

Assessing Health Disparities in Digital Services and Technologies During and After the COVID-19 Pandemic: A Pooled Cross-Sectional Analysis Using HINTS Data

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Introduction: Digital health techniques were adopted faster during COVID-19, but the gap remains. This study analyzes how the digital gap affected pandemic patient portal uptake during and after. Patient portals improve physician connections and patient health information access, increasing health outcomes. Digital divide—lack of internet, digital literacy, and SDOH—may inhibit fair adoption. One study found that the internet and IT affected people during and after the pandemic. Learn why this patient demographic uses online patient portals so much. Like finding demographic, socioeconomic, and behavioral characteristics that affect portal usage, specifically drivers and barriers for health-conscious patients. This project developed a health promotion model and implemented initiatives to increase patient portal use and reduce health inequities.

Methods: In 2020 and 2022, we used Health Information National Trends Survey (HINTS) data. Patient portal use dominated. Our cross-sectional study assessed patient portal use and various predictors. Age, marital status, sex, mental health, education, income, urban/rural (urbanity), family size, trust, social media use, chronic condition, and health app use predict. We handled survey data collection biases with weighted analyses. Data was computed using survey weights for population representation. Logistic regression and weighted descriptive statistics utilized STATA SE 16.1.

Results: Demographic, socioeconomic, and behavioral characteristics significantly affect online patient portal use. Portal usage is positively correlated with health app use, urbanity, higher income, sex, Asian/Native American race/ethnicity, and hospital trust. In addition, our data shows low adoption rates across the digital divide. Patients who trust others utilize patient portals, and previously established characteristics affect self-motivation for health improvement.

Conclusion: Access obstacles and behavioral factors affect online patient portal adoption. Addressing the digital divide is crucial, but trust and self-motivation may improve patient portal utilization. Adopting health IT can improve patient participation and access to care, supporting equitable health outcomes.

Keywords: mobile health, health disparity, healthcare policy, Post-SARS Cov2 care management

Introduction

The 2009 health Information Technology for Economic and Clinical Health Act's Meaningful Use Stage 2 incentive has spurred the integration of online patient portals with Electronic Health Records (EHRs) in the US healthcare system. Despite the anticipated benefits of patient portals in enhancing patient engagement with the frontline staff/physicians and improving their healthcare quality,¹⁻⁴ adoption rates have remained suboptimal, ranging between 28% and 47%.⁵⁻⁷ About 6 in 10 individuals nationwide were offered access to their patient portal, and nearly 40% accessed their records at least once in 2020.⁵ Various factors influencing patient portal adoption have been identified, including demographic characteristics, socioeconomic status, health literacy, and concerns regarding privacy and security.^{3,8,9} Understanding

these factors is crucial, particularly given the demographic landscape of the US healthcare system, posing challenges in providing timely and accessible healthcare, especially for individuals residing in rural areas.¹⁰

Technology, including patient portals and personal health records, can play a pivotal role in overcoming barriers to care. These tools empower patients to access their health information, communicate with healthcare providers, and manage appointments or prescriptions.^{11,12} However, disparities in technology adoption persist, with specific populations experiencing lower rates of portal usage.^{6,13} Therefore, understanding the dynamics of patient portal adoption, particularly among motivated users seeking to improve health outcomes, is essential. The study aims to explore the intersection of the digital divide and patient portal adoption rates, focusing on motivated users during and after the COVID-19 pandemic. By investigating determinants contributing to low adoption rates, especially within interested user groups, the research seeks to uncover insights into usage behavior and equitable access. Additionally, the study examined potential correlations between social media usage and embracing patient-centered digital health tools.

