Briefing Paper

Understanding the Impact of Health IT in Underserved Communities and those with Health Disparities

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BRIEFING PAPER

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Introduction

NORC at the University of Chicago is pleased to present this draft Briefing Paper for "Understanding the Impact of Health Information Technology in Underserved Communities and those with Health Disparities," a project being conducted for the United States Department of Health and Human Services Office of the National Coordinator for Health Information Technology. The Briefing Paper is an initial overview of findings from an environmental scan and literature review on topics related to health information technology (health IT) and their potential impact in communities with health disparities and disproportionate numbers of medically underserved individuals. To facilitate discussion, we will refer to the key population of interest for this project broadly as "the underserved". This group includes those who live in communities with health disparities as well as communities with disproportionate numbers of medically underserved individuals. We characterize key health disparities and characteristics of the underserved in greater detail below.

The report describes what is known from the peer-reviewed and gray literature as well as discussions with technical experts and researchers. The paper focuses on how the integration of different types of information technology into health care delivery may influence processes and outcomes related to the overall health of residents in these communities. The paper also addresses the way individuals use information and information technology to manage their health and health care.

This is the first deliverable in a project that will include detailed case studies to help elaborate issues that are currently unknown regarding how adoption and effective use of health IT affect underserved communities. The project is also designed to help government officials and stakeholders adapt new and existing approaches to using health IT as a meaningful tool in addressing the problems facing these communities. The intent of this briefing paper and the project overall is to consider health IT to broadly include technologies, applications and platforms that are used by health care provider organizations or by consumers. Applications used by providers include electronic health records (EHRs), electronic registries, health information exchange (HIE) and clinical decision support (CDS) systems. Our focus also includes applications that are primarily used by consumers such as online social networking applications and stand-alone personal health records (PHRs). Finally our concept of health IT includes applications that facilitate electronic sharing of information between patients and providers, patient monitors that feed data directly to providers, patient portals, distance medicine applications, and applications that facilitate exchange of messages between providers and patients.

The overall objective of this report will be to identify existing knowledge and analyze issues related to health IT, disparities and the underserved and, most importantly, highlight specific areas that are currently poorly understood and are of greatest relevance to policy and program officials. Areas where more information and analysis can help establish programs and policies to address disparities and the needs of the underserved will be prioritized for further analysis through a case study methodology that will constitute the core of this project.

The remainder of this report is organized as follows:

- **Background.** We begin by providing some background on the legislative mandate for the project and the policy and programmatic issues framing the topics of disparities, the needs of underserved Americans and the use of health IT.
- **The Nature of Health Disparities and Potential Impact of Health IT.** In the next section we present challenges facing communities that have a disproportionate share of underserved individuals and populations with disparities both from an individual health maintenance perspective and a health care provider perspective, as well as the ways in which robust use of health IT may be used to address those challenges.
- **Health IT in Practice: Current Uses of Health IT in Communities with Disparities and the Underserved.** In this section we review specific technologies and platforms that are being adopted by health care providers and consumers and review opportunities for addressing the needs of underserved communities by wider spread adoption of these applications. We will look at both potential benefits and unintended negative consequences associated with these applications.
- **Barriers and Challenges.** In this section we review existing literature regarding the challenges of implementation and effective adoption of health IT among providers who serve populations that experience disparities. We also review factors that must be addressed in order to establish effective use of health IT by these populations.
- **Discussion and Issues for Further Study.** We end this initial briefing with a review of what is known on the topic of health IT as it relates to the underserved communities as well as outstanding questions that this project can address through detailed case studies and engagement with experts.

Background

To provide context to the core of this Briefing Paper, this background section summarizes recent legislative activity surrounding health IT and the provision of health care in underserved communities, as well as issues framing the topics of health disparities and the underserved, uninsured and medically underserved.

The American Recovery and Reinvestment Act of 2009

In 2009, the U.S. Congress passed the Health Information Technology for Economic and Clinical Health (HITECH) Act as part of the American Recovery and Reinvestment Act (ARRA). In many ways, the act continued and expanded on a series of programs implemented by the Federal government to encourage health IT adoption. The HITECH Act includes many provisions to advance the implementation of a nationwide health IT infrastructure that improves health care quality, reduces health disparities, and advances the delivery of patient-centered medical care, among other goals.[1] Infrastructure improvements funded by the HITECH Act include the Medicare and Medicaid Electronic Health Record Incentive Programs, which provide incentive payments for eligible professionals and hospitals that implement and meaningfully use EHR technology. Meaningful use of certified EHR technology refers to a three-stage approach intended to result in health care that is patient-centered, evidence-based, prevention-oriented, efficient, and equitable. The three main components of meaningful use specified under

Chart 1: ARRA/HITECH Funding for Providers Caring for the Underserved

Health Centers: ARRA included $2 billion to assist health centers in weathering the economic downturn while also creating and retaining jobs in low-income communities, including $500 million for health centers to expand their services and operating centers and $1.5 billion for facility construction and renovation, equipment and the acquisition of health IT.

Regional Extension Centers: HITECH included $677 million to support a nationwide system of Regional Extension Centers (RECs), which will contract with providers to offer technical assistance to qualify them for meaningful use, in an effort to support and accelerate providers' efforts to adopt EHRs. Providers targeted by RECs include individual and small group practices and those in settings predominantly serving uninsured, underinsured and medically underserved populations such as Critical Assess Hospitals and health centers.

Medicaid EHR Incentive Program: HITECH established funding for States to provide incentive payments to eligible Medicaid and Medicare providers and hospitals who meet minimum Medicaid patient volume percentages to purchase, implement and operate certified EHR technology.

Broadband Program: ARRA included $7.2 billion for the development and expansion of Broadband infrastructure and services in communities across the country. Priority is given to initiatives that encourage development in low-income, underserved or rural communities. In addition to other impacts, these investments in broadband infrastructure will support the implementation of telemedicine and tele-health programs.

HITECH include use of a certified EHR technology 1) in a meaningful manner (for example, e-prescribing); 2) for electronic exchange of health information to improve quality of health care; and 3) to submit clinical quality and other measures.[2]

Importantly, ARRA and HITECH included special provisions focused on improving use of health IT among providers that treat underserved populations. In particular the Regional Extension Center (REC) program is a technical assistance and EHR implementation and meaningful use support initiative that prioritizes services to Federally Qualified Health Centers (FQHCs) that provide primary care and ancillary medical services to the underserved. Furthermore, incentives for EHR adoption and meaningful use for those designated as Medicaid providers are favorable compared to the incentives available to Medicare providers and ARRA contained an additional $1.5 billion in direct support for health centers, some of which could be used for information technology related capital acquisition. Additional information on ARRA/HITECH-funded programs designed for providers caring for the underserved is included in Exhibit 1.

In addition to direct support for promoting use of health IT in the care of underserved populations, HITECH requires further research, such as the current study. Section 3001 of HITECH mandates an "Assessment of Impact of HIT on Communities with Health Disparities and Uninsured, Underinsured, and Medically Underserved Areas." The legislation specifically states the following: **"The National Coordinator shall assess and publish the impact of health information technology in communities with health disparities and in areas with a high proportion of individuals who are uninsured, underinsured, and medically underserved individuals (including urban and rural areas) and identify practices to increase the adoption of such technology by health care providers in such communities, and the use of health information technology to reduce and better manage chronic diseases."**[3]

The Role of Health Reform

Although this project originated prior to the Patient Protection and Affordable Care Act of 2010 (ACA), the ACA legislation includes numerous provisions that continue to advance developments in the use of health IT in underserved communities. Specifically, ACA requires the Secretary of Health and Human Services to improve the delivery of health care services, patient health outcomes, and population health, especially for vulnerable populations, by using health care data to improve quality, efficiency, transparency, and outcomes. Section 399hh also mandates the development of a National Strategy for Quality Improvement in Health Care that prioritizes the reduction in health disparities across priority populations and geographic areas, among other goals.[4]

ACA also provides $11 billion for health centers supported by the Health Resources and Services Administration (HRSA), which provide comprehensive primary health care and supportive services for high need communities.[5] These centers include grant-supported FQHCs, FQHC look-alikes and outpatient health programs/facilities operated by tribal organizations.

Background on Health IT

The types of applications that are considered health IT continue to grow and evolve. As such, we use the definition of health IT that accompanies the legislative mandate for this study as a starting point for this report. Section 3000 of the HITECH Act defines health IT to include the following: "hardware, software, integrated technologies or related licenses, intellectual property, upgrades, or packaged solutions sold as services that are designed for or support the use by health care entities or patients for the electronic creation, maintenance, access, or exchange of health information."[6] Although not explicitly mentioned in this definition, for the purposes of this study health IT has been defined broadly to also include applications that are primarily used by consumers and applications that facilitate electronic sharing of information between patients and providers, as described in our introduction. Health IT products and functionalities discussed in this report are described in Table 1 below.

Table 1: Health IT Product or Functionality and Description

Product or Functionality	Description	
Electronic Health Record (EHR)	Electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed and consulted by authorized clinicians and staff across more than one health care organization.[7]	
Clinical Decision Support (CDS)	Health IT functionality that builds upon the foundation of an EHR to provide persons involved in care processes with general and person-specific information, intelligently filtered and organized, at appropriate times, to enhance health and health care.[8]	
Consumer E-Health Tools	*Personal Health Record (PHR)*	An electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be drawn from multiple sources while being managed, shared and controlled by the individual.[9]
	Health Kiosks	Publicly available computer terminals are designed to allow patients to obtain information on health conditions or to access information on their own health.
	Mobile/ Smart phone Applications	Applications used to record and send health-related information and/or deliver email or short message services (SMS) messaging that reinforce healthy behavior.
Telemedicine	The use of telecommunication technologies to provide medical information and services. Typically these technologies involve the use of phone or video conferencing and remote monitoring.[10]	
Population Health Information Systems	A population health record system is a mechanism for recording, retrieving and manipulating information in population health records, which are defined as a repository of statistics, measures and indicators regarding the state of and influences on the health of a defined population, in computer processable form, stored and transmitted securely, and accessible by multiple authorized users. [11]	
Electronic Registry	A database feature that includes key clinical data, usually on a subset of chronically ill patients, for the purpose of tracking their condition and managing treatment.[12]	
Health Information Exchange (HIE)	The electronic movement of health-related information among organizations according to nationally recognized standards.[13]	

Role of the Health Safety Net Providers

Because this report focuses partially on the adoption and use of health IT among providers that treat underserved populations, we focus considerable attention on programs and policies that affect one of the most important sources of federally funded care for this population, Federally Qualified Health Centers (FQHCs). FQHCs include community health centers (CHCs), migrant health centers, health care for the homeless programs, and public housing primary care programs funded through Section 330 of the Public Health Service Act, which is administered by HRSA. Related types of providers include FQHC look-

alikes, which meet the definition of "health center" under Section 330 of the Public Health Service Act, but do not receive grant funding under Section 330; and outpatient health programs/facilities operated by tribal organizations. Health centers supported by HRSA are critical to the provision of care in communities with health disparities and in areas with a high proportion of individuals who are uninsured, underinsured, and medically underserved individuals. For example:

- In 2009, the proportion of uninsured patients of all ages treated in these centers was approximately 38%, while the number of uninsured patients increased from 4 million in 2001 to over 7.2 million in 2009.
- In 2009, 27% of health center patients were African American and 35% were Hispanic/Latino--more than twice the proportion of African Americans and over two times the proportion of Hispanics/Latinos reported in the overall U.S. population.
- In 2009, health centers served nearly 865,000 migrant and seasonal farm workers and their families; more than 1 million individuals experiencing homelessness; and more than 165,000 residents of public housing.[14]

To be successful in the health care arena, it is essential that health centers have state of the art information systems. According to several recent studies, health centers have quickly identified technology's potential to improve the efficiency and quality of their patients' care.[15] Over the past 15 years, HRSA has supported health IT adoption and use among these providers through a series of programs that emphasized collaboration through health center networks, which facilitate the purchase, implementation and use of health IT applications across a group of health centers.[16] Based on data submitted by grantees and collected through HRSA's Performance Improvement Measurement System (PIMS), health center networks have facilitated adoption of EHRs in over 500 health centers with thousands of health care delivery sites around the nation. As we explore in greater detail below, recent legislation continues to support health IT adoption among FQHCs. Because they are so critical to the provision of care for underserved populations and other medically underserved individuals, these providers and the barriers they face in providing care and adopting health IT will be a key focus of this report.

Other key providers who care for underserved populations include physicians in small and solo practices, free clinics, and critical access hospitals. Although not generally recognized as part of the safety net, data suggests that private practice physicians, the majority of whom are in small and solo practices, provide a significant portion of the care received by underserved and vulnerable individuals.[17] While there is a dearth of national data on the number of uninsured/underserved patients served by these physicians, a 2000 study found that 78% of patients who were uninsured or covered by Medicaid had primary care

visits that took place in private physician offices.[18] Free clinics offer basic health care services and are primarily, and often exclusively, staffed by volunteers.[19] These clinics serve about 1.8 million patients annually. Their patient populations consist of mostly uninsured and underserved individuals, at up to 200% of the federal poverty level. [20,21] In total, free clinics are estimated to provide 3.1 million medical visits and nearly 300,000 dental visits per year.[22]

It is important to note that, while physicians in small or solo practices and critical access hospitals are eligible for the Meaningful Use incentive payments, free clinics are not eligible. Additionally, because of limited resources, providers in small or solo practices serving underserved communities may face challenges in adopting health IT and thereby meeting the criteria for the meaningful use incentive payments. The inability of some safety net providers to adopt health IT may have implications for health disparities.

