

Revisiting Provider Role in Patient Use of Online Medical Records

Surma Mukhopadhyay¹ Ramsankar Basak² Saif Khairat³ Timothy J. Carney²

¹Independent Researcher, Durham, North Carolina, United States

²University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, United States

³Carolina Informatics Program, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, United States

Address for correspondence Ramsankar Basak, PhD, Department of Radiation Oncology, UNC-Chapel Hill, 100 Manning Dr, Chapel Hill, NC 27599, United States (e-mail: rams@email.unc.edu).

Appl Clin Inform 2021;12:1110–1119.

Abstract

Objectives Provider encouragement for patient use of online medical record (OMR) systems is poorly understood. The study examines temporal trends and predictors of provider encouragement and the effects of encouragement on OMR use.

Methods Health Information National Trends Survey administered in 2017 and 2020 were used. Subjects were 18 to 75 years old with access to the Internet or smart devices. From 2017 and 2020, 2,558 and 3,058 subjects were included, respectively.

Results In 2020, 52.8% reported receiving provider encouragement within the last year for OMR use compared with 41.3% in 2017 ($p < 0.001$). For respondents with chronic diseases (such as diabetes, hypertension, heart, or lung diseases [CVMD]), encouragement increased from 45.5 to 57.2% ($p < 0.001$). Sociodemographic determinants and clinical attributes (e.g., provider office visits, cancer history, or CVMDs) significantly ($p < 0.05$) predicted encouragement. Among CVMD subjects, gender and visit frequency were significant predictors. OMR use within a year grew recently (73.3% in 2020 vs. 60.6% in 2017, $p = 0.002$) among CVMD subjects reporting encouragement. Provider encouragement was associated ($p < 0.05$) with secure communication and viewing results using OMRs controlling for other predictors in the overall cohort and among CVMD subjects.

Conclusion Many respondents reported not receiving provider encouragement for OMR use. These subjects represent millions of U.S. adults, including those participating during the pandemic, with CVMDs or cancer history. Encouragement rates grew over time and was associated with demographic or disease attributes and with OMR use. Future research should assess the optimality of encouragement. Resources enabling provider encouragement should continue and help prevent disparity in health technology use.

Keywords

- ▶ physician
- ▶ online medical records
- ▶ patient portal
- ▶ facilitators and barriers
- ▶ disparity
- ▶ public health
- ▶ health policy

Background and Significance

Online medical record (OMR) systems—alternatively, patient portals—provide patients with secure access to personal health information contained in their electronic health re-

cord (EHR).¹ OMR offers an accessible and useful platform for patients and care delivery or coordination. Over the past year or so, health care providers have utilized OMR's ability to enable telehealth and other care access options.² For example, many providers have utilized these platforms to alert

received

July 26, 2021

accepted after revision

October 5, 2021

© 2021. Thieme. All rights reserved.

Georg Thieme Verlag KG,

Rüdigerstraße 14,

70469 Stuttgart, Germany

DOI <https://doi.org/>

10.1055/s-0041-1740189.

ISSN 1869-0327.

patients about COVID-19 vaccine eligibility or to set up visits.² Advances in Internet-enabled technology use or health care delivery call for reassessments of provider- or person-centered determinants of OMR use to ensure equity in health management in the postpandemic era.

OMR use among American adults has increased over years but only modestly³; while 25.6% of adults reported use in 2014, 31.4% did so in 2018 as noted by national surveys in the U.S.⁴ Studies have extensively investigated patient-side barriers to OMR adoption or use^{1,5,6} and issues associated with such barriers among population segments defined by demographic attributes (e.g., older adults),^{7,8} social determinants (e.g., disadvantaged population),⁹ or clinical attributes (e.g., people living with chronic health conditions).^{10,11} As for providers, attitudes and barriers include disruption to workflow and concerns about OMR causing cognitive overload for patients and patient anxiety.^{12–14} Physician-perceived barriers were echoed in patient surveys,¹⁰ including lack of providers' willingness to support patient use.¹⁵ While patients expected physicians to get more involved in patients' OMR use,¹⁶ patients reported that physicians did not view patients' OMR use as issues physicians could resolve.^{16,17} Only 39% of patients reported to have discussed health information technology use with their providers¹⁸ and 59% reported no provider encouragement for OMR use.¹⁹

Despite patient interest in OMRs, widespread use has not happened.^{1,3,12} Provider endorsement or encouragement may act as a stimulus for patient OMR use²⁰ but providers were not often found to discuss OMR use with patients.¹⁸ Yet, what predicts provider encouragement and, in turn, how provider encouragement affects OMR use remain understudied. Prior work noted a gap in understanding how follow-ups and reinforcements relate to patient engagement via OMRs.^{3,10} Indeed, provider encouragement needs to be investigated due to significant changes in more recent times (e.g., provider EHR adoption,³ EHR incentive programs,¹² Internet/smart device use, or rise in digital literacy^{12,21}). The study aims to examine (1) temporal trends in provider encouragement for patient use of OMR, (2) predictors of provider encouragement, and (3) association of provider encouragement with patient use of OMR. Chronic diseases (e.g., hypertension) are inflicting more people globally or often so do early.²² Thus, the study examines provider encouragement by disease status.

