The true penalty of the waiting room: the role of wait time in patient satisfaction in a busy spine practice

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OBJECTIVE Most clinics collect routine data on performance metrics on physicians for outpatient visits. However, the relationship of these metrics with patient experience is unclear. The goal of this study was to investigate the relationships between the Consumer Assessment of Healthcare Providers and Systems Clinician and Group Survey (CG-CAHPS), the standard patient experience survey, and clinic performance metrics to understand the determinants of patient satisfaction and identify targets for improving patient experience.

METHODS The authors performed a retrospective single-institution cohort review of spine surgeon metrics over 15 months including demographics, waiting-room times, in-room times, lead times, timely note closure, timely MyChart responses, and monthly patient volume. Kruskal-Wallis tests and mixed-model regression were used to determine the predictors of 3 domains of patient satisfaction—Global, Access, and Communication.

RESULTS Over 15 months, 22 surgeons conducted 27,090 visits. The average clinic visit total time was 85.17 ± 25.75 minutes. Increased wait times were associated with poor Global ($p = 0.008$), Access ($p < 0.001$), and Communication scores ($p = 0.003$) in univariate analysis. Every 10-minute increase in waiting time was associated with a 3%, 9.8%, and 2.4% decrease in Global, Access, and Communication scores, respectively. Increased in-room time was also an independent predictor of poor Access scores ($p < 0.001$). In multivariate analysis, increased wait times were negative predictors of Global ($p = 0.005$), Access ($p < 0.001$), and Communication ($p = 0.002$) scores.

CONCLUSIONS Excessive waiting-room time significantly impacts unexpected dimensions of the patient experience and impacts communication with patients. Understanding the complex relationship between the factors that inform the patient experience will help target effective interventions to improve clinic efficiency and patient satisfaction.

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KEYWORDS Consumer Assessment of Healthcare Providers and Systems Clinician and Group Survey; CG-CAHPS; cycle time; patient experience; patient satisfaction; spine clinic

CLINIC practices are constantly assessed for profitability, for operational standards such as access to care and efficiency, and—most importantly—for delivering high-quality healthcare and patient satisfaction as measured by the Consumer Assessment of Healthcare Providers and Systems Clinician and Group Survey (CG-CAHPS).^{15,27,39} These financial concerns exert forces on physicians to see more patients in less time and to meet specific quantitative performance metrics, which may not necessarily align with providing excellent care. Performance metrics for clinics and physicians may parameterize financial, process, and patient-reported outcomes.²⁶

There is substantial reporting on the current inefficiency of many practices: for example, clinics are faulted for not only keeping patients waiting for long periods of time but also spending short amounts of actual clinical care time with individual patients.²⁴ Suggestions have been presented both formally and informally as solutions to improve the patient experience by becoming more efficient, but it is important to first understand if and how these different concepts are related before significantly disrupting clinical practice by implementing large changes.

There have been several studies outside of neurosurgery that suggest a relationship between these quality

ABBREVIATIONS BH = Benjamini-Hochberg; CG-CAHPS = Consumer Assessment of Healthcare Providers and Systems Clinician and Group Survey; PCP = primary care provider.

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measures.^{4,31} For example, long wait times and poor interactions with clinicians have been shown to hurt general outpatient satisfaction scores, while administrative indicators such as access to care and readmissions have been correlated with clinical outcomes after hospital discharge. These relationships are important to identify in clinical settings for multiple reasons: they clarify areas for targeted improvement that can improve the quality of care from multiple perspectives, identify conflicting values between perspectives, and may prevent erroneous assumptions from being made about what patients value.^{2,44}

For spine surgery at our institution, the objective of this study was to answer three specific questions, as follows. 1) Is there any relationship between satisfaction and process measures for our population of spine surgeons and their patients? 2) Are the relationships present at this institution comparable to those at other institutions? 3) Can the relationships between patient and clinic variables be used to create a useful model of patient satisfaction?

