Disparities in Pediatric Patient Portal Activation and Feature Use

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ABSTRACT

Objective: Disparities in adult patient portal adoption are well-documented; however, less is known about disparities in portal adoption in pediatrics. This study examines the prevalence and factors associated with patient portal activation and the use of specific portal features in general pediatrics.

Materials and methods: We analyzed electronic health record data from 2012 to 2020 in a large academic medical center that offers both parent and adolescent portals. We summarized portal activation and use of select portal features (messaging, records access and management, appointment management, visit/admissions summaries, and interactive feature use). We used logistic regression to model factors associated with patient portal activation among all patients along with feature use and frequent feature use among ever users (ie, ≥1 portal use).

Results: Among 52,713 unique patients, 39% had activated the patient portal, including 36% of patients aged 0–11, 41% of patients aged 12–17, and 62% of patients aged 18–21 years. Among activated accounts, ever use of specific features ranged from 28% for visit/admission summaries to 92% for records access and management. Adjusted analyses showed patients with activated accounts were more likely to be adolescents or young adults, white, female, privately insured, and less socioeconomically vulnerable. Individual feature use among ever users generally followed the same pattern.

Conclusions: Our findings demonstrate that important disparities persist in portal adoption in pediatric populations, highlighting the need for strategies to promote equitable access to patient portals.

Key words: pediatrics, patient portal, digital divide, electronic health record

BACKGROUND AND SIGNIFICANCE

Patient engagement and empowerment can facilitate improved clinical outcomes in health care delivery.1 Health care organizations have implemented strategies to promote patient engagement through their electronic health records (EHR) systems, including offering patients access to patient portals.2,3 Mixed patient satisfaction has been reported, with greater satisfaction associated with specific portal features, such as messaging.4 Although there is limited evidence that portal use improves clinical outcomes, emerging evidence suggests an association between higher messaging activity and improved outcomes for metabolic diseases.5 Meanwhile, several reviews have highlighted the existence and widening of patient-level disparities in portal activation and utilization patterns among adult patients.2,6,7

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Pediatric portal activation rates have ranged from 1% to 64%, with recent studies reporting higher rates. Although previous studies suggest that portal activation rates vary by age, insurer, income level, and race/ethnicity, less is known on what patient-level factors are correlated with the use of specific portal features. Since portal use has been associated with improved outcomes, further understanding of portal use metrics is warranted. Specifically, it is important to examine the frequency of portal use as frequent use may indicate higher patient engagement in health management. Addressing this gap may help inform interventions that optimize portal use among vulnerable populations of children, adolescents, and their families. To address this gap, the current study aimed to identify the rates and patient-level correlates of (1) portal activation, (2) ever use of portal features, and (3) frequent use of those features.

MATERIALS AND METHODS

Setting and sample
This study was conducted in a large academic health system located in North Central Florida that utilizes the Epic EHR system (Epic Systems, Verona, WI). The health system institutional review board approved the study protocol. At this institution, clinic staffs provide patients and/or parents with a portal activation code via email. If the account is not activated within 90 days the patient must request a new code. Patients 18 years and older may also sign up online without an activation code.

Parents of patients under 18 are offered a proxy portal account. In the case of children aged 0–11 years, parents may perform several tasks through the portal, including sending messages to the clinical team and viewing clinical notes. Upon turning 12 years old, adolescents can create their own adolescent portal account, allowing them to independently perform these same tasks. For parents of adolescents, their proxy accounts allow restricted access to adolescents' records to maximize confidentiality. Although parents can request an appointment for the adolescent, they are restricted from reading notes or messaging the clinician.

Data source
We obtained patient-level data from the EHR, including sociodemographic variables (age, sex, race, ethnicity, primary insurer, and socioeconomic vulnerability) and portal use measures, for all pediatric primary care patient visits between September 1, 2012 and July 30, 2020. We geocoded patient addresses to identify residential census tract, which was linked to the socioeconomic vulnerability (SEV) measure. All variables were assessed at the time of the most recent visit.

