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Title

Electronic Clinical Surveillance to Measure and Improve Safety in Ambulatory Care

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Structured Abstract

Purpose: Efforts to improve patient safety have primarily focused on inpatient settings; however, an estimated one billion outpatient visits occur each year in the US. We sought to determine the frequency and risk factors for three types of outpatient care gaps.

Scope: We studied gaps in outpatient care related to diagnosis (delayed diagnosis of chronic kidney disease (CKD)), treatment (potentially inappropriate medication use among patients with a history of falls), and prevention (lack of annual laboratory monitoring for patients on angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs)). For each care gap, eligible adult patients were included from Kaiser Permanente Southern California, a large, diverse integrated delivery system.

Methods: We used a mixed methods study design, combining results from multivariable quantitative analyses of electronic health record data with qualitative analyses of patient or provider interviews. Quantitative analyses included 244,540 patients for delayed diagnosis of CKD, 113,809 patients for medication use after a fall, and 672,081 patients for annual laboratory monitoring. Qualitative analyses included 15 providers for delayed diagnosis of CKD, 22 providers for medication use after a fall, and 25 patients for laboratory monitoring.

Results: In outpatient settings, care gaps (or deviations from “ideal” care) occur regularly enough to warrant further investigation and intervention. Although they may not often result in harm, systems to prevent them or minimize their impact may be important components of care quality in the high-volume world of outpatient care.

Provider and patient perspectives generally aligned regarding insights and challenges related to improving care delivery.

Key Words: outpatient safety, outpatient care quality, diagnostic error, chronic kidney disease, medications, falls, laboratory monitoring, ACEi/ARBs

PURPOSE

This study sought to identify the frequency and risk factors for three types of outpatient care gaps within a large, integrated delivery system. The three care gaps were selected to represent different types of safety or quality issues and focused on diagnosis (delayed diagnosis of chronic kidney disease), treatment (potentially inappropriate medication use among patients with a history of falls), and prevention (lack of annual laboratory monitoring for patients on angiotensin-converting enzyme inhibitors (ACEi) or angiotensin receptor blockers (ARBs)). Additionally, we sought to identify potential ways to improve care in the future.

SCOPE

Although most patient safety research has focused on inpatient settings, there has been increased recognition in recent years of the need to focus on care in outpatient settings, as well. Each year, there are approximately a billion physician office visits in the United States. Thus, even relatively infrequent care gaps may be important, given the high volume of outpatient care. Outpatient care faces different challenges from inpatient care, so research specifically focused on outpatient settings is needed. For example, care is more diffuse, often involving multiple providers over long time periods. Additionally, the proportion of patients who have a serious illness among those with a certain set of symptoms or clinical presentation is lower in outpatient than inpatient settings, and the consequences of care gaps may be less immediate, which presents unique challenges to ensuring high-quality care in outpatient settings.

To add to the growing literature on outpatient care, we studied the frequency and risk factors for three types of outpatient care gaps and sought to identify potential future interventions to reduce the care gaps. Our study took place within Kaiser Permanente Southern California (KPSC), a large, integrated delivery system serving over 4.6 million current members who have over 12 million annual visits each year. Members are broadly representative of the diverse Southern California population. KPSC includes over 200 medical offices, pharmacies, and laboratories. It adopted an electronic health record in 2006 that contains information on diagnoses, procedures, medication use, and laboratory tests and results. The KPSC IRB approved this study.

All eligible adults from 2010-2015 were included in our study. For delayed diagnosis of chronic kidney disease and annual laboratory monitoring of patients on ACEi/ARBs, we included patients age 21 years or older. For analyses of medication use after a fall, we focused on patients age 65 and older to be consistent with the HEDIS® measure's focus on medication use among the elderly.

In these retrospective data analyses, all eligible patients were included, and, as a result, the distribution by race/ethnicity, sex, age, and income reflects the underlying distribution of eligible patients (i.e., no exclusions were made based on these characteristics, except for age, as described above). Thus, several key AHRQ priority populations, including the elderly, women, and racial/ethnic minorities, are included in our study in substantial numbers. Additionally, one measure (medication use after falls) focused specifically on the elderly population, one of the AHRQ priority populations. We also included information on chronic health conditions in our analyses (e.g., the Charlson Comorbidity Index as well as specific chronic health conditions).

