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Academic Health Science Centers and Health Disparities: A Qualitative Review of the Intervening Role of the Electronic Health Record and Social Determinants of Health

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A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University.

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To all of the wonderful and gracious participants of this volunteer study, my august chair and committee, Drs. Raskin, Cleary, Kim, and Teresa, and to my patient and loving family for sticking with me. Thank you.

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Abbreviation Guide

Abbreviation	Unabbreviated Phrasing	Definition/Usage
AHC	Academic Health Science Center	An educational institution that includes a medical school and at least one allied health professional school and either owns or is affiliated with a teaching hospital or healthcare system.
AMC	Academic Medical Center	A medical school and a university-based hospital that is organizationally and administratively integrated with one another.
DHT	Digital Health Technologies	Computing platforms, software, systems, digital tools and sensors to enhance healthcare delivery, broadly including: mobile health apps, electronic health record (EHR) and electronic medical record (EMR), smart ‘wearable’ devices, artificial intelligence, and machine learning.
EHR	Electronic Health Record	A digital version of an individual patient's complete records from multiple providers with a holistic, long-term view of a patient's health.
EMR	Electronic Medical Record	A digital version of an individual patient chart with the medical and treatment history from a single provider/practice.
HI	Health Informatics	The resources, devices, and methods required to acquire, store, retrieve, and use health and medical data. Healthcare informatics work provides electronic access to medical records for patients, doctors, nurses, hospital administrators, insurance companies, and health information technicians.
LGU	Land-Grant University	A historic institution of higher education that provides research-based programs and resources for residents within their state.
SDH	Social Determinants of Health	Economic and social conditions that influence individual and group differences in health status.

Abstract

ACADEMIC HEALTH SCIENCE CENTERS AND HEALTH DISPARITIES: A QUALITATIVE REVIEW OF THE INTERVENING ROLE OF THE ELECTRONIC HEALTH RECORD AND SOCIAL DETERMINANTS OF HEALTH

By Wies M. Rafi, MS

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Literature on the magnitude of negative health outcomes from health disparities is voluminous. Defined as the health effects of racism, environmental injustice, forms of discrimination, biases in science, and sociological or socioeconomic predictors across populations, health disparities are part of an ongoing and complicated national problem that health equity programs are specifically designed to address. Academic Health Science Centers (AHC) institutions are a complex and unique educational-healthcare ecosystem that often serves as a safety net for patients in vulnerable and lower-income communities. These institutions are often viewed as one of the most uniquely positioned entities in the U.S. with an abundance of resources and networks to advance health equity as a high-impact goal and strategic imperative. Relatively little progress, however, has been made to better understand the potentially transformative nature of how digital health technologies (DHT)—such as mobile health apps, electronic health record (EHR) and electronic medical record (EMR) systems, smart 'wearable' devices, artificial intelligence, and machine learning—may be optimized to better capture and analyze social determinants of health (SDH) data elements in order to inform strategies to address health disparities. Even less has been explored about the challenging implementation of electronic SDH screening and data capture processes within AHCs and how they are used to better inform decisions for patient and community care. This research examines how AHC institutions, as complex education-healthcare bureaucracies, have prioritized this specific challenge amongst many other competing incentives and agendas in order to ultimately develop better evidence-based strategies to advance health equity. While there are clear moral, ethical, and clinical motives for improving health outcomes for vulnerable populations, when an AHC demonstrates that electronically screening and capturing SDH can improve the ability to understand the "upstream" factors impacting their patients' health outcomes, this can inform and influence policy-level choices in government legislation directed at community-level factors. A qualitative thematic analysis of interview data from AHC administrators and leadership illustrates how AHCs have mobilized their EHR as a featured component of their healthcare delivery system to address health disparities, exposing other related, multifactorial dimensions of the Institution and region. Key findings indicated that: electronic SDH screening and updating workflow processes within an AHC's clinical enterprise is a significant venture with multiple risks and the potential of failure. Universal adoption and awareness of SDH screening is hampered by notions of hesitancy, skepticism, and doubt as to an AHC's ability to meaningfully extract and use the data for decision-support systems. Additional investment in resources and incentive structures for capturing SDH are needed for continued monitoring of patient health inequalities and community social factors. Data from this and future replicated studies can be used to inform AHC and government decisions around health and social protection, planning, and policy.

Chapter One: Introduction

The U.S. Centers for Disease Control and Prevention (CDC) defines ‘health disparities’ as “preventable differences in the burden of disease, injury, violence, or opportunities to achieve optimal health that are experienced by a socially disadvantaged population” (CDC, 2021). The phrase also serves as a broad, multidimensional construct used by countless public health organizations to define the health outcome effects of racism, environmental injustice, and other forms of discrimination, biases in science, or other social or socioeconomic predictors across minority populations. The enduring debate over how to meaningfully address health disparities remains unresolved. For many healthcare practitioners, policymakers, and organizations, the sheer complexity of the interlocking socioeconomic, historical, environmental, and political factors involved are staggering.

Between the academic and practical debates, relatively little progress has been made with the potentially transformative nature of how digital health technologies (DHT)—such as mobile health apps, electronic health record (EHR) and electronic medical record (EMR) systems, smart ‘wearable’ devices, artificial intelligence, and machine learning—may be optimized to better capture social determinants of health (SDH) data elements in order to inform strategies to address health disparities. Moreover, even less has been explored about the implementation of DHT systems within Academic Health Science Center (AHC) institutions, a complex and unique educational-healthcare ecosystem that often serves as a safety-net for patients in vulnerable and lower-income communities. AHCs are driven by a diverse array of incentives, with funding obtained through a composite web of sources that can include state appropriations, patient and insurer (public and private) payments, and federal and private research grants. The heavily bureaucratic agenda-setting and decision-making processes within them are not always entirely clear to the actors within them, let alone to the public. The constellation of AHCs, DHT, and their programs to combat health disparities create a rich intersection between administrative policy, public policy, technology acceptance, implementation science, and public health research that is worthy of novel scholarship.

Study Background and Goals

Under the Affordable Care Act (ACA), health systems are incentivized to manage the resources and health outcomes of the populations they serve, often by examining the root causes and sources of illness, poor population health, and negative contributors to health. For example, the ACA added new IRS regulations to Internal Revenue Code that “require charitable hospitals at least once every 3 years to conduct a community health needs assessment (CHNA) and adopt an implementation strategy that includes a description of how the hospital plans to meet identified needs and incorporates input from community representatives” (Sullivan, 2019). SDH, by definition, include factors such as race, ethnicity, gender, income, housing stability, mental health, substance use, education, language, incarceration history, and others (Wood et al., 2020). In order to uncover those ‘causes of the causes’ for poor population health, as demanded by the ACA, analyses of SDH are necessary as a large and compelling body of evidence has accumulated, particularly during the last two decades, that reveals a powerful role for social factors—apart from medical care—in shaping health outcomes across a wide range of health indicators, settings, and populations (Braveman & Gottlieb, 2014). The intricate relationships between social factors and health, however, are not simple, and there are active controversies regarding the strength of the evidence supporting a causal role of some social factors. Nonetheless, SDH (or proxy vocabulary in the clinical notes) can technically be recorded electronically by providers through multiple DHT tools and analyzed as fundamental drivers of negative health outcomes.

While DHTs, very broadly, encompass many different tools and platforms, the EHR/EMR remains the traditional standard-bearer within the vast ‘digital health’ arena to support healthcare, form meaningful indicators, and facilitate population-based studies by providing clinically procured data in an open-source and standardized digital format (Ehrenstein et al., 2019). These are especially critical to inform public health decisions in low-resource settings, such as those experienced by medically underserved populations. An EMR is considered a digital version of a patient's chart with the diagnoses, medicines, tests, allergies, immunizations, and treatment plans from one practice. An EHR, by contrast, contains the patient's records from multiple health professionals and provides a more holistic, longitudinal, and long-term view of a patient's health (Garrett & Seidman, 2011). The EHR provides a unified platform for doing almost everything health professionals require—recording and communicating medical observations, sending prescriptions to a patient’s pharmacy, ordering tests and scans, viewing results, scheduling appointments and procedures, and sending insurance bills (Ehrenstein et al., 2019). However, depending on any variety of implementation, operational, organizational, or policy decisions, SDH may or may not always be fully or meaningfully captured within an EHR/EMR. Despite attempts at standardization and interoperability by the Office of the National Coordinator for Health Information Technology (ONC), the Centers for Medicare and Medicaid Services’ (CMS) “Medicare and Medicaid EHR Incentive Programs,” and other initiatives by health informatics (HI) specialists, healthcare systems and the data they collect in the EHR are far from uniform and, as a result, have proliferated numerous variations across the United States.

This study, therefore, specifically aims to describe the facilitators, barriers, success stories, challenges, and opportunities faced by AHC bureaucracies and its administrators who implement and strive to make effective use of the EHR/EMR to improve SDH data for health equity programs. Leaders and administrators strategically rank mission-critical programs in their organizations based on a number of factors and circumstances. Identifying how, if at all, EHRs and SDH are implemented by these stakeholders and administrators will elucidate several themes, including the degree to which they position health equity and population health as central to the overall Institutional mission. Additionally, it will clarify if sufficient funding and dedicated resources have been allocated to fulfill that Institutional mission in lieu of symbolic, rhetorical support.

This research will contribute to the body of knowledge by examining the extent to which AHC institutions, as complex education-healthcare bureaucracies, have prioritized this specific challenge amongst many other competing incentives and agendas in order to ultimately develop better evidence-based strategies to advance health equity. The explicit research question to be investigated is "**how have AHC institutions used their EHR/EMR for the specific purpose of optimizing SDH data to advance health equity for medically underserved areas/populations**?" In order to answer this question, a qualitative content analysis of interview data from AHC administrators and leadership was conducted. An interpretative analysis helps illustrate how AHCs have mobilized their EHR as a featured component of their healthcare delivery system to address health disparities, potentially exposing other related, multifactorial dimensions of the Institution or region, to include: structural or cultural impediments, perceptions and interpretations of mission, medical mistrust, and socio-historical or political relationships with communities.

The theoretical/policy question in this study is situated within the following broad inquiry: ‘*How can DHTs such as EHRs be effectively used to address/reduce health disparities*?’ However, the more specific ‘practical’ question manifests as: ‘*How are SDH documented and optimized within the EHR as a focal point for AHC healthcare professionals working to advance health equity*?’ Leveraging (i) Pettigrew’s framework for Dimensions of Strategic Change and (ii) Normalization Process Theory (NPT), this study will assess Institutions’ current implementation of the EHR, their SDH fields (categories of information inputted into the patient record), and the overall role of these fields in helping to achieve health equity. As part of the broader family of implementation science, these theoretical approaches will provide a better understanding and evidence of optimized SDH implementation in AHCs needed by interventionists to guide how they address disparities. Specific goals included:

- To assess the Institution's current implementation of the EHR, the implemented SDH fields, and the overall role or impact of these fields in reducing health disparities.
- To identify structural or cultural dynamics within the administrative bureaucracies of AHCs with regard to digital health initiatives and/or EHRs.
- To identify unifying themes or patterns in implementation and to elucidate variation.
- To identify perceptions and interpretations of various environmental, policy, or organizational factors, which stakeholders use to guide their decisions.

This study will not address the ‘technical’ implementation of EHR/EMR systems, technical aspects of recording SDH, or the individual technical specifications of the various platforms. Rather than technical analyses, this study instead gauges the extent of Institutional or administrative implementation, use, and governance of EHR/EMR systems within AHCs executing their bureaucratic missions. Using a hybrid inductive-deductive approach, directed content analysis, and thematic analysis allowed for an interpretation of the raw interview data and observation of emergent themes. Each individual AHC represents the institutional unit of analysis to be studied. Interview data yielded observations of the realities of EHR and SDH implementation in different AHC organizational, regional, and associated settings.

As this study aims to contextualize the efficacy of EHRs within AHCs and the intervening role that SDH data plays in informing health disparities research and programs, it should be noted that this niche area of subject matter expertise has a paucity of scholarship. I approach this study as someone who is personally involved in the AHC ecosystem as an information technology (IT) and academic health professional who interacts with colleagues in this space. While I openly acknowledge my own experiences and biases, I make no assumptions about the effectiveness and usefulness of various DHTs, EHRs and SDH fields within the many AHC contexts and localities across the United States, as this specific question is unexplored in the literature. The following literature review reflects a substantive, environmental scan of these areas, which will help frame the study and ensuing policy implications.

Chapter Two: Literature Review

How do AHC institutions implement SDH data collection practices within their EHR/EMR? Are they actively using that data to address health disparities for medically underserved areas/populations? If so, have they encountered AHC-specific environmental, structural, or cultural dynamics that have created barriers or opportunities within their complex bureaucracies? Since they differ in setup and source funding from general healthcare or other smaller, safety-net clinics, an understanding of the current institutional administrative and structural norms within AHCs may help explain their incentive paradigms for DHT generally. By evaluating these and other factors, new theories and models could potentially be developed which explain how some organizational decisions and normative behaviors promote and encourage the use of EHRs to improve population health, design interventions, and better serve their regional communities.

This literature review is divided into five (5) sections and summarizes adjoining scholarship between health disparities, social determinants of health (SDH), digital health technology (DHT) and social equity, Academic Health Science Center (AHC) institutions, and finally the responsibilities of the AHC to advance health equity. Each section will reinforce the basis for the research question through a summary of current scholarship and lay the foundation for a qualitative interpretation of AHC administrator experiences. While I believe this is the first such national, U.S. study linking AHCs, EHRs/SDH, and health disparities, this review will reveal the connective tissue by synthesizing use-cases in general healthcare contexts and the role they play in guiding health equity work.

Health Disparities As A Societal Problem

> *"George Floyd was condemned to death as surely by entrenched and institutionalized racism as by his killer. His trial played out against a backdrop of continued violence against black and brown people, including women, children and adolescents in America and across the world. In addition to its impact on violent deaths, racial and ethnic discrimination often determines who is last in line for healthcare. This is especially so for those who bear the weight of social and economic bias – including women, children and adolescents. Yet if we do not redress inequities faced by women, children and adolescents, the world will not reach its development goals"* (Toure et al., 2021).

There is an active connection between the COVID-19 pandemic, racism in healthcare, the 2020–2022 social justice protests and racial unrest prompted by the murder of George Floyd, and health disparities, which have all crystallized rapidly in a relatively short amount of time in the national dialogue. The COVID-19 pandemic, in particular, explicitly drew a straight line between minorities, health disparities, and higher mortality rates and captured the attention of medical professionals, politicians, media, academia, and care organizations. While the reasons for those deadlier outcomes among minorities are complex, many argue that they are historically rooted in the American slave trade:

> Hundreds of years of slavery, followed by segregation, employment discrimination and redlining have left minority communities with lower-paying jobs and less wealth than established white families. That means living in poorer neighborhoods, cheaper or no health insurance and less access to healthy food options and quality doctors (Higgins-Dunn et al., 2020).

Additionally, minorities hold a disproportionate share of retail, municipal, and first responder "essential" jobs that interact directly with the public, according to data from the Center for Economic and Policy Research (Higgins-Dunn et al., 2020). Such jobs typically pay less and many don't offer health insurance, Higgins-Dunn et al. (2020) note, which is compounded by the reliance on public transportation by black and Hispanic people which puts them at greater risk of COVID-19 infection.

The 2020 pandemic and social justice movement refocused and recentered the national dialogue on systemic racism, co-morbidities (multiple underlying diseases or health conditions that disproportionately impact black and Hispanic people), injustice, inequality, and health disparities to levels of public attention and prominence never seen before. For example, in 2020 experts identified explicit factors contributing to increased vulnerability to COVID-19 and poor HIV-related health outcomes. Researchers pointed to high rates of pre-existing medical conditions, resistance to Medicaid expansion in the South, the lack of access to testing in low-income neighborhoods, and an over-representation among the essential workforce as factors that explain elevated risks for COVID-19 and poor HIV-related outcomes among people of color throughout the United States (Broder, 2021). Another study showed an association between redlining practices in New York City and greater COVID-19 mortality in primarily Black neighborhoods (Li & Yuan, 2022). The newly resurgent racial and social justice movement, since 2020, also highlighted that people of color were hardest hit not only by the health crisis itself, but by the economic devastation that came in the wake of COVID-19 (Hou et al., 2020). Ethnic minorities and migrants were also not spared from the negative impacts of SDH and co-morbidity factors leading to increased risk and severity of COVID-19 (Greenaway et al., 2020)

For much of the country, the 2020 reckoning simultaneously exposed close, interrelated health and social crises as the byproducts and offspring of systemic racism—a broad range of disadvantages in public policy, law, government, and culture—which proved itself to be deeply entrenched in society and institutions (healthcare included) writ large. Since then, the dialogue of systemic racism has been mainstreamed and officially included in local, regional, community, business, and institutional healthcare mission statements and is now unavoidably part of the conversation of how it also manifests in (and is influenced by) SDH (Broder, 2021). The omnipresent virus of systemic racism, coursing through the bloodstream of the U.S., consistently devalues the lives of people of color and methodically institutes barriers to opportunity, depriving them of the right to improve their conditions. AHCs and public health institutions cannot effectively combat race-based health inequities without a greater embrace of diversity, inclusion, and equity within their own walls and a deeper understanding of the SDH data fundamentally linked to systemic racism. While health disparities have long existed within the fabric of global health and U.S. health, and literature on the magnitude of negative health outcomes from SDH is voluminous, AHCs, as safety-net institutions, occupy a specific role in society that are impelled to respond to the social trends taking place which impact vulnerable communities. Those social trends cannot be ignored in the wake of multiple, historic social, political, and health crises colliding together from 2020 on forward. This section will review the disproportionate burden of health inequities among U.S. racial and ethnic minority groups and the causes of health disparities that AHCs are positioned to address.

The Burden Of Health Inequities

Using contractarian, Kantian, and utilitarian ethics, Jones (2010) argues that there is sufficient theoretical justification for classifying health disparities as a moral wrong whose existence exemplifies historical injustices inflicted on underserved communities and minority populations. The health effects of racism, environmental injustice and other forms of discrimination, biases in science, and other sociological or socioeconomic predictors across populations all contribute to a phenomenon to which there are no easy solutions. The World Health Organization refers to the fight for health equity as the explicit goal of, ideally, affording everyone an equal opportunity to attain their full health potential such that no one should be disadvantaged from achieving this potential if humanity can address “avoidable, unfair, or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically or by other means of stratification” (WHO, 2019). In a U.S. context, medically underserved areas are a significant area of focus for healthcare organizations and federal agencies when discussing strategies for achieving health equity.

Government entities officially define “medically underserved areas” as areas or populations designated by HRSA (Health Resources & Services Administration) which have “too few primary care providers, high infant mortality, high poverty or a high elderly population” (*MUA Find*, n.d.). Health Professional Shortage Areas (HPSAs) are designated by HRSA as having shortages of primary medical care, dental or mental health providers and may be a specific geographic area (a county or service area), population (e.g., low income or Medicaid eligible), or facility (e.g., federally qualified health center or other state or federal prisons). Healthcare programs, policy experts, and subsequent literature on health disparities, therefore, center on these frequently used terms.

Abundant research has demonstrated that, compared to whites, Black Americans have historically experienced poorer health outcomes from preventable and treatable conditions such as cardiovascular disease, diabetes, obesity, asthma, and cancer. A landmark 2002 health disparities report from the Institute of Medicine (IOM) declared that even when both white and Black groups had similar insurance or the same ability to pay for care, Black patients received inferior treatment to white patients across almost every single disease or condition (Institute of Medicine, 2003). More than any other single group, the Black community is most likely to have negative health outcomes, including higher rates of breast and prostate cancer, high incidence of HIV/AIDS, higher rates of infant mortality—along with high rates of childhood obesity and asthma in young adults.

In a comparative study of all-cause mortality rates and inequities between Black and White populations across the 30 most populous U.S. cities, Benjamins et al. (2021) recently found that the country's pervasive health inequities were evidenced by 74,402 excess deaths, on average, among Black Americans compared with white Americans each year between 2016 and 2018. In a publication commissioned by the National Academies of Sciences, Engineering, and Medicine, analysts found that factors such as infant gestational age and infant mortality rates are staggeringly higher for Native Americans and Alaska Natives, whose rate is 60 percent higher than the rate for their white counterparts (National Academies of Sciences, Engineering, and Medicine, 2017). From 2011 to 2014, Hispanic children and adolescents ages 2 to 19 had the highest prevalence of obesity in the U.S. (21.9 percent), and Asians had the lowest (8.6 percent). Black American and American Indian/Alaska Native females have higher rates of stroke-related death than Hispanic and White women. Black Americans were 30 percent more likely than whites to die prematurely from heart disease in 2010, and Black men are twice as likely as whites to die prematurely from stroke (National Academies of Sciences, Engineering, and Medicine, 2017).

In the era of the COVID-19 pandemic, studies have similarly revealed findings on the disproportionate burden of deaths among racial and ethnic minority groups. A study of selected states and cities with data on COVID-19 deaths by race and ethnicity showed that 34 percent of deaths were among non-Hispanic Black people, even though they are only 12 percent of the total U.S. population (CDC, 2021). Remarkably, Siegel et al. (2021) note that simply relying upon crude death rate ratios actually resulted in a substantial underestimation of the true magnitude of the Black-White disparity in COVID-19 mortality rates. Using a structural-racism index, which was adapted from previous scales developed to predict differences between states in the Black-White disparity in fatal police shooting rates of unarmed victims, the investigators found that each standard deviation increase in the racism index was associated with an increase of 0.26 in the ratio of COVID-19 mortality rates among Black people compared to whites (Siegel et al., 2021).

Another component of health equity work includes addressing the rural vs. urban divide. Over the past 20 years, Cross, Califf, & Warraich (2021) note that the gap between rural and urban death rates has tripled in part due to socioeconomic factors and rural health disparities. Their study, based on CDC's National Center for Health Statistics Urban-Rural Classification Scheme, also found that while age-adjusted mortality rates declined in rural and urban regions, non-Hispanic Black individuals still had the highest age-adjusted mortality rates of all racial and ethnic groups in both rural and urban regions. Rural areas have a higher prevalence of risk factors for these conditions like smoking, poor diet, lack of exercise, and obesity. Along with a record number of hospital closures in rural areas and a number of uncontrollable SDH factors, limited access to primary and emergency care has only exacerbated the health disparities problem across the U.S. (Cross, Califf, & Warraich, 2021).

Equally concerning, Schumaker (2015) writes that while financial and socioeconomic status directly impacts health status, inequality alone cannot account for the difference in health disparities. Research finds that nearly two-thirds of medical professionals display an unconscious racial bias, which exacerbates disparities, reduced trust between patients and their doctors, and causes Black patients to feel less respected by their doctors (Schumaker, 2015). Just as there are racial and ethnic disparities in health, there is also ample evidence of racial and ethnic disparities within the healthcare industry itself.

While restricted access to medical care accounts for about 10 percent of premature death or other undesirable health outcomes, all indications conclude that healthcare has modest effects on the extension of U.S. life expectancy while social circumstances, environmental exposure, behavioral patterns, and social determinants have much larger effects ranging from 25-60 percent of the proportional contribution (Kaplan & Milstein, 2019). Different studies have shown individual and community-level SDH impact multiple health-related outcomes across a variety of populations and age groups (Cantor & Thorpe, 2018). Addressing these determinants is a priority for many healthcare systems in the era of accountable care organizations (ACOs) and value-based payment for care. With the rising popularity of value-based care, healthcare organizations such as AHCs face more pressure than ever to speed up processes, improve health outcomes, reduce disparities, and lower costs.

The Causes of Health Disparities

> *"Health, disease, and death are not randomly distributed in a society. Poor health concentrates among low-income people and people of color residing in certain places. Access to proven health protective resources like clean air, healthy food, and recreational space, as well as opportunities for high-quality education, living wage employment, and decent housing, is highly dependent on the neighborhood where one lives, which is ultimately a reflection of the relative social, political, and economic power of the residents of these communities. These social inequities cluster and accumulate over people's lives, and over time, successfully conspire to diminish the ultimate quality and length of human life in these places"* (Iton et al., 2010).

As Iton et al. (2010) indicate, the causes and drivers of health disparities and the pathways by which they harm health are complex, controversial subjects for debate and cover a vast range of subject matter including, but not limited to, socioeconomic status (SES), biological differences, social and economic determinants, community factors, genetics, environment, language barriers, education, employment, individual agency, social and political capital. Over time and with sufficient pressure, these issues calcify in the body politic and become increasingly challenging to diagnose, parse, and remedy. A study by Jeffries et al. (2019) advocates for multilevel approaches, complex systems modeling techniques, and qualitative methods to untangle the root causes that generate health disparities. However, since potential causal factors are often correlated, it remains distinguish their individual effects, which "may include complex relationships with feedback loops and dynamic properties that traditional statistical models represent poorly." Even so, SES along with race/ethnicity are frequently implicated in scholarship as twin drivers (both jointly and independently) which affect health, though many of the studies end with inconsistent results (Shavers, 2007). Adler & Rehkopf (2008) conclude that SES measures often account for a large part of racial/ethnic differences, although independent effects of race/ethnicity on health outcomes also exist, depending on what outcome is examined. The authors note that adequate control for SES across racial/ethnic groups may be difficult to achieve, since SES indicators may have different meanings for different groups. The CDC offers a streamlined set of multiple factors as causes for health disparities, including: poverty, environmental threats, inadequate access to health care, individual and behavioral factors, and educational inequalities (CDC, 2022). Olden & White (2005) concur by arguing that its causes are traced to a complex interaction of multiple factors including individual, genetic and environmental risk factors. Meanwhile, the Office of Minority Health (OMH) under the Department of Health and Human Services (HHS) identify pervasive structural inequities and SDH itself as the primary cause (Office of Minority Health, 2011).

To explore why SDH is viewed as a broad category of the underlying cause of health disparities, it is important to define SDH (to the extent possible) and how the collection of SDH data is logistically, and sometimes ethically, problematic for many healthcare organizations, including AHCs.

Summary

This section reviewed the health disparities as a societal problem, the disproportionate burden of health inequity among U.S. racial and ethnic minority groups, and its causes. The literature establishes strong evidence for the need to take action to ameliorate these circumstances for vulnerable populations, and the SDH data that AHCs can leverage to evolve themselves towards better care models, better information systems, and better integrated partnerships with their communities to address those health inequities.

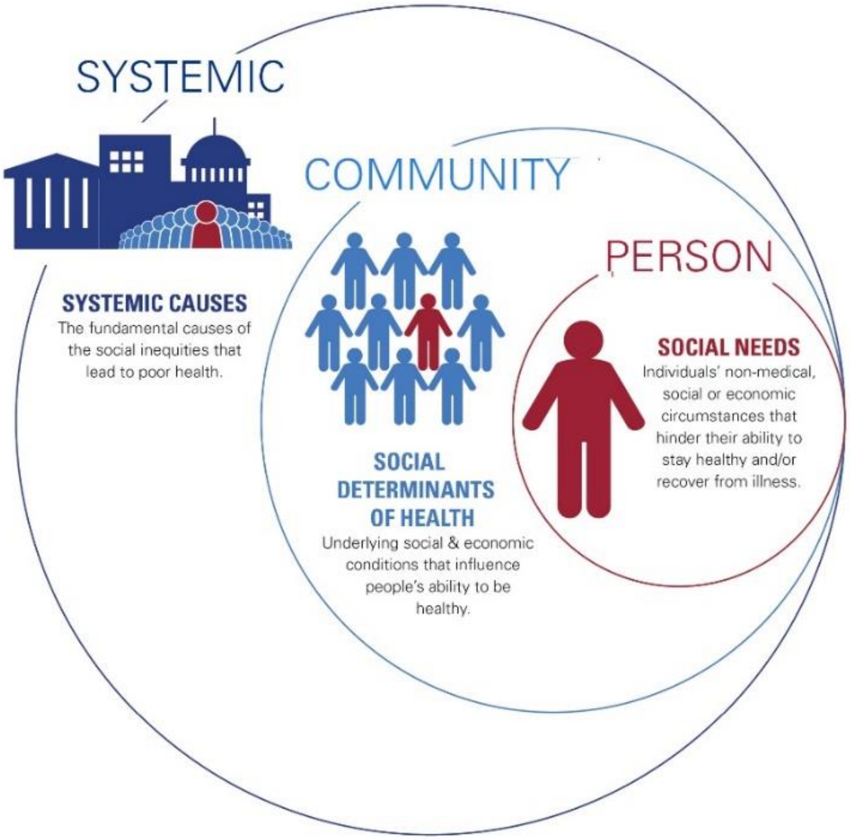
Social Determinants of Health (SDH) As An Underlying Cause of Health Disparities

Put simply, SDH may be defined as any nonmedical factors that influence our health. Health starts long before illness and begins in homes, schools, workplaces, neighborhoods, and communities (HealthyPeople.gov, 2021). Undoubtedly, these spaces are shaped by the social conditions in which people are born, grow, live, work and age, and which are defined by the distribution of money, power, and resources at global, national, and local levels (WHO, 2019). This section will contextualize SDH data itself and review the challenges healthcare organizations face when leveraging their EHR to electronically screen and capture such data.

Examples of SDH are expansive but may be broadly generalized into two different categories: *Community-level factors* (housing, air pollution levels, basic amenities, environment, food insecurity, working life conditions, percentage of community living in poverty, percentage of high school or college graduates, walkability of neighborhood, crime, structural conflict, access to affordable health services of decent quality), and *Individual-level factors* (early childhood development, household income, education, incarceration status, employment status, social protection, financial resource strain, intimate partner violence, physical activity, alcohol use, tobacco use, housing status, social inclusion and non-discrimination, transportation difficulties, utility assistance needs) (WHO, 2019). The concept map in Figure 1 depicts the symbiotic, societal factors that influence health along the continuum from systemic to personal. Figure 2 summarizes the spectrum of SDH domains and their multipronged impact on various health outcomes.

Figure 1

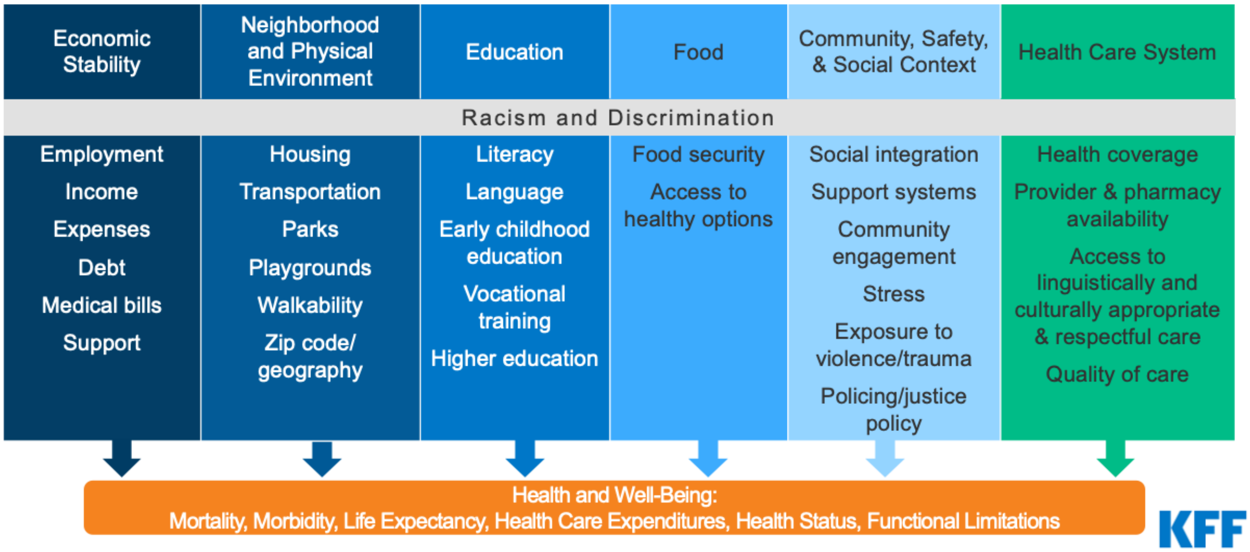
Concept Map: Societal Factors That Influence Health - A Framework for Hospitals



Source: (American Hospital Association, n.d.)

Figure 2

Domains of Social Determinants of Health and Healthcare Factors in Outcomes



Source: (Artiga & Hinton, 2018)

The terminology and language of SDH itself are, arguably, problematic. While healthcare systems and policymakers routinely weave the vocabulary of SDH in their strategies to improve health and control costs, the terms used are often misunderstood, conflated, and confused (Alderwick & Gottlieb, 2019). For example, Alderwick & Gottlieb (2019) explain that SDH is certainly related but is not the same as population health (“the health outcomes of a group of individuals, including the distribution of such outcomes within the group”). Social determinants are merely a one group of particular factors that shape population health, alongside health care, genetics, behaviors, commercial influences, and more. Using medical jargon in different ways with sometimes very different objectives has become routine in healthcare. Alderwick & Gottlieb (2019) argue that such misunderstandings over meaning will have important implications as a growing number of healthcare systems design new interventions to respond to patients’ social circumstances. A stark illustration of this reality is that there are over 1,000 codes to document screening, assessment, diagnosis, treatment, and intervention of social health-related clinical activities (Arons et al., 2019). Despite the breadth of these codes, there remains a gap in medical vocabulary and no all-encompassing list of SDH that a patient might present during their point of care. Torres et al. (2017) report that while many individual codes exist in the ICD-10 databases used by various health systems, SDH codes were only used in two (2) percent of all inpatient interactions. Proxy variables and other substitutes may be used interchangeably for convenience, which may unintentionally obscure the root causes of and opportunities to intervene in a medical or social issue.

Irrespective of how they are technically codified in the lexicon and in medical databases, it has long been known that SDH interplays with biological factors, disease status, and behavior to impact a myriad of health outcomes, principally with negative health effects on socioeconomically vulnerable populations (Berkowitz et al., 2016). The contribution of SDH to personal and population health is quite well-documented. For example, Monsen et al. (2018) state that with coronary artery disease, personal *medical* risk factors may include low-density lipoproteins and hypertension. However, SDH risk factors may include poverty and lack of social support, while behavioral risk factors may include physical inactivity and smoking. For example, a public health intervention strategy would target non-medical variables such as policy change to mitigate poverty, social media campaigns to promote healthy lifestyle behaviors, and community townhalls to help address behavioral risks (Monsen et al., 2018). As acute and ambulatory interventions may focus on individual medical care directed toward managing individual chronic conditions (such as lipid levels, salt intake, and blood pressure), public health interventions leverage multiple other diverse strategies. In this case, achieving optimal population health for chronic conditions requires a strategic alignment and intervention between primary care, acute care, long-term care, and public health. These specialties would be informed based on a shared, interoperable exchange of EHR data.

The wide assortment and permutations of SDH variations from region to region, EHR to EHR, healthcare system to healthcare system, all present an incredibly byzantine confluence of choices that hinder a unified taxonomy for HI experts. Cantor & Thorpe (2018) note the diversity of choice when trying to record SDH:

> Data on individual-level determinants are currently collected using a variety of instruments, including the Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences (PRAPARE), the Accountable Health Communities Screening (AHCS) tool, and a myriad of locally designed tools from a variety of organizations, some of which are tailored for use with specific populations. (p. 586)

Given this variation, how can practitioners determine which specific SDH to capture? An IOM committee convened in 2014 identified social and behavioral domains that most strongly determine health and also identified the measures of those domains that EHRs could adopt. That report recommended 11 candidate SDH data domains, selected on the basis of (1) association with health; (2) "actionability" when treating patients and developing interventions; (3) availability and standardization of reliable, valid measures; (4) the feasibility of collecting and general accessibility of data; and (5) sensitivity, such as patient comfort with disclosing information (LaForge et al., 2018).

Government agencies such as CMS, CDC, U.S. Department of Health & Human Services (HHS), and national HI organizations who launch ambitious initiatives to standardize and incentivize SDH screening tools, workflows, and data collection based on the IOM findings continue to provoke debate and fine-tuning of how to best resolve the diversity of choice and elegantly accommodate regional and organizational differences between systems. Despite growing national attention, few ambulatory care settings have developed or reported on systematic electronic SDH screening approaches (Chung et al., 2016); thus, lacking standardized workflows/screening tools, existing efforts to assess patients' SDH have typically been ad hoc (Adler & Stead, 2015). If systematically collected in a structured and organized method, patient-level screening about social risk factors can be extracted, analyzed, and ultimately influence decisions about medications, referrals, lifestyle recommendations, and other treatment plan components.

SDH Data Capture Challenges Within Healthcare Organizations

According to (Bryan et al., 2014), past efforts to bring diverse “patient-reported measures” (PRMs) into primary care settings faced multiple challenges:

> The logistical burden of collecting and using these data; inability to bill for time used to interpret PRM data; the need to tailor PRMs to meet clinic priorities; the difficulty of taking action on PRM data with available resources; and lack of clarity as to which PRMs matter most to primary care teams and/or patients. (p. 45)

PRMs are designed to be self-reported patient perspectives about how illness or care impacts their health and wellbeing; their quality of life, daily functioning, symptoms, mental and emotional wellbeing, and other aspects of their health outcomes that matter most (About PRMs, 2021). While PRMs are not necessarily inclusive of SDH (patients can still self-report environmental, social, or economic factors), they provide a useful, analogous paradigm by which such health data collection proved intensely difficult and problematic for healthcare organizations.

Beyond implementation, little is known and published about how healthcare organizations themselves are developing tools for identifying and addressing patient SDH via their EHR and integrating that work into their various SDH-centered physician specialties such as family medicine, pediatrics, psychiatry, and internal medicine. This is unfortunate because SDH screening in primary care settings could (i) improve healthcare teams' ability to understand the “upstream” factors impacting their patients' health and ability to act on care recommendations; (ii) inform clinical care decisions; and (iii) identify patients in need of referral to community resources to address identified needs (Garg et al., 2015). It could also inform the provision and funding of community resources by providing data showing the need for such services, as well as influencing policy-level choices in government legislation.

Monsen et al. (2018) examined the documentation of SDH in nine EHRs (six acute care, three community care) with and without standardized nursing terminologies. They found 107 SDH phrases scattered on diverse screens and by multiple clinicians, admitting personnel, and other staff. The authors concluded that further research is needed to determine which particular data elements are needed across settings, the uses of SDH data in everyday practice, and to scrutinize patient perspectives related to SDH assessments. Augmenting those conclusions, Chen et al. (2020) conducted an integrative literature review of SDH domains in EHRs, their impact on risk prediction, and the specific outcomes and SDH domains that have been tracked. A comprehensive literature scan of PubMed, CINAHL, Cochrane, EMBASE, and PsycINFO databases for English language studies published until March 2020 yielded little consensus on agreed-upon SDH measures and current screening tools. The literature, however, provided “early and rapidly growing evidence that integrating individual-level SDoH into EHRs can assist in risk assessment and predicting healthcare utilization and health outcomes, which further motivates efforts to collect and standardize patient-level SDoH information" (Chen et al., 2020).

LaForge et al. (2018) identified the processes used by six organizations to develop electronic SDH screening tools for ambulatory care and the barriers they faced during those efforts. Using semi-structured interviews, case studies were developed to showcase the efficacy of SDH screening in ambulatory primary care, their development processes, and how their tool/strategies were used. Among their conclusions, the investigators found that common processes employed by many of the organizations included charging their primary care staff from the various specialties with burdensome tasks such as SDH literature review, developing custom templates, and working to manually prioritize avoidance of redundant data collection. Interviewees, however, highlighted the importance of "messaging" SDH screening to patients in a way that builds trust. As SDH screening becomes more widespread, the authors suggest that it will be important to maintain awareness of how different patient populations respond to culturally-sensitive approaches.

In a novel study of 27 different U.S. community health centers (CHCs) and their use of SDH data within the Epic EHR, Gold et al. (2017) found that standardizing SDH data collection and presentation in EHRs could lead to improved patient and population health outcomes in CHCs and other care settings. The investigators implemented a suite of SDH data tools in three Pacific Northwest CHCs in June 2016 and used mixed methods to assess their adoption through July 2017. SDH data was collected on 1,130 patients during the study period. After developing a set of EHR-based SDH data collection, summary, and referral tools for CHCs, results indicated that adoption of systematic EHR-based SDH documentation may be feasible, but substantial barriers to adoption exist. Lessons learned included: consideration for how to best integrate tools into existing workflow processes, ensuring that staff tasked with SDH efforts receive adequate tool training and access, and considering the timing of data entry impacts how and when SDH data can be used (Gold et al., 2017). In another promising study, Byhoff et al. (2017) evaluated SDH screening at 39 healthcare organizations in Michigan, representing 167 delivery sites. Through content analysis and an examination of variation in screening domains and processes, the investigators discovered broad empiric consensus regarding a core set of 13 SDH screening domains that align with nationally recommended screening guidelines.

