

AHRQ Grant Final Progress Report

Title of Project:

What is Patient Safety in the Medical Home?

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NCQA: National Committee for Quality Assurance
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STRUCTURED ABSTRACT

Purpose

The project *What is Patient Safety in the Medical Home* aimed to improve patient safety in ambulatory care settings by evaluating the implementation of patient safety in patient-centered medical homes (PCMHs) and recommending improvements to current standards.

Scope

The project evaluated (1) trends and variation in the adoption of ambulatory patient safety activities in 5,007 U.S. primary care practices designated with the highest recognition level by the National Committee for Quality Assurance (NCQA); (2) patient, provider, and administrator perspectives on patient safety in 10 PCMHs; and (3) an association of contextual issues, patient safety practices, and patient safety culture in 24 PCMHs.

Methods

NCQA data on practices and providers were used to evaluate the associations between practice and community characteristics and implementation of patient safety activities. Data from clinician and staff interviews, observations, and patient focus groups were used to assess patient safety across four key domains of ambulatory safety. Qualitative comparative analysis was used to examine the relationship between contextual issues, patient safety practices, and safety culture.

Results

Implementation of patient safety activities varied across practices. Only military status was associated with significantly higher patient safety scores. Technology was identified as both a central improvement strategy as well as a central patient safety issue (e.g., lack of interoperability between health information systems) across safety domains. Patients valued clear and timely communication and trust with clinicians and staff. Safety culture was higher when clinicians and staff perceived that leadership prioritized patient safety and when there was high reciprocity among colleagues seeking each other's advice.

Key Words: patient safety, patient-centered medical home, ambulatory care, primary care

PURPOSE

The overall goal of this project was to improve patient safety in ambulatory care settings by evaluating the meaning and implementation of patient safety in patient-centered medical homes (PCMHs) and recommending improvements to current standards supporting primary care. In this study, we evaluated how primary care practices, using the best-case scenario of PCMHs that reached the highest level of recognition by the National Committee for Quality Assurance (NCQA), are addressing ambulatory patient safety across the four key safety domains. We used mixed methods and triangulated data from multiple perspectives, including physicians and other providers, staff, and patients. The results of our work are aimed to inform public and private sector efforts to advance ambulatory patient safety, to provide critical information on viability of various methods for evaluating ambulatory patient safety outcomes, and to suggest ways to better integrate patient safety into models such as the PCMH.

The specific aims included:

Aim 1) To explore trends and variation in the adoption of patient safety activities based on practice and regional characteristics, using data on practices that have achieved NCQA recognition and on providers who have participated in federal electronic medical record meaningful use incentives.

Aim 2) To analyze how the PCMH model interacts with patient safety from different perspectives – patient, provider, and administrator – across the four key domains of ambulatory safety, using triangulated data from interviews, observation, and patient focus groups.

Aim 3) To evaluate the potential association of contextual issues (practice type, geographic location) and specific PCMH implementation practices with assessed patient safety across the four key domains of ambulatory safety, using qualitative comparative analysis.

SCOPE

Ambulatory patient safety is a critical but understudied issue. Ambulatory safety is of increasing importance with more healthcare system dependence on ambulatory care. Many organizations have developed standards and initiatives in this area (AHRQ, 2001; TJC, 2015; AMA, 2015; NYACP, 2015; AHRQ, 2015; Promises Project, 2014). The recent AHRQ-sponsored systematic review of patient safety practices, Making Health Care Safer II, found little research in ambulatory safety relative to inpatient care, even among processes and practices that are more common in the outpatient setting, such as medication reconciliation (Shekelle et al., 2013).

Ambulatory safety issues are generally categorized in four domains (Webster et al., 2009; AMA, 2010):

- Missed, delayed, or incorrect diagnoses;
- Delay in proper treatment or preventive services;
- Medication errors and preventable adverse drug events;

- Issues of communication, information flow, and coordination of care, including provider-patient communication, coordination between sites, transitions to and from inpatient settings, and issues with communication of test results.

Making Health Care Safer II illustrated a broader perspective on patient safety, including areas not often included in ambulatory safety research, particularly key cross-cutting issues such as safety culture and human factors. The review highlighted key areas with insufficient research, particularly coordination of care and information flow, patient involvement in safety, and patient contributing factors, such as chronic conditions.

