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KATHERINE SANCHES

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HEALTH DISPARITIES ACROSS FUNCITONAL DISABILITY GROUPS

by

KATHERINE SANCHES, MPH

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DEAN, THE UNIVERSITY OF TEXAS

SCHOOL OF PUBLIC HEALTH

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Katherine Sanches, MPH, DrPH

2020

HEALTH DISPARITIES ACROSS FUNCTIONAL DISABILITY GROUPS

by

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MPH, University of Alabama at Birmingham, 2008

Presented to the Faculty of The University of Texas

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

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HEALTH DISPARITIES ACROSS FUNCTIONAL DISABILITY GROUPS

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The University of Texas

School of Public Health, 2020

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Background

The increasing number of people with disabilities and the corresponding health disparities experienced among this population presents a need to better understand the barriers and facilitators of good health (Krahn, Reyes & Fox, 2014). In recent years, disability and public health researchers have transitioned to thinking about disability in terms of functional limitation, rather than the way disability is characterized in the medical model, as a condition to be treated or cured (Iezzoni, 2011). This shift offers the field of public health a framework to examine health outcomes through a lens of disabling environmental barriers. In addition, health disparities can be examined within the context of five functional disability groups commonly used in state and national health surveys, such as the American Community Survey (ACS) and Behavioral Risk Factor Surveillance Survey (BRFSS) (Rios et al., 2016).

During the past decade, there has been a juxtaposition of two positions among health researchers (Drum, 2014). On one hand, there has been growing awareness that disability need not be equated with poor health - people with disabilities can, and do, live meaningful, healthy, productive lives (Krahn et al., 2015). On the other hand, research consistently indicates that people with disabilities experience poorer health outcomes relative to the general population (Carroll et al., 2014; Office of the Surgeon General, 2005). People with disabilities are more likely to report worse perceived health, and experience chronic conditions, preventable secondary conditions, and early death (Office of the Surgeon General, 2005). People with disabilities are also more likely to report barriers to adequate healthcare services and are less likely to receive

health promotion services or engage in health promoting activities (Reichard et al., 2011; Drum et al., 2005).

Until rather recently, public health has not considered disability to be a demographic variable that impacts health, but rather a failed outcome of the public health system (Krahn et al., 2015). And in both implicit and explicit ways, people with disabilities have been systematically excluded from health research through too-rigid inclusion criteria and inaccessible study design (Van Spall et al., 2007).

Progress has been made during the past two decades. Beginning in the 1960's, the disability rights movement called attention to the institutional, policy, and societal barriers that resulted in discrimination that kept people with disabilities from experiencing a full range of life activities. The culmination of the movement was the passage of the Americans with Disabilities Act in 1990, a federal statute that protects people with disabilities from discrimination at work and in the community. Specifically, Title II of the ADA posits that government services, including publicly funded public health activities, must be accessible to people with disabilities (ADA, 2008). National reports and documents, such as the Surgeon General's *Call to Action,* and a series of Institute of Medicine (IOM) reports (i.e. *Disability in America*, 1991; *Enabling America*, 1997; *The Future of Disability in America*, 2007) highlighted the fact that people with disabilities can lead healthy lives and require the same health promotion efforts as those without disabilities. Healthy People 2010 "Chapter 6: Disability and Secondary Condition" and Healthy People 2020, topic "Disability and Health", reinforced that health of people with disabilities is a major public health concern.

With the passage of the Affordable Care Act (ACA) came the requirement for all federally funded national surveys to standardize the questions used to determine disability status (ACA, 2010). The new "standard" six-question disability series was initially developed by an interagency group within the Census Bureau charged with revising the previous condition-focused questions to inquiries about how the condition impacts basic functioning (Brault et al., 2007). The revised disability questions were included in the 2008 American Community Survey (ACS) and have since been added to national census and health surveys (e.g., Behavioral Risk Factor Surveillance Survey (BRFSS), Census Population Survey, Survey of Income and Program Participation, etc.) The six questions ask about functional limitation in each of the following domains: vision, hearing, mobility, cognition, self-care and independent living. Disability and health researchers agree that categorizing people with disabilities in this way is preferred because people with similar functional limitations are more likely to experience similar barriers to health (Rios et al., 2016).