Floyd (2018) published the results of their efforts to implement a new, EHR-based SDH screening tool at the Duchesne Clinic in Kansas City, whose patients are uninsured and have an annual income at or 150 percent below the federal poverty line. The aim of the project was to implement an SDH screening tool to increase provider referral rates to community services for the unmet social needs of 416 adult patients 18 years and older. The results indicated that patients who screened positive for one or more SDH needs were referred to either the Community Health Council of Wyandotte County or to El Centro, both existing referral partners that provided an in-depth evaluation of patient needs and assistance with the resolution of needs.

Mixed method studies conducted by de la Vega et al. (2019) used the EHR to understand the burden of SDH and the feasibility of implementing a systematic clinical strategy to screen new primary care patients and improve population health outcomes. The authors indicate that new and evolving studies such as these can be used to 1) improve local administrative policies around SDH by identifying gaps in community, city, and state resources, and through a set of ‘lessons learned,’ formulate more advanced workflow uses of EHR and SDH for health equity; and 2) provide important contextual information to care teams, facilitating referrals to local resources, informing clinical decision making, enabling targeted outreach efforts, and supporting care coordination with community resources (de la Vega et al., 2019).

Finally, Sensmeier (2020), a practitioner of nursing who advocates for similar use of an EHR, outlines a number of policy recommendations for nurses to holistically address both social and behavioral determinants of health in order to positively impact an individuals’ health status. The author presents factors that can be mitigated through optimal use of the EHR, such as the development of shared decision support, common standards for data exchange, and accessibility via portals and personal health records. The article cites the 2007 *Health Information National Trends Survey*, which investigated relationships between a variety of socioeconomic variables and the use of web-based technologies for health information seeking personal health information management and patient-provider communication. Those findings emphasize the need to explore differences in the use of EHR portals by medically underserved and disadvantaged groups, which can be useful in further research on other SDH psychosocial variables, such as health literacy, that may be better predictors of health consumers' technology adoption.

Summary

This section provided contextual background on SDH and the challenges healthcare organizations face trying to screen and capture such data. Due to the acute issues in nationally standardizing SDH domains, EHR toolsets, and screening, there remains much uncertainty as to their future. In a broader digital context, SDH data can be generated from a variety of DHT, which inevitably present a number of ethical and moral debates with regard to the overall role of these tools and social equity.

Digital Health Technology (DHT) and Social Equity

What are the practical applications of and relationships between digital health technology (DHT) and social equity? English novelist D. H. Lawrence is quoted as writing, "*ethics and equity and the principles of justice do not change with the calendar*" (Swaminathan, 2020). Technologies may continue to advance beyond our ability to keep up, but the fundamental tenets of equity do not evolve with them and remain a fixture within the ethos of society. Safeguarding vulnerable populations and meeting their needs through compassion is relentlessly extolled as a cornerstone of quality healthcare by patients, families, clinicians, and policy makers (Sinclair et al., 2016). The necessity of compassion within healthcare is manifest in the first principle of the American Medical Association Code of Ethics which states, "*A physician shall be dedicated to providing competent medical care, with compassion and respect for human dignity and rights*" (Sinclair et al., 2016). Similarly, Frederickson's (1990) theory of social equity, which is regarded as the 'third pillar' of public administration, contends that social equity takes on the same "status as economy and efficiency as values or principles to which public administration should adhere." This section will review a specific DHT (telehealth) and how the COVID-19 pandemic prompted increased adoption of this DHT for patients from underrepresented backgrounds who benefitted from virtual care, digital health literacy, and inclusive applications of DHT to improve health and social equity.

DHT, and the endless sea of raw data they generate, possess the power to reveal our unconscious blind spots, objectively depict gaps in care across multiple socioeconomic domains, and expose raw truths about the broken aspects of our healthcare and social systems. Conversely, while it can play an important role in improving health and social equity, both the data and technology used to collect the data can and have been used to further spread health biases. For example, some studies have indicated that the automated artificial intelligence (AI) algorithms used by some hospitals and physicians to guide their decision-making with EHRs often ignore the underlying reasons for the concerns of vulnerable populations, such as lack of employment or food insecurity (Murray et al., 2020). For minorities and less affluent patients, there are serious concerns about latent bias in those algorithms and their ability to build “fair” models, which must be addressed in the dialogue around medical AI.

Health disparities, and the SDH that underlie them, are entwined in the larger discourse of the American social safety net. Digital health interventions, which can include modalities such as the internet, smartphones, and monitoring sensors, may help increase access to healthcare for medically underserved residents in both urban and rural settings, thus further expanding the safety net. DHT may ultimately help or worsen the goals of social equity depending on the context, individual, community, and care goals. Illustrative examples may help explain the real-world sources of these debates.

Telehealth and COVID-19

Virtual visits and remote monitoring are two functions of a DHT (telehealth) that have been heralded as allowing marginalized populations, regardless of location, income, and other social barriers, to obtain proper care. Early during the COVID-19 pandemic, the immediate expansion of remote healthcare service delivery was facilitated by HHS and CMS, which waived certain telemedicine restrictions so that patients in designated rural or medically underserved areas were now allowed the use of remote communication applications that may not meet Health Insurance Portability and Accountability Act (HIPAA) requirements (Loeb et al., 2020). This intentional policy choice from the government is a value-laden, social equity position enacted during a time of crisis in order to help provide services that would reduce spread and save lives.

It is also believed that these waivers would benefit some populations for whom transportation, work schedules, or caregiving demands have traditionally been barriers to accessing facility-based health services. With increased access to care via telemedicine and financial reimbursements/incentives for telehealth visits, the playing field would theoretically be equalized. The new waivers enabled the rapid and dramatic extension of virtual healthcare and patient empowerment even as many of these regulatory decrees remain temporary.

However, the rapid expansion and adoption of telehealth in the U.S. during the COVID-19 pandemic has arguably created new realities of widening extant racial/ethnic disparities and undermining access to care (Campos-Castillo & Anthony, 2021). In a secondary analysis of a cross-sectional, nationally representative survey of internet users, 17 percent of respondents reported using telehealth because of the pandemic, with significantly higher unadjusted odds among Blacks, Latinos, and those identified with other races compared to white respondents. Campos-Castillo & Anthony (2021) argue that while increased demand for telehealth among non-White patients during the pandemic presents new opportunities to leverage DHT to improve care, the digital divide on high-speed internet access, smartphone access, comfort with technology, and education level all remain significant barriers to entry.

Bakhtiar et al. (2020) also notes that for some specialties such as dermatology, digital access, and telehealth services must also meet specific medical quality standards to be useful and effective. A ‘teledermatology’ implementation with inconsistent quality (poor quality images, audio-video, lighting, positioning) may unintentionally burden vulnerable populations more. A separate study by Ye et al. (2021) of Columbia University Irving Medical Center patients suggested that vulnerable patient populations have difficulty engaging with audio-video telemedicine visits even as CMS restrictions on non-traditional platforms (such as FaceTime and

Skype) have been temporarily lifted, suggesting that caution is needed when more restrictive policies resume. In this study, older age, Black race, Hispanic ethnicity or Spanish as a primary language, and primary insurance being Medicaid or Medicare were all significantly associated with lower odds of audio-video telemedicine visits in the first place, suggesting that DHT still remains largely inaccessible to these populations as a result of socioeconomic inequity. Wegermann et al. (2021) also studied disparities in DHT accessibility with vulnerable adult liver disease patients leveraging telehealth in hepatology clinics at Duke University Health System. The study revealed suboptimal use among populations, including those that are older, non-Hispanic Black, or have Medicare/Medicaid health insurance. Poor use included incomplete visits, dropped appointments, and other circumstances which impeded patient-physician communication and rapport, let alone accurate assessments of jaundice, sarcopenia, ascites, and hepatic encephalopathy (Wegermann et al., 2021).

During the first year of the pandemic, Wood et al. (2020) reviewed how the digital divide and uneven implementation of telemedicine for some providers were exacerbated and avoidable, considering that SDH data predicted overall readiness for telemedicine visits. Data from cardiology clinic visits since the onset of the pandemic suggested that SDH significantly impacts a person’s ability to engage via telehealth. Similar results materialized from practitioners in the fields of infectious diseases and HIV medicine as they care for a disproportionately large number of individuals whose health outcomes are affected by SDH. The authors concluded that a person’s likelihood of being able to participate in video visits, communicate via EHR portals, request appointments or prescription refills electronically, accessing mobile health applications for individuals with limited English proficiency were all facets of social inequity faced by minority populations. By addressing critical access points—technology, technical literacy, broadband connectivity, and personal privacy—practitioners can better acknowledge ethical dilemmas that may arise in the implementation of DHT as well as the risks of exacerbating implicit biases that may impact care (Wood et al., 2020).

Studies and debates which indicate an exacerbation of social inequity by DHT are sometimes offset by other studies and individual use-cases which showcase telehealth reducing disparities among some groups. The University of Minnesota Broadway Family Medicine Clinic in Minneapolis implemented telehealth during the pandemic and simultaneously identified patients over the age of 60 with high-risk health conditions such as diabetes, chronic obstructive pulmonary disease and heart disease (Westby et al., 2021). Those patients were contacted by telephone to discuss COVID-19 and services currently being offered at the clinic, which led to a sense of safety and community among patients and providers, and as a result, many patients who had not been seen in the clinic in over a year scheduled and completed telephone visits.

Numerous studies such as Miyamoto et al. (2021), Qian et al. (2021), and Prahalad et al. (2021) also support similar conclusions and positive telehealth use-cases across different care needs such as sexual assault care, pediatric diabetes, and among Hispanic, non-Hispanic Black, and low-income groups during the COVID-19 pandemic. The use of virtual care potentially mitigated the impact of the pandemic on healthcare utilization in these vulnerable populations (Prahalad et al., 2021). Despite the mixed evidence of exacerbating social inequities, the debate about investment in telehealth also questions whether society will eventually ‘normalize’ the telehealth experience for the mainstream population by increasing patient and physician familiarity and introducing clinical changes that may endure after the threat of COVID-19 subsides. Bakhtiar et al. (2020) summarize the future of the telehealth space and what will be needed to ensure greater social equity by stating that more bandwidth, infrastructure, additional clinical appointments for those without proper devices, and physician encouragement of digital literacy as an acquired skill will be necessary going forward in a post-pandemic world.

Digital Health Literacy and Digital Health Technologies

Digital health literacy is defined as “the ability to appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health-related problem” (Smith & Magnani, 2019). Accordingly, its prerequisite skills and knowledge include the ability to navigate and operate computers or mobile devices/applications to efficiently to accomplish tasks, in addition to media literacy to use search engines, and information literacy to evaluate a wide variety of sources. As more healthcare interactions occur digitally and remotely, it has become more crucial than ever to reinforce digital health literacy in order to make DHT accessible for both patients and providers. Smith & Magnani (2019) argue that while patients “*may have access to more of their health information than ever before because of services like patient portals and Open Notes, this abundance of information without sufficient guidance and explanation could lead to confusion and stress*.” This aligns with studies which argue that public health experts and clinical leaders must critically analyze the use, usefulness, and impact of DHT in their professions, in addition to reckoning with the ethical and privacy considerations that envelop the debate (Gómez-Ramírez et al. 2021; Bates, 2021).

As the previous section illustrated, public health emergencies like COVID-19 have challenged the ethical imperatives of DHT and pushed experts to propose fair, effective, and expedient ways to address them. It is widely acknowledged that while they can *help* advance the fields of health equity, public health, and population health, its widespread adoption and normalized use cannot be a substitute for scrutiny and consideration of its layered repercussions. As such, AHCs, like every other healthcare organization, must ensure that the platforms and health information contained therein is communicated in a way that facilitates consented understanding and true, shared decision making, which can be facilitated by improved digital health literacy.

A related dimension of digital health literacy and the role of DHT centers on ‘digital health equity,’ or health interventions using DHT. Low health literacy disproportionately affects racial and ethnic minorities, people with lower socioeconomic status, people for whom English is not their first language, people with less education, and the elderly (Kutner et al., 2006). These groups also tend to experience high burdens of chronic disease as well as acute illness and persistent digital health disparities. For example, the 10 percent of U.S. citizens who do not have internet access is comprised mostly of people age 65 years and older, people who identify as African American or Hispanic, and people living in rural areas (Jackson et al., 2020). People and communities with lower income may also have less reliable access to telephone and WiFi service, which is needed for telehealth encounters. These groups could experience worsening health disparities as the result of increased use of telemedicine.

Rodriguez et al. (2020) review digital health literacy under the auspices of the passage of the 2020 Cures Act. The authors provide summary analyses through a multifaceted approach to both policy and institutional design, arguing that issues such as broadband access, querying patients about technology access as part of standard care, capturing sociodemographic and literacy metrics, and customized portal interfaces that respect culturally and linguistically appropriate standards will all be necessary inclusive approaches for all healthcare systems moving forward.

While discussing how to best promote health equity through improved health literacy, Azzopardi-Muscat and Sørensen (2019) reviewed the literature on the impact of DHT on health equity and provided recommendations to policymakers and research analysts on access, adoption, and active use of these technologies. Referencing the WHO, they group DHT into four distinct categories: interventions for clients, interventions for healthcare providers, interventions for health systems or resource management, and interventions for data services. These categories are used to create a model for health literacy, a theoretical framework, and a lens whereby policy for DHT can be crafted to ensure the transformation of health systems in combating health inequalities. They caution, however, that with the application of DHT comes a parallel threat of increasing inequities in healthcare. Paradoxically, as the digitization and democratization of health information can positively benefit certain groups, access will remain unequal for others. This is part of an axiomatic industry "inverse care law," which states that health products and services are always used most by those who need them least (Azzopardi-Muscat and Sørensen, 2019). Increased age, lower levels of technological literacy, educational attainment, socioeconomic status, geographical factors, and poor infrastructure can potentially handicap rather than advantage the populace as more hospitals and providers adopt DHT. The authors conclude by stating that the 'promise' of healthcare means that everyone—individual, organizational, commercial, technical, and political—must safeguard the most vulnerable through both policy and practice.

In the allied field of HI, Brewer et al. (2020) also discusses the promise of unleashing DHT in achieving better health equity. The paper presents both theoretical and specific, contextual examples of mobile health interventions that were creatively and functionally designed with community engagement and input. This form of participatory engagement, in and of itself, is meant to address health inequities by demonstrating community-engaged research approaches to create DHT solutions for the populous from the bottom-up rather than the top-down. The net result, therefore, is the development of an evidence-based, behavioral change DHT product/tool manufactured under the rubric of a “culturally aligned intervention,” which can positively impact study participants (Brewer et al. 2020). Despite the use-case success in the study, the authors maintain a general skepticism towards DHT researchers and innovators’ understanding of the healthcare and technology disparities for underserved populations, which can lead to unintended consequences such as perpetuating the additional disparities referenced by Azzopardi-Muscat and Sørensen (2019). Urging HI researchers to integrate community engagement into the development of data-driven, modernized DHT solutions means that all will benefit when everyone is fully vested in the final product:

> Their valuable perspectives toward addressing population health within the context of their social and physical environments lead to more successful interventions. Investigators must not only think outside the box but also examine the box itself and its surroundings to attain real, lasting change to impact health disparities within our communities. This intentional decision to meet people where they are in the community, whether culturally or digitally, is a return to the medical profession’s core principles of altruism and benevolence and a journey back to the future to achieve health equity for all. (p. 10)

This sort of inclusivity, rather than exclusivity, in the digital design and implementation process can help mitigate the conditions defined in the “inverse care law,” and also create positive reinforcement with AHCs and the informaticists who seek to optimize their information systems, including EHR/SDH data collection among others.

Inclusive Applications And Interventions With DHT

“Centering at the margins,” a bedrock of critical race theory, refers to “making the perspectives of socially marginalized groups, rather than those of people belonging to dominant race or culture, the central axis around which discourse on a topic revolves” (Westby et al., 2021). To provide true equity of care, it can be persuasively argued that physicians and care workers must center at the margins and make the system work for the people and communities who experience social inequities. DHT, through a personalized design and implementation, can help advance and sustain the core functions of public health, including health promotion and prevention, epidemiological surveillance, and response to emergent health issues in the community (Gómez-Ramírez et al., 2021). DHT is, thus, presented in the literature and discourse as being both necessary and inevitable to address routine and emergency public health issues. However, the circumstances and extent to which they are appropriately used as interventions remain a subject of critical reflection and empirical investigation.

For example, a major contributor to fetal infant mortality is social isolation, with one study indicating that infants whose families did not receive home visiting were 2.5 times more likely to die in infancy compared with infants whose families received home visiting (Donovan et al., 2007). The study suggested that Black infants were at least as likely to benefit from home visiting as were Non-Black infants. As part of community engagement efforts to eliminate disparities in infant mortality, the Henry Ford Health System turned to social media and virtual visits to network and empower not just low-income pregnant women but women of reproductive age, mothers, and caregivers in three neighborhoods with high infant mortality (National Academies of Sciences et al., 2016). This outreach with DHT to more than 200 women drove the infant mortality rate to zero, as it provided comfort, education, and reassurance to women even when it was difficult for them to travel physically.

While DHT continues to transform many fields of medicine, a subset known as ‘mHealth’ (mobile health via phones and wearables) affords yet another promising opportunity to deliver both health knowledge and healthcare interventions to patients on their smartphones. The FDA, in fact, reviews provider mobile medical and health apps under its Office of Device Evaluation, which include apps for radiation oncology, electrocardiograms, diabetes management, ophthalmoscope, and measuring blood loss in surgical procedures, among others (Casarez, 2013). For patients, there are a dizzying variety of mHealth options which can target nearly any individual care need, from OB-GYN period tracking to general nutrition, mental health counseling, acne treatment, medical marijuana, diabetes tracking, maternal care, chronic disease management, eye care, and many more.

Campbell et al. (2019) reviewed multiple case studies of mHealth interventions improving HIV patient outcomes with both text messaging services and mobile apps. mHealth interventions in this context are designed specifically to address the social challenges of youth at risk of HIV, inaccessible care options for minority populations, those of lower education, and those of lower socioeconomic status. A review of 45 HIV-related mHealth interventions showed that 74 percent of theory-driven interventions were efficacious in achieving outcomes of medication adherence, virologic suppression, and retention in care. The study indicated that SMS-only interventions improve visit attendance, CD4 count, viral suppression, and medication adherence in patients living with HIV, and they improve the odds of medication adherence across chronic diseases two-fold, independent of SMS frequency (Campbell et al., 2019). Additional HIV prevention and health education benefits of mHealth from the study indicated increased medication adherence to pre-exposure prophylaxis for patients at risk of acquiring HIV, leveraging geosocial networking apps which connect users with others nearby and are often used to identify potential sexual partners (common among young men who have sex with men), and other benefits that would not have been possible without this specific application of DHT.

In another study of mHealth interventions and e-health literacy, Moon et al. (2021) explored the accessibility of smartphone use among a large sample of breast cancer survivors. Breast cancer survivors present a particular demographic who would benefit from mobile apps specifically developed for pain management, mindfulness, symptom burden, and medication adherence. Systematic reviews and meta-analyses have shown that these interventions can significantly improve fatigue, physical activity, and depression in cancer survivors (Moon et al., 2021). Benefits for the providers who leverage this form of mHealth intervention include low cost, broad reach, and the potential for widespread implementation. However, issues with uptake and retention are, sadly, far too common. For example, in a trial of an online mindfulness-based cognitive therapy for anxiety and depression in cancer survivors, 80 percent of participants began treatment, but just over half (56 percent) completed all eight modules. Dropout rates of 30–40 percent are common, with some interventions reporting attrition rates as high as 70 percent (Moon et al., 2021) A study of 2,009 women from various communities participated in the study, which assessed the relationship between technology access and e-health literacy with sociodemographic variables such as age, social deprivation, and education. Findings included, 71 percent had access to a smartphone, 54 percent had access to a tablet, and 20 percent did not have access to either device with additional indicators that women who were younger, had higher levels of education, and who were from less deprived areas were more likely to have access to either device. Poorer e-health literacy was associated with being older, having less education, and not having access to a mobile device (Moon et al., 2021). Even as the benefits of mHealth interventions are apparent, evidence of a digital divide exists across some groups in this particular study and many others. As mHealth continues to explode proportionate to the adoption of smartphones, it is still crucial to note that older, less-educated, and lower-income individuals are more likely to lack smartphone and internet access (Campbell et al., (2019).

While DHT interventions show promise, current scholarship and debates often highlight its mixed effectiveness due to low participant engagement, high study attrition, and a lack of integration of behavioral change techniques. Yin et al. (2020) likewise caution that many mHealth interventions often limit the number of behavior change techniques and rarely offer “problem-solving, social support, and didactic education.” In a pilot study of the use of wearable DHT for obesity management among rural Latino populations, Yin et al. (2020) designed their intervention program by addressing the unique social, cultural, and environmental factors facing rural Latino families. The objectives were to (1) increase access to evidence-based health education content and resources; (2) address learning needs with content design; (3) address the need for individualized support, and (4) support behavior change with wearable technologies grounded in behavior change theory (Yin et al., 2020). The latter part of the study was a 12-month randomized controlled trial (RCT) to test the comparative effectiveness of the remote technology interventions on weight loss and energy balance behaviors among overweight and obese rural Latino adults relative to a control group.

While the study showed promising results, many participants expressed issues related to training, user-friendliness (equipment), user-friendliness (apps), lesson content and aesthetics, and family engagement. Cellular data connection speeds were problematic (as the participants lived in rural south Texas with weaker signals), which created significantly long wait times when downloading interventional lessons and often resulted in videos not being playable. Despite the best of intentions and forethought put into planning this culturally-competent DHT intervention, the study was not able to overcome the uncontrollable community-level SDH factors hindering a positive outcome.

Behavior change has long been a key ingredient in the calculus of achieving improved health and well-being for both individuals and populations. Dr. Misha Pavel, professor at the Bouvé College of Health Sciences at Northeastern University, summarizes the need to address behavior change (National Academies of Sciences et al., 2016):

> Behaviors are killing us. At least 40 percent of premature mortality is the result of people's behaviors. The problem is that behaviors are hard to change. Sexual behaviors, alcohol and drug use, smoking, a sedentary lifestyle, and even sleeping patterns—which are closely related to stress and its negative consequences—are deeply engrained behaviors…Human behaviors produce health states and biological indicators that can be measured. However, a connection needs to be drawn between what is being measured and what is of concern. For example, blood pressure is of interest for what it signifies about the health of the cardiovascular system. We need to have some way of transforming what we measure to what we want to know, then we can close the loop and intervene in an optimal way. (p. 18)

By adding SDH into the calculus of health behaviors, this approach shifts the lens from individual attribution and responsibility to social and community factors, institutions, structures, inequalities, and ideologies which negatively impact health behaviors. For example, poor personal nutrition choices by an individual could be directly linked to a food desert found in that individual's community, which has limited access to affordable and nutritious food. It could also be attributed to transportation insecurity, which limits the range of mobility to other regions which may offer better choices to help change that behavior. Health behavior dynamics are complex and multifaceted areas of study typically embedded within social, psychological and biological factors.

Yin et al. (2020) demonstrated that achieving behavior change with the application of DHT shows promise but remains immensely challenging. Lobitz et al. (2016) review the successes and failures of a digital health intervention intended to address the motivation and behavior change needed for children and adolescents suffering from sickle-cell disease (SCD) at an early stage. Using various mHealth apps and interactive tools, these modalities were used to facilitate daily and recurrent routines such as drug intake, appointments and helping patients to better cope with their disease through training programs, disease-specific social networks using secure communication channels, diaries, blogs, and even games. The most significant hindrance to the SCD app adoption was that developers failed to involve patients in the design, development, or evaluation process. As a result, most apps for SCD patients have one feature in common: “they have been rejected by the patient community and disappeared rapidly from the market” (Yin et al. (2020).

The effectiveness and long-term outcomes of DHT within social, community, and population health settings remain under active debate. People can use these tools to have private or difficult questions answered, enabling a proactive, timely, person-centered approach to healthcare. Wireless sensors can connect with the EHR, providing data for predictive health assessment frameworks and other cutting-edge features that HI professionals have yet to widely adopt. EHR data, in particular, affords providers, patients, and researchers access to a system to comprehensively analyze health data in a way that paper records cannot provide.

Summary

This section summarized scholarship on telehealth and how the COVID-19 pandemic necessitated changes to safeguard society and lives, the role of community engagement with mobile and social DHT, and the promise of EHR/SDH data. Within the rubric of social equity, universal design and accessibility principles, and “centering at the margins,” DHT interventions must be developed with consideration of individuals who are less e-health-literate and less technologically adept in order to increase the likelihood of engagement and better outcomes. Active inclusion is vital in the user-centered design, evaluation, and adaptation of technology-based interventions aimed at improving health and social equity in racial and ethnic minority groups. Arguably, reducing health disparities requires going beyond both the use of technology and healthcare in general to a “health-in-all-policies” approach (National Academies of Sciences et al., 2016).

The ongoing achievements and barriers toward an ideal SDH implementation within EHRs continue to generate contentious debates within HI communities and networks. Optimizing the EHR and SDH data collection tools are facets of an implementation science strategy, and organizational decision-making process that an AHC would undertake in order to advance health equity. The ‘gold standard’ that any AHC embedded in a local community would want to achieve is measurable, sustainable, and improved health equity outcomes for underserved populations. While many healthcare organizations struggle to provide basic provider services, AHCs may be one of the most uniquely positioned entities in the U.S., with an abundance of resources and networks to advance health equity as a high-impact goal and strategic imperative.

Academic Health Science Centers (AHC)

An academic health science center (AHC) consists of an allopathic or osteopathic medical school, at least one other health professions school or program (such as Dentistry, Nursing, Pharmacy, Public Health, or Allied Health), and at least one affiliated or owned teaching hospital (Academic Health Centers, n.d.). This unique combination of entities can qualify an educational institution as an AHC. As of 2022, there are 75 U.S. institutions and 48 international members of the Association of Academic Health Centers, each of whom operates within a complex set of independent administrative, business, and financial models, research missions, and public-private relationships with the communities they serve. Faculty, physician-scientists, healthcare administrators, and staff within AHCs regularly assist federal agencies, such as the National Institutes of Health (NIH), the Agency for Health Research and Quality (AHRQ), and the National Science Foundation (NSF). This cooperative assistance can include: policy recommendations and guidance, developing research agendas, and simultaneously playing a major advisory role for regulatory bodies such as the Food and Drug Administration (FDA) with impartial, critical appraisals of the validity and strength of evidence regarding the safety and efficacy of new drugs, vaccines, technologies, and medical devices (Anderson, Steinberg & Heyssel, 1994). As incubators of medical research, innovation, and the next generation of health professionals, AHCs play a vitally essential role in the U.S. writ large.

There are no central policy or national standards bodies for AHCs. Nonetheless, they are all universally grounded by their core, tripartite mission of furthering the academic, research, and patient care (clinical) goals of the nation. An AHC, by definition, must also house an Academic Medical Center (AMC), defined as a medical school and a university-based hospital that is organizationally and administratively integrated with one another (Garg, Pérez, Ramchandran, 2013). Although medical schools may be held accountable for some aspects of their governance to bodies such as the Association of American Medical College (AAMC), the absence of centralized, national standards for the umbrella AHC means that individual actors may have fundamentally different perspectives about the role of technology, technology assessments and their policy relationship to health equity. Academic freedom, as a general principle, permits a diversity of opinion in this ecosystem, which leads to varied opinions on altruism (i.e., what is best for the region/society) and self-interest (i.e., what will benefit the individual researcher, school, or hospital) when making decisions regarding which DHT projects to pursue or which has the best return on investment. As such, health equity and the collection of SDH to help inform health equity strategy is not an explicit accreditation standard required of AHCs but rather an assumed, fundamental, implicit goal based on their position in society.

With that unique position, Ellner et al. (2015) argue that AHCs serve many of the most medically and psychosocially complex patients in our society who also disproportionately contribute to total health care expenditure. Health systems innovations at AHCs that promote efficiency and value could directly impact overall health expenditures. As AHCs are responsible for training the future healthcare workforce, the authors maintain that without leadership creating a transformation-friendly internal culture, it is difficult to envision producing future healthcare professionals capable of leading innovative and high-value approaches to underserved populations.

In an example of how AHCs play a critical role for rural, uninsured, and underserved populations, who represent three of the most significant sectors of inequality in the U.S. healthcare system, Arora et al. (2007) reviewed a case-study with the University of New Mexico School of Medicine. Inequality is especially prominent in the treatment of chronic, common, and complex diseases that disproportionately contribute to the overall morbidity and mortality in the country. The University of New Mexico School of Medicine, as an AMC/AHC, launched an innovative program of care delivery and clinical education for the management of complex, common, and chronic diseases in underserved areas, using hepatitis C virus (HCV) as a model. The program represents a paradigm shift in thinking and funding for the threefold mission of AHCs, moving from traditional fee-for-service models to public health funding of knowledge networks. This program, Project Extension for Community Healthcare Outcomes (ECHO), involves a partnership of academic medicine, public health offices, corrections departments, and rural community clinics dedicated to providing best practices and protocol-driven healthcare in rural areas (Arora et al., 2007). Telemedicine enables specialists in the program to co-manage patients with complex diseases using case-based knowledge networks and learning loops. The authors believe this methodology will be generalizable to other complex and chronic conditions in a wide variety of underserved areas to improve disease outcomes, and it offers an opportunity for AHCs to enhance and expand their traditional mission of teaching, patient care, and research. Funding for the AHC healthcare mission and its financial reimbursement model, however, remain a major driver for its activities.

The heavily bureaucratic, agenda-setting, and decision-making processes within AHCs are compelled by a diverse array of incentives, as many AHCs obtain funding through a complex web of sources that include state appropriations, patient and insurer (public and private) payments, federal and private research grants (Spigel, 2006). State appropriations are not uniform, as some states appropriate faculty salaries and benefits to the host University budget and not the AHC hospital budget. Governance is varied and can include university-governed, a separate hospital board, outsourced hospital management, public corporation or hospital authority, transfer to a nonprofit corporation, or sale to or joint ownership with a for-profit corporation (Spigel, 2006). Given these multilayered competing interests, externalities, actors, and funding sources, it is important to review available studies on the elusive forces of influence within AHCs.

Research conducted by Ash (1997) attempts to identify the organizational factors within an AHC which influence technology diffusion, attitudes towards decision-making, and how widespread adoption can reach critical mass. The author conducted a survey study of 1,335 individuals in 67 AHCs and concluded that bureaucratic, organizational attributes, and cultural factors c who could wield influence over the institution (Ash, 1997). These ‘champions’ also serve as key, de-facto policy makers for AHCs, and are an essential ingredient for the realization of the true potential of DHT.

DePasse et al. (2014) critically reviewed two large bi-coastal Academic Medical Centers, the University of California, San Francisco (UCSF) through the Center for Digital Health Innovation (CDHI) and Massachusetts General Hospital (MGH) through the Center for Connected Health (CCH), each of whom launched centers focused on digital health innovation. Echoing Ash (1997), the study asserts that physician champions are a necessary requisite to help drive the formation of institutional goals and to reconfigure entrenched programs to be adaptable to DHT. This organizational reconfiguration includes specific targets such as developing clinical research technology infrastructure, integrating digital health into the medical education curriculum, collaborating with industry and technology accelerators, and developing new cost-effective and sustainable business models for administrative accountability (DePasse et al., 2014). The authors critically note that federal public policy and public funding for research on digital tools continues to lag far behind that for biomedical research and when such funding is issued, it tends to be for the evaluation of health information technology as opposed to its development or application towards health equity. An AHC will, therefore, carefully prioritize its own funding, development, and implementation of DHT based on recommendations from multiple internal and external stakeholders, often without federal subsidization or public financing but yet bound to federal and state regulatory and privacy controls on DHT's application with human subjects. The AHC assumes all of the risk as an incubator for DHT with an incentive to expand its research enterprise and provide care to its communities without any direct subsidy to do so.

Kohn (2004), in a comprehensive guide aimed at delivering evidence-based recommendations concerning AHCs to health and science policy to policy-makers, identified the need to develop a more robust "information and communications technology" infrastructure to manage complex systems like AHCs:

> AHCs must make innovation in and implementation of information technology a priority for both managing the enterprise and conducting their integrated teaching, research, and clinical activities.
>
> a. AHCs should have information systems that span the enterprise for integrated decision making, performance assessment, and financial management.
>
> b. AHCs need to pioneer the use of information systems for clinical purposes and incorporate their use into clinical education and research. (p. 13)

Here, Kohn (2004) argues that when AHCs properly invest and continuously fund the infrastructure necessary to support digital health innovation, they can expect to see a corresponding effect on the measurement of health surveillance as well. Since these DHT systems create new opportunities to analyze big data sets at the population level, the ability to conduct better analyses of clinical performance and cost-effectiveness, and to track changes over time can improve significantly. This, in turn, translates to enhanced surveillance networks for vulnerable and lower-income communities. Although Kohn (2004) does not explicitly identify health disparities by name, if current resources within an AHC are insufficient, then both federal and state governments must consider alternatives for subsidizing these critical investments, "particularly for those AHCs that face persistent financial difficulties as a result of serving as safety-net institutions in their communities" (p. 14).

In a separate study of AHC investment in technology infrastructure and its specific application towards the clinical research enterprise, Turisco et al. (2005) surveyed 37 different AHC institutions and concluded that none of the respondents had a "state-of-the-art" clinical research IT program, and none had all of the requisite, essential management foundations (i.e., a coherent vision, an overall strategy, a governance structure, and a dedicated budget) necessary to launch and sustain a truly successful implementation of a cohesive clinical research IT platform. A core strategic goal of all AHCs is to serve as translational research engines for the discovery of novel therapies to improve the health and safety of the nation, diverse populations, and the individual communities they serve. While many in this study had achieved breakthroughs in individual aspects of clinical research IT (such as with adverse event reporting systems or consent form templates), overall implementation of IT in AHCs to support clinical research was found to be "uneven and insufficient" (Turisco et al., 2005).

An enduring tension within AHCs, highlighted by Turisco et al. (2005), is the inherent struggle between the clinical research enterprise and care delivery missions of AHCs. This fuels internal competition for technology access and resources, often exacerbated by the absence of a single leader charged with the responsibility for all components of the clinical research IT spectrum of activities within the organization. AHCs are known as a complex and fragmented tapestry, the least of which includes patients, clinical investigators, basic scientists, clinical trials, scientific experiments, and regulatory infrastructure. As such, there is a spectrum of opinions and no hard rules to better inform administrative policies which could potentially govern how resources for clinical research IT and DHT for care delivery should be meaningfully balanced. As Turisco et al. (2005) note:

> All of these elements interact in a loosely interwoven series of work processes cast against a typically sketchy institutional infrastructure for information technologies. Most AHCs have invested heavily in their regulatory infrastructure. Investments in the day-to-day research and administrative infrastructures to support these processes have been more sparing. (p. 432)

Through focused investment and with dedicated institutional champions, AHCs can make more informed policy decisions to better reinforce the necessary infrastructure that would simultaneously enhance the research enterprise and care delivery for improving health equity.

Michener et al. (2012) developed several interdisciplinary models to help AHCs better integrate with community-engaged research (CEnR). These models are specifically designed to deliver more innovative and effective translational medicine to ultimately improve the health of the nation. While discussing health disparities, the authors argue that negative quality of care, as well as high costs, will persist without a CEnR agenda that finds answers to both medical and public health questions. One of the biggest barriers, they state, are the historical structures and processes of an AHC – including the complexities of how institutional review boards operate, accounting practices and indirect funding policies, and tenure and promotion paths. By aligning the motivations and goals of their researchers, clinicians, and community members into a vision of a healthier population that leverages innovative tools and solutions, they posit that AHC leadership will not just improve their own institutions but improve the health of the nation – starting with improving the health of their local communities, one community at a time (Michener et al., 2012).

Dzau et al. (2013), as well as Ellner et al. (2015), stress the internal and environmental factors necessary and important for health-related technology innovation to flourish in AHCs, maintaining that innovation must be actively cultivated by teaching it, creating “space” for and supporting it, and providing opportunities for implementation. Health equity cannot be realistically addressed, they argue, without continuous innovation and transformation within the AHC culture that requires a reframing of the traditional urgencies of day-to-day operations, patient care, and the research agenda.

AHCs operate within a vast array of externalities, constraints, incentives, and environmental factors in their makeup and approaches to DHT. What remains unresolved from the literature, however, is how the hospitals and providers within those AHCs make the best use of their EHR. In order to qualify for federal incentive payments through CMS, eligible providers, such as AHCs, must demonstrate “meaningful use” of their EHR. In this context, “meaningful use” is a precise compliance standard in HI that sets targeted objectives (e.g., improved health outcomes) that eligible providers and hospitals must achieve to participate in the EHR Incentive Programs. Arguably, improved health outcomes can be achieved beginning with a rigorous analysis of SDH data obtained from the EHR, which serves as the official digital patient record for the AHC.

Summary

This section summarized the role of AHCs as incubators of medical research, innovation, and the next generation of health professionals in addition to the vital role they play in the landscape of U.S. healthcare. As discussed, they are compelled by a diverse array of incentives connected to a complex web of sources that provide a funding model to serve rural, uninsured, and underserved populations, who represent three of the most significant sectors of inequality in the U.S. healthcare system. AHCs assume, without any explicit directive, a specific responsibility to advance health equity, which can be achieved through the electronic data capture of SDH through their EHR platform.

AHC's Responsibility to Advance Health Equity: The Role of SDH in the EHR

As stated earlier, eliminating health disparities is a fundamental, though not always explicit, goal of public health research and practice and, by extension, AHCs through their healthcare mission. This section will explore the ability of AHCs to advance health equity through health informatics, the EHR, and SDH data collection practices.

AHCs and Health Informatics

Examining the role of AHCs and how they can play a part in combating these disparities, Betancourt (2006) cites the IOM report of Unequal Treatment, which remains the first national study of the issue of racial and ethnic disparities in healthcare in the United States. The report notes that academic medicine has several important roles in society, including providing primary and specialty medical services, caring for the poor and uninsured, engaging in research, and educating health professionals. Betancourt (2006) argues that academic medicine should provide national leadership by identifying innovations and creating solutions to the challenges the healthcare system faces in its attempt to deliver high-quality care to all patients. For instance, patient care can be improved by collecting and reporting data on patients' race/ethnicity; education can minimize disparities by integrating cross-cultural education into health professions training; and research can help improve health outcomes by better identifying sources of disparities and promising interventions (Betancourt, 2006). Academic medicine, therefore, must make the elimination of healthcare disparities a critical part of its mission, provide national leadership by identifying quality improvement innovations, and actively work towards creating health equity solutions.

Validating the role of academic medicine in health equity work, McElfish et al. (2015) evaluated a new regional campus of an AHC engaged in community-based participatory research (CBPR). The AHC campus is situated among Marshallese and Hispanic populations who face significant health disparities and, with support from the Translational Research Institute, the University of Arkansas for Medical Sciences Northwest leveraged multiple levels of engagement chosen by the community: (1) chronic disease management and prevention; (2) obesity and physical activity; and (3) access to culturally appropriate healthcare. In 18 months, the CBPR collaboration resulted in ten grants, five collaboratively-written scholarly articles, 25 community publications and presentations, and initiated nine research projects and health programs. In addition, many interprofessional educational and service-learning objectives were aligned with the community-driven agenda resulting in practical action to address the needs identified (McElfish et al., 2015). AHCs, such as University of Arkansas for Medical Sciences Northwest, all possess some caliber of health informatics specialties and competencies which allow them to closely analyze patient and community health data for a variety of purposes. Practitioners in this field are known as health informaticists.

Health informaticists—as practitioners who integrate healthcare sciences, computer science, information science, and cognitive science to assist in the management of healthcare information—are uniquely positioned to harness the proficiencies of their discipline and offer multifaceted solutions to improving health equity through DHT. According to the U.S. National Library of Medicine, health informatics is the "interdisciplinary study of the design, development, adoption and application of IT-based innovations in health care" (Health Informatics, 2021). Their reach extends into medical practices, hospitals, allied health networks and insurance companies, research laboratories, consumer health agencies and public health organizations who rely on their expertise with EMR systems and modern technologies such as natural language processing (NLP), machine learning, and artificial intelligence (AI). As with any application of technology, there are pros and cons which require caution and careful, thoughtful consideration prior to implementation.

Veinot, Ancker and Bakken (2019) argue for informatics to play a more prominent role in recognition of health equity as a chief societal goal in order to reach marginalized and underserved groups. As of yet, however, they state that high-quality research and multidisciplinary approaches have not yet pushed for an intersection between health informatics and health equity. Through a summary of use-case articles from JAMIA (Journal of the American Medical Informatics Association) describing interventions with a focus on patient populations and the reduction of unequal consequences of illness, they detail how informaticists can leverage their unique expertise and lens to address these issues alongside traditional clinician-educators and administrators.

