Journal of the American Medical Informatics Association, 29(9), 2022, 1637–1641
https://doi.org/10.1093/jamia/ocac087
Advance Access Publication Date: 2 June 2022
Case report

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Automated patient self-scheduling: case study

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Received 27 February 2022; Revised 15 May 2022; Editorial Decision 16 May 2022; Accepted 19 May 2022

ABSTRACT

This case study assesses the uptake, user characteristics, and outcomes of automated self-scheduling in a community-based physician group affiliated with an academic health system. We analyzed 1 995 909 appointments booked between January 1, 2019, and June 30, 2021 at more than 30 practice sites. Over the study period, uptake of self-scheduling increased from 4% to 15% of kept appointments. Younger, commercially insured patients were more likely to be users. Missed appointments were lower and cancelations were higher for self-scheduled patients. An examination of characteristics, benefits, and usage of automated self-scheduling provides insight to those organizations contemplating the implementation or expansion of similar consumer-facing digital self-scheduling platforms.

Key words: appointment, scheduling, ambulatory, self-scheduling, digital health

BACKGROUND AND SIGNIFICANCE

Automated self-scheduling represents a technological solution that allows patients to book appointments online without the assistance of customer-support agents. The aim of self-scheduling is to improve the efficiency of the transaction and to enhance customer satisfaction. There is evidence that self-scheduling can reduce health systems' labor costs,[1–6] improve customer satisfaction,[7,8] and decrease no-show rates.[9–13] Despite demonstratable benefits, health systems often encounter barriers when implementing self-scheduling; there remains limited evidence on the uptake, characteristics of users, outcomes, and organizational-level determinants of success.[4,14]

We address some of these knowledge gaps through a case study of a de novo self-scheduling intervention in a large, predominantly primary care, multispecialty physician group affiliated with an academic health system. The setting was Johns Hopkins Community Physicians (JHCP), with more than 400 physicians seeing patients at over 30 office sites in the Baltimore/Washington region. Traditional appointment scheduling at JHCP is supported by customer-service agents available via a centralized call center, or at the point of care when the patient is at the clinic site.

Given this context, our study was able to address the following questions: To what degree do customers use automated self-scheduling after the technological solution is made broadly available? What are the characteristics of customers who use automated self-scheduling? What are some of the demonstrable benefits of self-scheduling for the health system?

MATERIALS AND METHODS

The automated self-scheduling system featured in the case study was fully integrated within the EHR-based patient portal (in this case, Epic's MyChart). The intervention could only be accessed by customers through the portal. The first pilot of the self-scheduling solution was launched at JHCP in November 2014. The data used for the case study reflected appointments as of January 1, 2019. During the 4-year period, there was targeted deployment in specific practice sites (eg, internal medicine) and for specific purposes (eg, flu shots)

but it was not until January 1, 2019 that it was broadly available across the physician group.

We used the available data extracted from the appointment system (both self-service and agent-based) to analyze the uptake, customer characteristics, appointment characteristics, and outcome of each appointment booking transaction. Our primary outcome for this analysis was whether an appointment booking was kept (patient presented for the appointment that was reserved and patient was seen); canceled; missed (patient did not show up for the appointment); or patient left without being seen. Our study analyzed all transactions associated with booking an appointment with a provider between January 1, 2019 and June 30, 2021, with a hiatus during the initial (April 1, 2020 to August 31, 2020) COVID-19 pandemic disruption period. Appointments with ancillary services (eg, lab and radiology) were not included.

The Johns Hopkins School of Public Health Institutional Review Board determined that this research study was exempt based on the use of a limited data set.

RESULTS

We identified 1 995 909 appointments transacted (ie, kept, canceled, missed, and left) at the JHCP practice sites scheduled for dates between January 1, 2019 and June 30, 2021 (except for the COVID-19 disruption period of April 1, 2020 to August 31, 2020).