The objective of this dissertation, comprised of three studies, was to examine associations between functional disability groups and health status, chronic conditions, select health behaviors, and access to health-promoting environments. The first and second study consisted of a secondary data analysis of 2013 Texas BRFSS data. The first study examined associations between functional disability status and CDC's Healthy Days measures and five chronic conditions. Similarly, the second study examined the relations between functional disability status with health promoting behaviors and access to health-promoting environments. The third study used a recently developed disability inclusion survey tool to examine physical and programmatic accessibility issues in 9 San Antonio senior centers.

Defining the Disability Population

The term "disability" has evolved to become a shorthand expression that is used to describe the full range of the disability experience (Krahn et al., 2015). The disability continuum starts with a chronic or temporary disease state, or injury, that results in some degree of impairment at the cellular, organ or limb level. The resulting impairment may be temporary (e.g., broken leg) or permanent (e.g., leg amputation), but results in some physical (e.g., inability to walk), emotional (e.g., inability to interpret or control emotions), or mental (e.g., difficulty thinking, remembering, speaking) functional limitation. The degree to which a disability impacts a person at home, work, or while participating in social or community events is complex and highly dependent on the situation and environment (Iezzoni, 2011).

There is enormous diversity within the disability population. People with disabilities experience unique underlying health conditions, etiologies, age of onset, longevity, and degrees of activity limitation. Disability severity may be static (e.g., deafness), episodic (e.g., seizures disorder), or progressive (e.g., multiple sclerosis). Etiologies range from premature or complication at birth, acute or chronic disease, or injury, and disability may be acquired at birth, the final years of life, or any time in between. Despite this variation, people with disabilities endure a shared experience of encountering barriers to individual-level activities and participating in employment, education, community, civic, recreation and health opportunities (Iezzoni, 2011; Surgeon General, 2007).

World Health Organization (WHO) International Classification of Functioning and Disability (ICF)

In 2001, the World Health Organization (WHO) published the *International Classification of Functioning Disability and Health* (ICF), a framework that builds upon the previously

dominating medical model and conceptually shifts “disability” from a person-focused deficiency that needs to be cured, treated or rehabilitated, to the gap between functional limitation and environment. While initially slow to be adopted in the United States, the model of disability presented in the ICF framework is preferred by both the international community and disability advocates and researchers in the U.S (Krahn et al., 2014).

The definition of disability presented in the ICF framework is conceptualized as the interaction between functional limitation caused by a health condition, and both environmental and personal factors. Furthermore, disability is dynamic, contextual, situation-dependent, and occurs on a continuum rather than in a dichotomous state. (Iezzoni, 2011). Within the ICF, functional limitations refer to body impairments, activity limitations and participation restrictions, and environmental factors include physical environment, attitudes, policies, and other social factors. Personal factors include age, gender, personality, etc. and while they are mentioned in the ICF, they are not categorized due to complexity.

In this dissertation, disability is used in two ways. When discussing disability in general, I rely on the WHO conceptualization of disability as defined by impairments, activity limitations, or participation restrictions related to a health condition and as experienced in interaction with the environment. When referring to studies citied within this paper, the definition of “disability” is determined by each study and may vary by data source.

Prevalence of Disability

Settling on a national disability prevalence estimate is problematic for two reasons. First, disability is circumstantial and not static, making it fundamentally difficult to measure (Burkhauser et al., 2014). Second, national health and census surveys conceptualize, define and

measure disability in different ways (Krahn et al., 2014), resulting in national disability prevalence estimates that range from 12.1% (Brault, 2012) to 27.2% (Taylor, 2018). Regardless of survey, health researchers have designated people with disabilities as the "largest underserved population" in the U.S (Brault, 2012; Drum, et al., 2008).

Compiled 2018 American Community Survey (ACS) data indicates that Texas alone is home to 3.2 million people living with a physical, cognitive, or sensory disability (U.S. Census Bureau, 2018). While variations in disability definitions across national surveys do not allow for a precise disability census, researchers agree that the incidence and prevalence of disability is increasing (Dejong et al., 2002; Lezzoni, 2011). Modern advances in neonatal intensive care have improved the survival rates of infants born with low birth weight or complex health condition (DeJong et al., 2002; Lezzoni, 2011). Advances in trauma medicine have resulted in greater survival rates of those injured in accidents or war, resulting in more individuals living with spinal cord injuries, traumatic brain injuries, or amputations (IOM, 2007). Finally, the success of medicine and public health initiatives means that people with chronic conditions are living longer, thus increasing the chance of acquiring a disability (DeJong et al., 2002; Gulley et al., 2011).