Methods

This study has been approved by the institutional review board at Duke. Patient consent was not sought because patients were not subjected to any intervention resulting from this study. Results were reported using the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) statement.¹¹

Patient Population

This was a single-center, retrospective cohort analysis of all spine surgeons within our academic health system, including both neurosurgeons and orthopedic surgeons at 3 practice locations. The department, subspecialty, years of experience, fellowship training, and sex of each surgeon were publicly available. We collected monthly data over 15 months for outpatient metrics followed by our clinic performance team that are used as internal measures of clinic efficiency and performance. These include overall time from check-in to check-out in minutes (“cycle time”), the time it took to room a patient from check-in in minutes (“waiting-room time”), the time patients were in the room until check-out in minutes (“in-room time”), the proportion of notes that were closed in a timely manner, the proportion of electronic patient messages that were replied to in a timely manner, the time in days from appointment request to appointment (“lead time”), the proportion of patients seen who used MyChart (the online patient interface for the Epic EMR), the proportion of patients seen who had a primary care provider (PCP) on file, total new visits, and the total of overall visits. All time stamps were routinely collected by nurses in our clinic.

The outcome measures were the CG-CAHPS Access, Global, and Communication scores, as well as the results for individual questions within those composite scores. Global ratings are based on a single question asking patients to rate providers from 0 to 10. The monthly score for a provider is the proportion of patients who gave a 9 or 10 out of 10 score.

Access question 5 (i.e., Access-5) asks the patient to recall if they were able to see their provider within 15

minutes of their appointment time. Physician scores were calculated as the proportion of patients in that month who answered in the affirmative. The other Access questions were not included in this analysis.

Communication scores were a composite of 6 different questions (i.e., Communication-1 through -6), as follows. 1) Provider explained things in a way that was easy to understand. 2) Provider listened carefully to patient. 3) Provider gave easy-to-understand information about health questions or concerns. 4) Provider knew important information about patient’s medical history. 5) Provider showed respect for what patient had to say. 6) Provider spent enough time with patient. We analyzed the relationship between our clinical variables and each of the communication questions as well as the composite communication score.

All analyses were performed in RStudio v1.1.422. Kruskal-Wallis testing was used for categorical variables and univariate mixed-model regression was used for continuous variables in single-variable analyses. Multivariate mixed-model regression was used for the complete models. Mixed-model regression with the individual surgeon as the blocking variable was used due to repeated measures within the same population of surgeons. Significance and false discovery rate were set at 0.05, and the Benjamini-Hochberg (BH) method was used to correct for multiple comparisons in the univariate models.⁶ Pearson correlation coefficients were calculated for a linear relationship between wait time and outcome variables if the mixed-model regression was significant at the $\alpha = 0.05$ level.

Results

Overall Performance

During the 15 months of observation, 22 neurosurgical and orthopedic spine surgeons conducted 27,090 patient encounters and generated 272 provider-months of data. The majority of surgeons were male (86%), trained in neurosurgery (68%), and fellowship trained (68%) (Table 1). The mean monthly clinic characteristics are also shown in Table 1.

Global Scores

In univariate analysis, among nonmodifiable traits, fellowship training and female sex were negatively associated with Global scores ($p < 0.001$) (Table 2). Overall cycle time ($p = 0.004$) and increased waiting-room time ($p = 0.008$), but not in-room time ($p = 0.05$), were significant predictors of poor Global scores (Fig. 1). In the multivariate analysis sex was no longer significant. However, waiting-room time remained significant ($p = 0.005$), and the proportion of patients who had a PCP on file also emerged as a significant positive predictor ($p = 0.01$) (Table 2).

Access-5 Scores

In univariate analysis there were no nonmodifiable characteristics that predicted Access-5 scores (Table 3). Longer overall cycle times, waiting-room times, and in-room times were all significant predictors of lower Access-5 scores ($p < 0.001$). A 10-minute increase in waiting-room time was associated with a 9.8% absolute decrease

