9 (95% CI: 71.9-98.0) minutes (t=2.4, df=47, *P*=.02), while the mean idling time reduced from 337.7 (95% CI: 297.2-378.2) minutes to 299.3 (95% CI: 248.3-350.3) minutes. The reduction in waiting time was mainly driven by a higher service rate since the difference of 38.4 (95% CI: -24.7-

101.5) minutes in idling time was not statistically significant (t=1.2, df=47, *P*=.2). Tables S1 and S2 of Multimedia Appendix 2 show the effect of the intervention on waiting and service times. The mean waiting time for women increased by 2.2% (9.6/428.8), while that for men was reduced by 30% (142.2/472.2). Service time for men was 1.6 times (33/20.4) more likely to reduce than service time for women. Also, the idling time for men was similar before (76.6%; 361.8 /472.2) and after the intervention (76.7%; 253.2/330), while that for women increased from 73.5% (315.4/428.8) to 78.8% (345.4/438.4). A detailed distribution of waiting time is provided in Table S1 of Multimedia Appendix 2.

The mean waiting time for new patients fell by 10.8% (52.6/485) and for reviews by 20% (70.9/358.6). The intervention was almost twice as likely to have a positive impact on the waiting time of reviews. Figure 5 shows the intervention effect on waiting time.

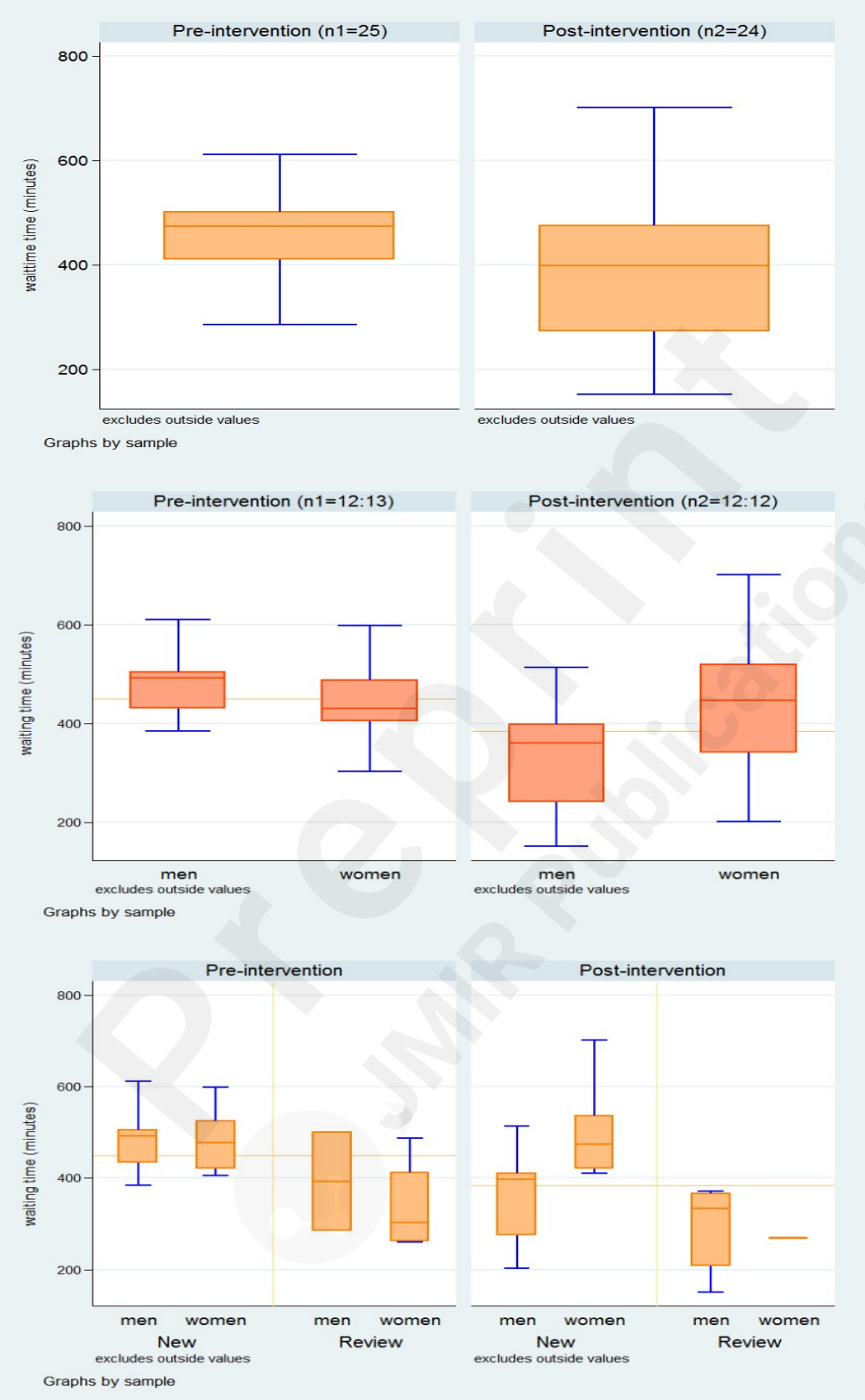

Figure 5: Intervention effect on waiting time

Figure 6 shows an overview of the intervention effect on the distribution of waiting time and satisfaction.