Per 2010 Census data, rates of disability increase with age, ranging from 2.3% for children younger than 3 years, 12.2% of school-aged children, 21% of those aged 15 years and older, and nearly 50% of those aged 65 years and older (Brault, 2012) For adults, 12.6% reported one type of functional limitation, and 8.2% reported disability in two or more domains (e.g., physical, vision, hearing, cognitive, emotional) (Brault, 2012) Rates of disability are highest among African Americans (29%), followed by Hispanics (25.9%),and there is a higher prevalence of disability among women (24.4%) than men (19.8%) (Courtney-Long et al., 2015). The most commonly

reported types of disability include mobility impairment (13.0%), followed by cognition (10.6%), independent living (6.5%), vision (4.6%) and self-care (3.6%) (Courtney-Long et al., 2015). Arthritis and back pain are the most cited causes of mobility disability (Carroll et al., 2014) and for children, the most prevalent conditions are neurodevelopmental or mental health conditions, such as attention-deficit/ hyperactivity disorder, speech disorder, autism, or learning disability, followed by physical conditions, such as cerebral palsy (Halfon et al., 2012).

History of Discrimination

The disability community has a long history of discrimination in the U.S. Federal legislation such as the Title V of the Social Security Act, Section 504 of the Rehabilitation Act, Fair Housing Act, the Individuals with Disabilities Education Act (IDEA), and the Americans with Disabilities Act (ADA) were all passed to address some form of discrimination (e.g., housing, education, employment, etc.) The Rehabilitation Act prohibits discrimination against persons with disabilities by agencies, organizations and employers that are either part of the federal government or receive federal funding, with Section 504 referring specifically to equal access for people with disabilities to programs and services funded by the federal government. This includes health promotion efforts by the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Health and Human Services. The ADA passed in 1990 and reauthorized in 2008, was designed to prevent the discrimination of people with disabilities in the workplace, at private businesses, and when participating or benefitting from local, Tribal, and state government funded goods and services. This means that public health activities sponsored or funded by local or state health departments should be equally accessible to people with disabilities, including health promotion materials shared through traditional and social media; and programs to

increase physical activity or improve nutrition; and health services such as blood pressure screening or vaccinations. Despite passage of the ADA and other federal legislation that protects the civil rights people with disabilities, barriers to health and healthcare services still exist (Iezzoni, 2011).

Access to Healthcare and Health Services

People with disabilities often experience a range of barriers to accessing adequate, high quality healthcare and health services (Iezzoni, 2011). Among others, inaccessible screening and diagnostic equipment (e.g., mammography machine with inadequate height adjustment, weight scales that do not accommodate a wheelchair), inaccessible facilities (e.g., no accessible parking, no elevator when services offered on second floor), health care professionals with limited capacity to understand and address healthcare needs (e.g., staff cannot provide accommodation, doctor does not promote physical activity), inadequate communication modalities (e.g., health brochures unavailable in alternative formats, sign language interpreter unavailable) and negative experiences interacting with medical staff (e.g., staff being disrespectful, unwilling to call sign language interpreter or assist with wheelchair transfer) are barriers commonly reported by people with disabilities (Iezzoni, 2011.)

Per Healthy People 2020 (2011), 76.8% of adults with disabilities experience physical or programmatic barriers that limit or prevent them from participating in local health and wellness programs. Both people with disabilities and caregivers of children with disabilities report substantial difficulty accessing health programs targeting physical activity and nutrition (Malone, et al., 2012; Kirchner et al., 2008). In addition to the barriers specific to healthcare services and health and wellness programs, people with disabilities also encounter transportation barriers,

such as access to public transportation, para transit services, and accessible taxi services (Reichard et al., 2011).