Health Disparities

As noted above, in this study we are focused on the potential for health IT to address the needs of underserved communities. Achieving consensus on a single, universal definition of the term "health disparity" is a challenge that has been long recognized by leaders in health care and public health. In fact, a recent review of available definitions of health disparities resulted in a total of 11 different definitions that are utilized by Federal, State and private organizations.[23] Publications from organizations and Federal agencies consulted in this review of the literature included the Agency for Healthcare Research and Quality (AHRQ), the Institutes of Medicine (IOM), the National Center for Minority Health and Health Disparities, and the National Institutes of Health (NIH). Following a comprehensive review of existing definitions, we propose, for purposes of this paper, to broadly define health disparity as a difference between two groups in one or more of the following: 1) access to care, 2) utilization of care, 3) quality of care, 4) health status, and 5) health outcomes. This definition is inclusive of disparities in health, broadly thought of as a "particular health difference that is closely linked with social or economic disadvantage", and disparities in health care that are associated with differences in access, utilization and quality of care. [24]

Priority populations where health disparities have been documented include: 1) racial and ethnic minorities, 2) immigrant/limited English/low-literacy, 3) poor, 4) women, 5) disabled/special health care needs[1], 6) older adults, 7) rural residents, 8) children and adolescents, and 9) Gay, Lesbian, Bi-

[1] The AHRQ 2009 National Healthcare Disparities report defines individuals with disabilities or special health care needs as those individuals who use nursing home and home health care or end-of-life health care and children with special heath care needs (CSHCN).

Sexual, Transgender, and Queer (GLBTQ). It is important to note that these priority populations are inclusive of those outlined in ARRA and ACA legislation with respect to data collection and reporting.

Measuring Disparities and Impact. In quantitative terms, disparity is "the quantity that separates a group from a specified reference point on a particular measure of health that is expressed in terms of a rate, percentage, mean, or some other quantitative measure."[25] One of the challenges in measuring disparity is choosing a reference point – depending on the situation, one might choose to compare against the group with the largest proportion of the population, the group with the most favorable health indicator status (also referred to as the "best" group), the un-arithmetic mean of the rates for the groups in the domain, the total population, or a standard, such as a Healthy People target. Once a reference point is selected, a disparity can be calculated in two ways: an absolute measure of disparity is the simple arithmetic difference between a group rate and a selected reference point, while a relative measure of disparity is the difference between the group rate and a selected reference point expressed as a percentage of the reference point.

The choice of specific measures for defining disparities as well as the reference point used is an important factor in any study looking at the potential impact of health IT on these populations. These challenges in measuring disparities further complicate our ability to understand the impact of health disparities on society and call for multi-pronged approaches when examining impact. For example, a recent study aimed at developing an understanding of the economic impact of health disparities used direct medical costs of health inequalities, indirect costs of health inequalities, and costs of premature death to estimate economic burden.[26] Although our scan found almost no work directly measuring the impact of health IT on disparities, we will focus subsequent aspects of this project, including site visits, on learning more about early efforts to measure this potential impact. Additional information on measuring disparity can be found in Appendix A.

The Uninsured, Underinsured and Medically Underserved

As noted above, we refer to the broad group of communities and individuals that are the focus of this study as "the underserved". Importantly, much of our focus is not on the population itself, but providers that care for this population. In order to provide a more detailed picture of the population in question, we characterize key groups included among the underserved below. These groups include the uninsured, underinsured and the medically underserved.

The uninsured. Although the topic seems relatively straightforward, the definition of the uninsured varies depending on the context of the measurement. For example, some estimates of the uninsured

incorporate individuals that have guaranteed access to health care through federal programs such as the Veterans Health Administration or the Indian Health Service, while others do not include these groups.

Estimates of the uninsured also vary relative to the measurement methods employed as well as the definition used. Methods that assess the rate of uninsurance in the population during a shorter time period result in higher estimates of the uninsured than methods that look at sustained uninsurance over a longer period of time. Also, even when the same time period is used, different surveys yield somewhat different results in terms of the total extent of uninsurance because of definitional issues.

The Current Population Survey, a monthly survey of about 50,000 households conducted by the Bureau of the Census for the Bureau of Labor Statistics, defines individuals as uninsured if they have lacked health insurance coverage for the entire previous calendar year, largely because the survey itself focuses on annual income and employment.[27] The Medical Expenditure Panel Survey (MEPS), cosponsored by AHRQ and the National Center for Health Statistics (NCHS), defines the uninsured as persons not covered by Medicare, TRICARE, Medicaid, other public hospital/physician programs, or private hospital/physician insurance (including Medigap coverage) during the period from January 1st through the time of the interview.[28] The MEPS also measures health insurance coverage for each month respondents are in the survey over a two-year period, and produces estimates of the individuals who are uninsured at specific times during a given period; estimates of persons who are uninsured for an entire calendar year; estimates of persons uninsured for two full years and estimates of the duration of spells of insurance and uninsurance. Other surveys, including the National Health Interview Survey, also sponsored by NCHS, categorize the uninsured in three ways: those who were uninsured at the time of the interview, those who had been uninsured for at least part of the year prior to the interview, and those who had been uninsured for more than a year at the time of the interview.[29] Although the time period specified in these definitions varies, there is general agreement that an uninsured individual lacks any form of health insurance coverage, public or private.

The underinsured and medically underserved. A single operational definition of underinsured is lacking. A recent *Health Affairs* article defined underinsured as, "being insured all year but without adequate financial protection."[30] Recent research published by AHRQ researchers defined underinsured as, "insured persons with health care service burdens in excess of 10% of tax-adjusted income."[31]

In addition, HRSA has created an operational definition of both Medically Underserved Areas (MUAs) and Populations (MUPs) using an index of four variables: ratio of primary care physicians per 1,000 population, infant mortality rate, percentage of population with incomes below the poverty level, and

percentage of population age 65 and over. [32] To identify MUAs, this ratio is applied to a defined geographic area. Similarly, with regard to MUPs, this index is used to determine if an "underserved population group" defined as those with "economic barriers or cultural and/or linguistic access barriers" is indeed underserved in a particular geographic area.[33]

When taking into consideration components of both of these definitions, the underserved population can be categorized as sharing one or more of the following characteristics (as defined in a previous report by NORC): 1) poor, 2) uninsured or underinsured, 3) limited English language proficiency and/or lack familiarity with the health care delivery system, or 4) live in locations where providers are not readily available to meet their needs.[34] Since both uninsured and underserved populations are not mutually exclusive from medically underserved populations, for purposes of this paper we consider these three populations as individuals who do not have adequate access to health care services and are therefore underserved.

Also included in our characterization of the underserved are the disparities populations identified above, including racial and ethnic minorities, immigrants, those with limited English proficiency, the poor, disabled/special health care needs individuals, rural residents and Gay, Lesbian, Bi-Sexual, Transgender and Queer individuals. These populations will be referred to as "the underserved" for the duration of this paper.

The Emerging Potential for IT to Address the Needs of the Underserved

For many years, digital disparities, defined as disparities in access to all types of information technology by different segments of the general population, have existed. For example, in 2003, internet utilization disparities existed with regard to race, education, income, and geography (urban vs. rural).[35] However, recent research has shown that many digital disparities have decreased over time or have been eliminated entirely.

A survey conducted by the Pew Internet and American Life Project in April-May 2010 revealed that some of the previously existing gaps in internet access have narrowed, as the percentage of all adults with broadband internet access at home was found to be consistent among White/non-Hispanic (67%, 2% increase from 2009) and Hispanic/English-speaking (66%, 2% decrease from 2009) populations.

Although broadband access was found to be slightly lower among non-Hispanic African American populations (56%), they are one of the few major demographic groups to experience notable year-to-year growth in home broadband adoption (10% increase from 2009), an indication that this gap in access could

quickly narrow. Disparities in access among rural populations remain largely unchanged. In 2010, 50% of rural individuals are broadband users, a 4% increase from 2009. In comparison, 70% of non-rural individuals have broadband internet access.[36]

The narrowing of some disparities in internet access mirrors trends observed for other information technologies. For example, in the cell phone market, many of the underserved communities in the U.S., including African Americans and Hispanics, were the largest users of cell phone voice minutes per person in 2005.[37]

There are underlying infrastructure and policy issues that influence access to technology for underserved populations. For instance, mobile phones often come with expensive data plans that may act as a barrier to their use. Similarly, internet access is increasingly bundled with cable or satellite television services rather than landline phone/modem services, creating another hurdle to internet access for those relying on landlines. Issues such as these must be addressed before information and communications technology can be effectively used to improve health care and health among underserved and vulnerable communities.

As more and more groups that are considered underserved for the purpose of this paper begin to have access to information technology in proportions similar to the population at large, the opportunities to use health IT, especially consumer-focused health IT, to address disparities will expand. Importantly, as information technology is utilized to address health disparities, it is important to consider rates of access to varying technologies for different groups in order to take advantage of the availability of internet and mobile technologies among targeted populations and tailor interventions accordingly. For example, the research referenced above suggests that cell phone-based health IT applications may represent a particularly effective tool to address the needs of specific populations that have been historically overrepresented among the underserved.

The Importance of the Current Study

There is a growing recognition that greater research and investment in health IT may be an important tool in addressing health disparities.[38] The use of computer technologies in health care has been associated with increased patient safety and improved personal decision-making, leading to improved quality and more efficient delivery of care.[39] For underserved populations, increased use of health IT could also enable enhanced characterization of the causes and determinants of health care disparities; the design of novel and more effective clinical and behavioral health care interventions; and improvements in current interventions.[40]

Earlier in our background section, we presented evidence of a shrinking digital divide in terms of access to technology by underserved individuals. Other evidence shows, however, that health care delivery systems that provide care to underserved populations are currently less likely to have implemented health IT systems, including EHRs. And, in this respect, an important digital divide may exist.[41] This digital divide may be caused by a number of barriers to health IT adoption in settings that most often provide care to underserved populations, including health centers, public hospitals, and unaffiliated rural hospitals, among others.

Results from a recent study indicate that hospitals that serve a large number of poor patients, as measured by the Medicare disproportionate-share hospital (DSH) index, had lower rates of adoption for all EHR-related functionalities (differences in electronic medication lists, discharge summaries, clinical decision support, clinical documentation and results viewing were statistically significant).[42] Similar results were observed in a 2009 American Hospital Association survey of acute care hospitals which found that small, public, and rural hospitals were significantly less likely to report new adoptions of EHRs compared to large, nonprofit, and urban hospitals, respectively.[43]

Barriers to health IT adoption in these settings include reduced return on investment, impaired ability to self-fund or borrow funds to finance implementation of a health IT system, and a less persuasive overall business case for the implementation of health IT.[44] These barriers will be discussed in further detail below. Importantly, it may be the case that the digital divide in health IT adoption among FQHCs is lower than for providers who provide care to the underserved in general, as a result of government investments in health IT to FQHCs through networks.

Regardless of the nature of the current digital divide as it relates to different categories of providers that care for the underserved, there is growing concern that increased overall adoption of health IT will cause a divide to emerge or widen. As populations served by providers adopting EHRs experience improved care quality and efficiency in the delivery of care, those without EHRs will continue to fall behind. On October 18, 2010, David Blumenthal, MD, MPP, National Coordinator for Health Information Technology, and Garth Graham, MD, MPH, Director of the Health and Human Services Office of Minority Health, published an open letter posted online to the health IT vendor community asking for their help "in making sure that we are not creating a new form of 'digital divide.'" Blumenthal also asked vendors of EHR systems to ensure that they "include providers who serve minority communities in their sales and marketing efforts." In the letter, Blumenthal and Graham explain that, although EHRs possess the ability to help improve both the quality and efficiency of medical care accessible by minorities, potentially decreasing the rates of chronic illness, mortality and morbidity within these communities, it is

critical that the current administration, Regional Extension Centers and EHR vendors work together and focus substantial efforts on priority populations.[45] The specific impacts of EHRs and other forms of health IT on underserved populations are discussed in greater detail below.

Methodology

In order to establish a useful baseline for the project that summarizes existing knowledge on key research questions, we used a systematic and far-ranging approach in producing this issue brief. A literature review was conducted using a number of databases, including MEDLINE, Cochrane Database of Systematic Reviews, EMBASE and others, primarily to access peer-reviewed literature on health IT and the underserved. To access the substantial amount of grey literature on these topics, web-based tools such as Google, Scirus, The New York Academy of Medicine Grey Literature Report, foundations such as the California Health Care Foundation and the Robert Wood Johnson Foundation, and Federal government sites such as AHRQ, HRSA and CDC were used. Population surveys, statistical reports and other available data were also collected using both search methods. The taxonomy of search terms is included in Table 2.

Table 2: Taxonomy of Key Search Terms

Topic Areas	Key Search Terms
Provider Patient Search Terms	
Providers	Providers: "Community health centers" OR "Critical access hospitals" OR "Rural health centers" OR "Providers" OR "Clinicians" AND " Underserved" OR "Medically Underserved" OR "Disparities" AND "Health IT" OR "Health Information Technology" OR "HIT" OR "EHR" or "EMR" AND (key search term for topic area)
Patients	"Patient" OR "Client" AND " Underserved" OR "Medically Underserved" OR "Disparities" AND "Health IT" OR "Health Information Technology" OR "HIT" OR "PHR" OR "Personal Health Record" OR "kiosk" OR "remote monitoring devices" AND (key search term for topic area)
Topic Area Search Terms	
Develop, Implementation and Adoption	Development: "development" OR "software development" OR "System development" OR "system design Implementation: "Implementation" OR "software implementation OR " system implementation" OR "rollout"
Methodologies to Reduce Disparities	"reduce disparities" OR "disparities reduction" OR "low-cost"
International Activities	"International" OR ""British" OR "European" OR " Canadian" OR "Australian"
Economic Models	"cost-effectiveness" OR "cost-benefit" OR "economic analysis" OR "decision analysis"
Publicly Available tools	"Open source" OR "tools" OR "methods"

Expert Input

A technical expert panel was convened for the purposes of this study. Technical expert panel members include individuals with extensive knowledge and experience with health IT, underserved communities, and/or health disparities. Technical expert panel members represent a wide range of Federal, non-profit, and private organizations and two panelists are clinicians in the field utilizing health IT in underserved communities. A list of technical expert panel members is included in Appendix B. An introductory web-based teleconference with the technical expert panel was held in September 2010 to present a project overview and to gather feedback from the panelists around the study's research questions. Peer-reviewed and grey literature, as well as feedback from the technical expert panelists, is included in this report as part of the environmental scan. The technical expert panel will continue to be engaged in this effort as this study moves forward.

