The Association Between Sociodemographic Factors, Social Determinants of Health, and Spine Surgical Patient Portal Utilization

Edwin Owolo, BA, Zoey Petitt, BS,* Antoinette Charles, BS,* César Baëta, MP, MMCi,* Emily Poehlein, MB,† Cynthia Green, PhD,† Chad Cook, PT, PhD,† Jacob Sperber, BA,* Anisha Chandiramani, MD, MMCi,‡§ Matthew Roman, MMCi, MHA,§‖ C. Rory Goodwin, MD, PhD,* and Melissa Erickson, MD, MBA¶*

Study Design: Retrospective cohort study.

Objective: To examine patient portal use among the surgical spine patient population across different sociodemographic groups and assess the impact of patient portal use on clinical outcomes.

Summary of Background Data: Patient portals (PP) have been shown to improve outcomes and quality of care. Engaging them requires internet access, technological literacy, and dexterity, which may serve as access barriers.

Methods: After exclusion criteria were applied, the study included data for 9211 encounters from 7955 patients. PP utilization was defined as having activated and used the Duke University Medical Center patient portal system, MyChart, at least once. Sociodemographic characteristics included urbanicity, age, race, ethnicity, language, employment, and primary insurer. Clinical outcomes included the length of hospital stay during the procedure, 30-day return to the emergency department, 30-day readmission, and being discharged somewhere other than home.

Results: Being older than 65, non-White, unemployed, non–English-speaking, male, not-partnered, uninsured or publicly insured (Medicaid, Medicare and under 65 years of age, or other government insurance), and living in a rural environment were all risk factors for decreased PP utilization among surgical spine patients. A one-risk factor decrease in the number of social risk factors was associated with a 78% increase in the odds of PP utilization [odds ratio (OR): 1.78; 95% Confidence interval (CI): 1.69–1.87; $P < 0.001$]. Patients not utilizing the portal at the time of their procedure had higher odds of 30-day readmission (OR: 1.59; 95% CI: 1.26–2.00), discharge somewhere other than home (OR: 2.41, 95% CI: 1.95–2.99), and an increased length of hospital stay (geometric mean ratio: 1.21; 95% CI: 1.12–1.30) compared with those who utilized it.

Conclusions: In patients undergoing spine procedures, PPs are not equally utilized among different sociodemographic groups. PP utilization is also associated with better outcomes. Interventions aimed at increasing PP uptake may improve care for certain patients.

Key Words: patient portal utilization, sociodemographic factors, social determinants of health, outcomes, spine surgery

(*Clin Spine Surg* 2023;36:301–309)

The development of the patient portal (PP) has given patients a more active role in their care by allowing them to see their medications, test results, imaging, upcoming appointments, medical bills, and price estimates. The portal also affords an opportunity to provide patient education and opportunities for engagement throughout an episode of care or for chronic care. Studies demonstrate that the use of these portals contributes to improved quality of care.[1] PPs require internet access, a digital device, and a minimum amount of technical proficiency, which has caused certain patients to forgo their use. Social determinants of health, such as financial security, as well as sociodemographic factors, such as race, age, and sex, have served as barriers to PP utilization in various patient populations.[2]

Given that PPs have been associated with better clinical outcomes but have shown to be associated with decreased utilization in certain populations,[1,2] this begs the question whether PP utilization has a unique role in the patient care experience. Existing literature on PP

Received for publication August 22, 2022; accepted March 9, 2023.

From the *Department of Neurosurgery; †Department of Biostatistics and Bioinformatics; ‡Division of General Internal Medicine; Department of Medicine; §Duke Health Technology Solutions; ‖Duke Network Services; and ¶Department of Orthopaedic Surgery, Duke University Medical Center, Durham, NC.

Data from this study was presented as a poster at the Duke Orthopedic Research Day on April 26, 2022 at Duke University (Durham, NC).

C.C.: Paid research consultant for the Hawkins Foundation. C.R.G.: Received grants from the Robert Wood Johnson Harold Amos Medical Faculty Development Program, the Federal Food and Drug Administration, and the NIH/NINDS K12 NRCDP Physician Scientist Award. Consultant for Medtronic. M.E.: Medtronic Honorarium and Fellowship Funding, Depuy Synthes Honorarium, Globus Honorarium, Restore3D Consulting and Shares. The remaining authors declare no conflict of interest.

Reprints: Melissa Erickson, MD, MBA, Associate Professor of Orthopedic Surgery, Department of Orthopedic Surgery, Duke University Medical Center, DUMC Box 3077, Durham, NC 27710 (e-mail: Melissa.erickson@duke.edu).

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

utilization across different specialties as it relates to sociodemographic factors and social determinants of health has demonstrated general trends of decreased PP utilization in patients who are older, non-White, and uninsured or publicly insured.[2–4]

While existing literature across different specialties has found general trends of decreased PP utilization in patients that are older, non-White, and uninsured or publicly insured,[2–4] there have been no studies examining the PP use in the surgical spine patient population specifically. The purpose of this study was to describe portal users from nonusers in terms of sociodemographic characteristics, identify which characteristics may predict nonusage, and look for associations between usage and clinical outcomes.

The association between sociodemographic factors, social determinants of health, and PP utilization was examined within several different contexts that could possibly have a confounding effect on PP utilization, including elective and nonelective procedures as well as pre–COVID-19 and post–COVID-19 pandemic. We hypothesized that (1) selected sociodemographic variables would be associated with lower PP utilization rates; (2) PP utilization would be associated with better clinical outcomes; (3) PP utilization rates would be higher in patients undergoing elective procedures rather than nonelective procedures; and (4) PP utilization rates would be higher in the postpandemic period. Identifying and understanding current barriers to access in postoperative spine patients with lower PP utilization could lead to targeted interventions that may improve patient satisfaction, postoperative management, and outcomes.

