

**EVALUATING THE USE OF HEALTH INFORMATION TECHNOLOGY TO
ADVANCE HEALTH EQUITY IN PRIMARY CARE**

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Abstract

Introduction: The concept of health equity has recently taken a central position in efforts to improve health care in the United States. With the 2021 National Academies' report on "Implementing High-Quality Primary Care," the United States is also experiencing renewed focus on primary health care. Follow up articles to the report highlighted the need for health equity to be centered in primary care and the importance of health information technology (HIT) in promoting high-quality care. Data-driven improvement has long been known to be an important building block of high-performing primary care, but the role of data and technology in advancing health equity is not well understood.

Methods: This study aims to investigate the link between data systems and health equity within the context of primary care practices by presenting a case study of a single, high-performing primary care practice selected through reputational sampling. Researchers reviewed the practice's policy documents related to equity and interviewed a clinic administrator, a physician, and a data specialist at the practice. The Consolidated Framework for Implementation Research (CFIR) was used to analyze interview transcripts. Themes derived from the interviews fell under the CFIR's five domains, intervention characteristics, outer setting, inner setting, characteristics of individuals, and implementation process.

Results: The practice was found to have a robust HIT system which includes an electronic medical record with both collection and analysis capabilities, a data reporting platform, and a data analysis and management team. As described by prior literature, the clinic followed a four-phase data use process which includes collection, analysis, reporting, and action. In addition to themes in each of the other CFIR categories, interviewees reported a number of process facilitators to data use for advancing health equity, including value-based contracting with payers, health equity champions, affiliation with a larger health system and with a university department, partnerships with peer clinics, receptive leadership, pandemic-motivated transitions to virtual care delivery, and external grant funding. Interviewees also reported barriers which included data limitations, data security concerns, staff burden, patient preference for convenience over continuity, and fee-for-service revenue models.

Conclusion: We found that the clinic closely followed the proposed theoretical continuum in developing their HIT capabilities and health equity practices. This supports the continuum and

offers an evidence-based framework for other primary care practices to follow in advancing equity through data-driven improvement. The facilitators and barriers identified through interviews point to the importance of implementing robust HIT and data collection, analysis, and reporting capabilities to achieving higher levels of clinic performance. Additionally, the findings of this study support the semi-cyclic nature of the proposed continuum where high-performing clinics must undergo continual reanalysis, rereporting, and reaction in order to perpetually improve equitability. Other primary care practices can learn from the facilitators and barriers identified in this study to navigate their own implementation of data-driven practices to advance health equity. Implications for the broader U.S. health care industry include the need for updated data security regulations which align with modern technology and the need for increased value-based care contracting which enables clinics to fund population-health initiatives.

Key Words: Health Equity, Data, Information Technology, Primary Care, Quality Improvement, Implementation Research, Social Determinants of Health, Electronic Health Records, Population Health

Introduction

Barbara Starfield's 1992 book, *Primary Care: Concept, Evaluation, and Policy*, outlines four central pillars for primary care: first-contact, comprehensiveness, continuity, and coordination.¹ One of the most notable updates to Starfield's pillars came in 2014 with the publication of "The 10 Building Blocks of High-Performing Primary Care."² In the article, Bodenheimer et al. evaluated which foundational aspects of primary care practices led to improved quality. Focusing on both structural and policy-oriented characteristics, they made recommendations on how access, continuity, comprehensiveness, and coordination could be maximized within primary care settings.² The second building block, "data-driven improvement," highlighted the need for clinics to measure, analyze, report, and act on patient data in order to improve their performance.^{2(p.168)} Using a case study method, this paper seeks to further explain how this second building block is foundational to advancing health equity within primary care settings. The key research questions being investigated are, first, what policies and practices do high-performing primary care clinics have in place to collect, analyze, report, and act on data related to health equity, and second, what are the facilitators and barriers that affect the use of data to advance health equity in a clinic's inner setting, outer setting, and implementation process?

Implementing High-Quality Primary Care Through Information Technology

The National Academies of Sciences, Engineering, and Medicine's (NASEM) 2021 report, "Implementing High-Quality Primary Care," defined high-quality primary care as "the provision of whole person, integrated, accessible, and equitable healthcare by interprofessional teams who are accountable for addressing most of an individual's health needs across settings and through sustained relationships with patients, families, and communities."^{3(p.370)}⁴ An entire section of the report explained the crucial role played by data, digital health systems, and information technology in improving primary care quality.³ The report's final plan for implementing high-quality primary care in the U.S. calls upon primary care practices, systems, and leaders to "design information technology that serves the patient, family, and interprofessional care team."^{3(p.371)} Policy makers and health care leaders should therefore focus urgently on creating greater information technology capability within primary care settings.

In a follow-up perspective piece, Krist et al., members of the NASEM committee which produced the report, expand on this recommendation by stating the need for improved health information technology (HIT) infrastructure to create an “easily accessible, equitable, and comprehensive patient record.”^{4(p.3741)} Krist et al. build on the two major related action steps in the NASEM report: that the federal government should, first, develop next-generation digital health certification standards to simplify and support person-centered care and, second, adopt a universal patient data system (EMR) to enable greater data sharing across care teams.^{3,4} The authors describe a vision for primary care digital health which includes “aggregating, analyzing, and applying information for action.”^{4(p.2740)} This vision echoes the building block model’s emphasis on not only measuring, but also analyzing, reporting, and acting on patient data in order to improve primary care clinic performance.² Therefore, it is vital that primary care clinics work to move beyond data collection to create protocols and policies which allow them to act upon patient data to reach clinic outcome and performance objectives.

Health Equity & Primary Care

The COVID-19 pandemic has exacerbated previously existing disparities in health outcomes for socially disadvantaged groups, such as racial minorities, those of low socioeconomic status, and uninsured populations.⁵ Prior to COVID-19, Black Americans had a lower life expectancy at birth by 3.7 years compared to White Americans; the effects of COVID-19 widened that gap to more than 5 years.⁶ Latinx populations also bore a greater burden from the effects of the pandemic, with data from 2020 projecting a loss of 3.1 years in life expectancy at birth for Latino Americans, compared to a loss of 0.7 years for White Americans.⁶ Disparities in health outcomes across socioeconomic divides are also substantial in the U.S., with a gap of almost 15 years in life expectancy at birth between the richest and poorest Americans.⁷

Health inequity, stemming from systemic racism, systematic exclusion, implicit bias, marginalization, and a long history of abuse and mistreatment of minoritized populations by the healthcare industry, is perpetuated in barriers to accessing care, poor coordination of services, lack of comprehensive treatment, and lack of long-term relationships between patients and providers.⁵ Starfield’s four pillars, while not explicit in their connection to issues of equity, can easily be applied to understand the role that primary care should play in eliminating health disparities. The “principle of first contact” positions primary care to improve accessibility for

excluded populations, while “coordination” enables primary care to reduce barriers throughout the rest of the healthcare system. Comprehensiveness empowers primary care to treat the whole person and address unmet social needs; continuity helps primary care clinicians to engender trust through deeper relationships with patients. With this in mind, primary care is unique among medical specialties in its ability to address health inequity through relationships and trust.⁵ The vitality of primary care to health equity is reflected also in patient visits: in 2004, adults with one or more markers of social disadvantage received almost half of their ambulatory care visits from family physicians, while adults without any markers of social disadvantage received only a third of their ambulatory care from family physicians.⁸ Further, while the causal factors are likely many, data from 2017 shows that patients in counties with less than one primary care physician per 3500 persons had almost a full year lower life expectancy compared with patients in counties with higher physician to patient ratios.⁹

Another major contribution of the NASEM report was in recognizing the need for greater attention to healthcare disparities within primary care.³ One recommendation of the NASEM report calls upon policy makers to “ensure that high-quality primary care is available to every individual and family in every community.”^{3(p.370)} As a follow up to the report, Eissa et al. published a perspective piece examining the NASEM recommendations within the context of health equity.¹⁰ Specific to the role of health IT infrastructure in addressing health equity, the article describes how the collection of racial/ethnic, gender identity, sexual orientation, and disability status data within EMRs is central to measuring health disparities among disadvantaged groups.¹⁰ Also important to data use for health equity is including patient perspectives from marginalized communities in deciding how data is managed and used to build trust in the context of historical exploitation within medical studies.¹⁰ The focal point of Eissa et al.’s commentary on the NASEM report is that high quality primary care must see health equity as a vital part of what “high quality” means, and that the achievement of quality for primary care clinics must, therefore, involve addressing health inequity for their patient population.

