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A Tale of Two Sister Clinics: Comparing the Use of Online Scheduling Tools to Reduce Patient Wait Times

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Abstract

Background: The Cardinal Free Clinics, Arbor Free Clinic (Arbor) in Menlo Park and Pacific Free Clinic (PFC) in San Jose, are student-run free clinics affiliated with Stanford operating since 1990. Patients are seen on a walk-in basis only, and on average, patients may wait more than an hour to be seen, decreasing patient satisfaction. In this study, we looked at whether we could improve patient wait times by administering a free online self-scheduling tool.
Methods: The free version of Acuity Online Scheduling Tool was used to set up 6 online appointment slots for patients at Arbor and 12 at PFC, and walk-in services were provided concurrently. On clinic days, patients with appointments were given priority over walk-ins. Wait times were calculated from time points collected by hand or through the electronic health record system. The Mann Whitney U test was used to compare wait times between patients with and without appointments in each clinic.
Results: The total number of patients being seen on a given day and whether or not patients had online appointments were significant determinants of wait times. Patients at Arbor with appointments had a median wait time of 35 minutes (N=46) compared to 60 minutes (N=231) without appointments ($p<0.05$). At PFC, patients with appointments waited 22 minutes (N=123) compared to 26 minutes (N=193) without appointments ($p=0.09$).
Conclusion: Free online scheduling tools can be customized to significantly decrease patient wait times and spread out patient arrival. Given the lack of resources often available for free clinics, it is important to explore the use of free tools to create a better patient experience.

Introduction

Long waiting times are a notorious problem in healthcare delivery and have been shown to substantially decrease patient satisfaction.[1,2] In most outpatient settings in the United States, patients make appointments to receive care weeks to months in advance, arrive for the appointment, and wait for a short period of time until they are seen. However, the waiting time is particularly problematic in student-run free clinics where patients are seen on a first come first serve (FCFS) basis. This strategy is more accessible to the diverse populations and more appealing to clinics with limited operational hours and resources. FCFS systems have inherently longer wait times than those with appointments due to the variability of arrival times.[3]

A first-line strategy to reduce patient waiting times in traditional appointment systems is to reduce the variability of arrivals by using open access scheduling.[4] Open access scheduling allows a small number of spread-out appointment slots to be filled by patients in advance and allocates the remaining appointment slots to be filled with same-day appointments only. A study which explored the cause of long waiting times for care at the National Health Services in England

concluded similarly that the problem was not the capacity to see patients, but rather the variability in patient arrivals.[5]

This study aims to determine if administering a free online self-scheduling tool for appointments, while continuing to accept walk-ins on a FCFS basis, can improve patient wait times in a student-run free clinic setting. Similar to strategies seen in other clinics, there are appointments available for self-scheduling, but the rest of the slots will be filled by walk-in patients rather than same-day appointments. While the phenomenon of reduced waiting time due to the introduction of scheduled appointments has been studied extensively in various outpatient settings with staff available to schedule the appointments, it has not been studied in a student-run free clinic using a self-serve online tool.[3,6] Our hypothesis is that the use of this scheduling tool will reduce average wait times of all patients seen in the clinic.

Cardinal Free Clinics

The Cardinal Free Clinics (CFCs) are student-run free clinics affiliated with the Stanford School of Medicine with operations dating back to 1990. Arbor Free Clinic (Arbor), as one of the two free clinics under the CFCs, is located on the Veterans Affairs campus in Menlo Park, California and has historically been open on Sundays from 8 AM to 1 PM for walk-in patients only. Pacific Free Clinic (PFC) is located in East San Jose, open on Saturdays from 8 AM to 1 PM for walk-in patients only. On average, patients may wait more than an hour to be seen by a provider based on historical estimates through patient surveys and intermittently collected data. In this study, we looked at whether we could improve patient wait times by administering a free online self-scheduling tool.

Methods

This study was reviewed by the Stanford University Institutional Review Board and was exempted as a quality improvement project.