Veinot et al. (2019) argues for potential macro-level and meso-level interventions in health informatics and suggest ways that DHT can accelerate progress in the following contexts:

socioeconomic and political, living and working conditions, social and community networks, and within health systems. For example, health informaticists can apply machine learning or artificial intelligence (AI) to better identify patterns and anomalies that may detect: bias and discrimination in administrative policies, negative exposures to environmental pollutants, structures of pricing of goods and services to encourage healthy behaviors, probing of community norms and attitudes, and bias and discrimination in a healthcare medical practice. Such DHT interventions could potentially help mitigate negative outcomes, such as the following case example by Veinot et al. (2019):

> To support these individuals, we should recognize that the effectiveness of individual-level interventions is sensitive not only to psychosocial, behavioral, and biological factors, but also to contextual factors beyond individual control. For instance, a recent meta-analysis of human immunodeficiency virus prevention interventions for African Americans found that condom-use effect sizes were moderated by local levels of racism and racial residential segregation. (p. 112)

However, as with any application of DHT, the unintended consequences referenced by Brewer et al. (2020) and Azzopardi-Muscat and Sørensen (2019) can also manifest themselves in this field. Acknowledged recently in a study by Crawford and Serhal (2020), they argue that as HI experts and providers have rapidly expanded digital health innovations during the COVID-19 pandemic in order to increase access to services while minimizing potential exposure to infection and maintaining social distancing, systemic factors such as poverty, lack of access to internet connectivity, poor engagement with digital health, and barriers to digital health literacy continue to endure and render poor health outcomes. Presented with this reality, they contend that a new “Digital Health Equity Framework” is needed for improved provider training at the individual, institutional, and social levels so that social determinants can be measured and acted upon within organizations.

Repeating the call to action made by Brewer et al. (2020), they urge that inclusivity for marginalized and vulnerable groups is crucial for the codesign at all stages of innovation and implementation, such that these individuals must be stewards of their own health outcome data and we studiously avoid duplicating the social stratification that already exists in society at large. In a similar study of DHT use and inclusivity during the COVID-19 pandemic, Xie et al. (2020) provides a use case study of adapting DHT to meet the needs of older adults by customizing digital public health campaigns to be linguistically and culturally attuned to their needs, especially since older adults represent a diverse population with various disabilities and vulnerabilities with coronavirus. The authors present a series of solutions centered around the development of usable informatics tools and increasing training with community health workers to deliver timely digital health interventions, improving eHealth literacy, and opening technologies to allow easy access to electronic medical records on mobile or online platforms via the 2020 Cures Act. The act is a new rule intended to encompass technology interoperability and patient healthcare data sharing policies that will inevitably lead to a greater demand for a closing of the digital divide. However well-intentioned the Cures Act was designed to be, the digital divide continues to be a persistent obstacle for those seeking to address health equity meaningfully through DHT.

Reiterating the need for inclusivity, Block et al. (2020) review a separate HI initiative by The Health Disparities Collaborative Research Group, commissioned by the Patient-Centered Outcomes Research Institute (PCORI), to examine the data science needs for quality and complete data, and provide recommendations for improving data science around health disparities. The recommendations are summarized using three primary domains: patient voice, accurate variables, and data linkage. The implementation of these recommendations within national datasets has the potential to accelerate health disparities research and promote efforts to reduce health inequities, but only if those marginalized groups have a sense of agency as their own health stewards.

In most modern healthcare systems, health disparities are electronically tracked and recorded by various DHT via SDH as the key data points for analysis. Capturing electronic SDH data is key to unlocking the power of EHRs in order to provide better interventions for ‘upstream’ (community) and ‘midstream’ (individual) social needs.

SDH Data Capture In The EHR

In order to digitally capture and share patient data (including SDH), healthcare providers require an EHR that stores data in a structured format. Structured data allows healthcare providers to easily retrieve and transfer electronic patient health information (ePHI) and use the EHR in ways that facilitate patient care. In this sense, EHRs are merely impartial data collection software instruments for healthcare practitioners. They are what they are customized or programmed to be and bounded by our own intentions, biases, or motives. It is the human and organizational element—the practitioners, providers, and support staff—who must be incentivized to leverage an EHR’s toolset and capabilities in the most optimal way possible to advance better care and health outcomes. CMS and the Office of the National Coordinator for Health Information Technology (ONC) have established criteria and financial incentives for structured patient data that EHRs must meet in order to qualify for use in the “Promoting Interoperability Programs,” formerly known as “Medicare and Medicaid EHR Incentive Programs.” Congruently, in 2014, the Institute of Medicine published two reports that made recommendations on which social and behavioral-related measures should be used for data collection in EHRs (Cantor & Thorpe, 2018).

Despite these painstaking and well-intentioned enterprises, there is neither consensus nor an officially accepted taxonomy for cataloging and structuring SDH data in a comprehensive, universally-accepted standard for EHRs. Even worse, according to an analysis by the Healthcare Information and Management Systems Society (HIMSS) of 571,045 providers affiliated with 4,023 hospitals, there are over 500 vendors offering some type of EHR product, with hospitals averaging at least 16 disparate EHR platforms within their own environments alone (Sullivan, 2018).

Notwithstanding the sheer size and saturation of the EHR market, a small fraction of large players disproportionately controls the overall landscape serving many of the various niche EHR markets. In a 2019 report, KLAS Research reported that Epic, Cerner, and Allscripts held the largest share of the acute care and ambulatory EHR market and will further consolidate their hold over the next several years across the U.S. (Drees, 2019). Market consolidation of EHRs, however, does not instantly translate to unanimity around SDH measures that can or should be captured in EHR systems. SDH data, regardless of its method of collection (paper or electronic), needs to be incorporated into a patient's medical record in order for providers to use it for clinical decision-making. This also requires a modification of multiple clinical workflows within the EHR itself. Cantor & Thorpe (2018), notably, argue that many challenges remain before SDH data are as readily accessible and actionable as medical data are, citing the lack of consensus on standards and insufficient evidence that once information on them has been collected, social determinants can be effectively addressed through referrals or other action tools.

These challenges are inherently tied to the EHR platform itself and the adjacent complexities which impact its use.

The Promise of EHR Data

Even after systemic social and health inequities have been identified, eliminating them entirely from the social fabric of our lives will continue to be a challenge, but perhaps not wholly beyond our reach. EHRs present an opportunity, however, to provide insightful data which can be used to help mitigate the impact. While EHRs are primarily designed for archiving patient information and performing administrative healthcare tasks like billing (in a ‘structured’ format), many researchers have found secondary use of these records (in an ‘unstructured’ format) for various clinical informatics applications, decision-support systems, and research databases that can be used towards improving health disparities and the social equity policies adopted by Institutions. EHRs may also simultaneously enhance public health surveillance by incorporating geographical variables and SDH with accurate, standardized measurement of exposures, outcomes, and confounders, which are critical to analyzing health disparities and, in turn, guide resource distribution, advocacy for policy change, and other high-impact outcomes.

Many have hoped that the EHR and the use of ‘big data’ would lift quality for all groups to receive approximately the same care. Bates (2021) comments that this has not happened since, although care does typically get better with decision support and improved data, it tends to get better at about the same rate in different groups leaving the disparities in care still about the same. One study from 2011 also assessed whether that Blacks and Hispanics were less likely than non-Hispanic whites to be enrolled in a personal health record but that once enrolled, they were just as likely to use the record (Yamin et al., 2011). In all groups, patients with more comorbid conditions were more likely to enroll and to use the EHR portal after enrollment.

Nonetheless, EHR/SDH data can make it easier for providers and HI specialists to identify vulnerable groups that the social safety net is designed to support, such as LGBTQIA patients, the economically disadvantaged, racial and ethnic minorities, the uninsured, low-income children, the elderly, the homeless, those with HIV, and those with other chronic health conditions, including severe mental illness. In addition, individuals or community populations that may identify as belonging to multiple groups (e.g., someone who is Black, transgender, and uninsured) can be rapidly extracted from EHR systems, which can then inform custom intervention approaches that consider these multiple intersectional layers (Bates, 2021).

In order for SDH data to have any relevant connection to the EHR, electronic screening for SDH must be properly implemented and instituted in the first place within multiple workflows. As early as 2014, a report by the National Academies of Medicine recognized that electronic integration of SDH screening into EHRs would better enable health providers to address health inequities and support research into how social and environmental factors influence health (Freij et al., 2019). Since then, various subsequent federal policy initiatives and incentive programs, many of which are managed via CMS, have likewise spurred SDH data collection through EHRs. As a result, three primary SDH screening tools and approaches have since emerged: (1) the NAM (2014) set of social and behavioral measures; (2) the National Association of Community Health Center (NACHC) Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences (PRAPARE) tool; and (3) the Centers for Medicare and Medicaid Innovation's Accountable Health Communities tool. The degree to which each of these specific tools (or some variation of them) have been incorporated into each particular vendor's EHR is varied.

Many federal and state value-based payment programs require that hospitals implement quality-based initiatives and demonstrate meaningful community engagement and improvements in health outcomes over time to be eligible for those payments. As a result, SDH screening and reporting have become crucial for those healthcare organizations to receive payments based on their performance on key measures, which may include demonstrating that Medicaid enrollees are formally screened for core social needs during or within 12 months of admission (Colorado Health Institute, 2021). Unfortunately, for many AHCs, electronic screening is imperfect–especially given the complexities and nuances of integrating SDH screening into the EHR workflow process, adopting strategies for implementing screening respectfully and unobtrusively, and overcoming notions of hesitancy, futility, and skepticism from both providers and patients.

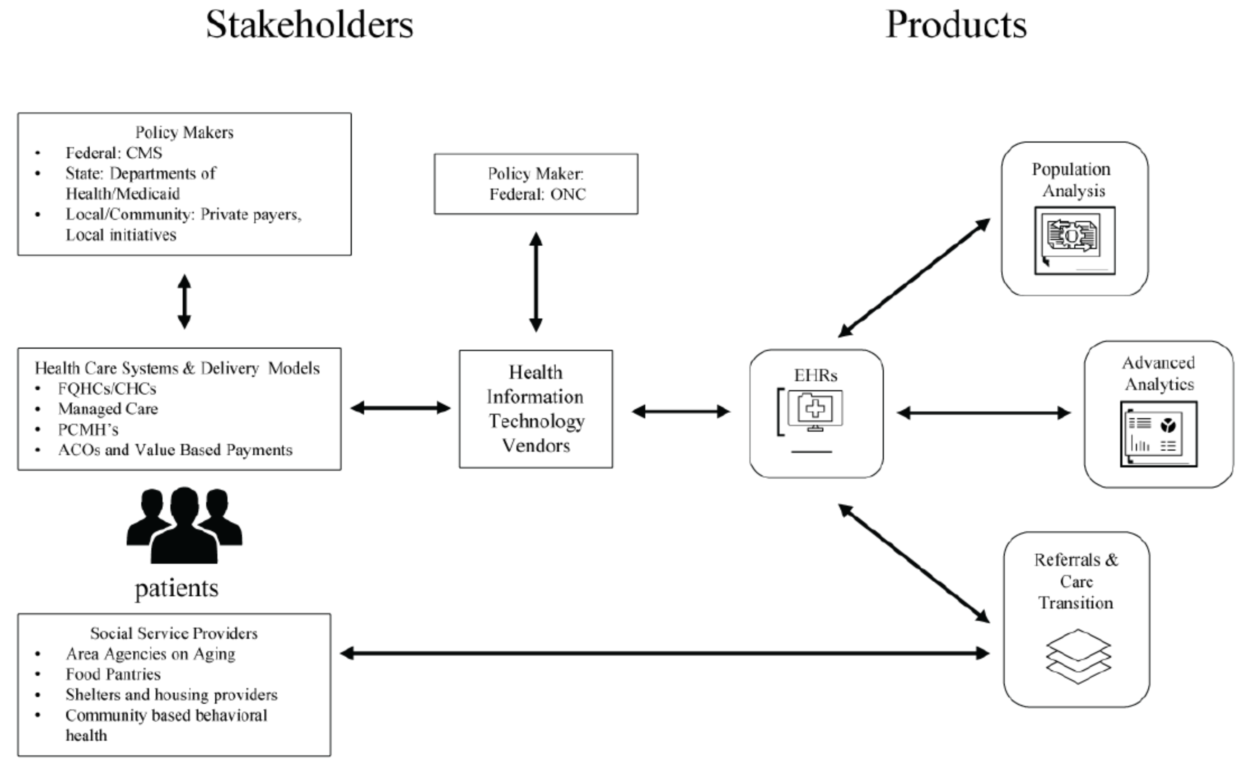
As each screening tool varies in the number of domains and questions, AHCs, like other healthcare organizations, have effectively created assorted options within the SDH screening tools that have contributed to the lack of standardization, inconsistent collection practices, notions of skepticism, hesitancy, and questions regarding the overall return on investment for integration into the EHR. A 2018 report commissioned by HHS studied the motivations of EHR *vendors* to build the relatively new SDH screening into their platforms and the facilitators and challenges to collection and use of SDH data from the vendor perspective. The study concluded that EHR vendors have had both indirect and direct roles in working with policymakers and healthcare systems, which has resulted in policymakers directly contributing to the evolution of EHR vendors' interest in actively engaging in population health as opposed to only developing medical record-keeping products (Freij et al., 2019). The study also noted that with the lack of federal policy standards around SDH data collection, product-specific decisions may end-up being de-facto policies given the market shares of particular vendors. How exactly, though, does the ecosystem between vendor, policymaker, and healthcare systems work?

Freij et al. (2019) conducted interviews with top EHR vendors to identify the facilitators and challenges to collecting and using SDH data at the point of care or in population health interventions. The conclusions from this study indicated that EHR systems and their functionalities are strongly influenced by “client demand and initiative, federal initiatives, and the vendors’ strategic vision about opportunities in the health care system,” especially with regard to developing and integrating SDH-related products in collaboration with government agencies and policymakers. This inherently implies a symbiotic, ‘supply and demand’ model whereby AHCs, as EHR stakeholders, can influence better standardization of SDH performance measures across various federal and state programs, better mapping of SDH measures to multiple types of codes, and development of codes for all SDH measures of interest in future versions of the EHR (Freij et al., 2019).

Figure 3 from the study depicts the relationship between stakeholders, patients, and products. In this depiction, an AHC’s associated health system, depending on its legally registered status, may qualify as a Patient Centered Medical Home (PCMH) or Federally Qualified Health Center (FQHC), either of which affords them influence and agency with the vendors who create products on their behalf and the Office of the National Coordinator for Health Information Technology (ONC) —the principal federal entity charged with coordination of nationwide efforts to implement and use the most advanced health information technology and the electronic exchange of health information.

Figure 3

Stakeholders that inform vendors' social determinants of health–related products in electronic health records (Freij et al., 2019).



The Freij et al. (2019) study corroborates a separate study from Palacio et al. (2018), whereby 37 stakeholders from a single Southern AHC were interviewed and highlighted the importance of vendors proactively linking the EHR SDH screening tools with clinical outcomes and having resources and processes in place to address social risks.

Shickel et al. (2018) highlight an advantage that the EHR presents with the introduction of 'deep learning' to clinical tasks based on EHR data. As a type of machine learning, deep learning refers to a neural network that attempts to use multiple layers of data to progressively extract higher-level features from the raw input that would not be possible with paper records or by human analysis alone (Ravì et al., 2017). The EHR data processed for clinical use can include general information extraction, representation learning, outcome prediction, phenotyping, and deidentification (Shickel et al., 2018). The data can be efficiently processed on supercomputing and commercial cloud platforms, producing predictive analytics which may help physicians and care providers with early intervention techniques. For example, case-control analysis of EMR data from 73.4 million unique patients yielded multiple predictive analytics about patients with a recent diagnosis of cancer who were at significantly increased risk for COVID-19 infection and its adverse outcomes, especially in African Americans (Wang et al., 2021). This analysis of patient EHR data compiled risk factors for COVID-19 (comorbidities, cancer treatments, transplant procedures, and nursing home stay) against any recent diagnoses of each of the 13 cancer types, inclusive of demographics such as age, sex, and race. These types of comprehensive health informatics analyses and recommendations simply would have been both logistically and cost-prohibitive without an electronic, digital health record.

In another illustration of the raw power of EHR data, Grasso et al. (2020) conducted analyses of sexual orientation and gender identity (SOGI) to identify LGBTQIA populations who have an increased risk of multiple adverse health outcomes. The study extracted three consecutive months of EHR patient data on SOGI and routine screening for cervical cancer, tobacco use, and clinical depression. Results indicated that cervical cancer screening percentages were lower among lesbian/gay patients than among bisexual and straight/heterosexual patients, and cervical cancer screening percentages were lower for transgender men than for cisgender women. This suggested that using SOGI EHR data to detect preventive screening disparities has immense value in helping to proactively identify services that LGBTQIA patients need and informing policymakers, administrators, and providers of those needs.

Roth et al. (2014) augmented EHR-derived data on 62,701 patients with zip code-level socioeconomic and obesogenic data to study community-level determinants, the impact of obesity prevention, and other significant public health issues. Results indicated that more farmers' markets/1,000 people (0.19, 0.10-0.36), more grocery stores/1,000 people (0.58, 0.36-0.93) and a 10 percent increase in percentage of college graduates (0.80, 0.77-0.84) were associated with lower odds of obesity. The same factors yielded odds ratios of smaller magnitudes for overweight and indicated that larger grocery stores might be inversely associated with obesity. Yet again, leveraging the EHR as the source data repository and cross-referencing with other data sources can yield incredibly powerful and actionable results.

Literature on the negative aspects of EHRs tends to center on their usability and unintended consequences of provider screen-time distracting from patient interactions and communications. For example, Hanauer & Zheng (2015) studied the impact of EHRs on the patient-provider relationship with the understanding that communication is at the heart of that relationship and that providers are concerned about the potential for EHRs to reduce the quality of their communications with patients. However, when compared to paper records, the study found that EHRs actually fostered better overall communications with patients across nearly all measures. Even while clinicians in the exam room are burdened with taking on more tasks and interacting with the EHR in ways that were not possible with paper records, this study indicated that use of an EHR on a laptop computer appears to improve the ability of first-year residents to communicate with patients relative to using a paper chart (Hanauer & Zheng, 2015).

Finally, many analyses point to EHR data contributing to understanding the overall causes of health disparities and to identifying useful opportunities for their reduction, but only if "big data collection includes health disparities populations and if researchers who focus on these populations are trained to use big data" (Zhang et al., 2017). For example, studies on DHT barriers and health disparities have assumed that certain "individual" level factors are barriers that cannot be overcome by clinical or systemic innovation. However, Antonio et al. (2019) cautioned about the importance of not misinterpreting demographic factors as individual, unavoidable predictors of health outcomes. Instead, they recommend viewing these demographic factors as "social determinants of health inequities" to emphasize that they are socially mediated rather than personal or individual. Researchers must take these into consideration when analyzing EHR data with any good faith, and well-intentioned efforts to address social and health disparities.

Summary of Literature Review

This literature review summarized and organized adjoining scholarship between health disparities, social determinants of health (SDH), digital health technology (DHT) and social equity, Academic Health Science Center (AHC) institutions, and finally the responsibilities of the AHC to advance health equity. These sections provide a contextual foundation for the theoretical framework, methodology, and subsequent analyses. Accordingly, the research question—**how have AHC institutions used their EHR/EMR for the specific purpose of optimizing SDH data to advance health equity for medically underserved areas/populations**?—can be positioned into an appropriate frame for analysis that is consistent with the available body of evidence. An evaluation of the relationship between health disparities, AHC institutions and stakeholders, EHRs, and SDH data collection for the specific purpose of improving health equity, requires an underlying convergence of administrative theory, technology adoption/acceptance, and implementation science. This study intends to analyze that intersection within the rubric of two relevant theoretical frameworks and appropriately position the resulting analysis.

Chapter Three: Theoretical Framework & Methodology

The research question is best suited for analysis through implementation science, which plays an important role in identifying barriers to addressing gaps in the translation of evidence into policy and programs. To that end, this study will leverage (i) Pettigrew’s framework for Dimensions of Strategic Change and (ii) Normalization Process Theory (NPT) to assess the Institution's current implementation of the EHR, the implemented SDH fields, and the overall role or impact of these fields in reducing health disparities. As part of the broader family of implementation science, these theoretical approaches will provide a better understanding and evidence of optimized SDH implementation in AHCs needed by interventionists to guide how they address disparities.

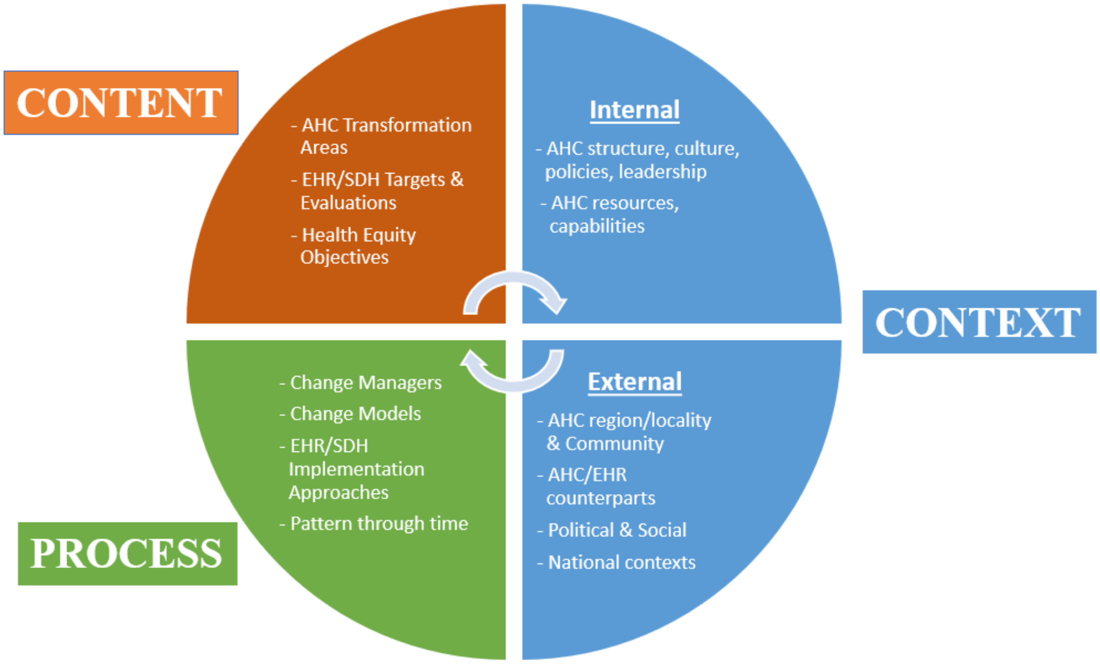
AHCs, like many large, heavily bureaucratic organizations, have a complex web of constraints, choices, and opportunities to prioritize their mission based on multiple inputs and externalities. Pressman and Wildavsky (1973) determined that simply having a broad agreement on an outcome’s ends (e.g., improving health equity) does not necessarily translate into an agreement on means between all parties. Each layer of an institution or bureaucracy, such as an AHC, may have its own perspective, not just on how things should be done but on who should do them. Whereas all may generally agree that a particular policy objective is worthwhile, they may prioritize that objective differently (Smith & Larimer, 2009). From an administrative perspective, the responsible executive leaders, administrators, and bureaucrats who push for evidence-based advocacy of SDH data collection in EHRs, are helping to ensure that the message permeates throughout the Institution and collection of SDH data then transitions onto the policy agenda. Lipsky (2010) argued that bureaucrats within the ranks, such as faculty, staff, public health analysts, health scientists, epidemiologists, physicians, and other essential healthcare workers, play an essential role in successful policy implementation and that the “top-downers” ignored them at their peril. Bureaucrats were better able to capture the full range of an implementation's intricacies and, therefore, any policy formulation calculations needed to involve them. If they were not involved, the long-term costs, in terms of programmatic compliance, would be immense with sustained damage to the public good.

Pettigrew’s framework for understanding strategic change has been widely applied during case-study research into organizational contexts as well as in studies on the implementation of healthcare innovations (Hage et al., 2013). The framework analyzes three interactive dimensions—*Context*, *Content*, and *Process*—that together shape organizational change (Pettigrew, 2012). Pettigrew’s framework is applicable since implementing an EHR is an organization-wide effort, even as customization of electronic SDH data collection is a specific facet of that effort. This framework was selected for its focus on organizational change, its ease of understanding, and its relatively general dimensions allowing a broad range of findings to be included, as illustrated in Figure 4.

An organization’s ‘context’ can be divided into *internal* (structure, culture, resources, capabilities, and politics of an organization) and *external* (social, economic, political, and competitive environments) components in which an organization operates (Pettigrew, 2012). An organization’s ‘content’ refers to specific areas of the transformation under examination: the EHR/SDH system itself, the work processes, and everything related to these (e.g., social conditions). An organization’s ‘process’ dimension concerns the processes of change, made up of the plans, actions, reactions, and interactions of the stakeholders, rather than work processes in general (Pettigrew & Whipp, 1993). Pettigrew does not regard strategic change as a rational, analytical process but rather as an iterative, continuous, multilevel process (Pettigrew, 2012). In this view, the ultimate outcome of an organizational change will be determined by the context, content, and process of that change.

Figure 4

Pettigrew's Framework for Dimensions of Strategic Change

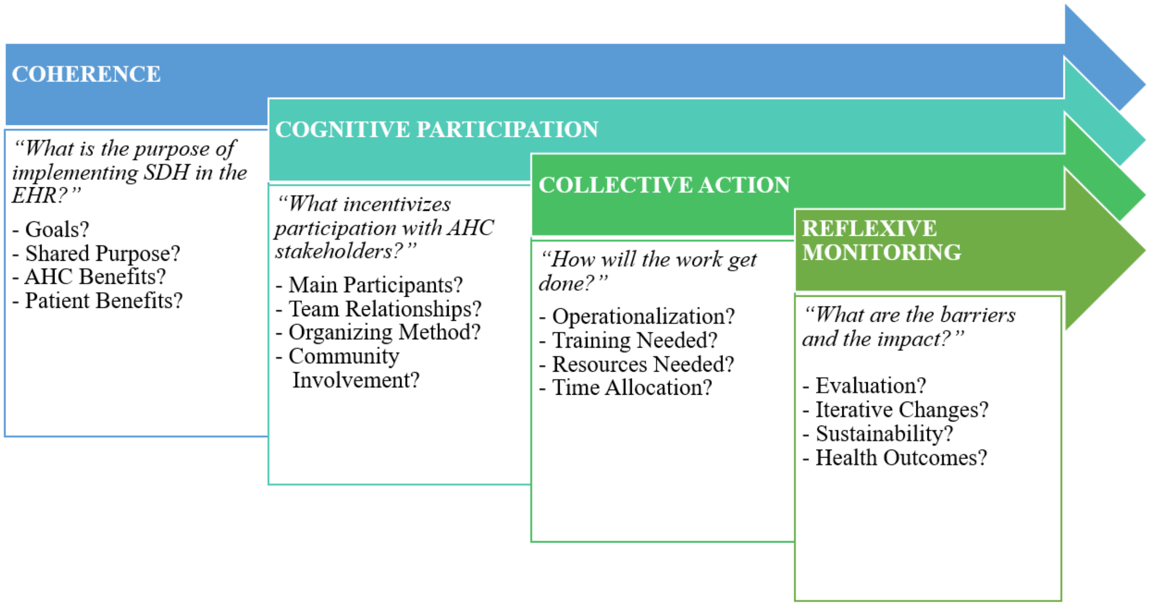


Source: (Pettigrew & Whipp, 1993)

While Pettigrew's framework seeks to understand organizational issues, Normalization Process Theory (NPT), in Figure 4, offers a focus on the work that individuals and groups do to integrate interventions into routine practice. Included are four distinct components as the basic structure for analysis: *Coherence* (understanding of reasons for implementation and potential value of the technology), *Cognitive participation* (preparedness to engage and commit to using the technology), *Collective action* (ability to do the work to use the technology) and *Reflexive monitoring* (how staff appraises the technology) (Mair et al., 2012). These components can help in understanding why some processes seem to lead to practice becoming normalized while others do not, in addition to elucidating perceptions and interpretations of various environmental, policy, or social factors which stakeholders use to guide their decisions (May, 2013). It is generally accepted that NPT provides a consistent framework to explore the implementation of digital health interventions that can be used to describe, assess and enhance future implementation potential (May & Finch, 2009). The mechanisms have high stability across settings and, notwithstanding challenges in applying NPT in terms of managing overlaps between constructs, there is evidence that it is a beneficial heuristic device to explain and guide implementation processes. NPT has also been leveraged in studies introducing EHRs in specific care settings (O'Connor et al., 2016; Bouamrane, M. 2013). Using NPT to explore AHC stakeholder expectations of an optimized EHRs/SDH for health disparities work could generate a better understanding of how they can best be facilitated through the adoption process. This understanding is vital for those managing the change process as well as for those who may be thinking of developing policy and implementation guidance for other AHCs.

Figure 5

Implementation with Normalization Process Theory (NPT) Construct



The theoretical constructs within these two frameworks will inform and provide boundaries for the qualitative data analysis and interpretation of AHC interview data. Alternatively, new theories and models may emerge from these existing frameworks, which explain how some organizational decisions and normative behaviors promote and encourage the use of EHR/SDH to improve the health of the patients and communities who are served by AHCs.

Research Design and Setting

This study employs a qualitative research methodology to investigate **how AHC institutions have used their EHR/EMR for the specific purpose of optimizing SDH data to advance health equity for medically underserved areas/populations.** A qualitative approach was selected based on the uncertain and multifaceted nature of how AHCs interdigitate with EHRs and their programmatic health disparities work. A qualitative lens presents a number of strengths, including its inductive approach or ability to focus on context, people, and language rather than the numerical emphasis of quantitative analysis (Maxwell, 2012). This aligns with the stated objectives and goals for this study:

- To assess the Institution's current implementation of the EHR, the implemented SDH fields, and the overall role or impact of these fields in reducing health disparities.
- To identify structural or cultural dynamics within the administrative bureaucracies of AHCs with regard to digital health initiatives and/or EHRs.
- To identify unifying themes or patterns in implementation and to elucidate variation.
- To identify perceptions and interpretations of various environmental, policy, or organizational factors which stakeholders use to guide their decisions.

To summarize, an academic health science center (AHC) consists of an allopathic or osteopathic medical school, at least one other health professions school or program (such as Dentistry, Nursing, Pharmacy, Public Health, or Allied Health), and at least one affiliated or owned teaching hospital (Academic Health Centers, n.d.). As of 2022, there are 75 U.S. institutions and 48 international members of the Association of Academic Health Centers, each of whom operates within a complex set of independent administrative, business, and financial models, research missions, and public-private relationships with the communities they serve.

Studying the nature of stakeholder views on EHR/SDH implementation for health disparities across all 75 AHCs is a daunting task considering the breadth of complexity between the aforementioned themes. While each stakeholder's experience is unique and can vary depending on a multitude of structural factors, I am focusing exclusively on two sets of individuals within the AHC as the targets for this study: (i) the implementation/street-level bureaucrat or program specialist and (ii) the strategic/leadership stakeholder responsible for the success of the Institution's EHR or health disparities programs. I believe these two distinct personas can serve as authentic representatives and offer a precise, expository narrative for many AHCs across the nation. As I have familiarity and working knowledge of both of these groups, my ability to navigate, communicate, and operate within their mental model is advantageous to this type of qualitative research project.

This hybrid process of qualitative analysis is both 1) deductive, directed content analysis (aligned with the two selected theoretical frameworks and the initial codebook referenced in Appendix D) along with 2) an inductive, thematic analysis to interpret the raw interview data and observation of emergent themes. The deductive (*a priori*) codes and analysis are rooted in both (i) Pettigrew's framework for Dimensions of Strategic Change and (ii) Normalization Process Theory (NPT), whereas the inductive codes were added from new ideas discerned in the interview data themselves. Based on the strategy detailed by Fereday & Muir-Cochrane (2006), this approach and particular lens will make it possible to clearly identify themes and patterns, which will uncover deeper meanings that explain the use and application of EHR/SDH by administrators within the AHC ecosystem. The steps and processes used in this data analysis can be replicated and assist other researchers in demonstrating a high degree of clarity of the conceptual framework and method of analysis applied (Fereday & Muir-Cochrane, 2006).

Sample Size and Participant Recruitment

Founded in 1969, the Association of Academic Health Centers (AAHC) is a 501(c)(3) non-profit organization that advances the special interests of AHCs. The Association of Academic Health Centers International (AAHCI) is a member-based association founded in 2008 as a subsidiary of the US-based AAHC. The AAHC and AAHCI list approximately 75 individual U.S. institutions total that are official member academic health science centers. Table 1 summarizes the landscape of U.S. AHCs.

Table 1

Summary of U.S. AHCs by Region, Type, and Land Grant Status

	Midwest	*Northeast*	*South*	*West*	***TOTAL***
Total Number	**13**	**15**	**32**	**15**	**75**
Public	9	8	21	10	**48**
Private	4	7	11	5	**27**
Land-Grant University	5	2	6	5	**18**
Non Land-Grant University	8	13	26	10	**57**

Each individual AHC represents the Institutional unit of analysis to be studied and sampled. When divided by region and type, Southern AHCs account for a proportionately larger share of total AHCs, followed by Northeast, West, and Midwest, respectively. Public AHCs also represent a larger absolute number by type. Additionally, Land-Grant Universities (LGU) will be sampled in this study. The National Institute of Food and Agriculture (NIFA) under the U.S. Department of Agriculture serves as a federal partner in a vast network of scientists, educators, and extension staff that address critical issues about agriculture, food, the environment, and communities (Land-Grant University Website Directory, n.d.). NIFA's key partner is the nation's Land-Grant University (LGU) System, which includes the "1862 public universities, 1890 historically black colleges and universities (HBCU) and Tuskegee University, and the 1994 tribal colleges and universities" (Land-Grant University Website Directory, n.d.).

The target sample size of stakeholders (*n*) was 37 individuals from 17 AHCs, which is based on an anticipated response rate of 25% of total U.S. AHC membership (75 institutions) while averaging 2-3 stakeholders per AHC enrolling. To ensure adequate representation by region, each region is sampled based on its proportionate percentage of 75 institutions against the total *n* of 37. To ensure diversity of participants, public, private, and LGU, Institutions were recruited as part of the sampling strategy and recruitment communications detailed in Appendix B. Table 2 summarizes the target sample size per region.

Table 2

Summary of Target Sample Size

	Midwest	**Northeast**	**South**	**West**	**TOTAL**
Proportion to Total	**18%**	**20%**	**42%**	**20%**	**100%**
Target AHC per region	3	3	8	3	**17**
Target n per region (2-3 per AHC)	7	7	16	7	**37**

The intent is to maximize geographic and population variation, one each from the Midwest, Northeast, South, and West, plus one that likely serves a LatinX population, one that likely serves a large American Indian population, and one that serves the rural, vulnerable population. The overall goal was to achieve the aforementioned *n per region* with 2-3 stakeholders from each individual AHC who represent either part of the leadership or street-level bureaucracy. These individuals must be involved with the ecology/ecosystem of EHR and its implementation towards addressing health disparities. The specific stakeholders for this study represent a much smaller fraction of individuals from the total AHC population, and the precise number will vary widely based on Institutional size, funding, goals, program maturity in either digital health innovation or health equity, and any number of assorted bureaucratic factors. Thematic saturation is achieved when observations and analyses reveal no new themes from each of the two persona types and when further coding from interview data is no longer feasible.

Study Inclusion and Exclusion

Due to the variability in the ecology/ecosystem of U.S. Academic Health Science Center (AHC) size, funding, region, and programmatic functions, this study targeted those administrators and/or stakeholders involved in EHRs and its implementation to advance health equity. The range of personas and professional titles of AHC representatives working in these roles can include *senior research dean, chief medical informatics officer, VP of population health, chief research/data informatics officer, department chair, program manager, program specialists and analysts, community navigators, EHR implementation specialists, EHR vendors, and technology managers*. Participants representing these various levels and specialties provide unique, rich, and diverse perspectives of value to the study based on their different administrative tiers. Anyone who is not employed by a U.S. AHC or who is not involved as a stakeholder with EHR implementations and health disparities work will be excluded from this study.

Data Collection and Analysis

The primary objective of the data collection is to represent the unique, subjective viewpoints of AHC administrators who will share their experiences and perceptions of the EHR/SDH implementation, health disparities work, and digital health innovation. Data was collected from Key Informant interviews using a semi-structured interview format. Subsequent data analyses were centered on interpreting those perspectives within the Pettigrew/NPT frameworks, the literature review, and to ultimately respond to the research question.

Interviews were conducted between January 2022 and March 2022, during the height of the COVID-19 Omicron surge, with data collected from 23 total respondents across 12 different AHCs. Email recruitment attempts for 2-3 participants from each AHC occurred every three weeks for three months. Over 100+ emails were sent across 75 individual U.S. institutions that are official member academic health science centers. In addition, emails were directed to program offices, departments, and individual, institutional contacts with approximately five total message attempts per contact (3 months x 5 weeks = 15 weeks / every three weeks = five messages). The total number of official member AHCs fell from 75 (in 2021) to 70 in February 2022. However, as this study began in 2021, the previous 75 members were included in the outreach.

The interview data necessary to address the research question was collected remotely due to the COVID-19 pandemic and the pausing of all VCU human research activity involving in-person interaction that does not involve potential health benefits to participants (VCU, 2020). Participants were allowed to pause the interview and resume it at a time not to exceed two weeks past the first interview session. This mechanism was designed to be accommodating to research participants who face time constraints with COVID-19 related challenges in the AHC.

Participants were identified by responses to the email solicitation on various listservs and institutional AHC research program offices. Recruitment was carried out as follows:

1. I, the student investigator, conducted an environmental scan of all U.S. AHC Institutions and created a list of contacts for its research program offices or distribution lists, in addition to existing listservs for academic digital health technology practitioners, EDUCAUSE listservs, the College of Healthcare Information Management Executives, Healthcare Information and Management Systems Society (HIMSS), and the American Medical Informatics Association. Each contact was emailed using a standard recruitment script (Appendix B) and interested participants were invited to contact the student investigator to volunteer for the study with their contact information. Email recruitment attempts for participants occurred every three weeks for three months, or approximately five total messages (3 months x 5 weeks = 15 weeks / every three weeks = 5 messages).
2. I, the student investigator, e-mailed selected participants with an introduction to the study and to the PI (Raskin), a description of the interview protocol and interview format, which was sent before beginning the interview.
3. When potential participants expressed and confirmed interest, I confirmed the nature of their role within the AHC ecosystem to ensure alignment with the research question.
4. Once confirmed, participants were invited to participate via e-mail and calendar invitation. Invitees who responded that they would like to participate (Key Informants) were communicated with directly to schedule a date and time to be interviewed that was convenient to them.

Key Informants were informed on the Information Sheet (Appendix C) and during study enrollment of their ability to skip questions and, if they so desired, to review a list of interview questions. On the date and time of the interview, I met via Zoom and reviewed the Information Sheet with the Key Informant and answered any questions they had, emphasizing both the Key Informant's autonomy of participation (e.g., to skip questions) and the perspective from which they are asked to speak (as an expert on the topic). Zoom was selected as the web-based platform for its (1) ease of use, (2) capacity to record, and (3) security behind the student investigator's VCU login. Data was not directly linked to identifiers such as name, position title, and employer. Interview recordings and transcripts were labeled and filed using Unique Identification Numbers. I kept the UID key in an encrypted file stored in a dedicated folder on the University Wilder School's secure server. Raw audio files were uploaded to a third party (Otter.ai, an established vendor) that uses automated transcription. Once the vendor produced the written transcript, each were edited for accuracy. All recordings and transcripts were then destroyed from the Otter.ai service platform.

Outreach Constraints

While an AHC’s mission spans academic, research, clinical, and administrative functions, it is essential to note the difficulty of recruitment between one domain over the other. The Omicron surge was an incredibly challenging time to request voluntary interviews from AHC healthcare professionals directly involved in clinical care or community work. Most invitations were left unanswered, or participants were simply inaccessible or unresponsive. The accessibility of these participants may or may not have been correlated to the direct impact Omicron had on their particular region and the AHC resource strain. Academic, research, and administrative profiles involved with the EHR/SDH were slightly more responsive, although still challenging to schedule.

