Research and Applications

Inviting patients to identify diagnostic concerns through structured evaluation of their online visit notes

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ABSTRACT

Background: The 21st Century Cures Act mandates patients’ access to their electronic health record (EHR) notes. To our knowledge, no previous work has systematically invited patients to proactively report diagnostic concerns while documenting and tracking their diagnostic experiences through EHR-based clinician note review.

Objective: To test if patients can identify concerns about their diagnosis through structured evaluation of their online visit notes.

Methods: In a large integrated health system, patients aged 18–85 years actively using the patient portal and seen between October 2019 and February 2020 were invited to respond to an online questionnaire if an EHR algorithm detected any recent unexpected return visit following an initial primary care consultation (“at-risk” visit). We developed and tested an instrument (Safer Dx Patient Instrument) to help patients identify concerns related to several dimensions of the diagnostic process based on notes review and recall of recent “at-risk” visits. Additional questions assessed patients’ trust in their providers and their general feelings about the visit. The primary outcome was a self-reported diagnostic concern. Multivariate logistic regression tested whether the primary outcome was predicted by instrument variables.

Results: Of 293,566 visits, the algorithm identified 1282 eligible patients, of whom 486 responded. After applying exclusion criteria, 418 patients were included in the analysis. Fifty-one patients (12.2%) identified a diagnostic concern. Patients were more likely to report a concern if they disagreed with statements “the care plan the provider developed for me addressed all my medical concerns” [odds ratio (OR), 2.65; 95% confidence interval (CI), 1.45–4.87] and “I trust the provider that I saw during my visit” (OR, 2.10; 95% CI, 1.19–3.71) and agreed with the statement “I did not have a good feeling about my visit” (OR, 1.48; 95% CI, 1.09–2.01).

Conclusion: Patients can identify diagnostic concerns based on a proactive online structured evaluation of visit notes. This surveillance strategy could potentially improve transparency in the diagnostic process.

Key words: OpenNotes, patient safety, communication, diagnostic errors, patient experience
INTRODUCTION

According to the National Academies of Sciences, Engineering, and Medicine (NASEM) report Improving Diagnosis in Healthcare, most people will experience at least one diagnostic error in their lifetime. Lack of adequate data sources and insufficient measurement methods provide a limited view of the problem. The NASEM report highlights the need to monitor the diagnostic process (ie, “a complex, collaborative activity that involves clinical reasoning and information gathering to determine a patient’s health problem”) and to create further opportunities to identify, learn from, and reduce diagnostic errors. Among the report’s recommendations is to increase engagement of patients and families to contribute valuable input to facilitate accurate and timely diagnosis. Prior research indicates that patients can identify concerns related to the diagnostic process and often disclose information that existing measurement methods fail to capture. In the inpatient setting, there has been movement toward understanding patients’ needs for engagement in quality- and safety-focused informatics interventions. However, patients remain on the periphery of diagnostic safety initiatives.

Implementation of the 21st Century Cures Act mandates patients’ access to their clinical notes, diagnostic test results, and other information in their electronic health records (EHRs) beginning in 2021. Increased transparency of medical information and evolving capabilities of patient-facing technologies could provide a novel opportunity to engage patients in safety surveillance. For example, patients have reported medication concerns and incorrect documentation while accessing their providers’ notes online (eg, open notes) through secure web-based portals. In one study, 1 in 5 patients who read their notes found a mistake—many of which were related to the diagnostic process. To our knowledge, no previous work has systematically invited patients to identify concerns about diagnosis in their recent visits. This type of approach can enhance safety surveillance from patients and raise the bar for transparency of the diagnostic process.

Patients also need structured tools for reliable reporting that yield information that is meaningful to clinicians and health systems for improving safety. Our long-term goal is to develop a proactive surveillance strategy that helps identify diagnostic safety concerns in patients. However, methods to study if and how patients can evaluate the diagnostic process via note review have not been developed. Such methods could uncover patients’ feedback about the diagnostic process both when things go well and when they do not. As a first step to achieving the goal of a proactive surveillance safety strategy related to diagnosis, we developed and tested methods to allow patients to systematically identify any diagnostic concerns while accessing and reviewing their recent visit notes and to identify predictors of patient-reported diagnostic concerns.

MATERIALS AND METHODS

Participants and setting

Our study team partnered with Geisinger, a large integrated healthcare organization in central, south-central, and northeast Pennsylvania, spanning 45 counties, mostly rural, serving approximately 4.2 million residents. The study was approved by the local Institutional Review Boards.

To ensure an appropriate target population for testing, we first applied methods to select patients who were more likely to experience diagnostic concerns. We use the term “diagnostic concern” rather than diagnostic error to account for variations in how patients may self-report and perceive diagnostic accuracy and because diagnosis is an evolving process involving uncertainty. In the context of this study, a diagnostic concern is present when a patient disagrees with the statement, “I feel I was correctly diagnosed during my first visit.” We used an electronic trigger algorithm (e-trigger) based on unexpected visit patterns, an approach that has been tested in prior work. The e-triggers mine EHR databases to identify signals for likely adverse events that can be confirmed with additional review. The trigger was based on the rationale that an unexpected hospitalization or return to clinic, urgent care, or ED visit after an initial primary care visit may indicate that a diagnosis was missed during the first visit. All planned/previously scheduled office visits or elective admissions were excluded to increase the potential that the visit was “unexpected.” We applied this algorithm in Geisinger’s enterprise data warehouse from October 2019 to February 2020 and identified patients with an index primary care visit followed by an unplanned return visit (such as an emergency department, primary care or urgent care visit, or nonelective hospitalization) within 14 days. We defined this cohort “at-risk” for diagnostic concerns because the diagnosis may have been missed or evolved at the first visit.