Patient Population and Study Setting

The free version of Acuity Online Scheduling Tool was used to set up online sign-up slots, customized to the different needs of the two clinics. The different student managers at the two clinics were given flexibility in determining what would best fit the needs of the two clinics. At Arbor, six online sign-up slots for patients were created to make 30-minute appointments from 9:00 AM to 11:30 AM starting from April 22, 2018. At PFC, the online platform was made available on September 8, 2018 with 12 available slots for patients to make either a 30-minute follow-up appointment or a 1-hour new patient appointment for 8:15 AM, 9:45 AM, and 11:15 AM. Arbor's priority in creating only 6 later slots was based on prior knowledge that morning rushes were the biggest hurdle in patient wait times, whereas PFC created 12 evenly spaced out slots to better predict clinic flow. Arbor also did not have more than 1 slot for a given period of time, so that even if a patient arrived late for their appointment, this would not delay the next appointment since there were many more providers than there were appointment slots.

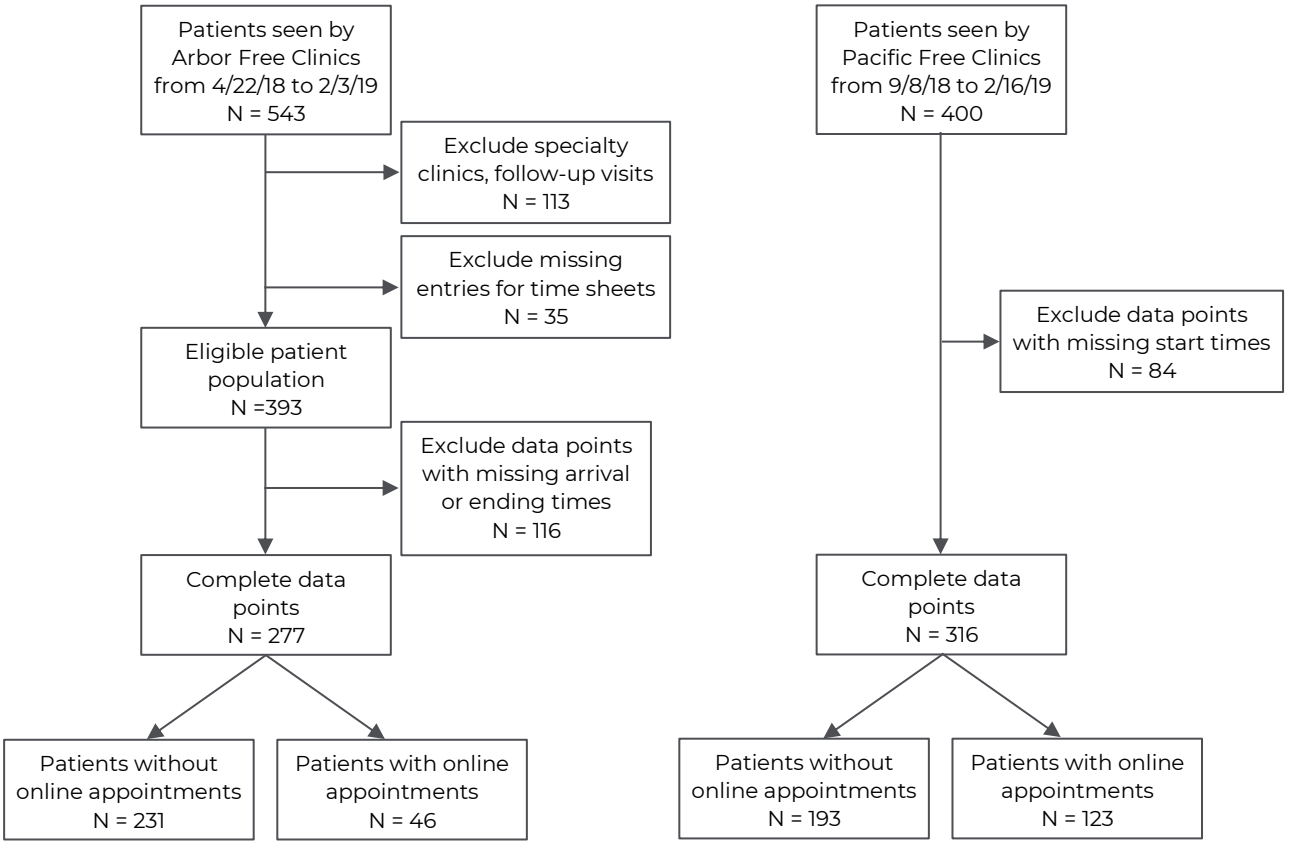
Patients could access the scheduling tool directly on the Cardinal Free Clinics website under "Self-Scheduling". An application programming interface (API) was used to imbed the scheduling tool interface onto the pre-existing website. Patients could make online appointments if available or walk in. On clinic days, patients with online appointments were given priority in the waitlist over walk-in patients.