Additionally, many AHC Institutional websites intentionally obfuscated academic and clinical contact information from public view in order to reduce the number of direct emails from patients seeking appointments, instead redirecting them to a patient portal. Even as the study outreach was academic research, it was extremely difficult in some cases as some AHCs did not list specific internal email listservs or program contacts. While some AHCs had entire websites and Centers solely dedicated to either clinical informatics, health informatics, population health, health equity, or health disparities research, others either chose to not advertise it, did not have such internal resources, funding, programs, relevant faculty, or basic Institutional initiatives in this space. In this sense, many AHCs epitomized the nature of resource disparities between their own national or regional counterparts. Speculatively, these resource deficiencies and workforce challenges may directly contribute to the lack of an intentional, articulated Institutional mission statement or focus on health equity.

With an overall goal to achieve 2-3 stakeholders from each AHC who represent either part of the leadership or street-level bureaucracy, the respondents who were interviewed possessed direct or mid-level familiarity and involvement with the ecology/ecosystem of EHR, SDH, and its implementation, and/or involved in the Institutional goals of addressing health disparities. All participants (*n* = 23) met the aforementioned inclusion criteria and were considered subject matter experts within their specialty areas. No demographic data were collected on the sample frame as it was not relevant to the research question and to preserve the anonymity and confidentiality of the participants given the niche area of expertise within their AHC.

Interview Process

Once a respondent confirmed interest and their role, which matched the inclusion criteria, I proceeded with scheduling the Zoom calendar invite for the formal interview based on the best time according to their geographic region and availability. The research setting for this study took place within the confidentiality and privacy settings available for Zoom interviews, with participants either calling from their home offices, work offices, or other rooms conducive to an isolated, quiet space. The interview process itself followed an open, honest, conversational format while I remained mindful of the time and burden on the participant. Participants had the option of changing their screen name and disabling video-sharing prior to the interview to protect their privacy.

At the beginning of the session, participants were asked if they had any questions regarding the confidentiality and privacy terms of the study and asked not to disclose the identity of others during responses. Any accidental disclosure during the process would be scrubbed from the final transcript. Participants were then explicitly asked if they granted permission to record the session for transcription purposes only, with data being reported only in the aggregate. Once permission was granted, the recording was initiated with a verbal ‘thank you’ and confirmation by the interviewer. Finally, the recordings and transcripts were scrubbed for identifiers, labeled, and filed using Unique Identification Numbers in an encrypted file stored in a dedicated folder on the University Wilder School's secure server.

The semi-structured questions from the interview guide were asked until the interview was concluded, lasting approximately 30-45 minutes, beginning with broad open questions, followed by a set of narrower, *a priori* questions and prompted in a funneled structure to satisfy the hybrid methodological approach. Empirical observations, patterns, and other notes were taken with the intent to transfer them into theoretical and analytical memos, which probed the concepts in the frameworks and the initial codes. Memos also satisfied the practice of researcher bracketing to reduce the chances of introducing bias into the study findings during data analyses (Weatherford & Maitra, 2019). All follow-up questions and clarifications presented an opportunity for inductively adding or evolving new codes with the emergence of new themes or parent codes, whereas the inductive codes were added from any new ideas discerned in the interview data themselves. Observations captured during the course of the interview included interpretations of the participant's discourse, beliefs, tone, content, context, process, coherence, active participation or motivation towards the goals, actions, and relationships with other entities and stakeholders—observations which would amplify key concepts from both Pettigrew's framework and NPT. These were captured by a single interviewer and coder.

Actively watching and listening for varied insights was critical to recognizing the importance of each stakeholder's role concerning the broader and complex ecosystem. If at any time the participant did not provide a complete response to the question the first time it was asked, the question would be rephrased, time permitting, with a specific example provided to help elucidate greater insight. Due to the complexity and depth of the EHR implementation and SDH collection process, or the newness of the Institution's progress in the area, study participants sometimes struggled to recall specific details or how precisely the AHC operationalized such a massive undertaking. To assist with recall of specific content, participants were asked to elaborate on particular responses with prompts crafted to generate additional ideas, discussion, or new intuitions on a specific area. To minimize the potential threat of recall bias, the research question would be repeated in the context of the question, with a definition and articulation of the research question clarified for additional context. Additionally, where necessary, participants were asked to recall the decisions leading up to actions rather than the time frame following it (for example, the decision behind SDH implementation rather than the actual events of the implementation itself). This helped to lessen the overall number of sequential events to recall. Many participants were visibly intrigued by the questions and seemed genuinely interested in providing thoughtful, responsive answers to help refine their personal understanding of the multifaceted AHC environment and the work they do. Each participant was thanked for volunteering their time and participation, and offered a transcript or summary of the study.

The interview protocol was designed to produce stakeholder perspectives on their role and impact of the AHC in relation to the planning and effective use of EHR/SDH data with daily activities, interactions with patients, communities, informatics research, and impact on reducing health disparities, not just care delivery. The interview protocol was highly effective at eliciting comments about AHC structures, culture, policies, leadership, resources, barriers, capabilities, EHR/SDH targets and evaluations, operationalization, health equity objectives, change leaders, change models, implementation approaches, patterns through time, AHC relationships to the region/locality and community, political or social contexts, team relationships, sustainability, and future trends.

Qualitative Analysis Software

Following data collection from Key Informants and editing of the transcript, individual documents from 23 participants were added to the qualitative analysis tool ATLAS.ti document manager for coding and refinement of the initial codebook developed *a priori* (Appendix D). The identification of emergent themes and patterns occurred during the coding of each transcript document, which precisely followed the flow of questions arranged sequentially for a hybrid approach: broad open questions, followed by a set of narrower, *a priori* questions in a funneled structure. As a result, each final coded document also primarily flowed sequentially from Parent Code Group 1 to Parent Code Group 6, with expected themes occurring at key points. When new themes, patterns, or ideas emerged, inductive codes were added under their respective parent codes to accommodate the responses' breadth and scope relevant to the research question. Appendix F reflects the final codebook used in the data analyses.

The Network View Manager was used to link related nodes and create categories of concepts (“Network Map of Codes”) to establish a logical pattern that could explain the incentives, motivations, bureaucratic or policy structures for AHC administrators in addition to benchmarking thematic saturation. Saturation was achieved when the codes fully fit the emerging concepts, categories, and theories from the data (Rambaree, 2014). The collected data was organized into categories based on both Pettigrew’s framework and NPT, and a code-frequency summary count was used to cluster primary themes together that addressed the research question and allowed for its translation into a specific narrative. The iterative process of transcription, reading memos and listening to the recordings later allowed for clarification of vague or ambiguous findings while reiterating the participants’ point of reference.

Using both the Co-Occurrence and Cross Tabulation features in ATLAS.ti to explain the number of codes and code groups within each interview transcript, Appendix G was produced. The values here represent Groundedness (Gr) of codes (number of quotations coded by a code) or transcripts (quotes created in a transcript). The number of documents in a document group or the number of codes in a code group is represented by GS. Row-relative frequencies and quotation counts are also included. The groundedness of codes from the final codebook (Appendix F), combined with the NPT and Pettigrew frameworks, the core research question, and the interview question funnel together, represented the mapping by which the results and illustrative quotes would be included.

The narratives within the transcripts, networks and codes provided several layers of data that were analyzed until saturation was felt in the concepts, categories, and the theoretical patterns being developed. Saturation was achieved when the codes fully fit the emerging concepts, categories, and theories from the data (Rambaree, 2014). Objectively, saturation can be confirmed when each of the concepts and categories has no new data that was any different from what was already found in the analysis. For example, a concept from the codebook such as "cultural competencies" can be confirmed as being saturated when new data from new interview transcripts are found to be similar, in their explanatory terms, to the ones already existing in the analysis or when causes/occurrences/observations from the data are in repetition to the already existing ones (Rambaree, 2014). All quotations selected for inclusion have been edited and cleaned for readability without changing the content or sentiment of the interviewee.

Deductive Coding and Directed Content Analysis

Data analysis began with the initial codebook in Appendix D aimed at deductive, directed content analysis. Appendix A presents the two categories of interview questions whose answers were funneled into six broad code categories in Appendix D (academic health science centers, community, digital health technology and social equity, health disparities, health informatics, and social determinants of health). This taxonomy formed the basis of the parent codes and subsequent child codes.

Key concepts from both Pettigrew's framework and NPT were also extracted and integrated with questions from Appendix A to create the initial codes, which provided the foundation for directed content analysis. For example, the first question asks the Key Informant to describe their involvement with the AHC's EHR. This question best relates to NPT and leverages the parent code "AHC." All questions from Appendix A in each category were sequentially arranged to satisfy the hybrid approach: broad open questions, followed by a set of narrower, *a priori* questions in a funneled structure. Questions were specifically written with the intent to probe the concepts in the frameworks and the initial codes. With directed content analysis, the grouping of excerpts associated with a particular code were followed by an interpretation and analysis to validate or invalidate Pettigrew or NPT. Follow-up questions and clarifications presented an opportunity for inductively adding or evolving new codes with the emergence of new themes or parent codes.

Inductive Coding and Thematic Analysis

For any text that did not fit within the code frame but felt significant or important in some way, new codes were created to describe it. For this study, codes were written with reference to the Fereday & Muir-Cochrane (2006) hybrid approach of inductive and deductive coding in order to achieve rigor with thematic analysis. Once all interview recordings were transcribed, edited, and analyzed, the initial codebook evolved as new codes required during the analysis needed to be kept to a controllable number to avoid becoming too unwieldy or disconnected from core themes. During the coding of transcripts, inductive codes were assigned to segments of interview data that describe a new theme observed in the text. For example, after reading the transcripts, it was determined that "**SDH_ongoing**" needed to be added as a new observable theme/code to describe SDH collection work that is still evolving or ongoing, incomplete, or not fully refined. In fact, due to the frequency of stakeholder references to "ongoing" and "work in progress," the following new codes were added and became the most frequently used during coding:

HD_ongoing: *Health equity work that is still evolving or ongoing, incomplete, or not fully refined*

SDH_ongoing: *SDH collection work that is still evolving or ongoing, incomplete, or not fully refined*

Analysis of the text was guided, but not confined, by the preliminary codes from Appendix D. Emergent themes were mapped from the four core mechanisms of Pettigrew's framework (Figure 4) and NPT (Figure 5) or systematically mapped onto another new theme to facilitate understanding of participants' expectations of the EHR/SDH, their knowledge of how it was or is being implemented, their engagement with and commitment to implementation and their perceptions of the impact, benefits, barriers, and disadvantages of implementation. Similarities and differences between groups of data emerged, which indicated areas of consensus in response to the research question and areas of potential conflict (Fereday & Muir-Cochrane, 2006). As themes within each data group clustered, findings were corroborated to avoid any unintentional, unconscious "seeing" of data that I may have expected to find. Previous steps were closely scrutinized to ensure that the clustered themes were representative of the initial data analysis and assigned codes before proceeding to the interpretive narrative. Additional scrutiny was provided by the project Chair/advisor and an additional peer reviewer to help remove uncertainty and improve the clarity of coding.

Validity and Reliability

For this study, it is important to be realistic about the availability of resources, and balance the elimination of validity threats with the pursuit of good qualitative research to augment knowledge of AHC administration and health equity policy. Maxwell (2012) defines validity as relative to the purpose of the study and given those parameters, I believe I addressed the most serious threats via the following actions:

- Researcher bias – To avoid the selection of data that fit an existing theory, goals, or preconceptions, I maintained meticulous record-keeping to demonstrate a clear decision trail to ensure data selection, and interpretations are consistent and transparent. Methods were critically reflected upon on an ongoing basis to ensure sufficient depth and relevance of data collection and analysis.
- Reactivity - While eliminating all researcher influence is impossible, I acknowledge that I, the student investigator, currently serve in a leadership capacity within an AHC. Although my professional responsibilities do not involve the implementation of an electronic health record for health disparities research or capturing social determinants of health, I do maintain professional relationships and affiliations with colleagues in this ecosystem. I conducted this study exclusively as a doctoral student from VCU's L. Douglas Wilder School of Government and Public Affairs, which has firewalled my professional work and implied power differential in order to avoid biasing or influencing participants in this study.
- Sampling bias – The concern with this study is that the *n* chosen for the interviews are not representative of the population of AHC administrators from varying levels of the institution or not representative of a typical AHC based on available scholarship. To counter this, I ensured that the background of the AHCs included in the study has the sufficient qualities found in other AHCs of similar size and makeup and that the interview subjects belong to different strata that are also consistent with other AHCs.

- Reflexivity (Hawthorne effect) – This describes the tendency for participants to change their behaviors simply because they know they are being studied. With the selected representatives, it is possible they altered their responses due to a desire to be politically sensitive or not damage to the credibility of the Institution or program simply because they are being probed as part of a research project. To counter this, I reworded the questions to reflect more neutral language that would still help answer the research question but not entice them to directly discuss financial matters, program burdens, or constraints that may reflect poorly on their leadership. I also restated the goals and scope of the study, in addition to reiterating all of the confidentiality mechanisms afforded.
- Attrition – If any participants withdrew, I planned for alternative participants who may be of a similar background, administrative tier, and job profile to ensure that saturation was achieved.

In addition to these actions, the dissertation Chair reviewed a sample of transcripts, recorded reflexive memos, and the final code list before application. This helped with ensuring the reliability of record-keeping as well as the applicability of the codes to the data found within the transcripts. The threat of recall bias was countered with careful and deliberate repetition and explanation of the research question, where appropriate, in order to contextualize the purpose and scope behind the question. Participants were asked to elaborate on particular responses with prompts crafted to generate additional ideas, discussion, or new intuitions on a specific area. To reduce the overall number of sequential events to recall, time frames would be restated and limited. If participant could not recollect the event or context, the question would be skipped.

Ethical and Privacy Considerations

This research is entirely self-funded and included participants who are above 18 years of age, none of whom are included in a special population nor are currently incarcerated.

Informed Consent

As this study qualifies as exempt from federal regulations, a consent form was not required. Although there is no formal consent process required for exempt studies, the Information Sheet (Appendix C) was provided in order for individuals to make an informed decision about whether or not they would like to participate.

Confidentiality

Participants were assigned unique randomized, four-digit alphanumeric codes to deidentify their interview data and decouple it from recruitment information (name, professional e-mail address, name of AHC where they work). The key was accessible to the PI and student investigator, and stored in an encrypted file in an encrypted folder on VCU's secure and encrypted Google Drive folders and servers. The key will be indefinitely retained until all analyses under this project are complete, at which time it will be destroyed through deletion. Zoom Video/Audio recordings will be destroyed once all analyses under this project have been completed.

Assumptions and Limitations

This study and the participant interviews depend entirely on an authentic, factual, and personal account of the facilitators, barriers, success stories, challenges, and opportunities faced by AHC bureaucracies and its administrators. This infers that I, as the student investigator, have assumed the integrity of the participant's responses who are agreeing to be interviewed voluntarily without any incentive or punishment being levied according to their response. This also assumes that the participant maintains an authentic relationship with their AHC, their colleagues, the program, and Institutional leadership, who set the direction for the initiatives. As power dynamics can certainly influence human behavior and relationships, AHC bureaucracies and the stakeholders within them are not immune from traditional workplace politics. Such politics may potentially coerce or manufacture opinion, which could contaminate the data within this study. Their responses to the questions posed in this interview may have ramifications on those relationships, and appropriate attention is required when interviewing an AHC representative who may be navigating this dynamic.

Limitations include the recall and interpretation of individual experiences and memories from interview participants. Depending on an individual's cognitive fitness or time proximity to events around the EHR/SDH implementation, certain details may be altered or omitted from that person's memory of their experience. Finally, as this research is conducted during the COVID-19 pandemic, participant anxieties and burn-out as a health professional may be exacerbated. Therefore, it is reasonable to expect a participant's memory and responses to be somewhat impacted by these added stressors.

Chapter Four: Findings and Analysis

Overview

This study sought to identify the administrative, bureaucratic and cultural forces of influence and other incentives that guide AHC stakeholders in leveraging SDH data to improve health equity in underserved populations. Unlike other healthcare organizations, AHCs exist as powerful, well-resourced, unique educational-healthcare ecosystems which often serve as a safety-net for patients in vulnerable and lower-income communities. From that lens, they are perfectly positioned to address health disparities directly and measurably with a straightforward strategy and by leveraging the broad array of digital health tools, researchers, academics, and funding at their disposal. Determining how the EHR/SDH data collection is operationalized, implemented, and tied to the Institutional health equity mission is critical for a number of reasons.

While there are clear moral, ethical, and clinical motives for improving health outcomes for vulnerable populations, when an AHC demonstrates that electronically screening and capturing SDH can improve the ability to understand the “upstream” factors impacting their patients' health outcomes, this can inform and influence policy-level choices in government legislation directed at community-level factors. Such factors include housing, air pollution levels, basic amenities, the environment, food insecurity, working life conditions, percentage of community living in poverty, percentage of high school or college graduates, walkability of the neighborhood, crime, structural conflict, and access to affordable health services of decent quality (WHO, 2019). Thus, the overall success of a heavily bureaucratic AHC may be gauged not only by their ability to deliver positive health outcomes in everyday patient interactions but the extent to which they can incrementally transform the societies and communities they serve as advocates for the voiceless and invisible who are at most risk for being negatively impacted by SDH.

This chapter presents findings in two sections:

- The Institutional Mission – A Quest for Health Equity
- The People – Patient and Community Needs

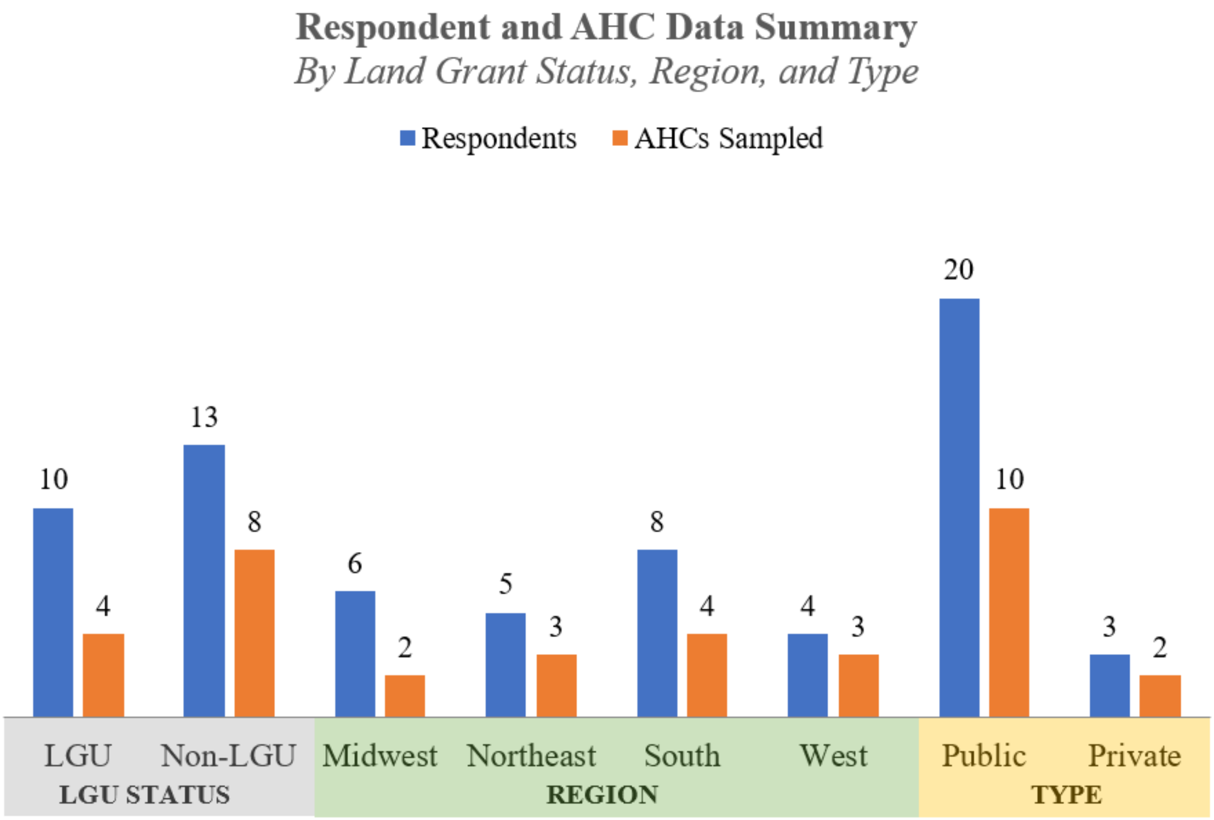
These sections will present the data, illustrative quotes, analyses, and interpretations of several observed themes and patterns that emerged during the course of data collection, such as *heterogeneous perspectives between academic research, administrative, and clinical roles, the critical role of partnerships, SDH data collection and screening priorities, perceptions of evolving and lagging processes, resource disparities,* and *notions of hesitancy, mistrust and skepticism*. Themes will be clustered within their respective Dimensions of Strategic Change (Pettigrew) and Normalization Process Theory (NPT) frameworks and addressed in the Discussion section with the complete analysis.

Sample

Interviews were conducted between January 2022 and March 2022, during the height of the COVID-19 Omicron surge, with data collected from 23 total respondents across 12 different AHCs. Figure 6 summarizes the total number and variation of respondents and AHCs sampled. AHCs can be reflected in more than one category, such as a *Northeast* and *Public* and *Non-Land Grant* institution, or a *Midwest* and *Private* and *Land Grant* institution. In this Figure, the top represented categories of respondents include Southern, Public, and Non-Land Grant institutions. The least sampled number of respondents include Western, Private, and Land Grant AHCs. The cross-section between respondents, the AHCs samples, and their geographic location, type, and LGU status is reflected in the following table underneath Figure 6.

Figure 6

Respondent and AHC Data Summary



To better illustrate the national cross-section and total possible available representation in the U.S., the total number of AHCs sampled by region and type referenced against the total number of available AHCs by region and type (in parenthesis) are listed below:

	Midwest (13)	*Northeast (15)*	*South (32)*	*West (15)*	***TOTAL***
Total Respondents	**7**	**5**	**8**	**4**	**23**
Public (48)	6	4	8	2	**20**
Private (27)	-	1	-	2	**3**
Land-Grant University (18)	6	-	4	-	**10**
Non Land-Grant University (57)	-	5	4	4	**13**

To simplify the broad range of official position titles and roles found between respondents and to preserve anonymity, Figure 7 summarizes the variation in respondent profiles with an abridged role type label. Based on these labels, there were an equal number of Clinical Leadership and Administrative Staff respondents, followed by Executive Leadership, and Research Staff.

Figure 7

Respondent Profile Summary

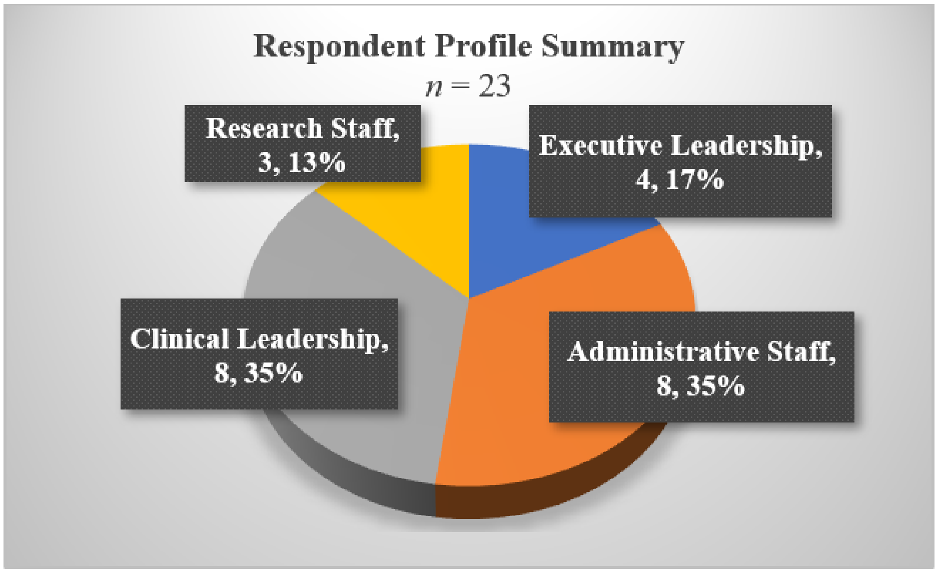


Table 3 combines the respondent role type and their respective AHC types represented. The ID for each of the 23 Key Informants will be used in all of the subsequent illustrative quotations and are numbered by role type for ease of reference.

Table 3

Respondent Profile Detailed

Clinical Leadership			
ID	**Region**	**AHC Type**	**LGU**
Clinical Leader A	Midwest	Public	yes
Clinical Leader B	Northeast	Private	no
Clinical Leader C	South	Public	no
Clinical Leader D	South	Public	yes
Clinical Leader E	Northeast	Public	no
Clinical Leader F	Northeast	Public	no

Clinical Leader G	Midwest	Public	yes
Clinical Leader H	Northeast	Public	no
Administrative Staff			
ID	**Region**	**AHC Type**	**LGU**
Administrative Staffer A	Midwest	Public	yes
Administrative Staffer B	South	Public	yes
Administrative Staffer C	South	Public	no
Administrative Staffer D	West	Private	no
Administrative Staffer E	West	Private	no
Administrative Staffer F	Midwest	Public	yes
Administrative Staffer G	Northeast	Public	no
Administrative Staffer H	Midwest	Public	yes
Research Staff			
ID	**Region**	**AHC Type**	**LGU**
Research Staffer A	West	Public	no
Research Staffer B	South	Public	yes
Research Staffer C	West	Public	no
Executive Leadership			
ID	**Region**	**AHC Type**	**LGU**
Executive Leader A	South	Public	no
Executive Leader B	South	Public	no
Executive Leader C	South	Public	yes
Executive Leader D	Midwest	Public	yes

Stakeholder Profiles

Each of the participants related the study questions to the specific type of EHR within their own AHC rather than generic descriptions of how EHRs in the marketplace are supposed to function with regard to data capture and clinical care. For those bureaucrats who routinely leverage and analyze the Institutions' SDH data but are not directly involved with clinical work or the EHR platform itself, some responses were more difficult to elicit. This may be due to restrictions on the use of the technology and limited familiarity with its operations and implementation.

A pivotal role within the AHC and its associated health system leadership hierarchy is the Chief Medical Information Officer (CMIO), who may be alternatively appointed as the Chief Health Information Officer (CHIO). Distinct from a Chief Information Officer (CIO) who oversees an organizations' IT systems and infrastructure, the CMIO is a physician healthcare executive with health informatics expertise that is positioned to work with or manage other doctors, nurses, the pharmacy, specific clinical applications, and systems (Leviss & Mohaideen, 2006). The CMIO is often considered the principal officer responsible for the successful execution of the EHR, and their responsibilities reflect their dual areas of expertise between physician and clinical technology systems (Chief Medical Information Officer, 2017):

- Evaluate an organization's IT systems
- Design and apply EMR/EHR software and applications
- Convert and analyze medical and health data analytics for research and other uses
- Ensure quality of care across multiple information systems
- Leverage medical and health data to improve services and daily operations
- Train physicians and other medical professionals in IT systems and applications, especially EMR/EHR and computerized physician order entry (CPOE)

This study included six (6) CMIO stakeholders who contributed significant insight and perspectives on their Institutional, regional, and community health equity goals relative to the EHR and SDH collection operationalization. Because their appointments differed from AHC to AHC, the CMIOs for this study are included within the Clinical Leadership and Executive Leadership profiles. While some AHCs did not have a specific appointed CMIO, proxy roles were also included in the recruitment invitations.

As expected, each Institution and its associated health system varied in size, funding, expertise, business and financial incentives, inpatient, outpatient/ambulatory settings, affiliate and public-private relationships with various external organizations and the communities they serve. Some AHCs designed entire rural health initiative programs to enhance the primary care for those specific communities, with governance managed via state statute and a supported annual budget. Other Institutions focused on urban health disparities centered around their downtown city residents, especially those in low-income and minority communities. Others did not have a specific population as a target and instead broadened the scope of their mission statement as providing equal care and access to all. Meanwhile, some specifically directed efforts at the local immigrant population, particularly undocumented migrants. This population is consistently, negatively impacted by social determinants of health such as poverty, food and housing insecurity, lack of educational attainment, and challenges with healthcare access. These groups, in particular, face stigma and marginalization, difficulties with acculturation, and fear of deportation, which are unique challenges compared to other AHC target populations (Chang, 2019). Even still, some Institutions are geographically situated in both very affluent and impoverished sections of the city, which created striking dichotomies in their managed care settings. Clinical care settings and their program funding varied widely and could be ascribed to state funding, Medicare and Medicaid payments, statewide community consortiums, grant funds, or any other variation. LGU status, region, and type heavily influenced the culture at the AHCs organization and, thus, the specific stakeholder role and their own internalized perceptions of the mission.

The Institutional Mission – A Quest for Health Equity

As discussed earlier, leaders and administrators strategically rank mission-critical programs in their organizations based on several factors and circumstances. AHCs, as massive educational-healthcare bureaucracies, are no different and routinely evaluate their incentives and balance those against the needs demanded upon them. Each AHC included in this study varied in the degree to which they positioned health equity and population health as central to the overall Institutional mission. Variation was found between each type (Land-Grant, Public, Private, and Region), with some possessing explicit health equity mission statements and dedicated Offices, while others simply regarded it as part of their core work without requiring a formal declaration from their leadership.

Perspectives on the nature of the mission varied between the type of stakeholder role (leadership, bureaucrat, academic, administrative, and clinical), as some took a broader holistic view while others were more concerned with operational needs. Partnerships are an essential ingredient for many, and some expressed how recent events such as the 2020 George Floyd social justice protests and the COVID-19 pandemic acted as accelerants of internal change for more health and social equity. The data below conveys a broader picture of the sources of influence, perceptions, and narratives in which the Institutional representatives operated. In the interest of space and clarity, this analysis is focused on the most prevalent characters, and their characterizations and valuations.

Heterogeneous Perspectives Among Research, Administrative, and Clinical Roles

All AHCs all universally grounded by their core, tripartite mission of furthering the academic, research, and patient care (clinical) goals of their organization and the broader population. The stakeholder profiles summarized in Table 3 represent layers of that institutional bureaucracy and mission focus. Each person spoke contextually and within their own framework as decision-makers, program managers, data specialists, and healthcare professionals—how they believe their AHC functions, how things should be done for better health outcomes, who should ideally do them, and the barriers to success based on their own judgments and experiences.

Their respective interpretations of the health equity mission are, likewise, shaped by their personal reference level, their role, responsibilities, and the lens by which they approach key issues such as population health, community engagement, and SDH advocacy. Further heterogeneity occurred between the two (2) personas recruited for this study: (i) the implementation/street-level bureaucrat or program specialist and (ii) the strategic/leadership stakeholder responsible for the success of the Institution's EHR or health disparities programs. While the variation may possibly be random, the position and hierarchical role of each participant along with their lived experiences may have influenced the degree to which they viewed their initiatives as emergent or evolving. For some at the top of their organizational chart and in leadership, progress is viewed as steady and evolving. Others in staff positions emphasized the lack of program resources and uncertainty that a cohesive health equity mission across the AHC has materialized. Those in administrative program roles (frontline workers deeply involved in community interventions and engagements) sometimes expressed a more pessimistic worldview than their leadership counterparts, who were more ambiguous, balanced, or anodyne with regard to the mission.

Table 4 depicts the extent of this stratification with illustrative quotes from various tiers of the AHC.

Table 4

Stakeholder Perspectives on AHC Health Equity Mission/Goals

Role	Quotation
Administrative Staff	*Resources have been quite scarce to address that part of their needs. I'm sure there are other specific initiatives around health equity at [redacted], but I'd have to say they're not coming to mind at the moment, but it's a very live topic.* – Administrative Staffer G
Administrative Staff	*I would say we're still working on a system-wide strategy to engage the community in improving health equity, I don't know that we have that yet.* – Administrative Staffer C
Administrative Staff	*It was always kind of in there, but there wasn't a significant amount of resources or focus placed on that. How [to address] equities and especially underserved communities, even though we are centered right in the middle. It was always kind of just assumed that's what we were doing. Now, we are much more cognizant. Unfortunately, I can't give you anything more concrete in terms of programs that we've done. We are still currently, unfortunately, realizing those programs.* – Administrative Staffer E
Administrative Staff	*What I would describe as our mission is the Medicaid population of [redacted]. So these are a unique population of people who have some high needs. And so where we really focus on those people are in the area of emergency room visits and usage. And by focusing on that... particular aspect of that population, that starts the process of providing the health equity....So we just kind of fill in the blanks, where we see the need.* – Administrative Staffer B
Administrative Staff	*I believe we have a mission to the University. It is the face of health, it envisions healthy people and healthy society. In regards to programs, the University does have programs that help with homelessness, and they use it through the students. So the students have programs off-campus that they do.* – Administrative Staffer D
Clinical Leadership	*To some extent, there have been little projects here and there, probably not so much institution-wide, but little projects here and there looking at equity issues, and using EHR data to do that.* – Clinical Leader E
Clinical Leadership	*We're not specifically trying to say we do this as a targeted area, because we always do. That, again, is part of our role as a safety net hospital.* – Clinical Leader A
Clinical Leadership	*I think that is an emerging area for our health system. It has become a very high priority within our leadership, I would say in the past three to four years or so, to promote health equity as part of our mission. We have a number of guiding documents that sort of guide our work as a health system, and one of them is the blueprint for quality and safety. And that blueprint for quality and safety is prepared by the chief medical officers Office and includes language around promoting health equity. That is a guiding star for our organization, among other things. I know that has been a sort of declared goal in the language that I've heard our leaders use in*

	terms of promoting health equity, not just for medicine patients, but extending to our community here in [redacted]. – Clinical Leader B
Clinical Leadership	*So the institution looks broadly at health equity and shares the mission. For a lot of us, it breaks down into access and equitable care. We're always working on creating the best access possible for our patients.* – Clinical Leader C
Research Staff	*There are multiple levels of health equity-related programs or offices within the university. And until recently, we had a newer initiative to address and improve health equity related activities. But that is broader than health. It's more about diversity, inclusion, and equity for employees and our trainings and other folks as well. And from the research side, I'm a researcher as well. So we have various initiatives to understand how data reflects the barriers and the other issues in terms of health equity. And that includes the electronic health records. So there are various research projects that are going on across the campus.* – Research Staffer A
Executive Leadership	*Across the university, we're also finding that there are individuals who are working in areas that they may not have specific titles that say this is a health equity space. But the work that they're doing is very much engaged in addressing health equity.* – Executive Leader B
Executive Leadership	*It's not fully developed. And I think we're just in kind of the nascent stages of this... we have a new Chief Diversity and Equity Officer that will also address a lot of social determinants.* – Executive Leader D

The variation in perspectives represented here was reflected by their LGU status and region, and perhaps less so by the public/private type. Stakeholders from LGU Institutions made explicit, unprompted references to their status as either an LGU institution or safety-net AHC for their region since it plays a direct part in the scope of the mission. As one clinical leader from a Midwest LGU put it:

> *"[redacted] is a land grant institution. So we are duty-bound to the state right to take care of the citizens of the state…we are one of only two safety-net hospitals in the state of [redacted]. Obviously, being in the middle of [redacted], except for a couple of population centers, is a pretty rural area with a lot of underserved populations. And a lot of the mission that we have very much is around rural [redacted], whether it's the School of Medicine, or a new healthcare clinical enterprise.* – Clinical Leader A

Another clinical leader from a Southern LGU noted that "*In terms of true health equity, especially for underserved populations, we've always declared ourselves to be a clinic that serves a health system that serves an underserved community*" (Clinical Leader D). An administrative staff member from the Midwest, Administrative Staffer F, commented on the reality of their AHC's population relative to the region: "*We just have lots of patients that are circulating to the local health system, or the local hospital system, who don't have access to care or not aware of the resources that are available to them and are just sort of bouncing from one location to the other until something catastrophic happens or they pass.*" Another administrative staff member from the Northeast, Administrative Staffer G, noted: "*We serve more patients on some form of government assistance who are uninsured more than any of the other academic medical centers. There's many levels of specialties and hospitals. So we're a safety net, understaffed, underfunded organization.*"

The notion of being the last option for the local underserved community and region, especially as smaller rural hospitals have been closing down, added an additional sense of urgency, passion, and intensity to some responses. In fact, 171 rural hospitals closed across the United States between January 2005 and July 2020, including Federally Qualified Health Centers (FQHCs) and Rural Health Clinics (RHCs) (Miller et al., 2021). While few could recall an explicit mission statement or policy declaration that referred to "health equity," each of these different AHC stakeholders articulated their accountability and relational understanding of their duties towards that end goal from their vantage point. As policies and mission statements are often considered binding, authoritative choices, the absence of a health equity mission statement or office, based on the responses, does not necessarily indicate that the Institution does not value the need. Rather, there is active and evolving work towards prioritizing it as an unambiguous goal while concurrent clinical care work and small pockets of success stories continue to emerge. One insightful viewpoint is that the Institution's official bureaucratic language had not yet caught up with the work that was always taking place:

> *I would say that health equity has always been a part of [redacted]'s mission and its character. I think the words "health equity" may not have been part of the mission statement until recently. We just had a major rebranding and I think with that came a new mission statement.* – Administrative Staffer G

When asked about the existence of a health equity mission statement, another chief in an administrative leadership role summed up a recurrent theme:

> *The answer is no. There is not. That's part of an ongoing conversation. Given that I don't think health equity lives in any one place, nor should it.* – Executive Leader B

The idea of no single entity 'owning' the health equity mission is a salient viewpoint. When considering all of the multiple, complex interventions for 'upstream' (community) and 'midstream' (individual) social needs, referrals to community resources, in addition to making informed clinical care decisions, the diffuse nature of health equity work would, indeed, be spread across the massive AHC bureaucracy between academic, research, community, and clinical contexts. The variation in perspectives across those contexts, indicated in Table 4, results from a multi-dimensional goal (health equity) being injected into a multi-layered organization with diverse specialties and priorities. Logistically and operationally, the many vectors of addressing health outcomes require a range of specialties that no solitary person or unit can successfully accomplish in isolation. This precisely describes the desire and motivation of AHC stakeholders regularly seeking close internal and external collaborative partnerships in the calculus of health equity work.

George Floyd And Covid-19 As Accelerants of Internal Change

The 2020–2022 United States social justice protests and racial unrest, triggered by the murder of George Floyd, led to a national dialogue on police violence in addition to other social equity demands that were thrust into the spotlight. Galea (2021) argues that the focus on health inequities has grown and sharpened during the past few years as racial justice issues have escalated in the public consciousness, largely onset by the killing of George Floyd. This includes awareness that while health outcomes have improved over the past several decades for the wealthiest 20 percent, several health measures have worsened for the poorest 80 percent.

An unexpected finding from this study was the degree to which the sociopolitical and cultural impact of the George Floyd murder and 2020 social justice protests reverberated within some AHCs. Some participants emphasized that their Institution understood that the time for reckoning and action was now in this moment in history. In addition to recognizing their own biases and deficiencies in healthcare and health equity, there was added scrutiny on their own cultural competency or culturally responsive training, resources, or needs within the AHC, which have become priorities. An administrative staff member from a Midwest LGU put it plainly:

> *It's like all the stuff that's happened the last two or three years. I mean, real talk, we got together with several institutions after George Floyd, you know, to come together on this statement on racism in healthcare and so we're definitely in a better place than we've ever been.* – Administrative Staffer F

Another unprompted reference to George Floyd was made by an administrative staff member from a Western AHC:

> *In the beginning [when] George Floyd [happened], a commission for equity was formed in terms of not just tackling social issues but also addressing health equity. You know, to be honest, before that health equity was kind of encompassed in the mission statement or the mission of the university itself. And the central idea behind its mission and its values is humanism.* – Administrative Staffer E

Confronting public health inequities, its systemic rigidities, biases, and SDH such as poverty, limited access to education, and discrimination in the jobs market, are all reminders of how far AHCs must continue to evolve in order to better serve vulnerable groups. For some, the exposure of internalized biases in healthcare which occurred recently as the result of social unrest was revealing:

> *We would ask someone what their language preferences, but it may not be a normal part of every single patient process. And it should be, you know? Just because we're talking to someone in English doesn't mean that we should be automatically confident that that's a language that they're comfortable speaking in. When I started out in healthcare, there were abbreviations for race, like 'AM' means African American male. 'HM' means*

> *Hispanic male. But what I noticed for Caucasian patients is they tended to just put 'M' or 'F,' right? They wouldn't put 'CM or 'CF' to indicate Caucasian male or Caucasian female, which is how it's delineated in the medical abbreviation dictionary. They just didn't do it. And I don't think everyone who did that was necessarily racist. They probably just saw that that's how it was done. But the doctor who was sitting behind me, he's like, "You know what, I didn't even realize I did that." And it wasn't a Caucasian doctor, it was just someone who was doing it that same way, you know.* – Administrative Staffer F

In the above example, the administrator recognized that even a (presumably) physician of color was susceptible to a subtle, internalized a bias of assuming the Caucasian race was a normative field to input in their EHR for their patients. They realized that by deliberately labeling other races with a code and skipping over Caucasians with a specific race code, they themselves had assumed Caucasian patients were to be centered as the default, normative value in their worldview. If these subtle microaggressions were taking place behind the scenes in the data capture process, how were they materializing and manifesting in direct, real world interactions with patients? By recognizing the internalized failings and actively doing their part to re-educate and retain the workforce, many of the participants believed that it was a fitting time in history to shift the trajectory of their AHC. As an administrative staff member, Administrative Staffer E, observed: *"I think this is the opportune time, the environment, at least in terms of nationally, politically, to kind of address these things. It's also a volatile time."* In addition to individualized reflections within organizations that were onset by the murder of George Floyd and social justice protests, the national mood also demanded an examination across the spectrum from rural and urban landscapes and how COVID-19 injected yet another accelerant of change.