The findings of this research should help advance understanding of determinants of OMR use. Pains and disruptions inflicted by the COVID-19 pandemic will not go anytime soon and certainly not the need for care available or managed digitally. With the pandemic obviating the need for digital care advancement efforts, the study should help reduce the current disparity in technology-driven health management. This study extends understanding of a key motivator of OMR use and holds implications for implementation scientists, and health systems and public health leaders. Specifically, insights from analyses of subgroups defined by disease or OMR use attributes are novel. Overall, the study will serve to rethink roles, identify opportunities to improve access to care, and facilitate patient engagement with OMR, including those for patients in need of more proactive management.

Methods

Study Design and Participants

The Health Information National Trends Survey (HINTS) explores noninstitutionalized U.S. adults' health information and communication behavior.²³ HINTS-5, cycle 1 and 4 iterations administered in early 2017 and 2020 were used. In 2020, data were collected during the pandemic from March through June, 2020. Each iteration used a two-stage sampling design—selecting a stratified sample of households followed by selecting an adult respondent from each sampled household. Inclusion criteria were imposed to improve the findings' validity. First, subjects having information on provider office visits in the past year were included. Office visit was measured by frequencies a respondent went to doctors or other health professionals to get care for the respondent in the past year without counting emergency room visits. This is to compare by or control for ongoing care needs in recent times and minimize biases (e.g., one could argue providers did not have a chance to ask). Second, respondents reporting having access to the Internet or smart devices were selected. This should exclude barriers not of interest and better explicate the effects of focal variable. Third, 18 to 75 years old subjects were included consistent with the literature¹⁸; far older adults may be too heterogeneous (e.g., caregiver responses, lacking/declining technical skills, etc.). About 95% also reported doing online activities (e.g., searching or sharing health information, visiting social media) in the past year.

Variable Description

This study has three outcome measures. Provider encouragement was the primary variable of interest and measured by yes/no to “(h)ave any of your health care providers, including doctors, nurses, or office staff ever encouraged you to use an online medical record?” For OMR function use in the past year, viewing results (“have you used your online medical record to (l)ook up test results?”) and messaging (“have you used your online medical record to (s)ecurely message health care provider and staff (for example, e-mail)?”) were binary outcomes. Of those reporting to have accessed OMR within a year, these most frequently used functions⁸ were asked in both cycles and together should capture OMR use.

“Big five” disease (diabetes, cardiovascular diseases, respiratory disease, cancer, and stroke) patients stand to benefit from information and communication technology use.²⁴ A set of diseases—termed as priority conditions—were previously identified as having significant population-level impacts due to their incidence rates or cost of management.^{25,26} HINTS asked whether subjects had some of these conditions: chronic diseases such as diabetes, hypertension, heart, or lung diseases (defined as CVMD herein) and cancer. Patient-reported number of CVMDs was calculated as an approximate measure of disease burden. Furthermore, a binary variable—CVMD status—indicates the presence/absence of any CVMDs and was used either as a predictor or for subgroup analyses. Frequency of provider office visits by a patient within a year was used as a measure of health care utilization. Respondent demographic

attributes include race/ethnicity, education, residential area (per U.S. Department of Agriculture or USDA Rural/Urban Designation, 2013), income, marital status, gender, and age.

Statistical Analysis

The study provides descriptive statistics and population-level estimates (i.e., weighted frequencies/percent) using HINTS-provided weights. Analysis was undertaken with all years combined, by survey year (interchangeably specified as

year) to examine longitudinal changes, or by subgroups defined by clinical attributes (i.e., disease profile or health care utilization) or year. OMR access status (i.e., no [0] vs. yes [≥ 1]), computed from number of times subjects had accessed OMRs in the past year, was used for subgroup analysis. Multivariable logistic regression models were run separately with three outcome variables, provider encouragement and its associations with OMR feature usage (i.e., secure communication and viewing results), controlling for

Table 1 Respondent attributes

Variable	Overall N (weighted %)	2017 N (weighted %)	2020 N (weighted %)
N/weighted N	5,616	2,558/205M	3,058/218M
Age (weighted mean/SE)	45.4 (0.24)	45.6 (0.36)	45.1 (0.32)
Male	2,214 (49.1)	1,008 (48.6)	1,206 (49.5)
Race			
White	3,930 (76.5)	1,805 (76.9)	2,125 (76.1)
African American	818 (12.5)	368 (11.9)	450 (12.9)
Others	586 (11.0)	277 (11.1)	309 (11.0)
Education			
≤ High school	1,133 (27.0)	497 (26.5)	636 (27.4)
Some college	1,657 (37.0)	772 (34.0)	885 (39.9)
≥ College	2,758 (36.0)	1,275 (39.6)	1,483 (32.7)
Married (yes)	3,227 (56.7)	1,523 (57.7)	1,704 (55.8)
Household income (\$)			
< 20K	764 (13.4)	342 (13.8)	422 (13.1)
20K–34K	625 (10.7)	291 (11.1)	334 (10.4)
35K–49K	657 (13.4)	301 (15.0)	356 (11.9)
50K–74K	970 (19.3)	461 (19.9)	509 (18.8)
≥ 75K	2,195 (43.1)	980 (40.2)	1,215 (45.8)
Residence			
Nonmetro	246 (5.3)	118 (5.2)	128 (5.3)
Metro	4,983 (87.7)	2,239 (86.6)	2,744 (88.7)
Rural	387 (7.0)	201 (8.2)	186 (6.0)
Visit frequency (mean/SE)	2.5 (0.04)	2.4 (0.06)	2.6 (0.05)
Number of CVMDs			
0	2,728 (55.9)	1,256 (56.9)	1,472 (54.9)
1	1,720 (27.9)	779 (27.4)	941 (28.3)
2	856 (12.2)	391 (11.9)	465 (12.4)
3	250 (3.2)	102 (2.7)	148 (3.6)
4	62 (0.9)	30 (1.1)	32 (0.7)
Cancer survivor	750 (7.2)	327 (6.8)	423 (7.7)
Provider encouraged	2,885 (47.1)	1,198 (41.3)	1,687 (52.8)
Accessed OMRs	2,312 (37.9)	914 (32.2)	1,398 (43.1)