TABLE 1. Surgeon demographics and clinic characteristics

Variable	Value
Surgeon demographics	
Sex	
Male	19 (86%)
Female	3 (14%)
Specialty	
Neurosurgery	15 (68%)
Orthopedic surgery	7 (32%)
Fellowship	15 (68%)
Experience, yrs (median, IQR)	6.5 (3.25, 15.75)
Clinic characteristics	
Cycle time, mins (mean $\pm$ SD)	85.17 $\pm$ 25.75
Waiting-room time, mins (mean $\pm$ SD)	21.74 $\pm$ 12.21
In-room time, mins (mean $\pm$ SD)	64.00 $\pm$ 18.92
Lead time, days (mean $\pm$ SD)	17.87 $\pm$ 10.43
Timely closed notes	80%
Patient MyChart utilization rate	62%
Patient PCP utilization rate	86%
Monthly total patient vol (mean $\pm$ SD)	103.40 $\pm$ 74.61
Monthly new patient vol (mean $\pm$ SD)	29.67 $\pm$ 18.35

IQR = interquartile range.

in Access-5 scores (Fig. 2). In multivariate analysis, both waiting-room time and in-room time were significant and independent predictors of lower Access-5 scores (Table 3). A 10-minute increase in waiting-room time was correlated with a 7.87% absolute drop in scores ($p < 0.001$); a 10-minute increase in in-room time correlated with a separate 4.06% drop in scores ($p = 0.002$).

Communication Scores

In univariate analysis, specialty, month, fellowship training, and sex were all statistically significant predictors of overall Communication scores (Table 4). Overall cycle time was also a significant negative predictor ($-1.23\%/10$ minutes, $p = 0.004$). However, after being split into its components, in-room time was not significant, whereas waiting-room time was ($-2.37\%/10$ minutes, $p = 0.003$) (Fig. 3). In multivariate analysis, waiting-room time held as a predictor, with an absolute decrease of 2.74% per additional 10 minutes ($p = 0.002$). Furthermore, patient PCP utilization rate was positively correlated with higher score (Table 4).

Clinic cycle time remained a significant predictor across all questions except Communication-3. Waiting-room time was an independent predictor for Communication-1, -2, -5, and -6 (Table 5). In-room time was an independent predictor for Communication-1 only. In all cases, increased time was associated with lower scores.

Integrated Model of Patient Satisfaction

A review of the literature reveals several other contributors in addition to our own findings, and we propose a new model for patient satisfaction in the outpatient set-

ting. In our model a patient's intrinsic characteristics, including individual demographics, disease diagnosis, and overall health status establish patient preferences a priori.^{10,34,37} The patient then forms expectations prior to the visit based on available information in 4 major extrinsic categories: their doctor's characteristics,^{9,42} the reputation of the practice or institution,^{8,20} their own prior experience with the doctor/institution, and their chief complaints.³⁹ These expectations, in a multifactorial fashion, influence the interpretation of 4 major domains of experience during the visit: their interaction with the doctor, their interaction with the staff, the logistics of the visit itself, and the resolution of their chief complaints.³³ Logistics include scheduling the visit, the convenience of the location and parking, paperwork, and waiting time in between interactions—the last of which is parameterized in this study as overall cycle time, waiting-room time, and in-room time.^{13,36}

Discussion

Key Findings

The primary objective of this study was to determine which outpatient performance metrics were predictive of patient experience measures. In our population of 22 spine surgeons at our institution we found that, among modifiable factors, protracted cycle time—time spent both in the waiting room and in the examination room—resulted in not only lower Access scores but in significantly lower Global ratings and Communication scores as well.

Interpretation of Findings

The secondary objective of this study was to inform and supplement our overall understanding of the effect of wait time on nonlogistical measures of patient satisfaction. Our results are important because they demonstrate clearly that increased waiting-room time impairs surgeon–patient communication. The mechanism connecting wait time to communication issues may be rooted on the patient side in the fact that ongoing pain and neurological symptoms are endemic to our spine surgery population. Evidence shows that patients with chronic pain secondary to their condition have latent anger and frustration at baseline; these feelings are almost certainly aggravated by long wait times in clinic.^{14,17} Low-level anger has been shown to modulate attention, increase passive-aggressive behaviors, and influence the perception of time, which leaves patients retaining less information or feeling that they received less time with their provider.^{19,21} On the physician side, frustration with clinic flows can stimulate similar behavioral patterns.^{5,30} Even outside of disease-related issues, patients are additionally burdened by scheduling, parking, long wait times, and difficulty communicating with the office.^{7,13,25}