The Cross, Califf, & Warraich (2021) study examined the health disparities gap between rural and urban environments, which remain a crucial focus for many organizations and social services organizations. A clinical leader from a Southern AHC touched on the urban and rural divide within the current milieu of addressing systemic racism:

> *Our whole institution goes from urban environment to very rural environment. So we've got lots of lots of different ways people can be underserved. You can be underserved because you've got because either systemic racism or because of socioeconomic factors in the city, you can be underserved because you're in a rural area, like nobody's around for 50 miles, right. All of those are our areas which we serve as an institution, so it's pretty broad.* – Clinical Leader E

For this particular leader and their institution, it was clear that no matter your geographic location and zip code, an element of discrimination or negative source of SDH would follow an individual from one environment to the next. Such a dynamic suggests that the institutional expertise needed to address such a wide range of health disparities across borders would usually be greater than what the AHC could provide. When a pandemic is introduced into that equation, the stressors on the providers and the institution would become even more unmanageable.

COVID-19 vaccination efforts, as an additional pressure point during a time of social unrest, created another major moment of reckoning as the federal government created equity-based guidelines for vaccine distribution to vulnerable populations (Galea, 2021). A clinical leader in a Northeastern AHC noted that COVID-19 vaccination sites were viewed as an extension of the AHC's health equity mission and commitment to its status as a safety-net institution for communities:

> *We conduct and continue to operate a number of free vaccine clinics, for example, to provide COVID-19 vaccines to members of our community or around [redacted]. So that is one way that we try to practice our health equity mission.* – Clinical Leader B

For this participant and others, vaccination efforts represented a significant, community engagement initiative that connected local entities serving communities of color directly with their AHC. By creating the atmosphere of inclusivity, they could ultimately shape the direction of the AHC's health equity goals and addressing negative impacts of SDH. One administrative staffer from a Southern AHC suggests that this linkage would be better operationalized with creating another link to the compensation incentive structure:

> *I've been at [redacted] for almost six years and have, since COVID, seen much more intentional incorporation of equity-related measures into our system goals, which are how people get paid. And I think ultimately tying performance on those equity goals to compensation is a really good idea. And specifically social determinants of health screening as one of our quality measures that drives practice compensation has been an exciting development for us.* – Administrative Staffer C

Interpreted broadly, this suggests that there would be direct and indirect lines from AHC health equity goals to community engagement to SDH screening to tracking equity-related measures to compensation. This idealistic relationship, and the Venn diagram that it conjures, has undoubtedly sparked the imaginations of healthcare providers and leaders, likely as a result of the pandemic accelerating contentious, theoretical debates on health equity.

Resource scarcity and COVID burnout as related factors, however, emerged and accelerated during the pandemic as the result of an intense reprioritization of AHC resources and people. This resource drain reverberated upon several AHC initiatives, including those related to the EHR and SDH screening implementation, negatively impacting progress that many perceived as necessary for some AHCs. An executive leader from a Southern AHC expressed concerns with resource constraints during the pandemic and its impact on screening:

> *We don't always know what each other are doing, especially during COVID when the hospitals are all underwater with COVID response….And we really want to emphasize to our providers who are all burned out, because we've had COVID that [poor screening] is not something that we're expecting them to fix necessarily…*– Executive Leader A

In this case, as lives were under immediate, short-term threat from COVID, the directives given from the leadership to its providers included a pause on improving processes for SDH screening, which was interpreted as an Institutional objective designed for improving long-term health outcomes. In other words, focus on the proximate danger rather than the long-term vulnerability. This rebalancing act was the most logical choice, from an organizational and community-focused perspective, when faced with resource scarcity and a once-in-a-generation pandemic. While the pandemic simply magnified the fissures already present in the healthcare system, it also presented opportunities to further solidify the local partnerships between AHC and community resources.

Partnerships as a Key Ingredient in the Health Equity Formula

The evolving American healthcare system includes increased demand for clinical care to large segments of urban and rural communities. As AHCs continue to be squeezed for the time and resources required to render this care indefinitely and continuously, stakeholders have recognized that strategic partnerships add to the body of expertise and services needed by managed care systems to remain effective and competitive. Internal alliances, health information exchanges (HIEs), external public-private partnerships, community-engaged advisory boards, and other practices aimed at better alignment of intra-Institutional resources are now part of the incorporated business practices of AHCs to ensure excellence and sustainability.

Leveraging resources and expertise from these partnerships have become an essential practice to help realize the AHCs' health equity initiatives. They bolster the credibility of the AHC, incentivize participation, and generate an awareness of resources. As a kind of advocacy coalition, the extensive training, research, technology, capital, and personnel resources of AHCs can be combined with those of social work, public health, and managed care backgrounds to complement their service mission. An executive leader in a Southern AHC realized the benefits thusly:

> *One of the things that I've learned is that it takes partners from multiple sectors in order to be successful. And it's important that we have a sense internally of who's doing what, as we reach out to community partners, because at the end of the day, there are only so many people working on food insecurity.* – Executive Leader B

This particular executive leader commented elsewhere on the need to comprehensively inventory all of the available internal AHC resources and staffing dedicated to health equity work. To do so would create a strategic mapping between community needs and demands, available AHC funding and resources, and the ability of leadership to marshal community partnerships collectively towards achieving health equity objectives. This remains an important theme as there is no "one size fits all" approach with either policy, community engagement, population health, or addressing health disparities in urban and rural environments. Coalitions, however, are crucial for organizations regarded as safety-net institutions. Without such active coalitions, SDH disparities are potentially exacerbated even more and the safety-net model is weakened with negative impacts to the region. An administrative staff member in a Midwest AHC illustrated this point within a rural health context:

> *We do have a lot of outreach activities that happen with a lot of the affiliates that I mentioned. Having those relationships [exist] are because of the mission. We also have a pretty big focus on rural health strategy. And a lot of that is really driven by a lot of the dynamics that are going on with healthcare in general, especially in rural part, where you see a lot of the rural hospitals closing down. It's difficult to recruit fighters into those.* – Administrative Staffer A

As this staff member observed, the shuttering of rural hospitals has only increased the necessity of coalitions and partnerships where entire communities and people suffer from a lack of care. Small, rural hospitals, clinics, and social services often rely on grants and incremental funding opportunities to ensure they remain solvent and continue treating patients. When those funding streams evaporate, the barriers and hardships that rural residents experience such as poverty, community infrastructure, environmental health, food and transportation are all exponentially exacerbated. Community coalitions are essential for another administrative staff member in a Southern AHC where the county has been shown to be more impactful with their networks than the AHC:

> *We don't have like an overarching collective impact framework or anything like that. Instead, I would describe our role, or at least my team's role, more as plugging into existing community coalitions wherever we can, which are often county-based. For example, there's one called the [redacted], which is a formal collective impact framework that we participate in. I would say the most formal one that my team participates in is in our county department on Aging, which has a five-year strategic plan and we're responsible for some*

> *of the goals that they identified in that plan.* – Administrative Staffer C

In this example, the AHC's clinical arm is responsible for successfully executing strategic goals from the county rather than the AHC itself. From the perspective of this staffer, the AHC had not yet arrived at a mature funding or operational state to be able to address community needs on their own. It became necessary, therefore, to trust that the county's leadership, sponsorship, and direction would provide the impetus needed to create a robust coalition that would grow over time. With one particular historic AHC, existing state and community partnerships grew so strong over time that some entities were eventually absorbed into the larger AHC bureaucracy. A clinical leader from a Northeast AHC described the merger and its complexity as follows:

> *So we're a big organization and an old organization. We have lots of different stakeholders. We are not sort-of "one" organization, but an amalgamation of lots of different institutions that have almost gotten married over time. For example, in the past several years we formed a relationship with [redacted]. In 2017, we formed a partnership with [redacted] so that institution became part of our organization as well. So we encompass a number of institutions that existed before [redacted], and so it increases the overall geographic size of our Institution, and the complexity of managing the EHR as well.* – Clinical Leader B

Here, we observe that while growing the coalition may expand the overall reach and resources of the Institution, it also presents complicated administrative, operational, and technical challenges that must be resolved to provide optimal service to its constituencies. There is no indication, however, that such broad-based coalitions would provide objectively improved service, better care, or increased efficacy with SDH screening and EHR use. Nevertheless, these partnerships and coalitions are vital as kind of bureaucratic collective and failsafe for communities.

Many of the trends of hospital–community partnerships across the country can also be traced to efforts to improve health equity, as CMS awarded funding to 31 hospitals and other healthcare organizations to help boost screening for social needs and referral to community services through its Accountable Health Communities program (Kuehn, 2019). The AHCs represented in this study, incentivized by either reporting, accreditation, financial or moral obligations, have emphasized engagement as a pillar of public health outreach to include and engage with those in poverty, communities of color, immigrant communities, and others experiencing health inequities. Brewer et al. (2020), in the literature review, noted that inclusivity for marginalized and vulnerable groups is crucial for the codesign at all stages of innovation. Authentic efforts to advance health equity on behalf of the AHC will be more successful if they are designed with (not simply for) communities experiencing health disparities.

The People – Patient and Community Needs

At the macro level, many AHCs in this study contend that health equity goals are embedded, in some form, within their broader Institutional mission statement. At the micro-level, the AHC stakeholders (providers, case managers, social workers, community navigators, students, and partners) work directly with the people and rural and underserved communities to operationalize those goals through direct and intimate personal engagements. This can include patient navigation, telephone calls and prompts, reminders for cancer screenings, vaccinations, and other healthcare needs documented in the EHR. As the first section addressed the Institutional factors, this section will reveal various examples of how the Institution used technology to meet the needs of the people and the community.

It may be tempting for those not directly involved in healthcare delivery to conflate risk factors: personal medical risk factors, SDH risk factors, and behavioral risk factors. While there are sometimes clear linkages and dependencies, behavioral health often falls in the gray area between SDH and clinical healthcare. Whereas clinicians primarily provide clinical care and may want to provide assistance to address SDH or behavioral health, they are often not trained or empowered to do so. Neither are they incentivized in the current U.S. healthcare reimbursement model. Addressing SDH is more time-consuming and requires more resources, follow-up, and other intersected changes in the institutional prioritization matrix. An executive leader from the Midwest provided an illustrative example of the clinical workforce entrusted with responding to behavioral health and SDH extracted from the EHR:

> *My clinical specialization is healthcare super-utilizers. And so I look very closely at that population. I run a program here called [redacted] for complex patient care team. And what we do with that is we look at the super-utilizers of the emergency department and over the health system. And so as it turns out, 75% of those individuals, the preponderance of the excess utilization comes from behavioral health conditions and homelessness with their return visits to the ER and so forth. So we have people that come over 200 times a*

> *year to ours and other emergency departments. And we're taking a close look at like, what drives all that utilization?* – Executive Leader D

Health informaticists, population health experts, and practitioners who leverage the EHR data, as in the above example, often use their knowledge of people, systems, and technology to make policy recommendations based on multifactorial analyses of the conditions in communities. Those analyses may also help guide administrators and leaders to create specific programs to address community needs. The participants in this study provided various descriptive scenarios of how the EHR connects to their engagement with the people and meeting community needs.

EHRs and Guided Community Engagement

It is premature to assess the overall effectiveness of AHCs' use of the EHR to create and sustain programs that impact the community and population health. However, the stakeholders in this study provided evidence of rudimentary progress, some of which include feedback mechanisms back to the AHC from community members. For example, a clinical leader in a Southern AHC discussed how their EHR implementation itself was designed:

> *There is no such thing anymore as 'how the EHR engages everybody.' Really, the EHR is the principal tool for the care of patients and communication in the health system. So every meeting has to include a conversation about the EHR, every change that we want to make has to take it into account…We tried to get patients very engaged in the design of the system, especially where it impacts them. For things like how they register and how they're reminded and how they work within the MyChart patient portal and what access they have. But for a lot of us, as providers, as nurses, everyone sort of is trying to look out for the patient and their experience, but you really need them at the table to speak to what the actual experience is. So yes, we are trying to do that. I'm not sure how well we're doing it, but we're trying.* – Clinical Leader C

This feedback mechanism supports the recommendations stated earlier by Brewer et al. (2020), whereby inclusivity for marginalized and vulnerable groups is crucial for the codesign at all stages of innovation and implementation of digital health tools. This systematic, inclusive process allows the community to become stewards of their own health outcome data when there is a vested interest in ensuring its success. In some cases, EHR data has been used to justify the creation of novel programs which directly benefit community needs. An administrative staff member from a Western AHC explained the impact of their EHR data in creating a number of interrelated programs:

> *We have a smoking cessation program that was borne out of this data, with our clinical pharmacist here on one of our special needs, and then for the housing assistance. That was how we created a relationship of [redacted], which was a homeless program for women, and abused women. So that data also went to them and had a positive outcome…So it's a long road, I think. But I think it's a worthwhile endeavor for our organization.* – Administrative Staffer E

In this example, there is a direct correlation between the quality of the data produced within the EHR and the ability of institutional champions to provide persuasive justification to executive sponsors that additional programs could be borne from the collected data. The architects of the smoking cessation program, the housing assistance program, and other programs certainly pointed to the power of their EHR and the body of evidence produced from its toolsets. By painting the broader picture of real-world impact and targeted community engagement, those champions successfully forged a winning narrative which yielded funding, resources, and staffing to meet the needs of vulnerable populations. In another example which addressed transportation and housing SDH domains within the community, one executive leader from a Midwestern LGU connected their EHR to specific services:

> *There's a company headquartered in [redacted] and they've created a platform with Lyft. And we're using it now for inpatient discharges. So we can offer transportation rides home for people that don't have complex medical conditions. So because we know transportation is a barrier to healthcare, what we also wanted to be able to do was to create patient-matching between a Homeless Management Information System [HMIs] and EHR. We could then feed the HMIs if we found a homeless person, and they become part of the registry.* – Executive Leader D

As illustrated here, the utility of an EHR can evolve from merely a clinical charting tool to one that helps integrate with and promote other services that directly benefit patients in need and the community. Community and patient engagement through the EHR portal itself is interpreted by an executive leader from a Southern LGU as a specific strategy they use to address equity:

> *We also think access through MyChart as a patient portal is also important. And that's one more way we can provide care, whether it be virtual care, telemedicine video visits, asynchronous care visits, convenient scheduling, and stuff like that. So MyChart, I think, is pretty critical to our access, where patients have some level of access to their care team remotely without having to just get on a phone call and schedule something in person. So I think those are the two biggest ways we are addressing equity and access. Just by making sure anyone can have access, we're doing our best in that way.* – Executive Leader C

These programs and active efforts towards addressing health equity would not have been achievable without Institutional and community champions who fought to direct attention towards improving outcomes via their EHR. By prioritizing these issues as part of the AHC agenda, and leveraging the EHR to facilitate the work, population health and community health goals can be slowly realized over time. Despite the obvious and positive successes, the incremental pace of this progress has shaped various stakeholder perceptions in different ways that are not always optimistic.

Perceptions of Meeting Patient/Community Needs

Some participants in this study made clear and separate distinctions between what happens on the "academic" side as opposed to the “clinical” mission of the AHC. Clinical operations and its healthcare culture were primarily associated with the attached Hospital/Health system that sometimes does not integrate with the academic campus. However, the respective narratives tended to focus on relational connections, engaging in collaborative and interdisciplinary opportunities together, and working to ensure that community needs are being met. All participants—across role, AHC type, and region—expressed their belief that their well-intentioned, collective work was “ongoing” or a “work in progress.” This sentiment mainly related to perceptions of the current state of their EHR implementation, the recognition of the importance of SDH screening and reporting in the EHR, and the impact of their health equity programs in the community. Even when recalling examples of success stories, a persistent mood reflected in the responses was that the impact was not deep or meaningful enough to address the needs and that more could be done given adequate time and resources.

Evolving And Lagging Progress

As mentioned in Chapter Three, the incidence of stakeholder references to "ongoing" and "work in progress," demanded the creation of new codes to accommodate the repetition of this theme. Even in cases where specific AHC institutions were (by comparison) better resourced, more mature in their health equity model, or had more advanced, integrated technology and SDH screening, their representatives insisted that their successes were incomplete, not fully refined, or still evolving. Table 5 provides a sample of various perspectives across the spectrum narrating the view that their AHC still has much to do in order to make real progress.

Table 5

Stakeholder Perspectives on AHC Progress Towards Health Equity Goals

Role	Quotation
Administrative Staff	*So I'd have to say we're behind the eight ball on that. We don't currently have any SDOH screen in our system. We've been talking to different constituencies, have been talking about it, but we may not be the foremost groups that are served by the EMR because as you know, it's an academic medical center. There's many levels of specialties and hospitals...having social determinants of health screening in the EMR has not been high on the agenda at all.* – Administrative Staffer G
Administrative Staff	*The biggest issue that we've run into in the near past here is that we don't, frankly, do a great job of capturing what areas have.* – Administrative Staffer F
Clinical Leadership	*I'm not sure we're far enough along to really measure the outcomes. I will tell you that I think we're in a moment of awakening when it comes to what the EHR is really about. So I think that this is probably happening nationwide, too. But we're starting to realize that it's not a record. You know, [redacted] said it best, you know, record means this is where you come to do your work. And it's not, it's where we all come together to manage the patient. And we're starting to sort of get that awakening here where people are starting to realize what impact it has on what you do.* – Clinical Leader A
Clinical Leadership	*I think that is an emerging area for our health system. It has become a very high priority within our leadership. I would say in the past three to four years*

	or so, promoting health equity as part of our mission – Clinical Leader B
Research Staff	*We are just in the process of trying to get better descriptors of inequality. I believe that [we have] in the order of 20% of the people have proper race or ethnicity. And even that data is kind of fuzzy.* – Research Staffer C
Research Staff	*The outcomes, I think, would be researched down the road. Right now, we are just at a preliminary stage about how to integrate that. But the long-term goal is to come up with a better treatment plan that considers all these other factors, at the same time, develop policies and recommendations that consider those factors or research applications as well. And those outcomes can be measured in terms of in general health index, like how people are doing in different vulnerable populations, and groups, their healthcare utilization, their health outcomes, as their as well as policy changes from the university and state and local governments. But those are long-term outcomes, and we don't have a proper framework to evaluate those outcomes yet.* – Research Staffer A
Executive Leadership	*It's not fully developed. And I think we're just in kind of the nascent stages of this. We have a new Chief Diversity and Equity officer that will address a lot of social determinants. She's just getting her legs underneath her. So I think it needs to come from all areas of the healthcare system. So there's a unifying function for this person to bring these things together. I just created a behavioral health interest group to draw together all the clinicians that are interested in increasing the screening, referral, and treatment of people with substance use issues and mental health issues.* – Executive Leader D
Executive Leadership	*We are really just starting on this journey. As I mentioned, we've launched a couple of pilots…Our next step is to figure out how to standardize a screening process in our organization and roll it out in the various sectors.* – Executive Leader B
Executive Leadership	*We've been working to set an organizational goal across our 12 hospitals to collect food and security data on every patient. And then [redacted] team is partnering with us to be a resource, at least for some of those hospitals, where if patients self identify as food insecure we could actually start handing out resources. So, we're trying. It's not perfect, but we're swimming in that direction. I would love to see even more of an explicit commitment to equity built into everything we do, but I think it's getting there.* – Executive Leader A

These quotations and the sentiments expressed by the participants illustrate that the ongoing refinement of their respective EHRs, SDH screening processes, and health equity work is perceived as a living, breathing initiative. There was clear uncertainty about how far along they actually were in their evolution as there was no baseline referenced or a specific view of what health equity would actually look like in its ideal state. This tracks with the nature of the U.S. healthcare system, in general, as it will never be totally and wholly resourced to meaningfully confront the entire spectrum of equity challenges in society. While some of the respondents were upfront about their perceived shortcomings, many seemed to slightly hesitate on their answer when comparing themselves with others. For example, one Executive Leader from a Southern AHC, Executive Leader C, immediately drew comparisons to a neighboring AHC and responded by asking if they were further ahead than their regional counterpart with SDH collection and health equity progress. As I did not know the answer, I could not offer any evidence to the contrary. Since no national baseline or standards have been established on health equity progress, individual AHCs may try to informally ascertain their own evolution based on improved health outcomes from other regions and counterparts. This highly subjective perspective with its many variables is obviously not a scientific measure but rather a gut instinct or perhaps general "feeling" based on conversations with their counterparts or media campaigns/announcements about AHC health equity programs. Without a rubric or standard to assess progress, AHCs are free to interpret their own measures and justify their activities/accomplishments to their own local, regional leadership and communities. When there is a vacuum in national policy, the results are an inconsistent application of accountability as the norm. As some AHCs in this study were better resourced than others, the inherent inequities between AHCs themselves were also evident.

Resource Disparities: Technology and Workforce

Inequities between and within AHCs relate to one or more of the following: resource disparities with respective IT teams, interoperability of technologies across environments, access to social workers and frontline community navigators, workforce competencies, financial and administrative support, and program development or maturity. When different hospitals manage different EHRs and yet want to share records with one another, the systems may not be compatible or interoperable with one another. For example, an executive leader from the Midwest discussed the challenges of connecting disparate hospital technology systems together and the difficulties with tracking behavioral health data:

> *There's a disparity that arises from the use of EPIC, because if you're in the network, it's great. You can see almost everything. And you can get to the highest level of interoperability, which in my mind is, 'I can see everything that I need within what I'm used to, without having to navigate anywhere else within my electronic health record to see exactly what I need.' So labs here in my own hospital, appear in the same queue as in other hospitals which appear in the same queue that I have here. And that's true interoperability. But if you think about it, we have three academic medical centers and a safety net hospital. Then we have 40 Different FQHC sites, and then several community mental health centers which are, you know, completely disconnected. And we know that we need to be able to integrate behavioral health into this. How do you interconnect all that, right?* – Executive Leader D

The complexity of connecting multiple academic medical centers, community health centers, and their respective programs and dissimilar EHRs cannot be understated. It requires substantial funding and a level of technical sophistication that is often not afforded to many organizations, as the evidence from this study suggests. As this particular AHC was considered financially solvent, the same executive leader offered commentary of the inherent disparities between their well-resourced AHC and the referral social service networks used by the institution:

> *In healthcare, we have this embarrassment of riches…we've seen rapid EHR adoption, we've seen IT budgets going up year over year, and then you step into social services, and it's the vast wasteland.*– Executive Leader D

Comparatively, the available grants, federal and state funding, revenue and budgets for many AHCs would easily surpass most social services networks in the country. However, in contrast to that 'embarrassment of riches,' an administrative staff member in a Northeast AHC offered a counter-example of the state of their Institution's dearth of both people and technology resources in the context of SDH screening in the EHR:

> *We don't even have the roles. We have minimal social workers. We have a nurse-heavy, weird kind of staffing structure, which is very heavily union-driven. So we don't really have MAs [medical assistants], we have nurses. People may not be really working to the top of their license, but we don't have a lot of ready, support staff who can do care coordination. We just don't have that. So there's a technological barrier in that it would need to be put into the EMR, but it takes resources to do that. They literally have to pay whoever's working on it to build it. But then again, once it's in there, will it get used? The workforce is currently not sufficient. We just don't have enough people in the social worker / care coordination role to do it. And we would have to make a new workflow because we don't.* – Administrative Staffer G

The disparity illustrated in this account was clearly frustrating to the staffer, knowing that needs are being unmet and there is little on the horizon that can be done about it. Within an AHC itself, the imbalance of internal resource distribution can also proliferate amongst departments and programs, especially with regard to addressing SDH. One clinical leader in a Northeast institution narrated the problem thusly:

> *There is a great deal of talk about what one can do with SDOH. There is a great deal of concern that merely asking is not appropriate. And so there are sort of isolated cases in which there's been a long-standing collection of social in terms of health with active intervention. So our main Pediatrics group has asked about food insecurity, housing, and transportation for a long time. They have food boxes in their clinics so that if someone's identified as food insecure, they can actually hand them a resource. They have dedicated social workers that they can work with to follow up and work on all those sorts of things. We have a few other clinics also who have social workers who are interested and have been collecting data even more broadly than those three categories. But I would say that those are the exception rather than the rule. Most groups cannot afford to have they can't afford front desk staff or social workers.* – Clinical Leader F

For an AHC with fewer resources than expected, the workforce may try their best to simply live with what they have and continue to search for partnerships and collaborators that can help make incremental progress with the health equity mission. These examples of EHR/SDH implementation and workforce resource disparities tell part of the story related to Institutional barriers to success. When asked about future trends and outcomes for their AHC, the EHR, and SDH collection, the respondents provided an array of different responses (including resource disparities) and other rate-limiting factors. Real barriers exist and are systemic, and they have to work within the conditions and boundaries that are preset.

Barriers and Incentives as Drivers of Future Outcomes

The state of DHT in healthcare has shifted dramatically since the 2020 COVID-19 pandemic disrupted the sector. A 2021 survey from the financial adviser BDO revealed that 60 percent of healthcare organizations had initiated new digital projects since the start of the pandemic, while 42 percent are accelerating some or even all of their existing digital transformation plans (Eastwood, 2021). In January 2020, just 24 percent of U.S. healthcare organizations had a virtual care program. However, by the fall of 2020, 80 percent of physicians claimed to have used telehealth as part of their routine care. While the pandemic and other forces of influence continue to disrupt, drive, and shape conditions for AHCs and other healthcare organizations, they have also highlighted the extant barriers that must be addressed with better incentives. This includes removing obstacles to optimizing workflows in the EHR, capturing more precise and better SDH, and infusing more resources where needed to act upon the data when collected.

The top AHC barriers articulated in the interviews were: the length of the SDH screening, lack of human resources needed to conduct the screenings, dearth of social workers and other referral services, optimizing the EHR workflow, lack of widespread interoperable technology adoption, and challenges in training a culturally responsive workforce. The representative examples presented in Appendix H from across regions, AHC types, and stakeholder profiles illustrate the extent of the barriers nationally. A clinical leader from a Northeast AHC articulated a common theme amongst many, that infrastructure and behavior are at the crux:

> *One barrier is that [screening] is a lot of questions. We think patient, self-administered is the way to go. But there are technology barriers to that. And not just technology, there's people that don't fill out questionnaires, even people who have the resources don't do it. And then you have to deal with the infrastructure in the office, if you want to deal with tablets, and having people do it that way. That's a lot of infrastructure, a lot of trouble. Patients these days don't like touching tablets, because they think we'll get COVID or whatever.* – Clinical Leader E

This three-tiered barricade between patient tolerance, office staff workload, and technology infrastructure represent the heart of the problem for many AHCs. While the patient-organization digital divide referenced from the literature review remains a concern, this study presents numerous other conspicuous and practical factors which occupy the majority of anxieties towards a successful future outcome. AHCs must first train a culturally responsive workforce, they must acquire the EHR tools, they must assure that screening tools have a smooth integration into the technical workflow, and finally they must then reassure a skeptical public that the data collection is not an opportunistic or intrusive process but a helpful one. The quote from an administrative staff member at a Northeastern AHC in Appendix H, Administrative Staffer G, details the numerous screening tools that effectively slowed the nurse triaging process for the primary care provider. With additional social workers, this could perhaps be mitigated for better outcomes.

When asked about the future of EHR/SDH and health equity at the AHC and to describe any local, regional, or national trends that will impact the field, many respondents discussed some of the incentives for overcoming the aforementioned current barriers. Of particular note was an expansive and incisive narrative from an executive leader from a Southern AHC who connected multiple points of financial incentives from payers, collected metrics, and where the federal standards are trending:

> *The future? You know, it's very interesting that you asked this question. Yes, I do see trends coming down the path. And I think they're going to be driven by payers. I do think that external agencies and payers will be driving forces. And there's one thing in particular that I am tracking very closely. The Centers for Medicare and Medicaid Services has a list of metrics that they mandate that health systems report on. And they change from year to year. As of December of this year, CMS measures under consideration, which are…it's reams of new quality metrics, but there were three related to health equity.*

> *One is on the screening for the column social drivers of health, that will impact hospital inpatient payment and some hospital inpatient payment. The second is the screen-positive rate for social drivers of health, that will also have an impact on hospital payments and their two payments, types of they've included hospital IQR [Hospital Inpatient Quality Reporting] programs, and MIPS [Merit-Based Incentive Payment System]. And then the third was kind of interesting, is a hospital commitment to health equity. And that also will have an impact on hospital IQR program….*
>
> *So it's interesting that you would ask this question, because the trends that we're seeing is that now CMS is actually looking at this. And we think this will be driven by whatever comes out of the Accountable Health Communities now that all the data has been collected, what did they burn? Do they really see changes in cost and utilization for Medicare and Medicaid beneficiaries who are screened and referred for follow-up services. But the other thing is, we also know where Medicare goes, Medicaid follows. –* Executive Leader B

Other clinical leaders, such as Clinical Leader F, also reflected this sentiment and expressed hope that reimbursements for mandated SDH collection and reporting would become commonplace. These incremental moves from Medicare, Medicaid, and other payers would unquestionably shift the landscape in healthcare towards ensuring that electronic SDH collection and health equity for medically underserved populations remain centered in the care process. Combined with a stable set of governance structures, as one clinical leader articulated, this would create an ideal paradigm for AHCs:

> *We are interested in trying to refine that over time, as I'm sure most institutions are, in terms of how do you get to the sort of Goldilocks ideal, you know? Not too much governance, not too little but just the right amount of governance, to operate efficiently. To make sure the changes made to our systems are consistent with our strategy as a system, make sure that stakeholders have the right level of engagement and approval and oversight. –* Clinical Leader B

The EHR systems for each of the AHCs in Appendix H serve as a singularly unique and powerful tool that can intervene and add to their institution's level of success and connectedness. In the end, though, it is simply a tool. Likewise, SDH are essential markers and indicators, but they are merely data points residing in the EHR, and a means to an end. The EHR is not the panacea for the layers upon layers of more prominent, complex barriers and incentives that intersect in these environments, as demonstrated by the findings above. Having a more informed understanding of the role of the EHR and better Institutional support is crucial. Still, the future state for AHCs and health equity is driven by far more than full technology adoption. A workforce is needed to capture data on SDH and act on this data (social workers, care navigators, etc.), and sufficient resources and networks are needed to provide social services to patients who are flagged by developed technology and workflows.

Chapter Five: The Technology and Process - Connecting the EHR to Health Equity

While case managers, social workers, community navigators, partners, and others continue their frontline work to engage with and meet community needs based on the AHC mission statement and goals, equally critical is the technical data analysis and informatics work necessary to optimize the supporting technologies, SDH data capture, and related workflow processes. This section will address the core, practical aspects of the central research question: *how are SDH documented and optimized within the EHR as a focal point for AHC healthcare professionals working to advance health equity*? Several of the perspectives articulated in Table 5 shared that while there may be some pockets of individuals or programs who make a direct connection between the EHR/SDH data and health equity, it is largely an ongoing “work in progress” – a phrase repeatedly used by nearly all of the AHCs in this study. Nevertheless, understanding the choices made behind the scenes is an important marker in explaining how the bureaucracy responds to multiple externalities and the frontline needs of the community.

SDH Data Collection and the EHR – The How, What, and Why

The interview protocol, see Appendix A, asks the respondent to describe the AHC’s experience collecting SDH fields in the EHR, how they were prioritized amongst the wide variety of options, and by whom. For example, were the decisions made arbitrarily by an internal committee, or were multiple workgroups engaged with community advisory boards and other forms of input?

Selecting and Prioritizing the SDH to Capture

The overwhelming majority of respondents directly involved with patient care stated that, for both simplicity and ease of use, they simply opted to use the “out of the box” tools already available and integrated with their EHR platform rather than develop their own. Nearly all were users of EPIC, the most popular EHR, and almost all used the “SDOH wheel” to leverage clinically validated assessments into the system for the following SDH domains:

Table 6

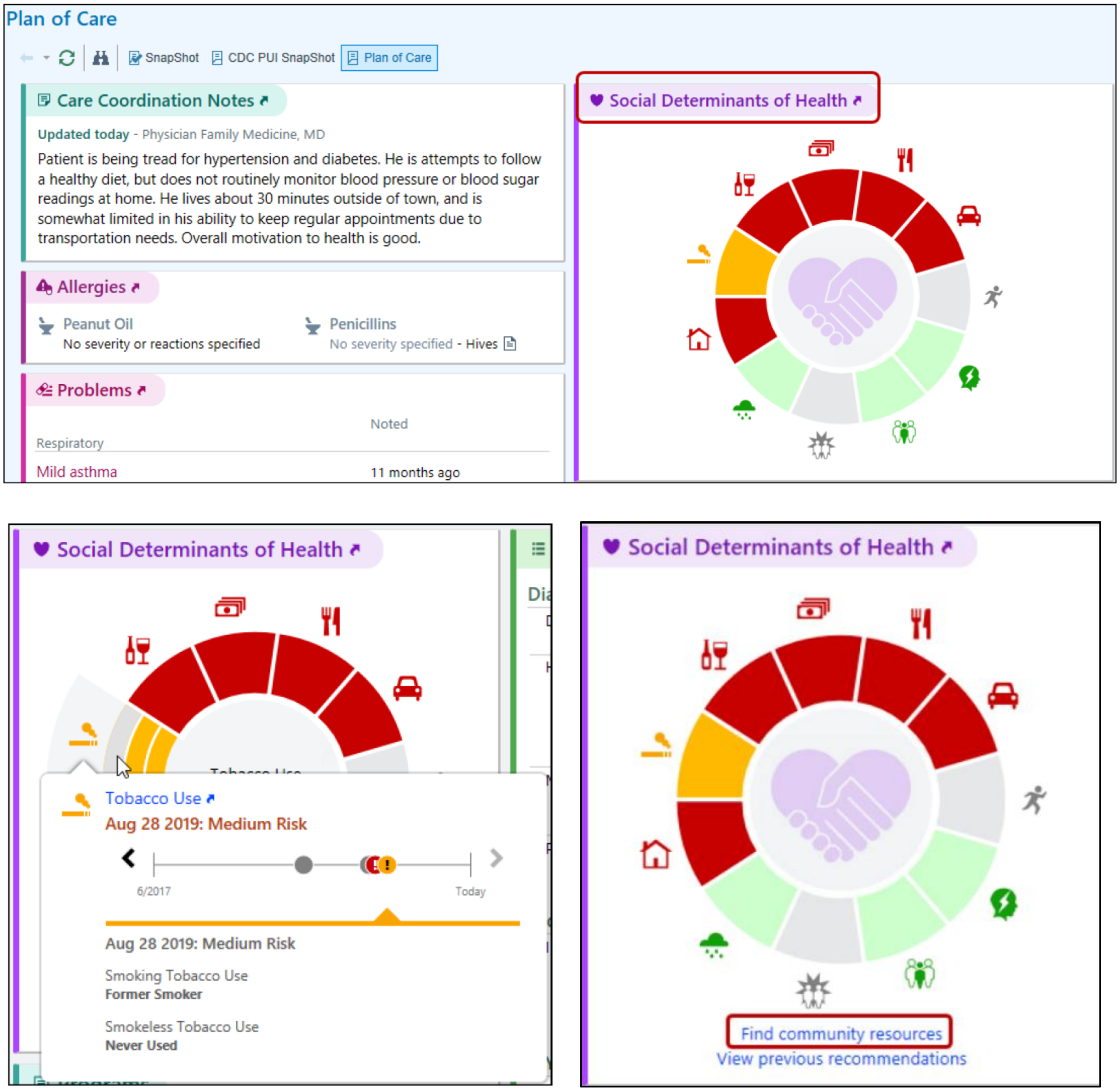
SDH Domains Used Within EPIC

Domain Number	SDH Title
1	Alcohol Use
2	Depression
3	Financial Resource Strain
4	Food Insecurity
5	Housing Stability
6	Intimate Partner Violence
7	Physical Activity
8	Postpartum Depression
9	Social Connections
10	Stress
11	Tobacco Use
12	Transportation Needs

Figure 8 depicts the user interface for providers to record and input their plan of care, notes, SDH domains, find community resources, and other problems that can be tracked longitudinally. The patient's risk classification for each domain is based on their previous responses to the assessments, with darker red areas of the wheel indicating the highest level of risk. A high-risk classification for food insecurity, for example, can trigger the provider to use the timeline to understand better when they became at risk and refer them accordingly. By using this wheel to first select the SDH domain from Table 6, the clinician is given a powerful tool to longitudinally track the progress of the patient’s upstream needs and offer referral services and resources as needed. As opposed to a paper record, this keeps the record digitized and accessible, even if the patient moves to another EPIC-compatible system in a different healthcare setting (provided the setting participates in a health information exchange). It also allows for structured data extraction, which helps informaticists, researchers, and population health professionals.

Figure 8

Screenshots of the SDOH Wheel in EPIC [screenshot courtesy of participant response]



Updated today - Physician Family Medicine, MD

Patient is being tread for hypertension and diabetes. He is attempts to follow a healthy diet, but does not routinely monitor blood pressure or blood sugar readings at home. He lives about 30 minutes outside of town, and is somewhat limited in his ability to keep regular appointments due to transportation needs. Overall motivation to health is good.

Peanut Oil
No severity or reactions specified

Penicillins
No severity specified - Hives

	Noted
Respiratory	
Mild asthma	11 months ago

Tobacco Use
Aug 28 2019: Medium Risk

Aug 28 2019: Medium Risk

Smoking Tobacco Use
Former Smoker

Smokeless Tobacco Use
Never Used

However, simply because the tools are available and easy to use does not imply widespread adoption, as illustrated by quotes from the previous chapter. Numerous implementation, training, and awareness challenges exist across the spectrum. Appendix I provides multiple illustrative quotes across the spectrum on why specific domains were selected and some of the decisions made by AHC governance bodies. A clinical leader from a Midwestern LGU summed up the general prioritization and incentive structure common for many AHCs, where regulatory requirements followed an internal champion:

> *First, I would say regulatory. Like if there's, there's regulatory, we're gonna follow the regulatory and do that, then I would say if there's champions that recognize the need. So one - recognizing a need, but then having a champion that can help drive the initiative and effort.* – Clinical Leader G

This parallels the response from Executive Leader B, where a combination of regulatory and legacy needs drive the collection methodology. While regulatory requirements may force the hand of the AHC depending on the legal classification of its hospital/clinical operations and financial models, for others the incentives may not be based on any particular factors other than population health research. If EPIC provides the basic templates for the clinical enterprise, non-clinical champions in the AHC must then arduously persuade the other half of its enterprise that it is worth the time, hassle, and effort to invest in the specific kinds of SDH collection that are not tied to clinical needs. For those health informaticists and academic researchers who want to leverage the aggregated data collected in the EHR, the SDOH wheel may still not provide enough structure and formal taxonomy, according to one research staff member, Research Staffer C.

In one case where EPIC was recently implemented in an AHC, and the memory was still therefore relatively fresh with Clinical Leader C, decisions regarding SDH implementation were made largely by committees that also included community voices. This transparent and inclusive process ensured that everyone in the enterprise from “physicians, nurses, therapists, front desk, administrators, revenue cycle, lab, environmental" all shared equal ownership of the implementation.

For those executive leaders with the power to set the direction from the top-down, decisions regarding how to capture SDH in the EHR are sometimes deferred to providers and clinics. Leaving the decision to providers, the specialties, and their clinics is based on the trust relationship that the providers have with the population they know best. For example, Clinical Leader H articulated that some of their current clinical SDH screening questions were not relevant for their pediatrics patient population. Knowing their audience and the tolerance levels, question relevance, and applicability is incredibly important for designing an optimal patient experience and reinforcing trust. If forced from the top down without any insight or intuition into the clinical specialty, SDH collection becomes a fruitless exercise.