Moreover, the overarching goal is to examine the dynamic interplay between the digital divide and patient portal adoption rates, especially among patients already motivated to leverage health technology solutions. This includes an investigation into determinants contributing to low adoption rates, even within interested user groups. The study also explores potential correlations between social media usage and embracing patient-centered digital health tools. Examining this information may help implement the health promotion model, encouraging people to make healthier choices, be consistent in knowing their health, and be more motivated to get their medical records online.^{14,15}

The findings from this research, based on recent national survey data, provided a nuanced understanding of the relationships between motivation, usage behavior, and equitable access to patient-centered health information technologies. These insights can inform strategies for promoting adoption among underserved communities, addressing persistent disparity gaps, and realizing optimal value and outcomes from patient-centered healthcare technologies.¹⁶

Methods

Data Source

The study utilized the Health Information National Trends Survey (HINTS) dataset, which is a nationally representative survey conducted in 2020 and 2022. The dataset provides information on health-related behaviors, knowledge, and disparities in digital health adoption. The study population consisted of 10,117 patients, comprising two datasets: HINT 5 cycle 4 (February through June 2020 with total respondents = 3865) and HINT 6 cycle (from March through November 2022 with total respondents = 6252).¹⁷ These datasets were combined to achieve a final sample size of 10,117. This study was approved for waiver from the National Institute of Health (NIH) Office of IRB Operation (IRBO) (45 DFR 46.102).

Outcomes

The primary outcome variable was the frequency of accessing online medical records in the last 12 months. Responses were recoded as “yes” for those who accessed their online medical records at least once and “no” for those who did not access their online medical records. In addition, our study identifies self-motivation as a significant predictor of patient portal usage, highlighting that individuals who exhibit intrinsic motivation toward managing their health are more inclined to adopt digital health technologies.

How many times have you accessed your online medical record in the last 12 months?

Independent Variables

We included demographic parameters, overall health, mental health status, and behavioral aspects, which were part of the HINT questionnaire.

The study defines patients who demonstrated self-motivation for using patient portals as those who answered “yes” to the following questions (a new variable was also created called self-motivated): In the past 12 months, have you used your online medical record or patient portal to download your health information to your computer or mobile device, such as a cell phone or tablet? (yes/no); Do you ever go online to access the Internet or the World Wide Web, or to send and receive e-mail? (yes/no); Have you ever been offered online access to your medical records (for example, a patient portal) by your healthcare

provider? (yes/no); Have you ever been offered online access to your medical records (for example, a patient portal) by your health insurer? (yes/no); Only patients who fit these criteria were included in our analysis.

Demographic covariates included the following measures: Demographic factors (age, sex, race/ethnicity, income, education). Age was re-coded as an ordinal variable: 18–49, 50–74, >75 years. Sex was re-coded as male or female. Marital status was re-coded as married (married and living as married) or not married (single, widowed, divorced, other). Education used the question, “What is the highest level of education you completed?” This response was re-coded as high school or less, some college, and a college degree or more. Income was re-coded as <\$35,000, \$35,000–\$75,000, and >\$75,000. Another variable, ‘urbanity,’ was also recoded into binary (urban/rural) based on the United States Department of Agriculture’s 2023 Rural-Urban Continuum (RUC) Code.¹⁸ This classification separates respondents into metro and non-metro counties according to county population size.

Question related to app use were also included such as: In the last 12 months, how often did you visit a social media site? (yes/no); Health app use was re-coded as yes or no (no, do not know, no tablet or smartphone).

Chronic disease status was re-coded as yes or no by combining responses from several survey questions. The question was, Has a doctor or other health professional ever told you that you had any of the following medical conditions: diabetes, hypertension, chronic lung disease, arthritis or rheumatism, a heart condition, depression, or anxiety?. “Yes” was coded if a respondent chose any of the options. Furthermore, people in the household were re-coded as one person or more than one person in the household. Medicaid health insurance information such as “Are you currently covered by any of the following types of health insurance or health coverage plans?”.