We identified 52,713 unique records. No more than 3% of the data had missing values for race and ethnicity. A total of 2.2% of patients lived outside of Florida and were not geocoded. Among Florida residents, 1,679 gave a postal office box and 31 declined to give a residential address. These records could not be assigned to a census tract or SEV value. The remaining 43,221 records with residential addresses were geocoded to residential streets and census tracts.

Analytical variables
We used a retrospective, observational, and pooled cross-sectional design to assess the patient-level characteristics related to portal activation and use. We examined portal activation status among all patients. Among activated accounts, ever use (ie, at least one instance of portal utilization) and frequency of use were assessed for each of the portal features of interest.

We assessed the following patient covariates: age, sex, race, ethnicity, primary insurer, and socioeconomic vulnerability. Age was treated as a categorical variable, and age groups were defined as 0–11 years (younger children with parents using the portal), 12–17 years (adolescents whose parents are proxies), and 18–21 years (young adults who have full portal access without parental involvement). These age groups have been previously used in related research at the same health system. We combined Medicare, Medicaid, and other public insurance plans into a “public” insurer group. For “private” insurers, we combined all commercial plans. All other plans (eg, worker’s compensation) were categorized as “other.” Socioeconomic vulnerability (SEV) is one component of the Centers for Disease Control and Prevention (CDC)’s Social Vulnerability Index. SEV is calculated using census tract-level data on income, poverty, education, and employment rates. SEV was grouped into quartiles and treated as an ordinal variable.

Categorization of portal features was informed by a previous study that assessed correlates of portal activation and use among adult patients. These categories include: medical record access and management (eg, viewing lab results and updating medications), appointment management, messaging, and visit/admission summaries. We also formed a dichotomous variable ("interactive feature use") that represents if the patient’s account had ever accessed features that require information to be entered after these features are assumed to require greater patient engagement. Interactive feature use included updating patient information, completing questionnaires, requesting medication renewals, and sending messages.

Data analyses
We reported patient characteristics using descriptive statistics. Missing data were treated as a separate category per variable. We conducted bivariate analyses with the Pearson's chi-square test for all categorical variables. After identification of associations that were significant in the unadjusted analyses, we conducted a logistic regression analysis to control for possible confounding variables on the outcome variable. We then conducted five different logistic regression models to assess correlates of utilization for each of the four portal activities and interactive feature use among ever users. To investigate correlates of frequent portal use among ever users, we conducted an additional five logistic regression models that categorized portal use into quartiles. For each portal activity studied, we defined frequent users as all those in the top 25% for that feature. We considered $P < .05$ as the threshold for statistical significance. Bivariate and multivariate analyses were completed with Stata SE 16.0 (Stata-Corp LP, College Station, TX), and geocoding was completed with ArcGIS StreetMap Premium (ESRI, Redlands, CA). Data were obtained in 2020 and analyzed in 2021.

RESULTS
Among unique patient records ($n = 52,713$), most patients were between 0 and 11 years old (73.3%), white (55.4%), non-Hispanic (88.6%), and privately insured (47.1%). Overall, 38.6% of patients had activated portal accounts. Among patients with activated accounts, 9.8% had never used the portal. About one-third (36.0%) of adolescents had their own portal account.

Portal activation
In unadjusted analyses, significant differences in activation rates were observed across age groups, sex, race, insurer, and SEV.
No differences were seen across ethnicity groups. In adjusted models, higher odds of portal activation were observed among adolescents and young adults when compared to parents of younger children, and lower odds were observed for male patients, Black or African American patients compared to white patients, patients with public insurance when compared to private insurance, and patients in the highest SEV quartile (most vulnerable) when compared to the lowest SEV quartile (Table 1).