"Wait time" was defined as the time a patient had to wait from first walking into the clinic until they were seen by a medical student/resident/attending. Wait times for patients who had made online appointments were from the time of arrival or from the time of appointment, whichever was later. During the wait time, patients at Arbor are seen by a separate triage team that collects vital signs and demographic information whereas this information is collected by the health provider once patients are in rooms at PFC. Final date of data collection was February 2, 2019 for Arbor and February 16, 2019 for PFC.

Data Collection

At PFC, different timepoints were recorded using Point and Click Solutions (Burlington, Massachusetts), the Electronic Health Record system, whereas the timepoints were manually collected by student managers at Arbor. Each time point was recorded on the patient intake sheet by an undergraduate or medical student accompany-

Figure 1. Data collection



ing the patient throughout their visit. The following timepoints were collected: patient arrival in clinic, entrance of first healthcare provider into room, resident/attending entrance into room, patient departure from room, departure from clinic. This data was then transferred to Microsoft Excel. At Arbor, specialty clinic patients (dermatology, cardiology, ophthalmology, etc.) and follow-up visits were excluded given that the scheduling process is managed independently, whereas specialty clinic patients (women's clinic, hepatology, dermatology, mental health and ophthalmology) at PFC were included. At both clinics, data points with missing arrival or ending times were also excluded as shown in Figure 1.

Statistical Analysis

Analyses were performed using JMP (SAS, Cary, North Carolina) and data visualization was performed using R version 3.4.3. Categorical and continuous variables were compared between Arbor and PFC using chi-squared tests and two-tailed t-tests, respectively. A one-tailed Mann Whitney U test was used to compare the non-normal distribution of wait times for patients with and without appointments. To find the determinants for patient wait times in the two clinics, Cox proportional hazards were used to carry out univariate and multivariable analyses. Variables that were significant at $p<0.05$ in the univariate analysis were included in the multivariable model.

Results

At Arbor, there were 101 online appointments made for an average of 4.8 appointments per clinic session out of a total of 6 available slots (80%; Table 1). In comparison, at PFC, there were 123 online appointments made for an average of 9.8 appointments per clinic session out of 12 available slots (82%). Of the appointments made, Arbor and PFC patients missed 31% and 39% of their appointments, respectively (p=0.09). With more slots available, a higher percentage of patients at

Table 1. Characteristics of patients, appointments, and clinic day operations by clinic

Parameters	Arbor	PFC	p-value
Patient Demographics, N (%)	277 (100)	316 (100)	
Sex			0.46
Female	127 (46)	182 (58)	
Male	101 (36)	127 (40)	
Age, median (range)	45 (19-83)	55 (18-89)	<0.01†
18-30	63 (23)	49 (16)	
31-50	74 (27)	94 (30)	
51-70	85 (31)	130 (41)	
71-90	12 (4.3)	38 (12)	
Appointments*, N (%)			
Appointments made, N per week (% of slots)	4.8 (80)	9.8 (82)	0.93
Missed appointments	58 (31)	80 (39)	0.09
Patients with appointments	52 (17)	123 (39)	<0.01
Clinic Day Operations, N (%)			
Totals patients per day, median (range)	14 (6-29)	18 (12-29)	<0.01
5-15	22 (56)	5 (25)	
16-25	15 (38)	13 (65)	
26-35	2 (5)	2 (10)	
Arrival time, median	9:00 AM	9:11 AM	0.01†
7:00 AM - 8:59 AM	132 (48)	136 (43)	
9:00 AM - 10:59 AM	108 (37)	135 (43)	
11:00 AM - 1:00 PM	37 (13)	45 (14)	