Quantitative analyses included 244,540 patients for delayed diagnosis of chronic kidney disease (*AHRQ priority populations*: mean age, 63 years; 58% women; 44% race/ethnicity other than non-Hispanic White), 113,809 patients for medication use after a fall (*AHRQ priority populations:* all patients were 65 or older; 66% women; 40% race/ethnicity other than non-Hispanic White), and 672,081 patients for annual laboratory monitoring (*AHRQ priority populations*: mean age, 64 years; 48% women; 56% race/ethnicity other than non-Hispanic White).

METHODS

Our study used a mixed methods design that combined quantitative analyses of electronic health record data with qualitative analyses of patient and provider interviews.

For the quantitative analyses, care gaps/practices were used as outcome variables. They were defined based on expert recommendations or existing standards, with two care gaps based on Healthcare Effectiveness Data and Information Set measures (HEDIS® is a registered trademark of the National Committee for Quality Assurance (NCQA)).

Data on patient-, provider-, and system-level factors were pulled from the electronic health record. Additionally, we used administrative data from the KPSC quality group. Variables of interest were identified from literature searches and input from the study team, including clinical collaborators and quality and operational leaders. In some cases, medical record reviews were conducted on a sample of records to support data cleaning and coding.

They were categorized according to standard practices in health services research (e.g., using a 1-year look-back period to capture comorbidities; classifying comorbidities according to an established, commonly used comorbidity score, the Charlson Comorbidity Index) and based on frequencies or natural classification groups in our population. Multivariable models were used to estimate associations (e.g., relative risks and 95% confidence intervals) overall and in sub-analyses.

Qualitative analyses were based on semi-structured interviews of patients and providers conducted in-person or by phone. Interview guide questions were developed based on the study goals, literature, and input from the study team, including clinical collaborators, quality leaders, and our study's advisory board.

Verbal consent was obtained from providers and patients for the interviews, following the IRB's guidance. We used maximal variation sampling (e.g., sampling providers with both low and high frequencies of care gaps) to obtain diverse perspectives.

Deductive codes were developed *a priori*, and a team coding approach was used with two coders. Coders assigned both deductive and emergent codes to the text (emergent codes inductively capture unexpected themes/sub-themes that were grounded in the data).

We also obtained input from the Kaiser Permanente Southern California Regional Patient Advisory Council on medications at one of their regular meetings, which served as a focus group, and collected some feedback via an online survey, as approved by the IRB.

Qualitative analyses included 15 providers for delayed diagnosis of chronic kidney disease, 22 providers for medication use after a fall, and 25 patients for annual laboratory monitoring for patients on ACE inhibitors or ARBs. We coded findings from the focus group with the Regional Patient Advisory Council as well, and we used online survey results from 23 patient advisors to gain additional insights into the patient perspective.

Limitations of our study include the retrospective use of electronic health record data, which was not collected for purposes of our study. Though use of this data allowed us to efficiently study a large population and a wide variety of risk factors in quantitative analyses, it did not allow for the collection of mitigating factors specific to our study hypotheses. It also did not allow for qualitative interviews to focus on specific, recent practices of individual patients to gather insights through close to real-time assessments of specific cases.

However, the advantage of using data collected and recorded as part of routine practice is that it reflects the real-world operation of outpatient care within a large, integrated delivery system. Data also were not recorded with any knowledge of our study and, thus, would not be expected to be biased based on study hypotheses. Additionally, the interviews collected general provider and patient perspectives, and this broad perspective provided insights beyond the specific care gap that was the focus of the interviews. For example, we gained insights from both providers and patients on laboratory testing beyond testing related to chronic kidney disease or annual monitoring for ACEi/ARB medication use.

Thus, facilitators and challenges to recommended care and suggestions about potential future interventions may be more generalizable to improving healthcare delivery (e.g., generalizable to other laboratory tests) because we were not focused on specific patients or instances of care.

