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Title of Project: Patient Outcomes Reporting for Timely Assessments of Life with Depression: PORTAL-Depression

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STRUCTURED ABSTRACT (maximum of 250 words)

- Purpose: This aim of this study was to test if using a patient portal to conduct population-level depression screening and symptom monitoring improved assessment rates and outcomes compared to usual care.
- Scope: Systematic depression screening and monitoring improve case identification, treatment, and outcomes. In primary care, where most patients with depression are seen, depression screening and monitoring are not done consistently.
- Methods: We randomized adult patients at an outpatient internal medicine clinic who had active patient portal accounts to usual care (depression screening or monitoring in clinic) or to population health (usual care plus invitations to complete depression screening or monitoring sent via the patient portal). In the population health arm, patients received notifications to login to their portal account and complete an online depression assessment. Invitations were sent regardless of whether patients had a scheduled appointment or not. Results completed via the portal were stored in the medical record and positive results were automatically sent to the patient's primary care provider.
- Results: The population health arm had higher screening (43% (N=578) vs. 33% (N=459), p<0.0001) and monitoring rates (59% (N=427) vs. 18% (N=126), p<0.001) than usual care. Depression symptoms were more common and more severe among people who completed assessments via portal than in clinic. More patients with moderate to severe symptoms completed at least one follow-up assessment in the population health arm than usual care (57% (N=80/140) vs. 37% (N=13/35)). Portal response rates differed by race and insurance.
- Key Words: depression, primary care, portal, screening, population health

PURPOSE (Objectives of Study).

The goal of this project was to integrate a computerized adaptive test for depression symptoms into the electronic health record and test if using a patient portal to conduct population-level depression screening and symptom monitoring improved assessment rates and outcomes compared to usual care.

SCOPE (Background, Context, Settings, Participants, Incidence, Prevalence).

Background. Depression is highly prevalent and one of the leading causes of disability in the U.S.[1] Screening for depression is recommended by the U.S. Preventative Services Task Force,[2] but many patients are not routinely screened.[3] Without systematic screening, only half of symptomatic patients are identified. Furthermore, among primary care patients who are identified and diagnosed with depression, a third receive no treatment, and half of those treated receive inadequate treatment.[4] Measurement-based care (i.e., regular assessment of depression symptoms using validated tools to inform clinical decision-making) has been shown to improve depression treatment and outcomes but has not been widely adopted within primary care.[5]

Context. Currently in primary care, depression assessments are typically completed when patients have clinic visits. However, with limited time to address a large number of priorities during primary care visits,[6] it can be difficult to administer depression assessments consistently in clinic. Moreover, patients in need of care may not schedule or attend visits. A population health strategy to conduct depression screening and monitoring for patients regardless of scheduled appointments could identify more patients with depression symptoms and facilitate more timely treatment adjustments if results are communicated and easily accessible to clinicians.

Setting. This project was done at the outpatient adult internal medicine clinic of an urban academic medical center. Prior to the study, the clinic had implemented Epic health maintenance topics with corresponding best practice advisories (BPA) to remind the healthcare team to assess depression symptoms, including: annual screening for patients with no history of depression, annual surveillance for patients with a history of depression, and monthly monitoring for patients who had a PHQ-9 ≥ 10 until they reached a score less than 5. A depression clinical decision support tool was available to primary care physicians (PCPs) in clinic and online.

Participants. Eligible patients were adults (≥18 years old) with active patient portal accounts who were attributed to the clinic, defined by having attended an appointment within the past 26 months (age 18-64) or 14

months (age ≥65). For the screening trial, patients had to be due for depression screening at the start of the trial. For the monitoring trial, patients had to have either a depression diagnosis on their problem list or a positive depression screening result in the past year. Three of the 140 faculty and resident PCPs in the clinic opted out and their patients were excluded from the trials.

METHODS (Study Design, Data Sources/Collection, Interventions, Measures, Limitations).

Study design. We conducted two randomized controlled trials: screening and monitoring. For both trials, patients were randomized with 1:1 allocation to usual care or to population health (usual care plus invitations to complete depression screening or monitoring sent via the patient portal). Randomization was stratified by provider type (faculty vs. resident). The screening trial ran from May 2019-February 2020. The monitoring trial ran from February 2020-February 2021. The usual care protocol was paused from March-June 2020 due to the COVID-19 pandemic. The normal workflow resumed in July 2020. Portal invitations continued uninterrupted throughout the trial.

Intervention. For usual care, medical assistants (MAs) were expected to administer depression assessments during triage when patients were due, as indicated by the depression screening, monitoring, and surveillance BPAs. The BPAs and assessment tool were also accessible to PCPs if the assessment was not completed during triage. Clinic administrators and medical assistants were given regular feedback on screening, monitoring, and surveillance rates as part of continuous quality improvement efforts, and additional training was provided to MAs and PCPs as needed.