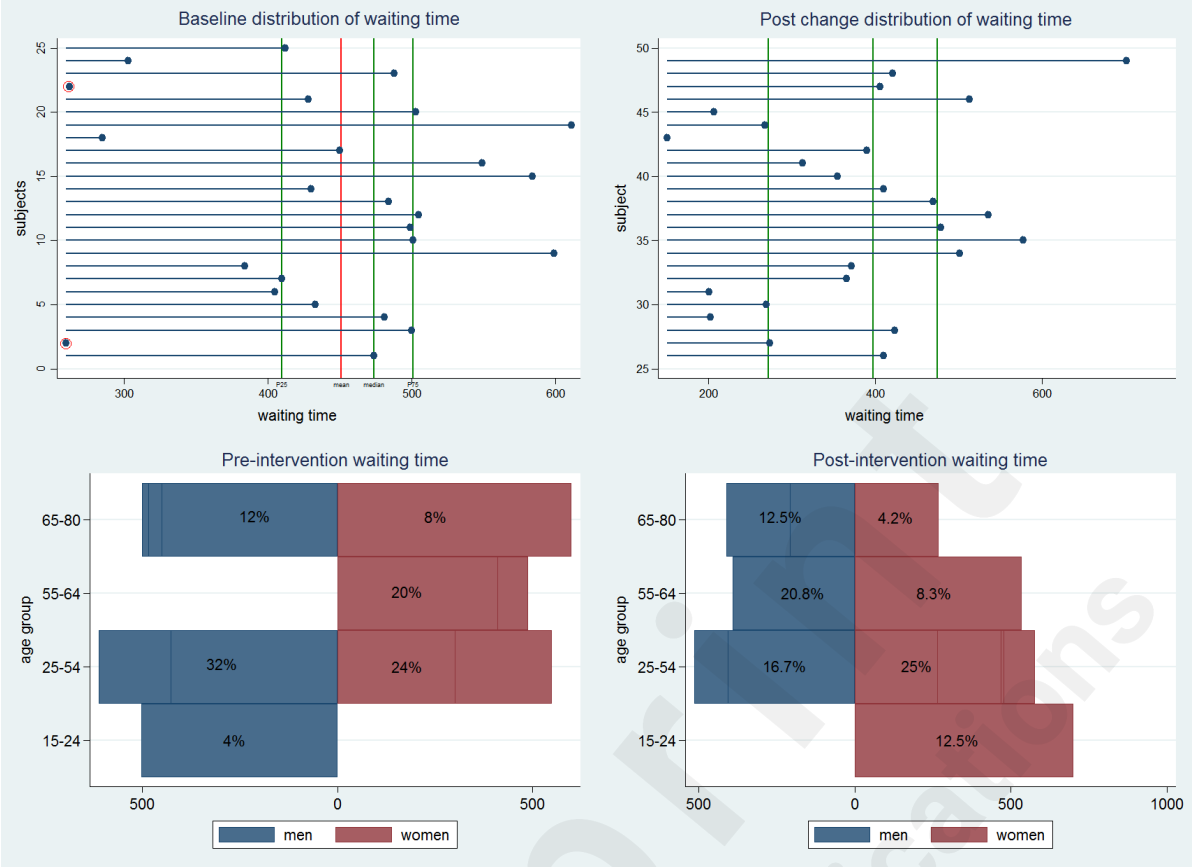

Figure 6: Comparison of pre and post-intervention waiting time

The satisfaction with waiting time increased slightly from 32% (8/25) at baseline to 33.3% (8/24) after the intervention. This difference (0.01, 95% CI: -0.2-0.3) was not statistically significant (z=0.1, *P*=.9). The percentage of new patients who reported to be satisfied increased from 33.3% (6/18) to 37.5% (6/16) while that for reviews fell from 28.6% (2/7) to 25% (2/8). Also, those who said they were satisfied tended to be older than those who did not. Figure 7 shows the satisfaction with waiting time by gender.

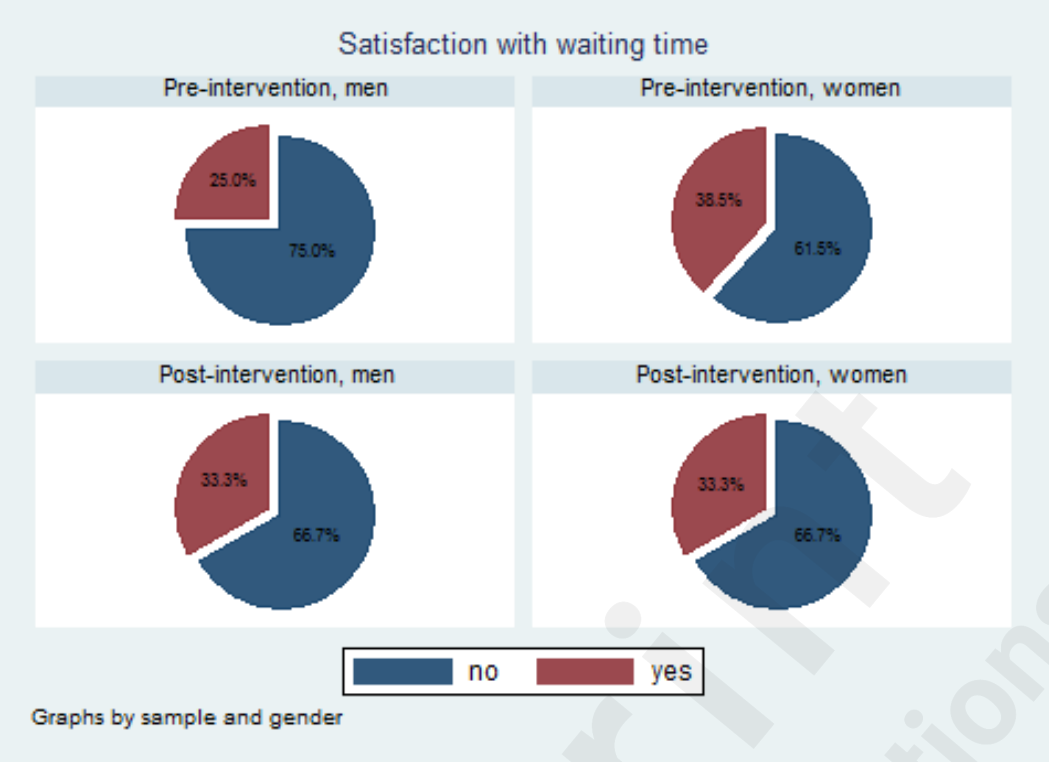

Figure 7: Pre and post comparison of patient satisfaction

Unintended Outcomes

The intervention led to an unexpected increase in the waiting time for the general ophthalmologist exam. Also, the intervention appeared to have affected women adversely as evidenced by the reported slight increase in waiting time. A mean comparison across variables showed that this effect was more marked for women in the 15-24 age group (as shown in Figure 8).

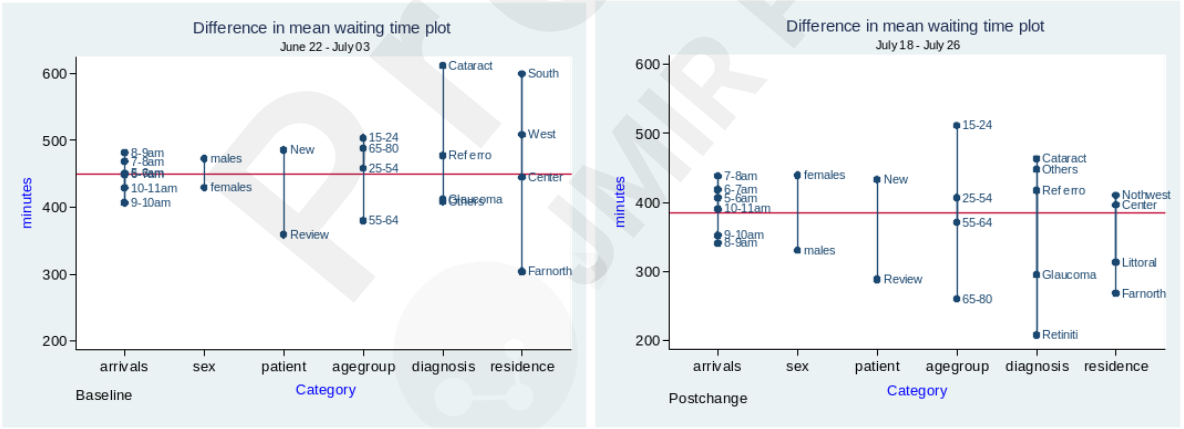

Figure 8: Difference in means by category

Further Investigation showed that the 6.1% (3/49) of women who fell in the 15-24 age group were enrolled after the intervention, giving a wrong indication of an adverse effect.