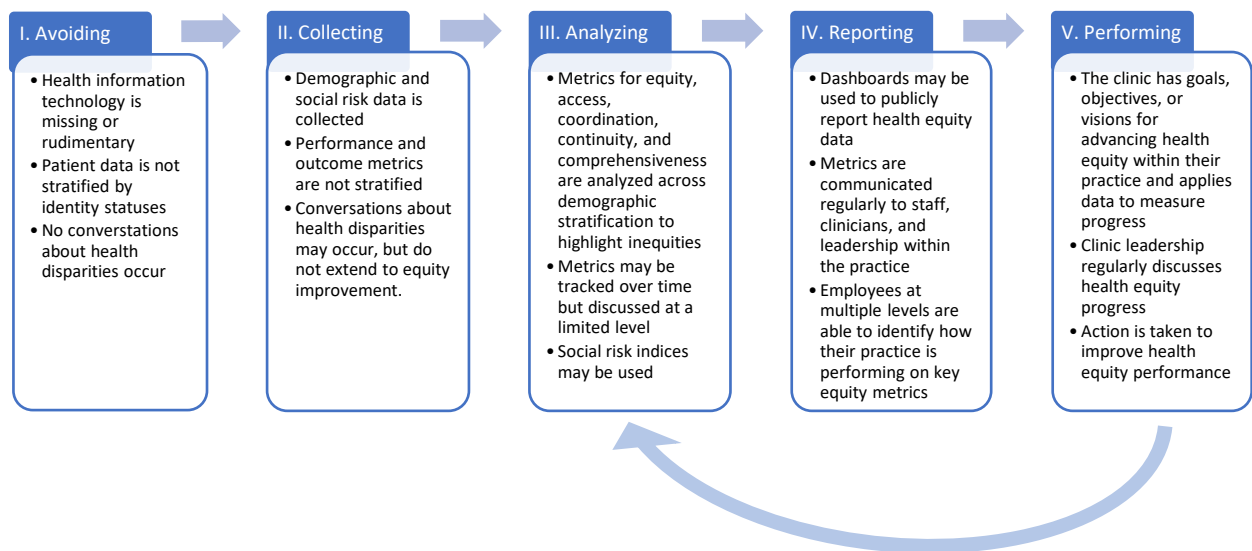
Bridging Health Equity and Information Technology Within Primary Care

The NASEM report has been followed up by articles separately calling for greater use of digital health solutions within primary care and greater recognition for the role that primary care should play in advancing health equity.^{4,10} This paper posits that these two objectives are not

only complimentary, but integrally linked to one another. An application of the building block framework to health equity necessitates that data on health disparities is not only collected and reported, but also applied to improve quality of care at the clinic level.² Clinicians and practice leaders need to both understand health disparities within their patient population through next-generation HIT and use that data to drive decision making. The key issue at hand, therefore, is that many primary care clinics currently may not have the capacity to collect, analyze, and act on patient data to achieve health equity for their patient population. Further, many clinic leaders may not understand the steps necessary to move their practices towards greater health equity. This paper seeks to identify the characteristics that enable high-equity primary care clinics to successfully use data and information technology to address health inequities within their patient populations. In answering this central question, this paper will also aim to discover the structures and policies of primary care clinics that serve as facilitators or barriers to using data effectively for health equity goals and will provide key recommendations for clinicians and practice leaders to improve their use of HIT to advance health equity among their patient population.

Health Equity and HIT Integration Continuum

This paper presents the following theoretical continuum for understanding data usage within primary care settings as it relates to advancing health equity.



Avoiding

Clinics at the first stage of the continuum currently do not have the infrastructure or policies in place to use data effectively in addressing health disparities. Health information technology at these clinics is either nonexistent or rudimentary. Patient data is not stratified by different social disadvantage metrics (race, ethnicity, language, socio-economic status, etc.). Conversations about health disparities likely do not occur with any regular frequency. Further focus on data collection practices and HIT integration into clinician workflows is needed to move along the continuum.

Collecting

In the second stage, clinics are beginning to recognize the opportunities offered by health information technology and patient data to better understand health equity. Demographic and social disadvantage data is collected within their EMR system and aggregate data can be stratified. However, performance and outcomes metrics are not stratified by social disadvantage markers and very little visibility is available for health equity metrics. Conversations about health disparities within their patient population may take place but are not tied to metrics. Clinics may continue to progress by adopting key metrics for measuring health equity and dedicating resources to data analysis capabilities.

Analyzing

Clinics in stage three of the continuum use their data effectively to measure health equity performance through stratified metrics. Metrics used are applicable to better understanding the status of health equity among the practice's patient population, such as measuring access, coordination, continuity, and comprehensiveness across different socially disadvantaged groups. Social risk indices may be used to understand inequity and vulnerability in the clinic's service area and may be combined with individual patient data to better screen for unmet social needs. Metrics may be tracked over time but are not discussed or communicated broadly; metrics may only be visible to leadership. Practices at this stage can improve through creating both internal and external communication strategies, as well as role-dependent goals for understanding the clinic's health equity status.

Reporting

Practices at the fourth stage of the continuum track metrics for health equity performance over time to better understand how health equity changes over time within their patient population. The status of health equity within the practice and among patients is discussed among leadership and reported widely to practice staff and may even be reported out to the wider community. Employees at each level of the practice (support staff, nurses, physicians, pharmacists, managers, etc.) can describe health equity performance at the practice and see health equity as relevant to their job. Health equity metrics may not yet inform practices or policy. Practices in this stage should work towards integrating reported health equity metrics into regular leadership meetings and decision-making procedures, as well as adopt long-term strategies and goals for improving their health equity performance.

Performing

In the final stage of the framework, clinics have clearly stated goals, objectives, or strategies for addressing health inequity within their practice. Health equity metrics are tracked over time and discussed regularly in the context of shaping decisions, practices, or policy. Action is taken to improve health equity among the patient population and the broader community. Clinics in this stage of the continuum should continue evaluating new health equity needs among their patients and regularly reflect on possible improvements to their collection, analysis, and reporting procedures.

Methods

Methodological Theory

This study employed a case study design, conducting semi-structured interviews with various staff at a high-performing primary care clinic.^{11,12} Three interviews were conducted focusing on different components of data use for health equity: one with a member of the clinic administration, one with a staff member in charge of population health and data analysis, and one with a family medicine physician. This methodology describes a type 1 case study, in which a single unit of analysis (the clinic) is analyzed within a single, wholistic context.¹¹ The clinic

profiled for this study falls at stage five on the HIT implementation continuum (figure 1), reflecting a motivation to study an extreme case in order to understand the characteristics of high-performing clinics that enable them to stand out from other primary care practices.¹¹

Researchers chose a case study design to collect more detailed information on the facilitators and barriers to utilizing HIT systems to advance health equity, which could not easily be ascertained through a survey design or through analysis of many clinics together. Researchers conducted multiple interviews at the site for two main reasons: first, to gather perspectives from staff involved in different aspects of the clinic's functioning, and second, to better understand the depth of penetration of health equity objectives within different segments of clinic staff.

Clinic & Participant Selection

The clinic profiled in this case study was selected using a reputation sampling method in order to select an innovative and high-performing practice, as described by Etz et al.¹³ Key researchers, clinicians, and policymakers known to the author were consulted for their recommendations of clinics or other researchers to contact. This process was repeated with subsequent contact recommendations until no further contacts were suggested. Researchers chose this sampling method to ensure that unusually-successful cases were found, rather than conducting random or convenience sampling which would be unlikely to yield clinics in the desired continuum range.

After compiling an initial list of seven potential clinics, the primary researcher conducted a one-phase screening approach by contacting clinic administrators or recommended contacts to gauge willingness to participate, quality of HIT systems, and status of health equity initiatives. After the screening process was complete, a single clinic was identified for inclusion as a case study. Clinics on the initial list were deemed non-participants if they self-identified as poor examples of HIT and data use for advancing health equity, reported a limited knowledge of health equity, reported a limited use of HIT systems for data analysis, did not respond to outreach, or declined to be included.

Researchers coordinated participant selection through clinic administrators based on suggestions for which staff would be best suited to provide answers related to the topics of health equity or health information technology use. Researchers also ensured that selected participants

represented a variety of different roles including administration, care delivery, and data management.

Interview Setting

Researchers used a HIPAA-compliant Zoom account licensed through the University of North Carolina at Chapel Hill to conduct virtual audio-visual interviews. Only the researcher and the interview subject were present in the Zoom call at the time of interview.

Data Collection

Prior to conducting interviews, clinic staff provided researchers with the clinic's diversity, equity, and inclusion (DEI) strategic objectives and opportunities document. This document, created in 2021, outlined the clinic's plan to advance DEI over a five-year period. Researchers extracted information from the DEI plan related to the clinic's goals and vision for health equity improvement. The clinic also shared the health system's nondiscrimination policy for further contextual information around health equity-related policy at the clinic.

Researchers created individual semi-structured interview guides for each of the three interview types: administrator, data manager, and clinician.¹² The full interview guides can be found in appendix A. Interviews began with a brief description of the study, and participants verbally provided consent to be interviewed and recorded at the beginning of each interview. Interviews lasted between 30 and 60 minutes each.

The primary researcher conducted three total interviews: one with the clinic's data management and population health leader, one with a clinic administrator, and one with a family medicine physician. The researcher conducting the interviews also took notes during the discussion. The interviewee in a clinic administration role was asked about topics including how the clinic developed its current data-use practices, what outside influences were important to the clinic's development of current practices, how data was reported within and outside of the clinic setting, who at the clinic was responsible for managing and analyzing clinic-level health equity metrics, what goals and objectives the clinic had for advancing health equity, and how health equity metrics were used to shape decisions around clinic policy and practices. Physician interviewees were asked about topics including how patient-level demographic and social determinant data was collected, how they viewed their role in advancing the clinic's health

equity goals, and how they used equity-related metrics to shape their clinical practice. The interviewee in a data management role was asked about topics including which metrics the clinic relied on to measure their health equity status, how often metrics were updated, how metrics were shared with clinic management and outside entities, how their health equity data practices were developed, and what outside factors enabled them to create meaningful metrics.