PFC: Pacific Free Clinic
p-values calculated using Pearson's chi-squared test unless specified
**Includes total number of appointments prior to application of exclusion criteria*
†*Mann-Whitney U test for non-normal distribution*

PFC were on an appointment basis as opposed to being walk-ins (39% vs 17%, p<0.01).

During clinic days, Arbor saw a median of 14 patients (range 6-29) compared to PFC's 18 patients (range 12-29), with the difference being significant (p<0.01). Patients at Arbor arrived earlier, with more than 50% of patients arriving before 9:00 AM, despite the clinic hours spanning from 8:30 AM to 12:30 PM. Half of patients at PFC arrived before 9:11 AM.

In comparing the two patient demographics of the clinics, there was no significant differences in the sex of patients, whereas Arbor saw younger patients compared to PFC (median age 45 vs 55 years; p<0.01).

In comparing patients with and without online appointments at Arbor (Figure 2), the median arrival times were 10:17 AM and 8:45 AM, respectively (p<0.01, one-tailed Mann Whitney U). At PFC, the median arrival times were 9:38 AM and 9:04 AM for patients with and without online appointments, respectively; this difference was not statistically significant (p=0.1, one-tailed Mann Whitney U).

In comparing patient wait times for those with and without online appointments using a one-tailed Mann-Whitney U test (Figure 3), median wait times for patients at Arbor with (N=46) and without appointments (N=231) were 35 and 60 minutes, respectively; the distributions in the two groups differed significantly (p<0.05). At PFC, the difference in the distribution of the two groups was not significant (p=0.09) with a median wait time of 22 and 26 minutes for patients with (N=193) and without (N=123) appointments, respectively.

Figure 2. Arbor and Pacific Free Clinic arrival times for patients with and without online appointments