Discussion

Key Findings

We found a mean(SD) waiting time of 449.6(96.6) minutes, a mean service time of 111.9(47.0)

minutes, and a mean idling time of 337.7(98.1) minutes. The PDSA intervention led to a 14.5% (65.4/449.6) improvement in mean waiting time (t=2.0, df=47, *P*=.05), from 449.6 (95% CI: 409.7-489.5) minutes at baseline to 384.2 (95% CI: 327.8-440.6) minutes post-intervention. Only over a third of participants reported being satisfied with waiting time (32%, 8/25) at baseline. Waiting time was not found to be associated with satisfaction (odds ratio=1.0; 95% CI: 0.99-1.0; *P*=.37; Chi2=.43).

Comparison With Prior Work

Baseline Waiting Time

Other studies have reported high mean clinic waiting times, although we have not found any reports as high as our finding. A mean(SD) waiting time of 274(103.4) minutes was reported among adults visiting the University of Port Harcourt Teaching Hospital in Nigeria, which was lower than the 449.6(96.6) minutes we found in this study[48]. The sample size (n=401) was much larger than ours as did the medical services and patient flow that involved significantly fewer steps for the patient to navigate. The shorter patient pathway may explain the shorter time spent at the clinic. The mean waiting time in a study undertaken at the Thong Nhat Hospital in Vietnam was also lower than our finding at 104.1(96.4) minutes [49]. In this study, patients saw the consultant straight after registering, who either recommends a blood or imaging test. The patient revisits the doctor and then is sent to the pharmacy. This 5 service point pathway and rapid access to the senior doctor could explain the lower waiting time, compared to our study where patients had to visit 12 service points on average. Another study conducted in a teaching hospital in Nigeria reported 160.2(62.4) minutes of waiting time. [50] In this study, the waiting time was defined as the time from the registration to seeing the doctor, rather than the total visit time which we used in our study. In the same way, a study at the Kintampo Municipal Hospital in Ghana reported a mean total visit time of 303.6(94.8) minutes (5.06 hours) [51]. Their patient pathway was composed of six service points only. A pilot quality improvement making use of PDSA cycles in an operating theater unit of a tertiary hospital in India found the average waiting time at baseline to be 221 minutes. [42] Differences in waiting time measurement can explain the lower waiting time which was limited to time at the operating theater. Similarly, at the Medunsa Oral Clinic in South Africa, the mean total time spent at the clinic among 149 patient patients was reported to be 235.79(78.79) minutes, almost two times lower than the 449.6(96.6) minutes reported in our study. [52],The patient pathway for the dental clinic was simple with just 5 service points(check-in, reception, diagnostic room, treatment and check out). Another study at the Jos University Teaching Hospital in Nigeria showed that the total mean outpatient time was 248 minutes[53]. Again patients in this study followed a simpler patient pathway, being sent to see the doctor after registration after which they were sent to the pharmacy. A waiting time audit among 316 women attending an antenatal clinic in Ghana showed that the mean time spent at the clinic was 6.5 hours which is closer to the 7.5 hours reported in our study[54]. Albeit the definition of waiting time in their study was similar to ours, the 6.5 hours waiting time in their study was subject to reported time spent at the clinic rather than a time audit as was the case in our study. As such, no details about the patient pathway were given but 73% of participants (n=204) noted that most of the time was spent waiting to see the doctor.

From these findings, it appears that streamlining the patient pathway by reducing the number of service points that the patients have to navigate and giving the patient access to the doctor faster may be a good strategy to reduce overall waiting times.

Service and Idling Times

In our study, the proportion of idling time increased from 75% (337.7/449.6) to 78% (299.3/384.2) after the intervention, even when there was a general reduction of mean waiting time.

Similar studies in other settings also reported high idling times such as one in China among 49

outpatient patients to an endocrinology center that reported the idling time to be 89.4% (150.5/168.3) [14]. A multicenter study across 9 clinics in NkwaZulu-Natal (South Africa) with a sample size of 1763 (baseline=860 and follow-up=903) used a health service strengthening framework over 12 months and reported the proportion of idling time post-intervention to be 94% (115/122)[55]. Akinyinka and colleagues found the eye clinic service time at a primary care center in Lagos to be 8.2(2) minutes, similar to our findings of 8.5(8.8) minutes for the general ophthalmologist in our study[56]. In Southwestern Ethiopia, a study including 853 patients showed that patients spent a total time of 553.4 minutes going through all service points, of which 49.6% (274.9/553.4) was spent waiting for services [57]. At the University of Benin Teaching Hospital in Nigeria, the proportion of time spent before seeing the doctor was reported to be 84.9% (22/146)[58].

In New York, patients spent 57.7% (53/91.9) of the mean total visit time waiting to be called into a room (20.1 minutes), for the provider (18.6 minutes), and the preceptor (14.3 minutes) [59]. Visit time was based on appointment visits, with a much simpler patient pathway including only registration and exam room. A study including 555 patients attending a teaching clinic in Sacramento (USA) reported the time spent at the clinic to be 80.5(30) minutes were 19(16) minutes were spent idling. [60] Their waiting time was based on an individual appointment system and involved a 2-stage consultation (registration and exam room). Our study was based on a block appointment system with multiple provider service points. A study in a pediatric clinic in the USA reported the idling time to be 20.9 to 23.9 minutes for consultations and 15.8 to 20.32 minutes for the filling of prescriptions, using a Lean Six Sigma model [61]. Their idling times were not computed for the entire patient pathway as these were the times patients waited before being attended to after registration and the time between paying the prescription bill and being called at the pharmacy respectively.

This evidence suggests that patients attending clinics in low and middle-income settings, in particular, maybe spending most of their time there waiting to receive a service, referred to as idling waiting time in our study. It would be pertinent to consider interventions that focus specifically on decreasing the time patients spend between service points and possibly reducing the number of service points in the patients' pathway. Our intervention decreased the overall waiting but likely through a proportionally larger reduction in service time rather than idling time. The length of consultation may affect patient safety and clinical effectiveness and caution should be exercised if introducing measures that reduce the time of already brief consultations[62–66].

Reduction in Waiting Time

Our study reports a reduction of 14.5% in waiting time reduction through the intervention short of the original target of a 25% reduction. This could be a result of not being able to implement all the originally planned components of the intervention and also the short time from intervention implementation to analysis. Additionally, the involvement of doctors in training on the last day of our study led to an unusually high waiting time of 702 minutes for the last participant, thereby affecting our mean results.

Several studies of interventions to reduce waiting times report reductions in the same range as that reported in our study. Racine et al.[59] conducted a before and after study including 844 patients (n1=426; n2=418) at a pediatric clinic in the East Bronx in New York and reported a reduction of 14.8% (13.6/91.9) in mean total visit time. Our achieved reduction in mean waiting time was also comparable to 13.5% (28/208) reported in a before and after study making use of the Lean Six Sigma model, with the National Heart Institute in Cairo, Egypt over 16 months[67]. In the USA, Ciulla et al. [68] achieved an 18% reduction in their intervention using the Lean Sigma model. Another study in an emergency department in Singapore conducted over 6 months showed a 12.5% reduction using a similar model [69]. Improvements at the Fujiang provincial hospital in China[12] reduced the mean

waiting time per month for consultations by 33.8% (8.1/23.9). Two public primary care centers in South Africa reported reductions of 20.9% (27/129) and 28.7% (79/275) in waiting time [70]. This study was also implemented in 3 phases over 8 months which could explain the higher reduction compared to our study.