In addition, a wide range of Federal stakeholders have had the opportunity to review our key research questions and the outline and focus of this report. Federal stakeholders reviewing this study's progress include representatives from the Office of the National Coordinator for Health Information Technology (ONC) and HRSA Office of Health Information Technology & Quality, Office of Rural Health Policy, and the Office of Planning, Analysis and Evaluation as well as representatives from AHRQ.

Relevant peer-reviewed and grey literature and feedback on the focus and content of this report was also collected from members of the NORC and George Washington University staff, the prime contractor for this study. Michael Christopher Gibbons, MD, MPH, Assistant Professor of Medicine, Public Health and Health Informatics at Johns Hopkins and Associate Director of the Johns Hopkins Urban Health Institute, serves as a consultant for this study and will also contribute to the development of this report.

The Nature of Health Disparities and Potential Impacts of Health IT

As noted above, this project will explore the opportunity for health IT to improve health care delivered in underserved communities. There are many such communities in the United States ranging from highly urbanized to extremely rural settings; locations with high concentrations of new immigrants or minority groups; and places that are predominantly low-income or that suffer from a poor health care infrastructure, among others. Health disparities currently faced by members of these populations are described below.

Quality of Care. Measures of quality of care indicate that there are racial, ethnic and socioeconomic disparities in quality that have persisted over time. AHRQ's *National Healthcare Disparities Report, 2009* examines disparities for measures of quality that include effectiveness (the percentage of patients with a disease or condition who get recommended care), patient safety, and timeliness. Data collected comparing disparities in 2000-2002 to 2005-2007 revealed a number of discouraging conclusions, including that there was no improvement for African Americans, Asians, and Hispanics in at least two-thirds of the measures of quality of care over the 7 year time period examined (gap either stayed the same or increased).[46]

Access to Care. Differences in access to care for populations in underserved communities are significant. A number of different measures are used to assess access to care including health insurance coverage, having a usual source of care, patient perceptions of need, and potentially avoidable hospital admissions, among others. Disparities in access to a regular primary care provider were examined in AHRQ's *National Healthcare Disparities Report, 2009*. The results indicated that Asians were less likely than Whites to have a regular primary care provider (64.7% compared with 78.7%), that Latinos were also less likely to have a regular primary care provider compared to Whites (65.6% compared with 81.7%) and uninsured individuals were almost half as likely as people with private insurance to have a regular primary care provider (45.4% compared with 80.6%), among other similar differences. [47]

Health Outcomes. Disparities in health outcomes are influenced by a number of different factors, including disparities in quality and access to care and genetic and environmental factors, among others. Health outcome disparities vary from differences in morbidity and mortality rates for cancer and other illnesses, to rates of new AIDS cases and infant mortality. Notably, disparities in health outcomes for chronic diseases are particularly troubling: Of all racial and ethnic minorities, African Americans are most likely to have a chronic illness or disability with almost half reporting such a condition, while

Hispanics have a higher incidence rate of infection-related cancers, including stomach, liver, and cervical cancers in comparison to other racial/ethnic populations.[48] Additional examples of disparities in health outcomes are included in Appendix C.

Patient Engagement. About one-third of Americans are not "health literate," meaning they lack the "capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."[49] Lack of health literacy has been shown to impact health for the patient, including: less preventive care, poorer understanding of their conditions and care, higher use of emergency and inpatient services and higher rates of re-hospitalization, lower adherence to medication schedules, and lower participation in medical decision-making. Additional factors influencing patient engagement include: language barriers, racial and ethnic concordance between the patient and provider, effects of disabilities on patients' health care experiences and providers' cultural competency.[50] AHRQ's *National Healthcare Disparities Report, 2009* measured patient engagement by examining patient self-reported data on patient-provider communication. Results from 2006 indicate that the percentage of adults who reported poor communication was higher for poor individuals than for high-income individuals (13.4% compared with 7.1%), with similar differences observed for racial and ethnic minorities.[51]

Management of Chronic Diseases. Differences in management of chronic diseases are evident in comparing underserved populations with the rest of population. This measure is particularly important for the underserved, as groups composing this population often experience higher rates of cancer, asthma, obesity, behavioral health disorders, and other chronic diseases. Data has shown that these populations are more likely to exhibit signs of poor management of chronic disease. AHRQ's *National Healthcare Disparities Report, 2009* examines rates of hospital admissions for short-term complications for individual with diabetes as an indicator of disease management. In 2006, the rate of hospital admissions for short-term complications was more than three times as high for African Americans as for Whites (151.2 per 100,000 population compared with 46.8 per 100,000 population) and the rate of hospital admissions for short-term complications was almost three times as high for people living in communities with median household incomes of less than $25,000 as it was for people living in communities with median household incomes of $45,000 or more (90.1 per 100,000 population compared with 33.3 per 100,000 population).[52] Similar differences persist among underserved populations for patients with asthma and other chronic diseases.

Impacts of Health IT

Many potential benefits of health IT exist for underserved populations and communities, particularly in terms of facilitating behavior change, improving health care and enhancing health outcomes.[53] Furthermore, as illustrated in Table 3 below, the promise of health IT can address specific disparities in many areas. At the same time, unintended negative consequences can arise if these technologies are developed and implemented in a manner that excludes the underserved. The passage of ARRA and ACA has highlighted the importance of providing effective and equitable care for underserved populations and communities through the meaningful use of health IT.

Table 3: Current Disparities and Examples of the Potential Impact of Health IT

	Current Disparities	Potential Impact of Health IT
Quality of Care	Disparities exist for underserved populations for measures of quality that include effectiveness, patient safety, and timeliness.	Health IT tools can improve providers' decision-making processes as it relates to the needs of special populations, facilitate quality improvement reporting, and increase access to a broader range of quality health care services.
Access to Care	Disparities exist in health insurance coverage, patient perceptions of need, and potentially avoidable hospital admissions.	Health IT including tele-health and distance medicine can improve access to specialist services and ancillary services such as case management, transportation and translation and can assist in providing free or low-cost preventative health services.
Health Outcomes	Underserved populations are more likely to experience health outcome disparities, which vary from differences in morbidity and mortality rates for cancer and other illnesses to other measures of health.	The impact of health IT on health care delivery, safety and patient engagement has the potential to improve health outcomes for the underserved.
Patient Engagement	Lack of patient involvement in their own care can impact health, resulting in less preventive care and poorer understanding of their conditions and care, among other impacts. Lack of involvement may be due to lack of cultural sensitivity on the part of providers, health literacy on the part of patients or a general feeling that it is not the patient's prerogative or responsibility to take an active role.	Health IT can aid in educating users about their condition and their treatment options as well as improve health literacy in general. Health IT can also help aid providers in offering more targeted care that addresses the cultural and language needs of their patients and that encourages patients to stay actively involved in their own health care plan.
Chronic Disease Management	Data has shown that underserved populations are more likely to exhibit signs of poor management of chronic disease, such as higher rates of hospital admissions for short-term complications associated with chronic diseases.	Health IT tools can facilitate improved coordination of care for individuals with chronic diseases, and consumer-oriented health IT tools can promote more active patient involvement, resulting in better management of chronic disease.

Quality of care. Evidence shows that lack of access to quality care contributes to disparities among the underserved.[54] Specifically, research indicates differences in clinical performance measures related to the following: how well providers deliver specific services needed by specific patients, such as whether children get the immunizations they need; assessments by patients of how well providers meet health care needs from the patient's perspective, such as whether providers communicate clearly; and outcome measures, such as death rates from cancers detectable by screening, that may be affected by the quality of health care received. In some cases, robust health IT solutions have facilitated care quality improvements among the underserved.[55] Data from EHR and chronic disease registries, for example, can be applied to identify individuals in need of health interventions or preventative care services. These tools can also facilitate quality improvement (QI) reporting and collection of customized quality data for performance reporting. Health IT can be utilized in addressing the various factors influencing the occurrence of health care disparities. For instance, tools such as CDS afford providers more accurate, up-to-date and timely information to improve their decision-making process through the use of evidence-based guidelines of care.

Access to care. Members of underserved populations frequently do not have the same access to care as other individuals.[56] This is particularly so for uninsured and underinsured individuals, who might have issues of access hinging on the affordability of care, and for individuals residing in remote or underserved areas. Health IT offers a myriad of solutions to address these barriers. Telemedicine and tele-health options, for instance, have been successfully applied to improve access to specialist services for patients residing within rural areas. Here, the solutions offered by health IT can be more cost-effective than other options such as commuting to urban areas for a consultation. Furthermore, application of new and increasingly advanced technology, such as high-definition cameras and instant videoconferencing, can have a similar level of effectiveness as a face-to-face visit. Similarly, health IT can be applied in providing free or low-cost health services for individuals who would otherwise be likely to forgo or delay them. In addition, community-based health IT interventions such as patient kiosks, websites or portals that are accessible to the underserved population can be used to assist these groups in learning about opportunities to access health care as well as ancillary services, such as case management, transportation and translation, that can help them make effective use of available health care services.

Health outcomes. The impact of health IT on health care delivery, safety and patient engagement can also lead to improved health outcomes. Research has demonstrated that underserved individuals are at greater risk for poorer health outcomes, including morbidity and mortality.[57] Application of consumer e-health tools has great potential to address these disparities. Patients who are informed and active participants in their health care have been found to have better outcomes.[58] Furthermore, EHR-based CDS

features, such as error identification, drug interaction checking, improved medication dosing and the ability to promptly alert physicians of results that are out of range, can serve to improve patient safety and reduce the occurrence of adverse events.

Patient engagement. Consumer e-health technologies can enable users to take a more active role in their health care. In particular, these tools have been recognized both as a method for educating users about their condition and their treatment options as well as a potential avenue for improving health literacy in general. [59] Also, more robust PHR tools can provide patients with personalized information and support to better manage their health and functionality which may allow for better patient self-management and possibly behavior change. Patient self-management has been shown to reduce hospitalizations, emergency room visits, and health care costs. [60] Finally, the often fragmented nature of health care for underserved individuals means that they visit multiple providers that do not have access to the complete details of their health record. As in the case of linked PHRs, patient-facing health IT tools can be instrumental in ensuring continuity of care for these patients.

Consumer e-health technologies can also help underserved populations communicate and share information more effectively with their providers through features such as secure messaging, which allows for exchange of written messages between providers and patients. This form of communication has the potential to replace unnecessary office visits, potentially increasing efficiency and provider availability, but it is not generally covered by public or private insurers. Furthermore, some tools provide patients the ability to supply clinicians with the results from online assessments (e.g., psychological assessments or assessments of patient activation) that can be taken in languages other than English and the ability to integrate data from physiologic monitors into an electronic format accessible by providers. Many EHR systems also feature culturally appropriate health literacy education materials, which can be printed during the patient visit.[61] These systems can also potentially facilitate linguistic access by allowing patients' language needs to be flagged in the EHR so that providers throughout the entire continuum of care are made aware of the need to provide language appropriate services and materials.

Management of chronic diseases. As noted above, one important area of health disparities is the increased prevalence of chronic illness, morbidity and mortality among underserved populations. Decision support capabilities and health IT functions, such as disease tracking, automated reminders, and support for medication reconciliation, can be useful in the management of chronic diseases. Such tools have been proven effective in decreasing morbidity and mortality for this population.[62] Telemedicine and tele-health features like remote monitoring and patient consultations can also be instrumental in the management of chronic diseases. Furthermore, individuals suffering from chronic diseases often receive

care from multiple health providers. Health IT tools can facilitate appropriate sharing of data and information essential to the treatment of the patient among providers resulting in improved coordination of care. Consumer e-health tools also have great utility in the treatment and management of chronic diseases by promoting more active patient involvement, encouraging individuals to take more responsibility in monitoring their health and enhancing their access to health promotion information. Research has shown that individuals suffering from chronic diseases benefit a great deal from the use of these tools.

Unintended consequences. A large proportion of the available literature on health IT and disparities focuses on the benefits of adoption and effective use of these tools. At the same time, uneven implementation of health IT can potentially play a role in exacerbating disparities in health care quality and outcomes. If disparities populations and the providers that serve them are allowed to lag behind as these technologies are implemented and do not have equal access to the benefits associated with health IT, existing disparities are only likely to worsen.[63] Tools that are disproportionately accessed by those not underserved, while improving health care outcomes for this group, can also serve to widen the gap. Furthermore, care must be taken to ensure that the effects of health disparities are not exacerbated by the exclusion of providers who serve these populations in adoption initiatives. This is particularly important as these providers may face greater challenges and costs in the adoption and utilization of health IT.[64]

Finally, health IT tools must be developed and deployed in a manner appropriate to underserved populations in order for the full potential benefits to be accrued. For instance, research has shown that members of disparities communities can have specific privacy and security concerns that serve to reduce their likelihood of adopting consumer e-health tools.[65] In order to properly address disparities or differences in key health outcomes or processes of care, it is often necessary to utilize customized interventions or implement the same intervention differently for different populations. Examples highlighted in the section below emphasize the ways in which many communities have tailored or generated new health IT interventions to meet the needs of specific populations in order to reduce or eliminate disparities.