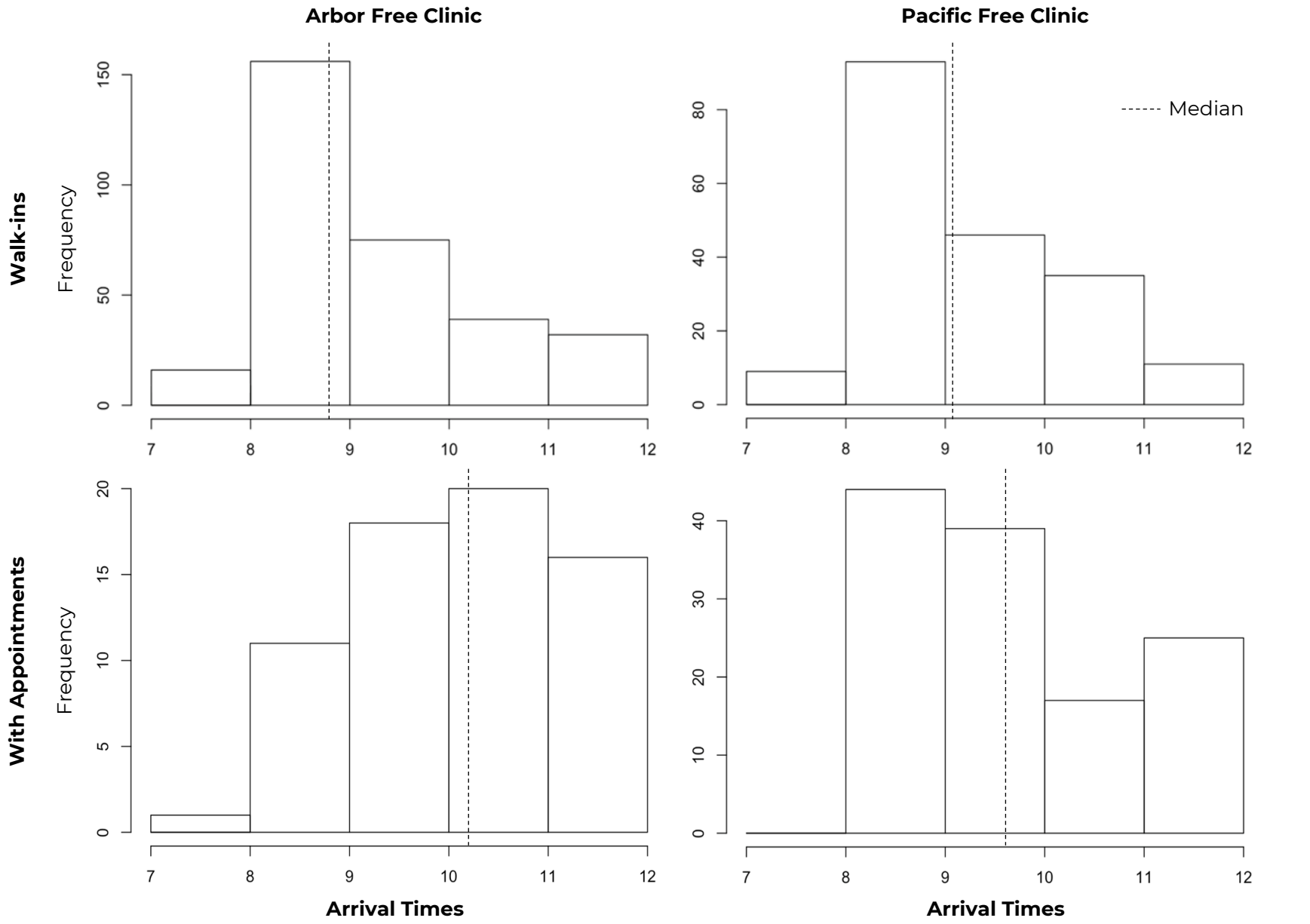
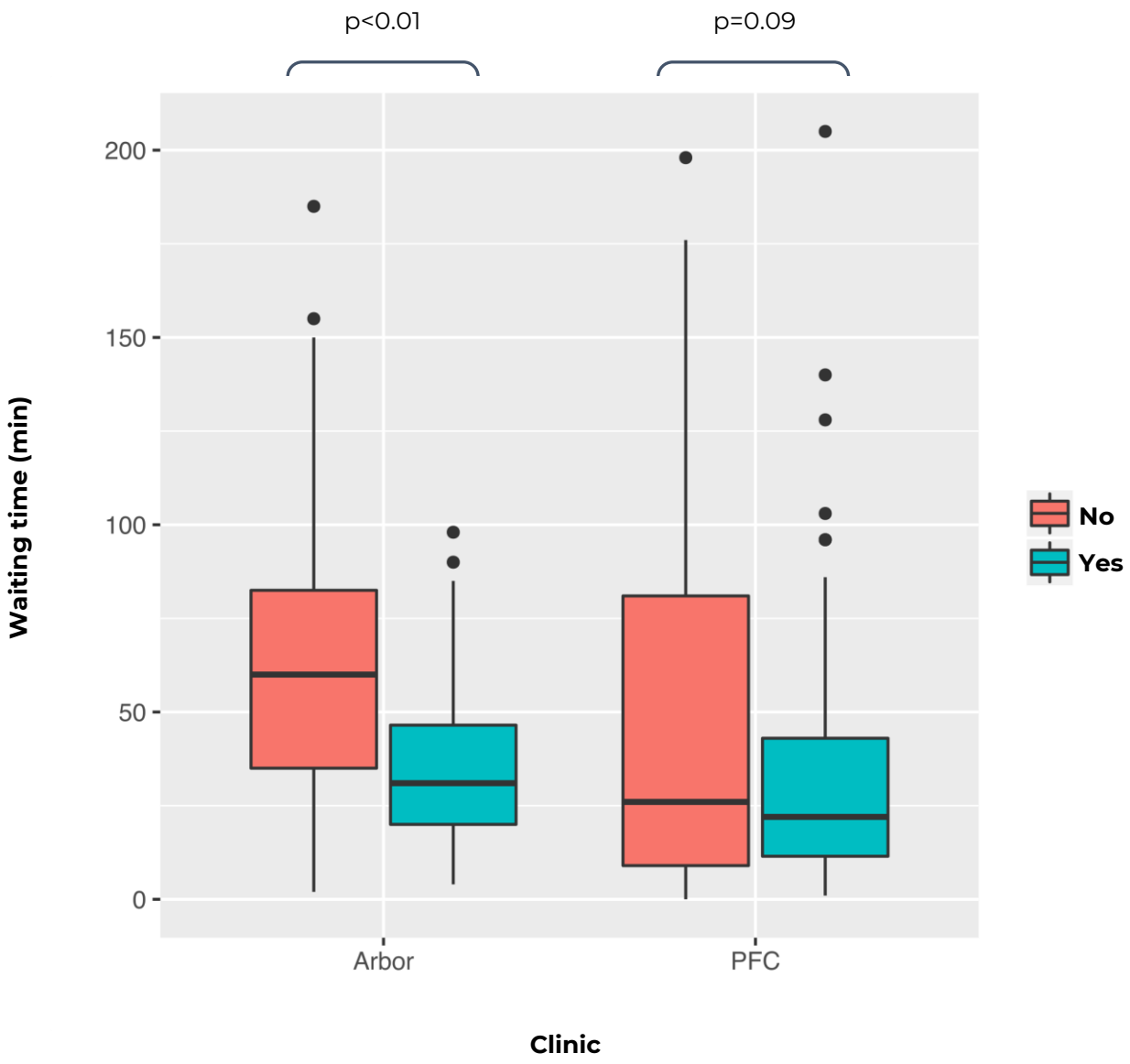