Interviews were audio recorded through the Zoom platform and recordings were stored on a secure, university-managed server. Recordings were then used to transcribe each interview using Otter.ai software and Microsoft Office 365 applications. Full interview transcripts can be found in appendix B. After analysis was complete, all recordings were deleted.

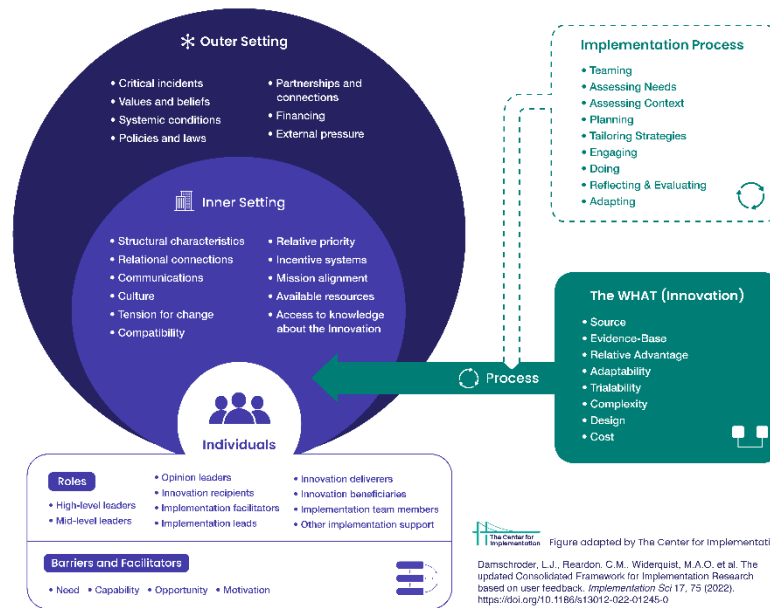
Methodological Limitations

A single case study design was chosen due to time and resource constraints, but replicated study of additional high-performing clinics would likely improve the accuracy of findings. While researchers found that many themes were repeated across different interviews within the clinic, greater thematic saturation could be reached through further interviews with additional staff types (e.g., medical assistants, nurses, front-desk staff). Further, a more holistic perspective of the clinic's inner setting characteristics could be obtained through surveying a greater number of staff, in addition to the conducted interviews. Finally, the inherently subjective nature of individual staff perspectives may lead to conclusions that cannot be generalized to the perceptions or experiences of every staff member or clinician. However, this should not negatively affect the validity of this studies results as each experience and perspective related to the intervention of interest can be relevant to the future implementation of similar interventions.

Data Analysis

This study used the updated Consolidated Framework for Implementation Science (CFIR) to guide analysis of the collected interviews in a theory-driven approach (figure 1).^{11,14,15}

Figure 1. Consolidated Framework for Implementation Research 2.0.¹⁵



The CFIR is a well-established and highly regarded framework in the field of implementation science which was developed specifically for health services research.¹⁴ A second edition of the CFIR was published in 2022 with changes based on feedback from implementation science researchers.¹⁵ The CFIR has even been adapted for use specifically in electronic medical record implementation studies.¹⁶ The CFIR has five main domains: intervention characteristics, outer setting, inner setting, characteristics of individuals, and process (Table 2).¹⁴ In applying the CFIR framework to this study, researchers mapped each CFIR domain to a component of HIT implementation to advance health equity (Table 3).

Table 1. Overview of the CFIR Framework.¹⁴

CFIR Domain	Sub-Domains
I. Intervention Characteristics	a. Intervention source b. Evidence strength and quality c. Relative advantage d. Adaptability e. Triability f. Complexity

	g. Design quality and packaging h. Cost
II. Outer Setting	a. Patient needs and resources b. Cosmopolitanism / External networks c. Peer pressure d. External policies and incentives
III. Inner Setting	a. Structural characteristics b. Internal networks and communications c. Culture d. Implementation climate
IV. Characteristics of Individuals	a. Knowledge and beliefs about the intervention b. Self-efficacy c. Individual stage of change d. Individual identification with organization e. Other personal attributes / personality
V. Implementation Process	a. Planning b. Engaging c. Executing d. Reflecting and evaluating

Table 2. Mapping of CFIR domains to components of HIT implementation for health equity.

CFIR Domain	Study-Specific Components
I. Intervention Characteristics	a. Types of health information technology in use b. Data collection and analysis processes c. Key health equity metrics d. Frequency of data analysis and reporting e. Reporting platforms/methods f. Application of data to clinical practice g. Application of data to organizational activities

II. Outer Setting	<ul style="list-style-type: none"> a. Clinic affiliation (private vs. system, academic, etc.) b. Affiliated health system policy c. State or national policy d. Patient population characteristics and preferences e. Influential clinics or health systems f. Influential organizations and innovation sources
III. Inner Setting	<ul style="list-style-type: none"> a. Data management infrastructure and staff b. Internal resources c. Internal communication frequency and type d. Clinic culture / Attitude towards innovation
IV. Characteristics of Individuals	<ul style="list-style-type: none"> a. Familiarity with health equity b. Self-perception of role in promoting health equity c. Individual willingness to adopt innovation d. Leaders e. Champions of change
V. Implementation Process	<ul style="list-style-type: none"> a. Drivers of change b. Objective setting processes c. Decision making processes d. Implementation barriers e. Implementation facilitators

The primary researcher coded the collected interview transcripts using Atlas.ti software. First, themes from each interview were analyzed independently and coded to a corresponding CFIR domain. The primary researcher also extracted facilitators and barriers identified by interviewees within the CFIR domain of implementation process. After the initial coding process was complete, themes derived from each interview were checked with interview subjects to verify the researcher's interpretation and results. To do this, the researcher sent summary documents from each interview to the respective participants to certify derived themes and accept clarifying comments. Finally, themes from interview were combined to analyze the

overall facilitators and barriers to HIT implementation for health equity. Methods, data, and findings were reported according to the COREQ guidelines for qualitative studies.¹⁷

Results

Clinic Description

The selected clinic (“the clinic”) profiled in this case study is a family medicine practice affiliated with a large academic medical center health system (“the health system”) and attached to a university’s medical school department of family medicine (“the department”). The clinic is located in a suburban community in the Southeastern United States, employs more than 75 staff physicians, trains roughly 40 resident physicians, and serves approximately 20,000 patients across all ages. A breakdown of the clinic’s patient population based on a variety of demographic characteristics can be found in Table 3.

Table 3. Characteristics of Clinic Patient Population

Patient Population Characteristic	Percent of patients (%)
<i>Race</i>	
White	57
Black or African American	25
Asian	5.5
American Indian/Alaskan Native	0.6
Native Hawaiian/Pacific Islander	0.2
Unknown/Chose not to disclose	11
<i>Ethnicity</i>	
Hispanic or Latino	9.3
Non-Hispanic or Latino	89.6
Unknown/Chose not to disclose	1
<i>Preferred Language</i>	
English	94.5
Non-English	5.5
<i>Insurance (approximate)</i>	
Privately Insured	50
Medicare	30
Medicaid	10
Uninsured	10

The clinic has a number of goals related to health equity, which are largely driven by their Diversity, Equity, and Inclusion (DEI) strategic plan for 2021-2026. This plan established

the department's Health Equity Advisory Group to guide the department's goals related to health equity. Some of the strategic plan's goals include fostering an inclusive working environment, partnering with community organizations, and investing in research on health inequities. The interviewed administrator reported that one of the most prominent goals of the plan is currently the diversification of their provider staff as they seek to hire a greater number of non-White physicians in order to provide more culturally informed care to patients of color. This goal includes working with the associated school of medicine to develop the pipeline for more people of color to become physicians.

I guess what I think about this, because it's probably the most relevant to my role is that, you know, it's trying to increase the diversity, the diversity of our medical providers in the department, especially our faculty and residents. We have, you know, there's a number of strategies that we've... we've got a diversity, equity, and inclusion strategic plan that we are pursuing to try to part of that as is around improving our improving the diversity of our faculty, which would then result in a population or a group of providers, that's more reflective of the population that we see.

Intervention Characteristics

Health Information Technology

The clinic uses the Epic electronic medical record (EMR) system to collect and manage patient data and store physician charting/notes. The introduction of Epic to the clinic has enabled greater capabilities around data collection, analysis, and reporting.

...a game changer was moving to Epic....

The Epic system includes a secure, online patient portal, MyChart, which enables patients to send and receive provider messages, access lab results, complete surveys, and schedule appointments. The clinic also utilizes Tableau, a data analysis and visualization platform, to create performance metric dashboards and display analyzed data.

Data Collection

At the time of registration, demographic data for new patients is collected and stored in their EMR profile. Patients can also enter or update their demographic information through the

patient portal. In the context of a visit, providers can use questionnaires built into the EMR to collect patient information, including screenings for social determinants of health (SDOH) and unmet social needs. While providers are encouraged to conduct this SDOH screening during the patient visit, this screening can also take place during the rooming process before the physician arrives, through outreach in the patient portal, during a social work consultation, or in the hospital should the patient be admitted. Interviewees reported that the integration of these questionnaires into the EMR system has greatly improved the collection process. While paper surveys do still exist for clinicians or patients who choose to use them, all SDOH data ends up in the same place in the EMR, enabling greater visibility into the SDOH status of the clinic's patient population.