These facts explain why cycle time was correlated with individual communication questions. Surgeons may have received poor scores for “spends enough time” because patients spending more time in the examination room does not equal time spent usefully or perceived in relation to time in the waiting room. To better understand this result, it is important to avoid the trap of the so-called ecological fallacy that the patients' desire for more time with

TABLE 2. Univariate and multivariate predictors of global rating for surgeons

Global univariate predictors, n = 250	Mean Score	SD	p Value
Specialty			0.004
Spine	0.86	0.15	
Functional	0.91	0.16	
Department*			0.03
Orthopedics	0.86	0.13	
Neurosurgery	0.87	0.17	
Fellowship			<0.001
Yes	0.85	0.14	
No	0.90	0.17	
Sex			<0.001
Male	0.88	0.15	
Female	0.80	0.15	
	Mean Effect	SE	p Value
Month	0.0032	0.0021	0.13
Experience	0.0019	0.0017	0.28
Timely note closure rate	-0.036	0.061	0.56
Cycle time	-0.0017†	0.0006	0.004
Waiting-room time (mins)	-0.0030‡	0.0011	0.008
In-room time (mins)*	-0.0015§	0.0008	0.05
Timely in-basket response rate	-0.033	0.046	0.48
Lead time (days)	-0.00032	0.0011	0.77
Patient MyChart utilization rate	-0.135	0.120	0.26
Patient PCP utilization rate	0.341	0.190	0.07
Monthly new visits	-0.00021	0.00067	0.75
Monthly total visits	-0.000045	0.00019	0.81
Global multivariate predictors, n = 227	Mean Score	SD	p Value
Intercept	0.62	0.20	0.003
Spine specialty (ref = Functional)	-0.03	0.05	0.54
Orthopedic surgery (ref = Neurosurgery)	-0.03	0.04	0.46
Month	0.004	0.002	0.10
Experience (yrs)	0.002	0.002	0.27
Female surgeon	-0.07	0.05	0.16
Timely note closure rate	-0.06	0.06	0.38
Waiting-room time (mins)	-0.00352¶	0.001	0.005
In-room time (mins)	-0.00089**	0.001	0.28
Timely in-basket response rate	-0.04	0.05	0.41
Lead time (days)	-0.0003	0.001	0.83
Patient MyChart utilization rate	-0.06	0.14	0.66
Patient PCP utilization rate	0.55	0.20	0.01
Monthly new visits	0.0001	0.001	0.94
Monthly total visits	0.0002	0.0003	0.54

Boldface type indicates statistical significance.

* Not significant after BH correction.

† -1.7% per 10 minutes.

‡ -3.0% per 10 minutes.

§ -1.5% per 10 minutes.

¶ -3.52% per 10 minutes.

** -0.89% per 10 minutes.

FIG. 1. Global rating as a function of wait time. Across all providers and encounters, prolonged average waiting time was associated with a 2.99% absolute reduction in global rating scores per 10 additional minutes of waiting in univariate mixed-methods regression. Dept = department; N = neurosurgery (red dots); O = orthopedic surgery (blue dots). $R = -0.18$, $p = 0.0056$. Figure is available in color online only.

the provider does not translate to longer time in the examination room.^{18,43} “Clear explanations” may get poor scores because angry and frustrated patients are not able to pay as much attention, and physicians, frustrated perhaps by long wait times or overbooked clinics, are not taking the time to explain better.³⁰ Patients may rate surgeons poorly for “knowing medical history” and “careful listening” because it seems to them that surgeons are busy looking them up in the chart before and during the visit. Whether or not these effects are due to physician or patient responses to frustration with long wait times, the responsibility lies with the clinics to improve the root cause.