Health IT in Practice: Current Uses of Health IT in Communities with Disparities and the Underserved

In the section below we highlight several commonly used health IT applications, providing specific examples of how they have been employed to help address the challenge of improving health care in underserved communities. While this is not a comprehensive discussion of all applications that may be used for this purpose, our intent is to highlight those technologies whose adoption has been incentivized through HITECH, technologies that have particular relevance to the context in which underserved populations live, and where detailed study may reveal important lessons learned. These technologies include (1) EHRs and CDS, (2) Consumer e-health Tools, including PHRs, mobile/smart phones, and health kiosks, (3) Telemedicine and Tele-health, (4) Population Health Information Systems, and (5) HIEs.

Electronic Health Record (EHR) and Clinical Decision Support

Broadly defined by the National Alliance for Health IT, an EHR is an electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed and consulted by authorized clinicians and staff across more than one health care organization.[66] EHRs are primarily controlled and used by providers to electronically record and maintain patient clinical and demographic information, including information on activities, diagnoses, and orders associated with a clinical episode.

The HITECH Act further classifies EHRs by defining qualified and certified EHRs. The definition of a qualified EHR outlines the minimum functionality that must be included in an EHR for it to be certified. This functionality includes (1) the collection of patient demographic and clinical information, and the ability (2) to provide clinical decision support (CDS), (3) to support physician order entry, (4) to capture and query information relevant to health care quality, and (5) to exchange electronic health information with, and integrate such information, from other sources.[67] A certified EHR is more comprehensive than a qualified EHR and must not only meet the above requirements, but also be tested and certified in accordance with the certification program established by the Office of the National Coordinator for Health IT.[68]

Thus, while EHRs may be implemented as a standalone health IT application to document a patient's clinical data for treatment and billing purposes and share information across different health care providers, additional functionalities, such as CDS, are typically available as part of an EHR. As defined in

the Meaningful Use Final Rule, CDS is a health IT functionality that builds upon the foundation of an EHR to provide persons involved in care processes with general and person-specific information, intelligently filtered and organized, at appropriate terms to enhance health and health care.[69] Furthermore, the functionality of CDS is also defined in the Meaningful Use Final Rule as (1) the implementation of automatic decision support rules based on problem or medication list, demographic or laboratory test data (i.e., medication alerts to warn clinicians about possible adverse drug reactions), and (2) notifications of care suggestions based on clinical decision support rules (i.e., preventative care reminders or diagnostic-based assistance).

Research has shown that EHRs have the potential to create health care efficiencies and improve quality of care.[70] EHR systems with CDS and additional functionalities have the potential to make the most impact on improving quality of care in underserved communities because these systems help to facilitate meaningful use of an EHR. However, as mentioned above, it has been documented that providers that serve low-income and underserved individuals have fallen behind in EHR implementation and adoption and face special barriers to health IT adoption as compared to other private physicians and hospitals that do not primarily serve these populations.[71] [72] [73] While it is expected that the evidence-base for the utilization of EHRs in underserved communities will grow as ARRA-funded health centers develop and implement EHRs and other health IT technologies, our current understanding of the effectiveness of this technology in these communities is lacking. However, limited research does suggest that this type of Health IT has the potential to not only improve patient outcomes and the management of chronic disease, but to also reduce health disparities in underserved communities. Selected examples illustrating the potential impact of EHRs implemented in these communities is reviewed below.

Columbia Basin Health Association EHR. [74] [75] Columbia Basin Health Association (CBHA) is a community and migrant health center comprised of three clinics in central, rural Washington. The community served by CBHA is largely limited English proficient and poor (96% were below the 200% FPL in 2007). CBHA implemented an EHR using GE Centricity software in 2006. Key components of the EHR included a practice management system, dictation software for charting, and document management. Additional functionalities, such as a lab interface with Centricity, which allows for lab ordering and results reporting, are also included.

The benefits of the EHR have included improvements in efficiencies (i.e. total encounters per provider increased after implementation) and quality, especially in regard to the management of diabetic patients. Data from CBHA show that when providers began to use the EHR to monitor their diabetic patients, eye exams increased drastically (from 31% in January 2008 to 80% in August 2008). A similar trend was

observed with HbA1c levels and foot exams. Other performance improvements include an increase in screenings and therapy for osteoporosis. While the EHR was originally utilized in only three CBHA clinics, nearby Othello Community Hospital recently partnered with CBHA and now both organizations have access to each other's EHRs, which is expected to lead to further improvements in care coordination and quality of care for this community.

Primary Care Information Project (PCIP). [76] [77] The PCIP initiative began in 2005 with a mission of improving the quality of health care services in underserved communities in New York City through successful adoption of EHRs. Overseen by the New York City Department of Health and Mental Hygiene, this large, one-of-a-kind initiative provides eligible (at least 10% of patients served must be Medicaid/uninsured), committed primary care practices with licenses to eClinicalWorks (eCW) integrated EHRs, on-site training, and two years of software maintenance and support. Operating on $60 million, the 2010 goal of the initiative is to support 2,500 primary care practices serving over 2 million patients.

In collaboration with the PCIP project, **Urban Health Plan (UHP)**[78] [79], a network of federally qualified community health centers serving primarily poor Hispanic and African American patients in the South Bronx and surrounding communities, implemented an eCW EHR in 2006. According to UHP, the community faces significant racial/ethnic health disparities and has a higher prevalence of chronic disease, including diabetes, asthma, and HIV/AIDs, compared to New York City (NYC) as a whole. The EHR was implemented in an effort to develop a better understanding of the health needs of this vulnerable community and implement evidence-based programs. The comprehensive UHP EHR includes the following components: patient-centric dashboard, CDS, order sets, progress notes, referrals, e-prescribing, a patient portal, and a practice management system. The EHR also includes registry functionality and vaccine data is electronically transferred to the NYC immunization database on a daily basis. Additional interfaces, such as a bi-directional interface with a laboratory company and an iris recognition patient identification interface, are also included.

Both anecdotal and outcome data provided by UHP suggest that the UHP EHR has been successful at improving health outcomes, care coordination, patient/family satisfaction, reporting, staff and provider productivity and revenue. With specific regard to performance improvement, UHP outcome data imply that the EHR implementation has led to improvements in the management of chronic disease. For example, the percent of asthma patients with an influenza vaccine increased from 8.5% in 2006 to 28.5% in 2008. Furthermore, UHP providers attribute improvements in asthma-related outcomes to their ability to use the EHR to efficiently create reports on their asthma patients, previously a cumbersome process because all data was stored in a Microsoft ACCESS database. By utilizing the EHR, providers were able

to identify a subset of patients with extremely high HgbA1C's and better target their disease management efforts.

Improved results for other preventative care outcomes related to obesity, cancer and safer sex practices were also attributed to the EHR. For example, the percentage of women age 42 or greater who received mammograms increased from 24.5% in 2006 to 49.4% in 2008. UHP providers noted that CDS functionality has provided real time evidence-based reminders, which contributed to these improvements. Based on UHP's effective use of their EHR, the Health Information Management Systems Society (HIMSS) awarded UHP with its prestigious Davies Award in 2009. Next steps for UHP include a text messaging pilot program implemented in partnership with NYC Department of Health and Mental Health (DOHMH) that will send reminders for preventive vaccinations and other alerts to patients.

San Francisco Department of Public Health Lifetime Clinical Record (LCR). [80] Housed by the San Francisco Department of Public Health (SDPH), Siemens Lifetime Clinical Record (LCR) is an EHR utilized by various partners, including local hospitals, the San Francisco Community Clinics Consortium (SFCCC), the Department of Housing and the county jail system. SDPH is required through regulation to comprehensively use the LCR to deliver high quality care. SDPH clinics, as well as providers associated with San Francisco General Hospital, use the LCR to record progress notes, access information from specialists and hospitals, or transmit referral orders. Patient registration information, lab, pharmacy, radiology, and diagnostic data are all available through LCR. Clinic staff have noted that utilization of the LCR has improved coordination of care between community providers, but information on the impact of this system on patient outcomes and other quality of care measures has not yet been comprehensively assessed.

Boston Health Care for the Homeless (BHCHP) EHR. [81] [82] Developed by the Boston Health Care for the Homeless Program (BHCHP) in 1996, the BHCHP EHR is utilized by health care providers in over 80 health service sites, including Boston Medical Center and Massachusetts General Hospital, who serve the diverse homeless population of Boston. Providers use a secure web portal to access comprehensive medical information for their patients, including medical histories, allergies, health conditions, and medication lists. Providers can also use the EHR to record detailed notes, file e-prescriptions and process e-referrals which helps to facilitate care coordination for this population. In addition to their EHR, teledermatology is now used to triage and refer individuals who present with skin conditions. With regard to outcomes assessment, BHCP staff have used data from the EHR to investigate and assess a variety of clinical outcomes. For example, data from the EHR has been used to assess if HIV treatment provided to homeless individuals is as effective as treatment provided to those who are not homeless.

Consumer E-Health Tools

Consumer e-health tools include applications used by patients and their surrogates to access and/or update health information. These tools provide various health assessment, knowledge building and health management functions.[83] They can facilitate greater consumer participation and engagement in their health care, support health behavior change, and enhance delivery of patient-centered care. Examples of consumer e-health tools include PHRs, health kiosks, disease risk calculators, electronic medication reminder systems, personalized health risk assessment tools and interactive consumer websites.[84] The consumer e-health tools that we chose to focus on for the purpose of this report are (1) PHRs, (2) health kiosks, and (3) mobile/smart phone applications.

Perhaps the most common of these tools, PHRs, are similar to EHRs in the fact that they electronically record and maintain patient demographic and health-related information. However, unlike EHRs, they are used and controlled by patients rather than clinicians. Consensus has not been reached on the definition of a PHR. A definition that is often referenced is one by the Markle Foundation's Connecting for Health collaborative which describes PHRs as an electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment.[85]

In addition to PHRs, health kiosks are another health IT application aimed directly at patients. These publicly available computer terminals are placed in locations where targeted audiences are known to congregate and are designed to allow patients to obtain information on health conditions or to access information on their own health. Finally, mobile phone applications used to record and send health-related information and/or deliver email or short message services (SMS) messaging that reinforce healthy behavior have both been explored as technology solutions to improve the quality of care.

While consumer e-health tools are said to hold much promise for reducing health disparities and chronic disease management, they are still in the early stages of development and adoption and usage, particularly with regard to underserved populations. It has been suggested that PHRs can help augment patient-provider communication, reduce disparities in treatment, and improve management of chronic conditions by maintaining continuity of care.[86] On the other hand, mobile phones may play an important role in the reduction of health disparities by improving access to health-related information for underserved populations, particularly African Americans and Hispanic populations who have become the largest per capita users of this technology.[87] Similarly, health kiosks are considered another mechanism for improving access to health-related information not readily available to many underserved and poor individuals who do not have access to the internet.

Below we provide additional details about each of these e-health tools as well as relevant examples and available evidence around their implementation in underserved communities.

PHRs

There are many different models of PHRs. Tethered PHRs are populated with information stored in a provider's EHR or from a claims database, while untethered PHRs are standalone PHRs that rely on consumers entering their own information. Health record banks are gaining momentum as promising PHR applications because they are consumer-controlled, but may be populated by provider data. Health record banks are central repositories of health information where consumers control their provider's ability to access to their information. Data in health record banks can be entered directly by patients or populated through interfaces with providers. Furthermore, population- or condition-oriented PHRs are PHRs designed for specialized user groups. These different models of PHRs can be used to facilitate communication between consumers and providers electronically and may allow consumers to look up lab or tests results and request prescription refills online, among other features. Select examples of different types of PHRs implemented in underserved communities are described below.

MiViA. [88] [89] Perhaps the most widely recognized example of a successfully implemented PHR in an underserved community is MiViA. MiViA is a portable population-oriented PHR that was originally targeted at migrant, Spanish-speaking populations in Sonoma Valley, California. It now serves approximately 24,000 individuals across sites in California, Oregon and upstate New York. Launched in 2003 by the Community Health Resource & Development Center (CHRDC), FollowMe PHR Company, and community-based partners, the functionality of MiViA continues to expand and includes documentation of clinical visits, health information, and other data, as well as mechanisms for access and input from providers or family members (following patient consent), a picture ID, and links to health-

related websites. A Spanish version of MiViA is also available. Anecdotal evidence suggests that users of MiViA have improved continuity of care; however, a comprehensive evaluation of this effort does not appear to have been conducted. A PHR modeled off of MiViA, **Health Shack**, which targets homeless and system based youth in Sacramento, was just recently launched in by the Sierra Health Foundation, United Health Group, and community partners, in January 2010.

myHERO. [90] [91] An example of a condition-based PHR implemented by safety net providers is myHERO. myHERO was implemented in 2007 by the HIV/AIDS Program at San Francisco General Hospital, which serves 3,000 HIV/AIDS patients, most of whom are members of racial/ethnic minority groups. The data stored by myHERO includes health condition, medication/allergy, and laboratory information. The laboratory interface not only provides users with results, but also information about their results and access to reputable resources, such as the National Library of Medicine, if more information is desired. This functionality may allow for better self-management and improved health literacy, both of which have the potential to improve outcomes for individuals with chronic conditions such as HIV/AIDS Still in early phases of adoption, a comprehensive evaluation of myHERO has not yet been conducted.

MyChart-MyHealth. [92] MyChart-MyHealth is an EHR-tethered PHR available through the Institute for Family Health, a network of community health centers in New York City. The Institute primarily serves a minority population, of which 15% are uninsured. The core functionality of MyChart-MyHealth includes access to health information and test results, the ability to request prescription renewals, and communication with providers and office staff through secure messaging. Secure messaging, a functionality rated highly by users, allows patients to communicate with health care providers through the electronic exchange of information. Launched in 2007, MyChart-MyHealth is currently working to implement a Spanish-version of the PHR, provide access to educational resources, and build interfaces with additional providers.