The PCMH, “a model of the organization of primary care that delivers the core functions of primary healthcare” (www.pcmh.ahrq.org), includes providing care that is comprehensive, patient centered, coordinated, accessible, of high quality, and safe. The PCMH model may provide a best-case scenario in ambulatory safety. Although safety is not explicit in the NCQA standards, the PCMH model and standards may encourage a focus on safety across key domains by encouraging practices such as care coordination and patient engagement. Recent PCMH initiatives to improve quality have involved changing how clinical information is delivered, particularly through health information technology and care coordination. No previous research has explicitly evaluated safety in the PCMH.

What is Patient Safety in the Medical Home also aims to reveal how the PCMH and specific implementation elements interact with patient safety and potentially impact safety outcomes across diverse ambulatory safety domains and PCMH programs. The findings aim to inform public and private sector efforts to advance ambulatory safety, provide critical information on viability of various methods for evaluating ambulatory safety outcomes, and suggest ways to better integrate safety into models, such as the PCMH. Findings will be disseminated through NCQA standards and to PCMH community partners and will improve knowledge about ambulatory safety and how best to design future interventions to improve patient outcomes.

METHODS

AIM 1: Using data on practices that have achieved NCQA recognition and on providers who have participated in federal electronic medical record meaningful use incentives, explore trends and variation in the adoption of patient safety activities based on practice and regional characteristics.

Setting/Population: We focused on primary care practices that were recognized under NCQA’s 2014 PCMH program as of May 2017. We included only Level-3 practices, as the most mature, fully functioning PCMHs. After excluding 951 Level-1 and -2 practices, we included 84% of all recognized PCMH practices (n=5,007).

Among the 5,007 Level-3 PCMH practices, approximately two thirds treated both adult and pediatric populations; nearly half were affiliated with a hospital, health system, or health plan; 2.4% were military; and one third operated as independent private practices. Most were small to mid-size practices, with 2 to 4 (44%) or 5 to 9 (27%) practicing clinicians.

Many were located in large metropolitan areas (59%), and most were located in counties designated as having a partial primary care health professional shortage (88%). Roughly a quarter of these PCMH practices were located in counties with an African American population greater than twenty percent (27%), and approximately one tenth of PCMH practices were in communities with significant economic strain, defined as low employment (9%), low educational attainment (9%), or high poverty (12%).

Data Sources: Data collected by NCQA's 2014 PCMH program as of May 2017.

Measures: A novel method for measuring the implementation of patient safety activities in ambulatory care was developed and applied. Using a consensus process, we selected elements among the 169 NCQA PCMH standards representing activities that, according to a physician panel, represented patient safety overall and in four domains (diagnosis errors, treatment and prevention delays, medication errors, and issues of communication, information flow, and coordination) and generated a score for each. After several rounds of scoring and discussions, the final patient safety implementation score had 28 items.

Analysis: We constructed hierarchical linear models with the overall patient safety implementation score and each of the four domain-specific scores as the dependent variables. The multilevel linear regressions accounted for practice- and county-level characteristics and nested practices within states, recognizing that regulatory differences and the public, commercial, and multi-payer incentive programs that drive PCMH adoption are frequently determined at a state level. Independent variables included practice and community characteristics.

AIM 2: Using triangulated data from interviews, observation, and patient focus groups, analyze how the PCMH model interacts with patient safety from different perspectives – patient, provider, and administrator – across the four key domains of ambulatory safety.

Setting/Population: Ten Level-3 PCMHs in Colorado, Maryland, North Carolina, and Pennsylvania were selected. Onsite visits were conducted by teams of researchers, resulting in 101 interviews with frontline clinicians, administrators, and staff. Twelve focus groups were conducted with a total of 65 patients who were over the age of 18, had a chronic medical condition, and had visited the PCMH more than once a year.

Data Collection: We conducted 2-day site visits at each of the 10 sites from May 2017 to April 2018. The site visits included (1) in-depth interviews or focus groups with clinicians and staff (N=101 participants) (*Papers 2, 3, 4, see below*); (2) focus groups with patients and caregivers (N=65 participants) (*Papers 2, 3, 5, see below*); and (3) in-situ observations by the visit team of PCMH staff as they were conducting routine activities related to patient safety (N=79 participants) (*Paper 2, see below*).