Figure 3. Patient wait times for those with and without online appointments



PFC: Pacific Free Clinic

Table 2. Multivariable analysis – Arbor

Parameters	Univariate HR (95% CI)	p-value	Multivariable HR (95% CI)	p-value
Sex, Female	1.09 (0.48-2.44)	0.84		
Age	0.99 (0.99-1.00)	0.15		
Total patients on clinic day	0.93 (0.91-0.96)	<0.01	0.92 (0.89-0.95)	<0.01
Online appointment	2.27 (1.59-3.23)	<0.01	2.53 (1.73-3.68)	<0.01
Arrival time*	2.44 (1.34-4.38)	<0.01	2.94 (1.50-5.78)	<0.01

HR: hazard ratio; CI: confidence interval
*Range risk ratios were used to calculate the per change in regressor over the entire range

Table 3. Multivariable analysis – Pacific Free Clinic

Parameters	Univariate HR (95% CI)	p-value	Multivariable HR (95% CI)	p-value
Sex, Female	2.06 (0.80-5.27)	0.13		
Age	0.51 (0.30-0.87)	0.01	0.99 (0.98-1.00)	<0.01
Total patients on clinic day	0.96 (0.94-0.98)	<0.01	0.95 (0.93-0.97)	<0.01
Online appointment	1.34 (1.05-1.70)	0.02	1.31 (1.03-1.66)	0.03
Arrival time*	1.37 (0.74-2.50)	0.31		

HR: hazard ratio; CI: confidence interval
*Range risk ratios were used to calculate the per change in regressor over the entire range

At Arbor, in a multivariable analysis, the total number of patients seen on a given day, whether or not the patient had an online appointment, and patient arrival times were significant determinants in patient wait times (Table 2). Hazard and risk ratios for online appointments and arrival times were 2.53 (95% confidence interval 1.73-3.68) and 2.94 (1.50-5.78), respectively, whereas the hazard ratio for the total number of patients seen on clinic day was 0.92. In comparison, at PFC (Table 3), age, total number of patients seen on a clinic day, and whether or not patients had an online appointment were found to be significant, with only online appointments having a significant hazard ratio of 1.31 (1.03-1.66).