Exclusion from Health Research

In the past, people with disabilities were systematically excluded from participating in health research, and while there has been a substantial uptick in studies and interventions targeting specific subgroups of the disability population, such as those with a specific diagnosis (e.g., diabetes, Autism etc.), people with disabilities remain largely excluded (Rios et al, 2016). Exclusion of people with disabilities occurs intentionally through "poorly justified" (Rios et al., 2016) exclusion criteria and through study designs that do not accommodate sensory, mobility or cognitive limitations. Recruitment methods, consent forms, educational materials, equipment, and measurement tools present an accessibility challenge if the item is unusable due to that person's functional limitation. Public health research may exclude people with disabilities by selecting an activity location with inaccessible facilities or that cannot be accessed via accessible public transportation. (Rios et al, 2016).

Exclusion of people with disabilities from research studies is well documented. Van Spall et al., (2007) conducted a scoping review to examine the possible reasons people with disabilities were unnecessarily excluded from studies and found that the majority of trials (84.1%) contained at least 1 poorly justified exclusion criterion and one quarter of all exclusions were poorly justified in 61.5% of the randomized controlled trials (Van Spall, et al., 2007). Specifically, of the studies examined, 11% excluded because of physical disability or functional status, 7.8% excluded because of cognitive impairment, 81.3% excluded because of medical comorbidities, and 10.6% excluded because of language or communication barriers. Excluding people with disabilities from

health research is not only a social justice and equity issue, but it also limits the generalizability of research findings in real-world clinical and policy applications, making it difficult to not only develop effective health interventions, but also guide decisions related to risk, prevention, and treatment of this population (Rios et al, 2016).

History of Disability within Public Health

The concept of disability within the field of public health has evolved over the past three decades, primarily due to the publication of several reports, clearly identified focus within APHA, and national health initiatives (Lollar & Andresen, 2007). In 1991 the Institute of Medicine published, *Disability in America: Toward a National Agenda for Prevention* which served as the catalyst for the shift in how disability is viewed within the field of public health. The 1991 IOM report identified disability as the nation's largest public health problem and emphasized the importance of promoting optimal health and preventing secondary conditions among people with disabilities. This report also presented a conceptual framework that framed disability not only as a consequence of disease or injury, but also a result of the relationship with the environment (IOM, 1991). In 1997, IOM published a subsequent report titled *Enabling America*, promoting a model of disability that focuses on the interaction between the individual and both the social and physical environments. The focus on the environment and its impact on disability was a critical shift in how disability is viewed and was reinforced by the WHO ICF Framework in 2001.

Healthy People 2010 legitimized disability as a domain within the public health field with the inclusion of Chapter 6 *Disability and Secondary Conditions.* Chapter 6 not only documented the differences between people with and without disabilities, including poorer health status, high

levels of depression, less satisfaction with health care, and lower levels of emotional support, community participation, and employment, but also covered public health themes to promote policies and interventions targeting people with disabilities (U. S. Department of Health and Human Services, 2001). Healthy People 2010 also lists promoting the health of people with disabilities, preventing the onset of secondary conditions, and eliminating health disparities between people with disabilities and people without disabilities in the United States as issues that require further attention (U. S. Department of Health and Human Services, 2001.)

The U.S. Surgeon General's *Call to Action* (2005) promotes the idea that people with disabilities can be – and often are – healthy, productive citizens, and presents policy recommendations to achieve this goal. The document also states that disability is not solely of medical concern, that health promotion is an important element for people with disabilities to achieve optimal health, and that maintaining independence is a goal achieved through accessible healthcare and support services.

In 2007 IOM released its third report: *The Future of Disability in America* which documented gaps in disability science and recommended actions to reduce the impact of disability through evidence-based private and public action (IOM, 2007). Healthy People 2020 confirmed that public health needs a standardized definition of disability and should not only focus on preventing disabling conditions but should also use a variety of health promotion activities to improve general health and wellbeing (U.S. Department of Health and Human Services, 2010).

Health Disparities

National health data consistently indicate that people with disabilities report worse health outcomes than people without disabilities. People with disabilities are more likely to rate their health as poor or fair, report one or more chronic diseases (Dixon-Ibarra & Horner-Johnson, 2014) and are more likely to be inactive, have obesity, and smoke (Carroll et al., 2014) and less likely to obtain preventive screenings (Armour et al., 2009).