In general, we found that our reduction rate falls within the range of other published studies using similar methodologies. A longer time to implement and the opportunity to incorporate all the components of the intervention might have had a positive effect on our results.

Association between patient satisfaction and waiting time

In this study, we found little evidence of an association between waiting time and patient satisfaction (OR=1.0; 95% CI: 0.99-1.0, *P*=.37). Another study from China with a similarly small sample size (49 patients) also reporting a non-significant negative association between time spent at the clinic and satisfaction (r=-0.07) [14].

A study at the Hamilton Regional Eye Institute in Canada reported a significant association between waiting time and patient satisfaction (OR=0.92; 95% CI 0.86-0.98, *P*=.01)[71]. The study was based on an appointment system and implemented over 8 months, more likely to be a sufficient period to explore this relationship. A comparative study between primary care centers in Gauteng and Free state in South Africa, found a negative association between patient impression about time spent at the clinic and satisfaction.[72] A strong negative association between patient satisfaction and waiting time was also reported among 1403 antenatal care visits in Kenya and 859 in Namibia, across 564 and 303 health facilities respectively[73]. A negative association was also observed among 1617 HIV patients undergoing antiretroviral therapy in Nigeria[74]. In Malawi, a negative association between waiting time and patient satisfaction was reported among 120 women undergoing cervical cancer screening as was the case among 406 seeking laboratory services at antiretroviral therapy clinics in Addis Ababa in Ethiopia[75,76].

We report that dissatisfied patients commonly complained of long waiting times (76.5%; 13/17). Other studies from Canada,India and Cameroon report similar findings (79%, 73.3%, 73%)[77–79].

The decrease in waiting time achieved through our intervention was not reflected in a significant improvement in patient satisfaction post-intervention. We believe that the effect size was not large enough to impact patient satisfaction over a short time at the clinic and it is probable that a larger significant impact on waiting time reduction is needed for it to be a good predictor of patient satisfaction as well as a larger sample size.

Strengths and Limitations

This is the first quality improvement study in Cameroon with the primary endpoint of improving waiting time, and that made use of a mobile data collection kit for real-time patient monitoring. In addition to providing some evidence in circumstances under which randomized controlled trials may not be possible[80], this study prioritizes and puts users at the forefront of quality improvement[81]. The data collection method was automated, thereby reducing data entry errors.

Being the first quality improvement, the change process was slower than expected. The limited influence over contextual factors could have affected the intervention’s degree of success. Besides, not all changes that were proposed were finally implemented which also limited the impact of the intervention. The sample size was limited by the data collection method. Each data collector could only follow-up a single patient at a time from start to finish. This limited the daily enrolment to a maximum of 2 per data collector and sometimes just a single participant depending on the consultation cycle. A larger sample size would have led to a more normally distributed outcome variable and better inference. Finally, we did not do a subgroup analysis of changes implemented, to measure the impact of each change on waiting time and satisfaction..

The unexpected increase in the waiting time for the general ophthalmologist exam might have been caused by a faster service rate of preceding units indicating the importance to consider the patient

pathway in its entirety when designing interventions. It was also found that women experienced a slight increase in waiting time. Investigating the reasons for this finding are beyond the scope of this paper and would require further exploration in a study with a larger sample size.

Public Health Implications

This study sets the pace for further considerations regarding the delivery of evidence-based patient-centered eye care[82]. There is an urgent need to rethink the eye care delivery strategy in Cameroon[22,83]. The post-pandemic era will need even more efficient health systems. This will require that patients be considered partners in quality improvement. Our intervention is a demonstration of how relatively small investments could lead to service improvements. Further research is needed to improve waiting time and reduce patients' opportunity cost of their consultation.

Conclusions

We sought to improve waiting time and patients' satisfaction using PDSA-led quality improvement. We found a 14.5% borderline significant improvement in waiting time over 6 weeks suggesting that PDSA-led quality improvement at MICEI is promising over a longer period. Our results suggest that improving waiting time in the short run will not produce significant improvements in patient satisfaction in the setting under study. This study highlights the importance of patient-centered quality improvement, which helps to improve the provider-user relationship. Given the lack of evidence on what the acceptable waiting time for a comprehensive eye exam is at MICEI, our results provide a benchmark for standardizing the cycle time for a comprehensive eye exam.
We recommend that strategies aimed to reduce waiting time focus on reducing the idling time rather than affect the consultation time. These may include the reduction of service points that the patient has to navigate in the clinic as well as considering placing the consultation with the doctor earlier in the patient flow. Additionally, introduce a phasic appointment system starting with reviews and progressively introduced to new patients. Specific measures introduced with this intervention should be incorporated routinely in the clinic: these are (1) automated patient flow monitoring system that tracts the start and finish times at each service point, (2) introduction of a second receptionist for the separate handling of reviews, (3) implementation of robust ticketing at the gate and the reception for all patients, (4) queue length checks along the patient pathway and waiting time threshold alert system for on-the-spot handling of bottlenecks, (5) triaging of patient files led by assistant nurses at the general ophthalmology, (6) proactive sorting of patient files at the medical records, (7) Use of audiovisuals for patient education on the patient pathway and waiting time.

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Authors' contributions

MM designed the study and intervention, led the participant recruitment, data analysis, and development of the manuscript. CB contributed to developing the intervention and manuscript preparation. NA provided guidance in study development. HN contributed to the IRB approval and the QI team setup. CBunce advised on analysis and reviewed the statistics in the manuscript. All

authors read and approved the manuscript.

Conflicts of Interest

None declared

Data Availability

The dataset for this study will be made available upon reasonable request. Kindly contact the corresponding author with a detailed study protocol and justification of funding to undertake the study.