The predetermined SDH screening templates in the EHR, which already include the structured fields and vocabulary, were a welcome addition for many, even though they contained some inherent flaws. The AHC is left to decide the appropriateness of the templates, whether to include them if they are inadequate and how they are prioritized in their practice setting (ambulatory, inpatient, outpatient). One administrative staff member from a Southern AHC noted the unsuitability of one field in particular:

> *I know, there's been discussion of like the questions themselves and how they're not ideal, because again, it was kind of what EPIC handed to us, in particular, the social connections field, and the way that it's, it's dreadful. It's basically saying, if you're not connected to a religious organization, you're a, you're a shut-in with no friends. It's not a good measure.* – Administrative Staffer C

Another administrative staff member from a Midwestern LGU, Administrative Staffer F, cast doubt on the utility of some EPIC features. The problems with certain templates and the latitude granted to opt-in or opt-out by the practice settings could prove to be inherently challenging. As variations in implementation sprawl across the enterprise, it opens the door for ungovernable systems that are difficult to standardize and incentivize at the leadership level across different units.

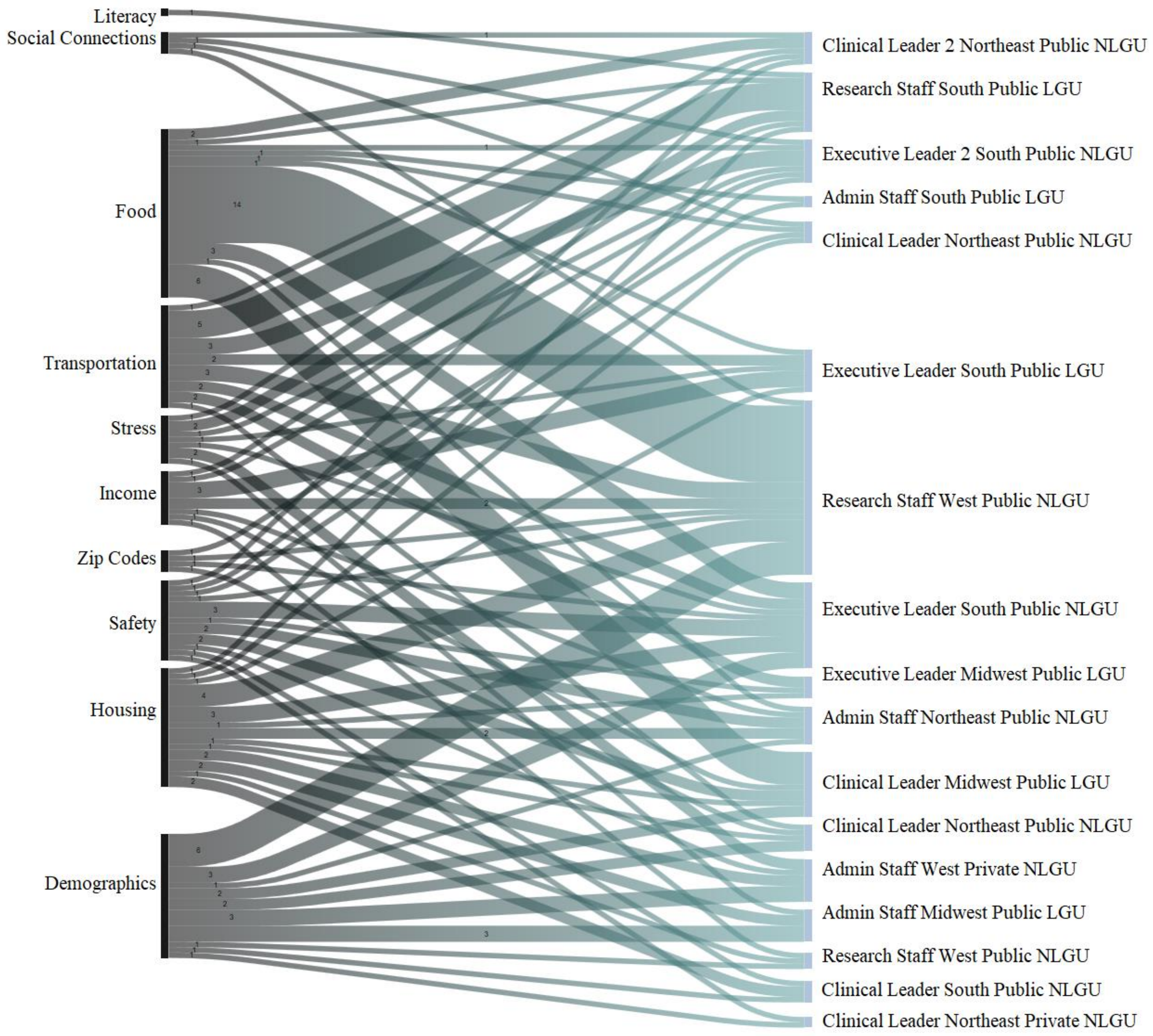
Food, Housing, Transportation as Leading Fields

There was insufficient data generated to disaggregate geographic differences (rural vs urban populations) or whether AHC type influences the prioritization of which SDH fields to screen for. However, based on transcript coding for each of the SDH domains, the top referenced areas of significance for the majority of AHCs were food, housing, and transportation (aside from standard demographics). Figure 9 depicts all of the top referenced SDH domains in this study on the left column and their frequency/connection to the specific participant on the right column who referenced the SDH domain. For example, based on this diagram, the most frequently discussed domain was food (or food insecurity) referenced most frequently by a research staff member in a Western, public AHC. Housing and transportation, followed by demographics, were referenced more often by a broader range of participants across the spectrum. By contrast, literacy, zip code, income, and stress were referenced less frequently. This, by no means, indicates that the less frequently referenced SDH are of less importance or consume less AHC resources to address, especially considering the role that income and literacy play in the calculus of an SES determination. It merely could represent a focused priority for the institution or the individual respondent based on their role type in the AHC. For example, an administrative staff member from a Southern LGU may have a more proximate relationship with migrants due to the frontline work required with resolving language barriers than a clinical leader in a Northeastern AHC. The clinical leader from Northeastern AHC may also need to resolve language barriers as well, but housing may be a more proximate SDH issue for their region.

Given the limited interview time, respondents may have also selected to focus their responses on the programmatic areas where the AHC has made the most impact. Future research that replicates this national study could potentially use this baseline as an indicator of the importance of these respective domains to each geographic region.

Figure 9

Sankey Diagram of Top Referenced SDH Domains by Respondent



These domains, and others, carry different weight depending on the needs of the patient, community, and AHC. For example, for an executive leader in a Southern AHC, there is a direct connection between certain SDH domains for their population:

> *So this is our first time kind of setting a like a goal for this system on food insecurity because it seemed to like if your food insecurity, you're probably rent and secure and housing insecure and you're probably transportation insecure. We'd looked at it as kind of like the bare minimum that would inform all these others.* – Executive Leader A

For another executive leader at a different Southern AHC, capturing the incarceration status of their patients was a need specific for their system:

> *We do capture information about incarceration because we serve a very large inmate population and it is tied to billing status. So if you are an incarcerated individual, depending on which locality – i.e., Are you local like [redacted], your care may be covered by one group. But if you're state or federal, it's covered by another group. So we have to know if you are incarcerated. Plus all the appointments are scheduled through the entity that is housing.* – Executive Leader B

The impact of environmental racism on health outcomes was referenced less frequently during the interviews, despite the increased prominence and visibility of the environmental justice movement in literature and public debate. However, all Western AHCs included in this study drew connections between the broader national social justice and equity issues (i.e., George Floyd protests), SDH collection, and the upstream environmental factors that the EHR does not necessarily collect but have an acute impact on community, rural, and population health outcomes.

EHR vendors individually select the timeframe by which their new software updates are released for organizational adoption/upgrades. For EPIC, these are quarterly updates to the system which may include updated SDH templates, features, and functionalities based on the discretion of the vendor and what they may decide to collect. Healthcare organizations, via their technology governance structures, subsequently make value-based judgments on whether the organization can or should adopt those new updates and the impact it would have on patients, internal workflows, and other disruptive outcomes to be considered.

Screenings

As discussed in Chapter Two, the promise of EHR/SDH data can be realized when electronic screening and data capture/extraction are sufficiently implemented, widely adopted, and integrated with new organizational workflows and resources. The 2014 report by the National Academies of Medicine recognized that electronic integration of SDH screening into EHRs would better enable health providers to address health inequities and support research into how social and environmental factors influence health (Freij et al., 2019). The three current methods of SDH screening (electronic, paper, and phone) are discussed in the following section and their relevance to the specific stakeholders' AHC.

Electronic, Paper, and Phone

Participants shared a varied mix of screening methodologies used across different AHC settings. Appendix J provides example quotes of the full spectrum between electronic, paper and phone. The resource disparities discussed earlier as well as the AHC maturity model, certainly, influence the extent to which electronic screening is even possible for many AHCs. For example, a clinical leader from a Midwestern LGU, Clinical Leader A, stated that while they conduct screenings for food insecurity and violence at home, the collected data doesn't always end up in the EHR and remains on paper. So even if the EHR is available, some clinics may opt not to use it specifically for SDH screening due to a variety of structural or operational reasons. Other voices, such as Clinical Leader A, confirmed that some sites conduct screenings on paper while others may be capturing data via their EHR. Phone screenings for SDH are also relatively common in areas where either the technology or workflow is not conducive, as one administrative staff member in a Southern AHC, Administrative Staffer B, noted. In this case, the ease of use and comfort level with an initial, personable intake phone call was reassuring to both providers and patients.

Electronic screening, for those actively using the integrated EHR tools, is either accomplished at the point of care with a nursing professional or social worker or using self-reported, pre-screening measures by directing the patient to their portal and chart to enter their information ahead of time. However imperfect, electronic is still the preferred method for informaticists, researchers, clinicians, and administrators who are dependent on structured data for analyses and reporting. EHR patient portals can also be used as a tool for pre-screening:

> *We're also using our patient portal, my chart, which I think counts is kind of part of the EHR to do some pre-screening for SDOH. So basically just building in more clinic workflows to allow for that consistent screening, which you know, is of course, tied to equity.* – Executive Leader A

For this leader in particular, introducing electronic SDH pre-screening early in the process helped to acclimate both the patient and provider to a workflow where they otherwise would have expressed hesitancy. Another executive leader from a Southern LGU, Executive Leader C, also described their workflow processes for electronic SDH pre-screening as tied to the greater equity mission. These efforts build organizational habits and a disciplined process that can be interpreted as part of the maturing and evolutionary growth process for AHCs who look towards better serving their constituencies with more effective and/or efficient data collection methods. An administrative staff member from a Southern AHC described the benefits and challenges of the electronic screening workflow process in EPIC, even with its imperfections:

> *We've got standard questions. And I think really one of the big pushes right now is ensuring that everyone is using them because there are certainly providers that were doing some form of screening before this all rolled out. And I would say in particular, for domestic violence, and also a lot of our peds clinics were doing it before. And so some of it is just getting people to use the existing questions that are in EPIC now instead of what processes they used before.*

> *The EPIC process is not perfect. But the answer is to follow the patient across the continuum of care. And when you look at their chart, you can see on the left-hand side, like on their face sheet, whether they've been screened or not. And that's really for our care managers in particular who were doing a lot of standardized SDOH screening. By documenting it in their notes, no one was seeing it except for them. So that was really the goal of this SDH module. And EPIC, in my understanding, is to have that single place to capture it, and have a unified definition of this patient - is food insecure or not. Obviously, it's messier than we'd like it to be.* – Administrative Staffer C

Similar to the pre-screening efforts, the directive to standardize screening processes is a facet of an organizational desire to evolve towards meeting health equity objectives. In their evolutionary timeline, AHCs may hit certain milestones that demonstrate their readiness and preparedness to further advance the level of sophistication with their EHR/SDH data collection and reporting. With additional incentives, be they financial or regulatory, these efforts can be further developed. For one institution, electronic screening is tied to financial incentives and Medicare accreditation according to an executive leader from a Southern AHC:

> *Yes, there's a financial incentive because if we don't screen for finances for low-income individuals who are uninsured, then we don't get paid. Simple as that - from any source, whether it's the state's indigent care program, or Medicaid or if people are eligible for a health insurance exchange. But in regards to financial incentives for capturing the information, there are two answers that I would give you one is for the primary care first model that our 12 primary care practices are involved in, that is a Value Based Payment Model. And integrated into that model is screening for social determinants of health.*
>
> *So if we don't do it, there's a disincentive. My understanding, after one year, is that we did well. And we did achieve incentive payments...In regards to the penalties, if we do not capture the race, ethnicity and language data, then during our Joint Commission reviews, we could be cited. And if you have so many citations for serious issues, you could lose your Medicare accreditation, or you could get you could lose your ability to participate in Medicare.* – Executive Leader B

As this leader narrated, their AHC is heavily influenced by the payers who adopted a carrot and stick approach to induce a desired effect with regard to screening. Whether it is the state, the Federal government, or the Joint Commission, the AHC primarily moves and acts accordingly to ensure that its vital revenue streams and reputation from those sources are not disrupted. The Joint Commission is a nonprofit, tax-exempt 501 organization which "accredits and certifies more than 22,000 health care organizations and programs in the United States, including hospitals and health care organizations that provide ambulatory and office-based surgery, behavioral health, home health care, laboratory and nursing care center services" (Joint Commission FAQs, 2002). A clinical leader from a Midwest LGU, likewise, mirrored that financial incentives played a part in opting to digitally screen for SDH:

> *EPIC has a social determinants of health wheel that they utilize that has, you know, from mental health, to housing instability to transportation issues, to stress to substance use to safety in the home. A lot of those questions (the internal Finance Department) built in, but it's not something that we have operationalized for every patient yet. So I think we do a good job in primary care of screening for depression screening, you know, we're kind of required to do substance use questionnaires.* – Clinical Leader G

The above narratives and those expressed in Appendix J demonstrate that while SDH screening is being performed via different mediums, the benefits and efficiencies of electronic screening are apparent once adoption can take hold and if workflows are properly implemented. Whether electronic, paper, or phone, however, there are perceptible, psychosocial feelings of hesitancy, mistrust, or skepticism that are inherent in the screening processes when caring for patients and communities.

Hesitancy, Mistrust, And Skepticism

Despite evidence and literature demonstrating the stratified influence of SDH on health outcomes, whether and how exactly providers in AHCs should address them remains unclear. Screening instruments are helpful insofar as both the providers and patients are incentivized to use them. Otherwise, the exercise can appear to the patient as intrusive snooping, collecting data for data's sake, or evoking other cynical feelings of medical mistrust which emerge in the interaction. Similarly, the burdensome task of collecting the data for the provider while not knowing if they can address social needs, address gaps in care, or improve morbidity and mortality also contributes to screening hesitancy. Tong et al. (2018) argues that with such uncertainty, it is not clear if addressing SDH should be within the domain of the healthcare delivery system at all.

Among the many provider-hesitancy themes discovered in this study, validating Tong et al. (2018), are: (1) SDH screening processes are complicated and resource-intensive, (2) other than a referral to a social worker or external partner, there are not many resources to help patients with social needs, and (3) SDH screening could potentially cause harm in the provider-patient relationship and undermine trust. This 'hesitancy spectrum' from both providers and patients is manifested by a range of mixed feelings and beliefs such as caution, restraint, resignation, wariness, and the "do no harm" maxim of the Hippocratic Oath. Appendix K provides abundant quotes from participants who exemplify this uncertainty. One clinical leader expressed their concerns about provider hesitancy as such:

> *Sometimes (providers) are a little bit hesitant to ask about the information if they don't have a means to act. So we might have the fields in the EMR that we've built out, but they aren't necessarily being routinely asked about because they don't feel like they can do anything. And then we have to balance that with who's going to collect it, when are you going to collect it?*
>
> *And you know, particularly on the inpatient side, as [redacted] mentioned, you have a patient, let's just say, with a whole team of people buzzing around them and the patient is pretty captive, right? They're not going anywhere for a few days. In the outpatient clinics, where you're seeing we see about 700,000 outpatient visits a year, it really becomes an issue of who's going to collect this, do you have the time to collect it?* – Clinical Leader A

The time and resource demands required to conduct these screenings, even knowing the potential for the return on investment, are still not enough to assure the AHC leadership at times. A clinical leader from a Northeastern AHC expressed similar apprehensions about both resources and the ability to act on the data:

> *I think the concern is: if we ask the question and don't intervene, why are we asking? So there's been a great deal of talk about asking, both from our own health plan and from the state. There's been a discussion of reimbursement for asking all those things that will make physicians do it. But I think there's been, again, just a great deal of hesitancy about asking without a resource...It's a chicken and egg problem. No one wants to pay for the resources until we're being paid to collect the data. But no one can succeed unless we*

> *have the resources.* – Clinical Leader F

As indicated in Appendix K, the clinical, research, and executive profiles verbalized that time and resources are the most significant barriers to adopting full SDH screening on the provider side. The intake process will always require a level of effort and tolerance that must be balanced against the available mental and emotional willpower on both sides. As the last section referenced, electronic pre-screening can potentially help mediate these issues prior to the time of care. Additionally, while references to the 'digital divide' did not explicitly occur within the interviews or expressed as an issue of concern for AHCs, there were, nonetheless, a few use cases where access to modern technology was mentioned concerning screening. To help alleviate the burdens of technology, along with the human time and resources required to complete electronic SDH screening, some AHCs are investigating the use of AI, Natural Language Processing (NLP), and other automation tools to help populate the EHR databases. A clinical leader from a Midwestern LGU, Clinical Leader A, narrated how upfront data collection from AI could potentially leave only a minimal set of screening data to be collected later. Another clinical leader from a Midwestern LGU, Clinical Leader G, expressed support for NLP as a promising tool to pre-populate electronic databases and build registries. A more unconventional (and perhaps uniquely controversial) method of leveraging systems and technologies to auto-populate certain fields was discussed by an executive leader from a Midwestern LGU:

> *They're (patient navigators) doing social determinants of health screening. They'll ask 7 or 8 questions about some of the key SDOH. But if you think about that, that's an incredibly inefficient model. So what we're seeing are three or three patient navigators, we're only doing about 15 screenings a week…We tend to think of everything as face to face interviews as part of the patient encounter. But that's a no-go on that because we're going to have to be able to proactively seek out these individuals through their credit data, or other sources to be able to uncover some of their social determinants.*
>
> *We've been in conversations with TransUnion, the big credit reporting agency, and they have just a wealth of information on every American consumer. As I spoke about before, some of that could be tapped in ways that would help us understand those people that are most at risk. It has to be proactive. So, you know, that is where the future is.* – Executive

Leader D

These innovative tools and technologies are not without controversy due to their potential for automated biases, as the literature review indicated. How would medically underserved patients react, for example, knowing that the bulk of their health information was pre-populated by the same disliked data sources which deny them housing loans or credit lines? Or by a commercial artificial intelligence with questionable logic models that infer data based on untested algorithms? These tools, while pioneering and exciting for the field, may unintentionally embody another reinforcer of mistrust and skepticism.

Notions of patient hesitancy and provider hesitancy sometimes intersect with one another when its viewed as 'policing poverty,' as one executive leader articulated:

> *We're not trying to embarrass people. We're trying to help them and understand our patient population. So communications and marketing are important, too. One of the first resources my team built was actually a poster to put in the clinics. It basically says: "We ask because we care" because there's a lot of fear.*
>
> *And there's a lot of sense of like, "you're gonna look down on me because of this," or "you're going to try to take my kids away," or "you're going to try to put my mom in a home because we're food insecure." So really trying to emphasize that we're not trying to police poverty, we're just trying to get a better understanding of patient needs so that we can provide more comprehensive and patient-centered care.* – Executive Leader A

As this leader stated, fear of exposure to law enforcement or other government reporting agencies will often drive the screening decisions behind the scenes and during the point of care. Treating already vulnerable populations with sensitivity, kindness, empathy, and culturally-responsive approaches should remain part of the entire continuum of healthcare: from medical education, to residency, to ongoing healthcare workforce training and development for both front-line workers and providers. Otherwise, as the narrative above explain, fear and trauma could potentially be reinforced with groups who would then possibly seek less medical attention for their needs or simply go elsewhere. Some of the reasons behind patient hesitancy cross geographic boundaries and are shared across the AHCs. An administrative staff member from a Western AHC shared their narrative of employment status as a driver of skepticism:

> *There's definitely a lot of people here that don't want to share their employment status. You know, especially if they're running their own little business and money's on the table. Then there's, there's a lot of fears that are they happening in communities.* – Administrative Staffer E

Another administrative staff member from a Southern AHC described the sensibilities of their rural population:

> *I do think patient education is a huge piece of it. Because we find, especially in our rural areas, people are like, "Why are you minding my business," which is a fair question. As stated earlier, the technology is less of an issue and the workflow process is the difficult challenge to overcome.* – Administrative Staffer C

Finally, another clinical leader from a Northeastern AHC discussed how the disclosure of income levels and internal decisions regarding 'Z codes' (ICD-10-CM encounter reason codes used to document SDH data and identify non-medical factors that may affect a patient's health status) can create negative experiences for patients and their partners:

> *I think it's skepticism in general. One of my colleagues has been asking (screening questions) and people would get very, like, "why do you want to know my income?" You know? "I'm not gonna tell you that so you people come and bill me." I think there's concern for stigma. I think there is just sort of a, like, "why does it matter for my medical?" like, "this shouldn't matter for my medical care" necessarily.*
>
> *We did an informal survey of folks within one of our clinics and 20% are uncomfortable having these data in their medical records. And so I think there is concern for that kind of documentation. I think there's some mistrust. We've had a lot of discussion about Z codes. And if we're dropping Z codes, and [what if] patients can see it? If patients partners can see it? How are we exposing our patients to what kinds of risks? I think there are risks.* – Clinical Leader F

One of the most insightful comments regarding hesitancy with community screenings and engagement was articulated by participants from a Southern AHC who served primarily Black and Hispanic communities. While provider hesitancy is rooted mainly in time and resources, and patient hesitancy can be traced to emotionally-driven fears of exposure and intrusiveness, another dimension that both share are that sometimes the AHC positions themselves as the

"Savior" of the community. This 'savior complex' with community health workers is a shrewd observation that was not considered in the original formulation of the research proposal. These frontline workers, assigned the arduous task of SDH collection, can only be successful by building trust and demonstrating value to their community without exploiting their role, by recognizing systemic oppression, and by maintaining humility. Since they serve as ambassadors for the AHC, medical mistrust could be manifested in community interactions depending on the track record and history of the AHC in the region. This balancing act is a delicate one, as one administrative staff member from a Southern AHC narrated:

> *I think right now, it's just getting people comfortable to even have this conversation with their patients and figuring out a way to do it in a way that's not alienating and that doesn't take up the whole visit. So hopefully these improvement efforts will make it easier to screen...And really helping [frontline workers] live with the fact that patients are going to experience poverty. They've often been living in poverty for a long time when this need is identified.*
>
> *So how do you cope with that emotionally without feeling terrible? That there is no housing resource for this patient and really using it to tailor care but not coming in with that Savior Complex either. Because that's really a challenging balance to walk and something that community health workers deal with quite a bit.* – Administrative Staffer C

AHCs, like other healthcare organizations with an EHR, will continue to face the challenges referenced in the narratives related to both electronic, paper, and phone SDH screening activities and accurately populating their databases with SDH. Once the data is properly situated in the EHR, it can then be extracted and repurposed for analyses and decision-support systems, including referrals and interventions.

Referrals and Interventions

A 2017 survey by consulting firm Deloitte found that 80 percent of hospitals and health system leaders are committed to addressing social needs (Lee, 2018). The AHC leadership profiles interviewed for this study reflect this finding with their interpretations of their respective mission statements. While addressing social needs and achieving better health outcomes will always remain the gold standard, the more practical, immediate, and tangible success metrics continue to be referrals to social workers or external partner resources. Making a dent in the upstream community factors will take far more time, resources, government incentives, patience, and resiliency than most AHCs are resourced or prepared to do. As a result, many AHCs stop at referrals and interventions as the most common, realistic, and achievable metric instead of the laudable goal of changing long-term health outcomes.

Referrals and interventions have been a feature of the U.S. healthcare system well before the invention of the EHR and the more recent, integrated electronic SDH screenings. Even without a specific SDH screening, the provider may include referrals in their patient notes and provide community resources information at the end of the clinical visit. The EPIC EHR, in particular, has made referral directories localized and easier to access as a component of the SDH screening module shown in Figure 6. For many AHCs, these referrals are an indispensable tool in the uphill battle to reduce health and resource disparities, especially within food, housing, and transportation domains. One narrative from an administrative staff member in Appendix L illustrates a creative, referral partnership to address transportation in particular. By establishing same-day transportation for urgent care, they are able to quickly provide an intervention that would have otherwise been unavailable to the person without transportation options. Connecting distant geographic regions together through a referral network was essential for one executive leader from a Southern LGU:

> *So we're trying to do more about making sure we capture social determinants data and make sure we have the ability within EPIC to provide tools so that it maps to local resources. So we are set across the state…And so this will take a you know, someone in a clinic in eastern panhandle and lead them to resources at their in their locale.* – Executive Leader C

Separately, an executive leader from a Midwestern LGU predicted the creation of a broad network of referral services for hospitals and social service agencies:

> *In the next 18 to 24 months, we're going to see the gap be bridged between healthcare and Human Services. And that will involve a very complex approach, but a very necessary approach. The first is to build networks of social service agencies that can accommodate and can take referrals from hospitals. And then secondary to that is creating payment streams from either the hospital or MCOs that flow through the hospital and create an annuity or create a revenue stream for some of these social service agencies. – Executive Leader D*

The "closed-loop" referrals to community service providers are especially important for high-risk patients who have multiple emergency room visits within a specific time frame and/or at least one social need identified through screening tools. Closed-loop referrals generally refer to a process for healthcare professionals to secure the right resources at the right time in order to send patients to external, community-based social services. Simplifying the closed-loop workflow is one of the benefits that an EHR affords with its ease of screening for SDH and ability to manage statewide, coordinated care networks of health and social services providers on a single platform. For many of the respondents, given the current state of their Institutions' health equity progress, there was a tangible sense of resignation knowing that they had discharged the "patched up" patient but could not go any further than a referral or short-term intervention for SDH or behavioral challenges. It is far easier to patch people up and send them on their way and exponentially more challenging to create legislation or conditions in the community to impact upstream factors which are out of their control. A clinical leader from an LGU in the Midwest expressed hope that this would improve for his rural population in particular:

> *We are really good at bringing patients into the hospital and disabling them so that we can make them better. We are very bad at re-enabling them and getting them prepared. We don't see the moment you step into the hospital as the first step out of the hospital. We sort of think of that in the last two days that you're here. And then there's this big rush to sort of patch things up. And here…you drive 10 minutes in any direction from [redacted] and you're in somebody's farm. We're not urban, we're 'sort of' urban. It's like we're the fourth largest city in the state. And literally 10-15 minutes any direction, and there's a whole lot of dirt between people. So it's a very interesting, challenging population to manage. –* Clinical Leader A

Another clinical leader from a Northeastern AHC provided a nuanced and slightly more pessimistic view on referrals and interventions:

> *I worry that we have a little bit of a God complex about it. Like 'oh, we doctors can give you this resource you didn't have.' 'We doctors can solve your psychosocial problems,' which is not that simple. We did a project where one of my colleagues through just blood, sweat, and tears, went and interviewed a whole lot of patients in the hospital and tried to connect them to resources herself. All the resources that she could find – two-thirds of them already knew about. And only, I mean, one thirds good. Don't get me wrong, like that's important, but this sort of idea that patients don't know what resources are available to them. I think this may be a little naive.*
>
> *So I think that, you know, a lot of the EHR-based solutions, are these –'we're going to ask you these questions, we're gonna link it to your home address, we're gonna spit out some resources'—and handed a piece of paper. I think that's better than nothing. I think it makes it acceptable. But I don't think it's going to move the needle much. I think what we actually need are case managers or individual people, helping you fill out the form to get into the thing, right, like helping you make the follow-up calls. And those are expensive resources. And so those are going to take dedication, either on the parts of the systems or the health insurers to do that. I don't think that's impossible. I do think people care about it. But I do also think it's really expensive.* – Clinical Leader F

In this example, most patients already had agency and knowledge of local community resources without the assistance of the AHC, the EHR, or any SDH screening. Through this lens, it is quite easy to sympathize with the sense of futility that a provider or Institution views towards their role at times. Meeting the people and the community where they are, and centering their experiences, are part of a greater mission to change the social factors that influence health along the continuum from systemic to personal.

Chapter Six: Discussion

“The physician must be able to tell the antecedents, know the present, and foretell the future — must mediate these things, and have two special objects in view with regard to disease, namely, to do good or to do no harm.” — **Hippocrates**

The findings from this study lay bare notions of AHC providers and adjacent health equity stakeholders as sincere and dedicated professionals locked into a resource struggle together within the confluence of administrative policy, public policy, technology acceptance, implementation science, and public health demands. AHCs, and their adjoining hospital system, are characteristically set up to encompass a wide array of talent and expertise across specialties. They are compelled by a diverse array of incentives, political/social forces, and organizational factors which influence technology diffusion, attitudes towards decision-making, and the likelihood of technology adoption reaching critical mass. While many employed by the AHC harbor a passion for their field, that passion often appears unrequited at times due to the structural and resource impediments in the AHC bureaucracy itself. Institutional progress remains uneven or lagging, SDH data-collection hesitancy spoils the potential for evidence-based informed decisions, resources and referrals are wanting for those who need it most, health outcomes cannot be effectively measured, and skepticism or burnout is often customary.

This study intended to produce evidence that:

1. Illustrate how AHCs from various regions and types view their EHR with regard to health equity, the implemented SDH fields, and the connecting role these fields play in reducing health disparities.
2. Inform decision-makers on the structural or cultural dynamics within the administrative bureaucracies of AHCs which hinder or facilitate digital health initiatives and/or EHRs.

3. Add to the body of knowledge on the variation of SDH fields under consideration within AHC-specific environments to shape future research in this ecosystem.

This discussion section will address themes from the two selected theoretical frameworks—Dimensions of Strategic Change (Pettigrew) and Normalization Process Theory (NPT)—and use directed content analysis and thematic analysis by mapping the objectives mentioned above to the data produced. Evidence of the many competing interests, contradictions, paradoxes, and other areas of variation that were elucidated in participant responses will also be discussed.

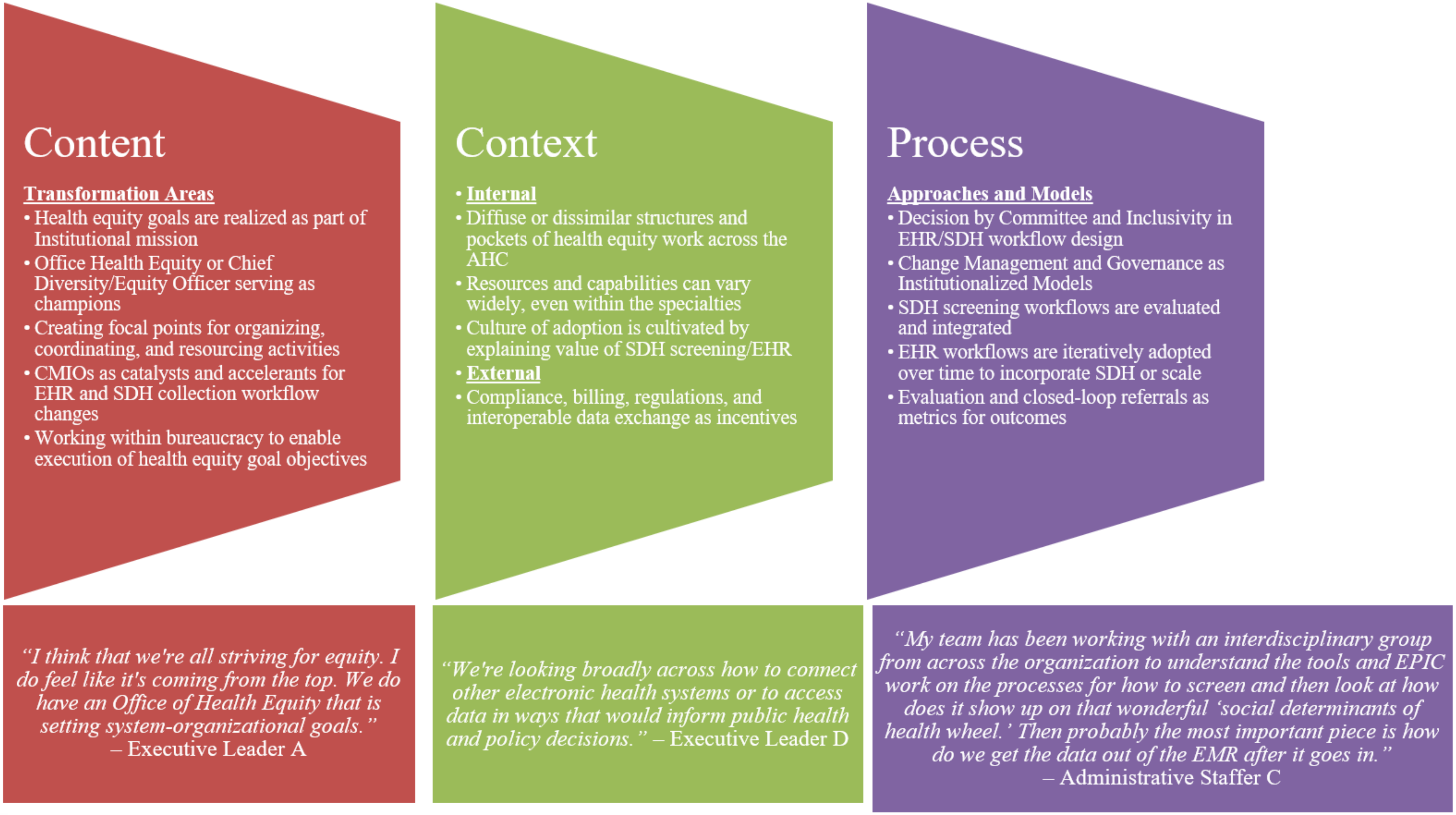
Theoretical Framework Analyses

To recap, Pettigrew's framework identifies three interactive dimensions—*Context*, *Content*, and *Process*—that together shape organizational change (Pettigrew, 2012). Pettigrew's framework is applicable since implementing an EHR is an organization-wide effort, even as customization of electronic SDH data collection is a specific facet of that effort. Figure 4 illustrates the sub-components in which an organization operates. Figure 5 shows Normalization Process Theory (NPT), which focuses on the work that individuals and groups do to integrate interventions into routine practice. It is generally accepted that NPT provides a consistent framework to explore the implementation of digital health interventions that can be used to describe, assess, and enhance future implementation potential (May & Finch, 2009).

Figure 10 summarizes the AHC factors within Pettigrew's Framework for Dimensions of Strategic Change mapped with the collected data in this study.

Figure 10

AHC Factors Within Pettigrew's Framework for Dimensions of Strategic Change



Content

Transformation Areas

- Health equity goals are realized as part of Institutional mission
- Office Health Equity or Chief Diversity/Equity Officer serving as champions
- Creating focal points for organizing, coordinating, and resourcing activities
- CMIOs as catalysts and accelerants for EHR and SDH collection workflow changes
- Working within bureaucracy to enable execution of health equity goal objectives

"I think that we're all striving for equity. I do feel like it's coming from the top. We do have an Office of Health Equity that is setting system-organizational goals."
– Executive Leader A

Context

- **Internal**
- Diffuse or dissimilar structures and pockets of health equity work across the AHC
- Resources and capabilities can vary widely, even within the specialties
- Culture of adoption is cultivated by explaining value of SDH screening/EHR
- **External**
- Compliance, billing, regulations, and interoperable data exchange as incentives

"We're looking broadly across how to connect other electronic health systems or to access data in ways that would inform public health and policy decisions." – Executive Leader D

Process

Approaches and Models

- Decision by Committee and Inclusivity in EHR/SDH workflow design
- Change Management and Governance as Institutionalized Models
- SDH screening workflows are evaluated and integrated
- EHR workflows are iteratively adopted over time to incorporate SDH or scale
- Evaluation and closed-loop referrals as metrics for outcomes

"My team has been working with an interdisciplinary group from across the organization to understand the tools and EPIC work on the processes for how to screen and then look at how does it show up on that wonderful 'social determinants of health wheel.' Then probably the most important piece is how do we get the data out of the EMR after it goes in."
– Administrative Staffer C

Within the *Content* dimension, the specific areas of transformation from the interviews relate to the health equity mission, its relationship to the EHR/SDH collection, and how specific job roles function as champions and accelerants. Several AHC representatives identified some form of a Chief Diversity/Equity Officer position that was established as part of Institutional transformation efforts. The institutional health equity objectives and goals do not necessarily emanate from these newly established offices and positions. While these positions may possibly represent mere figureheads in the bureaucracy who were created to appease increased externalities and internal pressures on AHCs, there are ostensibly other reasons for their existence. They tend to serve as focal points for organizing, coordinating, and representing the official Institutional health equity objectives and associated mission statements, which in itself is enormously challenging given the structural dynamics of an AHC. They may serve as catalysts and accelerants for organizational change by working with other positions, such as the CMIO, in developing best practices, liaison with community leaders, informing processes and standards, and bringing SDH screening data into scope.

Research from DePasse et al. (2014), Dzau et al. (2013), and Ellner et al. (2015) support the idea of AHCs and the innovation-centric appointments within (such as CMIOs) acting as catalyzing agents of transformation with digital health. The authors characterizations are in line with the findings of this study and the Pettigrew *Content* dimension, where Chief Diversity Officers and CMIOs are presented as disruptors who can revolutionize the status quo within a stagnant bureaucracy. Indeed, the CMIOs from this study discussed the intense challenges they personally face within their dual roles as physicians and technology advocates trying to persuade a reluctant workforce and create welcoming environments for creative, novel solutions with DHT. Dzau et al. (2013), in particular, note that AHCs must actively cultivate this space by teaching and supporting transformative innovations, which are "game changers, and leapfrog current approaches to push the envelope of what we believe is possible. They are based on nonobvious insights that are then translated into novel, bold solutions.” This specific portrayal indicates a clash of cultures within the organization, with individual disruptors swimming upstream, reorganizing resources, redirecting processes, and serving as change agents to actualize the full capabilities of the AHC by unlocking the potential of not only its technology but its people and next generation of professionals. Kohn (2004) and Ellner et al. (2015) support this notion, by arguing that AHCs can focus their considerable influence and expertise on health systems innovation to “nurture leaders of transformation.” As incubators of learning and research, it is a perfect distillation of their strategic aspirations. The *Content* dimension illustrates ongoing transformation or evolution related to the AHC operationalization of health equity, EHR, and SDH screening practices. This forms the baseline for the other components, which will help lead to the broader strategic change needed to realize the mission fully.

The *Contex*t dimension lists both internal and external factors that designate the AHC’s structures, resources, incentives, capabilities, and any forces of influence that will ultimately shape the *Content* or *Process*. Internal descriptors provided during interviews include diffuse or dissimilar structures and pockets of health equity work across the AHC. This, in part, explains the need for the Chief Equity Officers and offices to coordinate and organize the existing Institutional efforts and resources. Ash (1997) and Turisco et al. (2005) agree that internal organizational attributes, such as financial resources, are important predictors for the spread and usage of DHT innovations within AHCs. However, only Turisco et al. (2005) cites specific, major internal impediments to implementing that sustainable infrastructure, including a lack of vision, funding, process, and governance issues. This aligns with participant responses established in Chapter Four and the internal structures from the Pettigrew *Context* dimension; many respondents detailed AHC resources and capabilities can vary widely, even within various specialties and disciplines in the AHC, unintentionally creating institutional inequities and disparities across environments. As a result, advocating for the adoption of the EHR and/or SDH screening can prove exceedingly challenging when balanced against other priorities. This indicates that champions must continue their attempts, however futile it may seem, to create an internal culture in which dialogue remains open, the value of electronic SDH screening is taught and reinforced, and, perhaps most importantly, securing financial/workforce resources and changing workflows to make it possible. Kohn (2004), specifically, cites an IOM recommendation that "AHCs must make innovation in and implementation of information technology a priority for both managing the enterprise and conducting their integrated teaching, research, and clinical activities." Doing so involves overcoming both internal and external factors in the Pettigrew model. The role of the institutional champion was substantiated by Ash (1997) in the literature review, where their strong advocacy was key in order for creative and innovative ideas to emerge, to push back against bureaucratic resistance, and to act as enthusiastic and decisive decision-makers who could wield influence over the institution's financial resources. Aside from primary external factors such as compliance, billing, and regulations, pushing for interoperable data exchanges by those same champions can also serve as an incentive for persuasion.