Our results also reiterate that waiting-room time is a modifiable factor that is a significant contributor to global satisfaction. This has been demonstrated both in other spine practices and in specialties outside of spine surgery.^{12,27,31,35–37} This is important because overall satisfaction has been shown to influence downstream patient behavior: patients who are less satisfied are less likely to schedule follow-up clinic visits, more likely to use emergency services, and less likely to adhere to medications and treatment recommendations.^{4,22,37}

So how do we improve wait times and the perception thereof? We must address the underlying causes of an inefficient clinic. Some logistical issues have been identified, such as appointment type, late doctor arrival, and early-arriving patients who wait long periods until their actual appointment time.^{1,23} Communication delays are also a significant source of problems and are frustrating to patients.⁴¹

There have been several interventions that have dem-

onstrated the proof of these concepts, many of which were rooted in the basic principles of quality and process improvement. In order to create an effective intervention, a team must analyze the factors contributing to clinic delays, improve those processes, reduce variability within those processes, and then address the psychology among all stakeholders about delays.²⁸ Some specific methods of doing so use plan-do-study-act (PDSA) cycles, lean-manufacturing principles, and lean and 5-sigma strategies.^{25,32,38,40} Addition of physician extenders including physician assistants and nurse practitioners to the health-care team has also been shown to improve patient satisfaction with their visit as well as healthcare staff satisfaction in communication with families and clinical documentations.²⁹ Each intervention, including our own suggestions listed below, is not strictly generalizable because the factors present within each health system will be unique at both a system and provider level, but they do provide a framework for addressing those factors.^{3,19}

In our own clinic we have identified and addressed some areas for improvement that may be helpful for other practices to consider, including the following.

- Using the Clinic Satisfaction Tool to solicit chief complaints up front during the visit and reduce door handle delays⁴⁵
- Chart reviewing complete list before clinic day and dictating notes after, not in between, patient visits
- Limiting the total number of patients seen on a given day
- Employing more physician extenders to conduct initial patient interviews

TABLE 3. Univariate and multivariate predictors of Access-5 rating

Access-5 univariate predictors, n = 250	Mean Score	SD	p Value
Specialty			0.13
Spine	0.71	0.25	
Functional	0.63	0.30	
Department*			0.18
Orthopedics	0.68	0.21	
Neurosurgery	0.70	0.28	
Fellowship			0.13
Yes	0.70	0.24	
No	0.68	0.29	
Sex			0.27
Male	0.69	0.25	
Female	0.73	0.26	
	Mean Effect	SE	p Value
Month*	0.0065	0.0032	0.04
Experience	-0.0039	0.0034	0.26
Timely note closure rate	-0.011	0.10	0.91
Cycle time	-0.0060†	0.00075	<0.001
Waiting-room time (mins)	-0.0098‡	0.0017	<0.001
In-room time (mins)	-0.0064§	0.0010	<0.001
Timely in-basket response rate	0.028	0.074	0.71
Lead time (days)	-0.0012	0.0017	0.50
Patient MyChart utilization rate	-0.34	0.19	0.09
Patient PCP utilization rate	0.36	0.30	0.23
Monthly new visits	-0.0016	0.0011	0.14
Monthly total visits	-0.00049	0.00032	0.13
Access-5 multivariate predictors, n = 227	Mean Score	SD	p Value
Intercept	0.78	0.31	0.01
Spine specialty (ref = Functional)	0.10	0.08	0.25
Orthopedic surgery (ref = Neurosurgery)	-0.04	0.07	0.59
Month	0.001	0.003	0.75
Experience (yrs)	0.002	0.003	0.45
Female surgeon	-0.05	0.08	0.55
Timely note closure rate	0.02	0.10	0.80
Waiting-room time (mins)	-0.00787¶	0.002	<0.001
In-room time (mins)	-0.00406**	0.001	0.002
Timely in-basket response rate	0.02	0.07	0.75
Lead time (days)	-0.0003	0.002	0.88
Patient MyChart utilization rate	-0.23	0.21	0.26
Patient PCP utilization rate	0.49	0.30	0.11
Monthly new visits	-0.001	0.002	0.62
Monthly total visits	-0.0003	0.001	0.55

Boldface type indicates statistical significance.

* Not significant after BH correction.

† -6.0% per 10 minutes.

‡ -9.8% per 10 minutes.

§ -6.4% per 10 minutes.

¶ -7.87% per 10 minutes.

** -4.06% per 10 minutes.

FIG. 2. Access-5 rating as a function of wait time. Across all providers and encounters, prolonged average waiting time was associated with a 9.84% absolute reduction in Access question 5 scores per 10 additional minutes of waiting in univariate mixed-methods regression. *Red dots* indicate neurosurgery department and *blue dots* indicate orthopedic surgery department. $R = -0.32$, $p < 0.0001$. Figure is available in color online only.