Dixon-Ibarra and Horner-Johnson (2014) examined National Health Interview Survey data from 2006 to 2012 and found that adults with lifelong disabilities had increased odds of heart disease, hypertension, diabetes, cancer and obesity and were likely to be obese and significantly higher BMI scores compared to those with no disabilities. Dixon-Ibarra and Horner-Johnson (2014) only included people who had a lifelong disability, thus showing that people with disabilities are at increased risk of developing a chronic condition after disability onset. Carroll et al. (2014) also examined National Health Interview Survey Data and found that people with hearing, vision, cognitive and mobility limitations were move likely to report diabetes, cancer, stroke and heart disease than those who did not report a disability, with all four functional disability groups significantly ($p < .001$) more likely to report more than one chronic condition than those without disabilities. Carroll et al. (2014) found that that rates of inactivity were nearly two times higher for people with disabilities compared to those with no disabilities.

In addition, people with disabilities are less likely to engage in physical activity, more likely to have obesity, and more likely to smoke than those with no disabilities (Altman & Bernstein, 2008; Gulley et al., 2011). Reichard et al. (2011) found that people with cognitive limitations or physical disabilities are more likely to have obesity and had significantly higher BMI values than

those with no disabilities. Marks et al. (2010) reported that among adults with intellectual disabilities, 93% consumed a diet high in fat and 66% did not consume enough fruits and vegetables. In 2011, smoking prevalence was higher among individuals who reported having a disability (25.4%) compared with those who reported no disability (17.3%) (CDC, 2011).

Using data from the Florida Behavioral Risk Factor Surveillance Survey (BRFSS) from 2007-2009, Hall et al., (2013) found people with disabilities were significantly more likely to smoke cigarettes and be exposed to secondhand smoke. Havercamp et al. (2004) used North Carolina BRFSS data to compare health status, health risk behaviors, chronic health conditions, and utilization of medical care among those without a disability, with a disability, and with a developmental disability, and found that adults with developmental disabilities were more likely to report fair or poor health and had a similar or greater risk of having four of five chronic conditions compared to non-disabled adults (Havercamp et al., 2004). Community-based studies have reported health disparities between adults with intellectual disabilities and those without across a range of health outcomes, including oral health care (Cumella et al., 2000) and quality of health care (Lewis et al., 2002).

Prevention of Secondary Conditions

People with disabilities are at risk for secondary conditions that are preventable physical (e.g., pain, pressure sores, etc.), mental (e.g., depression), or social disorders (e.g., isolation, anxiety, loneliness, etc.) resulting directly from a disabling condition (Kinne et al., 2004). Studies focusing on disparities in secondary conditions have been documented among women with disabilities (Coyle et al., 2000; Kinne et al., 2004; Nosek et al., 2006), and adults served by independent living centers in a rural state (Seekins, Clay & Ravesloot, 1994). While people

without disabilities also experience conditions such as fatigue, pain, and depression, the rates at which children and adults with disabilities experience these conditions are much higher (Rimmer). Preventing secondary conditions among people with disabilities was a focus of public health in the late 1990's and 2000's. Since then, the focus has broadened to include prevention of chronic conditions.

Focus on Chronic Conditions

With the recent paradigm shift of disability within public health there is emerging support for distinction between the concepts of disability and chronic conditions (Reichard, Stolzle & Fox, 2011). The degree to which chronic disease and disability overlap empirically is unknown and in part depends on how we define disability and chronic conditions (Reichard, Nary & Simpson, 2014). While chronic conditions may result in disability, people with disabilities are also at risk of developing chronic conditions independent of the cause of the original disability. Having a disability does not cause chronic conditions the same way that chronic conditions may cause a disability. The same factors which contribute to chronic conditions among people without disabilities contribute to chronic conditions in people with disabilities - genetics, social determinants, and health behaviors. However, research indicates that people with disabilities are disproportionately impacted by the social mediating factors that lead to chronic conditions and are more likely to experience the onset chronic disease earlier (Dejong et al., 2002), live with multiple chronic conditions, and are more likely to die as a result of chronic disease (Drum et al., 2005). Thus, disentangling the two concepts enables researchers, policy makers, and public health practitioners understand the contributing factors to the development of a chronic

condition and tailor health promotion interventions appropriately (Drum & Horner-Johnson, 2014).