In the population health arm, patients received email notifications to login to their portal account and complete an online depression assessment (the Computerized Adaptive Test for Mental Health (CAT-MH™, described below under Measures). Invitations were sent regardless of whether patients had a scheduled appointment or not. In the screening trial, reminders were sent every one to two months if screening was not completed for up to three invitations sent in the first 6 months, and then repeated again 6 months later. In the monitoring trial, invitations were sent monthly until the patient's score indicated remission (PHQ-9 < 5 or CAT-DI < 30, completed in clinic or via portal) or the patient did not respond to three invitations in a row; this process was repeated at months 1, 5, and 11 . Invitations were sent on different days and times of the week. Results completed via the portal were stored in the medical record. Positive results were automatically sent to the PCP's electronic inbasket.

In case PCPs missed positive results completed via the portal, a study physician reviewed cases of patients who had moderate-to-severe portal-based assessment results. If patients did not have an appointment discussing their mental health in the last 30 days or in the next 30 days, results were forwarded to the clinic social worker, copying the PCP. The social worker reached out to patients to assess for safety and provide care linkage.

Measures. For depression screening both in clinic and via the portal, the Computerized Adaptive Test for Mental Health (CAT-MH™) was used, specifically the CAD-Major Depressive Disorder (MDD) diagnostic test followed by the CAT-Depression Inventory (DI) severity assessment if the CAD-MDD was positive. Three months prior to the trial (February 2019), the clinic switched from the PHQ-2 to the adaptive depression assessments in the CAT-MH™,[7,8] because we had demonstrated it was more sensitive than the PHQ-2 for our population.[9] The machine-learning based diagnostic test (CAD-MDD) reflexes into a dimensional severity assessment tool (CAT-DI) in patients that screen positive for depression.[7,8,10] PHQ-2/9 forms were also available in clinic if patients were triaged in a non-private space without a computer. For depression surveillance and monitoring via the portal, the CAT-DI was used. However, for in-clinic depression surveillance and monitoring, the PHQ-9 was used, because of national quality measure requirements that use only the PHQ-9 to assess the quality of depression remission.[11]

Data were extracted from the electronic health record for analysis. The primary outcome for the screening trial was the percentage of patients screened for depression. The primary outcome for the monitoring trial was the percentage of patients with moderate to severe symptoms who achieved symptom remission (PHQ-9 < 5 or CAT-DI < 30) during the study period. Other outcomes included percentage of patients who completed an

assessment for monitoring or surveillance, portal response rates, depression severity, and health care utilization.

Analysis. An intention-to-treat approach was used for analyses. Quantitative outcomes were summarized using descriptive statistics. For binary and categorical outcomes, a chi-square test or Fisher's exact test and logistic regression were used for comparisons. For continuous outcomes, a two-sample t-test or Wilcoxon rank-sum test and linear regression were utilized for comparisons. A two-sided significance level of 0.05 was used and unadjusted results are reported. We conducted subgroup analyses by age group, sex, race/ethnicity, insurance, and PCP type.

Limitations. As a single-center study, results may not be generalizable to all populations or settings. Differentiating features of our site include a large Black population, high portal enrollment rates (58%) prior to the SAR-CoV-2 pandemic, an active behavioral health integration program, and strong clinician buy-in for integrated behavioral health. We did not measure all relevant outcomes, such as depression diagnosis confirmation, treatment initiation after positive screening, and engagement in mental health care outside the institution. The monitoring trial was conducted during the COVID-19 pandemic when there were major changes to clinical practice, the prevalence and salience of depression symptoms, and how patients engaged in care. Still, we found similar results when we limited our analyses to after the usual care workflow resumed in July 2020.

RESULTS (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications).

Screening trial results. A total of 2,713 patients were eligible (population health: N=1,341; usual care: N=1,372). The number of patients differed by arm due to a 4-month delay between randomizing the list of eligible patients and trial launch, during which time patients became ineligible (e.g., death, new diagnosis of depression or bipolar, received screening). Mean age was 55 (SD=17), 58% (N=1,571) were female, and 47% (N=1,274) were African-American. At baseline, nearly all patients had been screened for depression at least once previously. There were no significant differences between arms.

More patients were screened in the population health arm than the usual care arm (43% (N=578) vs. 33% (N=459), p<0.0001). Screening rates were higher in the population health arm than the usual care arm across most patient groups. There were no differences between arms for patients age 65 and older, African American patients, Asian patients, and patients with public insurance.

Seven percent (N=75/1,037) of all patients who were screened had a positive result and 6% (N=59/1,037) had moderate-to-severe symptoms. The rate of positive screens was higher in the population health arm than the usual care arm (10% (N=58) vs. 4% (N=17)), as was the number of patients identified with moderate-to-severe symptoms (8% (N=46) vs. 3% (N=13)).

Fifty-eight percent (N=333) of patients in the population health arm who completed screening were screened in clinic and 42% (N=245) were screened via the portal. Patients who filled out the screener via the portal had a higher rate of positive screens than those who filled out the screener in clinic (16% (N=40) vs. 4% (N=17)).