Multimedia Appendix 1: Evaluation of contextual factors

Multimedia Appendix 2: Distribution of waiting time

Multimedia Appendix 3: Research questionnaire

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Abbreviations

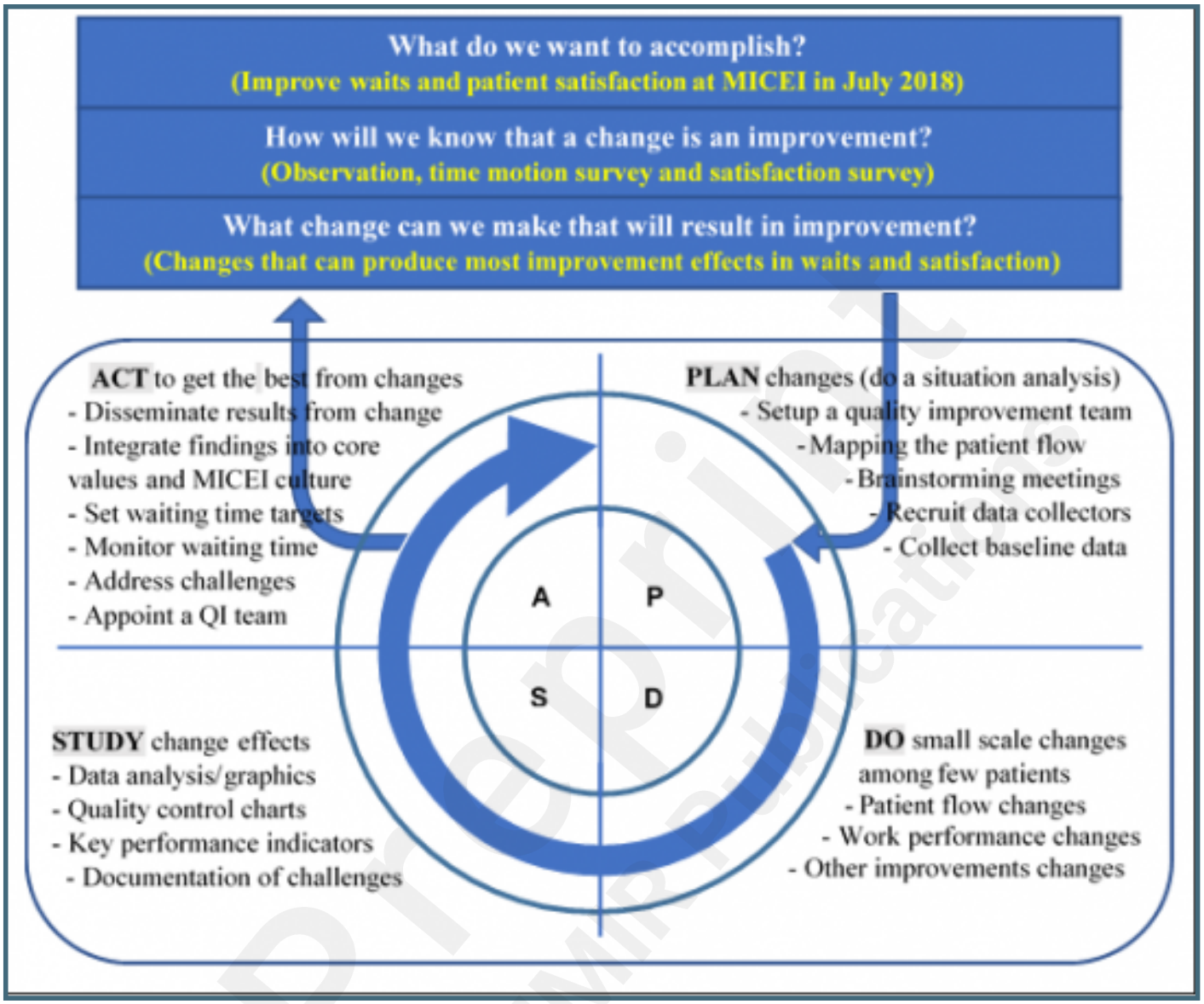
PDSA: Plan Do Study Act
ODK: Open Data Kit
SLMTA: Strengthening Laboratory Management Toward Accreditation
HIV: Hiuman Immunodeficiency Virus
SMS: Short Message Service
COVID-19: Coronavirus Disease
MUSIQ: Model for Understanding Success in Quality
VIP: Very important person
XLS: Microsoft Excel spreadsheet file
SQUIRE: Standard for Quality Improvement Reporting Excellence
NHS: National Health Service
MICEI: Magrabi ICO Cameroon Eye Institute
LSHTM: London School of Hygiene & Tropical Medicine
CEHC: Community Eye Health Consortium

Supplementary Files

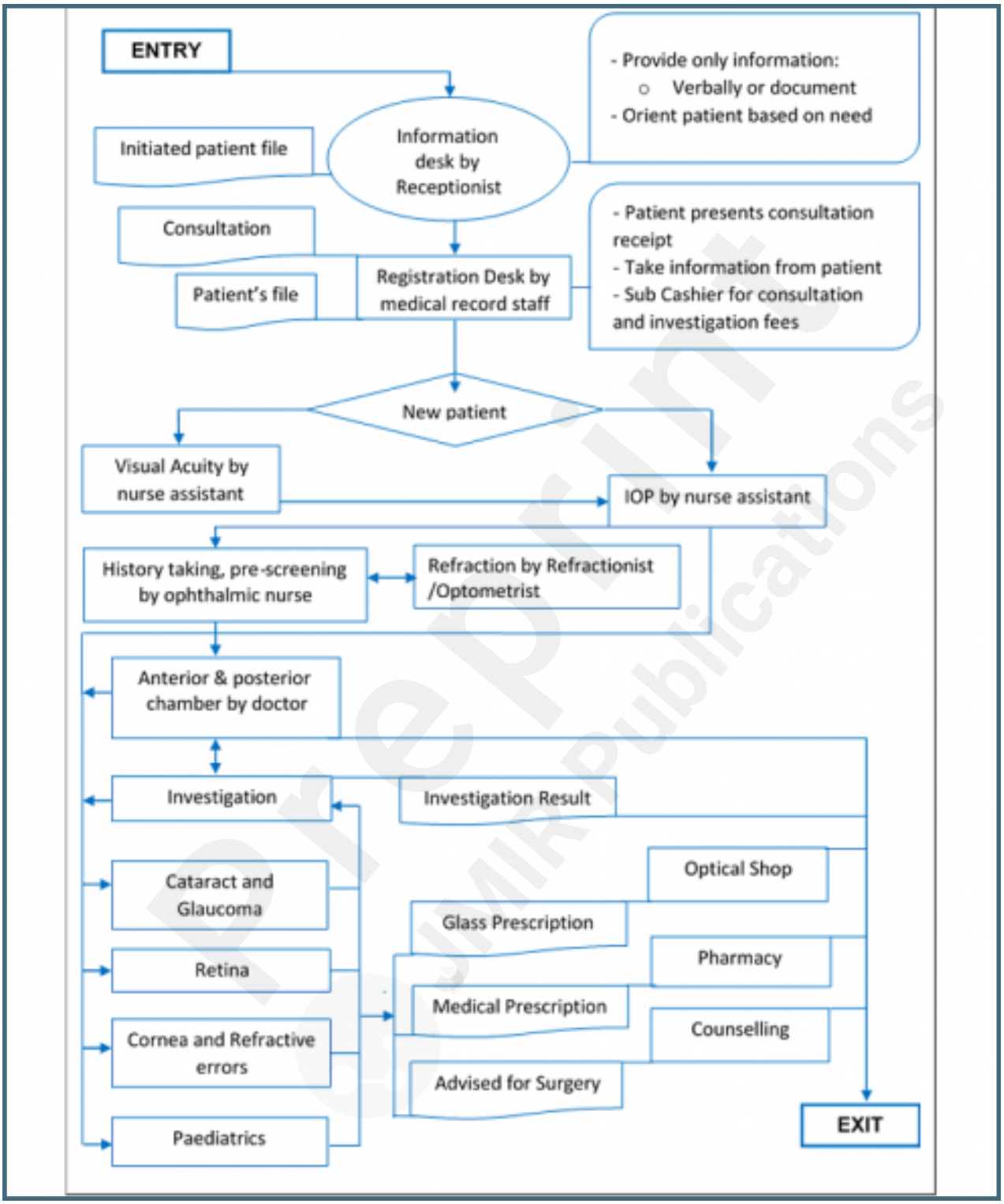
Round2AuthorResponses.
URL: http://asset.jmir.pub/assets/cbf68214b8b752e8ca26745bf9c6c754.docx