Although the clinic has these SDOH screening practices in place and tracks performance around social needs data collection, staff report that greater standardization must occur to fully utilize SDOH data for analysis purposes. Variability in frequency of SDOH screening leads to gaps in understanding and missing data for segments of the patient population.

And we're, sort of, continuing to work on ways to better standardize it so we're asking every patient at every visit...

So we don't have 100% of our patients screened. You know, there are... patients have a right not to respond but we aren't asking every patient every time, at every opportunity.

So it is only as good as the data we have.

Additionally, phrasing of the standardized screening questions and long look-back periods (up to 12 months) can sometimes lead to patient confusion or misunderstanding.

I think, sometimes the way that the questions are written, and they're based off of Medicaid's Social Determinants of Health required questions, have pretty long look back periods, I think some of them are 12 months. And so it sort of seems redundant if, like, I come in to see my doctor every month that I'm asked every month if the question is asking me about the past 12 months.

Other relevant data is collected through a variety of methods, including patient surveys on experience and satisfaction, staff surveys on wellness and engagement, telephone call logs

(abandonment rate and wait time), and appointment data (appointment availability and patient-provider continuity).

Data Analysis

The EMR system enables staff to view and analyze data at the clinic or patient level, including quality and performance metrics stratified by patient demographic characteristics. Stratification allows the clinic to use every metric, not just those directly related to health equity, to evaluate disparities and inequities in care.

[The EMR is] so great, everything is right there in front of you.

The clinic analyzes performance and quality of care through a set of common metrics, generated from the EMR data daily. The Tableau dashboards are similarly automatically updated each day based on the prior day's data, enabling staff to rapidly analyze the effects of interventions or altered practices based on changes in performance metrics. For example, percentage of patients screened for SDOH is measured through a specific metric which the clinic uses to track performance on health equity goals. The interviewed physician reported that, unlike demographic data, SDOH data cannot currently be used to stratify patient health outcomes. However, responses by other interviewees indicate that the population health team may have enhanced analysis capabilities over other staff that allow them to perform such stratification.

Most data analysis at the clinic is conducted by the population health senior leader, who uses both the EMR and metrics dashboard systems to calculate and stratify different metrics, evaluating clinic performance on key measures and looking for outcome disparities across demographic groups. Prior to the introduction of the EMR and the Tableau tool, interviewees report that they would often have to wait for data requests to be fulfilled to run analyses or tabulate metrics.

But from Tableau being able to see it, and when you're like, "Oh, I wonder like, what about this," and that, that you can just sort of do it, rather than have to wait and put in requests for data. And then, you know, a lot of things can change between the time you requested and the time the data comes in, [the Tableau] data is all pretty available in real time, updated as of the day prior. So that I think is really, really helpful.

Data Reporting

The practice has a well-established internal reporting mechanism that is facilitated by the population health team. Epic allows data managers at the clinic to create reports that then allow data related to outcome disparities to be more effectively shared with leadership and other staff.

I'll build reports in EPIC and export them and then sort of do my own analysis to help us target populations...

...increasingly, some of the data that we get at the system level is stratified [by patient demographics], but our department invests in... through [the population health leader], we invest in having more in-depth reports that give us that information.

The Tableau dashboard also serves as an important component of the clinic's reporting mechanisms. Interviewees described how the introduction of the Tableau tool has enabled greater access to metrics and understanding of clinic performance across the staff.

I think [Tableau] has definitely helped put [data] in the hands of anyone who wants to look at it...

Physicians reported that they use the Tableau dashboard to track their personal performance across the clinic's quality metrics, including those related to health equity. This can then help them understand how they need to alter their clinical activities to reach metric benchmarks, such as increasing the number of SDOH screenings they perform.

Tableau goes down to the practice level and then the provider level, and then it's updated every day.

Tableau is really kind of my scorecard of how I'm doing... You can see, like, how I've done over time and kind of compare it. Month to month. That's going to, so... I kind of use this, like, I'll check on this a couple of times a week to see how I'm doing...

Interviewees also noted that the dashboard is available to the entire clinic, allowing all staff to view clinic performance. Although staff have to request access for a specific provider's metrics, the physician interviewee reported that all of their associated medical assistants, nurses, and other support staff have access to their dashboard, allowing the entire care team to collectively respond to unmet metric benchmarks. Although overall practice metrics can be stratified by

patient demographics through the EMR and are shared out via the population health team's reports, the Tableau dashboard does not allow staff to see stratified metrics at either a practice or provider level.

Data Use & Action

At the individual provider level, the clinician-specific metrics available through their personal Tableau dashboard allow them to quickly take action to address poor performance.

...I can kind of see how I'm doing and then I can go back to Epic and run a report and see who these patients are to be able to do outreach on that.

Providers are also able to act based on data from the SDOH questionnaire. When patients present with unmet social needs that are uncovered by the screening, clinicians are able to tailor their treatment plan to best fit the patient's individual needs or constraints, as well as facilitate referral to other resources.

I think for prescriptions I will make sure I'm, like, thinking about, like, a low-cost prescription, for like, resources like financial assistance, so, like, GoodRX, like, make sure it gets cheaper. I think from like a transportation situation, if they need a follow up appointment, I'll try to figure out, like, "can I do the appointment virtual?" Or like, "how often do I need to see them?" And if it's like a food or housing issue, I guess I'll just, like, think... about, like, social work. Just, like, talking to them about, like, resources that I can, like, put in their after-visit summary or have someone reach out to them about resources. If it's a literacy issue, I might just think about how I present information and maybe not present them with, like, as much written information in the instructions.

However, interviewees did highlight the difficulty of moving from identification to action around SDOHs and the importance of training in helping staff understand how to best respond to unmet social needs.

...talking about not only the importance of screening, but what do you do with positive screens beyond just giving a resource, but also then using that, to inform our care, I think is really important, and definitely something that we're seeing talked about more

regularly and incorporated into not only provider trainings, and resident trainings, but also staff trainings.

At the practice level, data on inequities and SDOH are similarly used to inform resource prioritization and decision-making. Administrative staff described relying on the analysis and reports generated by the population health team in allocating resources and targeting quality improvement activities. Interviewees also reported comparing performance metrics and outcome disparities with similar clinics to make decisions about altering practice activities.

We really look at how are we comparing to other similar clinics... how do we compare to those clinics? And, and where are our gaps to our competitors, or at least those in our peer group? And then how are we going to resource, you know, choose where we're focusing our efforts and resource those efforts appropriately? ... we looked as a group at "where are the areas where we have a large number of gaps?" and then stratifying our patients across populations compared to our peers. ... so given that, how do we improve the way we intervene with those groups? ... how do we provide the resources to do the types of interventions we want to do?

The data management interviewee described the importance of data in convincing practice leadership to allocate resources toward advancing health equity, highlighting the central theme of the HIT implementation continuum for health equity.

... part of why we are screening is so that we can understand the need and advocate for resources and you have to do that in data-informed ways to get buy-in from executives because while the patient-level story is important, the numbers are what really will get people to pay attention.

Outer Setting

Patient Preferences and Needs

Patient language preferences present a significant area for improvement for the clinic, which is currently unable to provide many translation services in a timely manner. Delivery of care and information in a patient's preferred language was described as a major component of health equity improvement that still needs to be improved within the clinic.

...that's part of creating an environment where people feel safe, [patients] want to go to care where people look like them.

Interviewees also described a wide range of patient preferences around technology use and engagement with virtual care delivery modalities.

External Networks and Communication

The clinic is a member of two different cross-clinic collaborative groups, a primary care quality improvement group within the associated health system (“quality improvement group”) and a collaborative of similar academic medical center primary care clinics (“peer clinic collaborative”). Interviewees highlighted that the quality improvement group plays a major role in dictating the performance metrics that the clinic will focus on each year. In fact, the quality improvement group’s primary role is to collect all of the required metrics from the various value-based care contracts between the health system and managed care organizations and synthesize a cohesive list of major metrics to which the clinic is accountable.

So we're part of the [quality improvement collaborative focused on primary care] within the health care system. And so every year there are a set of clinical quality measures that are based on evidence based practices and research...

...the function of the, of the [quality improvement group] is to take the whole, the list of metrics we have coming from insurance companies for our contracts, the ones that are important to the value based pieces of those contracts, which all may have slightly different operational definitions around different metrics, are trying to pull that down and condense it into one set of metrics that we as a group of primary care practices are going to respond to, that's what [quality improvement group] does for us.

Through these dictated metrics, the quality improvement group has been a major motivating force in the clinic’s adoption of metrics related to SDOH and health equity.

the most visible and practical ones would be those that are [quality improvement group] metrics that are related to health equity.

The peer clinic collaborative, on the other hand, serves as a data comparison group and collective innovation source for the clinic. Interviewees described the importance of having a

group of similar clinics to which they can compare their own performance and outcome disparities.

...it is nice when you have these, like, more similar programs or clinics or even areas...