Patients aged 18–85 years old were included if they met e-trigger criteria and if they had previously logged on to MyGeisinger, a patient portal based on the Epic EHR, at least once to view clinical notes. We applied the electronic algorithm to Geisinger’s enterprise data warehouse daily to identify patients as soon as they become eligible, thus detecting “at-risk” patients in real time as possible. After confirming eligibility criteria, we contacted patients via a secure electronic message with an invitation to complete a newly developed instrument, the Safer Dx Patient Instrument, about their experience of diagnosis at the time of the index visit, including an assessment of the diagnostic process. A follow-up message was sent to patients who did not respond after 2 weeks. We excluded patient caregivers (n = 17), patients who were unsure (n = 49), or did not respond (n = 1) to whether or not the diagnosis was correct, and one patient who was unable to view the clinician’s notes in MyGeisinger. Patients received a $25 gift card for instrument completion.

Development and testing of the Safer Dx Patient Instrument

We adapted the Revised Safer Dx Instrument, a medical record review tool developed to enable clinicians to determine the presence or absence of diagnostic error for a specific episode of care. The Safer Dx Instrument has been previously validated and applied in multiple settings to evaluate the diagnostic process. When used for review of high-risk records (eg, records flagged by electronic algorithms), the instrument can help clinicians reliably identify missed opportunities in diagnosis. We adapted this instrument to be used similarly by patients.

The Safer Dx Instrument evaluates 5 dimensions of the diagnostic process: (1) the patient-provider encounter (history, physical exam, symptom presentation, determinations regarding need for further evaluation, testing and/or referral), (2) performance and interpretation of diagnostic tests, (3) follow-up and tracking of diagnostic information over time, (4) subspecialty and referral-specific factors, and (5) patient-related factors. Early drafts of the Safer Dx Patient Instrument were created, reviewed, and revised over multiple meetings among the authorship team and assessed by a psychometrician (CS). A patient advocate and a health literacy expert from Geisinger reviewed multiple versions of the instrument to
ensure questions were patient-centered and that questions and formatting were appropriate for the patient population. The items were adapted to assess the 5 dimensions of the diagnostic process from the perspective of the patient, including questions about the reason for the visit, the accuracy of patient symptoms documented, relevance and accuracy of the physical exam documented, testing concerns, adequacy of follow-up instructions, adequacy and completeness of the care plan to address all medical concerns, and assessment of the diagnosis (Table 1).

Patients were asked to rate their level of agreement with statements about the diagnostic process using a 5-point scale (agree, somewhat agree, neither agree nor disagree, somewhat disagree and disagree) and were also able to provide open-ended comments on most items. Response choices for one item (“Did the provider order any tests?”) were dichotomous. Skip pattern questions associated with a conditional response were used. A self-reported assessment of the diagnosis was captured through a single question: “I feel I was correctly diagnosed at my first visit.” To assess for diagnostic concerns, patients were given a specific date and instructed to review available notes. We expected patients to use this information to reflect on their visit experience and rely on hindsight knowledge about their care experiences to answer questions. In addition to questions about the diagnostic process, the instrument included items that assessed trust in the clinician, feelings about the visit, and health literacy.

Initial versions of the instrument were reviewed using the think-aloud method with patients at a separate site ($n = 5$) to assess for clarity. To obtain further feedback, the instrument was also presented to Geisinger’s Patient and Family Advisory Council, the Patient Experience department leadership, and a multidisciplinary system-wide committee focused on improving clinical diagnosis. The instrument was piloted at Geisinger twice ($n = 27$ and $n = 59$, respectively). In the first pilot, we identified inconsistencies in the data and reworked the skip patterns, while the second pilot ensured item response variability.

**Patient involvement**

Patients were consulted throughout the study. Initially, a patient advocate met with the first author to discuss the purpose of the study and how to adapt the instrument to capture the diagnostic process while also being patient-centered. They reviewed multiple drafts of the survey. In addition, the Patient and Family Advisory Council reviewed the instrument and suggestions were incorporated.

**Table 1. The Safer Dx Patient Instrument: items for determining presence or absence of diagnostic concern in a primary care encounter**

| Questions                                                                 | Response       |
|---------------------------------------------------------------------------|----------------|
| 1. Please tell us why you visited the doctor on this day.                 | Open ended     |
| 2. The notes captured information related to my symptoms accurately*      | Likert 1 2 3 4 5 |
| Please describe any inaccuracies:                                         |                 |
| 3. The provider conducted a physical exam relevant to my symptoms during my visit.* | Likert 1 2 3 4 5 |
| 4. The notes captured my physical exam accurately.*                       | Likert 1 2 3 4 5 |
| Please describe any inaccuracies:                                         |                 |
| 5. Did the provider order any tests?*                                      | Yes/no         |
| a. Based on the notes reviewed, I had concerns about the test(s) my doctor ordered (eg, lab imaging or any procedure). | Likert 1 2 3 4 5 |
| Please explain:                                                           |                 |
| b. Based on the notes review, I had concerns about my test results.       |                 |
| Please explain:                                                           |                 |
| 6. The notes reflected what I was supposed to do if my symptoms did not get better.* | Likert 1 2 3 4 5 |
| 7. The care plan the provider developed for me addressed all my medical concerns.* | Likert 1 2 3 4 5 |
| 8. I feel I was correctly diagnosed during my first visit.*               | Likert 1 2 3 4 5 |
| If not, please explain:                                                   |                 |
| a. The notes reflected multiple alternative diagnoses that were discussed with me. | Likert 1 2 3 4 5 |
| b. I received a new diagnosis at my follow-up visit.                      |                 |
| Please explain:                                                           |                 |
| 9. I trust the provider that I saw during my visit.                       |                 |
| 10. I did not have a good feeling about my visit.                         |                 |
| 11. How often do you need to have someone help you when you read instructions, pamphlets, or other written material from the provider or pharmacy? | Likert 1 2 3 4 5 |
|                                                                           |                 |

*Question related to the dimensions of the diagnostic process.