Abbreviations: CVMD, chronic diseases include diabetes, high blood pressure, heart, or lung diseases; OMR, online medical record; SE, standard error computed utilizing survey weights.

Abbreviations: Area of residence was measured per U.S. Department of Agriculture (USDA) Rural/Urban Designation (2013) as metro ($\geq 250K$ population or in metro counties), nonmetro (urban or $\geq 20K$ population), and rural ($< 20K$); visit frequency: provider office visit frequency in the past year.

sociodemographic determinants (i.e., age, gender, race, education, marital status, income, and area of residence), clinical predictors (i.e., office visit frequency, number of CVMDs, cancer history/survivor), and survey year. As survey weights were used in regressions, standard error estimations applied methods appropriate for weighted analysis. In the models for OMR feature use, encouragement was the focal predictor. For comparative reasons and better interpretation, regression analyses were repeated in subgroups; however, regression models did not include year and/or CVMDs as appropriate. Data analysis was performed with SAS version 9.4.

Results

From cycle 1 (2017) and cycle 4 (2020), 2,558 and 3,058 respondents were included, respectively, and these repre-

sented approximately 205 and 218 million U.S. adults in the respective year. On average, respondents were approximately 45 years old and made 2.5 provider office visits in the past year (–Table 1). About 44% were CVMD patients and 7% were cancer survivors.

Trends in Provider Encouragement

In 2020, 52.8% (representing ~113 million adults) reported providers encouraging OMR use within the past year compared with 41.3% (representing ~84 million adults) in 2017 ($p < 0.001$). The trends increased among respondents with select CVMDs (57.2% in 2020 vs. 45.5% in 2017; $p < 0.001$) and without select diseases (49.2% in 2020 vs. 38% in 2017, $p < 0.001$) as well. Of 2,878 subjects with chronic conditions or cancer survivors that made an office visit within the past year, the trend increased from 48.5 to 58.7% ($p < 0.001$).

Table 2 Predictors of provider encouragement from overall and subgroups analyses

Predictor	Overall	No CVMD	CVMD	2017	2020
Year [ref: 2017]					
2020	1.52 ^c	1.46 ^b	1.61 ^c	–	–
Age	1	1	0.99	1	1
Gender [ref: Female]					
Male	0.58 ^c	0.50 ^c	0.65 ^b	0.53 ^c	0.63 ^b
Race [ref: white]					
African American	1.08	2.06 ^b	0.68 ^a	0.89	1.3
Others	1.06	1.13	1.01	0.93	1.18
Education [ref: ≥college]					
≤ High school	0.54 ^c	0.45 ^c	0.69 ^a	0.56 ^b	0.52 ^c
Some college	0.75 ^b	0.64 ^b	0.93	0.72 ^b	0.78
Marital status [ref: not married]					
Married	1.46 ^b	1.58 ^b	1.35 ^a	1.74 ^b	1.27
Household income (\$) [ref: ≥75K]					
< 20K	0.41 ^c	0.34 ^c	0.49 ^b	0.46 ^b	0.36 ^c
20K–34K	0.49 ^c	0.40 ^c	0.59 ^b	0.47 ^c	0.49 ^b
35K–49K	0.62 ^b	0.63 ^a	0.61 ^a	0.64 ^b	0.63 ^a
50K–74K	0.69 ^b	0.69 ^a	0.70 ^b	0.84	0.58 ^b
Residence [ref: rural]					
Nonmetro	1.12	0.62	1.88	1.62	0.73
Metro	1.15	0.95	1.33	1.89 ^b	0.68
Visit frequency	1.17 ^c	1.20 ^c	1.13 ^b	1.19 ^c	1.16 ^c
Number of CVMDs	1.20 ^b		1.08	1.23 ^b	1.18 ^a
Cancer survivor [ref: no]					
Yes	1.38 ^b	1.57 ^a	1.31	1.03	1.71 ^b

Abbreviation: CVMD, chronic diseases include diabetes, high blood pressure, heart, or lung diseases.

Note: Numbers are odds ratios derived from weighted multivariable logistic regression models. Area of residence was measured per U.S. Department of Agriculture (USDA) Rural/Urban Designation (2013) as metro (≥ 250K population or in metro counties), nonmetro (urban or ≥ 20K population), and rural (< 20K); visit frequency: provider office visit frequency in the past year.

^a $p < 0.1$.

^b $p < 0.05$.

^c $p < 0.001$.