METHODS

Study Design, Setting, and Participants

A retrospective study of patients with a spine-related condition treated surgically (elective and nonelective) between the dates of January 1, 2019 and June 30, 2021 at Duke University Medical Center was performed. Patients were required to have at least 1 scheduled form of visit, either an outpatient visit or an inpatient visit, for their spine-related condition. Patients under the age of 18 were excluded. In addition, only patients with complete demographic data and patient portal status information were included in the analysis. Data were collected from Duke University Medical Center electronic health records, obtained through performance services, and were consecutive (IRB #: 90408).

Variables

The primary outcome of interest was PP (MyChart engineered by Epic Systems Corporation) utilization, which was defined as having activated and used MyChart at the time of their procedure (ie, activated or not activated). Patients who did not activate and use MyChart may have declined utilization, de-activated, have pending activation, etc. Binary sociodemographic variables of interest used for modelling included the following: urbanicity (rural vs. urban, defined by zip code); age at the time of the procedure (≥ 65 vs. < 65 y); sex (male vs. female); marital status (divorced, separated, single, or widowed vs. in a domestic partnership); race (non-White vs. White); ethnicity (Hispanic vs. non-Hispanic); language (no English vs. English); employment (unemployed vs. employed); and primary insurer (no insurance/public insurance vs. private insurance). A composite continuous variable of the number of social determinants of health (hereby termed social risk factors), calculated from the sociodemographic variables above, was used as a predictor variable in the models. Clinical outcomes of interest included the length of hospital stay for the procedure (continuous), 30-day return to the emergency department after discharge (ED; binary), 30-day readmission after discharge (binary), and being discharged somewhere other than home (binary).

Statistical Analysis

Demographic and clinical characteristics of the study cohort were summarized descriptively on the patient level, stratified by MyChart utilization. Continuous variables are displayed as mean/SD, median/25th–75th percentiles (Q1–Q3), and range. Categorical variables are displayed as count (percentage) for non-missing data.

To assess the association between sociodemographic characteristics and MyChart utilization, multivariable generalized linear mixed models, with a binary distribution and logit link function, were constructed using the binary social risk factor variables defined above. A random intercept was used to account for repeated encounters among some patients. Since the rate of MyChart utilization was high in this cohort, all candidate variables were included in the regression models. In addition, a model with the composite number of social risk factors variable as a predictor was run using the same model specifications as above.

Analyses were conducted separately among patients with elective and nonelective procedures and patients receiving procedures pre-COVID (January 1, 2019–March 17, 2020) and post-COVID(March 18, 2020–June 30, 2021) pandemic to assess utilization differences between these groups using the same methods as mentioned above. Associations pre-COVID and post-COVID were statistically compared for ethnicity, insurance type, race, and language using interaction terms in the multivariable model.

Clinical outcomes were compared using mixed-effects models for each clinical outcome, with MyChart utilization as the predictor. A binary distribution with a logit link function was used for binary outcomes (logistic regression), while a log-normal distribution was used for the length of stay. The purpose of the log-normal distribution was to create a normal distribution for the length of stay as most patients have relatively short stays compared with a select few that require longer stays. Mixed-effects models included covariates for all social risk factors assessed above, as well as elective versus nonelective surgery. Models were adjusted for all social risk factors and nonelective versus elective indicators. A random intercept was included to account for multiple encounters for some patients. Fixed-effect estimates [odds ratios (OR) for binary outcomes and

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

geometric mean ratios (GMR), a measure of the relative difference in medians between the 2 groups for continuous outcomes] and associated 95% confidence intervals (CI) are reported. The GMR approximates the expected mean difference on the log scale.

SAS version 9.4 (SAS Institute, Inc.,) was used for all analyses, and a P value < 0.05 was considered statistically significant.

RESULTS

Data were obtained for 9793 encounters from 8480 patients, with some patients completing more than 1 encounter. Sixty-one patients were excluded because the patients were under the age of 18 and 16 patients were excluded due to missing PP utilization status. An additional 448 patients were excluded due to incomplete demographic data. After exclusion criteria were applied, the study included data for 9211 encounters from 7955 patients (Fig. 1).

Demographic Characteristics

Table 1 summarizes the demographic and clinical characteristics of the study cohort on the patient level by PP utilization status at the first encounter. The average age for patients in the cohort was 60.1 years (SD 13.9 y). Most patients in the study cohort were Caucasian/White (79.2%), Not Hispanic or Latino (98.2%), and English-speaking (99.2%). A large proportion were married (67.7%), retired (45.2%), insured through Medicare (47.9%), and residing in an urban area (70.2%). PP was activated and utilized in 7500 of 9211 encounters (81.4%). A higher proportion of those who activated and utilized the PP were younger (59.3 vs. 63.4 y, respectively), female (51.9% vs. 42.9%), Caucasian/White (81.8% vs. 68.3%), married (70.7% vs. 55.5%), employed full time (31.2% vs. 16.1%), residing in an urban area (72.9% vs. 59.2%), and insured through a private company (47.2% vs. 24.3%). Patients who did not use the PP had a higher average number of social risk factors (mean 3.3 [SD 1.3]) compared with those who did utilize the PP [mean 2.4 (SD 1.2)].