Utilization of online patient-facing medical records and patient portals. Questions related to how much one trusts information about cancer from doctors/family/friends/government health agencies/charitable organizations/religious organizations, and leaders/ scientists: In general, how much would you trust information about cancer from a doctor? (4 “not at all”, 3 “a little”, 2 “some”, and 1 “a lot”); In general, how much would you trust information about cancer from family or friends? (4 “not at all”, 3 “a little”, 2 “some”, and 1 “a lot”); In general, how much would you trust information about cancer from government health agencies? (4 “not at all”, 3 “a little”, 2 “some”, and 1 “a lot”); In general, how much would you trust information about cancer from charitable organizations? (4 “not at all”, 3 “a little”, 2 “some”, and 1 “a lot”); In general, how much would you trust information about cancer from religious organizations and leaders? (4 “not at all”, 3 “a little”, 2 “some”, and 1 “a lot”). The survey responses were ordinal (4 “not at all”, 3 “a little”, 2 “some”, and 1 “a lot”). For a respondent, a total score of 20 (no trust at all), 15 (a little), 10 (some trust), and 5 (full trust). This was recorded as a binary variable of trust (some/full trust < 10) and no trust (a little/no trust > 10).

Statistical Analysis

All statistical analyses for HINT 2020 and 2022 utilized sampling weights to accurately represent the entire population. Initially, the characteristics of the final dataset sample were examined. The characteristics of the population were displayed as weighted frequency (percentage) or standard of error (SE). In our multivariable analysis, we used binary logistic regression associated with accessing online portals. STATA statistical software was used for all analyses (StataCorp.2019. Stata Statistical Software: Version 16. College Station, TX: Stata Corp LLC).¹⁹ All statistical tests were two-sided, and a p-value of 0.05 was used to determine statistical significance.²⁰

Results

Based on the fundamental demographic characteristics of our final sample population, which comprises 10,117 individuals, analysis reveals a balanced representation of various key factors. Approximately half of the sample consists of males (40.26%), while females represent 59.74%. Regarding racial composition, the majority identifies as white non-Hispanic (58.93%). A significant portion of the population is married, accounting for 52.05%, and slightly less than half of the individuals possess a college degree (45.81%). A diverse spread is evident when examining income distribution within the analyzed population. Approximately 30.81% earn less than \$35,000, 30.34% fall within the \$35,000 to \$75,000 range, and 38.85% earn more than \$75,000. These demographic characteristics lay the foundation for a comprehensive understanding of our study population, allowing for nuanced interpretations of subsequent analyses.

In addition, among the respondents, 48.77% were classified as self-motivated, 50.83% were not self-motivated, and 0.41% had missing data for this variable. The urbanity shows that 12.24% of the sample is rural, while 87.76% is urban (Table 1).

Among those with internet access who have been offered online access to their medical records by their healthcare provider or health insurance company, the overall logistic regression analysis revealed that sex, race, trust, income,

Table 1 Demographic Characteristics of Adults

| Characteristics | N | Weighted (Proportion, SE) |
|--------------------------------------|---------------|---------------------------|
| Total | 6252 | |
| Access Medical Records Online | | |
| No Access | 3375 (34.67) | 0.39 (0.08) |
| Yes Access | 6360 (65.33) | 0.60 (0.08) |
| Age | | |
| 18–49 | 3366 (34.03) | 0.51 (0.004) |
| 50–74 | 5139 (51.95) | 0.39 (0.004) |
| >75 | 1387 (14.02) | 0.08 (4.7 e-04) |
| Sex | | |
| Male | 3868 (40.26) | 0.48 (0.002) |
| Female | 5739 (59.74) | 0.51 (0.002) |
| Race | | |
| White | 5,336 (58.93) | 0.62 (0.002) |
| Black | 1,370 (15.13) | 0.11 (0.001) |
| Hispanic | 1,597 (17.64) | 0.17 (0.001) |
| Asian | 518 (5.72) | 0.06 (0.003) |
| Multiple | 234 (2.58) | 0.02 (0.002) |
| Marital Status | | |
| Married | 4,975 (52.05) | 0.55 (0.002) |
| Not Married | 4,583 (47.95) | 0.45 (0.002) |
| Education | | |
| High School | 2,433 (25.42) | 0.29 (0.005) |
| Some College | 2,753 (28.77) | 0.39 (0.005) |
| College | 4,384 (45.81) | 0.31 (0.001) |
| Income | | |
| <\$35,000 | 2,763 (30.81) | 0.26 (0.006) |
| \$35,000–\$75,000 | 2,721 (30.34) | 0.30 (0.008) |
| >\$75,000 | 3,484 (38.85) | 0.43 (0.008) |

