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Patient punctuality and clinic performance: observations from an academic-based private practice pain centre: a prospective quality improvement study

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ABSTRACT

Objectives: The aim of this study was to examine the effects of an intervention to alter patient unpunctuality. The major hypothesis was that the intervention will change the distribution of patient unpunctuality by decreasing patient tardiness and increasing patient earliness.

Design: Prospective Quality Improvement.

Setting: Specialty Pain Clinic in suburban Baltimore, Maryland, USA.

Participants: The patient population ranged in age from 18 to 93 years. All patients presenting to the clinic during the study period were included in the study. The average monthly volume was 86.2 (SD=13) patients. A total of 1500 patient visits were included in this study.

Interventions: We tracked appointment times and patient arrival times at an ambulatory pain clinic. An intervention was made in which patients were informed that tardy patients would not be seen and would be rescheduled. This policy was enforced over a 12-month period.

Primary and secondary outcome measures: The distribution of patient unpunctuality was developed preintervention and at 12 months after implementation. Distribution parameters were used as inputs to a discrete event simulation to determine effects of the change in patient unpunctuality on clinic delay.

Results: Data regarding patient unpunctuality were gathered by direct observation before and after implementation of the intervention. The mean unpunctuality changed from −20.5 min (110 observations, SD=1.7) preintervention to −23.2 (169, 1.2) at 1 month after the intervention, −23.8 min (69, 1.8) at 6 months and −25.0 min (71, 1.2) after 1 year. The unpunctuality 12 months after initiation of the intervention was significantly different from that prior to the intervention ($p<0.05$).

Conclusions: Physicians and staff are able to alter patient arrival patterns to reduce patient unpunctuality. Reducing tardiness improves some measures of clinic performance, but may not always improve waiting times. Accommodating early arriving patients does serve to improve clinic performance.

Strengths and limitations of this study

- To the best of our knowledge this is the first study to examine the influence of an intervention to change patient punctuality behavior and documents the related improvements in operating efficiency.
- In addition we utilise the novel combination of an intervention and simulation to explore issues impossible to consider using a single intervention increasing the time or cost of data acquisition.
- Simulation is also used to explain which patients benefit from changes in unpunctuality and which patients are negatively affected. This has never been considered in prior works.
- Several setting-related factors limited the impact of this intervention. Most significantly, waiting times were already at relatively low levels in this clinic.
- The impact of this intervention was limited by the fact that most of the patients (roughly 90%) routinely arrived early for clinic appointments before the intervention was made. Clinics experiencing higher levels of patient tardiness would see a greater impact from such an intervention.

INTRODUCTION

Managers of outpatient clinics are concerned with multiple quality measures, including delays in the delivery of care, and patient waiting times. Poor performance along these dimensions has been shown to significantly affect the satisfaction of patients and staff and to increase costs.[1 2] One factor linked to these metrics of clinic performance is patient unpunctuality. Unpunctuality has been defined as appointment time minus arrival time.[3] Negative values reflect early arrivals and positive values reflect tardy arrivals. A handful of published articles have provided detailed accounts of patient unpunctuality in outpatient settings.[3–8] However, this work is the first to develop an empirical distribution of patient unpunctuality, describe an intervention to alter that distribution, and measure how patient and system behaviours change over time as a result. Various simulation-based studies have shown that patient tardiness increases delays and extends clinic sessions.[9–12] Intuition suggests that if patient unpunctuality is reduced, and if physicians are willing to see patients early, clinic performance would improve. We combined an intervention with discrete event simulation to test this intuition.

The first step in this study was to document the impact of an intervention designed to affect the unpunctuality of patients. The intervention consisted of adding a statement to the appointment letter indicating that tardy patients would be asked to reschedule, verbally emphasising the policy when patients were contacted by telephone 24–48 h in advance, and posting a notice at the sign-in desk as a visual reminder. In the second step, we used the collected data as inputs to a clinic simulation to conduct virtual experiments to glean insights regarding system performance that were absent from prior treatment of the topic.

The first major hypothesis that this study considers is that the intervention will change the distribution of patient unpunctuality by decreasing patient tardiness and increasing patient earliness. Such changes would be seen in a reduction in average unpunctuality and an increase in the likelihood that a patient would arrive at least 15 min before each appointment, as requested in the appointment letter. The second major hypothesis is that reducing patient unpunctuality will reduce average service delay (DELAY) and the average length of the clinic session (MAKESPAN). DELAY refers to the difference between the appointment time and the patient's interaction with the attending physician. MAKESPAN refers to the time span from the start of the clinic session to the completion of service for the last patient on the schedule. These metrics are commonly cited as manageable variables that affect patient and provider satisfaction, as well as overtime-related costs.