Predictors of Provider Encouragement

Multivariable analysis reveals (►Table 2) that year significantly predicted provider encouragement (odds ratio [OR] for 2020 vs. 2017 = 1.52, $p < 0.001$). Among sociodemographic determinants, gender (male vs. female OR = 0.58), education (e.g., high school [HS] or less vs. college graduate OR = 0.54), marital status (currently married vs. not OR = 1.46), and income (< 20K vs. \geq 75K OR = 0.41) were significant ($p < 0.05$). In addition, visit frequency (OR = 1.17, $p < 0.001$), number of CVMDs (OR = 1.2, $p = 0.006$), and cancer survivorship (OR = 1.38, $p = 0.028$) were significant predictors.

Among those without select CVMDs, year had a significant effect (OR = 1.46, $p = 0.005$). In addition, gender (male vs. female OR = 0.50, $p < 0.001$), race (African American [AA] vs. white OR = 2.1, $p = 0.03$), education (e.g., HS or less vs. college graduate OR = 0.45, $p = 0.008$), marital status (currently married vs. not OR = 1.58, $p = 0.009$), income (< 20K vs. \geq 75K OR = 0.34, $p < 0.001$ and 20–35K vs. \geq 75K OR = 0.40, $p < 0.001$), and visit frequency (OR = 1.2, $p < 0.001$) were significant. For those with CVMDs, year (2020 vs. 2017 OR = 1.61, $p = 0.001$) had a strong effect along with gender (male vs. female OR = 0.65, $p = 0.006$), income, and visit frequency (OR = 1.13, $p = 0.002$).

Trend Analysis on Effects of Provider Encouragement on Patient Use of OMRs

►Fig. 1 presents OMR accessing rates by years stratified by provider encouragement. Among those reporting providers encouraging them, a large percent used OMR (62.9% in 2017 vs. 67.4% in 2020) in both years; a significant increase in OMR use over years is seen among subjects with CVMDs (60.6% in 2017 to 73.3% in 2020, $p = 0.002$) but increase among cancer survivors (63.3 to 72.4%) was not significant. For those reporting no encouragement, there is an increase ($p = 0.009$) in use over years; a similar trend in use is noted among CVMD subjects (11.3 to 21.4%, $p = 0.006$).

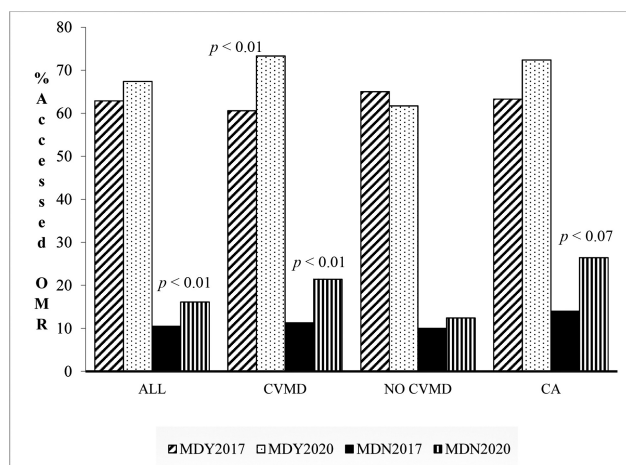


Fig. 1 Rates of accessing online medical record (OMR) in 2020 and 2017 stratified by provider encouragement. Estimates used survey weights. 20xx, survey year 20xx; Ca, cancer survivor; CVMD, chronic diseases include diabetes, high blood pressure, heart, or lung diseases; MDN, subjects not reporting provider encouragement; MDY, subjects reporting provider encouragement for OMR use; OMR, online medical records systems.

Associations of Provider Encouragement with Patient Use of OMR Features

►Table 3 describes patterns of effects of encouragement on secure communication and viewing results using OMR. Provider encouragement was significantly associated (OR = 2, $p < 0.001$) with patient communication securely using OMR after controlling for other predictors, including year. A similar effect of encouragement (OR = 2.71, $p = 0.002$) was noted among CVMD subjects. An effect of encouragement on viewing results via OMR was found overall (OR = 1.74, $p = 0.03$) and among CVMD subjects (OR = 2.13, $p = 0.01$).

Discussion

Nationally representative data collected 3 years apart reveal the growth in provider encouragement, which was associated with social or demographic determinants. The study confirms variability in associations between provider encouragement and OMR feature usage. This study makes several contributions. First, this is the first study to longitudinally assess both determinants of provider encouragement and associations of OMR feature use with encouragement and those within disease-based or other attributes-based subgroups. Second, this work occurs amid the ongoing COVID pandemic and included data before and after meaningful use stage 3, which had quality measures to capture patient education and engagement objectives.²⁷ That is measuring the provider impact amid changing contexts (e.g., smartphone use growth) in recent years. The results are relevant for bridging the gap in or advancing OMR use in the post-pandemic era, especially among subjects with digital access and/or literacy. As providers are the reliable source for patient education or persuading patients^{8,28} regarding health care decisions, favorable usage patterns are expected in this population—including those who may access OMRs through smartphone apps—if patients are appropriately—more nondiscriminatorily—targeted.