**Appointment management**
Higher odds of using appointment management features were observed among adolescents and young adults compared to parents of younger children and lower odds were observed among Black or African American race and those having public insurance when compared to private insurance. Higher odds of frequent use of these features were observed among young adults compared to parents of younger children, and being in the top 50–74% quartile of SEV when compared to the top 25% quartile. Lower odds of frequent use of these features were observed among adolescents when compared to parents of younger children, male sex, Black or African American patients when compared to the white race, and those having public insurance when compared to private insurance.

**Messaging**
Higher odds of secure messaging ever use were observed among young adults when compared to younger children and lower odds were observed among adolescents when compared to parents of younger children, male sex, Black or African American race when compared to whites, and those having public insurance when compared to private insurance. Higher odds of frequent messaging were observed among young adults when compared to parents of younger children and lower odds were observed among adolescents when compared to parents of younger children, male sex, Black or African American race when compared to the white race, and those having public insurance when compared to private insurance.

**Visit/admission summaries**
Higher odds of ever use of visit/admission summary features were observed among young adults when compared to parents of younger children and lower odds were observed among young adults when compared to parents of younger children, male sex, Black or African American race when compared to whites, and those having public insurance when compared to private insurance.
children and lower odds were observed among male sex Black or African American race when compared to whites, and those having public insurance when compared to private insurance. Higher odds of utilizing visit and admission summary features frequently were observed among young adults compared to parents of younger children and lower odds were observed among male sex, Black or African American patients when compared to the white race, and those having public insurance when compared to private insurance.

**Interactive feature use**

Higher odds of interactive feature ever use were observed among young adults compared to parents of younger children and lower odds were observed among adolescents when compared to parents of younger children, male sex, Black or African American race when compared to the white race, and those having public insurance when compared to private insurance.

**DISCUSSION**

This study identified patient characteristics associated with patient portal activation as well as the use of portal features among general pediatric populations. Portal activation was less likely for patients who were younger, male, Black, publicly insured, and more socioeconomically vulnerable. Individual feature use among ever users generally followed the same pattern, with the exception of socioeconomic vulnerability. This research demonstrates that disparities ob-

### Table 2. Ever use of patient portal features by age group among patients with activated accounts

| Functionality                  | Younger children 0–11 years | Adolescents 12–17 years | Young adults 18–21 years | Total (N = 20335) |
|-------------------------------|----------------------------|-------------------------|--------------------------|-------------------|
| Records access and management | 10291 (74.0%)              | 3525 (81.4%)            | 1942 (92.3%)             | 15758 (77.5%)     |
| Appointment management        | 8993 (64.7%)               | 3083 (71.2%)            | 1850 (87.9%)             | 13926 (68.5%)     |
| Messaging                     | 8409 (60.5%)               | 2357 (54.4%)            | 1621 (77.0%)             | 12387 (60.9%)     |
| Visit/admission summaries     | 3909 (28.1%)               | 1228 (28.4%)            | 1047 (49.8%)             | 6184 (30.4%)      |
| Interactive feature use       | 9738 (70.8%)               | 2998 (69.3%)            | 1764 (83.8%)             | 14500 (71.3%)     |
| Any feature use               | 12243 (88.1%)              | 4039 (93.3%)            | 2060 (97.9%)             | 18342 (90.2%)     |

*Defined as use of any of the four features studied.