**Skip pattern based on response (1 = disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, 5 = agree).**
### Statistical analysis

The primary outcome was self-identified diagnostic concern (defined as disagreement [eg, disagree, somewhat disagree] with the statement “I feel I was correctly diagnosed during my first visit”). Likert scale response data were treated as continuous data and assumptions of normality and equal variance of residuals were tested and met. Univariate and multivariate logistic regression models were used to identify whether patient-identified diagnostic concerns were associated with responses to other items assessing patients’ perceptions of the 5 different dimensions in the diagnostic process, trust, and feelings about the visit. In addition, we adjusted for potential confounding factors using patient-related variables (ie, age at the time of the visit, sex, race, ethnicity, type of health insurance, and health literacy). Questionnaire responses were examined for any values that were missing, and sampling weights were used to account for missing data and other potential biases.

We used t-tests to compare patient characteristics between patients who identified their diagnosis as correct and those who reported a diagnostic concern. Bivariate correlations were used to determine the relationship between variables and detect any multicollinearity in our data. To further assess the potential for multicollinearity for each independent variable, we also examined variance inflation factor (VIF) scores (<10). All variables in our analyses were entered sequentially in the model using the forward selection approach to determine which variables to add or drop in the model. Our criterion for entry was at \( P < .05 \) and remaining variables that did not meet criteria were removed. We used the Hosmer-Lemeshow test to determine the goodness-of-fit of our model. All analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

### RESULTS

#### Patient characteristics

The algorithm was applied to 293,566 primary care visits from October 2019 to February 2020 to identify eligible patients. We sent surveys to 1282 patients who met all inclusion criteria and received 486 responses (response rate: 37.9%). Of these, 469 (96.5%) were completed by patients and 17 (3.5%) by caregivers. After applying exclusion criteria (ie, 17 caregivers, 49 patients were unsure and one was unresponsive to the question of whether the diagnosis was correct, and one who did not have access to notes), our final sample consisted of 418 patients. Of 418 patients, 12.2% (\( n = 51 \)) had a diagnostic concern.

The average age of patients was 48.6 years (SD ±16.0 years) at the time of the visit. Just over three-fourths of patients were female (76.8%), and almost all were White (95.9%), followed by Black or African American (2.9%), Asian (0.7%), and American Indian or Alaska Native (0.5%). Most had private insurance (83.3%), followed by public insurance (14.1%), federal (1.9%), and no insurance (0.7%). Characteristics of patients with and without self-identified diagnostic concerns were similar, with the exception that latter patients were older (\( P < .001 \), Table 2). Half of patients reported that their provider ordered tests during the visit (49.8%; \( n = 208 \)).

#### Table 2. Characteristics of Safer Dx Patient Instrument respondents

| Variables                        | Self-identified diagnostic concern (\( n = 51 \)) | No diagnostic concern (\( n = 367 \)) | \( P \) value |
|----------------------------------|-----------------------------------------------|---------------------------------------|--------------|
| Age at index visit (years), mean (±SD) | 40.4 (±13.7)                                    | 49.8 (±16.0)                           | <.001*       |
| Gender                           |                                               |                                       | .32          |
| Male                             | 9 (17.6)                                       | 88 (24.0)                              |              |
| Female                           | 42 (82.4)                                      | 279 (76.0)                             |              |
| Race                             |                                               |                                       | .24          |
| White                            | 47 (92.2)                                      | 354 (96.5)                             |              |
| Black or African American        | 2 (3.9)                                        | 10 (2.7)                               |              |
| Asian                            | 1 (1.9)                                        | 2 (0.5)                                |              |
| American Indian or Alaska Native | 1 (1.9)                                        | 1 (0.3)                                |              |
| Ethnicity                        |                                               |                                       | .75          |
| Hispanic or Latino               | 1 (2.0)                                        | 10 (2.7)                               |              |
| Not Hispanic or Latino           | 50 (98.0)                                      | 357 (97.3)                             |              |
| Insurance                        |                                               |                                       | .30          |
| Private                          | 47 (92.2)                                      | 301 (82.0)                             |              |
| Public                           | 4 (7.8)                                        | 55 (15.0)                              |              |
| Federal                          | 0 (0.0)                                        | 8 (2.2)                                |              |
| None                             | 0 (0.0)                                        | 3 (0.8)                                |              |
| Health literacy                  |                                               |                                       | .31          |
| Never needs help with reading    | 39 (76.5)                                      | 301 (82.0)                             |              |
| Rarely needs help with reading   | 6 (11.8)                                       | 47 (12.8)                              |              |
| Sometimes needs help with reading| 4 (7.8)                                        | 14 (3.8)                               |              |
| Often needs help with reading    | 2 (3.9)                                        | 5 (1.4)                                |              |
| Always needs help with reading   | 0 (0.0)                                        | 0 (0.0)                                |              |

*Significant at 0.05.
Safer Dx Patient Instrument responses

There were significant differences in responses to what dimensions of the diagnostic process were involved across patients with self-identified diagnostic concerns. Patients who identified diagnostic concerns reported more breakdowns in diagnostic processes: symptoms were not captured adequately [24.5% (n = 12) vs 2.4% (n = 9) for patients reporting correct diagnosis, \( P < .001 \)], physical exam was not relevant to symptoms [11.8% (n = 6) vs 2.2% (n = 8), \( P < .001 \)], the notes did not capture the physical exam accurately [19.6% (n = 10) vs 3.5% (n = 13), \( P < .001 \)], the notes did not reflect what to do if symptoms did not get better [35.3% (n = 18) vs 5.4% (n = 20), \( P < .001 \)], and disagreement that the care plan addressed all medical concerns [39.2% (n = 20) vs 1.4% (n = 5), \( P < .001 \)]. Patients identifying a diagnostic concern also indicated lower agreement with items assessing the adequacy of the care plan, trust in the provider, and positive perception of the visit (Table 3).