Research Challenges

Those focusing on public health and disability have encountered numerous challenges, two of which include the varying definitions of disability and adequate data from surveillance. There are over 60 definitions of disability across federal agencies, national data systems, and international frameworks (Krahn, 2015) For policies and government agencies, the definition used for disability is driven by the purpose and intended mission. For example, the ADA deliberately defines disability in broad terms with the intention of providing anti-discriminatory protection to as many as possible. Other agencies define disability in a more restrictive manner to limit beneficiaries of financial support or health services (e.g., Medicaid, Social Security Income.) Variations in how we operationally define disability across national data sets results in studies that pertain to different population groups, making comparisons and generalizations difficult.

Fundamentally, measuring disability is difficult because for most people, it is not a simple yes or no situation. How people experience disability depends on their functional ability, in those environmental conditions, at that moment in time. One functional limitation may be restricted by some environments, but not others; and functional ability may vary at different times or in different locations.

At the core, survey questions are supposed to capture information unique to a subgroup of the population. Grouping people with disabilities by diagnosis results in people with some functional limitation from an undiagnosed condition not being identified, whereas people who

have been diagnosed, but do not experience any limitation will be identified. There is a consensus that measuring the physical, sensory or cognitive limitation in functioning captures a more reasonable representation of the population at risk of environmental barriers that restrict participation.

Improving Accessibility to Public Health Programs

As the focus of disability within the field of public health has increasingly received more attention there have been an increase in public health interventions targeting people with disabilities (Seekins et al., 2010) and calls for public health practitioners to design public health programs that are universally accessible to all members of the community (Drum et al., 2009). Public health programs should be cognizant of the need to include people with disabilities from the beginning phase and would preferably be designed in a way that satisfies "universal design" standards so that all people, regardless of functional limitation, can access the goods or services (Drum et al., 2009; Rios, Magaski, Novak & Hamiss, 2016). Universal design has been applied to a diverse array of environments and situations, including architecture, learning, Web-based interfaces, and playgrounds. (Rios, Magaski, Novak & Hamiss, 2016).

Public health initiatives are being implemented on an ongoing basis in communities throughout the United States. Communities can retroactively increase the accessibility of public health programs by evaluating and addressing environmental, programmatic, and policy barriers. Measurement tools such as, the Community Health Living Index (CHLI) and the Community Health Assessment aNd Group Evaluation Tool (CHANGE) include some items that apply to environmental accessibility and policies for people with disabilities but lack the scope and depth necessary to detect potential problems that people with disabilities may encounter when

attempting to access these services (Eisenberg et a., 2014). The Community Health Inclusion Index (CHII) and supplemental resources provide communities pursing inclusive health programs with the tools to evaluate accessibility and identify the strategies and resources necessary to participate in health promoting opportunities

Public Health Significance

The public health significance of this research proposal is grounded in the fact that there is a dearth of information regarding health disparities across subgroups of disability (Krahn et al., 2014; Drum, 2011). While we know that people with disabilities experience worse health outcomes, most studies focusing on this topic, group people with disabilities into categories that are too narrowly (e.g., etiology) or too broadly defined (e.g., requires assistance/uses assistive device), leaving us without a clear understanding of the differences in health across disability subgroups with similar functional limitations. Identifying if, or how, disability subgroups differ across health disparity measures will generate the specificity needed to develop and implement tailored public health interventions the meet the access and inclusion needs of this population.

To date, there are no published studies which use Texas BRFSS data to examine self-rated health, chronic conditions, health behaviors, or related environmental characteristics across functional disability groups. Health and disability researchers have called for more in-depth research to identify the specific causes of these disparities and develop interventions to address the barriers people with disabilities often experience (Horner-Johnson, Dobbertin, Lee, & Andresen, 2014; Krahn et al.,2014). Papers 1 and 2 will lay the groundwork for this future research to be done in Texas.

As people with disabilities have become more of a focus within the field of public health, there has been a push to improve access to heath promoting activities, specifically, community level initiatives to reduce obesity and smoking, two major contributors to chronic disease. Use of the Community Health Inclusion Index a progressive step toward this end because it not only assesses physical, programmatic, and policy barriers to inclusion, but it also presents an example of how the disability community should –and can- be involved in developing and implementing disability-focused health initiatives. Study 3 is a collaborative effort with the City of San Antonio Disability Access Office, Human Services Department, and Metro Health Equity Office, and the data generated will be used to improve the health opportunities for San Antonio seniors. Information regarding the usability of the CHII and supplemental resources will benefit future researchers and practitioners interested in this topic.