The final *Process* dimension describes AHC change management processes, governance, workflows, evaluations, outcomes, and plans of action. This layer, based on the findings from this study, indicates that it is the most cumbersome and long-term out of the other dimensions. Due to the articulated operational and logistical barriers such as provider and patient hesitancy, implementing efficient electronic SDH screening workflows, and the lack of metrics on health equity progress or outcomes, AHCs can expect their EHR/SDH collection efforts to come to fruition in slow, iterative phases rather than all-at-once. Research from de la Vega et al. (2019) and LaForge et al. (2018) identified different processes used by organizations to develop electronic SDH screening tools in primary care settings and the barriers they faced during those efforts. The results from LaForge et al. (2018), in particular, indicated that despite concerns about patient willingness to share SDH information, interviewees' actual experience demonstrated low “refusal rates.” In contrast, the results from this study demonstrated that administrators, researchers, clinicians and executive leaders all cited problematic feelings of patient and provider hesitancy with implied higher “refusal rates” from their experiences. These are, most certainly, the variations in approach that the *Process* dimension from Pettigrew theorized. The LaForge et al. (2018) study also included only one (1) AHC and multiple nonprofit organizations who were interviewed on their approaches, which may explain the dissimilarity in hesitancy.

Both de la Vega et al. (2019) and LaForge et al. (2018) studied organizations that uniformly agreed that existing electronic SDH screening tools from their EHR were inadequate and did not meet their needs (e.g., inappropriate for a given organization's structure, preferences, and patients). Many of those organizations sought to develop their own by writing their own items or picking specific items/domains to include. In contrast, the overwhelming majority of respondents in this study preferred to use the “out of the box” tools already available and integrated into their EHR platform, which was usually the EPIC “SDOH wheel” (as imperfect as it is). The decision to implement that specific feature, from some participant responses, indicated that implementation decisions are driven by multiple committees with specific input from change leaders and sometimes community advisory boards on the particular SDH which are most relevant. Countering those decisions were internal concerns about the increased SDH screening workload and perceived lack of use, thus creating barriers to the process. The discrepancy between the organizations' screening tool preference in the aforementioned studies and this study could potentially be explained by the relatively recent introduction of the EPIC "SDOH wheel," and perhaps the cost-prohibitive nature of acquiring EPIC which many AHCs can afford to do. Cantor & Thorpe (2018), as a coda to the aforementioned studies, provide recommendations for creating national SDH standards in the EHR and how to best incentivize its collection through financial or quality measures such as those within Medicaid incentives. The financial and reimbursement incentives were thoroughly addressed by select participants in this study, bringing it in accord with the Cantor & Thorpe (2018) recommendations to improve SDH screening adoption and provide a high-level framework for AHCs to "check the box" (at a minimum), indicating their willingness to participate. Despite those incentives, the *Process* dimension still exhibits numerous obstacles to overcome in order to fully manifest a complete EHR/SDH screening model with improved health outcomes.

The clinical, research, and administrative roles from this study all viewed their professions and mission as an iterative, ongoing, evolving process with tangents rather than a direct and linear process, reflecting the Pettigrew framework. In this view, the ultimate outcome of any organizational change related to the advancement of health equity initiatives and the role of the EHR will be determined by the many contextual, content, and process factors for the specific AHC.

Figure 11 summarizes the NPT framework mapped with the collected data in this study. Similar to the *Process* dimension in Pettigrew, much of the observed data from this study points to an aspirational process for many AHCs who are ahead in some regards but behind in others. Thus, participation, action, and monitoring are expected to materialize slowly over time and iteratively rather than all-at-once.

Figure 11

EHR/SDH Implementation within Normalization Process Theory (NPT)

1. COHERENCE *Purpose of implementing electronic SDH in the EHR?*	**2. COGNITIVE PARTICIPATION** *Incentives for AHC stakeholders?*	**3. COLLECTIVE ACTION** *How will the work get done?*	**4. REFLEXIVE MONITORING** *How to evaluate work, impact assessments, and measuring success?*
Digitize paper processes for 2020 Cures Act and other internal efficiencies.	Compliance, billing, regulations, federal or state-level reimbursements.	AHC nurturing close internal and external collaborative partnerships in the calculus of health equity work.	Closed-loop referrals and active interventions.
Unlock EHR datasets for better evidence-based decisions and interventions for ‘upstream’ (community) and ‘midstream’ (individual) social needs.	Creating interoperable health information data exchange systems and networks across boundaries.	Overcoming workflow burdens via automation, removing screening hesitancy, diminished staffing resources and time.	Streamlining the EHR tools, removing technology burdens and digital divide. Extracting necessary data for informatics applications, decision-support systems, and research databases.
Provide large datasets for Medicaid or high risk population (e.g., ER visits and usage) research analyses.	Community engagement, building trust, making real impact at the grass roots level with services and partnerships.	Increasing confidence in the return on investment, improving key health indicators incrementally.	Centering marginalized populations and their experiences to create better continuum of care and health outcomes.

Coherence (understanding of reasons for implementation and potential value of the technology) can be defined by reviewing some example motives for adopting electronic SDH for the AHCs in this study:

- The need to digitize antiquated, paper processes to meet the demands of the 2020 Cures Act and other internal efficiencies with digital health data.
- Creating a technology, research, and informatics ecosystem that unlocks the power and potential of EHRs: providing better longitudinal datasets and indicators that will inform interventions for ‘upstream’ (community) and ‘midstream’ (individual) social needs.
- Provide large datasets for Medicaid or high-risk population (e.g., ER visits and usage) to facilitate population health analyses.

Many scholars have contributed thoughtful commentary and studies on the growing recognition that our health is shaped by SDH and that identifying, diagnosing, and intervening in those associated social risks will improve health care delivery and outcomes. Electronic SDH data capture in the EHR is merely one modality to accomplish that objective. Several studies reviewed earlier discussed best practices in SDH screening and the particular domains of interest for clinical decision-making, population health strategies, and the design of performance-based incentives (Torres et al., 2017; Gold et al., 2017; Byhoff et al., 2017; Arons et al., 2019; Floyd, 2018). While these are all important contributors to the body of knowledge, improving SDH documentation and workflows in the EHR, in and of itself, is an exercise that contributes to *Coherence* by providing experiential, trial and error use-cases. The referenced studies do not provide any judgements on the macro, organizational benefits of the discovery process for electronic SDH screening. Arguably, AHCs can only truly understand and analyze the limits and value of their SDH documentation by operationalizing it in real-time within their practices and in various specialties specific to their region and organization. Doing so indicates that they are absorbing not only the body of academic and technical scholarship for their decision-making, but they are also teaching themselves, in practice, the reasons for implementation and potential value of the technology. Torres et al. (2017), specifically, argue that better utilization incentives must be developed to realize the potential benefits of cataloging SDH information. This notion is substantiated by several respondents in this study who agreed that an attractive incentive structure must be created to entice AHCs. Over time, as more AHCs become incentivized and the more they learn from their experiences with a feedback loop on how to best optimize the practice, it reinforces the original decision to pursue electronic SDH capture to help realize their Institutional health equity mission, slowly and iteratively. *Coherence* from NPT illustrates not only the intrinsic value of the technology to the AHC, but the conceivable benefits to both the Institution and the patient.

Cognitive Participation, the preparedness to engage and commit to using the technology for electronic SDH screening and capture, is driven by the classic incentives model of carrots and sticks. The top incentives identified in this study are regulatory compliance, billing, and federal or state-level reimbursements. While there are currently no federal regulatory or billing requirements to electronically capture SDH as of 2022, it looms on the horizon with new federal incentives from CMS as revealed in Chapter Five. However, under the American Recovery and Reinvestment Act (ARRA), the Electronic Medical Records (EMR) Mandate within the Act incentivizes all healthcare professionals (including AHCs) to use their EHR as the mandated tool of clinical data collection, which would digitize health records and make them more accurate and accessible to patients. AHCs which do not implement EHRs and/or demonstrate a “meaningful use” standard will see a reduction in Medicare reimbursements up to five (5) percent. This creates another cascading incentive to create interoperable health information data exchange systems and networks across geographic boundaries. Both Executive Leader B and Clinical Leader F provided extensive, reflective narratives on financial reimbursements for mandating SDH collection and reporting via Medicare, Medicaid, and other payers, which would unquestionably shift the landscape in healthcare towards ensuring that electronic SDH collection and health equity for medically underserved populations remain centered in the care process. Freij (2019) posits that the EHR vendors who develop the SDH screening features in their tools are uncertain if federally mandated incentives "*will be fair and whether SDH collection is a fad versus a priority with longevity*" and whether "*SDH will come to be as large a movement as quality improvement was for health care*." This transparently profit-driven concern from vendors cannot be ignored within the motivation and incentive equation in this ecosystem.

Gómez-Ramírez et al. (2021) caution that a social justice lens must be applied when examining the motivations of healthcare organizations, such as AHCs, and their application of DHT and how profit distribution is managed. They astutely ask: "*Have stakeholders considered how the people who contributed to creating and implementing the DT (digital technology), including by providing their health data, will be fairly compensated? If financial profits are to be made from the development and use of DTs in public health, have stakeholders considered who will receive the profit and how it can ultimately be fairly redistributed to benefit communities and population health?"* (Gómez-Ramírez et al., 2021). This assertion begs an ethical question: are better community resources, better quality care, and improved health outcomes an acceptable or sufficient tradeoff for patients contributing their health information to the success of the DHT? Is that a more equitable exchange than mere community profit sharing and distribution? As an example, Garg et al. (2015) conducted a cluster RCT with 8 urban community health centers which demonstrated that systematic screening and referring for social determinants during well child care can lead to the receipt of more community resources for underserved families. Could these, and other such studies which demonstrate positive impact to medically underserved areas, sufficiently offset the ethical and social justice concerns raised by Gómez-Ramírez et al. (2021)?

After all, as Gold et al. (2017) and others consistently note, standardizing SDH data collection in EHRs *could* lead to improved patient and population health outcomes, but nothing is certain without years of additional study and evaluations. EHRs, undoubtedly, make it *easier* to identify and aggregate vulnerable groups, such as LGBT+ patients or those facing disparities from gender-based, racial, or ethnic, cultural or economic SDH, but translating that aggregation of data into a decision-support and health equity or population health support systems is a largely unproven proposition (Bates, 2021). Ultimately, the extent of Cognitive Participation and “buy-in” defined by the NPT framework will be shaped by multiple inputs that are, ideally, community and patient-sensitive, federally mandated, and carefully balanced against AHC financial sustainability models to avoid any exploitive pitfalls of DHT.

Collective Action (the ability to do the work and to use the technology) asks, “*How will the work get done”*? As discussed in Chapter Four, AHC partnerships serve as a key ingredient in the overall health equity formula and strategy across regions, types, and sizes. Nurturing close internal and external collaborative partnerships in the calculus of health equity work is crucial to satisfy *Collective Action* by opening the door to additional resources and community-based networks. However, the most significant barriers to doing the work remain: overcoming workflow burdens via better automation, removing screening hesitancy, and repairing the conditions that lead to diminished staffing resources and time. While easier said than done, these actions, per NPT, will increase confidence in the return on investment by demonstrating incremental progress on improving key health indicators for patients and communities. This aligns with one of the many recommendations in the Sensmeier (2020) analysis, whereby healthcare organizations must continuously advocate for more precise use of DHT tools that impact populations at risk for social health inequities, and strategically include individuals at risk in the development of these technologies.

Finally, *Reflexive Monitoring* (how staff appraises the technology) speaks to how evaluations, impact assessments, and success metrics are incorporated into the final step of NPT. Measuring long-term health outcomes remains a distant ambition for everyone interviewed for this study. Additionally, given the current perceptions of lagging progress, the dominant success metric that one can expect for the foreseeable future is the “closed-loop” referrals to community-based service providers. As providers continue to implement those close-loop referrals, they must also be mindful to center marginalized populations and their experiences to create a better continuum of care and health outcomes, which is the underlying philosophical and ethical impulse for much of the profession. Wood et al. (2021) support this inclusivity policy in their telemedicine case study, whereby intentional interventions are needed to ensure vulnerable persons are not excluded from care with the rapid adoption of DHT. Success metrics for the DHT systems are based on streamlining the EHR tools, removing technology burdens, and ameliorating the digital divide. For informaticists and public health research, devising the capability to extract the necessary data for informatics applications, decision-support systems, and research databases is also paramount and considered a success measure.

However, as data extraction and automation become more rapidly implemented in DHT and healthcare through the use of medical AI and other tools, caution must be applied for minorities and less affluent patients due to serious concerns about latent bias in algorithms.

Several studies discussed how to build "fair" models and avoid latent biases that would further propagate health inequities both explicitly and implicitly (Bates, 2021; Murray et al. 2020; Shickel et al. 2018). The respondents in this study did not address any of those intrinsic problems, but rather praised the capabilities of those technologies to potentially transform the onerous way SDH are currently collected and extracted. This could either indicate a rush to embrace modern tools without the necessary rigor or due process that should be afforded with unproven technologies, or merely a proof-of-concept exploration of the potential of these platforms. The lack of a uniform lexicon and medical codes for SDH continue to hamper progress, as they add an additional stressor and pressure point for informaticists, clinicians, researchers, and population health experts who demand better and higher quality data. As reviewed earlier, SDH documentation that is meaningful and retrievable is documented in vastly different ways based on the presence of a standardized terminology (Monsen et al., 2018). The research and administrative staff members in this study validated those concerns, which impede their ability to evaluate the success of their own work at the *Reflexive Monitoring* layer.

Taken together, these components of the NPT framework narrate a consistent pattern that helps explain an AHC’s implementation of digital health interventions that can be used to describe, assess and enhance its future potential.

Research Inquiry Insights

Recalling the original research question—**how have AHC institutions used their EHR/EMR for the specific purpose of optimizing SDH data to advance health equity for medically underserved areas/populations**?—Chapter Four framed the corpus of evidence toward answering the central research inquiry. AHC policymakers and administrators, as their illustrative quotes reveal, have remarkably similar struggles nationally across the board with

EHR implementation, SDH screening hesitancy, resource challenges, extracting the data, justifying its impact and return on investment, and continuously evaluating the overall role of the EHR in helping to reduce health disparities. While electronic SDH screening and intervention are yet not part of standard clinical care, they provide a window into assessing and managing social needs and aggregating large sums of data that were previously unavailable at this scale. This is an attractive value proposition, especially for AHCs whose work as a safety-net bureaucracy promotes patient and population health. Each of the heterogeneous perspectives from the academic research, administrative, and clinical roles in this study spoke extensively on the vendor's platform offerings, resource and staffing challenges for conducting health equity work, and how it connected to their overall proficiencies. Despite AHCs having a reputation for being well-financed and resourced environments, the reality from the data embodied in Chapter Four paints a different portrait for those involved in frontline health equity work.

Analyses of Present and Emergent Themes

A clear and present theme amongst those interviewed is that while there is not a categorical declaration of a health equity mission found in the language of the broader Institutional AHC mission statement, the work carries on regardless. The AMC (Academic Medical Center) or a Departmental mission may express discrete health equity goals differently, but there equally is no expressed notion of harnessing specific technologies such as the EHR to achieve those goals. Health equity exists as a dispersed initiative across Departmental boundaries without centralized governance. While no single entity may 'own' the health equity mission across specialties and Departments, the Chief Diversity/Equity Officer and their respective offices are certainly there to help coordinate and organize the existing efforts and resources. One interpretation of this dynamic is that the AHCs carefully invest resources, people, and infrastructure to actualize or operationalize the frontline work (e.g., operating free vaccine clinics) without calling attention to a specific technology, methods, or vendor platform which facilitates operations. This reputational safeguard would ensure that they are not beholden to one particular vendor or system but rather to standardized workflows that allow them to do the job.

At the mission level, less weight is placed on the technology platform, and more emphasis is on the workforce's contributions to patient and community impact. Beneath that, at the operational level, best practices, policies, and guidance will undoubtedly reference the EHR as a tool to be used by many. While not a question directly posed to participants, one may ask whether digital health technology tools and platforms are significant and consequential enough to make an overall measurable impact?

A surprising and unifying theme uncovered during the interviews was the extent to which the AHC's capabilities, capacity, and effectiveness in meeting patient/community needs were perceived as lagging, stifled, or not as evolved as it should be given their resources. This was surprising considering the common perception of abundant wealth of resources within AHCs, especially AMCs which drive a significant portion of University revenue between their medical school and hospital system. Undoubtedly, the 2020 George Floyd social justice protests and COVID-19 pandemic added new pressure points, a sense of urgency, and an accelerated desire for internal changes, forcing AHCs to recognize and implement more health and social equity initiatives formally. Yet, as Table 5 depicts, even when recalling examples of success stories, a persistent mood reflected from the responses was that the impact was not deep or meaningful enough to address the needs and that more could be done given adequate time and resources.

Aside from the typical workflow and technology challenges, directly addressing patient SDH is an even higher and more stressful burden, as high caseloads, time constraints, inefficiencies in tracking, and lack of extensive community resources continue to encumber AHCs of all types, sizes, and regions. Browne et al. (2021) support the observation, through sentiment analysis, that most frontline healthcare workers who attempt to address SDH express “distress associated with having to communicate to patients that they were unable to address certain needs.” Consider a healthcare worker documenting a case of intimate partner violence or food insecurity as an SDH and being powerless to help or intervene directly. While leadership and administrators agonize about improving EHR/SDH screening workflows, operational change management, responding to political and social movements, acquiring financial resources, and persuading the C-Suite for additional support and stronger community partnerships, the psychological burden on frontline resource staff is a fundamentally crucial factor which contributes to burnout and, most likely, to patient care. Combined with powerful feelings of patient or community mistrust and skepticism expressed towards them, it is easy to understand how and why fatigue, burnout, and cynicism can contribute to a disheartening cycle in the delivery and management of healthcare. How can one be expected to improve health and outcomes if the community lives in perpetual fear, as one clinical leader narrated regarding undocumented patients:

> *We have the majority of [redacted]. If you look at the demographic, it’s fairly young, I think the average age is about 28-30. A lot of blue-collar families. So culturally, there's a lot of pride, and a lot of them don't want to share the poverty levels or income levels. There's also a pretty big group of patients that might not be documented. And so any type of these kinds of questions related to real lifestyle, they might be apprehensive about providing data, because there might be some fear that it might affect their status here in the United States.* – Clinical Leader C

Clearly, national policy issues such as immigration and resolving undocumented migrants’ status should not be the burden of frontline healthcare workers. Nonetheless, they are caught in the crossfire of providing optimal care based on the patient’s background and needs, addressing behavioral and social factors, satisfying AHC mission goals, tempering mistrust and skepticism, and building trust expressed by the passionate dedication to their profession. Despite the EHR consuming an inordinate and significant part of their clinical time, there was resounding and positive recognition from all those interviewed for its benefits to patient safety, data collection, and integrated SDH screening toolsets. In this sense, the EHR’s potential is viewed as one of the most promising facets of the health equity mission and the AHC’s ability to meet its goals at the operational level.

Thus, a potential emergent hypothesis I offer is that AHCs, unlike a generic hospital or health system, can serve as unique educational-healthcare, safety-net, research anchor institutions that may wield a distinct influence, collectively, over the design of appropriate national standards/policy for EHR/SDH data collection and reporting, and meeting health equity targets for underserved populations. As defined earlier, all AHCs are universally grounded by their core, tripartite mission of furthering their organization's academic, research, and patient care (clinical) goals and the broader population. The stakeholder profiles from this study represent layers of that institutional bureaucracy and mission focus. Inclusive in this cohort is a multitude of clinical specialties, basic health science researchers, informaticists, academic staff, community-engaged programs, student-based outreach initiatives, and other health equity-adjacent enterprises. With such depth and breadth across a multiplicity of perspectives for input and influence, they may be better positioned to orchestrate guidance and approaches around SDH collection and tangible actions to address it in the context of reducing health disparities. From the literature review, we note that Betancourt (2006) and the IOM report of Unequal Treatment specifically appealed to academic medicine to play a more central role in society, including providing primary and specialty medical services, caring for the poor and uninsured, engaging in research, and educating health professionals. Betancourt (2006) argued that academic medicine should provide national leadership by identifying innovations and creating solutions to the challenges the healthcare system faces in its attempt to deliver high-quality care to all patients. This aligns with the emergent theory where AHCs may wield a powerful influence over SDH standardization by asserting a position of national leadership and pushing for solutions from their bully pulpit.

National policy and decision-support systems, though, cannot be effectively informed if the underlying issues are not well understood. As health equity projects continue to proliferate across an AHCs geographic boundaries and as payers increasingly shift to value-based care, the data from those initiatives will provide astute revelations as to the best forms of intervention and prevention. In addition, devising new ways to extract and leverage data will help policy-level decision-makers stay informed on how best to make direct, tangible impacts on their communities' well-being.

Evidence of Contradictions, Paradoxes, and Variations

> *"I worry that we have a little bit of a God complex about it. Like 'oh, we doctors can give you this resource you didn't have.' 'We doctors can solve your psychosocial problems,' which is not that simple.* – Clinical Leader F

The lofty expectations placed on AHCs as stable, trustworthy, safety-net Institutions for patients in vulnerable and lower-income communities are immense. They contribute to multiple paradoxes wherein profitability and charitability, privacy and transparency, passion and hesitancy, resource-rich and resource-poor must all somehow peacefully coexist together. If health equity does not belong to any individual program, leader, or institution (as one executive leader posited in Chapter Four), then how can an AHC be expected to achieve its common institutional goal with a fragmented operation? Likewise, if electronically capturing SDH data is essential to address health disparities (and acquire more resources to help with screening), how can that be accomplished if the standards are not universally agreed upon, if the resources to capture the SDH are not present, if the financial incentives have not yet materialized nationally, or if barriers such as hesitancy and skepticism continue to obstruct progress? One clinical leader from a Northeastern AHC correctly labeled this as a “chicken and egg problem” in Chapter Four. Throughout the study, evidence of competing interests, contradictions, paradoxes, and other nuanced areas of variation were elucidated from participant responses.

SDH Data Collection And The Value of DHT

As the literature review, results, and narratives uphold, there must be community and patient inclusivity with the design and implementation of DHT, but in particular with how the EHR is implemented for electronic SDH capture and collection. However, a paradox with EHR/SDH standards, as Figure 3 depicts, is that patients, by design, are often the recipients of the end product and are not present at every stage of the lifecycle. The confluence of government policymakers, vendors, health systems, and other actors tend to converge around meeting finance/regulatory needs rather than accessibility or patient needs. This is not to imply that patients should have direct input on which SDH fields to capture or which technology protocols are best suited for health systems, but rather their sensibilities and concerns about hesitancy, mistrust, and skepticism must be absorbed and respected. For example, Chapter Five cites an executive leader from a Midwestern LGU who articulated explicit intentions to extract data from credit reporting agencies to populate their health databases. Without consent, this could very easily be interpreted by patients as a nefarious violation of privacy and confidentiality, further aggravating feelings of medical mistrust and hesitancy. Sensitivity to these concerns should remain evergreen and paramount in all stages of implementation. The recipients of these health equity initiatives, DHT products and innovations must be seen, heard, and valued.

In a related example, electronic SDH capture presents an additional Catch-22. In order to make any progress on community health equity, aggregate population-level data and registries with SDH must be created and managed. These are necessary to make evidence-based analyses and inform decision-support systems. To achieve that level of sophistication, obviously, requires resources – resources which, ironically, must be justified by demonstrating the utility and effectiveness of that very same collected data. Electronic SDH capture, health information exchanges, and interoperability all necessitate that AHCs acquire new resources or institute a re-prioritization of current resources to overcome impediments like hesitancy. However, those resources also cannot be acquired until the efficacy and value of those technological innovations can be proven in the first place. Thus, pilot projects and early adopters in this ecosystem become vital to showcasing proof-of-concept success stories that may be scaled and adapted for wider use. As they gain momentum, achieve saturation in the marketplace, and produce scholarship on their effectiveness, they will eventually become normalized, expected, and finally (through many years of trial and error) incentivized through the payer system or via legislation.

Recalling the role of AHCs and health informatics from the literature review, health informaticists possess a significant amount of technical expertise with EMR systems and modern technologies such as natural language processing (NLP), machine learning, and artificial intelligence (AI) that can be leveraged to pre-populate SDH in electronic databases and build registries (Veinot et al., 2019). That collected data can then be used to craft additional evidence-based, customized DHT for patients and communities. These informatics experts and the innovations they leverage continue to demonstrate tremendous efficiencies which will bear fruit in the decades ahead that will advance the mission of AHCs. However, the overall value of DHT and its ability to directly impact health outcomes on a macro scale will linger as a contentious debate with mixed results, both within AHCs and with other healthcare organizations. As AHCs invest more in DHT, contradictory evidence on its efficacy cloud any definitive verdict that can be rendered on its widespread adoption. Micro-level targeting may well continue to be the norm until highly accessible DHT such as telehealth truly become mainstreamed rather than the irregular exception.

Studies such as Miyamoto et al. (2021), Qian et al. (2021), and Prahalad et al. (2021) discussed positive DHT telehealth use-cases across different care needs such as sexual assault care and pediatric diabetes among Hispanic, non-Hispanic Black, and low-income groups during the COVID-19 pandemic. The providers from these cases do not view telehealth as a temporary solution to compensate for the pandemic, but rather a reliable clinical tool that simply experienced an accelerated adoption timeline. Despite the mixed evidence of exacerbating social inequities as discussed earlier, as well as the EHR consuming an inordinate and significant part of their time, the AHC respondents from this study continue to express hope that the potential of the EHR and subsequent DHT represents the most promising facets of the health equity mission and the AHC's ability to meet its goals at the operational level. As the opening quote implies, physicians and the technologies they use will not be able to solve every behavioral health issue, every psychosocial problem, every social illness, or compensate for every deficiency or gap in care, but with targeted and sensitive integrations it may indeed help measurably reduce some disparities among some groups (Westby et al., 2021).

Health Equity Ownership

This study included four distinct respondent profiles: research staff, administrative staff, executive leadership, and clinical leadership. While there are most certainly leaders within each of these profile types, no single leader in any AHC has every single programmatic, health equity initiative reporting directly to them. The findings and narratives reinforced a recurring tension of institutional vs. program ownership of health equity within AHCs and between these respective roles.

Administrative staff across various Departments, programs, and silos often serve as part of the entrenched bureaucracy and the bureaucrats within the ranks who carry out the daily, programmatic work. Their narratives in Table 4 describe active work in fulfilling their interpretation of inferred goals of the Institution even when that Institution has not provided a clear, explicit directive (which they can recall) to reduce health disparities. It is part of their program's core identity, rather than the Institution's idealized identity. Later in Table 5, the same cohort acknowledges that they are comparatively behind and are not adequately meeting those goals to the extent that they believe is achievable with adequate resources. From the macro lens, the executive leadership participants observed that health equity work has progressed in various pockets around the AHC, but they recognize it is not a simple endeavor that can be managed or governed from the top-down. There are simply too many specialties, diffuse levels of expertise, unknown variables, and factors spread across the massive AHC bureaucracy between academic, research, community, and clinical contexts. Individual programs and departments hold their own staff accountable. Since no single individual leads or owns health equity in its entirety from the top, it makes notions of accountability, transparency, and measurement of Institutional outcomes difficult to compile and logically assess. The model in place at several AHCs also raises the stakes for consistently elevating health equity onto the broader AHC agenda. When there are so many complementary projects across the board that spring from genuine efforts to improve community and patient outcomes, pulling those efforts together under one roof seems farfetched.

This dynamic represents a type of laissez-fare (and sometimes transactional) form of self-governance in AHCs observed from participant responses, where initiatives become so widely diffuse across specialties and siloes that it becomes politically challenging to centralize under one office or person. Neither the administrators, patients, clinicians, researchers, nor leadership may be able to fully capture and articulate the entire range of an EHR's capabilities, the Institutional health equity programs, or the many vectors involved in a program or technical implementations. Any policy formulation calculations, therefore, need to be a collective effort to resolve the opposing or contradictory views. If groups are not involved, the long-term costs, in terms of programmatic compliance and efficiencies, may be immense with sustained damage to quality and health outcomes. This lends further justification to AHC stakeholders seeking close, inclusive internal and external collaborative partnerships in the overall calculus of health equity work.

Recalling earlier discussions of inclusivity, a strong bidirectional shared relationship between an organization and community partners would support healthcare workers to "center at the margins" and make the system work for the people and communities who experience social inequities. Doing so would also potentially lessen the emergence of the "inverse care law," where health products and services are always used most by those who need them least (Azzopardi-Muscat and Sørensen, 2019). In the truest sense, this transfers part ownership of health equity to the communities, the people, and to society at large who can collectively work together change the conditions which negatively impact outcomes. This can include civic activism to appeal to state and local legislatures, policymakers, business owners, or others who have a vested stake in a prosperous and healthy populous.

Incentive Structures for Reimbursement

Another major discrepancy is the incentive structure of reimbursement. One account noted that it was an internal Finance Department who had already built-in financial screener questions in the EHR in order to document income levels. Even though this level of data was viewed as intrusive for many patients, as another participant in Chapter Four argued, it is nonetheless required by the AHC. The requirement to capture personal and family income has become a tacit requirement for healthcare systems in order for the associated AHC hospital to get paid, as one executive leader from a Southern AHC noted in their narrative:

> *Yes, there's a financial incentive because if we don't screen for finances for low-income individuals who are uninsured, then we don't get paid. Simple as that - from any source, whether it's the state's indigent care program, or Medicaid, or if people are eligible for a health insurance exchange.* – Executive Leader B

Value-based payment models are the incentivized drivers for capturing many types of personal, non-medical patient data, including SDH. While the electronic SDH screenings are ostensibly designed to collect data to improve health outcomes, provide referrals, and address upstream factors, there are clearly tangible, financial motivators that may appear concealed or obscured to the patient at the time of data collection. As the U.S. has not legislatively adopted a “Medicare for All” or universal health insurance coverage policy, this data collection, while seemingly intrusive, is needed for the AHC to be compensated for its services provided to the patient. In this sense, the patient is relinquishing their personal, private data and sense of agency in order to receive basic healthcare, which ironically may not have any impact whatsoever on their own long-term health outcomes. If patients already arrive in the health system with a sense of medical mistrust, hesitancy, and skepticism, then knowing that an (already frustrating) electronic screening process of their SDH also indirectly contributes to the financial profits of an AHC may simply add more salt to the proverbial wound. As the previous section on SDH screening indicated, even if an initiative remains a high priority for the provider or the health system, it can be a source of intrusion, embarrassment, shame, and ridicule for the patient. Unless the U.S. system of health insurance coverage is fundamentally and radically changed, this incentivized dynamic to collect personal information for payer reimbursements will remain indefinitely.

These aforementioned examples of nuanced variation and tensions throughout the study indicate that AHCs exist in a universe that is rife with contradictions and gravitational forces that sometimes pull them into opposing sides and positions which appear inconsistent to outsiders. In spite of those appearances, the health and research professionals interviewed for this study still tirelessly endeavor to limit bias and reduce stigma, improve quality, thoughtfully consider health communication and community engagement methods, address screening hesitancy and patient vulnerabilities, ensure privacy, and confront social needs to the extent possible with the technologies and tools available to them.

Chapter Seven: Conclusions and Recommendations

"Of all the forms of inequality, injustice in health is the most shocking and the most inhuman because it often results in physical death." — **Martin Luther King Jr.**

King's profound words on systemic poverty, racism, education, and housing all spoke to social determinants of health and the injustice that is sentenced out to society, namely the loss of life and life expectancy for marginalized communities. During the pandemic, U.S. life expectancy decreased from 78.86 years in 2019 to 76.60 years in 2021, yielding a net loss of 2.26 years, with U.S. Hispanic and non-Hispanic Black populations experiencing the most considerable losses in life expectancy (Masters et al., 2022). Simply expanding care coverage is insufficient. Improving health indicators such as life expectancy and infant mortality will require measuring and raising awareness of SDH and fortifying strong coalitions between public health, government, healthcare, and social service sectors of the nation to collectively fix this enormously complex challenge.

Several key findings strongly demonstrated by this study include:

- Undertaking an electronic SDH screening and updating workflow processes within an AHC's clinical enterprise is a significant venture with multiple points of failure and incomplete data on its return on investment.
- Merely converting the SDH screening process into EHR tools does not automatically lead to universal adoption and awareness, as numerous hesitancy factors from providers and patients diminish output.
- Furthermore, even when SDH data are collected, data extraction and analysis capabilities vary widely between AHCs. This variation underscores the need for additional investment in resources that accommodate differences in workflow,

staffing models, and screening targets between different care specialties within the AHC.

- The AHC incentive structure for capturing SDH and addressing the underlying significance of those factors, in the context of its health equity mission and regulatory, billing, and compliance needs, necessitates systematic and continuous monitoring of patient health inequalities and community social factors.
- While food, housing, and transportation appear to be the leading SDH fields captured and operationally addressed between AHCs, lingering stakeholder perceptions of doubt and the ‘ripeness’ of their health equity programs persist. It is still far too early in the journey for many to say that they can accurately measure actual health outcomes and the AHC's impact. Referrals and interventions are currently the only practicable metrics.

Success metrics will continue to be a moving and evolving target until internal workflows and standards are better stabilized in AHCs. The structural and cultural dynamics within the bureaucracies of AHCs lend themselves well to exploiting digital health tools such as EHRs in order to maximize the benefit for medically underserved areas/populations. As both Ash (1997) and DePasse et al. (2014) indicated in their studies, the presence of technology “champions” is essential for creative and innovative ideas to emerge, to push back against bureaucratic resistance, and to act as enthusiastic and decisive decision-makers who could wield influence over the institution. This study validated that these champions are, undoubtedly, the CMIO and Chief Health Equity/Diversity Officer within the AHC, serving as key, de-facto policymakers for AHCs and as an essential ingredient for realizing the true potential of electronic SDH screening and data capture.

Recommendations on Technology Accelerants and Inclusivity

The research from this paper highlighted some of the ongoing barriers and workforce resource disparities where AHCs cannot simply rely on existing assets and infrastructure but require a paradigm shift to better help patients and communities with social needs. Potential technology disruptors identified in the literature review and the CMIOs that would help drive a paradigm shift include the introduction of AI, NLP, and automation toward electronic SDH screening. Using these tools and processes to pre-populate the EHR databases is an appealing suggestion, though potentially fraught with privacy concerns and invasive methods used to collect the data. While it can eliminate the manual labor of screening, bypass hesitancy concerns, and provide recommendations from analyses of a variety of data sources, it will not resolve the closed-loop dilemma referenced in Chapter Four. Patra et al. (2021) concluded that NLP, in particular, offers significant potential to extract SDH data from the EHR's clinical notes, which in turn can aid in the development of screening tools, risk prediction models, and clinical decision support systems. As different leaders in this study noted, an exploration of these technologies remains on the horizon as a way to accelerate change and adoption of EHR/SDH data within their institution.

AHCs, given their unique role and access to powerful technology hubs, can direct resources to research, recommend, and standardize these technologies as a form of quality improvement and to drive innovation in SDH screening nationally. As knowledge workers responsible for ingesting and analyzing huge amounts of data in the care of patients and communities, this seems entirely apropos. Inaccurate and incomplete data collection processes, which are widespread, simply add to the Institutional sense of frustration and helplessness expressed in the qualitative interviews. These can be alleviated by leveraging technology accelerants to push forward the care and support model.

However, inclusivity in the design and development process, especially in finding appropriate consent models for data sharing, is a vital component. By increasing workforce diversity and ensuring access to culturally and linguistically competent care, AHC healthcare and community organizations can be brought together to improve the accessibility, quality, and coordination of services. As Brewer et al. (2020), Xie et al. (2020), and Block et al. (2020) argued in the literature review, inclusivity for marginalized and vulnerable groups is crucial for the codesign at all stages of innovation and implementation, such that they are also stewards of their own health outcome data and that we studiously avoid duplicating the social stratification that already exists in society at large. Community advisory boards, social media, and other innovative mediums of community engagement are entirely within the scope of an AHC's typical activities. Using the patient and community voice has the potential to accelerate health disparities research and promote efforts to reduce health inequities, but only if those marginalized groups have a sense of agency as their own health stewards. Such models may also help mitigate community perceptions of the 'savior complex' identified in Chapter Four.

Patients, providers, vendors, and the AHC can seek approaches that balance the use of existing data with the need to collect standardized new data to optimize the integration of SDH data in providers' workflow and create a holistic picture of patients that may ultimately reduce health disparities. To develop the community's trust and present tangible benefits that the AHC offers, community-academic partnerships with employment programs for hiring locally and using local companies for supplies can add to the sense of confidence that patients feel towards the AHC. Kuehn (2019) notes that "the main barrier to hospitals' efforts to address social determinants of health is funding, according to [a] Deloitte survey," despite that same survey revealing that 80 percent of hospitals and health system leaders are committed to addressing social needs. Additional government sponsorship of programs and grants funneled to AHCs, as the community anchor institutions, can help address gaps in education, long-term unemployment, or hiring those with criminal records, contributing to developing stable and healthy communities (Kuehn, 2019).

Nevertheless, the quintessential bureaucratic obstacle for AHCs and their associated AMC is their instinctive reluctance to make fast, sweeping, and dramatic changes. While not addressed directly in this study, Coopers (2012) details how this will be problematic for shifting the paradigm:

> "When asked how their organizations would manage internal and external challenges, AMC leaders responded less favorably to initiatives that would require significant changes to their governance structures, such as the development of a single governance structure or the consolidation of academic departments. For example, only 11% of leaders were considering the consolidation of departments or centers. However, a more streamlined organization can enable AMCs to quickly capitalize on partnership opportunities or research collaborations. "AMCs have always been viewed as slow to change, and we have defended ourselves by saying it is because we are complex entities," said John R. Brumsted, MD, interim president and chief executive officer at Fletcher Allen Health Care in Burlington, Vermont. "However, other large and complex organizations, such as Apple, are able to move a lot more quickly than we are." (p. 15)

For many AHCs, openness to change is a requisite if they are to make any significant leaps from the routine "intervention" over to "prevention" of the upstream factors for better long-term outcomes. While there is no single antidote in the health disparities formula, the industry's gravitational pull and national trends lean towards better population health and precision medicine via better SDH metrics to improve quality of care and lessen disparities. AHCs must adapt to this reality to play the central role they were always conceptually and philosophically designed to fulfill.

Limitations of the Study

While this was a national study that included multiple U.S. AHCs in differing regional contexts, types, and land-grant status, the lack of representation from vendors, patients, and community member voices and the limited scope of questions restricted a full understanding of the impact of an AHC’s use of EHR/SDH in medically underserved communities. By excluding the perspectives of vendors, patients, and community members, some of the findings or recommendations could be interpreted as “one-sided” that positively favor the AHC’s needs rather than community or patient concerns. For example, how would a patient respond to issues of hesitancy, skepticism, or medical mistrust or how would the vendors describe their own challenges with navigating complex federal policies and regulatory environment in order to get to a standardized SDH screening? Entire communities or patients may have a variety of stratified opinions towards their specific AHC or healthcare in general that could impact their view of inclusivity in the implementation design process. This would most certainly influence the strategies that the AHC would take in EHR/SDH screening adoption and patient engagement. Vendors may also not be in a position to issue prescriptive or proscriptive technology standards for their platforms if the upstream and midstream social conditions which define SDH continue to be endlessly debated as a moving target. They also may not view their platform as the appropriate medium for this specific type of data capture and cannot fully accommodate the demand set upon them by AHCs and other healthcare providers when there is such a wide variety of needs between specialties.

Further, not all varieties and stratifications of roles within the AHC groups were included as participants primarily due to a lack of response to requests to participate in the interview process. Convenience sampling was a limitation, as the target sample strategy focused on specific role types within the AHC ecosystem. There may indeed be several non-clinical voices who are not directly involved with the EHR or SDH collection in these Institutions but may hold strong beliefs in the capabilities (or lack thereof) of technology to address health equity issues for underserved populations. For example, AHC representatives from population health, behavioral health, social work, or student bodies, may differ in their approaches or recommended methodologies for community engagement or screening. This could imply a much wider variation and heterogeneity of perspectives within the Institution that may or may not fully support the broader Institutional goals and allocation of resources in favor of other priorities.

More data was also needed to disaggregate regional differences (rural vs. urban populations) or whether AHC type and the particular care practice from some AHCs influence the prioritization of which SDH fields to screen for. This specific limitation greatly limited the scope of this study as there could be a tremendous amount of granular data between regions that would help inform a region-specific or AHC type-specific strategy. For example, would an AHC positioned in more rural, conservative areas require an entirely different set of screening tools, community engagement approaches, or more social workers for their different care practices than those positioned in an urban environment with a different population and differing upstream community factors? These questions could potentially be resolved with additional quantitative or mixed-method approaches that would illustrate a full spectrum of data points from multiple dimensions of the AHC presence. Future research that replicates this study at yearly increments using a multi-case study approach could further extend an understanding of the impact of an AHC's electronic SDH data collection and usage.