Trends in Provider Encouragement: Contextual Attributes and Their Interactions

Patient-reported provider encouragement improved in the 2020 cohort compared with those in 2017 after controlling for sociodemographic or clinical determinants; such a trend remains steady and was seen across those without or with CVMDs. This work complements the literature on OMR use²⁹ by assessing the trend in a key driver of OMR use. General temporal comparisons look positive especially if one considers that for some 2020 respondents providers might have postponed nonurgent visits early in the pandemic; however, it is also not unreasonable to wonder whether the rate of increase is as expected given the pandemic often required providers offering Internet-enabled services. It is for policymakers to undertake comparative benchmark assessments on the role in the future. Of the 2020 respondents who had a provider visit in the past year, many (43%) did not specify encouragement; a similar finding is noted among CVMD subjects or cancer survivors. That a large proportion

Table 3 Association (odds ratio) of provider encouragement with online medical records feature use

Year	Secure messaging			View results		
	Overall	No CVMD	CVMD	Overall	No CVMD	CVMD
Combined	2.00 ^c	1.58 ^a	2.71 ^c	1.74 ^b	1.38	2.13 ^b
2017	–	1.51	2.52 ^b	–	1.63	1.88
2020	–	2.05 ^a	3.34 ^b	–	1.27	2.87 ^b

Abbreviation: CVMD, chronic diseases include diabetes, high blood pressure, heart, or lung diseases.

Note: Odds ratios were derived from weighted multivariable logistic regression models controlling for age, gender, race, education, marital status, income, residence, provider office visit frequency in the past year, cancer history, CVMDs (as appropriate), and survey year (as appropriate).

^a $p < 0.1$.

^b $p < 0.05$.

^c $p < 0.001$.

reportedly not receiving encouragement indicates the extent to which this key motivator can help expand OMR use.

Sociodemographic determinants were associated with receiving encouragement in the entire cohort or among subjects without CVMDs. As for the race effects, whites reported significantly lesser odds among subjects without CVMDs. However, this pattern is not seen among subjects with CVMDs; AA were marginally ($p = 0.06$) less likely to receive encouragement compared with whites. Such a pattern remains to be observed in future studies with more subjects. Also, alternative operationalization of race (e.g., non-Hispanic white, etc.) may change results (see [Appendix Table A1](#)). The current study suggests an interaction between disease status and race. Social or demographic determinants have been consistently associated with disparity in OMR adoption or usage patterns^{11,30}; the results of this study imply that such disparity may partially be rooted in differential encouragement. Providers may operate in systems where implicit bias or racism is not uncommon.³¹ Some providers may be aware of disparities and encouraging AAs to use OMR more than others or implicitly making efforts to engage certain patients in some contexts and not others. Only gender and income emerged as significant among CVMD patients. While providers may perceive that subjects with CVMDs need no further encouragement as many already adopted OMR, it may still be good practice to encourage continued use because adoption of OMR is known to not guarantee usage.¹¹ Visit frequency remained consistently a significant predictor and seems to interact with disease status; while the no select CVMD group reported lesser odds, those with diseases reported higher odds of encouragement with increasing visits. It remains to assess whether patient visits are optimally utilized for encouragement, including the state of alerts from EHR for providers.

Analyses within individual years reveal that the relative impacts of sociodemographic determinants on encouragement remained stable over years; as such, effects largely continued despite no apparent issues related to the digital divide among the subjects. It is not unlikely for providers to be sensitive to patients' abilities (e.g., understanding of health information in English, which is the predominant OMR format), or incorrectly assess abilities; either will lead providers to not encourage OMR use. Yet, these findings point toward a need for more proactive outreach to preclude

sociodemography-based disparity in or further delaying OMR use. Among clinical predictors, cancer survivorship was positively associated in 2020. This is a welcome change given that cancer survivors need care regularly. However, caution is warranted because responses in 2020 came in or after March when the World Health Organization declared the global pandemic; such encouragement may have been fueled by the pattern of care during the pandemic and not solely due to the motivation to encourage technology-based health management. Given provider concerns about resources to support patient use of OMRs^{30,32} and ongoing changes in locus of incentives for providers (e.g., proposed elimination of EHR engagement measure),³³ it is imperative to ensure resources facilitating provider encouragement do not abate moving forward. Adopting practices and policies responsive to stakeholders' needs (e.g., some patients need more help with portal setup than others) should help providers rethink their roles in patient OMR use.^{10,12,34} The study calls for reassessments of policies and priorities (e.g., lacking organizational priority reported as an impediment¹⁰) to enable providers to continue to encourage OMR use.

Provider Encouragement: OMR Use Patterns

There is a substantially higher rate of OMR access among those reporting encouragement compared with no encouragement. Unlike patterns in those receiving encouragement, a significant increase in OMR use from 2017 to 2020 was noted among those reporting no encouragement. Such patterns are difficult to explain; it may be just that some are motivated and see efficiency in care management through the utilization of OMRs. Among those with CVMDs, there are statistically significant increasing trends in OMR use in both groups reporting and not reporting encouragement. Among cancer survivors, rates were much larger in those reporting encouragement although there were no changes over time. Yet, a large number of subjects did not access OMRs; of those reporting to not have accessed OMRs despite provider visits in the past year, a large proportion (i.e., representing tens of millions) of cancer survivors or CVMD patients did not specify encouragement either. Encouragement should enhance uptake and continued use among these subjects.