(Continued)

Table 1 (Continued).

| Characteristics | N | Weighted (Proportion, SE) |
|---|---------------|---------------------------|
| Urbanity | | |
| Rural | 1,241 (12.27) | 0.12 (0.004) |
| Urban | 8,876 (87.73) | 0.87 (0.004) |
| Self Motivated | | |
| No | 5,142 (50.83) | 0.56 (0.008) |
| Yes | 4,934 (48.77) | 0.44 (0.008) |
| Use Internet | | |
| No Internet | 1,796 (17.76) | 0.14 (0.04) |
| Yes Internet | 8,314 (82.24) | 0.85 (0.04) |
| Offer Online Medical Access- Health care provider. | | 0.43 (0.01) |
| No Offer | 3,272 (33.23) | 0.36 (0.08) |
| Yes Offer | 6,576 (66.77) | 0.63 (0.08) |
| Offer Online Medical Access-Health Insurer | | |
| No Offer | 4,220 (44.39) | 0.50 (0.08) |
| Yes Offer | 5,287 (55.61) | 0.49 (0.08) |
| Social Media Site | | |
| No Access | 1,271 (12.82) | 0.08 (0.003) |
| Yes Access | 8640 (87.18) | 0.91 (0.003) |
| Total Trust | | |
| No Trust | 2267 (26.13) | 0.26 (0.008) |
| Yes Trust | 6409 (73.87) | 0.73 (0.008) |
| Used Health Wellness App | | |
| No | 2727 (37.63) | 0.34 (0.01) |
| Yes | 4519 (62.37) | 0.66 (0.01) |
| Chronic Total | | |
| No | 5984 (69.91) | 0.62 (0.004) |
| Yes | 2575 (30.09) | 0.38 (0.004) |
| Total Household | | |
| One Person | 3011 (31.65) | 0.17 (0.005) |
| More than one person | 6503 (68.35) | 0.83 (0.005) |
| Health Insurance | | |
| No Insurance | 3678 (38.19) | 0.49 (0.004) |
| Yes Insurance | 5952 (61.81) | 0.51 (0.004) |

urbanity, patients using health or wellness apps on their tablet or smartphone, and the total number of chronic conditions were significant predictors of online portal use in our population. Females had an odds ratio of 1.41 (P-value: 0.03, 95% CI: 1.03–1.94) for using the online portal compared to males. Those who scored above ten on questions related to trust, with a total trust score of 20 in cancer information provided by doctors, family members, government officials, charities, and religious organizations, had an odds ratio of 1.44 (P-value: 0.05, 95% CI: 1.00–2.09) for using the online portal compared to those with higher trust scores. Asian/Native American individuals had an odds ratio of 4.98 (P-value: 0.001, 95% CI: 2.02–12.29) for using their patient portal compared to white non-Hispanic individuals. Those earning \$75,000 or more had an odds ratio of 1.86 (P-value: 0.03, 95% CI: 1.05–3.29) for using the online portal. Individuals who used a health or wellness app on their tablet or smartphone had 3.6 times higher odds (P-value: 0.00, 95% CI: 2.40–5.41) of using the online portal than those without such apps. Lastly, Urban residents had an odds ratio of 1.53 (P-value: 0.04, 95% CI: 1.01–2.31) for the outcome compared to rural residents (Table 2).