Measures: For the in-depth interviews and focus groups, the semi-structured discussion guides addressed participants' perceptions of the meaning of patient safety, the functioning of the PCMH model as it relates to patient safety, and perceived challenges and improvement strategies associated with the four ambulatory safety domains.

For observations, we used a human factors approach and contextual inquiry, a process of asking questions of those performing tasks while or after tasks are underway, to explore key workflows and processes related to patient safety.

Analysis: A multidisciplinary coding team first identified an initial set of codes a priori using the previously described framework of ambulatory safety. We then reviewed interview transcripts and observation notes line by line using the constant comparative approach to inductively identify new codes that emerged from the data and revise the coding structure accordingly. Disagreements in coding and interpretation were resolved through discussion and group consensus, complemented by regular debriefings with the full research team. When the coding structure was considered final (i.e., no new concepts were apparent), two independent coders analyzed 20% of all materials independently to assess intercoder agreement. Coders achieved at least 80% agreement on code frequency and code existence for each transcript. When all coding was complete, we collated codes for each of the four ambulatory safety framework domains and then synthesized recurrent themes related to perceived challenges and strategies addressing patient safety issues. We used MAXQDA 12 to organize the data and facilitate analysis. We also obtained feedback on study materials, emerging themes, and results from both a patient advisory and expert advisory group and provided site-specific summary reports to each participating site.

Additional analyses that were unique to each paper included:

- (Paper 2): We used an intuitive approach to triangulate data from the three data collection methods (i.e., interviews, focus groups, and observations) and from multiple respondent groups (e.g., clinicians, staff, and patients).
- (Paper 3): To compare and contrast the perspectives of personnel, and perspectives of patients, a convergence assessment was performed to ascertain areas of agreement, partial agreement, dissonance, and non-narration.
- (Paper 4): A multiple case design with a qualitative approach, involving inductive and abductive phases of data analysis, was used to examine how primary care workers detect threats to safety in primary care.
- (Paper 5): We reviewed and analyzed coding across each of the four domains to examine common themes. Three team members identified the top three most commonly used codes for each domain for further review. Each associated quote was reviewed and was given one to two key words to further refine and provide further context and meaning. Team members also reviewed these key words in discussion with each other and the larger analysis team to identify the common themes across the domains.

AIM 3: Evaluate the potential association of contextual issues (practice type, geographic location) and specific PCMH implementation practices with assessed patient safety across the four key domains of ambulatory safety using qualitative comparative analysis.

Setting/Population: Telephone interviews with a clinician and an administrator were conducted, and surveys of clinicians and staff were collected from 24 diverse, Level-3 PCMHs in seven states (Colorado, North Carolina, Maryland, Florida, New York, Pennsylvania, Texas, Ohio).

One third of the participating practices had PCMH recognition for more than 5 years, 25% were small private practices, and 71% included pediatrics. We were also able to include several of the PCMH practices that participated in Aim 2.

Data Sources: (1) PCMH practice data submitted to NCQA (*Paper 6*), (2) interviews of practice administrators and clinicians (*Paper 6*), and (3) surveys of clinicians and staff (*Papers 6 and 7*).

Measures:

- (Paper 6): The dependent variable was patient safety culture (as assessed by the Safety Organizing Scale) from the surveys. The independent variables included contextual factors (e.g., ownership/size, population service) from the PCMH practice data, implementation factors (e.g., quality improvement climate, perceptions of teamwork, safety processes of care) from the interviews and surveys, and social network factors (e.g., advice-seeking ties) from the surveys.
- (Paper 7): The dependent variable was job satisfaction. We assessed two types of social network ties: (1) instrumental ties, which are considered pathways for work-related advice and information; and (2) expressive ties, which are considered pathways for intangible social resources such as social support.

Analysis:

- (Paper 6): We used coincidence analysis, a novel method based on set theory and Boolean logic, to evaluate the relationships between contextual, implementation, and social network factors and the implementation outcome of patient safety culture.
- (Paper 7): We used multivariable linear regression to estimate the relationship between an individual’s job satisfaction and two network properties: (1) eigenvector centrality (a measure of the importance of an individual in a network) and (2) ego network density (a measure of the cohesiveness of an individual’s network). We examined this relationship for both instrumental and expressive ties.