Figures

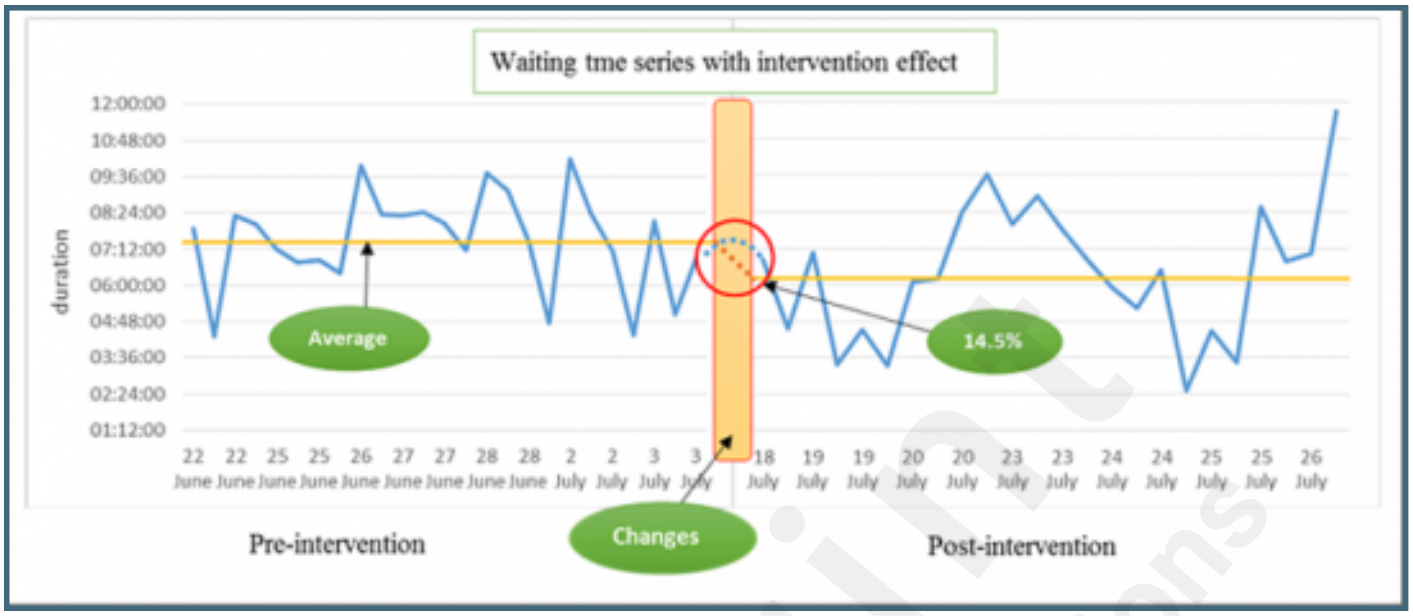
PDSA conceptual framework. Licensed under the Open Government License.



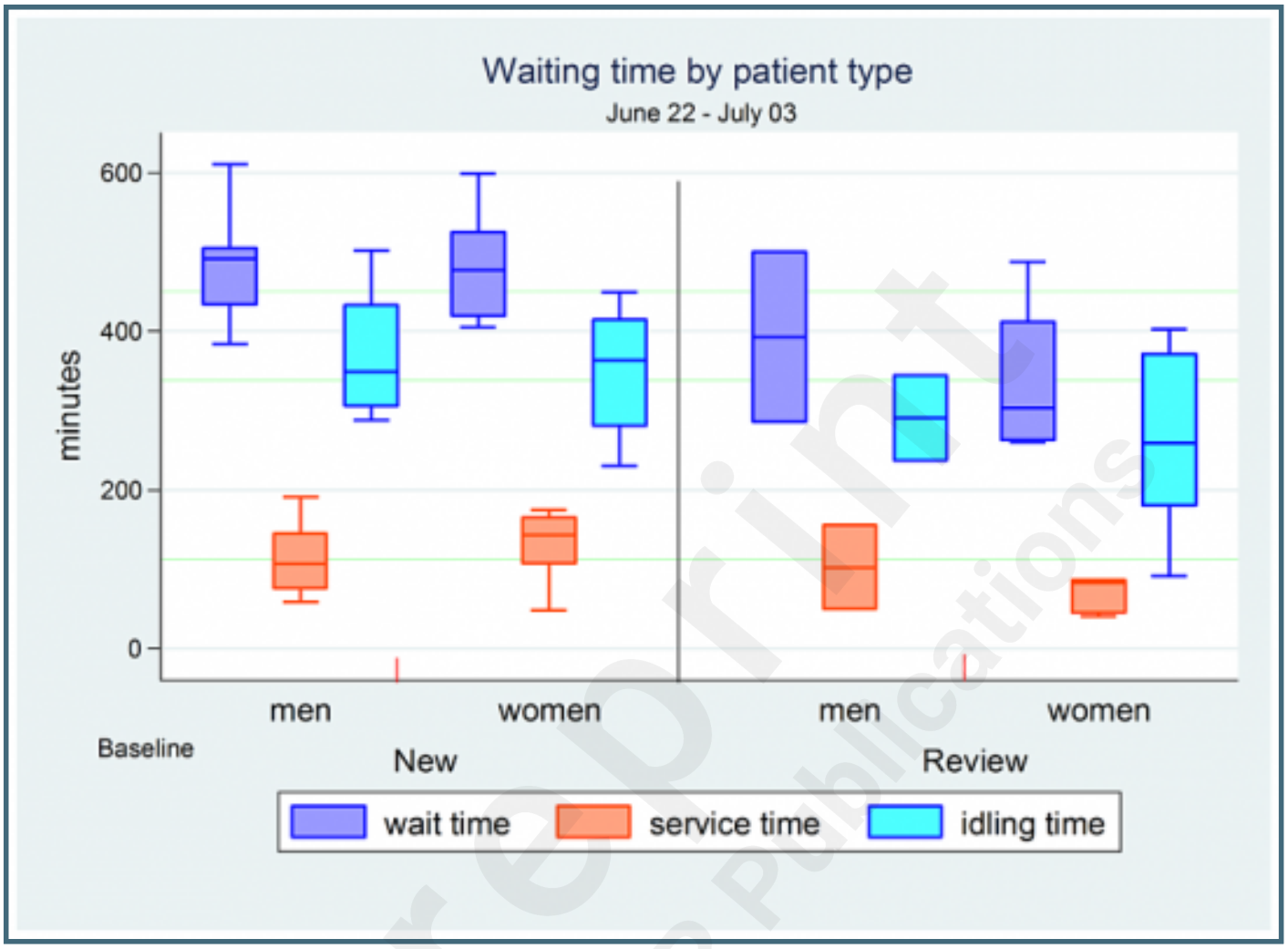
Authors' conception: Patient pathway protocol.