Sociodemographic Characteristics Associated with Patient Portal Utilization

All sociodemographic variables except for ethnicity were significantly associated with PP utilization (Table 2). Patients in lower-risk sociodemographic categories had higher odds of PP utilization. As shown in Figure 2, the proportion of patients utilizing PP decreased approximately linearly as the number of social risk factors increased. A one-risk factor decrease in the number of social risk factors was associated with a 78% increase in the odds of PP utilization (OR: 1.78; 95% CI: 1.69–1.87; $P < 0.001$). While age above 65 was associated with decreased odds of PP utilization, there was no obvious threshold for the age that discriminated the use of PP past 65 years of age (Fig. 3).

Association Between Sociodemographic Characteristics and Patient Portal Utilization Among Patients Receiving Elective Versus Nonelective Procedures

Of the patients receiving elective procedures, the PP was utilized in 7280 of the 8824 encounters (82.5%), compared with only 220 of the 387 encounters for nonelective procedures (56.8%). Among patients that received elective procedures, all risk factors with the exception of ethnicity and language, were significantly associated with PP utilization (Table 3). Patients in the lower-risk sociodemographic category had higher odds of PP utilization. For patients that received nonelective procedures, marital status was the only risk factor associated with PP utilization, with those in a domestic

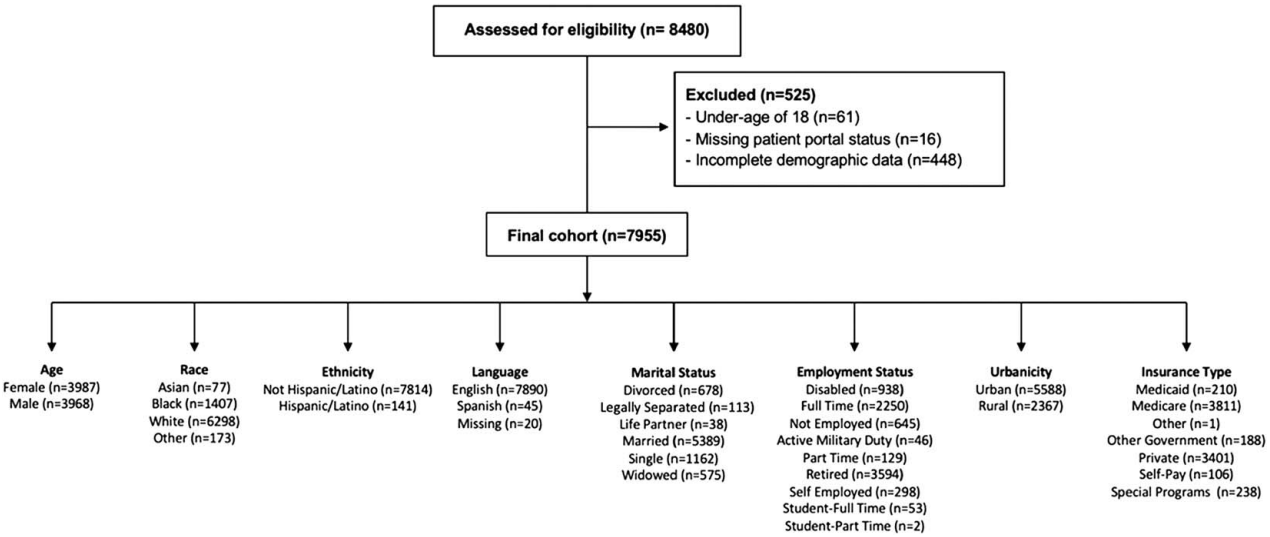

FIGURE 1. Study enrollment and sociodemographic data.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

TABLE 1. Demographic and Clinical Characteristics by Patient Portal Utilization on the Patient-Level (Using Characteristics at First Encounter)