Table 3. Predictors in the Safer Dx Patient Instrument for reported diagnostic accuracy with patient characteristics (n = 418)

| Variables                                                                 | All responses (n = 418) | Self-identified diagnostic concern (n = 51) | No diagnostic concern (n = 367) | \( P \) value |
|---------------------------------------------------------------------------|-------------------------|-------------------------------------------|--------------------------------|--------------|
| Safer Dx Patient Instrument                                               |                         |                                           |                                | <.001*       |
| The notes captured information related to my symptoms accurately*         |                         |                                           |                                | <.001*       |
| Agree                                                                     | 348 (83.3)              | 22 (43.1)                                 | 326 (89.3)                     |              |
| Somewhat agree                                                            | 33 (7.9)                | 9 (17.7)                                  | 24 (6.6)                       |              |
| Neither agree nor disagree                                                | 14 (3.3)                | 8 (15.7)                                  | 6 (1.6)                        |              |
| Somewhat disagree                                                         | 8 (1.9)                 | 5 (19.8)                                  | 3 (0.8)                        |              |
| Disagree                                                                  | 13 (3.1)                | 7 (13.7)                                  | 6 (1.6)                        |              |
| The provider conducted a physical exam relevant to my symptoms during my visit* |                         |                                           |                                | <.001*       |
| Agree                                                                     | 367 (87.8)              | 31 (62.0)                                 | 336 (92.6)                     |              |
| Somewhat agree                                                            | 27 (6.5)                | 10 (20.0)                                 | 17 (4.7)                       |              |
| Neither agree nor disagree                                                | 5 (1.2)                 | 3 (6.0)                                   | 2 (0.6)                        |              |
| Somewhat disagree                                                         | 6 (1.4)                 | 4 (8.0)                                   | 2 (0.6)                        |              |
| Disagree                                                                  | 8 (1.9)                 | 2 (4.0)                                   | 6 (1.7)                        |              |
| The notes captured my physical exam accurately*                           |                         |                                           |                                | <.001*       |
| Agree                                                                     | 354 (84.7)              | 27 (52.9)                                 | 327 (89.8)                     |              |
| Somewhat agree                                                            | 26 (6.2)                | 8 (15.7)                                  | 18 (5.0)                       |              |
| Neither agree nor disagree                                                | 12 (2.9)                | 6 (11.8)                                  | 6 (1.7)                        |              |
| Somewhat disagree                                                         | 8 (1.9)                 | 3 (5.9)                                   | 5 (1.4)                        |              |
| Disagree                                                                  | 15 (3.6)                | 7 (13.7)                                  | 8 (2.2)                        |              |
| Did the provider order any tests?*                                        |                         |                                           |                                | 0.44         |
| Yes                                                                       | 208 (49.8)              | 28 (54.9)                                 | 180 (49.2)                     |              |
| No                                                                        | 209 (50.0)              | 23 (45.1)                                 | 186 (50.8)                     |              |
| Based on notes reviewed, I had concerns about test(s)                     |                         |                                           |                                | 0.02         |
| my doctor ordered (eg, lab, imaging or any procedure)*                    |                         |                                           |                                |              |
| Agree                                                                     | 28 (6.7)                | 2 (7.1)                                   | 26 (14.5)                      |              |
| Somewhat agree                                                            | 16 (3.8)                | 5 (17.9)                                  | 11 (6.2)                       |              |
| Neither agree nor disagree                                                | 9 (2.2)                 | 9 (32.1)                                  | 26 (14.5)                      |              |
| Somewhat disagree                                                         | 5 (1.2)                 | 0 (0.0)                                   | 5 (2.8)                        |              |
| Disagree                                                                  | 123 (29.4)              | 12 (42.9)                                 | 111 (62.0)                     |              |
| Based on notes reviewed, I had concerns about my test results             |                         |                                           |                                | 0.02         |
| Agree                                                                     | 38 (9.1)                | 5 (17.9)                                  | 33 (18.9)                      |              |
| Somewhat agree                                                            | 22 (5.3)                | 8 (28.6)                                  | 14 (8.0)                       |              |
| Neither agree nor disagree                                                | 37 (8.9)                | 5 (17.9)                                  | 32 (18.3)                      |              |
| Somewhat disagree                                                         | 4 (1.0)                 | 1 (3.6)                                   | 3 (1.7)                        |              |
| Disagree                                                                  | 102 (24.4)              | 9 (32.1)                                  | 93 (53.1)                      |              |
| The notes reflected what I was supposed to do if symptoms did not get better* |                         |                                           |                                | <.001*       |
| Agree                                                                     | 313 (74.9)              | 19 (37.3)                                 | 294 (80.8)                     |              |
| Somewhat agree                                                            | 28 (6.7)                | 5 (9.8)                                   | 23 (6.3)                       |              |
| Neither agree nor disagree                                                | 36 (8.6)                | 9 (17.7)                                  | 27 (7.4)                       |              |
| Somewhat disagree                                                         | 14 (3.3)                | 8 (15.7)                                  | 6 (1.7)                        |              |
| Disagree                                                                  | 24 (5.7)                | 10 (19.6)                                 | 14 (3.9)                       |              |
| The care plan the provider developed for me addressed all my medical concerns* |                         |                                           |                                | <.001*       |
| Agree                                                                     | 326 (78.0)              | 10 (19.6)                                 | 316 (86.1)                     |              |
| Somewhat agree                                                            | 48 (11.5)               | 9 (17.7)                                  | 39 (10.6)                      |              |

(continued)
About one-third of patients who identified a diagnostic concern also indicated they received a new diagnosis at the follow-up visit.

**Predictors of patient-reported diagnostic concerns**

In univariate analyses, we found the following diagnostic processes to be associated with patient-identified diagnostic concerns: accuracy of patient symptoms documented, accuracy of physical exam according to symptoms, accuracy of the physical exam documented, adequacy of follow-up instructions, and adequacy of care plan to address all concerns. Items related to testing were not statistically significant.

A multivariate logistic regression analysis (Table 4) showed that patients who disagreed with the statement “the care plan the provider developed for me addressed all my medical concerns” were almost 3 times more likely to identify a diagnostic concern (Table 4). Additionally, patients who disagreed with the statement “I trust the provider that I saw during my visit” were 2.1 times more likely to identify a diagnostic concern (95% confidence interval [CI], 1.19–3.71). Patients who agreed with the statement “I did not have a good feeling about my visit” were 1.5 times as likely to identify a diagnostic concern (95% CI, 1.09–2.01). Regarding patient characteristics, patients who are not of Hispanic or Latinx ethnicity were almost 8 times more likely to identify a diagnostic concern compared to patients who are Hispanic or Latinx ethnicity (95% CI, 1.56–0.39).