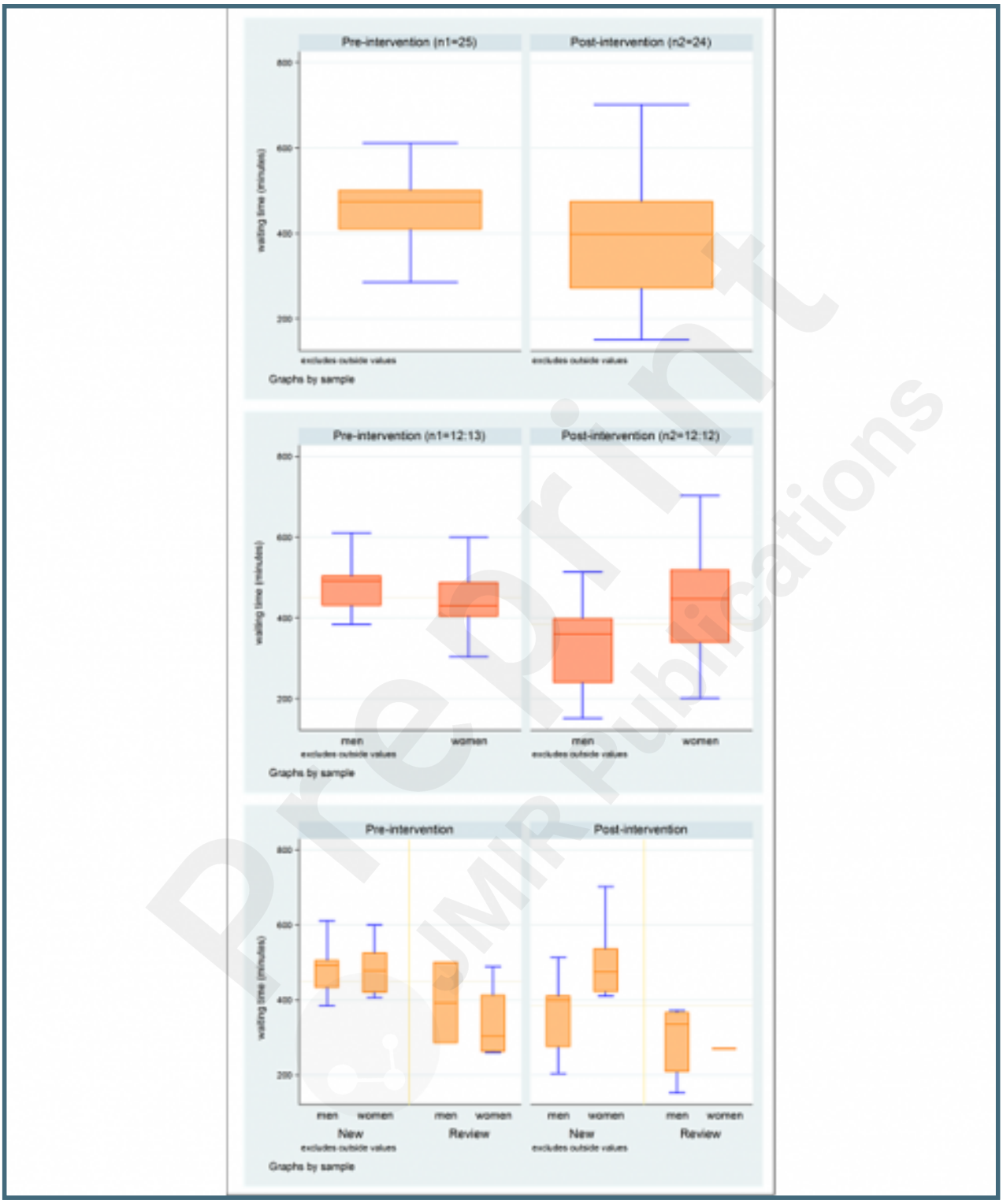
Timeline of time motion and satisfaction survey.



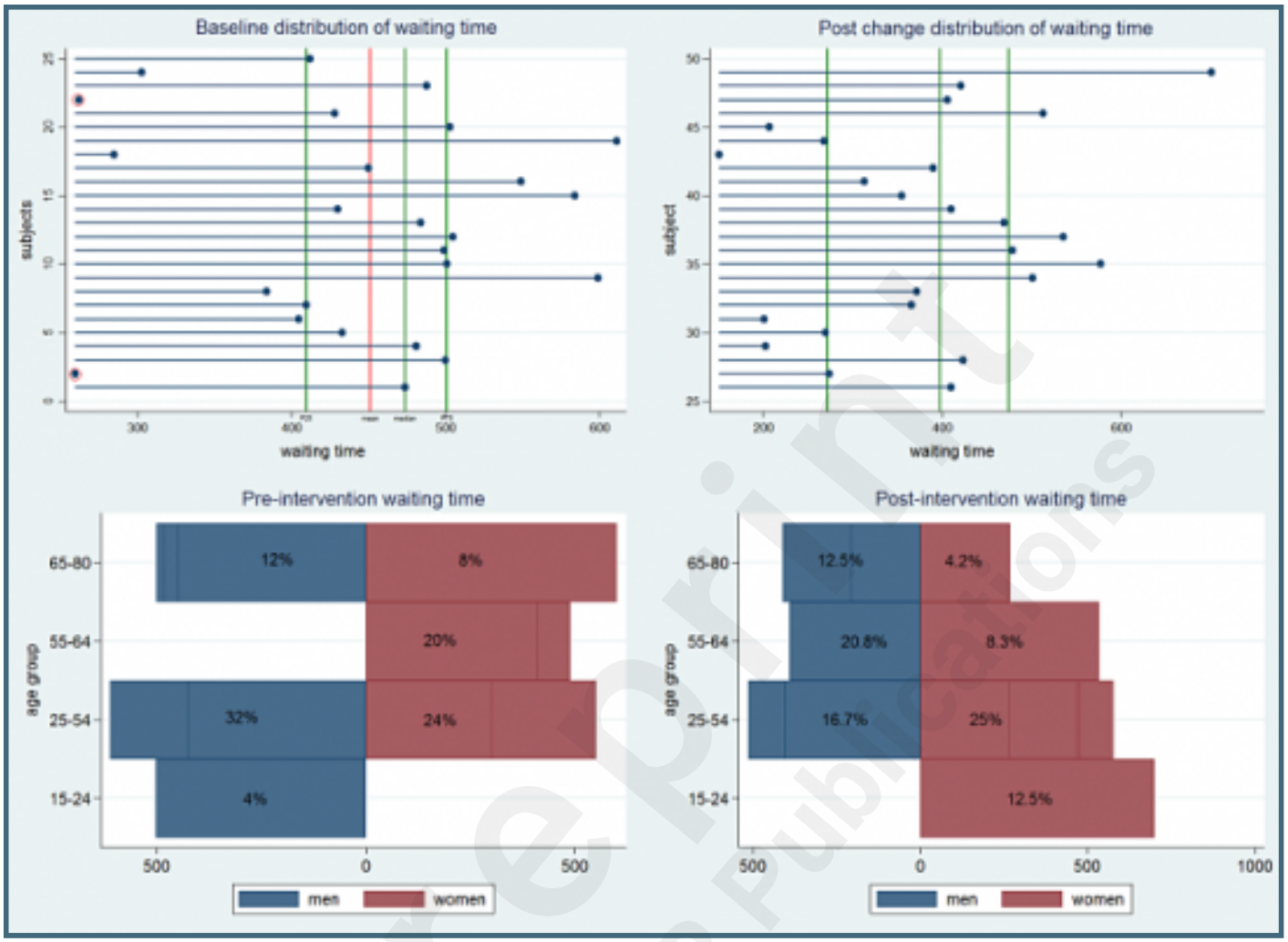
Baseline waiting time of new and review patients by sex.