RESULTS

Our results on delayed diagnosis of chronic kidney disease were published in November 2019. (The paper was initially published ahead of print online in July 2019, along with a press release from the National Kidney Foundation, https://www.kidney.org/news/researchers-find-more-half-patients-newly-abnormal-kidney-function-tests-are-not-getting-timely, and editorial by Ahmed S, McMahon GM, Mendu ML, AJKD 2019 doi: 10.1053/j.ajkd.2019.06.00.)

We found that timely follow-up of an initially abnormal estimated glomerular filtration (eGFR) rate for diagnosis of chronic kidney disease occurred less than half the time. Timely follow-up was defined as a repeat creatinine test 60-150 days after the initially abnormal result; the creatinine test result is used to calculate eGFR. The follow-up (repeat) laboratory test is recommended to evaluate the chronicity of kidney function impairment. Thus, follow-up of an initially abnormal eGFR result is complicated by the need to wait to repeat the laboratory test so that *chronic* kidney function impairment can be assessed.

For patients who had worse initial eGFR results, timely follow-up was more common than for patients overall. However, 28% of patients still did not have the recommended repeat creatinine laboratory test within the expected time frame. Quantitative and qualitative results converged to suggest that changes within the electronic health record – such as flagging abnormal eGFR test results (and not just abnormal creatinine results) – might be useful for improving timely test follow-up. Qualitative results suggested the importance of provider panel size and workload. Though the quantitative results did not find a strong association with panel size, this finding warrants further investigation as it may relate to physician burnout, which is an increasing area of concern for primary care physicians. Results from our study and from other studies also suggest the importance of secondary systems to help minimize the impact of any missed follow-up tests. Within KPSC, the SureNet Outpatient Safety Program uses electronic clinical surveillance to scan for missed, abnormal eGFR lab test follow-up and orders a second lab test in order to minimize the impact of missed or delayed follow-up testing.

Study manuscripts for the other analyses are in the process of being prepared for submission to peer-reviewed journals; thus, results are not presented here in detail. This report will be updated to include more information after the publication of the main study papers. In brief, we found that medication dispenses after a fall occurred among 35% of the study population. The reasons were multifactorial, and we are preparing both a mixed methods paper and a qualitative paper on study findings of risk factors and potential facilitators and barriers to improved care. For annual laboratory monitoring of ACE inhibitors and ARBs, we found that 9% of the study population did not have the recommended laboratory tests.

In some cases, patients had one, but not both, of the recommended laboratory tests. We are preparing a quantitative paper on the risk factors for laboratory test results and a qualitative paper that will combine data from patient and provider interviews across the two laboratory-focused interviews (delayed diagnosis of chronic kidney disease and annual laboratory monitoring for patients on ACEi or ARBs).

In examining study findings as a group, we found that potential care gaps in outpatient care varied in frequency by topic. However, because of the high volume of patients seen in outpatient care, even the less common care gaps underscored the importance of improving systems and processes to prevent errors from occurring in the first place. Our findings also suggested common solutions to improving outpatient care. For example, improvements to the electronic health record might help reduce multiple care gaps. Similarly, greater team-based management of laboratory test results may help reduce care gaps related to a wide variety of laboratory tests. KPSC uses secondary surveillance systems to try to reduce care gaps, but study results suggested that there are opportunities to improve efforts to prevent care gaps from occurring in the first place.

Future research should study similar care gaps in other settings, particularly in nonintegrated care settings. Additionally, future research could assess the utility of secondary surveillance systems to minimize the impact of any care gaps in nonintegrated delivery settings.

Improving efforts around primary prevention of care gaps, as well as secondary prevention of harms by minimizing the impact of care gaps, may be important for high-quality outpatient care delivery.

List of Publications and Products

Danforth KN, Hahn EE, Slezak JM, Chen LH, Li BH, Munoz-Plaza CE, Luong TQ, Harrison TN, Mittman BS, Sim JJ, Singh H, Kanter MH. Follow-up of abnormal estimated GFR results within a large integrated health care delivery system: a mixed-methods study. Am J Kidney Dis. 2019 Nov; 74(5):589-600. doi: 10.1053/j.ajkd.2019.05.003. Epub 2019 Jul 16. PMID: 31324445

* Other manuscripts are being prepared for submission; this report will be updated after the papers are published