Discussion

In this study, we found that a free online scheduling tool can be used in a student-run free clinic setting to more evenly distribute patient arrival times and decrease patient wait times as seen at Arbor. However, not all implementations are equal, as evidenced by the non-significant difference in wait times for patients at PFC. There are many possible causes for why there was only a significant decrease in wait times at Arbor and not at PFC. For one, Arbor has a coordinator whose sole responsibility is to assign patients to volunteers, whereas PFC has a decentralized method of volunteers taking on new patients, making it difficult to prioritize patients with appointments over walk-ins. Arbor also only had 6 appointments available later in the day that led to later arrival times for patients, whereas PFC had 12 total appointments throughout the day starting in the morning, which could have overwhelmed the clinic's capacity especially during the morning surge. This may have contributed to why arrival time was a significant determinant in wait time at Arbor but not at PFC, although another possible explanation is that the student managers felt that it was necessary to delay appointment slots at Arbor and not at PFC because a delay in patient care was only experienced at Arbor.

For both clinics, the total number of patients seen on that clinic day was a significant contributor to wait times. Therefore, it is important to understand a clinic's capacity at baseline before creating slots to prevent overburdening the system as well as to not push out patients who may not have the resources to make online appointments. For student-run clinics that would like to use online scheduling tools to decrease patient wait times, it is important to understand what the scheduling tool would enable the clinic to do before designing the slots.

Given the lack of resources in free clinic settings, exploring the utilization of free tools to improve patient satisfaction can help clinics better serve their communities. At the Cardinal Free Clinics, the use of the Acuity Online Scheduling Tool has decreased patient wait times in one setting and not in another. In clinical settings outside of student-run free clinics, this has been shown to increase patient satisfaction without the need for additional resources.[1,6] The implementation of this tool has addressed previous research that identified a need for interventions to improve areas associated with low patient satisfaction, although additional research is required to better understand if decreased patient wait times contribute to increased patient satisfaction in the free clinic setting.[7] Additionally, although this has not been discussed at length in this

paper, online appointments can potentially increase the number of patients seen in a clinic day, both by distributing resources equally and providing potential patients with a guaranteed timeslot. However, there is the risk of increasing the disparity in wait times between patients with access to or knowledge of the online appointment system and those without such benefits.

A significant limitation to this study is that patient wait times were only measured after online appointments were offered. Comparing wait times between patients with and without appointments after the intervention is implemented is not a perfect proxy for the pre-existing FCFS system, as it is impossible to determine how appointments may either negatively or positively impact wait times for patients without appointments. For example, the appointment system could have eased patient wait times by more evenly distributing arrival times as we have hypothesized. However, resources could have also been allocated in a way to favor patients with appointments, thereby delaying wait times for patients without appointments. Furthermore, as a quality-improvement study, the results are highly context-specific. Additional limitations to this study include variability in patient prioritization during each clinic day between the two clinics, lack of appointment reminders to patients, and the continued use of a first come first serve system. Variability in patient prioritization stems from two sources. The first is the use of a rotating group of clinic volunteers and managers who may use the tool differently, making it hard to standardize. The second is differences in tool implementation and available appointment slots between the two clinics, as highlighted by Arbor's exclusion of the specialty clinics from its data collection process. Furthermore, patients receive only one appointment reminder through the free online software. The use of different reminder tools on the rate of no-show rates is an area of future research. Finally, accepting walk-in patients makes it hard for the clinic to match supply and demand, which increases variability in patient wait times.

Next steps are two-fold. The first is fine-tuning the use of the scheduling tool to maximize outcomes. Specifically, the goals are to decrease the no-show rates and to standardize the tool between clinic days. The second is to better understand if decreased patient wait times contribute to increased patient satisfaction in the free clinic setting.

In summary, this study identified a free online scheduling tool that can be custom-tailored to fit the needs of student-run free clinics and explored how different implementation methods across two distinct clinic systems led to differences in patient arrival times and patient wait times. The combination of appointments, even without additional resources, and FCFS can be effectively applied to low-resource settings.

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Disclosures

The authors have no conflicts of interest to disclose.

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