Several prior researchers and intuition have suggested that reducing unpunctuality will reduce the average span of time between patient arrival and the patient's entrance into an examination room (WAIT).[9–12] We argue that this need not be the case. Moving the arrival stream of customers relative to fixed appointment times will alter the relationship between patient service and appointment times, but will not necessarily alter waiting times. Prior research has also verified that patients view waits after the appointment time much differently from waits before the appointment time because, when a patient is given a designated time for a clinic appointment, an expectation of timely service is created.[13] Consequently, we argue that DELAY is a more relevant measure of performance related to unpunctuality.

In addition, we argue that these aggregate measurements do not completely describe the effects of changing unpunctuality. Each patient visit includes four relevant time epochs: arrival time (Arr), appointment time (Appt), entrance into the examination room (Room) and the first encounter with the attending physician (MD). When Appt < Arr < Room < MD, the patients are tardy. Those in this group will be referred to as group L1. Those that arrive slightly early are likely to have Arr < Appt < Room < MD. This is group E1. Others will see Arr < Room < Appt < MD. This is group E2. Some patients arrive very early and have Arr < Room < MD < Appt. This is labelled as group E3. We note that since WAIT=Room−Arr, it is positive for all patient groups. On the other hand, DELAY=MD−Appt and will be negative for group E3. The key point is that altering unpunctuality has different effects on the values of WAIT and DELAY experienced by these four groups, with some groups being positively affected by a change in unpunctuality while other groups may be indifferent or even worse off by the change.

Additionally, a confounding factor that is rarely explored when considering clinic performance concerns the physician's willingness to see patients before their respective appointment times. Most simulation studies assume that patients are punctual, and those that account for unpunctuality assume that patients can be seen early if the system is empty.[3–12] In fact, many attending physicians (APs), including those involved in this study, choose to see the next patient on the schedule (if available) as soon as possible. We will refer to such settings as the 'Flexible' case. On the other hand, we have also observed many instances in which physicians use free time before a patient's appointment to perform other tasks, such as making phone calls, interacting with desk staff and processing forms. To consider the significance of this behaviour, we simulated systems in which the physician will not see a patient before the appointment time. We refer to this setting as the 'Rigid' case. Intuition suggests that reducing patient unpunctuality has different effects in these two different settings. We explored this issue using simulation because we could not enforce such a policy for the attending physicians involved in this work.

METHODS

Study methods

The first part of our study was conducted in a suburban pain clinic within the Johns Hopkins medical system. The patient population ranged in age from 18 to 93 years. One-third of the patients used Medicare as a payor, while 1.5% used Medicaid. The clinic had four examination rooms. The attending physician saw patients by appointment on Tuesdays and Fridays of each week. Clinics were scheduled to run in 4 h sessions. Average monthly volume was 86.2 (SD=13) patients. Physicians spent an additional 1.5 days per week on procedures, but procedure visits were not mixed with consultation visits on the daily schedule. The standard appointment template for the 4 h morning session is shown in figure 1, and the process flow of the clinic is depicted in figure 2. The first patient is scheduled for 08:00. Each patient signs in on entry to the clinic (step 0). A front-desk staff member retrieves the patient's records and completes patient registration (step 1). After an examination room becomes available, a clinical assistant leads the patient to the room and records the patient's vital signs (step 2). The attending physician or physician's assistant (PA) then enters the examination room and interacts with the patient (step 3). After completing the visit with the physician or PA, the patient proceeds to checkout (step 4). Finally, the patient exits the system.

Patients can be viewed as one of three types. Type 1 patients come for initial visits to the physician. We note that at this site the physician doubled as the clinic director. Type 2 patients are returning patients who need to be treated by the physician. Type 3 patients are those routinely handled by the PA. For type 3 patients, steps 0, 1 and 2 are identical to those of other patients, but step 3 is handled by the PA. However, in roughly 50% of these cases, the PA needs to consult with the physician