OMR feature usage patterns (i.e., viewing results or secure communication) among different population segments were

associated with encouragement. Prior research qualitatively observed similar findings,¹⁹ although our study adopted a different methodological and clinically focused approach. Similar effects of encouragement were noted among CVMD patients. As for longitudinal evolution, compared with 2017, OMR feature utilization in 2020 showed a general favorable trend although feature usage by some segments (e.g., CVMD folks viewing results or no CVMD folks utilizing secure communication) still stands to grow from continued encouragement if providers reflect positive beliefs about OMRs during patient-provider interactions. Given the positive relationship between visit frequency and encouragement, higher frequencies might have signaled providers to encourage those patients, and in turn, such encouragements lead to OMR usage. The usage pattern among CVMD subjects is evidence that usage is facilitated by patient engagement or needs as reported previously.^{14,35} Prior programs that incentivized providers to encourage patient engagement and electronic health information exchange yielded favorable OMR utilization.²⁹ This study shows provider encouragement helps realize high-priority public health goals, including utilization of electronic health information.³⁶

Removing access to technology (e.g., Internet) did not always eliminate disparities in OMR use.³⁷ Outreaching for encouragement offers providers opportunities to assess issues facing patients, including barriers associated with demographic and disease attributes,³⁸ or reeducate patients. As such, a patient-centric approach will help patients perceive OMR use as an integral part of patient-provider collaborations and facilitate equitable access to digital care given OMR activation status is related to telemedicine access.³⁹ In the post-COVID era, this will be important for some (e.g., low income or education subjects that experience less encouragement) that are disproportionately vulnerable to poor health outcomes. Making encouragement part of standard office visit interactions, when possible, may nudge more patients toward utilizing digital care or health services. Health care organizations and policymakers should determine strategies to keep the trajectory of encouragement optimal and serving patient needs across social strata.

The study has a few limitations. A generic question on provider encouragement was asked. Qualitative contents of encouragement that consider patient or disease attributes or other barriers (e.g., knowledge, self-efficacy)³⁷ should matter. Future studies should investigate content effects. Of many OMR functionalities, this study examined only two that were common to both years; however, these features served to unfold the role of encouragement. Of note, clinical outcomes of encouragement remain out of scope for the study because OMR use is just one of many dimensions of health management. Finally, encouragement may work differently among subjects excluded in this work (e.g., > 75 years, having access barriers such as no Internet). Furthermore, provider behaviors in 2020 that may have been influenced by the pandemic or other determinants not controlled for may have affected results. Despite limitations, the study results are likely conservative because of restricted inclusions yet affirm the importance of provider encouragement.

Conclusion

An upward trajectory of provider encouragement for use of OMR systems or patient portals was observed. Sociodemographic and clinical factors predicted encouragement and many of such determinants remained stable predictors over years. Variability in OMR access was noted by provider encouragement, which had mixed effects on feature use ranging from a strong one to none depending on disease status. That many subjects reported a lack of provider encouragement—some being cancer survivors, living with one or more chronic diseases, or having visited provider office within the past year—points toward a potential intervention task for providers. Lessening of intensification of provider encouragement may lessen OMR utilization and potentially widen disparity by perpetuating the problematic utilization of health technologies.

Clinical Relevance Statement

The recent disease outbreak has laid bare challenges to care providing for those who are vulnerable or need continuity of care (e.g., people with chronic diseases such as diabetes, high blood pressure, etc., or multiple chronic conditions). Public health initiatives (e.g., Million Hearts of CDC, Healthy People 2030, etc.) have advocated the use of health information technology (HIT) to optimize care. Through a deeper understanding of an important driver of HIT use, the findings should serve to expand equity in technology-enabled health management as envisioned by public health programs/initiatives and more so in the postpandemic times.

Multiple Choice Questions

1. Electronic health records (EHRs) adoption among U.S. providers has largely grown in recent years. What do we observe regarding provider encouragement for online medical records (OMR) or patient portal use? It has
 - a. Declined.
 - b. Remained stable.
 - c. Grown but disparities exist.
 - d. Grown but there is not any known predictors of encouragements.

Correct Answer: The correct answer is option c. An upward trajectory in provider encouragement for OMR use was observed. Sociodemographic determinants and clinical factors predicted provider encouragement even among those with access to the Internet or Internet-enabled technologies.

2. How Important is to study provider encouragement for OMR use?
 - a. Unrelated to patient OMR use.
 - b. Important but affects providers only.
 - c. Irrelevant as patients are always encouraged.
 - d. Important for patients and other stakeholders.

Correct Answer: The correct answer is option d. There is a significant and positive relationship between portal feature use (e.g., secure communication via OMR) and provider encouragement. Yet, a substantial proportion of subjects reported a lack of encouragement, including those during the COVID pandemic or those with a history of cancers or chronic diseases. Lessening of intensification of provider encouragement may lessen OMR utilization and potentially widen disparity in utilization of health technologies. Public health, implementation science, and health systems leaders can use the results to understand how encouragement facilitates OMR use overall or in clinical subgroups to prevent widening the current disparity in technology-driven health management among patients, including those in need of proactive management.

Protection of Human and Animal Subjects

This study utilized a publicly available data source provided by the National Cancer Institute (NCI). The data do not contain any information that can be used to identify subjects and harm subjects in any way. Furthermore, results are presented only in aggregated forms.

Conflict of Interest

None declared.