- Incorporating breaks within the schedule to allow staff to catch up with patient visits
- Real-time tracking of patient location in clinic to pinpoint bottleneck in traffic
- Improving communication between front and back nursing and staff¹³
- Enriching the waiting-room experience with pleasant décor, distractions, and refreshments¹¹

All of these interventions have worked because there is some true connection between wait times and a satisfactory patient experience, modulated by and interacting with several other factors, as illustrated in our proposed model.

Additionally, connection with a PCP had a positive impact on both Global and Communication scores. Not only do PCPs help patients cope better with their chronic conditions as the first line of contact in their care,¹⁶ but they also provide longitudinal care that translates to greater overall satisfaction with care and higher Global score. Furthermore, PCPs exercise great responsibility in the successful delivery of integrated care to patients. Hence, a good relationship between patients and their PCPs can result in better coordination of treatment and timely follow-ups that increase patients' perceptions of quality of care and that influence the Communication score.

A survey like the CG-CAHPS does not perfectly capture the 4 patient-centered domains we identified: doctor experience, staff experience, visit logistics, and resolution of the chief complaints. Instead, CG-CAHPS explores 3 themes relevant to this discussion that are each influenced in different degrees by multiple domains of experience. The Global score is, based on the general nature of the

question, likely to be an amalgamation of both the interaction with the doctor and the chief complaints. The Access score is based on staff interactions and logistics because these are the questions directly asked. Last, the Communication score, which in an ideal situation would capture only interaction with the doctor and resolution of the chief complaints (in the sense of properly communicating the plan with the patient), seems also to be capturing logistical issues, based on our findings.

This framework is important because it allows us to target specific areas to improve patient satisfaction, either in managing expectations or in improving the experience, and it also directs us to where we should look for downstream effects. Future study looking into the association between physician quality score and cycle time in its impact on patient satisfaction scores is warranted.

Limitations of the Study

The limitations of our findings are based mainly on variations between physicians in key encounter events. Because our center is a major academic facility, our in-room time may include interactions with nursing, medical students, residents, advanced practice providers, and attendings, as well additional waiting-room time between any of these encounters. Another limitation of the study is the measurement of cycle time, waiting-room time, and in-room time. Time started when patients checked in and ended when they checked out, and we rely on clinic staff to accurately document when patients are roomed. Last, months in which providers had fewer CG-CAHPS materials returned caused floor/ceiling effects in the response

TABLE 4. Univariate and multivariate predictors of communication rating

Communication rating univariate predictors, n = 250	Mean Score	SD	p Value
Specialty			0.004
Spine	0.89	0.11	
Functional	0.93	0.10	
Department*			0.03
Orthopedics	0.89	0.084	
Neurosurgery	0.90	0.13	
Fellowship			<0.001
Yes	0.88	0.11	
No	0.93	0.12	
Sex			<0.001
Male	0.91	0.11	
Female	0.86	0.093	
	Mean Effect	SE	p Value
Month	0.0041	0.0014	0.004
Experience	0.00092	0.0014	0.51
Timely note closure rate	0.0052	0.042	0.90
Cycle time	-0.0012†	0.00042	0.004
Waiting-room time (mins)	-0.0024‡	0.00079	0.003
In-room time (mins)	-0.00090§	0.00056	0.11
Timely in-basket response rate	-0.019	0.032	0.55
Lead time (days)	0.00024	0.00077	0.76
Patient MyChart utilization rate	-0.079	0.085	0.35
Patient PCP utilization rate	0.19	0.133	0.16
Monthly new visits	-0.000073	0.00047	0.88
Monthly total visits	-0.000014	0.00014	0.92
Communication rating multivariate predictors, n = 227	Mean Score	SD	p Value
Intercept	0.73	0.15	<0.001
Spine specialty (ref = Functional)	-0.03	0.04	0.46
Orthopedic surgery (ref = Neurosurgery)	-0.01	0.03	0.76
Month	0.004	0.002	0.01
Experience (yrs)	0.001	0.001	0.46
Female surgeon	-0.04	0.04	0.28
Timely note closure rate	0.001	0.04	0.98
Waiting-room time (mins)	-0.00274¶	0.001	0.002
In-room time (mins)	-0.00070**	0.001	0.25
Timely in-basket response rate	-0.04	0.03	0.28
Lead time (days)	0.0001	0.001	0.90
Patient MyChart utilization rate	-0.03	0.10	0.75
Patient PCP utilization rate	0.34	0.14	0.02
Monthly new visits	0.0002	0.001	0.80
Monthly total visits	0.0001	0.0002	0.80

Boldface type indicates statistical significance.