Finally, AHCs also only represent an overall fraction of all U.S. health systems, and the results from this study may not be totally applicable to other systems by comparison. As Figure 3 depicts, multiple healthcare systems and delivery models exist in the United States such as FQHCs, CHCs, Managed Care, PCMH, ACOs, private, and others. The unique and complex combination of academic, research and clinical domains and interdependencies within an AHC differentiate it from other healthcare systems, which could limit the recommendations of this study to AHCs alone. Advancing DHT and social equity, as noble ideals and strategic goals, may not even be relevant for private healthcare systems and medical groups, for example. From the perspective of corporate entities, those goals may be seen as inflated in the public consciousness and will fade with time. As safety-net institutions, the AHC may prioritize community needs and medically underserved populations more than others and, thus, the specific EHR/SDH implementation would also vary for them compared to others.

Future Research

Variations between AHC regions and care specialties should be further scrutinized to account for the non-standard SDH collection practices, barriers, and accelerants across the AHC ecosystem. For example, many in this study commented that they often leave it to their clinics to independently decide which SDH are collected, but there may exist additional variances between Land Grant vs. Non-Land Grant, those with more rural health needs than those without, or those with a more undocumented population than those without.

Combining such research on AHCs and geospatial factors and zip codes on patients at greater risk would also add a significant amount of contextual data to help with policy development. Sokol (2019) and other literature rightfully note that “an individual’s zip code is more predictive of her health than her genetic code, but it’s not just zip code data that can help tackle social determinants of health.” Zip-code level data is the starting point for most impact analyses, but there might be better and more ideal geographic units for assessment depending on the organization's goals and the accessibility of data.

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Appendices

Appendix A – Interview Guide & Protocol

INTERVIEW GUIDE & PROTOCOL

Study Name: Academic Health Science Centers and Health Disparities: The Intervening Role Of The Electronic Health Record
Student Investigator: Wies M. Rafi
VCU Investigator: Sarah Raskin, PhD, MPH (Dissertation Committee Chair for Wies Rafi)
Program/Institution: Public Policy and Administration (PPAD), L. Douglas Wilder School of Government and Public Affairs, Virginia Commonwealth University (VCU)

I. INTRODUCTION

Good afternoon. Thank you for taking the time to participate in this interview. My name is Wies Rafi and I am a second-year doctoral student from VCU's Wilder School of Government and Public Affairs. As part of my dissertation research, I am studying how AHC institutions and its administrators are using SDH in their EHR/EMR – specifically to advance health equity.

The purpose of this interview is to understand your experiences as an AHC administrator and your perceptions of the EHR/SDH implementation within your role. Results will only be reported in the aggregate and any quotations included will reference key descriptors (e.g. public/private university, job role, etc.). It will not be possible to identify you from the way that this analysis will be reported.

Our session today will last about 30-45 minutes.

II. INTERVIEW SESSION

The purpose of this interview session is to learn about your thoughts and experiences as an Academic Health Science Center administrator. I will ask you to explain some of your general experiences and follow up with any clarifying questions.

Before we begin, let's review the logistics. First, we will record the interview so that we don't miss anything you say, and so that all of your comments will be fully understood after the interview is over. Also, any information that could identify who you are, such as your name, will not be shared with anyone outside of this interview in order to protect your privacy. Do I have your consent to be recorded for the purposes of this study and to voluntarily participate in this interview?

(begin recording)

Thank you for granting permission to record. You will be asked a series of semi-structured questions related to study themes and your answers will be recorded for the purposes of analyses and interpretation. You may interrupt and ask questions at any point during this process. You do not have to participate in this study. If you choose to participate, you may stop or skip at any time without any questions. Your participation in this study is strictly voluntary.

(Warm Up):

1. Could you please introduce yourself and your role within (AHC name)?
2. Could you tell me how you came to work at (AHC name)and what interested you about the environment and mission?
3. How does your role interface between the technology, research, and clinical teams in (AHC name)?

Question	Literature Review Category	Applied Framework	Unit
Part 1 - Institutional Questions			
1. How does (AHC's name) operationalize its mission to improve health equity? *Prompts:* *1a. Could you describe your understanding of health equity initiatives and how (AHC name) formally articulates it?* *1b. How is responsibility for improving health equity distributed among AHC employees?* *1c. How does the shared mission motivate your teams?* *1d. How do your AHC units internally collaborate across departments?* *1e. Describe (AHC Name)'s relationship with the region and local community via its health equity programs?*	Health Disparities, DHT & Social Equity, AHC	Dimensions of Strategic Change (Pettigrew) Normalization Process Theory (NPT)	Individual Group
Part 2 - Implementation and Operationalization			
2. How are different roles in your Institution involved with the EHR?	SDH, DHT & Social Equity, AHC	Normalization Process Theory (NPT)	Individual Group
3. How does your Institution regard the role of the EHR with regard to health equity? *Prompts:* *3a. Could you describe any formal efforts in your*	Health Disparities, SDH, DHT & Social Equity	Normalization Process Theory (NPT)	Individual Group

AHC regarding 1) health equity or 2) how to use DHT in community settings (e.g. training programs, goal setting, etc)? *3b. Which specific health equity programs use DHT?*			
4. (Introduce Handout, Appendix E). Could you please describe (AHC name)'s experience collecting SDH fields in the EHR. Please begin by telling me how the fields were identified as priority, by whom, and then walk me through the processes from there. *Prompts:* *4a. What challenges did (AHC name) encounter trying to operationalize SDH in the EHR?* *4b. What successes did (AHC name) encounter trying to operationalize SDH in the EHR?* *4c. What key facilitators or resources in the AHC helped during the implementation?* *4d. How did (AHC name) involve people outside of (AHC name) in your EHR/SDH implementation, such as community members or other stakeholders?* *4e. Given the lack of a unified taxonomy, how do you leverage the medical vocabularies/databases (LOINC, SNOMED CT, ICD-10-CM, and CPT) to design your SDH strategy?* *4f. What community factors inform how your EHR is used in service of addressing health disparities? For example, are your SDH variables determined by a community advisory board or other benchmarks during care?*	Health Disparities, SDH, DHT & Social Equity, AHC	Normalization Process Theory (NPT)	Individual
5. What has been the impact of implementing SDH fields in the EHR on the AHC overall? *Prompts:* *5a. How did (AHC name) evaluate the outcomes of your EHR/SDH implementation? What did it reveal?*	DHT & Social Equity, AHC	Dimensions of Strategic Change (Pettigrew)	Organizational

5b. How was (AHC name)'s understanding of the EHR/SDH implementation communicated to internal and external stakeholders, patients, and others? *5c. How did (AHC name) consider the choices between non-digital solutions vs. DHTs?*			
6. How does (AHC name) plan to improve upon SDH collection and fields in the future?	SDH	Dimensions of Strategic Change (Pettigrew)	Organizational
7. What is the future of EHR/SDH and health equity at (AHC name)? How will the field be impacted by current trends?		Normalization Process Theory (NPT)	Individual Group

VI. CLOSING

Option 1: Time Still Remaining: Before we end the session, are there any other comments that you have or topics that we missed in our discussion? Thank you for your time and participation.

Option 2: Time is Up: If, after today's session, you think of any other comments or topics that were missed please feel free to contact me by email. Thank you for your time and participation.

Appendix B – Recruitment Script

Subject Line: Invitation for Interview Participants

Dear Colleagues,

I am writing to let you know about an exciting opportunity to participate in a voluntary research study about Academic Health Science Center (AHC) administrators, EHRs, social determinants of health (SDH) and health equity work.

Participation includes a 30-45-minute recorded Zoom interview session where participants share their unique perspectives, experiences, and expertise with their EHR and optimizing SDH data to advance health equity for medically underserved areas/populations. Example AHC administrators could include:

- senior research dean
- chief medical informatics officer
- chief research/data informatics officer
- department chair
- program manager
- program specialists and analysts
- community navigators
- EHR implementation specialists
- technology managers

This study is being conducted as part of the dissertation requirements for the completion of a Public Policy and Administration doctoral program at Virginia Commonwealth University (VCU).

Your participation will further add to the body of knowledge and scholarship for quality improvement with health informatics, public health, public policy, and implementation science. If you would like to participate or would like additional information about this Institutional Review Board approved study, please contact us below.

Thank you for your consideration!

Wies Rafi
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Appendix C – Research Participant Information Sheet

Study Title: Academic Health Science Centers and Health Disparities: The Intervening Role Of The Electronic Health Record
VCU Investigator: Sarah Raskin, PhD, MPH (Dissertation Committee Chair for Wies Rafi)
Student Investigator: Wies M. Rafi
Program/Institution: Public Policy and Administration (PPAD), L. Douglas Wilder School of Government and Public Affairs, Virginia Commonwealth University (VCU)

You are invited to participate in a research study about Academic Health Science Center (AHC) administrators and share your unique perspectives, experiences, and expertise with electronic health records (EHRs), social determinants of health (SDH) and health equity work. Your participation is voluntary.

In this study, you will be asked to do the following things:

1. Participate in a brief, 30-45 minute Zoom interview designed to understand your experiences as an AHC administrator and/or stakeholder.

2. Respond to a series of semi-structured questions related to the facilitators, barriers, success stories, challenges, and opportunities toward the optimization and effective use of EHR social determinants of health (SDH) data elements in order to advance health equity.

Your answers will be recorded for the purposes of analyses and interpretation. You may interrupt and ask questions at any point during this process.

CONFIDENTIALITY

- The interview will be recorded and transcribed for the purpose of analysis. Transcripts of these recordings will be provided to all participants for review and accuracy confirmation.

- You do not have to participate in this study. If you choose to participate, you may stop at any time without any questions. Your participation in this study is strictly voluntary.

- You have the option to receive a certificate of participation as a thank you, on behalf of Virginia Commonwealth University (VCU), at the completion of the interview. This does not count towards CME credits, and is more of a gesture of our thanks for your participation.

- You will have the option of changing your name, and disabling video sharing prior to the interview to protect your privacy.

- You will also be asked not to disclose the identity of others during your responses. Any accidental disclosure will be scrubbed from the final transcript. Only audio recording will be kept for transcription purposes, and will be deleted once transcription is complete.

If you have any questions, concerns, or complaints about this study now or in the future, please contact:

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Appendix D – Initial Codebook Developed *A Priori* From Interview Questions and Theoretical Frameworks

Group (Parent)	Code	Definition	Applied Framework
AHC	AHC_barriers	AHC barriers to success	NPT
AHC	AHC_change	Change managers, models, champions within the bureaucracy	Pettigrew
AHC	AHC_cultural	Cultural competency training or resources in the AHC	Pettigrew
AHC	AHC_incentives	Any financial/non-financial incentives that are articulated as part of the administration bureaucracy	NPT
AHC	AHC_institutional	Institutional issues that shape perceptions, influence policy or work	Pettigrew
AHC	AHC_goals	Goals, shared purpose, benefits of working towards an ideal EHR/SDH implementation or addressing health equity	NPT
AHC	AHC_leadership	Top down support from leadership to the bureaucracy for the EHR/SDH, or health equity programs	Pettigrew
AHC	AHC_policies	Reference to any formal or informal governance policies	Pettigrew
AHC	AHC_resources	Reference to any resources (internal or external)leveraged for EHR/SDH implementation	Pettigrew NPT
AHC	AHC_site	The specific AHC institution for the participants in this study	Pettigrew
AHC	AHC_site_norms	Any structural, cultural, or leadership norms at the specific AHC institution for the participants in this study	Pettigrew
AHC	AHC_site_research	Health disparities research programs and activities conducted at the specific AHC institution	Pettigrew
AHC	AHC_site_support	Specific actions or initiatives taken to support eliminating health disparities on behalf of the specific AHC institution	NPT
AHC	AHC_successes	Any particular successes or lessons learned that benefited the AHC	NPT
AHC	AHC_teams	Team science or team organizational work towards shared institutional/program goals	Pettigrew NPT

COMMUNITY	COMMUNITY_education	Community health education / or technology literacy efforts	Pettigrew
COMMUNITY	COMMUNITY_engagement	Programs and actions that denote community engagement and involvement with or without DHT	Pettigrew NPT
COMMUNITY	COMMUNITY_impact	Upstream factors for improving community or population health conditions and outcomes	NPT
COMMUNITY	COMMUNITY_intervention	Any type of community screening or intervention conducted on behalf of the AHC or as a form of midstream outreach	NPT
COMMUNITY	COMMUNITY_mistrust	Medical or research mistrust found in community via perceptions, norms, attitudes, and beliefs towards the AHC or its administrators	NPT
COMMUNITY	COMMUNITY_needs	Programs and actions that denote the AHC meeting community needs	NPT
DHTSE	DHTSE_adoption	Reference to any internal and external adoption of DHT or EHR/SDH	Pettigrew
DHTSE	DHTSE_awareness	Reference to awareness of DHT or EHR/SDH internally and externally	Pettigrew
DHTSE	DHTSE_categories	Broad SDH domains and categories evaluated or used by AHC stakeholders and specialists	Pettigrew
DHTSE	DHTSE_fields	Specific fields or codes used for the EHR/SDH work within the AHC.	Pettigrew
DHTSE	DHTSE_operational	Methods and practices that are used to operationalize DHT or EHR/SDH for everyday work.	Pettigrew
DHTSE	DHTSE_optimized	How DHT or EHR/SDH is optimized in care, research, or knowledge settings	Pettigrew
DHTSE	DHTSE_platform	Reference to the EHR platform(s) used by the AHC	Pettigrew
DHTSE	DHTSE_standards	Reference to standards, taxonomies, dictionaries, or other guidance used in EHR/SDH	Pettigrew
DHTSE	DHTSE_targets	Targets and goals that are set for the implementation and optimization	Pettigrew NPT
HD	HD_covid	Health disparities discussed within the COVID-19 pandemic context	Pettigrew
HD	HD_data	Data which illustrates the extent of health disparities among medically underserved populations	Pettigrew

HD	HD_examples	Specific health disparities that the AHC has focused on to track, research, or measure	Pettigrew
HD	HD_outcomes	Outcomes measured or observed by the AHC towards achieving health equity	Pettigrew NPT
HD	HD_posci	Political, social, historical, or national contexts for health disparities	Pettigrew
HD	HD_voice	Patient voice or scenario involving health disparities	Pettigrew NPT
HI	HI_influence	The influence and goals of health informatics within the AHC	Pettigrew
HI	HI_practice	Health informatics practitioners (informaticists) and their work	NPT
SDH	SDH_implementation	Implementation approaches for social determinants of health (paper or electronic)	Pettigrew NPT
SDH	SDH_electronic	Social determinants of health being electronically captured in the EHR for analysis	NPT
SDH	SDH_evaluation	Evaluating the success, failure, or challenges with social determinants of health implementation	Pettigrew NPT
SDH	SDH_refined	Refining social determinants of health through trial/error or other experiences	NPT

Appendix E – Key SDH Domains From Common Medical Coding Systems (LOINC, SNOMED CT, ICD-10-CM, and CPT)

Source: (Arons et al., 2018)

SDH Domain	**Search terms used to derive medical codes in EHRs**
Access to health care	Access to health care, healthcare, insurance, cost, access, afford, uninsured, remote, enroll
Child care	Child care, childcare, daycare, preschool, help
Clothing	Clothing, clothes, hygiene
Education	Education, school, academic, degree, reading, read, college, literacy
Employment	Employment, occupational, job, work, unemployed, vocation, train
Finances	
Income/ poverty	Income, poverty, salary
Financial Stress	Financial stress, financial strain, financial, finances, pay, money, income, resources, welfare, afford, tax
Food	Food insecurity, food, meal, meals, hungry, breakfast, lunch, dinner
Housing	
Housing instability/ insecurity	Housing, house, home, homeless, shelter, mortgage, rent, residence, household, sleep, live, evict
Housing quality	Housing, house, home, homeless, shelter, mortgage, rent, residence, household, mold, leak, infestation, infest, paint, smoke detector, crowded, medical legal partnership
Immigration/ Migration	Immigration, migration, immigrant, migrant, immigrate, migrate, seasonal, refugee, asylum, citizen, citizenship, country. Cultural, culture, visa
Incarceration	Incarceration, incarcerated, jail, prison ,felon, felony, correctional, arrest, arrested, crime, criminal, re-entry, legal
Primary language	Primary language, language, speak, English, interpreter, translator, translate

Race/ethnicity	Race, racial, ethnicity, ethnic, Hispanic, Latino
Residential address	residential address, address, residence
Safety	
General safety (including non-specific abuse)	Safety, safe, unsafe, violent, violence, abuse, afraid, scared, hurt, threatened
Child abuse	Child abuse, abuse, abused, abusive, non-accidental, hit, hurt, conflict, physically, sexually, neglect, protective
Intimate partner violence	Intimate partner violence, domestic violence, domestic, partner, intimate, abuse, abusive, abused, hit, hurt, conflict, physically, sexually, shelter, hotline
Neighborhood safety	Neighborhood safety, neighborhood, environment, violence, crime, unsafe
Social connections/ isolation	Social connection, isolation, isolated, social, support, loneliness, lonely, alone, church, club, friends, relatives, friend, relationship, separated
Stress	Stress, strain, stressor, life event, stressful, coping, relaxation, worry, overwhelmed
Transportation	Transportation, transport, transit, get there, far away, vehicle, voucher, mobile
Utilities	Utilities, electricity, telephone, cell phone, bill, shut off, electric, gas, heat, heating, air conditioning, water
Veteran status	Veteran, military, war, serve, active duty, army, navy, marines, air force
General	social determinants, Social, socioeconomic, Advocacy, community, resource, Screening

Appendix F – Final Codebook

Group (Parent)	Code	Definition
AHC	AHC_barriers	AHC barriers and challenges to success
AHC	AHC_change	Change managers, models, champions within the bureaucracy
AHC	AHC_cultural	Cultural competency or culturally responsive training, resources, or needs within the AHC
AHC	AHC_goals	Goals, shared purpose, benefits of working towards an ideal EHR/SDH implementation or towards addressing health equity
AHC	AHC_incentives	Any financial/non-financial incentives that are articulated as part of the administration bureaucracy or towards the healthcare mission
AHC	AHC_leadership	Top down support from leadership to the bureaucracy for the EHR/SDH or health equity programs
AHC	AHC_partnerships	Affiliates, partnerships, or cooperative agreements with external entities to improve the EHR or health equity
AHC	AHC_policies	Reference to any formal or informal governance policies
AHC	AHC_research	Health disparities research programs and activities conducted at the specific AHC institution
AHC	AHC_resources	Reference to any resources (internal or external) leveraged for EHR/SDH implementation, or for addressing health equity at programmatic levels
AHC	AHC_safetynet	Example of how the AHC mission or its programs serve as a safety net for the community, the underserved, and/or vulnerable populations
AHC	AHC_site_norms	Any structural, cultural, or leadership norms at the specific AHC institution which indicate how decisions are made, or how agendas are prioritized
AHC	AHC_successes	Any particular successes or lessons learned that benefited the AHC, which are tied to incentives to do more
COMMUNITY	COMMPATIENT_education	Community or individual patient health education efforts, or data collection education to ease skepticism
COMMUNITY	COMMPATIENT_engagement	Programs and actions that denote community or patient engagement and involvement with or without DHT
COMMUNITY	COMMPATIENT_impact	Upstream factors for improving community or patient or population health conditions and outcomes

COMMUNITY	COMMPATIENT_intervention	Any type of community or patient screening or intervention conducted on behalf of the AHC or as a form of midstream outreach
COMMUNITY	COMMPATIENT_mistrust	Medical or research mistrust found in community or patients via perceptions, norms, attitudes, and beliefs towards the AHC or its administrators
COMMUNITY	COMMPATIENT_needs	Programs and actions that denote the AHC meeting community or patient needs
DHTEHR	DHTEHR_adoption	Reference to any internal and external adoption of DHT or EHR/SDH
DHTEHR	DHTEHR_analytics	Analytics and data being captured and measured in the DHT to be used for quality improvement or HE measures
DHTEHR	DHTEHR_awareness	Reference to awareness of DHT or EHR/SDH internally and externally
DHTEHR	DHTEHR_governance	Governance factors, structures, or policies which influence the direction of how the AHC uses the EHR
DHTEHR	DHTEHR_HIE	Health Information Exchange, or other similar programs used to create network of EHRs/SDH across the continuum of health programs in a region
DHTEHR	DHTEHR_operational	Methods and practices that are used to operationalize DHT or EHR/SDH for everyday work.
DHTEHR	DHTEHR_optimized	How DHT or EHR/SDH is optimized in care, research, or knowledge settings
DHTEHR	DHTEHR_platform	Reference to the EHR platform(s) used by the AHC
DHTEHR	DHTEHR_standards	Reference to standards, taxonomies, dictionaries, or other guidance used in EHR/SDH implementation
DHTEHR	DHTEHR_targets	Any targets or goals that are set for the implementation and optimization of the EHR
HD	HD_analyticsdata	Analytics and data being captured which illustrate the extent of health disparities among medically underserved populations
HD	HD_covid	Health disparities or AHC mission challenges within the COVID-19 pandemic context
HD	HD_examples	Specific health disparities that the AHC has focused on to track, research, or measure
HD	HD_ongoing	Health equity work that is still evolving or ongoing, incomplete, or not fully refined
HD	HD_outcomes	Outcomes measured or observed by the AHC towards improving health equity
HD	HD_politicalsocial	Political, social, historical, or national contexts for health disparities that are encountered by the AHC

HD	HD_population_health	Population health initiatives, programs, or incentives
HD	HD_rural_health	Rural health initiatives, programs, or incentives
HI	HI_practitioners	Health informatics practitioners (informaticists) and their work
HI	HI_research	Health informatics research programs, activities, other academic research uses which leverage the EHR or SDH
HI	HI_work	Health informatics work conducted to realize the AHC's health equity goals or mission
SDH	SDH_evaluation	Evaluating the success, failure, or challenges with social determinants of health implementation
SDH	SDH_field	Reference to general fields or codes used for SDH data collection
SDH	SDH_field_demographics	Reference to any demographic fields or codes used for SDH data collection
SDH	SDH_field_food	Reference to any food insecurity fields or codes used for SDH data collection
SDH	SDH_field_housing	Reference to any housing insecurity fields or codes used for SDH data collection
SDH	SDH_field_income	Reference to any financial, poverty, or income insecurity fields or codes used for SDH data collection
SDH	SDH_field_literacy	Reference to any literacy fields or codes used for SDH data collection
SDH	SDH_field_safety	Reference to any violence, abuse, or safety fields or codes used for SDH data collection
SDH	SDH_field_socialconnections	Reference to any social connections or isolation fields or codes used for SDH data collection
SDH	SDH_field_stress	Reference to any anxiety or stress fields or codes used for SDH data collection
SDH	SDH_field_transportation	Reference to any transportation insecurity fields or codes used for SDH data collection
SDH	SDH_field_zipcodes	Reference to any zip code field collected for SDH or HE work
SDH	SDH_implementation	Implementation approaches for social determinants of health, collected via surveys, the EHR, paper or electronic
SDH	SDH_ongoing	SDH collection work that is still evolving or ongoing, incomplete, or not fully refined
SDH	SDH_referrals	Referrals to patient navigators, external community care specialists for follow-up occurring as the result of SDH screening
SDH	SDH_refined	Refining social determinants of health through trial/error or other experiences

SDH	SDH_screening_electronic	Patients screened for SDH and SDH being electronically captured in the EHR for analysis
SDH	SDH_screening_hesitancy	Providers may be hesitant to screen for SDH, or patients may be hesitant to share needs out of mistrust, skepticism, or embarrassment
SDH	SDH_screening_paper	Patients screened for SDH and SDH being manually captured via paper screening for analysis

Appendix G – Code-Document Theme Mapping and Prevalence to AHCs

AHC Type	AHC Gr=331; GS=13	COMMUNITY-PATIENT Gr=120; GS=6	DHT EHR Gr=186; GS=10	Health Disparities Gr=215; GS=8	Health Informatics Gr=52; GS=3	SDH Gr=228; GS=19
LGU Midwest Public	29.55%	11.36%	21.21%	16.67%	3.03%	18.18%
Non-LGU Northeast Private	28.57%	10.20%	26.53%	18.37%	2.04%	14.29%
Non-LGU West Public	35.00%	0.00%	15.00%	10.00%	17.50%	22.50%
Non-LGU South Public	17.02%	12.77%	25.53%	23.40%	4.26%	17.02%
LGU South Public	25.33%	13.33%	18.67%	16.00%	5.33%	21.33%
Non-LGU West Public	41.18%	5.88%	5.88%	20.59%	5.88%	20.59%
Non-LGU South Public	18.98%	12.41%	14.60%	22.63%	6.57%	24.82%
Non-LGU South Public	24.59%	4.92%	9.84%	21.31%	8.20%	31.15%
LGU South Public	18.64%	8.47%	15.25%	27.12%	3.39%	27.12%
Non-LGU West Private	30.68%	12.50%	7.95%	26.14%	3.41%	19.32%
LGU West Public	46.83%	12.66%	7.59%	20.25%	0.00%	12.66%
LGU Midwest Public	37.21%	9.30%	25.58%	12.79%	3.49%	11.63%

Non-LGU Northeast Public	31.58%	12.28%	14.03%	15.79%	3.51%	22.81%
Non-LGU Northeast Public	34.33%	8.96%	19.40%	16.42%	1.49%	19.40%
Non-LGU Northeast Public	27.40%	15.07%	13.70%	17.81%	4.11%	21.92%
LGU Midwest Public	29.17%	8.33%	20.83%	14.58%	8.33%	18.75%

Appendix H – Quotations on "Barriers and Incentives as Drivers of Future Outcomes"

Role	Quotation
Administrative Staff	*Mental health is assessed in the exact same way that medical things are assessed. Like somebody has a stomach ache, you ask them, when did it start? How frequently has that happened? How bad is your stomach ache? How's it impacting your daily life? We just don't ask those questions by default for mental health needs. And I know I'm sort of like mixing up mental health and cultural responsiveness. I mean, I feel like as a social worker, that there's a lot of overlap, they're not exactly the same thing, you know, but it's sort of overarching. I wouldn't even call it resistance. I would just call it sort of general ignorance about mental health and cultural responsiveness and how they should fit into the space.* – Administrative Staffer F
Administrative Staff	*As you know, PCMH [Patient-Centered Medical Home] requires a lot of reporting and ideally doing social determinants of health screening and connecting patients to resources. So we've struggled with that…[New screening tools] that was given to the nurse workflow. So it has had an effect of like slowing down the nurse triage and kind of slowing the flow. We've been struggling with that. But we're not backing off from it. I mean, it's part of it, but people are balking at like, say, asking the nurses to do anything else or adding another screen. So I don't know how it would be integrated. But if we had more social workers, you know, they could have separate appointments with some of these patients and maybe we wouldn't have universal screening of everybody. I don't even know if that's recommended the same way that PHQ9 [Patient Health Questionnaire-9] is. It might just be for people who have an indication that it might be a good idea. And then if we had enough social workers to do it, we could get it done and it could be collaborative. Our PCPs [primary care providers] care a lot about this. You know, a lot of times the people making referrals to community resources are the PCPs themselves and the [medical] residents. I mean, because of lack of care coordination staff, and then they don't have time to follow up and close a loop, either. So it's very frustrating.* – Administrative Staffer G
Administrative Staff	*I think that we're gonna see more widespread adoption of collecting Social Determinants of Health information. I'm hoping that we'll have better point of care access to referral services that are available. So I think that for sure. I think in terms of health equity, that we may start seeing more quality reporting that looks at equity as an outcome.* – Clinical Leader E
Clinical Leadership	*I think that we're gonna see more widespread adoption of collecting Social Determinants of Health information. I'm hoping that we'll have better point of care access to referral services that are available. So I think that for sure. I think in terms of health equity, that we may start seeing more quality reporting that looks at equity as an outcome.* – Clinical Leader E
Clinical Leadership	*We are interested in trying to refine that over time, as I'm sure most institutions are, in terms of how do you get to the sort of Goldilocks ideal, you*

	know? Not too much governance, not too little but just the right amount of governance, to operate efficiently. To make sure the changes made to our systems are consistent with our strategy as a system, make sure that stakeholders have the right level of engagement and approval and oversight. – Clinical Leader B
Research Staff	*In other words, the incentives need to be aligned to develop those kinds of technologies for patient care, as well as for research. But at the same time, we need to be cognizant about the digital divide for vulnerable populations because it's the other side of the client. And that can actually increase those issues if we are not cognizant about those issues of technology adoption to add to capture that information for a vulnerable population.* – Research Staffer A
Research Staff	*What is the future? You know, I think that we've all, in medicine in health systems, become more familiar with how important health equity is. And I think it has our radar antenna in terms of looking out for issues and concerns related to health equity. And I think that's really important. And I think that that's something I didn't see earlier in my training earlier in my career. But I do really appreciate that recognition is now there that sensitivity to making sure that that equity is a priority for all of us within our health system. I think, you know, it's, it's made me personally think about other aspects of the EHR as well which come up from time to time in my day-to-day work, such as, you know, flags, or markers or indicators in the chart that can indicate this patient is someone who's been in and out of the ER multiple times in the past six months.* – Research Staffer A
Executive Leadership	*I'm not sure that I would know what trends are. I know our biggest issue is trying to make sure we're capturing the data. And so we're trying to figure out how can we can efficiently capture the data for everyone so that we can act on it and we'll just follow any national trends that occur.* – Executive Leader C

Appendix I – Quotations on “Selecting and Prioritizing the SDH to Capture”

Role	Quotation
Administrative Staff	*We've really bought into the EPIC foundational tool to social determinants of health tool that they have. And I know that's what we're intending to use, at least in the near term here. And I'll tell you, too, that the tool is not the best in every instance. But it's what's supported by EPIC. And we want staff to be able to use the tool in EPIC as part of the normal workflow..And one question that I always get is, you know, well, ‘is this going to disrupt what other people use if we change it in this way or that way?’ At the same time, they're coming back to me to ask about which SDOH tools we’re using, you know? It's sort of a weird sort of circular conversation.* – Administrative Staffer F
Clinical Leadership	*I know that we focus on some of them, but I don't know how we ranked them and decided because it was a lot of the process of going live was, you know, compromise. Which of these you know, do we want to focus on all of everything? Which of these things will we focus on? And I don't know if we somehow rank-ordered specific ones. So we built it, using the sort of EPIC process and EPIC tries to make sure that through a system of workgroups, everybody is represented at the table as decisions are made around the EHR. So we have just undergone slightly less than two years of exhausting, exhaustive workgroup meetings, hotel meetings happening every day, several, you know, all types, all types of different groups trying to bring in representation from every walk of life of the health system. So physicians, nurses, therapists, front desk, administrators, revenue cycle, lab, environmental, everybody was supposed to be represented.* – Clinical Leader C
Clinical Leadership	*So we serve, you know, patient, pediatrics patient population. So some of these questions are not applicable. But for the most part, so we address demographic information, including race, ethnicity, zip code, whatever it is insurance, and then we have definitely surveillance to their housing environment. We do definitely request for transportation, if they have any transportation services, or if they have any challenges. Definitely utilities ..all based on our patient population. So almost all everything you have here is part of our screener.* – Clinical Leader H
Research Staff	*So I don't know exactly if there is a process to prioritize in terms of data capture. But once this data is captured, we are right now in the process of looking at housing, demographics like age, gender, race, ethnicity, as well as some form of income. That actually comes to the housing part. If there is any chance of being very stressful to pay rents on those things, in terms of income perspective. So clothing and childcare. I haven't seen that in our research data set. But other than that, we are capturing pretty much all of those in our EHR data right now.* – Research Staffer A

Research Staff	*Researchers interested in health disparities are sometimes forced to use zip code and things like that. So, there is an effort to do a better job in reporting social determinants of health. But it's not easy. There is no control that works out, I mean, sort of race and ethnicity, you can follow the government rules, the General Accounting Office rules, but beyond that, there is very little structure formed to recall the social determinants of health. I'm working with a group that is trying to develop standards to collect that information. But without a better standard to collect social determinants of health is very difficult to make comparisons because even we see in the same institution, different clinics, maybe college the same scene different names, and the like.* – Research Staffer C
Research Staff	*That would be a top-down decision from [redacted], basically, as a director, you know, to start collecting that information for every patient in a structured format, through the EHR system, so that we will have documentation for that. Right now, our documentation is nursing notes, which is a broad manner, not specific questions, but now, it will be a management decision to collect all the information in a structured format, so that we will have information on each specific category that you have. And based on that, we'll start performing more in-depth care.* – Research Staffer B
Executive Leadership	*What we're doing is we're setting things up to allow providers and clinics to use these tools for patients that have particular issues.* – Executive Leader C
Executive Leadership	*How did we prioritize which ones to capture? Some of them are legacy and some are defined by regulatory requirements. So for example, ones that are either legacy or defined by regulatory requirements include the finances, because we screen for insurance. For those who are uninsured, we help them with either signing up for our indigent care program or a system and looking for public benefits like Medicaid.* – Executive Leader B

Appendix J – Quotations on "Electronic, Paper, and Phone" Screenings

Role	Quotation
Administrative Staff	*Well, we were doing a few of the screens. I think a few sites are doing it on paper, and then maybe I don't know how they're capturing in EMR.* – Administrative Staffer G
Administrative Staff	*So they should be having that information in the EMR or not then we would do that in our initial phone call. A couple of phone calls, when they accept our services, we start asking questions. And we start setting goals based on those questions. So that some basically collect the information, but it's, it's not in any format right now. But they set goals based on that information...And then it gets changed in our database. 'Patient needs food,' you know, 'a place to live,' you know, 'transportation to the doctor,' they then change everything in their nursing notes.* – Administrative Staffer B
Clinical Leadership	*This is an area that all of us want to go in individual clinics. And again, it's going to be mostly in primary care, because that's where your medical home is. I think individual clinics have taken it upon themselves, not necessarily through the EHR, to do screening for social determinants. So in our clinic, we do food insecurity screening, and then we have the ability to refer them on to the food bank to help out with food. Starting to do more violence screening. 'Are you being exposed to violence or violence in the home?' You know, those kinds of things. But they're usually done in an individual clinic basis. And when that happens, it doesn't always end up in the EHR as structured data, it's usually the piece of paper.* – Clinical Leader A
Clinical Leadership	*EPIC has a social determinants of health wheel that they utilize that has, you know, from mental health, to housing instability to transportation issues, to stress to substance use to safety in the home. A lot of those questions (the internal Finance Department) built in, but it's not something that we have operationalized for every patient yet. So I think we do a good job in primary care of screening for depression screening, you know, we're kind of required to do substance use questionnaires.* – Clinical Leader G
Executive Leadership	*So we when we're sending the questionnaire out through the portal that are basically blank, we don't know what that patient has or doesn't have. So we send our set number of questions to try and get the critical responses and then should anyone come back as you know, high risk, then we reach out to them gotta try and offer help, or at least we can, you know, we give them either numbers to call in the locale or we try and connect them with somebody to address any specific issue.* – Executive Leader C

Executive Leadership	*Yes, there's a financial incentive because if we don't screen for finances for low-income individuals who are uninsured, then we don't get paid. Simple as that - from any source, whether it's the state's indigent care program, or Medicaid or if people are eligible for a health insurance exchange. But in regards to financial incentives for capturing the information, there are two answers that I would give you one is for the primary care first model that our 12 primary care practices are involved in, that is a Value Based Payment Model. And integrated into that model is screening for social determinants of health. So if we don't do it, there's a disincentive. My understanding after one year is that we did well. And we did achieve incentive payments...In regards to the penalties, if we do not capture the race, ethnicity and language data, then during our joint commission reviews, we could be cited. And if you have so many citations for serious issues, you could lose your Medicare accreditation, or you could get you could lose your ability to participate in Medicare.* – Executive Leader B

Appendix K – Quotations on "Hesitancy, Mistrust, And Skepticism"

Role	Quotation
Clinical Leadership	*I think that (provider hesitancy) is absolutely an everyday consideration, you know, for our nurses in particular who I would say have the greatest existing burden of documentation among all the clinicians in our system. But also for others, including therapists, physicians, advanced practice providers. And so we're extremely sensitive to creating systems that add additional burden, if you will, in terms of documentation, not to say in any way that the SDOH questions are not important.* – Clinical Leader B
Clinical Leadership	*But we're moving in the direction of trying to use more technologies like NLP and other things to automatically identify these things, maybe either pre-populate or build registries for those patients. This is a big deal and issue, which has impacted many of our patients. – Clinical Leader G*
Clinical Leadership	*And I think that there's a lot of these SDOH that are sort of, they're out there that could probably be populated by machines, rather than having somebody laboriously go through there. So then what really needs to be collected by the individual and a face to face conversation is much easier.* – Clinical Leader A
Clinical Leadership	*It's worse, because currently without technology, you can't do questionnaires on the phone. Yeah, you have to have an actual computer. But nevertheless, patients will be given these a week before they visit. Now, in practices that already have tablets, this might get rolled out more. We'll see, right? If a practice does this, if they don't do it at home, when they arrive, they will be given a tablet, and they can do it that way.* – Clinical Leader E
Clinical Leadership	*It's not a failing of the EHR platforms in any way to capture (the data). I mean it's not the technology, it's the people in the process. Where do you put it in the workflow? Where it gets done reliably, accurately? So it doesn't slow everything else down? Because obviously, these are priorities. As a pediatrician, I will tell you, they're very high priorities for my patient population.* – Clinical Leader A
Clinical Leadership	*Depending on you know, where they come from in terms of like, okay, "I really need help." So they're willing to give provide information. Some patients definitely have some hesitancy because it's kind of personal question. They don't want to disclose too much. So there is some hesitancy from patient side. Definitely some hesitance from provider side that is mostly related to time.* – Clinical Leader H

Clinical Leadership	*First of all, it's pretty clear to me that the number of questions and the nature of the questions are such that it's going to need to be patient-administered, that's been our assumption, all while self-administered, that it's not gonna be realistic to have someone ask patients all of these questions, right. That's why… I think going forward, that's going to be the plan is that patients will receive questionnaires through our portal, which, by the way, is already a little ironic, right? Because it means that those are patients already have access.* – Clinical Leader E
Research Staff	*All these you know, I mean, collecting all the information, we will increase the workload on a number of people and that will require complicated discussion.* – Research Staffer C
Executive Leadership	*Now, we know when we do chronic disease maps, we always make sure that the social determinants of health questionnaire are filled out. Same thing with our behavioral health integration project. While we have it available in clinics to capture the data, it is not an insignificant number of questions. So if you did it on every patient, it would be, you know, 20 some questions and they'll sit there and do the math. Okay, that takes me twenty minutes to do at times 50 patients and all of a sudden I've, I've spent an hour clicking that data.* – Executive Leader C

Appendix L – Quotations on "Referrals and Interventions"

Role	Quotation
Administrative Staff	*Here in [redacted], there are there are a number of transportation services, Uber, or just cab companies alone. And a large number of those have contracted with Medicaid to provide Medicaid transports. They call it 'sooner ride.' But their parameters for what they want are difficult to get around. You have to pre-schedule something three days in advance. And so what we've been able to accomplish to help a patient in need…If you've got a child with asthma, you've got a status as asthmatic on your hands.* *Mom can't schedule an appointment with the doctor three days from now, because of the Medicaid rules. But through our conversations and care managing them, we know that mom's got potential for an emergency at any given moment. If I'm care managing that person, mom can call me and say, "Hey [redacted] Johnny's having an asthma attack. Can you get me a ride? Can you get me an appointment?" And I can do that. I can give them same-day transportation and same-day appointment scheduling with the doctor. Because we've got those kinds of relationships built, and we know what their issues are* – Administrative Staffer B
Clinical Leadership	*The United Way has an app that we can connect into our EMR that we're talking about, that can look at, you know, kind of the coded needs and see just referrals. Ideally, you could make closed-loop referrals. But I, I honestly don't see that happening in the foreseeable, though in the future it would be ideal.* – Clinical Leader E

Vita

Wies Rafi was born in Atlanta, Georgia and is an American citizen. He graduated from Cross Keys High School, Atlanta, Georgia and received his Bachelor of Arts in Political Science from Georgia State University, Atlanta Georgia. He received a Master of Science in Information Technology from the University of Maryland Global Campus and subsequently worked in multiple government and academic positions with the U.S. Centers for Disease Control and Prevention, the U.S. Library of Congress, Florida Atlantic University, and Virginia Commonwealth University. His research focuses on the policy, cultural, technical, and structural factors of U.S. Academic Health Science Centers and their effective use of digital health technologies and the electronic health record (EHR) to advance health equity for medically underserved populations.