Being able to, sort of, have more comparable populations to share that data with is, I think, affirming and validating...

We really look at how are we comparing to other similar clinics. Not always easy to find a close analogue to ours, since we're one of the larger ones in the system. But how do we compare to those clinics? And, and where are our gaps to our competitors? Or at least those in our peer group?

The peer clinic collaborative also serves as a source of innovation, where the clinic can brainstorm ideas and learn about interventions being tested at similar clinics across the country.

Using [the collaborative] to, sort of, brainstorm together and hear what other practices are doing to pilot or adapt the tools that they have that maybe we can learn from and incorporate ourselves.

External Policies, Pressures, and Incentives

Some of the most significant external pressures affecting the clinic are those coming from the associated health system. As the health system experiences changes in contracting and increasingly prioritizes health equity, the clinic is forced to adopt new metrics and practices which align with the system's foci.

...even like our quality metrics like they changed the [social determinants of health] metric, it's one of our core metrics. They changed it in the past three months because the payers are focusing more on it, and thus the system is encouraging us, not encouraging, they are making us focus on it more too.

Just as the health system is impacted by changes in contracting, the clinic similarly experiences external pressure from payers to adopt practices around health equity data collection, analysis, and action.

So much of where our focuses will flow from... flows from the contracting piece, you know, as we are adding some of that to Medicare, a big piece of that is Medicare and what they do and the way they translate value-based practice into their value-based reimbursement into their programs, Other payers tend to sort of follow that lead in a lot of ways. So those, yeah, I think of those as the primary external pressures that are really affecting us and it really does affect us and that we... build where our focuses around what's going to generate some revenue...

I definitely think, like, Managed Medicaid, and some of these valued-care contracts that are making a requirement to screen, or to, you know, report out based on different criteria I think does just forces us to do it. And I think that's a good thing.

ultimately... I think the payers are the most important external factor.

So it's kind of a... because it's a bigger population insurance concern, it's then trickling down and making us prioritize on it.

Inner Setting

Resources and Structures

Most of the analysis and reporting of clinic data, especially those related to health equity, is completed by the population health team. This team is made up of four part-time fellows, four full-time social workers, and two full-time care managers. The analysis done by this team is shared with leadership and enables much of the clinic's action around health equity advancement. Interviewees described the clinic's investment in creating and supporting this team as vital to the practice's capacity for data management, analysis, reporting, and action.

The clinic's collection of data, including demographic information and SDOH screenings, is largely facilitated by front desk staff who assist patients with registration and by nurses, medical assistants, and other clinical support staff who administer the patient rooming process. Thus, the clinic's data collection process is decentralized across multiple staff roles and teams. Other resources relevant to the clinic's data use to advance health equity include the health information technology tools themselves, such as the EMR and data visualization software.

Internal Incentives

Just as the health system and clinic's incentives have been shaped by value-based contracting with payers, the clinic has passed many of those financial incentives directly to physicians. Interviewees described a redesigned physician incentive system which relies on individual clinician performance metrics to determine financial compensation. With the inclusion of SDOH screening and demographic-stratified metrics in the clinic's performance measurement, this incentive structure also incentivizes providers to address health disparities and buy into the data-driven nature of the clinic's work.

...as we began to have these metrics more and more available, and then we then began at the department to start shifting how we provide incentive to our faculty for doing that work. Because there's metrics now available, now we can build a component of the incentive plan around those.

So like my financial incentives, like, you know, I get, like, extra paid for bonuses all depending on those metrics.

In this way, the clinic has forced providers to internalize the external pressures of value-based contracting and has incentivized clinical action around quality improvement.

Internal Networks and Communication

Interviewees described multiple internal communication settings in which health equity is discussed and data-driven improvement takes place. One of the most important settings is the all-practice staff meetings, which take place once a month. The physician interviewee indicated that these all-staff meetings are one of the most important sources of equity-related information for most staff. Interviewees also reported that much of the equity-related discussion at staff meetings is driven by data and metrics related to health disparities. The administrative interviewee reported that health equity or related topics are discussed at roughly half of those meetings, with approximately two all-staff meetings per year being more specifically dedicated to health equity.

it's on our radar at some practice meetings. It's sort of mentioned as a topic, either briefly, or we had some more in depth presentations, grand rounds, that have focused on it, certainly. And so there's conversation about it.

So we have one monthly practice meeting, and I would venture to guess that you'd hear at least something around health equity at least something like four to six times a year. And then with a couple of those being more in depth than just a two minute "we're doing, we're shifting, starting a new project next month related to this metric, and it's a health equity related metric." Sort of quick mentions from time to time, and then you got the times that we get more in depth around, right, how are we approaching this set of metrics? That's the all-practice meeting...

Interviewees also highlighted that the population health team meetings are much more focused around health equity, with such topics being discussed regularly, if not at every meeting.

I think, within clinic staff meetings, for population health, that team, I think it's a regular part probably, I wouldn't be surprised if it's at every one of their monthly meetings in some aspect.

For other staff meetings, such as those for the clinical or administrative teams, interviewees reported that health equity or related themes are discussed with less frequency, approximately two to three times per year.

For clinical staff, A bit less, I would assume, ... I know it's on their radar, something that's coming up and staff meeting at least two or three times a year there for the clinical staff team, I think, and then the administrative staff, probably something similar, maybe a little bit less.

Outside of standardized meetings, interviewees also described less-formal communication settings and internal networks through which the population health team reports on metrics and other data analyses to clinic leadership. Additionally, physicians can refer patients who present with unmet social needs to the population health team for social work services. However, it seemed to researchers that interaction between the population health team and clinicians on the topics of data or general health equity improvement activities was largely contained within all-practice meetings.

Characteristics of Individuals

Knowledge About Health Equity and Information Technology

Interviewees described a general baseline knowledge of health equity topics across the practice. This baseline knowledge was primarily built through presentations and trainings administered to staff as required by the department and the health system.

I would say it's a there's a baseline familiarity there, that mostly comes out of a series of discussions... and then we sort of know practically what our practice is doing about it. Is it across the board? And that, you know, could you grab everybody, and they could give you a five minute elevator speech? Probably not. But I think people do certainly understand the concept.

Beyond this general understanding, interviewees reported some teams and staff having more in-depth knowledge of health equity due to either the nature of their work, as in the case of the population health team, or due to personal interest and academic research.

And then pockets within our practice, especially our population health team, and our some of the faculty and residents that really focus on that work, they're going to be really close to subject matter experts, and certainly more than just a baseline.

So as a social worker, you know, social determinants of health are something we just inherently like, think about and talk about, and maybe not using those terms.

Individual Stage of Change and Perception of Role

Some staff, especially physicians, were described as tending to focus more heavily on solving clinical issues, a perspective which can sometimes be at odds with the long-term approaches to addressing social needs, promoting population health, and reducing health inequity.

I think with physicians in particular, like, they like to have the answer, and they like to have a way to treat something and make it better. And these inequities and disparities and, and social determinants of health often aren't, really aren't easily solved. And they're long standing, and you can't just write a prescription for food, and make all of these other things go away, or all of a sudden, now the patient is managing their diabetes better, right? Like, those changes take time and seeing the, like, data markers that indicate improvements also take time...

This was reflected also in what the physician interviewee reported about their own role perception, focusing on equitable delivery of care at the individual patient-level, rather than on reducing larger, population-level health inequities and disparities.

I would say, you know, my job is to really I think try to avoid this disparity from impacting care as much as possible. I recognize I don't have a lot I can do from a social standpoint in terms of getting people work, but I can at least try to maximize their health and try to ensure that if they're able to work, that they're free from suffering and that they kind of get them to be able to do it as much as possible. And my goal is really to avoid them feeling like their resources or their background is going to change the quality of the care that I provide and that I'm not providing different levels of care because of the resources that they have. and so I need to make sure as much as I can provide, that they're able to follow it, that the finances or travel is not going to be a burden to them. And then I can do my best to keep them as healthy as possible within the constructs that we have and kind of looking for other things in the system to be able to support them in that.

Champions of Innovation

Being attached to an academic department, the clinic receives a great deal of their innovation through the work of researchers and medical students. Interviewees described medical students as being major champions of health equity improvement within the practice. By completing required quality-improvement projects related to social determinants of health or other health equity topics, students from the medical school drive a significant portion of the innovation related to health equity data analysis or data-driven action.

...when we do some of our quality improvement projects and work with medical students who are doing their projects, a lot of them will take a disparity lens when they're doing their project.

So it's actually coming down from the the School of Medicine that the project has to focus on an [social determinants of health] domain.

Interviewees also described the importance of having physician champions, or physicians who prioritize and are interested in health equity. These physicians, often residents, were

described as major drivers of health equity advancement within the clinic by working with data analysts to uncover disparities and convening staff work groups to address inequities.

I think physician champions are important. Having faculty, in our case, in our setting especially, and residents who are excited about this, but the resident excitement, you know, because our residents are very interested in learning about this and doing it better. And that's probably the first ingredient and then resident excitement about the topic tends to beget faculty excitement, because we got faculty who love teaching. And so once we have, you know, a couple of champions that are really trying to work with the analysts drive what we're doing, to get more data and ask questions and try to pull the work group together, that that tends to be... helps us get to the critical mass of really changing what we're doing fundamentally.