**DISCUSSION**

As a first step toward using open notes to engage patients in diagnostic safety surveillance, we tested methods to solicit patients’ feedback about diagnostic concerns on a near real-time basis. At-risk patients were able to review their visit notes, identify breakdowns in the diagnostic process, and self-report any diagnostic concerns. We found that patients who identified diagnostic concerns indicated more concerns about the adequacy of care planning, trust, and reported bad feelings about a visit.

This study builds on the NASEM report recommendations to develop patient-centered methods to measure diagnostic safety. The use of open notes has been associated with improved patient engagement and quality of care and this work builds on prior OpenNotes efforts to identify patient safety issues in the medical record. When paired with e-triggers to identify patients potentially vulnerable to diagnostic errors, use of the Safer Dx Patient Instrument may enable more proactive patient-centered measurement of patient-reported diagnostic concerns. Notably, this article focused on patient evaluations and perceptions of the diagnostic process, rather than the diagnostic process from a provider perspective. However, patient concerns, satisfaction, and perceptions are influential predictors of subsequent trust in the medical system, as well as follow-up visits and in some cases care outcomes. Systematic evaluation of visit notes by patients has potential to uncover underlying patient-centered contributory factors that affect diagnosis which is otherwise harder to gather. With additional development and testing, this strategy could be used in the future as part of larger organizational initiatives to identify and learn from patient-reported diagnostic concerns and promote organizational learning.

**Table 3. continued**

| Variables | All responses \( (n = 418) \) | Self-identified diagnostic concern \( (n = 51) \) | No diagnostic concern \( (n = 367) \) | \( P \) value |
|-----------|---------------------------------|---------------------------------|---------------------------------|----------------|
| Neither agree nor disagree | 19 (4.5) | 12 (23.5) | 7 (1.9) | |
| Somewhat disagree | 7 (1.7) | 4 (7.8) | 3 (0.8) | |
| Disagree | 18 (4.3) | 16 (31.4) | 2 (0.5) | |
| The notes reflected multiple alternative diagnoses that were discussed with me | | | | |
| Agree | — | 4 (7.8) | 0 (0.0) | |
| Somewhat agree | — | 6 (11.8) | 0 (0.0) | |
| Neither agree nor disagree | — | 20 (39.2) | 0 (0.0) | |
| Somewhat disagree | — | 3 (5.9) | 0 (0.0) | |
| Disagree | — | 18 (35.3) | 0 (0.0) | |
| I received a new diagnosis at my follow-up visit | | | | |
| Agree | — | 17 (34.0) | 0 (0.0) | |
| Somewhat agree | — | 8 (16.0) | 0 (0.0) | |
| Neither agree nor disagree | — | 11 (22.0) | 0 (0.0) | |
| Somewhat disagree | — | 2 (4.0) | 0 (0.0) | |
| Disagree | — | 12 (24.0) | 0 (0.0) | |
| I trust the provider that I saw during my visit | 348 (83.3) | 17 (33.3) | 331 (90.9) | <.001* |
| Agree | 32 (7.7) | 6 (11.8) | 26 (7.1) | |
| Somewhat agree | 19 (4.5) | 13 (25.5) | 6 (1.7) | |
| Neither agree nor disagree | 7 (1.7) | 6 (11.8) | 1 (0.3) | |
| Somewhat disagree | 9 (2.2) | 9 (17.7) | 0 (0.0) | |
| Disagree | 348 (83.3) | 17 (33.3) | 331 (90.9) | <.001* |
| I did not have a good feeling about my visit | 9 (2.2) | 9 (17.7) | 0 (0.0) | |
| Agree | 7 (1.7) | 6 (11.8) | 1 (0.3) | |
| Somewhat agree | 19 (4.5) | 13 (25.5) | 6 (1.7) | |
| Neither agree nor disagree | 32 (7.7) | 6 (11.8) | 26 (7.1) | |
| Somewhat disagree | 348 (83.3) | 17 (33.3) | 331 (90.9) | |

*Questions related to the dimensions of the diagnostic process.

*Significant at 0.05. 

About one-third of patients who identified a diagnostic concern also indicated they received a new diagnosis at the follow-up visit.

**Predictors of patient-reported diagnostic concerns**

In univariate analyses, we found the following diagnostic processes to be associated with patient-identified diagnostic concerns: accuracy of patient symptoms documented, accuracy of physical exam according to symptoms, accuracy of the physical exam documented, adequacy of follow-up instructions, and adequacy of care plan to address all concerns. Items related to testing were not statistically significant.

A multivariate logistic regression analysis (Table 4) showed that patients who disagreed with the statement “the care plan the provider developed for me addressed all my medical concerns” were almost 3 times more likely to identify a diagnostic concern (Table 4). Additionally, patients who disagreed with the statement “I trust the provider that I saw during my visit” were 2.1 times more likely to identify a diagnostic concern (95% confidence interval [CI], 1.19–3.71). Patients who agreed with the statement “I did not have a good feeling about my visit” were 1.5 times as likely to identify a diagnostic concern (95% CI, 1.09–2.01). Regarding patient characteristics, patients who are not of Hispanic or Latinx ethnicity were almost 8 times more likely to identify a diagnostic concern compared to patients who are Hispanic or Latinx ethnicity (95% CI, 1.56–0.39).
nostic process and intervene to avoid any potential safety issues or to address quality of care issues. Feedback from patients could be useful to both clinicians and health care organizations to improve practice\textsuperscript{40,41} (ie, patient-clinician communication) and potentially improve diagnostic performance.\textsuperscript{42} Such feedback programs are essential for the development of a learning health system to improve patient safety.\textsuperscript{43}