<table>
<tr><th></th><th>Appt. with MD</th><th>Appt. with PA</th></tr>
<tr><td>0800</td><td rowspan="3">Type 1</td><td rowspan="3">Type 3</td></tr>
<tr><td>0815</td></tr>
<tr><td>0830</td></tr>
<tr><td>0845</td><td rowspan="2">Type 2</td><td rowspan="3">Type 3</td></tr>
<tr><td>0900</td></tr>
<tr><td>0915</td><td rowspan="3">Type 1</td></tr>
<tr><td>0930</td><td rowspan="3">Type 3</td></tr>
<tr><td>0945</td></tr>
<tr><td>1000</td><td rowspan="2">Type 2</td></tr>
<tr><td>1015</td><td rowspan="3">Type 3</td></tr>
<tr><td>1030</td><td rowspan="3">Type 1</td></tr>
<tr><td>1045</td></tr>
<tr><td>1100</td><td rowspan="3">Type 3</td></tr>
<tr><td>1115</td><td rowspan="2">Type 2</td></tr>
<tr><td>1130</td></tr>
</table>

Figure 1 Schedule showing appointment times and patient types. Type 1=patients who come to the clinic for an initial visit; Type 2=patients who come for a follow-up visit; type 3=patients who come for services routinely handled by the physician's assistant (PA). Appt.=appointment. Adapted with permission from Lippincott Williams and Wilken/Wolters Kluwer Health.[14] Promotional and commercial use of the material in print, digital or mobile device format is prohibited without the permission from the publisher Lippincott Williams & Wilkins. Please contact journalpermissions@lww.com for further information.

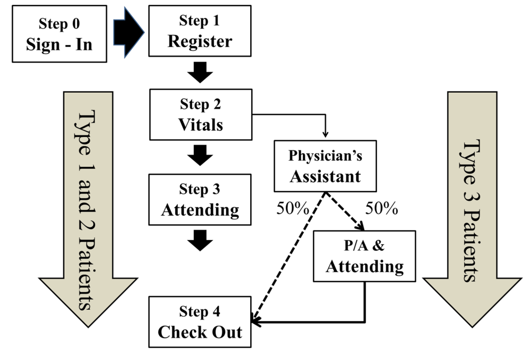

Figure 2 Process flows of the clinic. Type 1=patients who come to the clinic for an initial visit; type 2=patients who come for a follow-up visit; type 3=patients who come for services routinely handled by the physician's assistant (P/A). Reproduced with permission.[14] Promotional and commercial use of the material in print, digital or mobile device format is prohibited without the permission from the publisher Lippincott Williams & Wilkins. Please contact journalpermissions@lww.com for further information.

before releasing the patient to checkout. This consultation increases the utilisation of the physician and the congestion in the system. Consequently, this step is included in the process flow.

Activity time data were collected from February 2008 to July 2009 inclusive. Each patient visit was linked to a data sheet that travelled with the patient's file. The sign-in log was used to record the patient's arrival time. Front-desk staff recorded times for the start and end of the patient's registration time at the clinic. A clinical assistant led the patient to an examination room, gathered information from the patient and recorded start and end times for this step. The attending physician recorded the start and end times of his consultation time. The patient carried the file back to the front desk, and the staff there recorded start and end times for the step of checking out of the system.

In June 2008, the intervention was implemented to alter patient unpunctuality. Because many returning patients saw the attending physician after intervals of 90 days or more, it took time for the effects of the intervention to be fully realised. Therefore, patient unpunctuality was recorded before the intervention, and at 1, 6 and 12 months thereafter. To quantify the link between these changes and clinic performance under a fixed schedule and patient mix, we used these data as inputs to a simulation of the clinic that had been used in prior research.[14]

Role of simulation

The process flow shown in figure 2 was used to develop the simulation. Activity times are modelled as random variables with a β-distribution. The β-distribution is defined by the activity time's minimum and maximum, along with two shape parameters, which by convention are labelled α and β. This approach ensured that each of the approximating random variables shown in table 1 matched the

Table 1 Distribution parameters for activity times used in simulation of the clinic based on observations gathered after the intervention

Activity	Minimum (min)	Maximum (min)	Mean	STD	α	β
Registration	1	17	3.36	2.21	1.68	6.70
Retrieve patient	1	5	2.50	1.15	1.00	1.00
Vital time	1	25	5.52	4.52	0.60	2.63
Att time type 1	10	81	37.68	11.63	3.07	4.81
Att time type 2	7	55	22.41	9.57	1.45	3.08
PA time type 3	4	76	18.23	11.21	1.09	4.46
Att time type 3	5	10	7.48	1.43	1.00	1.00
Checkout	1	28	8.21	4.37	1.69	4.62

Att time type 1=time attending spends with type 1 patient; PA time type 3, time physician's assistant spends with type 3 patients; types 1–3 refer to patient types; Vital time, time required to check the patient's vital signs.