User take-up and characteristics

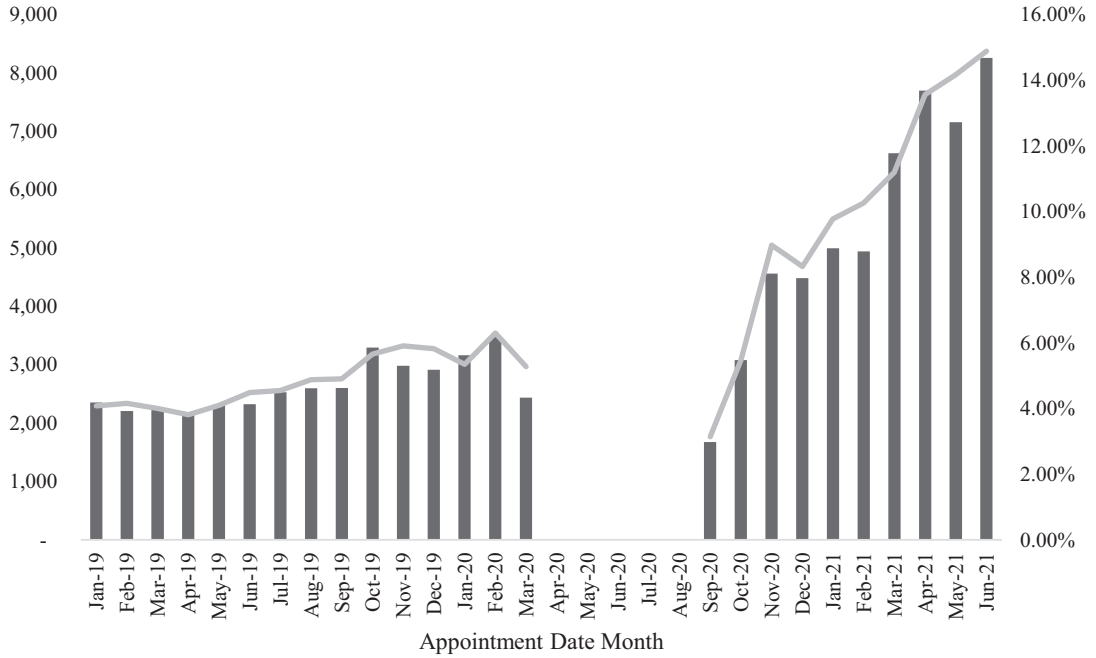
Of the 1 995 909 appointments booked at JHCP, 1 349 377 were kept. Of these kept appointments, 93 094 (6.9%) appointments were completed by patients who used automated self-scheduling to book their appointment. The uptake of automated self-scheduling at JHCP accelerated over time. In January 2019, the percent of kept appointments scheduled via automated self-scheduling was 4.1%. In June 2021, the percent increased to 14.9%. Figure 1 displays the uptake of volume based on kept appointments by appointment date month.

The mean [SD] and the median age for patients who booked appointments at JHCP were 47.2 [23.7] and 50.0 years, based on date of birth at the time of the appointment. The mean [SD] and the median age of patients who self-scheduled were 40.1 [19.57] and 41.0 years, respectively. By comparison, the age of patients who were serviced by an agent was 47.8 [23.92] and 51.0 years, respectively. Patients in the age range of 30–39 years were most likely to use automated self-scheduling (see Table 1).

The majority (99.7%) of JHCP's appointment bookings represented patients with insurance coverage; the remaining 0.3% were self-pay. The use of appointment booking methods varied by patients' insurance coverage. Sixty-seven percent of appointments booked by self-scheduling were performed by patients with commercial insurance. Appointments made by commercially insured patients represented 54.5% of agent-based bookings, by comparison. Usage by Medicaid recipients varied by the method of scheduling; 5.2% versus 7.1% of appointments were booked by users with Medicaid for automated compared to agent. The usage by Medicare beneficiaries also differed: 7.3% for self-scheduling and 23.2% for agent-based scheduling.

Outcomes of self-scheduling

The percentage of appointment bookings that ended with no-shows was lower among self-scheduled appointments compared to agent-based scheduling (2.7% vs 4.6%); however, the percentage of canceled appointments was higher (37.6% of self-scheduled appointments vs 27.0% of agent-scheduled appointments). In total, of the 1 839 824 appointments booked through an agent, 68.3% were kept, 4.6% were missed, 27.0% were canceled, and 0.1% left with-



No data were collected for the appointment transactions made between April 1, 2020 and August 30, 2020, due to operational disruptions related to the COVID-19 pandemic.

Figure 1. Uptake of automated self-scheduling during study period.

Table 1. Self-service versus agent appointment bookings by age of patient

			Customer agent		Automated self-scheduling	
Age category	*N*	% of population (column %)	*N*	% using agent (row %)	*N*	% self-scheduling (row %)
0–9	182 435	9.1	168 607	92.4	13 828	7.6
10–19	101 932	5.1	93 480	91.7	8452	8.3
20–29	151 444	7.6	134 239	88.6	17 205	11.4
30–39	264 098	13.2	232 676	88.1	31 422	11.9
40–49	261 133	13.1	230 384	88.2	30 749	11.8
50–59	303 867	15.2	278 256	91.6	25 611	8.4
60–69	317 250	15.9	299 150	94.3	18 100	5.7
70–79	255 989	12.8	247 635	96.7	8354	3.3
80+	157 719	7.9	155 360	98.5	2359	1.5
Grand total	1 995 867	100.0	1 839 824	92.2	156 085	7.8

Note: 37 persons in grand total had missing age information. Age of patient is based on date of birth at the appointment.
P-value≤.0001, calculated using the χ^2 (chi-squared) test with Prism 9.2.0 software (GraphPad Software, San Diego, CA).