* Not significant after BH correction.

† -1.2% per 10 minutes.

‡ -2.4% per 10 minutes.

§ -0.9% per 10 minutes.

¶ -2.74% per 10 minutes.

** -0.70% per 10 minutes.

FIG. 3. Communication rating as a function of wait time. Across all providers and encounters, prolonged average waiting time was associated with a 2.37% absolute reduction in communication rating scores per 10 additional minutes of waiting in univariate mixed-methods regression. Red dots indicate neurosurgery department and blue dots indicate orthopedic surgery department. $R = -0.19$, $p = 0.0041$. Figure is available in color online only.

variable due to monthly means of 100% or 0% that limit the interpretation of the slope of the regression.

Despite the unit of analysis being the physician's monthly aggregate and not the patient, there are some missing data if no patient who responded for that month answered a particular question; additionally, there are recently hired providers who supply less than 6 months of data to the analysis. The short period of time on the study may introduce an unmeasured bias related to a provider either being new to the practice or new as an attending. Despite these limitations, our mixed sample of neurosurgical and orthopedic spine surgeons was reasonably consistent across the included practice locations, and we believe

that our group constitutes a reasonable sample of academic spine surgeons.

Conclusions

We found that there were both modifiable and non-modifiable physician factors that had a significant impact on multiple domains of patient satisfaction, including sex, fellowship training, waiting-room time, and in-room time. The effect of cycle time on nonaccess measures of satisfaction implies that the roots of patient satisfaction are complex, and we have proposed an updated theoretical framework to clarify those relationships. This framework

TABLE 5. Univariate relationships between cycle time and communication scores

Assessments of Communication	Cycle Time		Waiting-Room Time		In-Room Time	
	%/10 Mins	p Value	%/10 Mins	p Value	%/10 Mins	p Value
1. Clear explanation	-1.6%	<0.001	-2.7%	0.005	-1.6%	0.01
2. Careful listening	-1.4%	0.004	-3.2%	<0.001	-0.9%	0.20
3. Easy-to-understand information	-0.7%	0.14	-1.3%	0.20	-0.5%	0.42
4. Knows medical history	-1.2%	0.05	-1.1%	0.16	-1.7%	0.12
5. Respect	-0.9%	0.03	-1.9%	0.02	-0.6%	0.29
6. Spent enough time	-1.7%	0.002	-3.4%	0.002	-1.3%	0.07

Univariate mixed-model regression results for average cycle time, waiting-room time, and in-room time as independent predictors for each of the 6 individual communication questions. Significance was set to $p < 0.05$. Cycle time is the sum of waiting-room and in-room time. Boldface type indicates statistical significance.

allows us and other practices to not only target specific areas for improvement, such as reducing cycle time, but also tells us where to expect to see an effect, which in the case of cycle time is across all satisfaction measures.

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Disclosures

Dr. Gottfried is a medical consultant for Pioneer Surgical Technology, Inc.

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Conception and design: Zakare-Fagbamila. Acquisition of data: Zakare-Fagbamila, Dickson. Analysis and interpretation of data: Zakare-Fagbamila, Park. Drafting the article: Zakare-Fagbamila, Park. Critically revising the article: Park. Reviewed submitted version of manuscript: Park. Statistical analysis: Zakare-Fagbamila, Cheng. Study supervision: Gottfried.

Supplemental Information

Previous Presentations

Portions of this work were given as oral presentations at the following venues: 1) North American Spine Society 34th Annual Meeting, September 25–28, 2019, Chicago, IL; and 2) Spine Summit 35th Annual Meeting, March 14–17, 2019, Miami, FL.

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