minimum, maximum, mean and variance of the observed variables.[15] Additional advantages stem from the fact that β-distributions can approximate a wider array of shapes than other commonly used distributions such as Log-normal, Gamma or Weibull. These parameters were used as inputs to a discrete event simulation of the clinic that was carried out with ExtendSim, V.7.0 (Imagine That Inc, San Jose, California, USA). This approach has a long history in the study of outpatient clinics.[14 16 17]

We generated the activity time distributions using activity times measured after the intervention to eliminate changes in physician behaviour as a possible explanation of changes in clinic performance. When a model of a phenomenon is repeatedly run with different sets of random data, the results of the individual runs are identically distributed and statistically independent of each other.[18–20] For that reason, we used multiple runs of the simulation with a given set of distribution parameters to generate results. All simulations used in this work include 10 000 replications, and all of the differences in average values tabulated are significant at the p<0.01 level. Interested readers may see the simulation in action at http://www.youtube.com/watch?v=EHOerKsyQKE

RESULTS

Data regarding patient unpunctuality were gathered by direct observation before and after implementation of the intervention. As shown in table 2, the mean unpunctuality changed from −20.5 min (110 observations, SD=1.7) preintervention to −23.2 (169, 1.2) at 1 month after the intervention, −23.8 min (69, 1.8) at 6 months and −25.0 min (71, 1.2) after 1 year. The unpunctuality 12 months after initiation of the intervention was significantly different from that prior to the intervention (p<0.05). The percentage of patients who arrived before the appointment time rose from 90.4% before the intervention to 95.4% after 12 months. Among those who arrived early, the average earliness rose from 24.1 min (1.44) to 26.2 min (1.5). The OR for arriving early was 2.37 (95% CI 0.63 to 8.90), and the OR for arriving at least 15 min early was 2.02 (95% CI 1.03 to 3.96). Thus, the portion of patients who arrived at least 15 min early rose significantly. The portion that arrived at least 1 min tardy fell from 7.69 to 1.5%. The average tardiness of those who were tardy fell from 16.75 min (5.59) to 2.0 min. The range of unpunctuality, defined as the maximum minus the minimum, decreased from 100 to 58 min.

Table 2 Characteristics and distribution parameters of unpunctuality at selected times

	All punctual	Preintervention	After 1 month	After 6 months	After 12 months
Minimum (min)	0.0	−60	−60	−58	−56
Maximum (min)	0.0	40	33	18	2
Mean (min)	0.0	−20.46	−23.21	−21.51	−25.03
STD	0.0	17.91	15.85	15.17	13.15
Observations	N/A	143	169	108	69
Portion early (%)	0.0	90.38	92.02	94.12	95.71
Ave earliness (min)	0.0	24.06	26.35	25.70	26.18
Portion tardy (%)	0.0	7.69	7.36	4.41	1.48
Ave tardiness (min)	0.0	16.75	14.17	8.67	2.08
α	1.0	2.55	2.86	2.34	2.05
β	1.0	3.90	4.37	2.87	1.79

All punctual, scenario in which all patients arrive at the appointment time; Portion early, proportion of patients arriving earlier than the appointment time; Ave earliness, average gap between the appointment time and arrival time for patients who arrive early.

Table 3 Performance metrics from simulations using distribution parameters for unpunctuality calculated at selected times

	All punctual	Preintervention Flex AP	Postintervention Flex AP	Preintervention Rigid AP	Postintervention Rigid AP
WAIT (min)	10.90	22.40	23.36	27.73	28.08
DELAY (min)	17.23	12.85	9.43	18.27	14.15
MAKESPAN (min)	252.29	250.61	244.49	262.34	256.62
FT Arrival (min)	56.06	69.96	71.72	79.56	79.91
FT Appt (min)	56.06	53.84	50.83	63.49	59.04
Added idle (min)				2.24	2.84
Comp by 1200 (%)	27.5	38.09	51.33	21.76	31.78
Proportion delayed (%)	100.00	66.54	61.23	74.48	71.02

AP, attending physician; DELAY, average gap between time to see attending physician or physician's assistant and appointment time; FT Arrival, time patient exits clinic minus patient's arrival time; FT Appt, time patient exits clinic minus patient's appointment time; MAKESPAN, the time span from the start of the clinic session to the completion of the last patient on the schedule; Comp by 1200 (%), percentage of 10 000 sessions in which the last patient leaves the system before 12:00; Proportion delayed, proportion of patients not making first contact with the attending physician or physician's assistant until after the appointment time; WAIT, average waiting time for all patients on the schedule.