Table 2. Distribution of appointment outcome by type of scheduling

Arrival status	*N*	% of population (column %)	Customer agent		Automated self-scheduling	
			Subtotal count	% of subtotal	Subtotal count	% of subtotal
Completed	1 349 377	67.6	1 256 281	68.3	93 096	59.6
No show	89 778	4.5	85 531	4.6	4247	2.7
Canceled	555 147	27.8	496 502	27.0	58 645	37.6
Left without being seen	1607	0.1	1510	0.1	97	0.1
Grand total	1 995 909	100	1 839 824	100.0	156 085	100.0

Note: "Completed" includes 47 transactions that were not documented in the system with a visit endpoint. They are included as "completed." (agent = 45; self = 2).
P-value≤.0001, calculated using the χ^2 (chi-squared) test with Prism 9.2.0 software (GraphPad Software, San Diego, CA).

out being seen. Of the 156 085 appointments made through automated self-scheduling technology, 59.6% were kept, 2.7% were missed, 37.6% were canceled, and 0.1% left without being seen (see Table 2).

DISCUSSION

The case study offered insight into automated self-scheduling in a predominantly primary care practice. We found uptake increased over time. The users of self-scheduling were more likely to be younger and commercially insured. Missed appointments were lower among users of self-scheduling; however, the cancelation rate was higher as compared to agent-based scheduling.

Users who booked using the automated solution were younger. Other studies have determined similar patterns related to the age of users.[2,13,15–17] Younger patients are more comfortable with the technology[13] and have expressed the value of self-scheduling.[18–20]

Missed appointments represent a financial burden for health systems.[21,22] Appointment nonattendance adversely impacts quality of care.[23–25] Further, Comer et al[26] concluded that missed appointments represent a "potential surrogate marker for lack of access to care." In our study, customers who transacted appointments via the automated self-scheduling solution were less likely to miss the appointment. This finding is consistent with other studies.[9–13]

While missed appointments decreased among those self-scheduling, the rate of cancelations increased when compared to agent-based scheduling. Engagement through self-service has myriad benefits for health systems[27,28]; however, evidence from other industries revealed that it must be thoughtfully and intentionally managed.[29] The timing, impact, and management of cancelations may be of import for health systems.

The findings of the case study demonstrated lower usage rates of automated self-scheduling by Medicaid recipients. The result is consistent with other studies.[15,30] The usage pattern may be evidence of digital inequity. Income-based Medicaid programs are more likely to provide coverage to members of racial minorities.[31] Broadband access in the United States is lower for racial minorities, and those with reduced economic status.[32] Other studies have identified the digital divide as a potential obstacle to self-scheduling.[4,11,17,33–36]

Some patients experience barriers to self-scheduling. For patients to self-schedule, they needed to be able to access the portal, which required an email address. Customers with reduced access to technology or lower technology literacy may be adversely impacted by self-scheduling solutions that are tethered to larger technology offerings such as portals. Self-motivation,[37] willingness,[38] and technology design[39] were factors that positively influenced the use of technology in patient cohorts that have historically suffered from a digital divide. Acknowledging and addressing these factors may offer an opportunity to overcome the challenges associated with technology access and literacy affecting lower usage rates. Training of patients has been cited as a positive influence for patients' use of other healthcare technology.[40]

Limitations

The case study represented a predominantly primary care ambulatory practice affiliated with an academic health system. Gathering

data from this setting may limit generalizability of the results. The research did not extend to the supplier or the users (eg, patients) of the technology. Engaging patients is of crucial importance in deploying, assessing, and improving consumer-facing technology in healthcare.[41–44] The self-scheduling solution is dynamic. The period of study did not extend to the initiation of the technology, which commenced with a pilot in 2014. The research results may be impacted by changing technological capabilities deployed over time. Various features were enabled (and disabled) during the research period based on organizational requirements, system issues, and preferences. The timing of the research period and changes during the research period may have introduced bias in the results. The adoption and use of the portal could not be associated with the JHCP appointment transactions under study. The inability to attribute portal adoption or usage to the customers of automated self-scheduling may limit generalizability of results. The COVID-19 pandemic occurred during the study period. With guidance from management, the data were removed for the period during which scheduling was disrupted. The use of telemedicine for provider appointments increased after the pandemic.[45,46] There may be effects of the pandemic that remain in the data, which may have influenced results.

CONCLUSION

The purpose of the exploratory case study was to evaluate self-scheduling within a predominantly primary care ambulatory practice. The case study identified the uptake, characteristics of users, and outcomes for the organization under study. Uptake increased with time, from 4% to 15% of kept appointments. Users were younger and more likely to be commercially insured. There was evidence of digital inequity based on lower usage rates by Medicaid patients, which may have been complicated by access to the intervention through a larger technology offering. Missed appointments were lower for patients who used the intervention, which presented a demonstrable advantage for the organization. A higher rate of cancelations was observed for patients who self-scheduled. As appointment self-scheduling in healthcare increases, these observations offer potential lessons to those designing, implementing, and managing this important digital-based innovation to settings across the United States and elsewhere.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

AUTHOR CONTRIBUTIONS

There are no contributors.

CONFLICT OF INTEREST STATEMENT

The authors have no competing interests to declare.

DATA AVAILABILITY

The data underlying this article cannot be shared publicly due to limitations of the use of limited data set in accordance with the data transfer and use agreement.

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