Leadership

Clinic leadership was described by interviewees as generally receptive to information related to health equity, such as analyses showing patient outcome disparities. Clinic leadership was also described as having “bought in” to the priority of health equity.

I think we have leadership buy in to make to make [health equity] a priority.

However, interviewees still noted the challenge of convincing leadership to take action around population health improvement and health equity advancement when these activities fail to generate revenue.

Implementation Process

Timeline of Implementation

The population health team at the clinic, who leads much of the data management, analysis, reporting, and implementation, began as a single staff member in 2010. The team was expanded to two social workers in 2013, but did not grow to the current size and structure until expansion was accelerated between 2017 and 2019. The establishment of this team served as one of the major facilitators to other HIT implementation and equity promotion efforts.

As discussed previously, the introduction of Epic to the clinic in 2014 enabled much of the data collection and analysis that currently drives the clinic’s practices around addressing

health inequities. In 2015 or shortly before, the quality improvement group was created, allowing greater consolidation of payer metrics and dissemination of best practices. Around 2017, the quality component of the clinic's provider compensation was introduced, adding a new incentive structure for physicians to adopt data-driven clinical practices.

However, the focus around health equity-related metrics only appeared within the last one to two years when SDOH screening metrics were introduced by the quality improvement group. In December of 2022, the SDOH screening metric was changed to better reflect the major access barriers being experienced by patients. Despite the high level of HIT integration and significant focus around health equity present in the clinic, interviewees described the clinic as still being in the collection phase as they do not yet have the critical mass of data they feel is necessary to perform all of the analysis they would like to.

Facilitators

The most important facilitator to the application of HIT to advance health equity is the information technology capabilities themselves. Expanded data collection, analysis, and reporting tools are crucial to data-driven improvement and resource allocation for health equity advancement. Interviewees reported that the introduction of new capabilities through the EMR software were crucial to the clinic's adoption of health equity-related practices. Data visualization tools, such as Tableau, help communicate disparities better and lead to improved resource advocacy since the overall story can be told more effectively.

[reports] help us not only understand [the data], but then also be able to talk about it in an informed way to others, and so we can advocate for resources as we sort of understand what the needs are for our patient populations to be able to really create meaningful change for what we have control over.

While the COVID-19 pandemic had widespread and profound negative impacts on the health of the U.S. population, interviewees did highlight that the rapid adoption of virtual care delivery modalities contributed to improved access to care for many patients, particularly for patients of marginalized backgrounds.

And there's been big shifts, I think, too, with COVID really helped expedite, I think a lot of healthcare systems' virtual care capacity, because we had to very quickly just do it.

And I think that was actually a really great unintended benefit of COVID, because we've seen it truly expand access to care for patients.

The clinic's affiliation with a research-focused university was reported as a major facilitator to many of the innovations that enable their use of data to improve health equity. Training required by the university helped to increase baseline knowledge of health equity topics among staff. The importance of the academic affiliation was also made evident through the discussion of medical students and residents as drivers of innovation. Affiliation with a health system also facilitated adoption of HIT for health equity advancement through new technologies being introduced and priority setting around health equity.

Involvement in external networks for data and innovation sharing was also reported as a major facilitator to the clinic's adoption of these practices. External networks helped to consolidate important metrics and disseminate new measures related to health equity. These networks can also help promote the type of innovations brought by academic research regardless of an individual clinic's affiliation.

Several individual characteristics facilitated the development of data use for health equity advancement. Buy-in from clinic leadership allowed greater action to be taken. The integration of social workers into the clinic's care teams also helped to increase health equity knowledge and greater focus on SDOH factors.

Interviewees also noted the importance of value-based care contracting in dictating what metrics and population health activities are adopted by the clinic. Almost all the clinic's focus around SDOH screening was introduced because of payer contracts which required that data to be reported. Revenue generated through value-based care contracts also enabled the clinic to fund non-patient service activities, including population health interventions. Interviewees noted that they one day hope to move to a fully capitated or globally budgeted model which will allow them to invest more heavily in population health and health equity. This showcases not only the positive effects on health equity brought about by value-based care transformation, but also the pivotal role that payers play in shaping health equity priorities at the practice level. The clinic also funded their development of HIT systems and creation of equity-oriented resources through some external grant funding and donations.

Barriers

Despite the facilitating nature of the HIT systems, interviewees did report a number of technology-related barriers. First, data collection and analysis are limited to which fields and questions have been built into the EMR system, meaning staff have limited control over how to stratify metrics or create new metrics. Additionally, analysis is limited by incomplete data collection. Interviewees described the clinic as still trying to understand where disparities exist and still needing to continue standardizing screening processes in order to reach universal data collection.

And we're, sort of, continuing to work on ways to better standardize it so we're asking every patient at every visit...

So, we don't have 100% of our patients screened. You know, there are... patients have a right not to respond but we aren't asking every patient every time, at every opportunity. So, it is only as good as the data we have.

While the online patient portal has allowed increased informational access and communication between patients and providers, the usefulness of the portal is limited by patients' technology literacy, willingness to engage with virtual care delivery, and language barriers. Messaging and outreach through the patient portal require that patients can access the internet, log in, and navigate to the correct screens to access lab results, provider messages, appointment scheduling, or screening prompts. Further, these pages are only automatically available in English, limiting access for patient's who have limited English proficiency.

I think we also assume that because a patient has MyChart, which is our patient portal, that they use it. And so, a lot of times that is the default way we communicate with patients even though they may have never opened up the MyChart portal or logged in. And so, we're not necessarily engaging with patients in the best ways that we can, although it is convenient and there are a lot of patients that do engage... ..I think it does not help providing equitable care. We need to be able to tailor better to our patients' needs.

Interviewees reported that these barriers limit the efficacy of data-driven outreach to patients or data collection methods which rely on patient self-reporting through the portal.

[the health system] sent a bulk MyChart message to everybody that is overdue for colorectal cancer screening saying that they were due. So my team actually then took everybody who was not MyChart active and did outreach to those patients.

We need to think about better ways to engage people who are not MyChart active, or even if they are not MyChart users...

Also related to the introduction of the EMR system, interviewees described the barriers presented by “click burden” and “alert burnout.” Clinicians may feel overwhelmed or disincentivized from engaging in data-centered activities when the software requires copious amounts of clicks to navigate between screens and progress through questionnaires. Patients and staff alike can also disengage from meaningful information and activities when the number of alerts becomes too great. Therefore, systems need to be designed in such a way as to minimize the number of clicks needed to effectively use them and prioritize alerts/notifications for information that is truly necessary.

I mean, I think the click burden is if it's not a provider that it's your normal flow to do, you're not going to be intentional about doing it.

And click burden, the click burden of electronic medical record systems. They are so great, everything is right there in front of you, but, there is provider alert burnout, and there is click burnout of you know... If I have to navigate to two screens to take another click, that could be enough to prevent someone from doing it, or do they choose that over something else that maybe is equally important but ends up being deprioritized.

Further, the increase in screening tasks associated with the recent focus on SDOH has led to some disruptions in workflow for clinic staff. Interviewees described the constant burden of new tasks being added for nurses, medical assistants, and physicians to complete in a limited amount of time.

I mean I think the burden is just like they just keep adding more work, right? You saw how many metrics there were and then they make [social determinants of health] and say, “well this is top priority.” But right, like I would argue, like, me screening for diabetes, so like me focusing on that is more... So I think it's just the amount of work and they just keep changing the goal posts of it.

...standardizing the collection is hard and trying to get buy in to ask, you know, have our [medical assistants] ask is one more thing. You know, how do you ask them to do one more thing and ask one more set of questions when they are already busy? and then you know how long does that take? and then does that slow down the provider? and then does that then result in delayed patient care which then results in decreased patient satisfaction? So there are all of these downstream affects that are unintended, that sometimes make it more difficult or a little bit slower to get the buy in to create the change.

Interviewees also reported on the difficulty of promoting continuity and affordability of care when patients prioritize convenience. Virtual and walk-in appointments give patients the option of paying slightly more to see a random provider sooner, rather than waiting to see their own primary care doctor later. This can make it hard to develop long-term patient-physician relationships that help to promote equitable health care.

...with as much as, like, convenient care has become something that people are interested [in], a segment of the population are less interested in... continuity with the provider, as opposed to convenience, even over cost.

Data interoperability was also described as a burden in some contexts for data analysis and cross-clinic comparison. While shared EMR systems have given the clinic the ability to look at data from a greater number of peer practices, data is not universally standardized and metrics may be operationalized in slightly different ways, preventing effective comparison and data integration.

A further barrier to implementation reported by interviewees was related to the need for data security measures. While interviewees highlighted that these barriers exist for the important purpose of protecting patient information, they also noted that the required restrictions often make it more difficult to access, manage, analyze, and report on clinical data. Further, the deidentification of data, while vital for maintaining patient privacy, can hinder clinical action based on observed disparities.

“it's just data security is one of the things that I worry about frequently because there is so much liability for an institution around misuse of data. ... when you start working with

this data, you got to be really careful about where you store it, how you store it, how it gets distributed, and making sure that stays de-identified. And sometimes, the fact that you have to de-identify things, makes it more difficult to then looking at the ground level and figure out, okay, what were the actual set of circumstances for these patients that led to this outcome. But its, so... I think fundamentally its not a barrier that I resent, its not a barrier that I think can be moved but privacy and data security does slow down, I think, the pace at which you can do this work to a degree.”