	Patient portal utilization		
Patient characteristics	**Not used (N = 1546)**	**Used (N = 6409)**	**Total (N = 7955)**
Age			
Mean (SD)	63.4 (13.9)	59.3 (13.8)	60.1 (13.9)
Median	66.0	61.0	62.0
Q1, Q3	56.0, 73.0	50.0, 70.0	51.0, 71.0
Range	(18.0–95.0)	(18.0–92.0)	(18.0–95.0)
Sex (%)			
Female	663 (42.9)	3,324 (51.9)	3,987 (50.1)
Male	883 (57.1)	3,085 (48.1)	3,968 (49.9)
Race (%)			
Asian	4 (0.3)	73 (1.1)	77 (1.0)
Black or African American	443 (28.7)	964 (15.0)	1,407 (17.7)
Caucasian/White	1,056 (68.3)	5,242 (81.8)	6,298 (79.2)
Other	43 (2.8)	130 (2.0)	173 (2.2)
Ethnicity (%)			
Not Hispanic or Latino	1,516 (98.1)	6,298 (98.3)	7,814 (98.2)
Hispanic or Latino	30 (1.9)	111 (1.7)	141 (1.8)
Language (%)			
English	1521 (98.4)	6369 (99.4)	7890 (99.2)
Spanish	19 (1.2)	26 (0.4)	45 (0.6)
Other	6 (0.4)	14 (0.2)	20 (0.3)
Marital status (%)			
Divorced	155 (10.0)	523 (8.2)	678 (8.5)
Legally Separated	36 (2.3)	77 (1.2)	113 (1.4)
Life Partner	3 (0.2)	35 (0.5)	38 (0.5)
Married	858 (55.5)	4531 (70.7)	5389 (67.7)
Single	316 (20.4)	846 (13.2)	1162 (14.6)
Widowed	178 (11.5)	397 (6.2)	575 (7.2)
Employment status (%)			
Disabled	245 (15.8)	693 (10.8)	938 (11.8)
Full Time	249 (16.1)	2001 (31.2)	2250 (28.3)
Not Employed	147 (9.5)	498 (7.8)	645 (8.1)
On Active Military Duty	6 (0.4)	40 (0.6)	46 (0.6)
Part Time	17 (1.1)	112 (1.7)	129 (1.6)
Retired	815 (52.7)	2779 (43.4)	3594 (45.2)
Self Employed	54 (3.5)	244 (3.8)	298 (3.7)
Student—Full Time	12 (0.8)	41 (0.6)	53 (0.7)
Student—Part Time	1 (0.1)	1 (0.0)	2 (0.0)
Urbanicity (%)			
Urban	916 (59.2)	4,672 (72.9)	5,588 (70.2)
Rural	630 (40.8)	1,737 (27.1)	2,367 (29.8)
Insurance type (%)			
Medicaid	81 (5.2)	129 (2.0)	210 (2.6)
Medicare	931 (60.2)	2,880 (44.9)	3,811 (47.9)
Other	1 (0.1)	0 (0.0)	1 (0.0)
Other Government	28 (1.8)	160 (2.5)	188 (2.4)
Private	375 (24.3)	3,026 (47.2)	3,401 (42.8)
Self-Pay	35 (2.3)	71 (1.1)	106 (1.3)
Special Programs	95 (6.1)	143 (2.2)	238 (3.0)
Number of social risk factors			
Mean (SD)	3.3 (1.3)	2.4 (1.2)	2.6 (1.3)
Median	3.0	2.0	3.0
Q1, Q3	2.0, 4.0	2.0, 3.0	2.0, 3.0
Range	(0.0–7.0)	(0.0–7.0)	(0.0–7.0)

partnership having 2.36 times the odds of utilizing PP compared with those who were single (OR: 2.36; 95% CI: 1.37–4.06; $P = 0.007$). Having fewer social risk factors was associated with higher odds of PP utilization among patients receiving both nonelective (OR: 1.56; 95% CI: 1.29–1.88; $P < 0.001$) and elective procedures (OR: 1.91, 95% CI: 1.78–2.05; $P < 0.001$).

Association Between Sociodemographic Characteristics and Patient Portal Utilization Among Patients Receiving Procedures Pre–COVID-19 Versus Post–COVID-19 Pandemic

Before the COVID-19 pandemic, patients in 3865 of the 4910 (78.7%) encounters utilized PP. Factors associated with increased odds of PP utilization for these

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

TABLE 2. Multivariable Regression Results for Patient Portal Utilization

Variable	OR (95% CI)	*P*
Age < 65	2.00 (1.69–2.37)	< 0.001
Employed	1.39 (1.17–1.65)	< 0.001
English-speaking	3.04 (1.56–5.92)	< 0.001
Female	1.70 (1.49–1.93)	< 0.001
In a domestic partnership	1.91 (1.68–2.18)	< 0.001
Non-Hispanic	0.63 (0.37–1.06)	0.082
Private insurance	1.97 (1.62–2.40)	< 0.001
Urban	1.95 (1.71–2.21)	< 0.001
White	2.01 (1.74–2.32)	< 0.001

patients were age below 65, speaking English, female sex, being in a domestic partnership, having private insurance, and White race. After the COVID-19 pandemic, patients in 3635 of the 4301 (84.5%) encounters utilized PP. Factors associated with higher odds of PP utilization after the COVID-19 pandemic were age below 65, being employed, female sex, being in a domestic partnership, having private insurance, and being White race (Table 4). Having fewer social risk factors was associated with higher odds of PP utilization among patients receiving procedures both pre–COVID-19 (OR: 1.87; 95% CI: 1.71–2.04; $P < 0.001$) and post–COVID-19 pandemic (OR: 2.10; 95% CI: 1.89–2.32). When comparing results from pre–COVID-19 and post–COVID-19 pandemic, there were no differences in the association between PP utilization and age, employment status, language, sex, marital status, ethnicity, insurance type, or race.

Association Between Patient Portal Utilization and Clinical Outcomes

After controlling for the social risk factors as defined above and elective versus nonelective procedures, patients who were not utilizing the PP at the time of their procedure had higher odds of 30-day readmission (OR: 1.59; 95% CI: 1.26–2.00), being discharged somewhere other than home (OR: 2.41, 95% CI: 1.95–2.99), and a 21% increase in the length of hospital stay (GMR: 1.21; 95% CI: 1.12–1.30) compared with those who utilized the PP (Table 5). The rate of 30-day return to the ED did not differ based on PP utilization.

DISCUSSION

While previous studies have examined the associations between sociodemographic characteristics and PP utilization, to our knowledge, this study is the first to do so in the surgical spine patient population. PP users were more likely to be younger, White, employed, English-speaking, female, in a domestic partnership, privately insured, and living in an urban environment. These findings support the existing literature on patient portal utilization that observe similar trends in other specialties.[5–8] The data clearly show that the more social risk factors one has, the less likely one is to use PPs. In addition, the data demonstrate an association between PP utilization and improved clinical outcomes such as decreased odds of 30-day readmission, being discharged somewhere other than home, and shorter length of stay. Overall, this study suggests that a targeted effort to increase PP utilization could improve clinical outcomes for patients with social risk factors.