Table 4. Predictors in the Safer Dx Patient Instrument for reported diagnostic accuracy

| Diagnostic process variable | Univariate logistic regression | Multivariate logistic regression |
|-----------------------------|--------------------------------|--------------------------------|
|                             | $n^a$ | Odds ratio | 95% CI limits | $P$ value (Pr > | $n^a$ | Odds ratio | 95% CI limits | $P$ value (Pr > |
|                             |      |            |            | $|t|$)          |      |            |            | $|t|$)          |
| The notes captured information related to my symptoms accurately | 416 | 2.50 | 1.84 | 3.39 | <.001* | 2.13 | 0.96 | 4.73 | .06 |
| The provider conducted a physical exam relevant to my symptoms during my visit | 413 | 1.98 | 1.41 | 2.77 | <.001* | 1.05 | 0.66 | 1.67 | .84 |
| The notes captured my physical exam accurately | 415 | 1.98 | 1.55 | 2.54 | <.001* | 0.39 | 0.17 | 0.90 | .03 |
| Did the provider order any tests? | 417 | 1.26 | 0.70 | 2.27 | .44 | — | — | — | — |
| Based on notes reviewed, I had concerns about test(s) my doctor ordered (eg, lab, imaging or any procedure) | 207$^b$ | 0.85 | 0.68 | 1.07 | .17 | — | — | — | — |
| The notes reflected what I was supposed to do if symptoms did not get better | 415 | 2.00 | 1.62 | 2.47 | <.001* | 1.10 | 0.63 | 1.90 | .75 |
| The care plan the provider developed for me addressed all my medical concerns | 418 | 4.53 | 2.97 | 6.89 | <.001* | 2.65 | 1.45 | 4.87 | .002* |
| I trust the provider that I saw during my visit | 415 | 5.94 | 3.83 | 9.21 | <.001* | 2.10 | 1.19 | 3.71 | .01* |
| I did not have a good feeling about my visit | 417 | 2.13 | 1.76 | 2.57 | <.001* | 1.48 | 1.09 | 2.01 | .01* |
| Patient characteristics | | | | | | | | | |
| Age at index visit | 418 | 0.96 | 0.94 | 0.98 | <.001* | 0.98 | 0.94 | 1.01 | .14 |
| Gender | 418 | | | | | | | | |
| Male (reference group) | 97 | 1.47 | 0.69 | 3.16 | .32 | 1.75 | 0.58 | 5.30 | .32 |
| Female | 321 | | | | | | | | |
| Race | 418 | | | | | | | | |
| White (reference group) | 401 | 2.32 | 0.72 | 7.45 | .16 | 0.84 | 0.28 | 2.51 | .76 |
| Other race | 17 | | | | | | | | |
| Ethnicity | 418 | | | | | | | | |
| Hispanic or Latino (reference group) | 11 | | | | | | | | |
| Non-Hispanic or Latino | 407 | 1.40 | 0.17 | 11.28 | .75 | 7.86 | 1.56 | 39.63 | .01* |
| Insurance | 418 | | | | | | | | |
| Private | 348 | 2.58 | 0.89 | 7.43 | .08 | 0.94 | 0.18 | 4.97 | .94 |
| Public or Other (reference group) | 70 | | | | | | | | |
| Health literacy | 417 | | | | | | | | |
| Never needs help with reading (reference group) | 339 | | | | | | | | |
| Rarely needs help with reading | 53 | 0.98 | 0.39 | 2.47 | .002 | 1.11 | 0.28 | 4.44 | .005 |
| Sometimes needs help with reading | 18 | 2.20 | 0.68 | 7.09 | <.001* | 2.92 | 0.75 | 11.45 | <.001 |
| Often needs help with reading | 7 | 3.08 | 0.57 | 16.65 | <.001* | 0.31 | 0.06 | 1.77 | .45 |

$^a$Sampling weights were used to account for missing responses.

$^b$Based on if patient responded “Yes” to having tests ordered in previous question.

$^*$Significant at .05.

Strengths of this approach include providing patients a means to identify where along the diagnostic pathway their concerns may have emerged—symptom accuracy, physical exam relevance and accuracy, follow-up, and care planning. For instance, one dimension of the diagnostic process, care planning (eg, whether the care plan was comprehensive and addressed all medical concerns) was found to be
significantly associated with self-identified diagnostic concerns. Discordance between care planning expectations and symptoms/diagnosis is important because if there is no shared understanding about diagnosis with patients, care will not be sensitive to patients’ preferences44 or patients may be left feeling their diagnostic safety was compromised. A surveillance strategy using the Safer Dx Patient Instrument is sensitive to patients’ experiences by helping uncover negative experiences or patient-perceived care breakdowns that are rarely documented in the medical record45 and otherwise invisible to the health system because many patients are hesitant to speak up.

We also found that trust and having a bad feeling about a visit were associated with self-identified diagnostic concerns. Patients and their families’ experiences of misdiagnosis are associated with reduced trust in their current clinicians.46 Interpersonal trust has long been considered an essential aspect of the patient-physician relationship47,48 and increased trust is associated with better patient outcomes.49 As Table 3 shows, patient concerns about elements of the diagnostic process, such as whether tests were conducted or whether the medical record45 and otherwise invisible to the health system is viewed by the patients. However, with the US federal mandate of guaranteed access, patient awareness, and active use of open notes is expected to grow. Future methods must reach a diverse set of patients, and thus we recommend replication and extensions of our findings in stratified samples that include a higher representation of diverse patient populations. Nonresponse bias could not be assessed, and it is possible that nonresponders may have had different experiences of the diagnostic process. Finally, upon further investigation, we observed a probable suppression effect in our model between the item “the notes captured my physical exam accurately” and patients’ trust in their providers. The change of direction in multivariate logistic regression for the item “the notes captured my physical exam accurately” is likely due to relationships between predictors and should not be overinterpreted. We thus recommend future research on open notes to determine when and how perceptions of exam and interaction components relate to patient perceptions of overall outcomes.

CONCLUSION

The movement toward full transparency in 2021 via 21st Century Cures Act14 is a unique opportunity to leverage patient’s access to their clinician’s notes as a method for patient-centered evaluation of quality and safety of care. The Safer Dx Patient Instrument provides at-risk patients an opportunity to self-report diagnostic concerns based on the evaluation of their visit notes. With additional development, testing, and evaluation with diverse patient populations, the proactive surveillance method we tested can guide patients in assessing the diagnostic process. The methods outlined herein may have the potential to engage patients in safety by encouraging self-reporting of diagnostic concerns and improving transparency of diagnostic processes, thus improving diagnostic safety.