Table 2 Logistic Regression Analysis of Factors Associated with Access to Online Health Records Among Self-Motivated Individuals

| | Odds Ratio (OR) | Standard Error | P t | 95% Confident Interval | |
|---------------------------|-----------------|----------------|---------|------------------------|-------|
| Age | | | | | |
| 18–49 (Ref) | | | | | |
| 50–74 | 1.24 | 0.25 | 0.29 | 0.81 | 1.89 |
| ≥75 | 0.83 | 0.30 | 0.61 | 0.39 | 1.73 |
| Gender | | | | | |
| Male (Ref) | | | | | |
| Female | 1.41 | 0.22 | 0.03* | 1.03 | 1.94 |
| Race | | | | | |
| White-Non Hispanic (Ref) | | | | | |
| Black-Non Hispanic | 1.08 | 0.35 | 0.81 | 0.55 | 2.10 |
| Hispanic | 0.75 | 0.17 | 0.22 | 0.47 | 1.19 |
| Asian/Native | 4.98 | 2.23 | 0.001** | 2.02 | 12.29 |
| Multiple races | 0.95 | 0.51 | 0.93 | 0.32 | 2.80 |
| Marital Status | | | | | |
| Married (Ref) | | | | | |
| Not Married | 1.05 | 0.23 | 0.80 | 0.68 | 1.64 |
| Education | | | | | |
| High School or less (Ref) | | | | | |
| Some College | 0.84 | 0.23 | 0.54 | 0.48 | 1.47 |
| College or more | 1.26 | 0.33 | 0.39 | 0.73 | 2.16 |
| Income | | | | | |
| <\$35,000 (Ref) | | | | | |
| \$35,000–\$75,000 | 1.67 | 0.50 | 0.09 | 0.91 | 3.08 |
| >\$75,000 | 1.86 | 0.52 | 0.03* | 1.05 | 3.29 |

(Continued)

Table 2 (Continued).

| | Odds Ratio (OR) | Standard Error | P t | 95% Confident Interval | |
|---------------------------------|-----------------|----------------|--------|------------------------|------|
| Urbanity | | | | | |
| Rural (Ref) | | | | | |
| Urban | 1.53 | 0.31 | 0.04* | 1.01 | 2.31 |
| Social Media Site | | | | | |
| No Access (Ref) | | | | | |
| Yes Access | 1.01 | 0.32 | 0.97 | 0.52 | 1.93 |
| Total Trust | | | | | |
| No Trust (Ref) | | | | | |
| Yes Trust | 1.44 | 0.26 | 0.05* | 1.00 | 2.09 |
| Used Health Wellness App | | | | | |
| No App (Ref) | | | | | |
| Yes App | 3.6 | 0.72 | 0.00** | 2.40 | 5.41 |
| Chronic Total | | | | | |
| No Chronic (Ref) | | | | | |
| Yes Chronic | 1.30 | 0.47 | 0.46 | 0.62 | 2.70 |
| Total Household | | | | | |
| One Person (Ref) | | | | | |
| More than one person | 0.89 | 0.21 | 0.66 | 0.54 | 1.46 |
| Health Insurance | | | | | |
| No Insurance (Ref) | | | | | |
| Yes Insurance | 1.46 | 0.37 | 0.14 | 0.87 | 2.45 |

Note: All odd ratios are significant (* $p < 0.05$, ** $p < 0.001$).

Abbreviations: OR, odds ratio; CI, confidence interval; ref, reference category.

Discussion

The findings from our study, coupled with the observed self-motivation to use IT for health improvement, underscore the significance of individual motivation in driving online patient portal usage and access. This aligns with most behavioral change theories and interventions, typically focused on public health issues.²¹ Given the evident impact of self-motivation on the adoption of online portals, there is a pressing need for more behavioral and motivational interventions tailored towards adopting health IT tools with significant public health implications. In other words, our study indicated that self-motivation is probably a significant influence on portal use for engagement aside from the factors contributing to the digital divide.²² Additionally, our findings highlight the critical role of trust in shaping patient engagement in healthcare and how often they would use the patient portal. Trust was measured using a composite score based on ordinal responses to questions about trust in information from various sources. A lower trust score indicates higher trust, reflecting greater confidence in information from healthcare providers, family, friends, government agencies, charities, and religious leaders. This understanding is consistent with the fundamental principles of health promotion theory, which prioritize the encouragement of healthy lifestyles and the comprehension of factors influencing behavior change. According to this theory, individuals possessing the requisite motivation and self-efficacy and perceiving the benefits of health-promoting actions are more likely