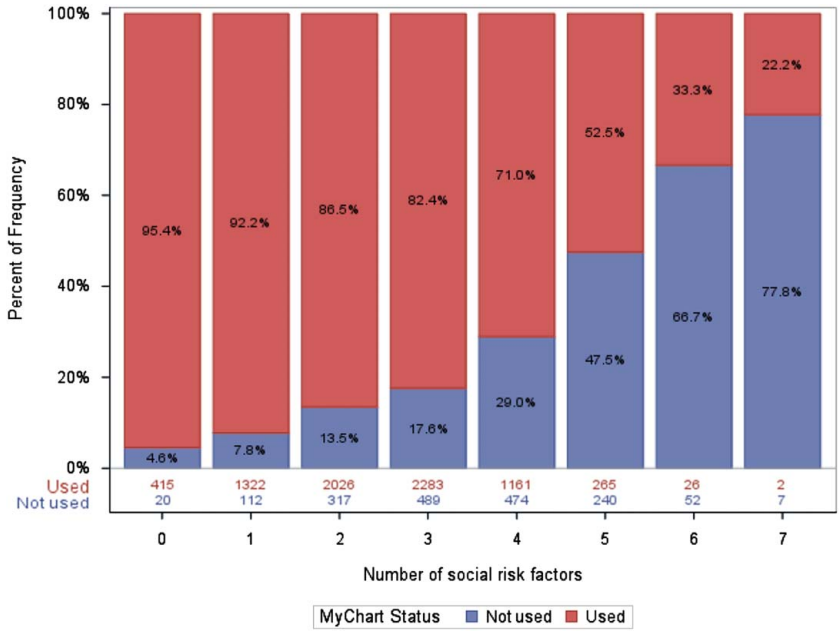

FIGURE 2. Association between the number of risk factors and patient portal utilization among patients receiving elective procedures. full color online

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

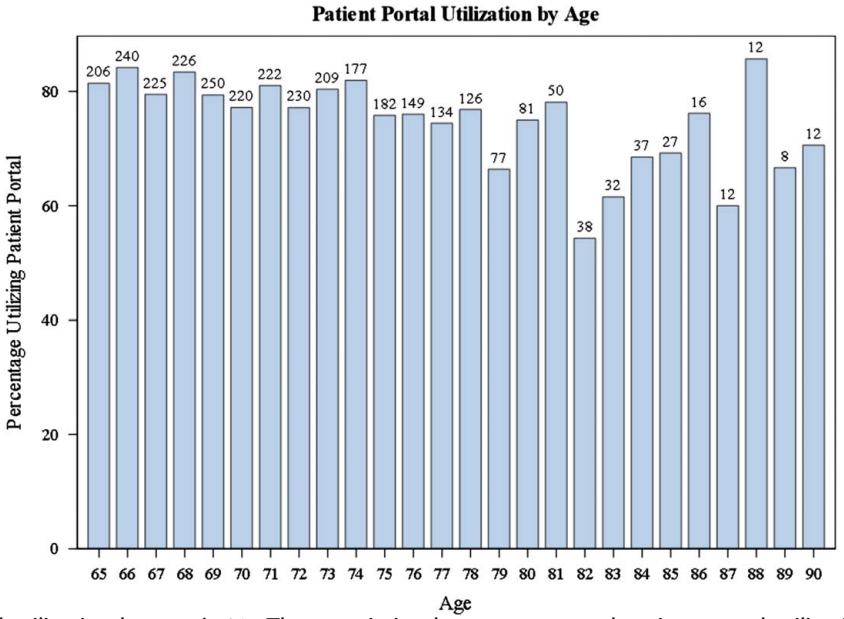

FIGURE 3. Patient Portal utilization by age (≥65): The association between age and patient portal utilization was further explored descriptively using a graph of patient portal utilization percentage by age to determine if there was a certain age greater than 65 at which patients were less likely to utilize the patient portal. While there is a general decline in patient portal utilization over the age of 65, there is no discrete threshold for the age that discriminated its use. The numbers atop the bars represent the number of patients in the given age that utilized the patient portal. full color online

There were significantly higher odds of being a PP user with an age younger than 65. A predilection for portal utilization among younger users is well-documented.[2,3,5–9] The most frequently cited barrier to online patient portal utilization for the elderly is a lack of familiarity with the technology. Additional factors such as preference, lack of accessibility, concerns about patient privacy, and health literacy are potential drawbacks to portal usage.[5,10–13] Kim and Fadem[14] found that within the elderly population, the use of PPs was centered around the desire to communicate effectively with providers. Moreover, they found that although most older adults favor more traditional means of communication like in-person or telephone conversations with providers, using PP messaging was utilized only if they believed their provider preferred this mode of communication, they were recommended to use it by their provider, or if they had positive experiences using the PP in the past. Providers giving reassurance to patients about potential doubts about using the PP and establishing it as an effective means of communication could be critical in its uptake by the elderly.[14]

In line with existing literature on PP utilization, the increased usage among Whites in comparison with non-Whites was observed.[2,5–8] Commonly cited barriers to PP utilization in minorities include limited access to technology, low health literacy, and concerns over privacy.[2,15–17] Although these barriers are formidable in the face of the uptake of PP utilization, additional barriers, such as provider perception of a group's ability or willingness to use them, may also be at play. Peacock et al[18] showed that Black and Hispanic patients were less likely to be offered access to personal health information portals. Even if unintentional, the disparity in PP utilization between