MyHealtheVet. [93] Unlike the community-based PHR projects describe above, MyHealtheVet is a PHR that targets veterans, active duty soldiers and their dependents across the U.S. Thirty seven percent of veterans enrolled in the VA Health Care System reside in rural or highly rural areas.[94] Research has shown that, in comparison to their urban counterparts, these veterans are likely to have greater health care needs, score lower in health-related quality of life measures, and experience a higher prevalence of physical illness.[95] MyHealtheVet is a population-oriented, EHR-tethered PHR that was launched in 2003 by the Veterans Health Administration (VHA). Users have access to an electronic copy of their health information along with a number of other features, including health logs to track blood pressure, weight, and other items; online VA prescription history and refills; self-assessment tools; and health education

resources. Additionally, secure messaging functionality was recently added in 2009-2010 and allows users to electronically communicate with participating VA center providers, enabling improved patient-provider communication.

Currently, there is limited evidence on the impact of PHRs on quality of care, chronic disease management, and outcomes because many of the previously mentioned PHRs are in early stages of adoption. Key staff from the projects mentioned above emphasized that adoption of these PHRs has increased over time and they expect the trend to continue. For example, a 2010 survey conducted by MyHealtheVet found that approximately 84% of users were satisfied with MyHealtheVet and 92% reported they would use MyHealtheVet again. Across all PHR projects, it was mentioned that engagement with the community in developing the application and providing comprehensive population-tailored training to individuals using the tool is necessary to make PHRs fully functional and effective for both providers and patients.

While the impact of individual PHRs on underserved populations is not adequately documented, a 2010 national survey conducted by the California HealthCare Foundation reported that low income and chronically ill populations report more benefits from using a PHR in comparison to the non-low-income individuals who responded to the survey.[96] Specifically, almost double the amount of low-income PHR users as compared to higher income users reported feeling connected to their doctor as a result of their PHR (60% of low income vs. 30% non-low-income). Additionally, 40% of individuals with chronic conditions reported health benefits from utilizing their PHR in comparison to only 24% of individuals with no reported conditions. Despite reporting more positive benefits from PHR utilization, the survey also confirmed that traditionally underserved populations are less likely to report using a PHR compared to their counterparts. Similarly, a study that examined registration rates for the Kaiser Permanente PHR found African Americans were less likely to register than Whites when controlling for education, income and internet access.[97]

Health Kiosks

Health kiosks are often utilized in one of two ways. The first, sometimes referred to as opportunistic kiosks, are placed in public locations (i.e., libraries, physician offices, community centers) for the purpose of health education and promotion. The second, integrated kiosks, are included as part of the clinical episode and often target a specific health condition(s). More recently, health kiosks have been considered as a mechanism for providing patients with access to their medical records.

The impact of health kiosks in enhancing the health and health care of underserved populations is unclear. In a recently published literature review on the role of health kiosks, authors noted that, despite the fact that research has shown that underserved populations are equally as likely as their counterparts to use a health kiosk, they did not think kiosks were an effective mechanism for reducing the digital divide because use of kiosks generally declines over time.[98] On the other hand, several efforts have documented positive impacts in underserved communities and could result in greater health IT familiarity and increased access to accurate health-related information. Select examples are described below.

Women's Wellness Guide Kiosks.[99] The Women's Wellness Guide (WWG) kiosks are opportunistic kiosks in women's prisons and waiting rooms, public assistance offices, health care facilities, and Women, Infant and Children centers that provide bilingual health information to underserved women in across Pennsylvania. Launched in 2008, the touch-activated kiosks provide information on 19 health-related topics, as well as a list of questions to ask a doctor for each topic and referral locations. Data suggest the WWG kiosks have had a positive impact of the community: over 90% of 6,000 unique users felt WWG kiosks were helpful, somewhat helpful or very helpful in teaching them to take control of their health. Furthermore, 87% of unique users indicated that they were likely to make a lifestyle change based on the information they received from the WWG kiosk. Data were not available to determine if health behaviors or outcomes changed as a result of this technology.

Safety in Seconds Kiosk.[100] The Safety in Seconds (SIS) kiosk is an intervention aimed at improving child safety seat, smoke alarm and poison storage knowledge among low-income, urban families in the metropolitan Baltimore area. The SIS kiosks were placed in a pediatric emergency department in 2004-2005 and a randomized control trial was conducted to assess the impact of the SIS kiosks on safety knowledge and behaviors. Individuals were instructed to use the SIS kiosk to answer questions on each safety topic and then a personalized report was produced that highlighted relevant safety information based on answers provided. Results showed significant improvements in smoke alarm and poison storage knowledge. Additionally, findings were positive for reported short-term outcomes: the intervention group was more likely to report positive child safety seat outcomes than the control group. The authors concluded that low-income families appear to positively benefit from targeted health messages transmitted via a kiosk.

Community Care Network of Virginia (CCNV) Innovations Kiosks. [101] [102] The Community Care Network of Virginia (CCNV) is a primary care provider network of Virginia's 24 Federally Qualified Health Centers. In 2007, approximately one third of the patients served by CCNV were uninsured. The Innovations Kiosks project, funded by HRSA, included the development and implementation of

Seepoint/Kiohealth kiosks across provider practices participating in the network. The first phase of the project rolled out in spring 2010 and involved utilization of kiosks for patient check-in and depression screening using the PHQ-2 and PHQ-9 behavioral health questionnaires. Results from the depression screening are immediately available for review by providers. It is anticipated that the availability of these results will facilitate better mental health care provided by CCNV clinicians.

Mobile/Smart Phone Applications

The use of mobile/smart phone applications to transmit health-related information, monitor disease, and directly communicate with providers is viewed as a potentially beneficial mechanism for improving the quality of health and management of chronic disease. Similar to health kiosks, cell phone health applications are viewed as potentially effective for reaching low-income minority populations who are more likely to have access to mobile phones than the internet.[103] As mentioned above, while disadvantaged populations continue to lag behind in internet access, the digital divide between racial minorities and Whites in cell phone usage is no longer existent. A recent survey by the Nielsen Company found that both African American and Hispanic cell phone users sent significantly more texts a month compared to their White counterparts.[104] Thus, mobile technology appears to be a powerful mechanism for reaching individuals in underserved communities. Select examples of mobile/smart phone applications targeted at these communities are described below.

Text4Baby.[105] Several pilot cell phone health application projects are under way, including a national initiative, *text4baby*, created by National Healthy Mothers, Healthy Babies Coalition, in partnership with a broad number of private and public organizations, including the Department of Health and Human Services. Other key partners include corporations, academic institutions, professional associations, tribal agencies and non-profit organizations. Text4baby is a free mobile information service designed to promote maternal and child health. A Spanish-language version of the application, Envia BEBE, is also available. Text4baby provides pregnant women and new moms with information they need to take care of their health and give their babies the best possible start in life. Women who sign up for the service by texting BABY (or BEBE for Spanish) to 511411 will receive free SMS text messages each week, timed to their due date or baby's date of birth. Launched in January 2010, two relevant goals of the initiative are to demonstrate the potential of mobile health technology to reach underserved populations and develop a base of evidence of the efficacy of mobile health interventions. The target audience is younger women, low-income women and women of color. The intervention will include a comprehensive evaluation, including a randomized experiment using claims data to assess and examine behavioral outcomes and other health status measures. A major potential barrier to the effective implementation and use of cell

phone health applications are the data charges that can be incurred as part of their use. Therefore, key to the success of the text4baby initiative is the participation of several major mobile phone carriers who have agreed to transmit the messages to participants without charge.

Diabetes Management.[106] On a smaller scale, a Children's Hospital in Columbus, Ohio used SMS messaging to send adolescents messages aimed at improving management of diabetes. The content of the messages was personalized, including reminders about treatment (i.e., How are your glucose checks going?), and personalized, supportive content (i.e., Keep up the good work!). The pilot was implemented in early 2010 and lasted 3 months. Results from the pilot showed improved diabetic outcomes for patients: both meal bolus adherence and HbA1C levels improved over the course of the project. On a broader level, several similar mobile phone chronic disease management initiatives have been implemented around the world and showed similar improvements in outcomes.[107]

Tuberculosis Medication Adherence. [108] [109] On an international level, efforts have been undertaken to utilize SMS technology to improve tuberculosis (TB) treatment adherence. The development of SIMpill – a pill bottle that contains a SIM card which delivers a message to central server when the bottle is opened – is used to track whether or not individuals are taking their medications. If a message is not received by the server during the prescribed time, an SMS is sent to an individual, caretaker, or provider phone to facilitate proper action. SIMpill was first utilized in South Africa and a pilot study conducted in 2006-2007 resulted in a 94% compliance rate and a 92% treatment success rate. More recently, this technology has been expanded with regard to location (now being utilized in Europe and the U.S.) and target illness (cancer, osteoporosis, hypertension, etc.).

While evidence on the use of mobile phone applications to better manage chronic disease appears to be building, the impact of SMS-based preventative care reminders and bi-directional communication with providers is less clear, especially for underserved populations. For example, two recent randomized control studies that examined the effectiveness of mobile SMS reminders for improving adherence to vitamin regimens and birth control found no significant results. [110] [111] Findings like these suggest the need for more thoughtfully developed interventions and additional research.

Telemedicine and Tele-health

Unlike the other types of health IT discussed in this paper, the target population for most telemedicine efforts has been largely underserved and rural populations. Thus, telemedicine is one of the more obvious health IT applications to consider when targeting health disparities. Telemedicine is defined by the American Telemedicine Association (ATA) as the use of medical information exchanged from one site to

another via electronic communications to improve patients' health status.[112] Tele-health is a broader term that is used to describe remote health care which does not necessarily include the provision of clinical services. Typically, both telemedicine and tele-health involve the use of phone or video conferencing. As outlined by the ATA, five buckets of commonly provided telemedicine services include: (1) specialist referral services where specialists collaborate with general practitioners to assist for diagnostic consultations, (2) patient consultations where medical data is shared between a patient and a medical provider, (3) remote monitoring where applications are utilized to collect and send data to a monitoring station, (4) remote medical education training, and (5) utilizing the internet to provide consumers with specialized health information and support.

The potential impacts of telemedicine are at least twofold: it has the ability to increase access to care and can facilitate the provision of evidence-based care as a result of the development of relationships among primary care teams and specialists. In the paragraphs below we provided examples of telemedicine projects that have been implemented in underserved communities and summarize any evidence surrounding their impact.

Alaska Federal Health Care Access Network (AFHCAN). [113] [114] One of the largest well-known telemedicine initiatives is the Alaska Federal Health Care Access Network (AFHCAN). AFHCAN, launched in 2001, was designed to improve health care access for Federal beneficiaries in rural Alaska. A total of 248 sites were equipped with telemedicine carts that were networked to larger health care centers, providing access to specialized care. A comprehensive evaluation was conducted to assess a number of interrelated objectives, including perspectives of providers and utilization of AFHCAN. Overall, the majority of physicians reported that AFHCAN improved quality of care (85%) and played a role in patient education (64%) for individuals in rural Alaska. Health-related outcomes were not assessed as part of the evaluation.

Open Door Community Health Center (ODCHC) Telemedicine Program. [115] ODCHC is a FQHC with ten satellite clinics that provides services to predominately Medicaid and uninsured patients in northern rural California. ODCHC implemented a telemedicine program in the late 1990's, beginning with the implementation of telemedicine technology throughout the network of clinics and then developing a standalone telemedicine and visiting specialist center. Each site is equipped with at least one telemedicine unit which allows for videoconferencing and sending of health information. Telemedicine technology implemented in the specialist center allows for real-time remote consultation and diagnosis by specialists. Anecdotal evidence suggests that, with over 10,000 telemedicine sessions annually, this

telemedicine program has helped reduce barriers in access to care for underserved populations in this community.

Project ECHO. [116] Project ECHO, is an example of a telemedicine program implemented in rural and underserved areas of New Mexico. Project ECHO is centered around chronic disease management with a specific focus on hepatitis C. The framework of the initiative included the development of approximately 400 "knowledge networks" of community health care providers throughout Arizona who meet with University of New Mexico (UNM) specialists weekly to discuss specific cases and jointly decide on a treatment plan. Additionally, an electronic disease management tool is used by UNM specialists for remote monitoring of treatment processes and outcomes. An evaluation was conducted to assess improvements in provider knowledge and skills and patient outcomes related to the treatment of hepatitis C. Results indicated that providers' knowledge and skills did improve, however the study did not show evidence that participation in Project ECHO resulted in improved treatment or cure rates for individuals who received care as part of the initiative verses patients at the control site.

Virtual Dental Home (VDH) Project. [117] Implemented by the University of the Pacific School of Dentistry, this project focuses on providing free dental services to vulnerable and underserved communities. Using portable imaging equipment and an internet-based dental record system, dental hygienists and dental assistants create electronic dental records that are uploaded to a secure website to be remotely reviewed by a dentist. Based on this review, a personalized dental treatment plan is created and dental hygienists and assistants provide any oral care that can be conducted in the community setting. Oral health care services are provided to various populations including children in Head Start Centers and elementary schools, and older or disabled adults in residential care settings. The project is currently in its demonstration phase with nine sites throughout California.

The Informatics for Diabetes and Education Telemedicine Project (IDEATel). [118] First implemented in 2000, IDEATel is a home telemedicine intervention targeted at ethnically diverse, medically underserved diabetic patients in New York. Participants received a web-based home telemedicine unit which allowed for interaction with nurse care managers, remote monitoring, and access to individualized clinical data. A randomized control trial was conducted to assess the success of the project and results indicated significant long term improvements for a number of diabetic outcomes after a 5 year follow up period, including HgbA1c, LDL-cholesterol, and blood pressure.

Although there is evidence of the efficacy and outcomes of telemedicine in comparison to traditional care, few randomized, controlled clinical trials have been conducted that document this evidence. Furthermore,

a key drawback of this type of technology is the high costs often associated with implementation, especially in underserved communities without a strong technology infrastructure. However, it is clear from recent experience that telemedicine and tele-health interventions can successfully provide access to care for populations that do not have any easy options for receiving specific types of health care in person and hold potential for improving quality of care.