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AUTHOR CONTRIBUTIONS

TDG is the guarantor, initiated the study, supervised the collaborative project, designed the data collection tool, monitored data collection for the entire study, developed the statistical analysis plan, and drafted and revised the paper. DTC designed the data collection tool, monitored data collection for the entire study, developed the statistical analysis plan, cleaned and analyzed data, and drafted and revised the paper. DKU implemented the study, designed the data collection tool, monitored data collection for the entire study, and revised the paper. SK implemented the study, monitored data collection for the entire study, designed the data collection tool, and analyzed data, and drafted and revised the paper. CSc maintained compliance records, monitored data collection for the entire study, and revised the paper. DTG implemented the study, monitored data collection for the entire study, and revised the paper. DTG designed the data collection tool, monitored data collection for the entire study, and revised the paper. CSc designed the data collection tool, monitored data collection for the entire study, and revised the paper. DTC designed the data collection tool, advised on data analysis, and revised the paper. DS designed the data collection tool, advised on data analysis, and revised the paper.

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SUPPLEMENTARY MATERIAL

Supplementary material is available at Journal of the American Medical Informatics Association online.

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CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY

The data collected in this study is not available for public use.

REFERENCES

1. National Academies of Sciences, Engineering, and Medicine. Improving Diagnosis in Health Care. Washington, DC: National Academies Press; 2015.
2. Graber M, Gordon R, Franklin N. Reducing diagnostic errors in medicine: what’s the goal? Acad Med 2002; 77 (10): 981–92. https://journals.lww.com/academicmedicine/fulltext/2002/10000/Reducing_Diagnostic_Errors_in_Medicine__What_s_the9.aspx Accessed August 10, 2020.
3. McGlynn EA, McDonald KM, Cassel CK. Measurement is essential for improving diagnosis and reducing diagnostic error: a report from the institute of medicine. JAMA 2015; 314 (23): 2501–2.
4. Singh H, Graber ML, Hofer TP. Measures to improve diagnostic safety in clinical practice. J Patient Saf 2019; 15 (4): 311–6.
5. Bell SK, Delbanco T, Emlore JG, et al. Frequency and types of patient-reported errors in electronic health record ambulatory care notes. JAMA Netw Open 2020; 3 (6): e205867.
6. Giardina TD, Haskell H, Menon S, et al. Learning from patients’ experiences related to diagnostic errors is essential for progress in patient safety. Health Aff (Millwood) 2018; 37 (11): 1821–7.
7. Giardina TD, Korukonda S, Shahid U, et al. Use of patient complaints to identify diagnosis-related safety concerns: a mixed-method evaluation. BMJ Qual Saf 2021; 30 (12): 996–1001.
8. Gallagher TH, Mazor KM. Taking complaints seriously: using the patient safety lens. BMJ Qual Saf 2015; 24 (6): 352–5.
9. Mazor KM, Roblin DW, Greene SM, et al. Toward patient-centered cancer care: patient perceptions of problematic events, impact, and response. J Clin Oncol 2012; 30 (15): 1784–90.
10. Kinnunen U-M, Saranto K. It is time for self-incident-reporting for patients and their families in every health care organization: a literature review. Stud Health Technol Inform 2013; 192: 92–6.
11. Haldar S, Mishra SR, Kim Y, Hartzler A, Pollack AH, Pratt W. Use and impact of an online community for hospital patients. J Am Med Inform Assoc 2020; 27 (4): 549–57.
12. Willis MA, Heim LB, Hu Z, et al. Feeling better on hemodialysis: user-centered design requirements for promoting patient involvement in the prevention of treatment complications. J Am Med Inform Assoc 2021; 28 (8): 1612–31.
13. Haldar S, Mishra SR, Pollack AH, Pratt W. Informatics opportunities to involve patients in hospital safety: a conceptual model. J Am Med Inform Assoc 2020; 27 (2): 202–11.
14. ONC’s Cures Act Final Rule. https://www.healthit.gov/curesrule Accessed November 30, 2020.
15. Dullabh PM, Sondheimer NK, Katsh E, Evans MA. How patients can improve the accuracy of their medical records. EGEMS (Wash DC) 2014; 2 (3): 1080.
16. Bell SK, Gerard M, Fossa A, et al. A patient feedback reporting tool for OpenNotes: implications for patient-clinician safety and quality partnerships. BMJ Qual Saf 2017; 26 (4): 312–22.
17. DesRoches CM, Bell SK, Dong Z, et al. Patients managing medications and reading their visit notes: a survey of OpenNotes participants. Ann Intern Med 2019; 171 (1): 69–71.
18. Wright E, Darer J, Tang X, et al. Sharing physician notes through an electronic portal is associated with improved medication adherence: quasi-experimental study. J Med Internet Res 2015; 17 (10): e226.
19. Kayastha N, Pollak KJ, LeBlanc TW. Open oncology notes: a qualitative study of oncology patients’ experiences reading their cancer care notes. J Oncol Pract 2018; 14 (4): e251–8.
20. Singh H, Giardina TD, Forjuoh SN, et al. Electronic health record-based surveillance of diagnostic errors in primary care. BMJ Qual Saf 2012; 21 (2): 93–100.
21. Murphy DR, Meyer AN, Sittig DF, Meeks DW, Thomas EJ, Singh H. Application of electronic trigger tools to identify targets for improving diagnostic safety. BMJ Qual Saf 2019; 28 (2): 151–9.