References

- Goldzweig CL, Orshansky G, Paige NM, et al. Electronic patient portals: evidence on health outcomes, satisfaction, efficiency, and attitudes: a systematic review. *Ann Intern Med* 2013;159(10):677–687
- Heath S. Low Patient Portal Adoption Could Stymie COVID-19 Vaccine Rollout. Accessed June 1, 2021 at: <https://patientengagementhit.com/news/low-patient-portal-adoption-could-stymie-covid-19-vaccine-rollout>
- Lyles CR, Nelson EC, Frampton S, Dykes PC, Cemballi AG, Sarkar U. Using electronic health record portals to improve patient engagement: research priorities and best practices. *Ann Intern Med* 2020;172(11, Suppl):S123–S129
- Hong YA, Jiang S, Liu PL. Use of patient portals of electronic health records remains low from 2014 to 2018: results from a national survey and policy implications. *Am J Health Promot* 2020;34(06):677–680
- Abd-Alrazaq AA, Bewick BM, Farragher T, Gardner P. Factors that affect the use of electronic personal health records among patients: a systematic review. *Int J Med Inform* 2019;126:164–175
- McAlearney AS, Gaughan A, MacEwan SR, Fareed N, Huerta TR. Improving acceptance of inpatient portals: patients' and care team members' perspectives. *Telemed J E Health* 2020;26(03):310–326
- Walker DM, Hefner JL, Fareed N, Huerta TR, McAlearney AS. Exploring the digital divide: age and race disparities in use of an inpatient OMR. *Telemed J E Health* 2020;26(05):603–613
- Nahm ES, Zhu S, Bellantoni M, et al. Patient portal use among older adults: what is really happening nationwide? *J Appl Gerontol* 2020;39(04):442–450
- Ancker JS, Barrón Y, Rockoff ML, et al. Use of an electronic patient portal among disadvantaged populations. *J Gen Intern Med* 2011;26(10):1117–1123
- Niazkhani Z, Toni E, Cheshmekaboodi M, Georgiou A, Pirnejad H. Barriers to patient, provider, and caregiver adoption and use of electronic personal health records in chronic care: a systematic review. *BMC Med Inform Decis Mak* 2020;20(01):153
- Zhong X, Park J, Liang M, et al. Characteristics of patients using different patient portal functions and the impact on primary care service utilization and appointment adherence: retrospective observational study. *J Med Internet Res* 2020;22(02):e14410
- Shah SD, Liebovitz D. It takes two to tango: engaging patients and providers with portals. *PM R* 2017;9(5S):S85–S97
- de Lusignan S, Mold F, Sheikh A, et al. Patients' online access to their electronic health records and linked online services: a systematic interpretative review. *BMJ Open* 2014;4(09):e006021
- Zhao JY, Song B, Anand E, et al. Barriers, facilitators, and solutions to optimal patient portal and personal health record use: a systematic review of the literature. *AMIA Annu Symp Proc* 2018;2017:1913–1922
- Wade-Vuturo AE, Mayberry LS, Osborn CY. Secure messaging and diabetes management: experiences and perspectives of patient portal users. *J Am Med Inform Assoc* 2013;20(03):519–525
- Urowitz S, Wiljer D, Dupak K, et al. Improving diabetes management with a patient portal: a qualitative study of diabetes self-management portal. *J Med Internet Res* 2012;14(06):e158
- Ryan BL, Brown JB, Terry A, Cejic S, Stewart M, Thind A. Implementing and using a patient portal: a qualitative exploration of patient and provider perspectives on engaging patients. *J Innov Health Inform* 2016;23(02):848
- Lee JL, Rawl SM, Dickinson S, et al. Communication about health information technology use between patients and providers. *J Gen Intern Med* 2020;35(09):2614–2620
- Shimoga SV, Lu YZ. Role of provider encouragement on patient engagement via online portals. *J Am Med Inform Assoc* 2019;26(10):968–976
- Powell KR. Patient-perceived facilitators of and barriers to electronic portal use: a systematic review. *Comput Inform Nurs* 2017;35(11):565–573
- Internet World Stats. World internet users statistics and 2019 world population stats. Published November 6, 2019. Accessed June 1, 2021 at: <https://www.internetworldstats.com/stats.htm>
- Boersma P, Black LI, Ward BW. Prevalence of multiple chronic conditions among US adults, 2018. *Prev Chronic Dis* 2020;17:E106
- National Cancer Institute. About the Health Information National Trends Survey (HINTS). Accessed March 31, 2021 at: <https://hints.cancer.gov/about-hints/learn-more-about-hints.aspx>
- Wildevuur SE, Simonse LW. Information and communication technology-enabled person-centered care for the "big five" chronic conditions: scoping review. *J Med Internet Res* 2015;17(03):e77
- Soni A. Top 10 Most Costly Conditions among Men and Women, 2008: Estimates for the U.S. Civilian Noninstitutionalized Adult Population, Age 18 and Older, STATISTICAL BRIEF #331 July 2011. Accessed June 1, 2021 at: https://meps.ahrq.gov/data_files/publications/st331/stat331.pdf
- Centers for Medicare & Medicaid Services. Stage 3 Program Requirements for Providers Attesting to their State's Medicaid Promoting Interoperability (PI) Programs. Accessed June 1, 2021 at: https://www.cms.gov/Regulationsand-Guidance/Legislation/EHRIncentivePrograms/Stage3Medicaid_Require
- Nahm ES, Resnick B, Brown C, et al. The effects of an online theory-based bone health program for older adults. *J Appl Gerontol* 2017;36(09):1117–1144
- Turner K, Hong YR, Yadav S, Huo J, Mainous AG. Patient portal utilization: before and after stage 2 electronic health record meaningful use. *J Am Med Inform Assoc* 2019;26(10):960–967
- Antonio MG, Petrovskaya O, Lau F. The state of evidence in patient portals: umbrella review. *J Med Internet Res* 2020;22(11):e23851. Doi: 10.2196/23851