RESULTS

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

<p>AIM 1: Using data on practices that have achieved NCQA recognition and providers who have participated in federal electronic medical record meaningful use incentives, explore trends and variation in the adoption of patient safety activities based on practice and regional characteristics.</p>	
<p>Related Papers:</p>	<p>Paper 1: <i>Implementation of Patient Safety Structures and Processes in the Patient-Centered Medical Home</i></p> <p>Purpose: To identify PCMH standards relevant to patient safety, construct a measure of patient safety activity implementation, and examine differences in adoptions of these activities by practice and community characteristics.</p>

Results (AIM 1):

- A method to measure the implementation of patient safety activities in ambulatory care was developed. We found that room for improvement exists for many of these activities, even among patient-centered medical homes achieving the highest level of recognition. Among practice characteristics, only military status was associated with significantly higher patient safety scores. Implementation of patient safety activities varied among 5,007 practices with the highest PCMH recognition level. The few military practices (2.4%) had the highest, and community clinics the lowest, patient safety score, both overall (82.0 and 72.0, respectively, $p < 0.001$) and across the four ambulatory safety domains. Other practice and community characteristics were not associated with the patient safety score.

<p>AIM 2: Using triangulated data from interviews, observation, and patient focus groups, analyze how the PCMH model interacts with patient safety from different perspectives – patient, provider, and administrator – across the four key domains of ambulatory safety.</p>	
<p>Related Papers:</p>	<p>Paper 2: <i>Patient Safety in Patient-Centered Medical Homes: A Qualitative Study of Perceived Challenges and Opportunities</i></p> <p>Purpose: To identify perceived challenges and strategies undertaken to address ambulatory patient safety.</p>
	<p>Paper 3: <i>Patient Safety in Primary Care: Conceptual Meanings to Clinicians, Administrators, Staff, and Patients</i></p> <p>Purpose: Our primary research aim was to elucidate the conceptual meanings of patient safety among frontline clinicians, administrators, staff, and patients in the primary care setting. Second, we compared and contrasted the meanings to clinicians, administrators, and staff with those to patients to ascertain the degree of alignment.</p>
	<p>Paper 4: <i>Focused Search and Elaborated Knowledge: Detecting Threats to Safety in Primary Care</i></p> <p>Purpose: To compare how primary care workers search and detect safety threats as a way to prevent medical errors.</p>
	<p>Paper 5: <i>Patient Perceptions of Safety in Primary Care: A Qualitative Study to Inform Care</i></p> <p>Purpose: To understand the patient perspective on patient safety in patient-centered medical homes (PCMHs).</p>

Results (AIM 2):

- (Paper 2): Multiple patient safety issues were identified across sites in clinician/ staff interviews, patient focus groups, and observations:

Safety Domain	Top Themes – Perceived Causes of Safety Issues
Missed, delayed, or incorrect diagnoses	Lack of interoperability between health information systems
	Perceptions that electronic health record (EHR) “problem lists” included outdated/incorrect diagnoses
	Lack of time to collect and synthesize patient information
	Communication failures between providers and patients
Delays in proper treatment or preventive services	Extended wait times to see specialists, particularly in behavioral or mental health
	Lack of patient compliance with recommended screenings and diagnostic procedures
	Lack of clear workflows to support health information technology
Medication safety issues	Challenges associated with patients’ adherence to medications
	Difficulties in maintaining a complete and accurate medication list
	Shortcuts during the medication reconciliation process
Issues of communication, information flow, and care coordination	Lack of interoperability between health information systems

- (Paper 2): Multiple strategies were identified to improve care in the ambulatory primary care setting:

Safety Domain	Top Themes – Strategies to Improve Ambulatory Patient Safety
Missed, delayed, or incorrect diagnoses	Using EHR systems to track test results/flag abnormal and overdue tests
	Using protocols to systematically gather new patient information, particularly after transitions of care
	Using a team-based approach during the diagnostic process
	Scheduling enough time for physicians to explore patients’ underlying conditions
	Providing coordinated “next steps” following a visit
Delays in proper treatment or preventive services	Increasing access to care through more timely appointments, onsite laboratory testing, and onsite specialty services
	Leveraging health information technology (HIT) systems to track outstanding referrals/health screenings
Medication safety Issues	Having clinical pharmacists on staff
	Using HIT systems to check for drug-drug interactions
	Facilitating medication reconciliation by printing medication lists for patients during the visit/asking patients to physically bring in pill bottles
	Conducting medication reconciliation in the patient’s home
	Providing patients with physical descriptions of medications (shape, color)