### Table 3. Adjusted odds ratios in multivariate analyses of correlates of patient portal feature use among ever users

| Variables                | Records access and management | Appointment management | Messaging | Visit/admission summaries | Interactive feature use |
|--------------------------|------------------------------|------------------------|----------|---------------------------|-------------------------|
| Age (years)              |                              |                        |          |                           |                         |
| 0–11                     | Ref                          | Ref                    | Ref      | Ref                       | Ref                     |
| 12–17                    | 1.56***                      | 1.43–1.70              | 1.38***  | 1.28–1.49                 | 0.80***                 |
| 18–21                    | 4.31***                      | 3.65–5.10              | 4.11***  | 3.58–4.72                 | 2.32***                 |
| Sex                      |                              |                        |          |                           |                         |
| Female                   | Ref                          | Ref                    | Ref      | Ref                       | Ref                     |
| Male                     | 0.98                         | 0.92–1.05              | 0.97     | 0.92–1.03                 | 0.90***                 |
| Race                     |                              |                        |          |                           |                         |
| White                    | Ref                          | Ref                    | Ref      | Ref                       | Ref                     |
| Black                    | 1.43                         | 0.90–1.07              | 0.82***  | 0.76–0.89                 | 0.71***                 |
| Other                    | 1.25***                      | 1.13–1.38              | 1.06     | 0.97–1.15                 | 1.03                   |
| Unknown                  | 0.94                         | 0.75–1.18              | 0.48***  | 0.39–0.59                 | 0.47***                 |
| Primary insurer          |                              |                        |          |                           |                         |
| Private                  | Ref                          | Ref                    | Ref      | Ref                       | Ref                     |
| Public                   | 1.16***                      | 1.08–1.26              | 0.91**   | 0.85–0.97                 | 0.83***                 |
| Other                    | 1.09*                        | 0.77–1.00              | 0.92***  | 0.72–0.91                 | 0.72*                  |
| Social vulnerability     |                              |                        |          |                           |                         |
| Top 25% (least vulnerable)| Ref                          | Ref                    | Ref      | Ref                       | Ref                     |
| 26–49%                   | 1.01                         | 0.91–1.12              | 1.01     | 0.92–1.11                 | 1.01                   |
| 50–74%                   | 1.03                         | 0.92–1.15              | 1.04     | 0.94–1.15                 | 1.02                   |
| 75–100% (Most vulnerable)| 1.06                         | 0.95–1.20              | 1.03     | 0.93–1.15                 | 1.02                   |
| Unknown                  | 0.89*                        | 0.79–1.00              | 1.05     | 0.95–1.16                 | 1.04                   |

*Boldface indicates statistical significance (*P < .05, **P < .01, ***P < .001). OR: odds ratio; CI: confidence interval.
served in patient portal adoption and the use in adults are also present in pediatric populations.

The patient portal activation rate in our sample was lower than a recent study conducted in another academic healthcare system. This may be partially explained by the fact that our sample had a higher proportion of publicly insured patients, who are less likely to use patient portals. Our findings that portal activation may not lead to subsequent portal utilization are consistent with prior studies. These findings highlight the need for consistent guidelines for protecting adolescent privacy in patient portals.22,23

Our findings should be interpreted under the following limitations. First, this study used data from one health system, limiting its generalizability. Second, we utilized patient-level data as opposed to granular data on patient portal visits, preventing us from determining which portal visits were made by adolescents or parents with proxy access. Third, the study site used an adolescent portal model that aims to protect adolescent confidentiality. Results may not generalize to organizations that utilize other patient portal privacy models.24