More patients in the population health arm than in the usual care arm had telephone encounters (48% (n=638) vs. 44% (n=599), p=0.04) and referrals to psychiatry/psychology (4% (n=58) vs. 3% (n=35), p=0.01). There were no differences between arms in the percentage of portal messages, primary care visits, ER visits, or hospitalizations.

Eighty-nine percent (N=1,102) of patients in the population health arm who were sent an email invitation logged into their portal account and 67% (N=830) logged into their account and opened the message. Thirty percent (N=248) of those who opened the message started the assessment, and then nearly all patients (N=245) completed the assessment. Patients completed screening a median of 2 days (IQR, 1-4) after receiving an invitation. Asians (OR 0.55 (95% CI 0.29-0.98)) and African-Americans (OR 0.64; 95% CI 0.47-0.85) were less likely to complete the portal-based screener than whites. There were no significant differences in portal response by age, sex, ethnicity, insurance, and PCP type.

Monitoring trial results. A total of 1448 patients were included (N=728 population health care; N=720 usual care). Patients' average age was 54, 73% of patients were female, 46% were Black/African American, and 45% were white. Only 13% of patients had a documented depression assessment (PHQ-9 or CAT-DI) prior to the trial. There were no significant differences in baseline characteristics between the two arms.

The percentage of patients who completed a depression assessment during the study was higher in the population health arm than the usual care arm (59% (N=427) vs. 18% (N=126), p<0.001). The percentage of patients who completed an assessment in clinic (19% (N=138) vs. 18% (N=126)) was similar between arms. However, an additional 40% (N=289) of patients in the population health arm completed assessments via portal only. Assessment rates were higher in the population health arm than the usual care arm across all patient subgroups. The difference between arms was smallest among patients with Medicaid insurance (32% (N=14) vs. 12% (N=5)).

In the population health arm, 57% (N=80/140) of patients with an initial score in the moderate to severe range completed at least one subsequent assessment during the study, and 18% (N=14/80) of these patients achieved remission. In the usual care arm, 37% (N=13/35) of patients with an initial score in the moderate to severe range completed at least one subsequent assessment during the study period, and 23% (N=3/13) of these patients achieved remission. We did not test for differences in depression remission between arms due to low assessment rates in the usual care arm.

Patients in the two arms had similar levels of health care utilization during the study. About two-thirds of patients had a primary care visit and about one-fifth had a behavioral health visit. Health care utilization and antidepressant initiation/titration after the first assessment were also similar between arms.

Seventy-nine percent (N=574) of patients in the population health care arm who were sent a portal invitation opened the letter, and 51% (N=369) completed the CAT-DI. On average, patients received 6.6 (3.4 SD) invitations over the course of the study, opened 64% (39% SD) of the letters, and completed the CAT-DI in response to 17% (23% SD) of the letters they received. Response rate was similar regardless of time or day the invitation was sent, although it was lowest for invitations sent on Fridays (8%). The median number of days between receiving an invitation and completing the CAT-DI was 1 (range 0-177).

Discussion. A portal-based, population health approach increased depression screening and monitoring rates and identified more patients with depression symptoms than usual clinic-based care. Patients were willing to take mental health assessments even when they did not have appointments. Administering screening and symptom measurement outside of appointments could save valuable time during primary care visits.

Furthermore, we found that depression symptoms were more common and more severe among patients who completed assessments via the portal than patients who completed assessments in clinic. An important public health implication of this work is that visit-based strategies may miss people in need of care, and waiting for patients to attend an appointment may hinder timely treatment initiation and titration.

Currently, quality measures from health insurers require depression symptoms to be measured during appointments, and if measured outside of appointments, that an appointment follows the measurement. For patient-centered care, PCPs with established patient panels could receive credit for screening and assessment that had appropriate follow-up and care plan documented, regardless of appointments.

Portal-based assessments could be combined with integrated behavioral health strategies—for example, the collaborative care model, in which a care manager conducts regular check-ins with patients, administers assessments, and coordinates communication between primary care clinicians and a psychiatric consultant. Having dedicated staff to review and respond to portal assessment results could help engage patients in care.

One important consideration for our findings was that response rates to the portal-based assessments varied by patient characteristics, including race and insurance. Barriers might include access to devices and internet, comfort level with technology, concerns about confidentiality, and mental health stigma. More tailored portal messages might increase response rates, as well as larger efforts to encourage portal use. Other

communication and outreach methods beyond the portal could also be used as part of a population health approach (e.g., phone, text, community health workers).

Conclusion. The results of this study suggest that portal-based assessments can increase the reach and frequency of depression screening and monitoring. Using a population health approach can proactively identify people with depression symptoms rather than waiting for individuals to seek care.

LIST OF PUBLICATIONS AND PRODUCTS (Bibliography of Published Works and Electronic Resources from Study—Use AHRQ Citation Style for Reference Lists).

Presentations

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