Issues of communication, information flow, and care coordination	Appointing/hiring staff to perform care coordination activities during transitions of care
	Using the EHR's patient portal to facilitate timely communication

- (Paper 3): Findings indicate that frontline personnel conceptualized patient safety more in terms of work functions, which reflect the grouping of tasks or responsibilities to guide how care is being delivered. Five work functions were identified on how frontline clinicians, administrators, staff, and patients conceptualize the meaning of patient safety in primary care. Frontline personnel and patients conceptualized patient safety in largely consistent ways, with some differences in *Coordinating Care*, in which personnel were focused on the tasks involved but patients were focused on the relationships instead; *Considering Social Determinants of Health*, which was non-narrated in patients' conceptualization of safety; and *Communicating Attentively*, which was non-narrated in personnel's conceptualization of safety. Function-based conceptualizations of patient safety in primary care may better reflect frontline personnel and patients' experiences than domain-based conceptualizations, which are favored by experts.
- (Paper 4): When discussing patient safety and medical errors, primary care workers expressed significantly more concerns for potential safety issues than for actual errors. They described threats to patient safety that, if no information was available or action taken (omissions), could plausibly lead to errors and undesirable patient outcomes in the future. The informants further highlighted the search for patient-related information in several domains to facilitate threat detection. This observation was aligned with the preventive role that primary care assumes in the field of medicine. To detect safety threats as part of error prevention, primary care workers engaged in a cognition-driven search motivated by omissions. Primary care workers anticipated safety events by thinking about the information they may be missing or do not possess. Omitted patient information and its plausible impact on safety were most concerning to primary care workers. Results showed that primary care workers used omissions as a cognitive representation to anticipate unwanted safety events, which motivated a set of information search targets and strategies for safety threats detection. Strategies included expanding the focused search for patient information by visiting patients' homes and involving multidisciplinary professionals, such as pharmacists or social workers, in the focused search. Prevention-focused organizations like primary care clinics acquire elaborated or unelaborated knowledge when detecting threats and preventing errors. Collectively, these discoveries extend our understanding of the interplay between error prevention and organizational learning.
- (Paper 5): Patients' perceptions of safety focused on clear and timely communication with and between clinicians and on patients' trust in the care team, including being heard, respected, and treated as a whole person across the four ambulatory safety domains. Other themes that were important to specific domains included education and medication reconciliation process, clear documentation, and others.

<p>AIM 3: Evaluate the potential association of contextual issues (practice type, geographic location) and specific PCMH implementation practices with assessed patient safety across the four key domains of ambulatory safety using qualitative comparative analysis.</p>	
<p>Related Papers:</p>	<p>Paper 6: <i>Association of Implementation and Social Network Factors With Patient Safety Culture in Medical Homes: A Coincidence Analysis</i></p> <p>Purpose: To understand which PCMH and patient safety implementation and social network factors may be necessary or sufficient for higher patient safety culture.</p>
	<p>Paper 7: <i>A Double-Edged Sword: The Effects of Social Network Ties on Job Satisfaction in Primary Care Organizations</i></p> <p>Purpose: To investigate how two types of workplace relationships – instrumental and expressive ties – are associated with job satisfaction among healthcare workers</p>

Results (AIM 3):

- (Paper 6): The coincidence analysis identified five equally parsimonious solutions (4 factors), accounting for all practices with higher safety culture. Three solutions contained the same core minimally sufficient condition: the implementation factor leadership priority for patient safety and the social network factor reciprocity in advice-seeking network ties (advice-seeking relationships). This minimally sufficient condition had the highest coverage (5/7 practices scoring higher on the outcome) and best performance across solutions; all included leadership priority for patient safety. Other key factors included self-efficacy and job satisfaction and quality improvement climate. The most common factor for which absence was associated with the outcome was a well-functioning process for behavioral health.
- (Paper 7): Individuals who were more central in the expressive network were less satisfied in their job ($\beta=-0.40$ (0.19), $p<0.05$), whereas individuals who had denser instrumental networks were more satisfied in their job ($\beta=0.49$ (0.21), $p<0.05$).