Interviewees also reported that the security regulations, along with general technological capabilities, have not yet caught up with the communication preferences of patients. For example, texting services for patient-provider communication are frustrating and difficult to use for many patients, presenting a communication barrier for patients, especially younger patients who may prefer texting over calling or using secure online portals. Finally, interviewees described how technological capabilities are not yet sufficient to facilitate communication in multiple languages, and hope to see automatic translation services integrated into the communication platforms used to interact with patients.

One of the more major barriers to allocating resources toward reducing disparities was the constant tension between prioritizing activities which generate revenue and spending money on promoting population health. Population health, by nature, only generates cost savings in the long-term, causing it to look considerably less favorable when compared to expanding fee-for-service offerings which pay off in the short-term. Therefore, staff time must be balanced between those activities which generate revenue and those activities which benefit health equity and population health. Interviewees highlighted the difficulty of advancing health equity within a business-driven healthcare system.

...healthcare is a business and there are a lot of business-minded people driving healthcare decisions. So, you know, its this balance, for us as [health care system], who is very committed to serving the underserved... we are not a free clinic, you know, we provide care for people who do not have insurance and there are financial assistance programs for those patients, but we also cannot provide 50% free care. And so, you know, how do you also move forward as a business and keep the lights on and have enough money to pay your staff, and also have enough money to continue providing

raises and bonuses and things that will keep your staff content and continue working while also providing care to people who cant afford to come into care, they cant afford their copays, they cant afford to take off of work, or childcare, or transportation?

...the struggle is going to be... accepting whatever it is that the data shows and being willing to invest in what is needed to reduce the disparity...

I think really, the fundamental one is that, it's the pressure of having to crank out fee-for-service work that keeps us from moving forward. So in a sense you could say everything about the US healthcare system and its finances is an external factor that affects us but I think that's all I got on that one.

Discussion

The clinic's implementation of HIT and robust practices around data collection, analysis, reporting, and action closely mirror the suggestions for data-driven improvement outlined by the building blocks of high-functioning primary care. By including metrics around SDOH screening and taking both clinical and administrative action to respond to disparities identified through data, the clinic has demonstrated how data and HIT systems can be used within a primary care setting to advance health equity. The facilitators and barriers described by clinic staff also serve as a blueprint for other primary care practices to adopt similar data-driven improvement activities to reduce disparities in health care.

In observing the example provided by this case study, other primary care clinics can learn both the intervention characteristics and implementation considerations necessary to achieve similar levels of performance and health equity promotion. A key takeaway from the clinic's example is the focus around continuous analysis and resource reprioritization. As shown by the curved arrow pointing back from stage five of the HIT implementation continuum to stage three, clinics endeavoring to advance health equity must regularly reevaluate where health disparities and inequities persist among marginalized demographic groups within their patient population and take action to ameliorate them. This process relies on dedicated staff, technologies, and reporting mechanisms which allow disparities to be identified, leadership to be informed, and resources to be reallocated. Additionally, this mechanism can only be fostered in an environment that is innovative and receptive to change. At a much larger scale, technology and associated

regulatory requirements must be improved to better facilitate meaningful interaction between patients and primary care providers in a way that responds to patient preferences and facilitates communication in multiple languages.

While there are certainly elements of this case study that can be broadly applied for health equity advancement in primary care settings, this research is not without limitations to the generalizability of its findings. First, the affiliation of this clinic with a university department served as a major driver of innovation. However, only 1.29% of physicians in the U.S. are engaged in teaching and only 1.30% are engaged in research.¹⁸ Therefore, most physicians are not affiliated with academic institutions and are consequently less likely to experience the same health equity motivations that this clinic reported from its academic connection. Second, this clinic is attached to a large health system which has helped contribute to the adoption of advanced HIT capabilities and the employment of a dedicated population health team to lead data management, analysis, and reporting. While the number of primary care physicians employed by a hospital or health system has steadily increased over the past decade, this figure is only around 50% currently.^{19,20} This means that roughly half of all primary care physicians in the U.S. may lack access to the HIT and staff capabilities that this clinic is able to benefit from due to health system affiliation. While these factors of the clinic's specific context may limit generalizability of this study's findings, the results related to benefits from quality improvement groups and peer practice collaboratives highlight that practices may allow independent private practices to still benefit from innovations originating in other settings.

As highlighted by the perspectives of this clinic, the fee-for-service revenue model which persists within the U.S. healthcare system is antagonistic toward the quality-based incentive structures which allow data to drive action. However, as reform efforts in the federal government and among payers shift payment models further toward value-based care, those with the power to shape metrics must be persuaded to include metrics related to SDOH and health equity within new reimbursement models. Only through adoption of health equity metrics can health equity be truly prioritized within value-based care systems. Greater focus must also be given to developing metrics that move beyond screening and data collection to include action, such as addressing unmet social needs, referring patients to community resources, and reducing the size of persistent disparities.

In a post-NASEM report paradigm of primary care improvement, policy makers, payers, and providers alike must all recognize the intertwined importance of developing next-generation health information technology capabilities and addressing long-standing inequities in the U.S. healthcare system. High-quality primary care is equitable primary care, equitable primary care is high-quality primary care, and both require robust health information technology.

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Appendix

Semi Structured Interview Guides

Semi-Structured Interview Guide A: Practice Management

Hello, my name is Ethan Phillips, and I am a student-researcher at the University of North Carolina at Chapel Hill in the Department of Health Policy and Management at the Gillings School of Global Public Health. I am conducting this interview today as part of a research study, “Evaluating the Use of Health Information Technology to Advance Health Equity in Primary Care: Case Studies of Data Use in High-Performing Primary Care Clinics.” If you have any questions or concerns related to the study after this interview, you can get in touch with me at 703-975-6223 or by email at ethan_phillips@unc.edu.

This study is being conducted with supervision from the Department of Health Policy and Management and has been reviewed by the UNC-Chapel Hill Institutional Review Board as study 23-0178. If you have any questions or concerns about your rights as a research subject, you may contact the UNC-CH IRB at 919-966-3113 or by email at IRB_subjects@unc.edu.

This interview will take between 45 minutes and 1 hour. You can choose to skip or move on from any question you wish not to answer, and you can withdraw your consent to participate at any point in the interview. You will not be compensated for your participation and participation will not affect your current or future relationship with UNC-Chapel Hill. There are no inherent risks either to you or your associated clinic with participating in this study. To protect your identity as a research subject and to avoid any risk associated with a breach of confidentiality, all data will be stored securely and all findings from this research will be anonymously reported. Are you willing to be interviewed about how data and information technology are used within your clinic to advance health equity? [Wait for Consent Response]

In order to facilitate analysis of the themes we discuss today, it would be helpful for me to record the audio from our conversation. Any accompanying video recording will be deleted immediately after the conclusion of our conversation. The audio recording will be stored on a secure server and only myself and my supervisor will have access to the recording or the interview transcript. The recording will be deleted after analysis is complete. Are you willing to have your interview recorded? [Wait for Recording Consent Response]

Thank you. To start, please tell me what your title is at your clinic.

First, I would like to ask a few questions about health equity in relation to your clinic's operations.

1. What is the approximate breakdown of your clinic's patient population in terms of race, ethnicity, and language?
2. How would you generally describe your staff's understanding of health equity and receptivity to change?
3. Please describe any goals, objectives, or strategic plans that your clinic has for advancing health equity within your patient population.
 - a. Probe: How were these goals, objectives, or plans developed?
 - b. Probe: How do your clinic's health equity practices or goals compare to other primary care clinics?
4. What activities or programs does your clinic have in place to reduce disparities between different demographic groups?
 - a. Probe: How long have these been in place?
 - b. Probe: Who oversees these activities?
5. In your role as a [Role], how do you contribute to reducing disparities between more and less privileged populations?
6. How often are health equity or related topics discussed as a part of staff meetings or other internal communications within your clinic?
 - a. Probe: In what settings?

Next, I will be asking you a few questions about data and information technology use at your practice.

1. Please describe the metrics your practice uses to better understand the health of your patient population or the quality of care provided.

- a. Probe: Are these metrics stratified by patient demographics? For example, by race, gender, insurance...
2. How often and in what settings are these metrics discussed?
 - a. Probe: Are equity-oriented metrics discussed with the same frequency or in the same places?
3. How do you use data or metrics from your clinic to inform your decisions and actions as a leader within the clinic?
 - a. Probe: From where and how often do you receive these data?
4. Who at your practice is responsible for managing and analyzing clinic data?

Thank you. Finally, I have a few questions about how your clinic developed its current practices around health equity and information technology use.

1. Please walk me through the timeline of your clinic's adoption of current practices related to health equity and data use.
2. What external trends or pressures influenced your clinic's current attention to health equity?
 - a. Probe: What influence did other primary care clinics or external leaders have on your clinic's practices related to health equity and data use?
 - b. Probe: What kind of local, state, or national performance measures, policies, regulations, or guidelines influenced the decision to implement your clinic's practices related to health equity and data use?
3. Which individuals at your clinic have served as champions of health equity transformation?
 - a. Probe: Did you experience any resistance to adopting new health equity data use practices?
4. What were the costs of implementing your clinic's practices related to health equity data collection, analysis, and use?
 - a. Probe: Other than patient service revenue, what funding sources were used to cover the costs of implementation?