- 30 Hardeman RR, Medina EM, Kozhimannil KB. Dismantling structural racism, supporting black lives and achieving health equity: our role. *N Engl J Med* 2016;375(22):2113
- 31 Miller DP Jr, Latulipe C, Melius KA, Quandt SA, Arcury TA. Primary care providers' views of patient portals: interview study of perceived benefits and consequences. *J Med Internet Res* 2016;18(01):e8
- 32 Health and Human Services Department. 21st Century Cures Act: Interoperability, Information Blocking, and the ONC Health IT Certification Program. Accessed June 1, 2021 at: <https://www.federalregister.gov/d/2020-07419>
- 33 Steitz BD, Wong JIS, Cobb JG, Carlson B, Smith G, Rosenbloom ST. Policies and procedures governing patient portal use at an Academic Medical Center. *JAMIA Open* 2019;2(04):479–488
- 34 Bergmo TS, Kummervold PE, Gammon D, Dahl LB. Electronic patient-provider communication: will it offset office visits and telephone consultations in primary care? *Int J Med Inform* 2005; 74(09):705–710
- 35 Healthy People 2030. Health IT Objectives - HC/HIT-D09. Accessed September 1, 2021 at: <https://health.gov/healthypeople/objectives-and-data/browse-objectives/health-it>
- 36 Grossman LV, Masterson Creber RM, Ancker JS, et al. Technology access, technical assistance, and disparities in inpatient portal use. *Appl Clin Inform* 2019;10(01):40–50
- 37 Reed ME, Huang J, Millman A, et al. Portal use among patients with chronic conditions: patient-reported care experiences. *Med Care* 2019;57(10):809–814
- 38 Hsiao V, Chandereng T, Lankton RL, et al. Disparities in telemedicine access: a cross-sectional study of a newly established infrastructure during the COVID-19 pandemic. *Appl Clin Inform* 2021; 12(03):445–458
- 39 Crotty BH, Winn AN, Asan O, Nagavally S, Walker RJ, Egede LE. Clinician encouragement and online health record usage. *J Gen Intern Med* 2019;34(11):2345–2347

Appendix Table A1 Predictors of provider encouragement from overall and subgroups analyses

Predictor	Overall	No CVMD	CVMD	2017	2020
Year [ref: 2017]					
2020	1.55 ^c	1.53 ^b	1.58 ^c	–	–
Age	1	1	0.99	1	1
Gender [ref: female]					
Male	0.59 ^c	0.53 ^c	0.64 ^b	0.51 ^c	0.67 ^b
Race [ref: non-Hispanic white]					
Non-Hispanic African American	1.08	2.52 ^c	0.59 ^b	0.92	1.26
Others	0.87	1.05	0.69 ^b	0.77	0.96
Education [ref: ≥college]					
≤ High school	0.50 ^c	0.43 ^c	0.60 ^b	0.51 ^b	0.50 ^c
Some college	0.77 ^b	0.69 ^b	0.90	0.70 ^b	0.83
Marital status [ref: not married]					
Married	1.51 ^b	1.53 ^b	1.53 ^b	1.95 ^b	1.24
Household income (\$) [ref: ≥75K]					
< 20K	0.42 ^c	0.31 ^c	0.59 ^b	0.50 ^b	0.36 ^c
20K–34K	0.49 ^c	0.38 ^c	0.67	0.53 ^b	0.45 ^b
35K–49K	0.65 ^b	0.62 ^a	0.71	0.75	0.59 ^b
50K–74K	0.68 ^b	0.64 ^b	0.75	0.83	0.57 ^b
Residence [ref: rural]					
Nonmetro	1.20	0.64	2.22 ^a	1.83	0.70
Metro	1.20	0.93	1.54 ^a	2.20 ^b	0.62
Visit frequency	1.17 ^c	1.19 ^c	1.13 ^b	1.18 ^c	1.16 ^c
Number of CVMDs	1.20 ^b		1.12	1.26 ^b	1.16 ^a
Cancer survivor [ref: no]					
Yes	1.40 ^b	1.57 ^a	1.34	1.05	1.71 ^b

Abbreviations: CVMD, chronic diseases include diabetes, high blood pressure, heart, or lung diseases.

Note: Numbers are odds ratios derived from weighted multivariable logistic regression models. Area of residence was measured per U.S. Department of Agriculture (USDA) Rural/Urban Designation (2013) as metro (≥250K population or in metro counties), nonmetro (urban or ≥20K population), and rural (< 20K); visit frequency: provider office visit frequency in the past year.

^a $p < 0.1$.

^b $p < 0.05$.

^c $p < 0.001$.