Discussion and Conclusions

The results of the project presented in the seven papers provide significant insights on the importance and current practice of patient safety in ambulatory care settings, as illustrated by the evaluation of meaning and implementation of patient safety in PCMHs) as best-case scenarios with relevance to primary care settings more generally. The mixed-methods data collection and analyses in these studies were innovative and robust and uniquely informed the identification of best safety practices in primary care.

Implementation of patient safety activities varied among over 5,000 practices with the highest PCMH recognition level. We found that room for improvement exists for many of these patient safety activities, even among patient-centered medical homes achieving the highest level of recognition. Among practice characteristics, only military status was associated with significantly higher patient safety scores. Better understanding of what factors are associated with implementation of patient safety activities may be a key step in improving ambulatory patient safety. Further research should evaluate other organizational and contextual factors and their associations with a wider range of ambulatory patient safety implementation strategies. Finally, defining and evaluating key patient safety outcomes for primary care would improve our understanding of the relationship between the environment of care and the ability of providers to maximize patient safety. (Paper 1)

Multiple perceived patient safety issues and strategies to improve care were identified by clinicians, staff, patients, and through observations. Lack of interoperability between health information systems was identified as a cross-cutting theme across multiple patient safety domains. Key themes identified by both clinicians, staff and patients as perceived causes of safety issues also included communication failures between providers and patients, lack of patient compliance with recommended screenings and diagnostic procedures, and challenges with adherence to medications. Safety strategies were identified for each ambulatory safety domain. Use of EHR and HIT systems were identified as potential strategies for each ambulatory safety domain. Although common strategies were identified and supported by clinicians, staff and patients alike, patients also identified strategies that were not raised in discussions with clinicians and staff, emphasizing the importance of their involvement in patient safety solutions in the PCMH. Patients also emphasized the importance and potential strategies to improve communication as a central aspect of patient safety and care delivery. (Paper 2)

Our systematic investigation into what patient safety means in primary care to frontline clinicians, administrators, staff, and patients underscored the importance of the patient perspective in patient safety research and provided some foundational context to help advance future patient safety efforts in primary care. We found a high degree of agreement in the conceptualization of patient safety in primary care between frontline clinicians, administrators and staff, and patients, with some differences noted with conceptualizing care coordination, consideration of social determinants of health, and attentive communication. Information security was also perceived to be an element of patient safety in primary care. Also, conceptualizing patient safety in the form of tasks or work functions better reflected the experiences of personnel than domain-based conceptualizations that are favored by experts. This differential approach in conceptualization should be considered in future measurements and interventions to improve overall patient safety in primary care. (Paper 3)

We applied concepts of organizational learning theory in evaluating patient safety in primary care organizations and investigated the role of cognition-driven learning in error prevention, specifically the search for threats to patient safety. When discussing patient safety and medical errors, primary care workers expressed significantly more concerns for potential safety issues than actual errors. Though patient information may be at the core of prevention and safety efforts, omitted information and its plausible impact on safety were most concerning to primary care workers.

To search for threats to patient safety, workers engage in a set of information search targets and strategies, which determines whether knowledge is being elaborated for threat detection. Strategies included expanding the focused search for patient information by visiting patients' homes and involving multidisciplinary professionals, such as pharmacists or social workers, in the focused search. Prevention-focused organizations like primary care clinics acquire elaborated or unelaborated knowledge when detecting threats and preventing errors. Collectively, these discoveries extend our understanding of the interplay between error prevention and organizational learning. (Paper 4)

By examining the patient's perspective on patient safety, we uncovered two key themes: (i) the importance of clear communication with their clinician and between their clinicians and (ii) the importance of patients' trust in their care team, including being heard, respected, and treated like a whole person. There are a few things that can be done to improve communication and trust. Patient advisory boards allow for the patient voice to be incorporated into the primary care setting. Improving the use of the patient portal for communication can also be emphasized, including having clinicians and staff respond to messages in a timely manner. Reviewing information found in the portal prior to visits could be used to improve trust. Further development of primary care models and ambulatory care initiatives should consider incorporating patients' perspectives to better address improving communication and building systems and care teams that patients can trust. (Paper 5)