Population Health Information Systems and Electronic Registries

Public health officials cite difficulty in capturing and reporting on key health and demographic indicators on a longitudinal basis as a barrier for effectively reducing health disparities and addressing the needs of underserved populations. Thus, in addressing disparities, there is growing recognition of the value of population health systems to accurately capture this information. These data can be used to better inform programmatic development and quality improvement initiatives, as well as to assess the impact of these efforts.

A recent 2010 article published in the Journal of American Medical Informatics Association provides a definition for both population health records and population health record systems by adapting the International Organization for Standardization definition of an EHR.[119] The authors define a population health record system as a mechanism for recording, retrieving and manipulating information in population health records. Furthermore, population health records are defined as a repository of statistics, measures and indicators regarding the state of and influences on the health of a defined population, in computer processable form, stored and transmitted securely, and accessible by multiple authorized users. Population health record systems can be established on many levels, with some focusing on a specific clinic or provider's populations while others cover an entire community, State or region.

An electronic disease registry is an example of a population health information system. An electronic disease registry is a database feature that includes key clinical data, usually on a subset of chronically ill patients, for the purpose of tracking their condition and managing treatment.[120] A recent white paper published by the Engelberg Center for Health Care Reform at the Brookings Institute emphasized that registry functionality is particularly important in addressing disparities because it allows for the collection of standardized race/ethnicity data and can include functionality that can engage providers in providing culturally appropriate care.[121]

Population health information systems are often designed for the purpose of improving the efficiency and/or effectiveness of health. Over time, however, the promise of using these systems to decrease health disparities and improve the quality of care for underserved populations is being recognized and is in early

phases of adoption. For example, all Center for Health Care Strategies Reducing Disparities at the Practice Site grantees, collaborations of small practices serving predominately racially and ethnically diverse Medicaid beneficiaries with a high prevalence of chronic disease, are planning to implement a registry health IT application (either as a standalone product or as part of an EHR) for the purpose of tracking and monitoring diabetic performance for their target population.[122] These grantees are in their second year of funding, thus evidence on the implementation of these applications is not yet available. However, other examples, such as a patient tracking and feedback registry used by a group of New York City hospitals for treating breast cancer patients, resulted in improved rates of oncology visits for all women, but, perhaps more importantly, also eliminated the disparity between adjuvant underuse between African American and Hispanic women compared to White and Asian women.[123]

Additionally, through the **Tools for Quality Program**[124], a joint effort sponsored by California Health Care Foundation and Community Clinics Initiative, among others, the **i2iTracks**[125]population health reporting tool has been implemented in 33 health centers and other safety net providers in California. The system, with strong chronic disease management functionality, allows for large database creation and interfaces with practice management systems, EHRs, and lab systems, allowing users to view, manage and analyze various data sources on a population level. i2i is particularly well-designed for FQHCs, as the system includes built-in report templates for Federal reporting requirements, such as Uniform Data System (UDS) reports, as well as the ability to create ad-hoc reports specific to the needs of clinics. Built-in disease management modules are available for diabetes, asthma, hypertension, cardiovascular disease, women's health and many others of particular concern to health centers with underserved populations, and i2i offers training sessions for implementation and use of each of these modules.

Clinics have used i2i to improve outcomes for high risk diabetics, track and manage provider panels, track referrals, and conduct outreach. One health center, San Ysidro Health Center, reported that implementation of this system has motivated participating physicians to take more of a team-based approach to monitoring their diabetic patients which likely contributed to documented improvements in HgA1c levels.[126]

On a larger scale, the **National Data Warehouse (NDW)**[127] is an Indian Health Service (IHS) data warehouse that was implemented in 2007 to store both clinical and administrative data from most IHS and tribal health care facilities. The warehouse is an upgrade from the National Patient Information Report System, which has been used by IHS since 1986 to primarily monitor administrative activities. The new system will allow users to examine clinical practice patterns and measures of quality of care, patient demographics and utilization patterns, among other capabilities. Ideally, the NDW will allow for better

management of patients, facilities and larger scale programs, ultimately resulting in delivery of better quality care for tribal populations.

Funded by HRSA, the **Pacific Innovation Collaborative (PIC)**[128] aims to reduce health disparities with the use of regional and central data repositories housing aggregate health information. The project involves a network of eight community health centers and two health plans in Hawaii and Washington. Through a combination of claims, PMS, and EHR data, selected performance measures are tracked with the goal of improving overall performance and provision of care within the health centers. Collected data is sent to one of three regional database repositories and aggregated in a central repository which provides user-friendly summary reports for all project sites to view and share.

Health Information Exchanges

As with many other types of Health IT, there is no single universal definition of HIE. However, the broad concept of an HIE, as described in a recent report to the State Alliance for e-Health, is the exchange of health-related data among providers, public health officials, payers and patients for the purpose of improving the quality and efficiencies of health care delivery and, in some cases, population health. [129] There are multiple models of HIE, some center around the exchange of information within a particular geographic area, usually referred to as Health Information Organizations (HIOs) and Regional Health Information Organizations (RHIOs), while others are more centralized efforts among multiple stakeholders in a particular community.

The availability of health information through an HIE has the potential to reduce disparities in a manner similar to public health information systems. The ability to gather data from many sources of treatment can be used to target quality improvement initiatives and improve patient treatment at the point of care. The establishment of a HIE among safety net providers who provide care to underserved populations can improve continuity of care by creating an electronic record for these transient individuals. In addition, HIE offers the opportunity for key information on diagnoses, allergies, medications and recent test results to be shared among providers in real time so that patients get safe, effective and efficient care in settings such as emergency rooms, medical specialty offices and other settings that may not be the patient's usual source of care. Finally, these systems may allow for increased access to underserved populations for clinical trials to develop a more comprehensive understanding of the health disparities that exist and culturally appropriate treatment models. Below we provide select examples of how HIEs are being used to improve quality of care specifically for underserved populations.

Boston Health Net. [130] The Boston Health Net (BHN) is a health center controlled network of 15 health centers that has collaborated with Boston Medical Center (BMC) to maintain a Community Information Exchange (CIE). With funding from HRSA in 2007, BHN and BMC implemented a CIE that serves as a repository for patient clinical data. The CIE grants health center providers access to inpatient and specialty care data elements available through BMC. CIE functionality includes the exchange of full Continuity of Care Documents (CCDs) (a standardized electronic document of patient summary information that can be accessed via the web or imported into an EHR); patient fact sheets summarizing important administrative, demographic and clinical information; and a referral management system, among other components. Data abstracted from the CIE demonstrate significant improvements in referral processes and access to specialty care, including improved no show rates and time to referral appointments. Anecdotal evidence suggests the CIE has also resulted in quality of care improvements; the system creates daily electronic practice management quality reports measuring over 40 health center-specific key performance indicators.

Metro DC Health Information Exchange (MeDHIX).[131] The MeDHIX HIE is a multi-jurisdictional open source HIE that links over 50 primary care providers, specialists, safety net clinics, and hospitals providing care to underserved populations in the Washington, DC metro area. The eCHART interface of the HIE provides users with the following key functionalities: a clinical summary, the ability to create picture ID cards, electronic laboratory results, a referral management module, and the ability to view faxed reports from specialists and hospitals. MeDHIX was implemented in 2007 and the number of patient records has grown rapidly over the past two years. Currently, the HIE includes over 500,000 records, of which over 100,000 represent "culturally, racially, ethnically, and linguistically diverse patients."

While two key goals of MeDHIX were related to improving health care (i.e., reduce emergency department (ED) usage) and data quality (i.e., provide data for public health surveillance), neither of these goals has been comprehensively evaluated. Data is currently being used by the public health staff to gain a better understanding of this population. However, increased usage of the system is needed before any analyses can be conducted to determine potential improvements in quality of care across users.

Barriers and Challenges

In general, providers serving underinsured populations are slower and less likely to adopt health IT. [132,133] Although the potential benefits of health IT can be particularly pronounced among underserved communities, there are major issues that impede implementation and adoption of technology in these settings. Developing an understanding of these challenges is critical to utilizing health IT to address issues related to disparities and unequal access to care.

Funding and Incentives

There has been a significant amount of documentation regarding the general barriers to adoption and implementation of health IT. These barriers include cost, lack of staff buy-in, provider training, challenges in planning and workflow redesign, and lack of perceived demand and utility. However, there are particular challenges which, while they may apply to a broad range of providers, are often more pronounced among providers of underserved populations. Below, we present the key challenges and barriers relating to the adoption of health IT tools in the context of providers serving underserved populations and members of this group who may be using consumer health IT tools.

Funding availability. One major barrier exists in the form of the substantial capital necessary for the initial investment in health IT.[134] This has historically been true in the case of the CHCs, free clinics and other safety net organizations that disproportionately serve underserved populations. These organizations frequently have limited budgets, face numerous competing demands for funds and are often particularly cautious about taking on debt.[135] Furthermore, although purchase and implementation costs for health IT are often significant, initial expenses are not limited to implementation, as ancillary costs can arise when the organizational infrastructure is not previously equipped to handle the technology and must be upgraded. In addition, there are often ongoing maintenance costs associated with adoption and use of health IT, as well as with updating and obtaining support for the system.[136] All these barriers together can contribute to high overall costs of implementation and use. Many facilities have been successful in obtaining outside funds in the form of grants and approaches, such as group purchasing and use of open source solutions, can contribute to reducing the financial burden. Similarly, funds from current initiatives, such as the EHR incentive program implemented under HITECH, can serve to mitigate these costs.

Limited infrastructure and technical expertise. As previously mentioned, a significant amount of the care for underserved populations is supplied by safety net providers. These providers frequently lack the staffing and implementation resources to independently embark on a health IT installation. Acquiring

qualified health IT staff in remote areas or for lower salaries has also been challenging. At the same time, studies on factors associated with successful implementation in these settings have demonstrated that having continuous in-house implementation support is critical to the success of the project.[137] Facilities that do not have trained in-house support personnel have to also consider the hiring of consultants or in-house personnel to manage the implementation at additional cost. In addition, the lack of appropriate technical infrastructure can act as a significant barrier. For instance, a certain level of hardware and software is necessary for any implementation and many of these IT tools may also require a level of broadband capacity that might not exist in some rural areas.[138]

Business case. Research has demonstrated that safety net providers that serve greater percentages of poor and uninsured patients may have less incentive to adopt health IT in the form of functional EHRs.[139] Furthermore, those that do implement tend to have higher EHR costs and lower financial benefits.[140] One reason for the poor business case for these providers is that health centers are subject to specific Medicaid and Medicare reimbursement policies, which differ significantly from those enjoyed by private providers.[141] Medicare and Medicaid reimbursement to these providers is granted on a per-encounter basis, with payments based on the average cost of an encounter.[142] There are many consequences of this in terms of potential financial rewards to providers of underserved populations for their use of health IT. For instance, due to this reimbursement structure, these individuals do not derive benefit from improved coding with an EHR that is one of the most commonly ascribed advantages for providers serving a predominantly privately-insured population. [143] Furthermore, while the current HITECH meaningful use incentives for Medicare and Medicaid may benefit some providers in underserved communities, others such as free clinics, which do not bill third party payers, and some behavioral health providers, do not qualify for incentive payments.

Special Needs of Safety Net Providers

While widespread adoption of health IT is complex and challenging for all providers, providers serving disparities and underserved communities have unique needs and demands for health IT tools. These can have an impact on the implementation of health IT in these settings.

Complex caseloads. There is a disproportionately high incidence of chronic and debilitating conditions such as behavioral health disorders, diabetes, cancer, heart disease, hypertension and HIV infection within underserved communities.[144] These populations are also disparately impacted by conditions that might complicate treatment, such as teen pregnancy, STDs and asthma.[145] As a result, members of underserved communities not only have diverse health care needs, but also varied expectations and demands in terms

of health IT tools. A significant challenge exists in implementing a system that can sufficiently accommodate the specific needs of these populations, particularly with respect to advanced CDS and integration of tools for patient outreach, which are important to quality improvement efforts targeting underserved populations with chronic illnesses.

Customization and configuration. Arguably as important as the successful implementation of the health IT application is its effective use for the targeted population. Most safety net providers provide patients with a wide variety of services, at times including both dental and behavioral health care. Viable tools must be capable of addressing the practices' needs in all these areas. Furthermore, the unique and varying needs of providers caring for the underserved, including both health centers and small practices, must be reflected in the functionality of the tool. These providers are also governed by complex reporting requirements and reimbursement policies and require robust tools that are capable of accurately capturing specific demographic information to facilitate reporting needs.[146] Additionally, specific data requirements can vary based on the population primarily served by these facilities.[147] CDS reminders and alerts within the system also need to be adjusted to handle vulnerable populations.[148] Finally, these tools are frequently expected to be capable of integration with pre-existing IT systems within the practice setting. In particular, many of these providers have implemented PMS systems to facilitate patient scheduling and billing and disease registries for quality reporting purposes.[149,150]

Design. Such issues also present a challenge to vendors and health IT developers who at times lack an understanding of the unique needs of disparities communities and generally develop new products without input of providers serving these populations.[151,152] For instance, these tools are frequently inconsistent in the manner in which they collect and record demographic data. It is also difficult to find consumer applications that are targeted to underserved communities and well-suited for use by these consumers.[153] Users cannot rely entirely on the off-the-shelf components of many health IT tools currently on the market, as these are not designed to address the complex and unique demands of a community-based setting. Tools might need to be customized and carefully implemented in order to adequately address the unique needs of these providers and their patients.[154] This customization, which generally requires an in-depth understanding of the practice, can serve to further increase the costs associated with implementation.[155,156] However, existing implementations in underserved settings demonstrate the feasibility of successfully utilizing health IT in these environments.