TABLE 3. Multivariable Regression Results for Patient Portal Utilization Among Patients Receiving Elective and Nonelective Procedures

	Elective procedures (n = 7655)		Nonelective procedures (n = 379)	
Variable	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***
Age < 65	2.03 (1.67–2.47)	< 0.001	1.84 (0.90–3.77)	0.085
Employed	1.54 (1.26–1.87)	< 0.001	1.10 (0.57–2.14)	0.745
English speaking	2.30 (0.95–5.58)	0.061	3.12 (0.29–33.15)	0.298
Female	1.82 (1.57–2.12)	< 0.001	1.48 (0.86–2.52)	0.133
In a domestic partnership	2.02 (1.73–2.36)	< 0.001	2.36 (1.37–4.06)	0.007
Non-Hispanic	0.65 (0.35–1.21)	0.158	0.62 (0.06–5.94)	0.637
Private insurance	1.85 (1.46–2.34)	< 0.001	1.82 (0.90–3.69)	0.084
Urban	2.23 (1.91–2.59)	< 0.001	1.36 (0.78–2.35)	0.237
White	2.37 (1.99–2.83)	< 0.001	1.44 (0.81–2.57)	0.178

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

TABLE 4. Multivariable Regression Results For Patient Portal Utilization Among Patients Receiving Procedures Pre–COVID-19 and Post–COVID-19 Surge

	Pre–COVID-19 surge (n = 4409)		Post–COVID-19 surge (n = 3933)	
Variable	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***
Age < 65	2.03 (1.64–2.52)	< 0.001	1.82 (1.40–2.37)	< 0.001
Employed	1.21 (0.97–1.50)	0.103	1.83 (1.40–2.39)	< 0.001
English speaking	2.34 (1.04–5.25)	0.040	2.79 (0.98–7.91)	0.054
Female	1.65 (1.40–1.93)	< 0.001	1.82 (1.51–2.21)	< 0.001
In a domestic partnership	1.80 (1.52–2.12)	< 0.001	2.05 (1.68–2.48)	< 0.001
Non-Hispanic	0.74 (0.38–1.46)	0.387	0.57 (0.27–1.22)	0.15
Private insurance	2.00 (1.55–2.56)	< 0.001	1.98 (1.47–2.67)	< 0.001
White	1.99 (1.66–2.38)	< 0.001	1.87 (1.52–2.31)	< 0.001

Whites and non-Whites could be partially driven by providers. In looking at PP utilization rates at a large academic medical center, Oest et al[4] found that once Black and Latino patients activated their online accounts, they used PPs at rates more similar to patients belonging to demographic groups with high utilization rates (Whites and Asians). These findings illustrate the necessity for more standardized approaches in enrolling patients in PPs. Previous studies have shown that having office staff dedicated to enrolling and teaching patients how to navigate PPs can lead to increased usage.[19,20]

This study showed that urban patients had nearly 2 times the odds of utilizing PPs versus rural patients. This corroborates existing trends in the literature that show increased rates of portal usage in urban environments located near large medical centers.[4] Given that nearly 33% of rural Americans lack access to high-speed Internet,[21] this disparity may be driven by a lack of access.

To examine potential exacerbations in pre-existing disparities and potential new ones in the uptake of patient portal utilization during the COVID-19 pandemic, associations between sociodemographic factors and PP utilization in the pre-pandemic (January 1, 2019–March 17, 2020) and postpandemic (March 8, 2020–June 30, 2021) periods were compared. In both periods, higher odds of portal utilization among those that were younger than 65, White, female, in a domestic partnership, and privately insured were observed. There was no significant difference in the strength of these associations pre-pandemic versus postpandemic. However, in the postpandemic period, we noticed increased odds of PP utilization associated with being employed. A possible explanation for this could be that the digital divide, which demonstrates the correlation between income and home internet access, was worsened with increased rates of unemployment during the pandemic.

This study aimed to gain a better understanding of how sociodemographic characteristics are associated with PP utilization within the elective and nonelective procedure patient populations. Only 57% of the patients that received nonelective procedures enrolled in the portal versus 82% of patients that received elective procedures. PP utilization rates could potentially be lower among those receiving nonelective surgery as these cases are more likely to be urgent. Further, patients seen for nonelective procedures might be less likely to have a designated spinal care provider in comparison with those scheduled for elective surgery that must first be seen in an outpatient setting. Looking at the sociodemographic breakdown of PP utilization within the elective patient population, all variables except ethnicity and English-speaking ability were associated with portal utilization. In the nonelective patient population, the only variable associated with PP utilization was being in a domestic partnership. In an urgent situation, patients are oftentimes unable to manage their own health and lean more heavily on social support that a domestic partner may provide. An additional challenge for nonelective patients may exist for those who

TABLE 5. Association Between Clinical Outcomes and Patient Portal Utilization (n = 7955)*

	Patient portal utilization			
Outcome	**Not used**	**Used**	**Odds ratio (95% CI)**	***P***
30-day readmission, N (%)	166 (9.1)	493 (6.3)	1.59 (1.26–2.00)	< 0.001
30-day return to ED, N (%)	332 (18.2)	1295 (16.42)	1.10 (0.92–1.32)	0.273
Discharged somewhere other than home, N (%)	395 (21.6)	614 (7.8)	2.41 (1.95–2.99)	< 0.001
—	—	—	—	—
Outcome	Not used	Used	Geometric mean ratio (95% CI)	*P*
Length of stay, mean (SD) median (Q1, Q3)	129.0 (300.0) 54.8 (27.8, 128.4)	67.8 (118.8) 32.0 (24.6, 79.6)	1.21 (1.12, 1.30)	< 0.001

*Models are adjusted for all social risk factors and nonelective versus elective indicator. Fixed-effect estimates [odds ratios (OR) for binary outcomes and geometric mean ratios (GMR), a measure of the relative difference in medians between the 2 groups, for continuous outcomes] and associated 95% confidence intervals (CI) are reported. The GMR approximates the expected mean difference on the log scale.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

were transferred in from a considerable distance and unable to have family available. Moreover, patients may be transferred from other facilities outside the Duke Hospital network and therefore would not be enrolled in the PP.