The observed changes in patient behaviour described above had direct implications for clinic performance as determined by discrete-event simulation. Table 3 shows a collection of performance metrics from simulations of five distinct scenarios. As a benchmark, the first column reports results when unpunctuality for every patient is set to 0. While this is not realistic, it does represent a bound on the benefits of eliminating tardy patients. The second column shows the results of using the patient unpunctuality distribution parameters measured before the intervention in the Flexible setting. The third column shows the results of using patient behavioural data at 12 months after the intervention in the Flexible setting. The fourth and fifth columns show the results of using the same patient data used in columns three and four but in the Rigid setting.

Next, we considered the hypothesis that DELAY is lessened by reducing unpunctuality. Simulating the Flexible policy with the distribution of unpunctuality observed prior to the intervention, we see that DELAY falls from 12.85 (12.74) min before the intervention to 9.43 (13.64) min at 12 months after the intervention. Assuming a Rigid policy, DELAY falls from 18.27 (14.83) to 14.15 (13.10) min. We note that the Rigid setting adds roughly 5 min to DELAY in both scenarios.

When we investigated the relationship between unpunctuality and overtime-related costs, we found that under the Flexible policy, MAKESPAN falls from 250.61 (26.50) to 244.49 (28.27) min. Table 3 also shows the related result that, in the same scenario, the likelihood of completing the session on time rises from 38.09 to 51.33%. This result implies that the odds of finishing within the 4 h block increase by a factor of 1.35. Similarly, the average Flow Time, measured relative to the appointment time, falls from 53.84 (17.45) to 50.55 (18.47) min. Under the Rigid policy, MAKESPAN falls from 262.34 (27.74) to 256.62 (27.61) min. The likelihood of completing the session on time rises from

Table 4 Performance metrics from simulations for each patient group using distribution parameters for unpunctuality calculated at selected times

	All punctual	Preintervention Flex AP	Postintervention Flex AP	Preintervention Rigid AP	Postintervention Flex AP
L1%	100	14.98	0.63	14.75	0.60
WAIT L1 (min)	9.28	10.72	0.87	11.26	0.91
DELAY L1 (min)	17.62	4.70	0.76	8.57	1.04
E1%	0.00	32.64	35.86	34.21	36.97
WAIT E1 (min)	0.00	21.23	22.01	23.08	22.99
DELAY E1 (min)	0.00	24.13	22.51	27.97	25.21
E2%	0.00	12.26	14.91	12.94	16.28
WAIT E2 (min)	0.00	10.35	11.25	11.45	11.86
DELAY E2 (min)	0.00	17.79	18.89	22.01	23.27
E3	0.00	40.12	48.59	38.10	46.14
WAIT E3 (min)	0.00	12.09	12.01	12.62	12.49
DELAY E3 (min)	0.00	−5.62	−5.09	−11.31	−10.10

AP, attending physician; DELAY, average gap between time to see attending physician or physician's assistant and appointment time; L1%, percentage of patients arriving in group L1; WAIT, average waiting time for all patients on the schedule.

21.76% to 31.78%. The odds of finishing within the 4 h block increase by a factor of 1.69. The average Flow Time, measured relative to the appointment time, falls from 63.49 (17.69) to 59.04 min (16.87).

Next, we explored the effect on WAIT created by reducing unpunctuality. Under the Flexible policy, WAIT rises from 22.40 (12.20) min before the intervention to 23.36 (12.76) min at 12 months after the intervention. Assuming a Rigid policy, WAIT rises from 27.73 (12.63) to 28.08 (12.40) min. In either case, we find that the results do not support the common view that waiting times are reduced by reducing unpunctuality. We also note that the Rigid setting adds roughly 5 min to WAIT in both scenarios.

Table 4 shows descriptive statistics for the four patient groups defined by the relationship between their arrival time and related time epochs. Comparing the populations before and after the intervention for the Flexible setting shows that the size of group L1 falls from 14.98 to 0.63%. The average value of WAIT for this group falls by 10.72–0.87=9.85 min. The average value of DELAY falls by 4.70–0.76=3.94 min. Changes in WAIT and DELAY are smaller for all other groups. For group E1, WAIT increases by 0.78 min and DELAY drops by 1.62 min. For group E2, WAIT increases by 0.90 min and DELAY increases by 1.10 min. For group E3, WAIT decreases by 0.08 and DELAY increases by 0.52 min. In this sense we see that group L1 is better off, while the impact on the other groups is comparatively much smaller.