Implementation. Additional challenges relate to the implementation effort, rather than the technology itself. Although these are not unique to providers caring for the underserved, they can be exacerbated by the resource poor environments in which these providers often work. For instance, providers caring for

the underserved should undertake workflow redesign to best utilize health IT.[157] However, the process of workflow redesign can be complicated, leading to shifts in roles and responsibilities as job descriptions evolve with changes in organizational workflow.[158] Project management staff can ensure that the planning and implementation process proceeds smoothly, increasing the likely success of the project as a whole. However, providers caring for the underserved often lack access to or funds to support such staff. For example, in a 2008 National Association of Community Health Centers (NACHC) survey, nearly 60% of CHCs surveyed identified "lack of project management staff to manage implementation" as an important or very important barrier to implementation of health IT.[159] Another implementation-related issue facing providers who care for the underserved is a lack of understanding of how much time it will take to adjust to the new technology. Similarly, while productivity might increase in the long run once the technology is fully implemented, in the short term, it can be adversely affected. In a 2006 survey of CHCs, 75% of the 633 CHCs surveyed who did not have a functional EHR cited concerns about loss of productivity and/or income during the EHR implementation as an important or very important barrier to adoption.[160] For providers operating on the edge economically, there may be no way to accommodate a short-term drop in productivity.

Challenges to Adoption of Consumer E-Health Tools

While there are many general challenges associated with the adoption of consumer e-health tools, including usability, utility, privacy concerns, and lack of awareness of their availability, several adoption barriers for e-health tools among underserved populations exist due to community and population-related factors. Because the successful application of e-health tools depends on the active involvement of the consumer, it is necessary that these technologies be implemented in careful consideration of the target population.

Health and Technological Literacy. Health literacy is defined as the ability of a person to obtain, process, and understand basic health information and services and to use that information in their health care.[161] The ability of patients to utilize health information in making decisions about their health care and to manage their care is severely limited in the absence of the capability to fully understand that information. However, many health IT tools rely heavily on these skills.[162] Similarly, limited technological literacy may impact the ability of individuals to utilize computer-based resources. Several studies have found that computer literacy and computer anxiety act as significant barriers to the use of consumer health IT tools.[163] Ideally, e-health tools and health information content should be easily and effectively used by consumers with limited training in the product, by those who may not be comfortable using these technologies and regardless of health literacy level.

Culture and language. Various cultural factors can have an impact on the way individuals perceive and navigate the health care system. Research has shown that use of consumer e-health tools can be significantly impacted by cultural differences and norms.[164] For instance, users are unlikely to follow behavioral modification suggestions that they perceive as not pertinent or feasible in their setting. Effective health IT tools must therefore be implemented in a culturally appropriate and competent manner. This involves incorporating the viewpoints and perspectives of the target population and presenting tools in a manner that is appropriate to their context, including making materials available in different languages to improve access for those with limited English proficiency.[165] In addition, specific groups might have certain care preferences or customs unique to their population. Educational resources and health information, in particular, must be presented in a manner sensitive to the needs of the population. This is particularly true in terms of the effectiveness of health IT in promoting behavior change.

Level of comfort interacting with health care system. Consumer acceptance is key to the successful application of many of these technologies. Because of this, ensuring that patients have a positive perception of the health care system is essential to encouraging utilization of consumer-oriented tools. Lack of trust for health care institutions is also an issue to consider when implementing health IT for use in underserved communities.[166] Consumers may not accept that their personal health information is secure and may have concerns about privacy. African Americans and Latinos, for instance, have expressed great distrust in the use of electronic PHRs that involve their personal health information being stored on the Internet.[167] Others may not trust the safety of their information against security breaches or that their personal information cannot be used against them. Such concerns can serve to greatly decrease the level of willingness of individuals to utilize health IT tools and improved understanding of these issues is needed if efforts to encourage the use of consumer e-health tools are to be successful.

Digital Divide. Although our background section describes a lessening digital divide in terms of access to technology among some underserved populations, there is still evidence that members of underserved populations are still more likely to have limited access to computer technologies and to the internet.[168] Economic status, geography, literacy level, local infrastructure and cultural differences have all been associated with access to technology. [169] For instance, homeless individuals in particular are unlikely to have internet "at home." Although use of the internet and computer is rising rapidly across all groups, there continues to be a difference, particularly in terms of socio-economic differences.[170] Low income individuals are still less likely to own a computer and to have easy access to the internet. Similarly, individuals residing in rural areas are disadvantaged in terms of the availability of technology. Lack of consistent access to a computer can make the application of tools like PHRs a challenge. Previous health

initiatives have found effective ways to address this issue. For example, participants in a project targeting migrant farm workers are also provided access to a mobile medical van that provides members with computer and internet access.[171]

Discussion

In this section, we review the overall research questions for our project and present an analysis of findings from our environmental scan that relate to these questions. Table 4 below outlines the key research questions for the project by domain.

Table 4: Key Research Questions

Domain	Research Questions
Impact of Adoption and Consequences	• Are there specific health IT tools that have the potential for greatest impact on communities with health disparities or are especially well-suited to addressing the clinical and personal health needs of this group? • Are there any unintended adverse consequences of health IT that might contribute to increasing disparities in health care or quality? • In what ways can the adoption of health IT improve chronic disease management? • To what extent can health IT help reduce or eliminate health care disparities and/or improve access for the medically underserved?
Health IT Barriers	• What are the unique barriers to health IT adoption—financial, structural, cultural, etc.—among the providers who serve these vulnerable populations? • Are there particular barriers that are especially salient with respect to health IT used by vulnerable patients? • How can systems be designed to address the unique needs of vulnerable populations?
Encouraging Adoption	• What are effective policy approaches for promoting adoption of health IT among providers in communities with disparities and areas with a high proportion of uninsured and underserved? • What are the specific steps HHS can take to help providers who are serving uninsured/underinsured patients or working in areas with high levels of health disparities to successfully adopt health IT? • How can new ARRA and ACA approaches be evaluated in terms of their impact on these providers and communities? • What are strategies to assure that adoption of health IT to address the needs of the uninsured is sustainable and cost effective?
Policy/Organizational Factors	• What are the most promising public- and private-sector policy options for maximizing the ability of health IT to redress health disparities, increase access for the medically underserved, and improve health outcomes for these populations? What are the gaps? • What organizational factors facilitate or impede the adoption and meaningful use of health IT?

Impact of Adoption and Consequences

There is emerging evidence that health IT has the potential to address disparities in health care, access and outcomes. Examples from our environmental scan suggest that these tools can be useful in bridging critical gaps in continuity of care for members of disparities populations, particularly in terms of uninsured/underinsured individuals. Since these individuals tend to receive care from multiple providers and have disproportionately complex health care problems, health IT has the potential to reduce duplication of care for members of underserved populations by allowing providers access to their current health information, including details of tests and medications, rather than needing to rely on patient memory alone or on paper records that might be unavailable or not easily accessible. Furthermore, for those suffering from chronic disease that might have multiple health care needs and a complex history, these technologies have been shown to be particularly beneficial.

Our findings also suggest that consumer e-health technologies such as PHRs, health kiosks and provider messaging tools may be among the most useful for addressing health disparities. These tools are beginning to show the potential to educate patients and provide them with information on their health, which can also serve to prompt positive behavior change. In some cases, these tools have been shown to allow patients to be better engaged in their care and have the added benefit of enhancing doctor-patient communication.

Although our environmental scan revealed many cases where marked improvements in health care outcomes and quality were achieved through the use of health IT, fewer studies existed that demonstrated an actual decrease in disparities that can be directly attributed to health IT applications. Furthermore, it is unclear to what extent these tools, all else being equal, can themselves serve to eliminate disparities. Additional research will need to be undertaken that compares the impact of health IT in settings that provide for both disparities and non-disparities populations.

Health IT Barriers

Our environmental scan revealed a great deal of available information in regards to the barriers and challenges to health IT adoption. Financial challenges were consistently cited as the major impediment to implementation among providers of disparities and underserved populations. These practices, which may be financially fragile, were at times not prepared or able to make a sizable investment in health IT. Other commonly cited barriers included lack of adequate infrastructure, inadequate provider buy-in, uncertainties about return of investment, and concerns about reductions in productivity and efficiency.

Results of the environmental scan indicate that there are significant gaps and uncertainties about return on investment (ROI) of health IT implementation, particularly for providers that treat the underserved. Analysis of experience of previous implementations suggests that most of the significant savings and productivity gains which can arise from the application of health IT do not occur immediately with implementation, but rather accrue over a period of months and even years. Also, it has been pointed out that, in some cases, much of these savings may be reinvested into maintenance of the system.[172] In terms of initial investment funds, the adoption incentives provided in association with ARRA, HITECH and ACA are likely to be instrumental in providing FQHCs with resources to implement and incentives to engage in meaningful use of health IT.

Adoption and utilization barriers to health IT exist for all stakeholder groups. However, there are some barriers that are especially salient with respect to health IT used by underserved patients. In particular, we found that encouraging adoption of health IT will require addressing the issues of consumer literacy and technological access, which frequently disadvantage underserved communities. Cultural and language issues can also impede effective use of consumer e-health tools among the underserved. Our research suggests that tools that are not implemented in a culturally appropriate manner are far less likely to enjoy significant support. Furthermore, in addition to heightened concerns about health IT security and privacy safeguards, there have been some reports of mistrust of health care institutions and technology among certain underserved groups, although this may be changing.[173,174] In addition, these individuals might not perceive a strong benefit to the tools and thus will be unlikely to use them consistently. This lack of patient support for use of the tool may also diminish provider motivation to adopt and implement new systems.

Finally, only a small number of IT vendors offer products optimized to meet the reporting, quality improvement, billing and management needs specific to FQHCs and other safety net providers. Furthermore, efforts to include these providers in sales and marketing efforts are lacking.[175] Areas for additional exploration include strategies for ensuring that vendors are capable of providing tools that will meet the needs of underserved communities and for encouraging vendor focus on this critical population.

Policy/Organizational Factors

Lack of capital and the financial resources to implement health IT have frequently been identified as the most insurmountable barriers among those providers who provide care for underserved populations. Public policy options that incentivize the meaningful use of some forms of health IT, like the provisions related to EHRs and HIE included in HITECH and ACA, may pave the way for increased use of technology, particularly among those providers serving low-income and other vulnerable populations. In

particular, the Medicare and Medicaid incentive programs that offer incentives for meaningful use of EHRs represents an important motivator for adoption among many providers, with the exception of free clinics that do not bill these programs, behavioral health providers (community mental health centers and outpatient substance abuse providers, among others) that are not eligible to receive these funds, as well as providers that are not able to meet meaningful use definitions. In addition, technical assistance provided by the Regional Extension Centers (RECs), established under HITECH, will be critical in moving from purchase of an EHR to meaningful use.

While these approaches are important steps to enhance adoption for some providers, meaningful use currently does not include incentives for the use of some consumer e-health tools, including health kiosks, and mobile/smart phone applications, as well as telemedicine and community-wide registries, all identified as forms of health IT that can impact health disparities in our environmental scan. Use of some of these applications or related functionality may or may not be incorporated into additional requirements for meaningful use to be implemented during Stages 2 and 3 of the program. In addition, little was found in the literature regarding policy options that address non-financial barriers to health IT implementation, such as workflow disruptions and limited technical infrastructure. However, the support provided by the RECs established under HITECH can be key to addressing these issues. An important initial test for the REC program will be its ability to help FQHCs and other safety net providers address these issues effectively.

Organizational factors that influence the adoption and meaningful use of EHRs include a lack of provider buy-in and/or clinical champion, need for workflow redesign, lack of qualified project management staff and lack of adequate technical support. There are additional barriers related to the use of consumer e-health tools, including personal health records, health kiosks, and mobile/smart phone applications, as well as telemedicine and registries. Because these technologies are not as widely implemented as EHRs, additional research will need to be undertaken to identify organizational factors that influence the adoption and successful use of these types of technologies.

Encouraging Adoption

It is unclear whether programs funded under HITECH and ARRA will be capable of successfully overcoming the significant barriers to effective health IT adoption among safety net providers documented in the existing literature. Furthermore,consumer demand for these technologies is still evolving, particularly among underserved populations. Also unclear is whether these programs will be able to enhance adoption of tools for greater consumer engagement in a way that improves the health of

underserved populations. Additional research will need to be undertaken to identify steps to mitigate the impact of non-financial barriers to health IT adoption among these providers.

Issues for Further Study

In conclusion, while there is growing evidence of the effectiveness of health IT and the promise of using these new tools to reduce health disparities, there is continued need for additional research in this area. In this section, we reflect on the findings and discussion from this initial environmental scan brief and identify potential areas of focus for our project. Our next deliverable will propose both locations and programs for case studies as well as specific types of information that require collection. Ultimately, this project will generate findings that will assist policy officials in managing existing programs and new initiatives to produce the greatest impact on underserved communities.

In particular, we have identified the following areas of focus for the remainder of the study:

- *Models for integrating provider and patient-facing technologies*. While our scan identified anecdotal evidence that both consumer e-health tools and health IT applications used by providers may play a role in improving access and care to special populations, there are relatively few projects focused on the underserved that allow for examination of the impact of the use of both these technologies in tandem. Due to the potential for complimentary benefits from the use of applications such as PHRs tethered to EHRs or applications that allow for direct communication between providers and patients, we propose prioritizing projects that have incorporated both patient-facing and provider-facing technologies into a single program.
- *Models for measuring the impact of health IT programs on disparities*. As noted above, disparities are defined in a number of ways and there are several mechanisms by which health IT applications could help improve (or in some cases worsen) disparities. There is great potential value in developing a common understanding of approaches to examining the impact of any given health IT implementation project on disparities. Therefore, we propose focusing on projects that have made some effort to monitor and measure disparities over time and on summarizing any data or conclusions that have emerged on the change in health disparities associated with the use of specific health IT applications.
- *Models for overcoming key challenges associated with using health IT in underserved communities*. Our scan also identified several important barriers and challenges associated with adoption and effective use of health IT in communities with disparities or large numbers of underserved individuals. In many cases, programs for health IT adoption in these communities have been successful only after several years of struggling to overcome key barriers. For some communities and providers, the challenges still impede effective adoption and use of health IT. In

order to maximize current and likely future investments (e.g., the RECs and HRSA funding initiatives) to enhance adoption and meaningful use of health IT in these communities, we propose examining projects that have recently addressed key adoption and implementation challenges or are in the midst of addressing these challenges.