5. What factors, internal or external, help facilitate your clinic's use of data or information technology to promote health equity?
 - a. Probe: for example, some factors to consider might be champions of health equity within the clinic, a dedicated data analysis team, or external funding sources which promote data use.
6. What factors, internal or external, present barriers to your clinic's use of data or information technology to promote health equity?
 - a. Probe: for example, some factors to consider might be resistance to change among staff, difficulty collecting social needs data, or complicated data infrastructure systems.
7. Is there anything else that I have not yet asked about which you feel is important for me to know?

Semi-Structured Interview Guide B: Data and Information Technology Expert

Hello, my name is Ethan Phillips, and I am a student-researcher at the University of North Carolina at Chapel Hill in the Department of Health Policy and Management at the Gillings School of Global Public Health. I am conducting this interview today as part of a research study, "Evaluating the Use of Health Information Technology to Advance Health Equity in Primary Care: Case Studies of Data Use in High-Performing Primary Care Clinics." If you have any questions or concerns related to the study after this interview, you can get in touch with me at 703-975-6223 or by email at ethan_phillips@unc.edu.

This study is being conducted with supervision from the Department of Health Policy and Management and has been reviewed by the UNC-Chapel Hill Institutional Review Board as study 23-0178. If you have any questions or concerns about your rights as a research subject, you may contact the UNC-CH IRB at 919-966-3113 or by email at IRB_subjects@unc.edu.

This interview will take between 45 minutes and 1 hour. You can choose to skip or move on from any question you wish not to answer, and you can withdraw your consent to participate at any point in the interview. You will not be compensated for your participation and participation

will not affect your current or future relationship with UNC-Chapel Hill. There are no inherent risks either to you or your associated clinic with participating in this study. To protect your identity as a research subject and to avoid any risk associated with a breach of confidentiality, all data will be stored securely and all findings from this research will be anonymously reported. Are you willing to be interviewed about how data and information technology are used within your clinic to advance health equity? [Wait for Consent Response]

In order to facilitate analysis of the themes we discuss today, it would be helpful for me to record the audio from our conversation. Any accompanying video recording will be deleted immediately after the conclusion of our conversation. The audio recording will be stored on a secure server and only myself and my supervisor will have access to the recording or the interview transcript. The recording will be deleted after analysis is complete. Are you willing to have your interview recorded? [Wait for Recording Consent Response]

Thank you. To start, please tell me what your title is at [Name of Clinic].

First, I would like to ask a few questions about health equity in relation to your clinic's operations.

1. How would you describe the culture and receptivity to change at your clinic?
2. What is the approximate breakdown of your clinic's patient population in terms of race, ethnicity, and language?
3. What practices does your clinic have in place to collect Race, Ethnicity, and Language data from patients?
4. What practices does your clinic have in place to collect social needs data from patients?
 - a. If needed: For example, these data might include a patient's risk for housing or food insecurity, a patient's socioeconomic status, or a patient's level of engagement with social services.
5. How often are health equity or related topics discussed as a part of staff meetings or other internal communications within your clinic?

6. In your role as a [Role], how do you contribute to reducing disparities between more and less privileged populations?

Next, I will be asking you a few questions about data and information technology use at your practice.

1. Please describe the metrics your practice uses to better understand the health of your patient population or the quality of care provided.
 - a. Probe: Are these metrics stratified by patient demographics? For example, race, ethnicity, gender, insurance, ...
 - b. Probe: Which of these metrics specifically relate to health equity?
2. What health information technology infrastructure or tools does your clinic use to measure, analyze, report, and act on clinic data?
 - a. Probe: when was this infrastructure introduced to the clinic?
 - b. Probe: In what ways does your current information technology infrastructure facilitate or hinder effective application of data to advance clinic practices?
3. In what ways do you report on clinic performance or quality metrics to clinic leadership?
 - a. Probe: Are health equity-related metrics discussed as a part of this internal reporting?
4. To what extent do you feel that clinic leaders are receptive to new information?
 - a. Probe: can you provide an example of how clinic leaders have acted on data or metrics related to clinic performance of quality, especially related to health equity?
5. In what ways does your clinic externally report quality metrics?
 - a. Probe: Are health-equity related metrics included in reporting mechanisms?
 - b. Probe: How long has this practice been in place?
 - c. Probe: How did this practice originate?

Thank you. I now have a few final questions about facilitators and barriers affecting your clinic's collection, analysis, reporting, and use of data to advance health equity.

1. What factors, internal or external, have helped facilitate your clinic's use of data or information technology to promote health equity?
 - a. Probe: for example, some factors to consider might be champions of health equity within the clinic, a dedicated data analysis team, or external funding sources which promote data use.
2. What factors, internal or external, have presented barriers to your clinic's use of data or information technology to promote health equity?
 - a. Probe: for example, some factors to consider might be resistance to change among staff, difficulty collecting social needs data, or complicated data infrastructure systems.
3. Is there anything else that I have not yet asked about which you feel is important for me to know?

Semi-Structured Interview Guide C: Primary Care Physician

Hello, my name is Ethan Phillips, and I am a student-researcher at the University of North Carolina at Chapel Hill in the Department of Health Policy and Management at the Gillings School of Global Public Health. I am conducting this interview today as part of a research study, "Evaluating the Use of Health Information Technology to Advance Health Equity in Primary Care: Case Studies of Data Use in High-Performing Primary Care Clinics." If you have any questions or concerns related to the study after this interview, you can get in touch with me at 703-975-6223 or by email at ethan_phillips@unc.edu.

This study is being conducted with supervision from the Department of Health Policy and Management and has been reviewed by the UNC-Chapel Hill Institutional Review Board as study 23-0178. If you have any questions or concerns about your rights as a research subject, you may contact the UNC-CH IRB at 919-966-3113 or by email at IRB_subjects@unc.edu.

This interview will take between 30 and 45 minutes. You can choose to skip or move on from any question you wish not to answer, and you can withdraw your consent to participate at any point in the interview. You will not be compensated for your participation and participation will not affect your current or future relationship with UNC-Chapel Hill. There are no inherent risks

either to you or your associated clinic with participating in this study. To protect your identity as a research subject and to avoid any risk associated with a breach of confidentiality, all data will be stored securely and all findings from this research will be anonymously reported. Are you willing to be interviewed about how data and information technology are used within your clinic to advance health equity? [Wait for Consent Response]

In order to facilitate analysis of the themes we discuss today, it would be helpful for me to record the audio from our conversation. Any accompanying video recording will be deleted immediately after the conclusion of our conversation. The audio recording will be stored on a secure server and only myself and my supervisor will have access to the recording or the interview transcript. The recording will be deleted after analysis is complete. Are you willing to have your interview recorded? [Wait for Recording Consent Response]

Thank you. First, I would like to ask a few questions about health equity in relation to your clinic's operations.

1. What is the approximate breakdown of your patient panel in terms of race, ethnicity, and language?
2. During a patient visit, what role do you have in collecting Race, Ethnicity, and Language data from patients?
 - a. Probe: how does the collection of this data impact your interactions with patients?
 - b. Probe: how is this information stored?
3. During a patient visit, what role do you have in collecting social needs data from patients?
 - a. If needed: For example, these data might include a patient's risk for housing or food insecurity, a patient's socioeconomic status, or a patient's level of engagement with social services.
 - b. Probe: How is this information stored?
 - c. Probe: What actions do you take if a patient presents with unmet social needs?
 - d. Probe: how does the collection of this data impact your interactions with patients?
4. In your role as a clinician, how do you contribute to reducing disparities between more and less privileged populations?

5. How often are health equity or related topics discussed as a part of staff meetings or other internal communications within your clinic?

Next, I will be asking you a few questions about data and information technology use at your practice.

6. What health information technology infrastructure or tools do you use in your role as a clinician?
7. What metrics or data help you to better understand the quality or performance of the care you provide?
 - a. Probe: How do you receive data related to the quality and performance of your clinic?
 - b. Probe: Are any of these metrics stratified by patient demographics?
 - c. Probe: are any of these metrics specific to health equity or related topics?
8. How do these metrics affect your practice as a clinician?

Thank you. I now have a few final questions about facilitators and barriers affecting your clinic's collection, analysis, reporting, and use of data to advance health equity.

6. To what extent do you feel that your clinic's adoption of health information technology has placed additional burden on your work as a clinician?
7. To what extent do you feel that your clinic's focus on health equity has placed additional burden on your work as a clinician?
8. What factors, internal or external, have helped facilitate your clinic's use of data or information technology to promote health equity?
 - a. Probe: for example, some factors to consider might be champions of health equity within the clinic, a dedicated data analysis team, or external funding sources which promote data use.
9. What factors, internal or external, have presented barriers to your clinic's use of data or information technology to promote health equity?

- a. Probe: for example, some factors to consider might be resistance to change among staff, difficulty collecting social needs data, or complicated data infrastructure systems.
10. Is there anything else that I have not yet asked about which you feel is important for me to know?