Not utilizing the PP may be associated with poorer clinical outcomes. After controlling for all social risk factors and nonelective versus elective procedures, PP nonusers had increased odds of 30-day readmission, being discharged to somewhere other than home, and having a longer length of stay. Preventing 30-day readmissions and lowering the length of hospital stay could motivate hospital systems to augment their efforts in enrolling patients in PPs. Given these results, it appears that PP users and nonusers are equally as likely to present to the ED within 30 days of being discharged, but nonusers are more likely to be readmitted. Numerous studies in the literature point to pain as the main factor leading to a 30-day return to the ED as well as readmission at 30 and 90 days.[22–30] We hypothesize that the increased odds of 30-day readmission for PP nonusers are influenced by the inability to adequately communicate the extent of their pain to their providers. By the time they present to the ED, their pain may be severe enough to warrant hospital admission. Follow-up studies that look at pain scores at discharge and return to the ED for PP users and nonusers would help further examine these outcomes.

While the association between clinical outcomes and PP utilization has been studied in the literature, there is not a clear consensus as to how it is associated with the return rate to the ED and readmission rates. The findings of this study corroborate a previous study in the total joint arthroplasty population that found PP utilization was not associated with increased ED return at the 90-day timepoint and that portal nonusers are more likely to be discharged to a skilled nursing facility.[3] A study examining PP utilization in patients with cardiopulmonary pathology found the opposite to be true in that users had higher rates of readmission.[31] Another study looking at PP trends in the atrial fibrillation patient population observed similar findings of PP usage being positively associated with readmission.[9] They found that users who were readmitted also had higher rates of logging into the portal than those who were not readmitted, suggesting that those who utilize PPs may be more engaged with their care and more likely to have complications identified.

Limitations

There are several limitations to this study. Given its retrospective nature, there could be other confounding variables that were not considered. In addition, there were low sample sizes for Hispanic/Latino and Spanish-speaking patients, as well as for those that underwent nonelective procedures. Further analysis must be done to understand how these variables influence PP utilization. A major limitation of this study is that it does not investigate the pattern of PP usage. Because portal utilization was defined as activating and/or using the portal at any time during care, this study lacks granularity regarding how and at what frequency patients use the PP. Portal use related to a nonspine encounter was counted the same as PP use for a spine encounter. Moreover, a 1-time user was counted the same as a weekly or daily user in this study. Follow-up studies could focus on understanding how sociodemographic characteristics are associated with different patterns of usage. Previous studies have assessed how different demographic groups use the PP's numerous functions. For example, Ramirez-Zohfeld et al[32] showed that patients 85 years of age or older used the portal at higher rates to schedule appointments and refill medications. Knowing how different patient groups utilize PPs could help providers tailor the portal toward specific patient needs and better focus efforts to increase the PP use.

CONCLUSIONS

At its core, this is a hypothesis-forming study that identifies gaps in the PP uptake by certain sociodemographic groups and its potential association with clinical outcomes. This study shows that within the spine patient population, an increased number of social risk factors is associated with decreased odds of PP utilization. Further, portal utilization appears to have a significant association with outcomes, including 30-day readmission, discharge disposition, and length of stay. While this data shows that certain members of this select patient population have lower odds of PP usage and that its use may improve outcomes, it is more than likely that the social risk factors defined in this study are driving outcomes and not the PP itself. While we did control for all social risk factors when evaluating the role that PP utilization may play in clinical outcomes, one could argue that PP utilization is reflective of an already engaged patient population that would be more likely to have better outcomes at baseline. Moreover, psycho-social factors that we did not account for could be contributing to the disparity in outcomes that we observe between PP users and nonusers. A follow-up study aimed at answering whether targeted efforts to enroll patients with social risk factors improve clinical outcomes is necessary to evaluate the efficacy of PPs in patient care.

REFERENCES

1. Winstanley EL, Burtchin M, Zhang Y, et al. Inpatient experiences with MyChart Bedside. *Telemed J E Health*. 2017;23:691–693.
2. Wallace LS, Angier H, Huguet N, et al. Patterns of electronic portal use among vulnerable patients in a nationwide practice-based research network: From the OCHIN Practice-based Research Network (PBRN. *J Am Board Fam Med*. 2016;29:592–603.
3. Plate JF, Ryan SP, Bergen MA, et al. Utilization of an electronic patient portal following total joint arthroplasty does not decrease readmissions. *J Arthroplasty*. 2019;34:211–214.
4. Oest SER, Hightower M, Krasowski MD. Activation and utilization of an electronic health record patient portal at an academic medical center—impact of patient demographics and geographic location. *Acad Pathol*. 2018;5:2374289518797573.
5. Gordon NP, Hornbrook MC. Differences in access to and preferences for using patient portals and other ehealth technologies based on race, ethnicity, and age: a database and survey study of seniors in a large health plan. *J Med Internet Res*. 2016;18:e50.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