- *Understanding how to integrate underserved populations in the design and development of health IT.* User-centered design is important to consider when developing health IT targeted at disparities and underserved populations and providers who care for these populations. These populations have a wide variety of unique needs that developers of health IT may not necessarily consider. Clarifying and incorporating the needs of the users of these technologies – consumers, caregivers, and providers – into the development process is an important consideration for reducing disparities. Consumer-centered design may lead to higher utility and more efficient use of health IT among these populations. Discussing the health IT development process and gaining perspectives on user-centered design approaches for the underserved is an important issue to consider when conducting cases.
- *Understanding how health IT should be used differently for different populations.* In order to properly address disparities or differences in key health outcomes or processes of care, it is often necessary to utilize customized interventions or implement the same intervention differently for different populations. It may also be the case that interventions targeting populations that suffer from disparities may need to be more resource intensive than those focused on the population at large in order to bridge the gap between the two populations. It will be important to focus cases on examples of health IT projects where specific populations receive targeted and unique interventions and/or more resource intensive interventions in order to reduce or eliminate disparities.
- *Understanding what works, where, when and how.* Ultimately, the purpose of our project will be to not only highlight examples of where health IT has been useful for improving care to the underserved or to populations that suffer from disparities, but rather on uncovering the specific mechanisms by which health IT interventions work, the conditions under which they work and the environmental, personnel, organizational and technical factors that underlie successful projects. As much as possible, the remainder of this study will focus on cases where we can clearly investigate the potential pitfalls associated with use of health IT in communities with underserved and disparities and how some initiatives have specifically addressed and avoided these pitfalls. Special attention will be given to identifying common themes that exist from project to project and translating these themes to programmatic elements that can be incorporated into future government and private sector investments.

- *Ensuring the broadest access and highest quality for all Americans.* Because the underserved is comprised of several distinct populations with their own characteristics and needs, it will be important to use our case studies to investigate how different approaches to the use of health IT can be applied to different sub-groups (e.g., new immigrants, rural populations, racial/ethnic minorities). For example, accessibility and usability of technology in consideration of language and cultural barriers will be particularly important for some groups, while other considerations such as cost and functionality will be greater concerns for others.
- *Understanding the impact of community-based health IT initiatives.* Information technology, particularly applications applied at a community or regional level, can be a powerful tool in identifying disparities, particularly where they may have been unrecognized. This can also lead to more targeted interventions when new disparities are identified. Comprehensive information can also ultimately be used to improve information around clinical trials and drug development through secondary uses of data. Part of our emphasis in conducting cases will be seeking out opportunities to learn where community-based health IT initiatives, including population health information systems and registries, have enhanced our ability to identify, track and address health disparities.
- *Understanding and minimizing new disparities that may result from the use of health IT.* Health IT can have a significant impact on addressing disparities among underserved populations. At the same time, there is the risk that the benefits arising from the use of health IT might be accrued primarily by communities without a disproportionate share of underserved individuals, thereby having the unintended consequence of exercabating existing disparities. It will be important to use our cases to understand how application of health IT can potentially contribute to exacerbating existing disparities in health care quality and outcomes.

Appendix A: Additional Information on Measuring Disparity

Additional information on measuring disparity is included below for individuals interested in obtaining further detail on this topic.

Choosing a Reference Point. In actual use, the advantages and disadvantages of any one reference point would depend on the context and it is not possible to recommend a single reference point for use in all situations, as the choice of a reference point will determine the size and directions of the disparity.[176] Potential advantages and disadvantages for each reference point are detailed in Table 5 below.

Table 5: Potential Advantages and Disadvantages for Differing Reference Points[177]

Reference Point	Potential Advantages	Potential Disadvantages
Largest Group	Rate for this group is usually the most stable.	There are frequently other groups within the domain that have a more favorable health indicator status than this group.
Best Group	Differences measured against this reference point are all in the same direction, making it a convenient comparison point.	This group might change over time and from region to region. It might be a very small group and therefore unstable for measuring purposes over time.
Mean of Group Rates	The mean is used in measures of variability (i.e., standard deviation), facilitating straight-forward analysis.	The mean is influenced by outliers. Over time, it is affected by any substantial change in the rate for any particular group(s).
Total Population	More stable than other reference points and it will have the same value across all domains that encompass the same population.	There are limitations when comparisons are made over time, geographic areas, or populations. When used across time, it can be difficult to distinguish the effects of changes in group rates from changes in group composition.
Standard	Standards can be fixed for an extended period of time. No sampling or other sources of random variation.	Standards are often selected through a deliberative process that may involve certain criteria, so comparisons made among disparities across indicators may be invalid.

Measuring Disparity in Absolute vs. Relative Terms. Absolute and relative measures of disparity from the same reference point lead to the same conclusions about disparities between groups when taken at one point in time. Over time, however, absolute and relative measures of disparity can provide contradictory evidence concerning changes in disparity. For example, if rates for a specific health indicator increased over time, a decrease in a relative measure of disparity might mask an increase in an absolute measure of

disparity. As a result, the National Center for Health Statistics recommends that disparities be measured in absolute and relative terms "in order to understand their magnitude, especially when making comparisons over time or across geographic areas, populations, or indicators."[178]

Use and Interpretation of Summary Measures of Disparity. Summary measures of disparity quantify the degree of disparity across all groups composing a domain by combining the disparities measures for the component groups. In this process, the signs attached to the differences of each from the reference point are ignored, either by taking the absolute value or squaring the differences. The summary measure expresses disparity in absolute terms, but each absolute summary measure can be converted into a relative measure by dividing by the reference point. Notably, summarization involves a loss of information, and the choices made with respect to how to measure disparity will be less transparent to the audience when summary measures are used in isolation. As a result, conclusions based on summary measures should always be interpreted in conjunction with the group-specific rates on which they are based.[179]

Alternative Definitions of Disparity. As discussed earlier, there are significant variations among definitions of the term "health disparity". One alternative definition, presented by the IOM in a 2003 report, defines health care disparities as racial or ethnic differences in quality of health care occurring not as a result of access-related factors, treatment preferences, and appropriateness of intervention[180]. This definition accounts for not only the contribution of the legal and regulatory system in which the health system functions, but also the impact of bias and prejudices on quality of care.

Appendix B: Technical Expert Panelists

Table 6: Technical Expert Panelists

Name	Title and Organization
Ignatius Bau, JD	Health Policy Consultant
Helen Burstin, MD, MPH	Senior Vice President, Performance Measures, National Quality Forum
Neil Calman, MD, ABFP, FAAFP	President and Chief Executive Officer, Institute of Family Health
Sarah Chouinard, MD	Medical Director, Community Health Network of West Virginia
Theresa Cullen, MD	CIO and Director of the Office of IT, Indian Health Service
Stephanie Ferguson, PhD, RN, FAAN	Associate Professor and Coordinator, Virginia Commonwealth University, School of Nursing, Community Nursing Organization
Jessica Briefer French, MHSA	Senior Consultant for Research & Analysis, National Committee on Quality Assurance
Garth Graham, MD, MPH	Deputy Assistant Secretary for Minority Health, Office of Minority Health
R. Scott Hawkins, MBA	Chief Information Officer, Boston Healthcare for the Homeless Program
David Hunt, MD, FACS	Chief Medical Officer, Office of the National Coordinator for Health IT
Jessica Kahn, MPH	Technical Director for Health IT, Center for Medicaid and State Operations, CMS
Kathy Lim Ko, MS	President & CEO, Asian and Pacific Islander American Health Forum
Leighton Ku, PhD, MPH	Professor, School of Public Health and Health Services, George Washington University
Michael Lardiere, LCSW	Clinical Affairs Director, Health Information Technology, National Association of Community Health Centers
Jennifer Lundblad, PhD, MBA	President & CEO, Stratis Health
Ruth Perot, MAT	Managing Director, National Health IT Collaborative for the Underserved
Elena Rios, MD, MSPH	President & CEO, National Hispanic Medical Association
Byron Sogie-Thomas, MS	Director, Office of Health Policy and Government Relations, National Medical Association
Cynthia Solomon, EdD	President, Follow Me

Appendix C: Examples of Disparities in Health and Health Care

Table 7: Examples of Health and Health Care Disparities for Varying Populations

Population	Examples of Health and Health Care Disparities
African Americans	• Higher rates of colorectal cancer deaths per 100,000 population in comparison to whites based on 2006 data.[181] • African Americans are 10 times more likely than whites and nearly three times more likely than Hispanics to have AIDS, based on 2005 data.[182] • Of all racial and ethnic minorities, African Americans are most likely to have a chronic illness or disability, with almost half reporting such a condition. The disparity in chronic illness between African Americans and whites persists across income levels and after adjusting for age based on 2005 data.[183] • For measures of infant mortality, African Americans are by far the worst off among all the races or ethnicities examined. The infant mortality rate for non-Hispanic blacks in 2003 was almost 2.5 times greater than for whites.[184]
Asian Americans	• Higher rates of deaths per 1,000 admissions with acute myocardial infarction as principal diagnosis for ages 18 and over in comparison to whites based on 2006 data.[185] • Worse rates of adults age 65 and over who ever received pneumococcal vaccination in comparison to whites based on 2006 data.[186]
American Indian/ Alaskan Natives/ Native Hawaiians and other Pacific Islanders	• Worse rates of tuberculosis patients who completed a curative course of treatment within 1 year of initiation of treatment in comparison to whites based on 2006 data.[187] • American Indians/Alaska Natives have higher infant mortality rates in comparison to whites based on 2003 data.[188] • American Indians/Alaska Natives are more likely than non-Hispanic whites to smoke, which could explain some of their health disparities, including higher occurrences of asthma. Nearly 29% of the American Indian/Alaska Native population currently smoke compared with 22% of whites based on 2002-2004 data.[189] • Native Hawaiians aged 36–65 are almost 1.5 times more likely to experience heart disease in comparison to other racial groups based on 2006 data.[190] • Pacific Islanders have poorer cause-specific survival for cancer in comparison to whites.[191]
Hispanics/ Latinos	• Worse rates of adults with diabetes who had three major exams in the past year in comparison to whites based on 2006 data.[192] • Hispanics have a higher incidence rate of infection-related cancers, including stomach, liver, and cervical cancers in comparison to other racial/ethnic populations. Hispanic men and women are 1.5 to 2 times more likely than non-Hispanic men and women to have these cancers based on 1999-2003 data.[193]

Population	Examples of Health and Health Care Disparities
Low-Income Populations	• Higher rates of deaths per 1,000 admissions with acute myocardial infarction as principal diagnosis for ages 18 and over in comparison to whites based on 2006 data.[194] • Worse rates of female Medicare beneficiaries age 65 and over who reported ever being screened for osteoporosis in comparison to high-income populations based on 2006 data.[195]
Immigrant/ Limited English/Low-Literacy	• Higher rates of certain diseases including Tuberculosis. In 2006, 56.6% of tuberculosis cases in the United States were among immigrants.[196] • Individuals who speak a foreign language at home are almost three times as likely to be uninsured as for individuals who speak English at home.[197] • Lower likelihood of having a usual source of care for individuals with limited English proficiency. Half of individuals with limited English proficiency did not have a usual source of care based on 2006 data.[198]
Lesbian, Gay, Bi-Sexual and Transgender (LGBT)	• Increased likelihood of delaying or not seek medical care, not getting needing prescription medicine, and lacking health insurance coverage in comparison to heterosexual counterparts based on 2007 data.[199] • LGBT adults are more likely to smoke cigarettes, to have problems with alcoholism and to have cancer.[200] • Lesbian and bisexual women are less likely than heterosexual women to receive mammograms.[201] • LGB youth are more likely to attempt suicide, smoke cigarettes and be overweight based on 2007 data.[202]
Women	• Higher likelihood of death for hospital admissions with Acute Myocardial Infarction compared to men based on 2006 data.[203] • Higher rates of obesity in comparison to males based on 2006 data.[204] • More likely than males to lack a usual source of care due to financial reasons or insurance reasons.[205]
Disabled/ Special health care needs	• More likely to be uninsured than individuals without disabilities based on 2006 data.[206] • Significantly more likely to be living in families with high medical financial burden than those without disabilities.[207]
Rural Residents	• More likely to be older, poor, uninsured, in worse health and to have chronic conditions than urban counterparts.[208] • Decreased likelihood of receiving recommended preventative services and more likely to report fewer visits to health care providers.[209] • Significantly higher heart attack death rates based on 2006 data.[210]
Children/ Adolescents	• Children who are members of ethnic groups tend to face higher health risks including lowered life expectancy and higher death rates.[211] • Children who are members of ethnic groups or from poor families are less likely to have had a dental visit in last year and to have received all vaccines.[212]

Population	Examples of Health and Health Care Disparities
Older Adults	• Increased likelihood of having a chronic condition. More than 80% of older Americans have one chronic condition and 50% have two.[213] • Experience highest rates of poor physical health and activity limitation based on 2004 data.[214] • Adults 65 and older are more likely to die from influenza and pneumonia and its complications.[215] • Increased risk of diseases such as breast cancer and colorectal cancer. Almost 80% of breast cancer cases and 90% of colorectal cancer cases occur in adults over age 50.[216]

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[3] American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, § 3001, 123 Stat. 232 - 233 (2009).

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