22. Vaghi V, Wei L, Mushtaq U, Sittig DF, Bradford A, Singh H. Validation of an electronic trigger to measure missed diagnosis of stroke in emergency departments. JAMIA 2021; 28 (10): 2202–11.
23. Al-Mutairi A, Meyer AND, Thomas EJ, et al. Accuracy of the Safer Dx Instrument to identify diagnostic errors in primary care. J Gen Intern Med 2016; 31 (6): 602–8.
24. Davalos MC, Samuels K, Meyer AND, et al. Finding diagnostic errors in children admitted to the PICU. Pediatr Crit Care Med 2017; 18 (3): 263–71.
25. Singh H, Sittig DF. Advancing the science of measurement of diagnostic errors in healthcare: the Safer Dx framework. BMJ Qual Saf 2015; 24 (2): 103–10.
26. Singh H, Giardina TD, Meyer A, Forjuoh SN, Reis MD, Thomas EJ. Types and origins of diagnostic errors in primary care settings. JAMA Intern Med 2013; 173 (6): 418–25.
27. Morris NS, MacLean CD, Chew LD, Littenberg B. The single item literacy screener: evaluation of a brief instrument to identify limited reading ability. BMC Fam Pract 2006; 7 (1): 21.
28. Charters E. The use of think-aloud methods in qualitative research an introduction to think-aloud methods. Brock Educ J Educ Res Pract 2003; 12 (2): 68–82. doi:10.26522/brocked.v12i2.38.
29. Singh H, Upadhyay DK, Torretti D. Developing health care organizations that pursue learning and exploration of diagnostic excellence: an action plan. Acad Med 2020; 95 (8): 1172–8.
30. Johnson DR, Creech JC. Ordinal measures in multiple indicator models: a simulation study of categorization error. Am Sociol Rev 1983; 48 (3): 398–407.
31. Norman G. Likert scales, levels of measurement and the “laws” of statistics. Adv Health Sci Educ Theory Pract 2010; 15 (5): 625–32.
32. Sullivan GM, Artino AR. Analyzing and interpreting data from Likert-type scales. Adv Health Sci Educ Theory Pract 2010; 15 (5): 625–32.
33. Zumbo BD, Zimmerman DW. Is the selection of statistical methods governed by level of measurement? Can Psychol Can 1993; 34 (4): 390–400.
34. Singh H, Giardina TD, Forjuoh SN, et al. Tackling ambulatory safety risks through patient engagement: what 10,000 patients and families say about safety-related knowledge, behaviors, and attitudes after reading visit notes. J Patient Saf 2021; 17 (8): e791–9.
35. Nazi KM, Turvey CL, Klein DM, Hogan TP, Woods SS. VA OpenNotes: exploring the experiences of early patient adopters with access to clinical notes. J Am Med Inform Assoc 2015; 22 (2): 380–9.
36. Wolff JL, Darer JD, Berger A, et al. Inviting patients and care partners to read doctors’ notes: OpenNotes and shared access to electronic medical records. J Am Med Inform Assoc 2017; 24 (1): e166–72.
37. Walker J, Leveille S, Bell S, et al. OpenNotes after 7 years: patient experiences with ongoing access to their clinicians’ outpatient visit notes. *J Med Internet Res* 2019; 21 (5): e13876. doi:10.2196/13876
38. Bell SK, Mejilla R, Anselmo M, et al. When doctors share visit notes with patients: a study of patient and doctor perceptions of documentation errors, safety opportunities and the patient–doctor relationship. *BMJ Qual Saf* 2017; 26 (4): 262–70.
39. Gupta D, Rodeghier M, Lis CG. Patient satisfaction with service quality as a predictor of survival outcomes in breast cancer. *Support Care Cancer* 2014; 22 (1): 129–34.
40. Ivers N, Jamtvedt G, Flottorp S, et al. Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev* 2012; (6): CD000259.
41. Lane K, Rhodes M, Olson A. Diagnostic reasoning feedback: improving diagnostic reasoning skills and feedback satisfaction through structured peer feedback. *MedEdPORTAL*. 2016; 12. doi:10.15766/mep_2374-8265.10340.
42. Larson DB, Donnelly LF, Podberesky DJ, Merrow AC, Sharpe RE, Kruskal JB. Peer feedback, learning, and improvement: answering the call of the institute of medicine report on diagnostic error. *Radiology* 2017; 283 (1): 231–41.
43. Meyer AND, Upadhyay DK, Collins CA, et al. A program to provide clinicians with feedback on their diagnostic performance in a learning health system. *Jt Comm J Qual Patient Saf* 2021; 47 (2): 120–6. doi:10.1016/j.jcjq.2020.08.014.
44. Schubart JR, Toran I, Whitehead M, Levi BH, Green MJ. Informed decision making in advance care planning: concordance of patient self-reported diagnosis with physician diagnosis. *Support Care Cancer* 2013; 21 (2): 637–41.
45. Khan A, Coffey M, Litterer KP, et al.; the Patient and Family Centered I-PASS Study Group. Families as partners in hospital error and adverse event surveillance. *JAMA Pediatrics* 2017; 171 (4): 372–81.
46. Suzuki R, Yajima N, Sakurai K, et al. Association of patients’ past misdiagnosis experiences with trust in their current physician among Japanese adults [published online ahead of print June 22, 2021]. *J Gen Intern Med.* 2021; doi:10.1007/s11606-021-06950-y.
47. Hendren EM, Kumagai AK. A matter of trust. *Acad Med* 2019; 94 (9): 1270–2.
48. Phillips-Salimi CR, Haase JE, Kooiken WC. Connectedness in the context of patient–provider relationships: a concept analysis. *J Adv Nurs* 2012; 68 (1): 230–45.
49. Birkhäuser J, Gaab J, Kosowsky J, et al. Trust in the health care professional and health outcome: a meta-analysis. *PLoS One* 2017; 12 (2): e0170988.
50. Berger ZD, Brito JP, Spina NS, et al. Patient centred diagnosis: sharing diagnostic decisions with patients in clinical practice. *BMJ* 2017; 359: j4218.
51. Mangus CW, Singh H, Mahajan P. *Health Information Technology for Engaging Patients in Diagnostic Decision Making in Emergency Departments*. Rockville, MD: Agency for Healthcare Research and Quality; 2021. AHRQ Publication No. 20(21)-0040-4-EF. http://www.ahrq.gov/patient-safety/reports/issue-briefs/healthit-ed.html Accessed February 6, 2021.