In our cross-case coincidence analysis to explore implementation and social network factors and primary care patient safety, we identified several combinations of factors associated with higher patient safety culture. The combination of leadership priority for patient safety plus reciprocity in advice seeking, explained more cases than any other combination of factors and was present with lower patient safety culture. This suggests that patient safety culture is higher when clinicians and staff perceive that leadership prioritizes patient safety across domains and when there is high reciprocity (i.e., clinicians/staff who receive advice from a colleague also give advice to that colleague). The results suggest that interventions to improve ambulatory patient safety should measure, evaluate, and address leadership support across safety domains and clinician and staff advice-seeking relationships. (Paper 6)

The well-being of healthcare workers is an important aspect of patient safety. We explored how the social networks of clinicians and staff working in primary care practices affect their job satisfaction. We found that density of the instrumental network was positively associated with job satisfaction and that centrality in the expressive network, which may require greater emotional labor, was negatively associated with job satisfaction. We found that cohesiveness, or the interconnectedness of healthcare workers' instrumental ties contributed far more to their ratings of job satisfaction than occupying a central position did. Cohesive (i.e., dense) social networks tend to promote reciprocity, trust, and shared norms among their members. Therefore, in dense instrumental networks, members may have greater confidence in the quality of information exchanged and may receive critical guidance and clear expectations for doing one's work, thus enhancing job satisfaction.

Workplace relationships affect worker well-being. These findings suggest that efforts to increase job satisfaction should consider the significant association of workplace relationships with individuals' sense of well-being and that this consideration should be extended to the *entire* healthcare team.

When seeking to improve worker well-being, job satisfaction can be improved by considering workers' position in instrumental and expressive networks. Dissatisfied workers may benefit from greater advice access and/or from resources that would help them to regulate emotionally exhausting network connections. (Paper 7)

Significance and Implications

Our project informs how patient safety is conceptualized and enacted in the ambulatory care setting. The findings from this work can inform public and private sector efforts to advance ambulatory safety, provide critical information on the viability of various methods for evaluating ambulatory safety outcomes, and highlight the importance of defining key patient safety outcomes for primary care. Our findings improve our knowledge about ambulatory safety and provide strategies for how best to design future interventions to improve patient outcomes.

LIST OF PUBLICATIONS AND PRODUCTS

- Paper 1. Oberlander T, Scholle SH, Marsteller J, Barr MS, Dy S. Implementation of Patient Safety Structures and Processes in the Patient-Centered Medical Home. *The Journal for Healthcare Quality*. 2020. *Under review*.
- Paper 2. Yuan CT, et al. Patient Safety in Patient-Centered Medical Homes: A Qualitative Study of Perceived Challenges and Opportunities. *In progress*.
- Paper 3. Lai AY, Yuan CT, Marsteller JA, Hannum SH, Lasser EC, Heughan J, Oberlander T, Berger ZD, Gurses AP, Kharrazi H, Pitts SI, Scholle SH, Dy SM. Patient safety in primary care: Conceptual meanings to the health care team and patients. *Journal of the American Board of Family Medicine*. 2020. *In press*.
- Paper 4. Lai, AY. Focused Search and Elaborated Knowledge: Detecting Threats to Safety in Primary Care. *Academy of Management Discoveries*. 2020. *Under review*.
- Paper 5. Lasser E, Heughan JA, Lai AY, Yuan CT, Dy SM, Bittle MK, Oberlander T, Pitts SI, Marsteller JA, Hannum SM. Patient perceptions of safety in primary care: A qualitative study to inform care. *Journal for Healthcare Quality*. *Under review*.
- Paper 6. Dy SM, Acton R, Yuan CT, Hsu YJ, Lai AY, Marsteller JA, Xia F, McGee N, Kharrazi H, Mahabare D, Sharma R, Kim J, Pitts SI, Gurses AP, Bittle MK, Scholle SH. Association of implementation and social network factors with patient safety culture in medical homes: A coincidence analysis. *Journal of Patient Safety*. 2020 Jul 29. doi: 10.1097/PTS.0000000000000752. *Online ahead of print*.
- Paper 7. Yuan CT, Lai AY, Benishek L, Mahabare D, Kharrazi H, Marsteller JA, Dy SM. A double-edged sword: The effects of social network ties on job satisfaction primary care organizations. *Health Care Management Review*. 2020. *Under review*.

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