to engage in behaviors conducive to improving health.²³ The results of our study provide critical insights into the complex interplay between individual characteristics, socioeconomic factors, and technology adoption in the healthcare domain. The analyses reveal disparities in patient portal adoption, highlighting the need for targeted interventions to address barriers and promote equitable access to digital health tools. However, further study is needed to understand how and whether social media can serve as an alternative means to motivate patients to use patient portals, as our results were inconsistent with one of the referenced research studies.¹⁷ One key implication of our findings is the importance of building trust in healthcare information among patient populations, which aligns with other research papers.^{24,25} Strategies to enhance trust in healthcare providers and information sources may help overcome skepticism and encourage greater engagement with online patient portals.^{7,26} Additionally, efforts to improve digital literacy and support individuals with lower incomes or limited access to technology can help mitigate disparities in adoption rates.^{27,28}

Furthermore, our study underscores the potential of health and wellness apps as gateways to online patient portal use. Integrating patient portal functionalities into existing health apps or leveraging digital health platforms may enhance user engagement and facilitate seamless access to medical records. Moving forward, future research should continue to explore the underlying determinants of patient portal adoption and evaluate the effectiveness of targeted interventions in promoting equitable access to healthcare technologies. By leveraging insights from behavioral theories such as the health promotion model, stakeholders can develop evidence-based strategies to encourage technology adoption, improve health outcomes, and advance health equity in diverse populations.

Limitations

The present study has several limitations that warrant acknowledgment. Firstly, the cross-sectional design employed in this research precludes the establishment of causal relationships between the variables examined, particularly regarding the use of patient portals by motivated patients. Additionally, reliance solely on self-reported survey data introduces the possibility of recall bias, response bias, or misreporting of medical issues. Furthermore, individuals who are active users of social media platforms may exhibit a predisposition towards trusting technology yet may not necessarily have a perceived need to utilize it for healthcare purposes. Our results show that social media use was not correlated with the outcome. Despite these limitations, our study highlights crucial variables associated with patient portal usage amidst an unprecedented adoption cycle, providing valuable insights into patient engagement with healthcare technology. Subsequent research conducted in the post-pandemic era is essential to elucidate the long-term effects of these findings on healthcare delivery.

Conclusions

The findings from this study provide valuable insights into the dynamics of online patient portal adoption among motivated users during and after the COVID-19 pandemic. Our study highlights the importance of self-motivation as a key determinant in adopting online patient portals. The findings underscore that patients who exhibit higher levels of intrinsic motivation—such as a willingness to use health technologies or engage with digital platforms—are more likely to access their online medical records. These results align with existing behavioral change theories, which emphasize that individuals with higher motivation and perceived benefits from technology are more inclined to adopt such tools.

Adoption rates remain suboptimal despite the significant push towards integrating patient portals with EHRs through incentives like the Health Information Technology for Economic and Clinical Health Act's Meaningful Use Stage 2. Our analysis reveals that various demographic, socioeconomic, and behavioral factors significantly influence the likelihood of individuals accessing their online medical records. Notably, our study underscores the critical role of trust, income, sex, race/ethnicity, urbanity, and health app usage in shaping patient portal adoption. Females, individuals with higher trust (lower score) in cancer-related information, Asian/Native American individuals, those who live in urban areas, and those with higher incomes demonstrated higher odds of using online patient portals. Moreover, individuals using health or wellness apps on their tablets or smartphones exhibited significantly higher odds of accessing their online medical records. These findings align with the principles of the health promotion model, which emphasizes the importance of addressing individual perceptions, motivations, and environmental factors in promoting health behaviors.²⁹ By identifying the factors associated with patient portal adoption, healthcare providers and policymakers can develop targeted

interventions to bridge the digital divide, promote equitable access to healthcare technologies, and empower individuals to take control of their health.

Disclosure

The authors report no conflicts of interest in this work.

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