DISCUSSION

Our results suggest that an effort to alter patient unpunctuality in an ambulatory clinic can substantially alter patient behaviour and increase the likelihood that patients arrive at least 15 min before their appointment. Additionally, simulations revealed that reducing patient unpunctuality reduces delays. In other words, when cycle times were measured from appointment times, they were reduced when unpunctuality was reduced. Less of the patient waiting time occurred after the appointment time. This shift is important even if waiting times are not reduced because several researchers have verified that customers view waits before the promised service time very differently from waits after the promised service time.[21] Furthermore, reducing patient unpunctuality significantly reduces the likelihood of needing overtime to complete the patient schedule. In our setting, the likelihood of completing the morning schedule by 12:00 improved from 38% to 51%.

Further consideration of our results shows that different patient groups were affected in different ways by the intervention. Patients who were on time or slightly tardy after the intervention can be said to receive a disproportionate share of the benefit. Considering patients who are prompt or only slightly tardy like those in group L1 after our intervention, we see that the intuition that reducing unpunctuality has a great impact on waiting times is indeed true for this group. This result is particularly significant (managerially speaking) if those patients who make a great effort to be punctual have higher expectations about the promptness of service. Our results show that if a patient wishes to minimise his own waiting time, the optimal strategy is to be on time, and this is particularly true when unpunctuality is reduced.

In addition, all of the key metrics of system performance, including WAIT, DELAY and MAKESPAN are made worse by having a rigid physician, as opposed to a flexible one. This finding is quantified by the value of 'idle' shown in table 3. This value is the amount of provider idle time that is effectively inserted into the schedule when the physician waits until each patient's appointment time before interacting with them. Consequently, improvement in system performance that results from the intervention is heightened in the Rigid case. For instance, the improvement in WAIT for group L1 is 9.85 min in the Flexible case and 10.35 min in the Rigid case. Similarly for group E1, WAIT increases by 0.78 in the Flexible case and falls by 0.09 min in the Rigid case. The differences in results exist because the flexibility of the physician serves to accommodate variability in patient arrival patterns. When this flexibility is already in place, the impact of reducing patient unpunctuality is less pronounced. In this sense, the intervention actually has a greater impact if a rigid policy is in effect.

Several setting-related factors limited the impact of this intervention. Most significantly, waiting times were already at relatively low levels in this clinic. The weighted average processing time, given the mix of cases, was 46.0 min and the average wait was 23 min. It also seems reasonable to argue that the impact of this intervention was limited by the fact that most of the patients (roughly 90%) routinely arrived early for clinic appointments before the intervention was made. This proportion is at the high end of the range of patient on-time arrivals, as documented by prior research. Raising this level above 95% after 12 months implies that fully half of the patients who would have been tardy altered their behaviour in the intended direction. In clinics with a larger portion of patients who are tardy, an intervention of this nature would have a more dramatic effect.

For example, White and Pike[12] present unpunctuality data for a clinic in which nearly 40% of patients arrive after their designated appointment time. We were able to modify our simulation to include this distribution of patient unpunctuality which White and Pike labelled 'Unpunctuality 1.' We can compare this to a setting in which this distribution is shifted to mimic a change so that only 20% of patients are tardy. This is comparable to the 50% drop in tardy arrivals that resulted from our intervention, and is accomplished by reducing the range of unpunctuality values from 200 (−100 to +100) to 167 (−100 to +67), keeping the shape parameters identical. This creates a very simple illustration of the potential impacts that arise from limiting patient tardiness. Comparing these settings, this change in patient unpunctuality increases the likelihood of completing the last patient before 12:00 h from 11.9% to 34.0%. The proportion of patients who see the doctor at or before the appointment time rises from 23.2% to 31.2%, and the average completion time for the last patient on the schedule falls from 269.4 min to 254.9 min. We acknowledge that this is a hypothetical illustration. However, the point is that the types of improvements obtained in our clinic are likely to be magnified in many more common settings. Finally, the results presented here are based on institutional data from only one outpatient clinic in a very large hospital system. Other sites within this system or at another medical centre may have very different characteristics and will require specific inputs to measure results in their institutions.

In closing, we find that fairly simple, low-cost methods may be employed to reduce patient unpunctuality. The impact on the patient experience is likely to be greatest with patients who make a great effort to be prompt to clinic appointments, and physicians who cannot accommodate early patient arrivals. Furthermore, this research demonstrates that simple policies regarding unpunctuality have the potential to reduce service delays and overtime related costs.

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