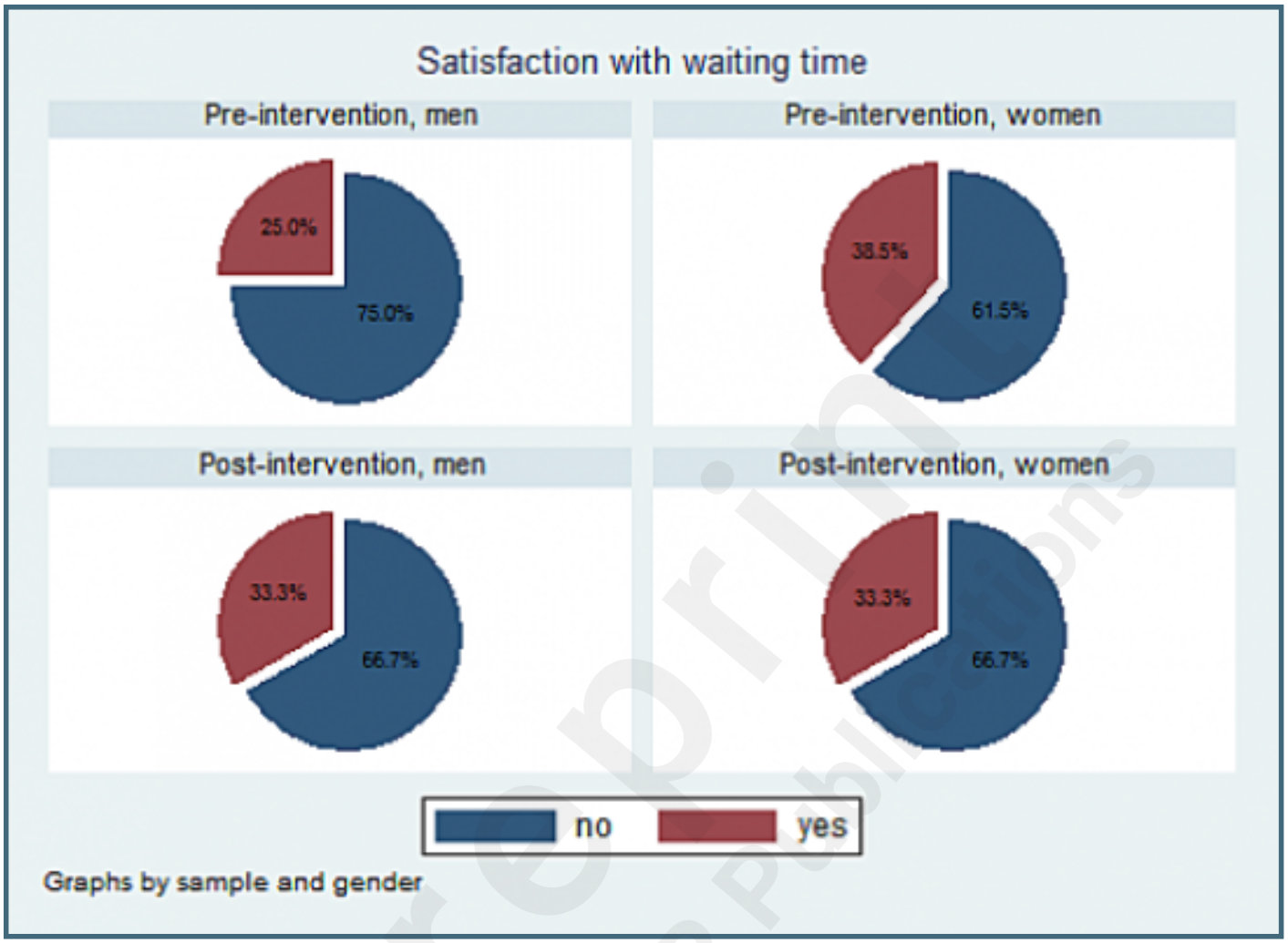
Intervention effect on waiting time.



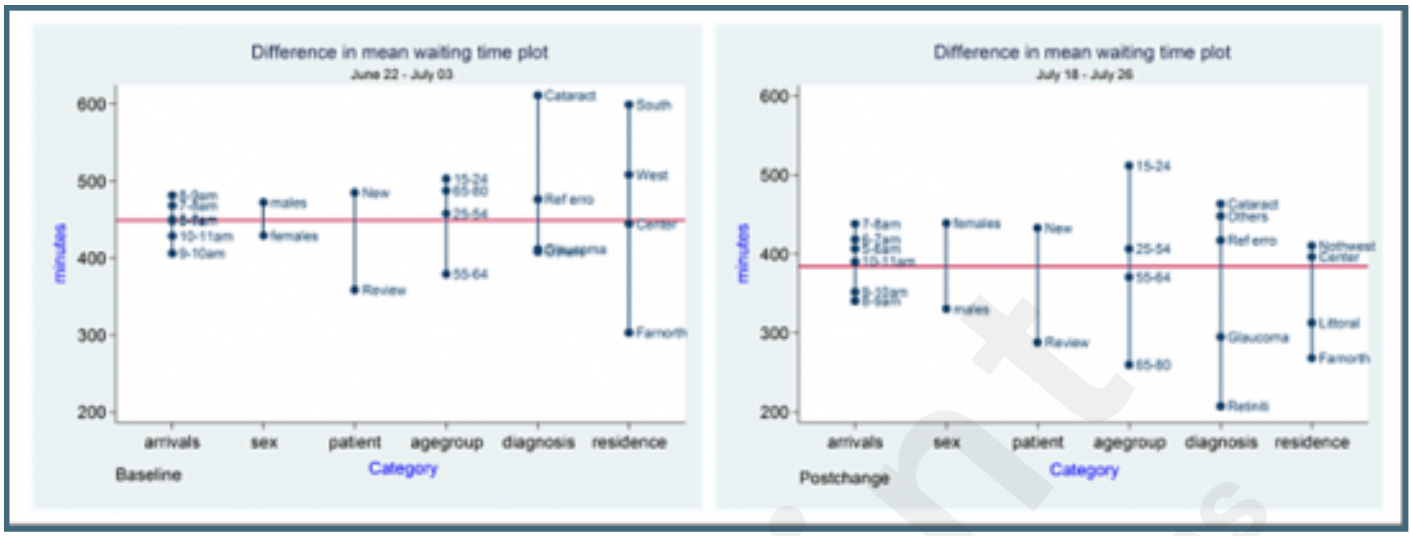
Comparison of pre and post-intervention waiting time.



Pre and post comparison of patient satisfaction.



Difference in means by category.



Multimedia Appendixes

Evaluation of contextual factors.
URL: http://asset.jmir.pub/assets/cf4362b8609fee960d6c28b124e9e89b.docx

Distribution of waiting time.
URL: http://asset.jmir.pub/assets/652e8e582e918c129a120d7505254c26.docx

Survey questionnaire.
URL: http://asset.jmir.pub/assets/03aa2c8ccd5a8d00cc420a03e7f224fd.pdf