6. Goel MS, Brown TL, Williams A, et al. Disparities in enrollment and use of an electronic patient portal. *J Gen Intern Med*. 2011;26: 1112–1116.
7. Krasowski MD, Grieme CV, Cassady B, et al. Variation in results release and patient portal access to diagnostic test results at an Academic Medical Center. *J Pathol Inform*. 2017;8:45.
8. Weingart SN, Rind D, Tofias Z, et al. Who uses the patient internet portal? The PatientSite experience. *J Am Med Inform Assoc*. 2006;13: 91–95.
9. Davis AP, Wilson GM, Erwin JP, et al. Use of web-based patient portals in patients with atrial fibrillation is associated with higher readmissions. *Ochsner J*. 2021;21:25–29.
10. Powell KR. Patient-perceived facilitators of and barriers to electronic portal use: a systematic review. *Comput Inform Nurs*. 2017;35:565–573.
11. Latulipe C, Gatto A, Nguyen HT, et al. Design considerations for patient portal adoption by low-income, older adults. *Proc SIGCHI Conf Hum Factor Comput Syst*. 2015;2015:3859–3868.
12. Nahm ES, Sagherian K, Zhu S. Use of patient portals in older adults: a comparison of three samples. *Stud Health Technol Inform*. 2016; 225:354–358.
13. Turner AM, Osterhage K, Hartzler A, et al. Use of patient portals for personal health information management: the older adult perspective. *AMIA Annu Symp Proc*. 2015;2015:1234–1241.
14. Kim S, Fadem S. Communication matters: Exploring older adults' current use of patient portals. *Int J Med Inform*. 2018;120:126–136.
15. Dhanireddy S, Walker J, Reisch L, et al. The urban underserved: attitudes towards gaining full access to electronic medical records. *Health Expect*. 2014;17:724–732.
16. Goel MS, Brown TL, Williams A, et al. Patient reported barriers to enrolling in a patient portal. *J Am Med Inform Assoc*. 2011;18 (suppl 1):i8–i12.
17. Kruse CS, Argueta DA, Lopez L, et al. Patient and provider attitudes toward the use of patient portals for the management of chronic disease: a systematic review. *J Med Internet Res*. 2015; 17:e40.
18. Peacock S, Reddy A, Leveille SG, et al. Patient portals and personal health information online: perception, access, and use by US adults. *J Am Med Inform Assoc*. 2017;24(e1):e173–e177.
19. Ramsey A, Lanzo E, Huston-Paterson H, et al. Increasing patient portal usage: preliminary outcomes from the MyChart Genius Project. *J Adolesc Health*. 2018;62:29–35.
20. Avdagovska M, Ballermann M, Olson K, et al. Patient portal implementation and uptake: qualitative comparative case study. *J Med Internet Res*. 2020;22:e18973.
21. Connect2HealthFCC. Mapping Broadband Health in America. 2017. Accessed December 28, 2021. https://www.fcc.gov/reports-research/maps/connect2health/data.html
22. Cho PG, Kim TH, Lee H, et al. Incidence, reasons, and risk factors for 30-day readmission after lumbar spine surgery for degenerative spinal disease. *Sci Rep*. 2020;10:12672.
23. Villavicencio A, Rajpal S, Lee Nelson E, et al. Unplanned 30-Day readmission rates after spine surgery in a community-based Hospital setting. *Clin Neurol Neurosurg*. 2020;191:105686.
24. Adogwa O, Elsamadicy AA, Han JL, et al. 30-day readmission after spine surgery: an analysis of 1400 consecutive spine surgery patients. *Spine (Phila Pa 1976)*. 2017;42:520–524.
25. Adogwa O, Elsamadicy AA, Han J, et al. Drivers of 30-day readmission in elderly patients (>65 years old) after spine surgery: An analysis of 500 consecutive spine surgery patients. *World Neurosurg*. 2017;97:518–522.
26. Pugely AJ, Martin CT, Gao Y, et al. Causes and risk factors for 30-day unplanned readmissions after lumbar. *spine surgery Spine (Phila Pa 1976)*. 2014;39:761–768.
27. Schafer E, Bazydlo M, Schultz L, et al. Rates and risk factors associated with 90-day readmission following cervical spine fusion surgery: analysis of the Michigan Spine Surgery Improvement Collaborative (MSSIC) registry. *Spine J*. 2020;20:708–716.
28. Elsamadicy AA, Adogwa O, Lubkin DT, et al. Thirty-day complication and readmission rates associated with resection of metastatic spinal tumors: a single institutional experience. *J Spine Surg*. 2018;4:304–310.
29. Hills J, Sivaganesan A, Khan I, et al. Causes and timing of unplanned 90-day readmissions following spine surgery. *Spine (Phila Pa 1976)*. 2018;43:991–998.
30. Jain N, Brock JL, Phillips FM, et al. 30-day emergency department visits after primary lumbar fusion: incidence, causes, risk factors, and costs. *Clin Spine Surg*. 2019;32:113–119.
31. Griffin A, Skinner A, Thornhill J, et al. Patient portals. *Appl Clin Inform*. 2016;7:489–501.
32. Ramirez-Zohfeld V, Seltzer A, Xiong L, et al. Use of Electronic Health Records by Older Adults, 85 Years and Older, and Their Caregivers. *J Am Geriatr Soc*. 2020;68:1078–1082.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.

Copyright © 2023 Wolters Kluwer Health, Inc. All rights reserved.