### Table 4. Adjusted odds ratios in multivariate analyses of frequent patient portal feature use among ever users

| Variables                        | Records access and management | Appointment management | Messaging | Visit/admission summaries | Interactive feature use |
|----------------------------------|------------------------------|------------------------|-----------|---------------------------|------------------------|
|                                   | OR   | 95% CI       | OR   | 95% CI       | OR   | 95% CI       | OR   | 95% CI       | OR   | 95% CI       |
| Age (years)                      |      |              |      |              |      |              |      |              |      |              |
| 0–11                             | Ref  |             | Ref  |             | Ref  |             | Ref  |             | Ref  |             |
| 12–17                            | 0.85*** | 0.78–0.93  | 0.63*** | 0.57–0.69  | 0.74*** | 0.68–0.81  | 0.99   | 0.91–1.08   | 0.72*** | 0.66–0.79   |
| 18–21                            | 2.55*** | 2.31–2.81  | 1.65*** | 1.49–1.83  | 2.01*** | 1.82–2.22  | 2.40*** | 2.17–2.66   | 1.95*** | 1.76–2.15   |
| Sex                              |      |              |      |              |      |              |      |              |      |              |
| Female                           | Ref  |             | Ref  |             | Ref  |             | Ref  |             | Ref  |             |
| Male                             | 0.80*** | 0.75–0.86  | 0.82*** | 0.77–0.88  | 0.86*** | 0.81–0.92  | 0.91*  | 0.85–0.98   | 0.87*** | 0.81–0.92   |
| Race                             |      |              |      |              |      |              |      |              |      |              |
| White                            | Ref  |             | Ref  |             | Ref  |             | Ref  |             | Ref  |             |
| Black                            | 0.70*** | 0.64–0.76  | 0.73*** | 0.67–0.80  | 0.64*** | 0.58–0.69  | 0.79*** | 0.72–0.86   | 0.65*** | 0.59–0.70   |
| Other                            | 0.96   | 0.88–1.05   | 0.95   | 0.87–1.05   | 0.94   | 0.86–1.03   | 0.99   | 0.90–1.09   | 0.94   | 0.86–1.02   |
| Unknown                          | 0.36*** | 0.26–0.50  | 0.39*** | 0.29–0.54  | 0.32*** | 0.23–0.44  | 0.48*** | 0.35–0.67   | 0.36   | 0.27–0.49   |
| Primary insurer                  |      |              |      |              |      |              |      |              |      |              |
| Private                          | Ref  |             | Ref  |             | Ref  |             | Ref  |             | Ref  |             |
| Public                           | 0.88*** | 0.81–0.94  | 0.91*  | 0.84–0.98   | 0.86*** | 0.80–0.92  | 0.71*** | 0.65–0.76   | 0.85*** | 0.79–0.91   |
| Other                            | 0.60*** | 0.52–0.69  | 0.53*** | 0.46–0.62  | 0.61*** | 0.53–0.69  | 0.83**  | 0.73–0.95   | 0.61*** | 0.54–0.70   |
| Social vulnerability             |      |              |      |              |      |              |      |              |      |              |
| Top 25% (least vulnerable)       | —    | —           | Ref  | —           | —    | —           | Ref  | —           | —    | —           |
| 26–49%                           | —    | —           | 1.04  | 0.93–1.16   | 1.01  | 0.95–1.11   | —     | —           | 1.00  | 0.90–1.11   |
| 50–74%                           | —    | —           | 1.16* | 1.03–1.29   | 1.07  | 0.96–1.19   | —     | —           | 1.08  | 0.97–1.20   |
| 75–100% (most vulnerable)        | —    | —           | 1.01  | 0.90–1.14   | 0.95  | 0.85–1.07   | —     | —           | 0.95  | 0.85–1.06   |
| Unknown                          | —    | —           | 1.08  | 0.96–1.21   | 1.13  | 1.01–1.26   | —     | —           | 1.11  | 0.99–1.24   |

*Boldface indicates statistical significance (*P < .05, **P < .01, ***P < .001). OR: odds ratio; CI: confidence interval.

CONCLUSION

This study revealed that, among a general pediatrics population, important patient-level disparities exist in patient portal activation, as well as in ever use and frequent use of examined portal features. Further research is needed to identify reasons patients do not activate or use patient portal accounts to better improve patient engagement via the portal among children, adolescents, and young adults.

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AUTHOR CONTRIBUTIONS
RGS conceptualized the study. JHL, ON, LAT, and RGS drafted the manuscript. All authors participated in the analyses and interpretation of data. JH, HDC, RA, JB, and CAH provided critical revisions to the manuscript. All authors approved the submission.

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DATA AVAILABILITY
The data underlying this article are available in the Dryad Digital Repository.

CONFLICT OF INTEREST STATEMENT
None declared.

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