Objectives and Specific Aims

Paper 1

Aim 1: National data reveal that Americans with disabilities have worse health across a number of health outcomes and report lower perceived health-related quality of life than those without disabilities. The aim of study 1 is to examine whether Texans with disabilities report significantly higher rates of poor health and higher rates of chronic health conditions than Texans without disabilities.

- Hypothesis 1.1: After controlling for demographic variables, Texans with disabilities (mobility, cognitive, vision, self-care, independent living) report significantly higher prevalence of fair/poor health status, more poor mental health days, more poor physical health days, more combined unhealthy days, and more days that poor physical or mental health prevented usual activity than Texans without disabilities.

  Hypothesis 1.2 After controlling for demographic variables, Texans with disabilities (mobility, cognitive, vision, self-care, independent living) have significantly higher prevalence of each of chronic diseases such as diabetes, cancer, heart disease, respiratory disease, and stroke than Texans who do not report a disability.

Paper 2

Aim 2: Preliminary data suggest that people with disabilities experience additional barriers to participating in recreational activities and health promotion activities. National data reveal that people with disabilities have poorer health behaviors than people without disabilities. The aim of study 2 is to examine whether people with disabilities experience less access to health-promoting environments and are less likely to engage in health-promoting behaviors compared to those without disabilities.

- Hypothesis 2.1: After controlling for demographic variables, Texans with disabilities (mobility, cognitive, vision, self-care, independent living) are significantly more likely to report less access to fruits and vegetables, less neighborhood access to physical activity, and greater exposure to secondhand smoke.

- Hypothesis 2.2: After controlling for demographic variables, Texans with disabilities (mobility, cognitive, vision, self-care, independent living) report significantly lower rates of fruit and vegetable consumption, physical activity, and higher rates of tobacco use.

Paper 3

Aim 3: Research indicates that people with disabilities experience additional barriers to participating in public health initiatives that aim to improve health. The purpose of this study is to assess the physical and programmatic accessibility of San Antonio senior centers using the Community Health Inclusion Index (CHII) survey tool. This study presents two research questions:

1) To what extent are San Antonio senior centers accessible and inclusive? and

2) What are the most prevalent barriers (e.g., programmatic, physical, transportation, etc.) and facilitators to accessibility and inclusion for people with disabilities?

Journal Article

Health Status Indicators and Chronic Conditions among Disability Groups in Texas

Targeted Journal: Disability and Health Journal

Abstract

Background: The prevalence of disabilities is rising steadily, reflecting an aging population and an increasing burden of chronic conditions affecting quality of life; however, there is limited information on the distribution of chronic diseases across different functional types of disability. Understanding how health varies among people with disabilities is vital to tailoring interventions for improving health and eliminating health disparities.

Objective: The purpose of this study was to examine the relation between functional disability type and chronic conditions and health status among Texas adults.

Methods: Data from the 2013 Texas BRFSS, a statewide telephone survey examining health-related behaviors, were analyzed. The prevalence of diabetes, cancer, heart disease, respiratory disease, and stroke by disability type were obtained and adjusted with sampling weights. Logistic and linear regression analysis were used to examine the relation between disability type and chronic disease and health status while controlling for covariates and number of disabilities.

Results: Adults with different disability types differed by demographic and health characteristics. Adults in the mobility and multiple disabilities groups reported significantly higher prevalence of diabetes, cancer, heart disease, respiratory disease, and stroke than those without disability. Those with a vision disability reported higher prevalence of stroke, and those with a self-care only disability reported higher prevalence of cancer and respiratory disease. After controlling for demographic characteristics and number of disabilities, all disability groups had higher odds of reporting fair or poor health, at least 14 total days of poor mental or physical health, and respiratory disease when compared to those without a disability and to those with other types of disabilities. Additionally, all disability groups had a higher odds of reporting stroke, except for the mobility disability group.

Conclusions: Demographic and health outcomes differ across functional disability groups, supporting the idea that disability type should be considered a demographic variable that impacts health outcomes in different ways, depending on the population. Future research should explore the relations between disability type and chronic conditions and health status to obtain information necessary to tailor public health interventions to the unique needs of people with different disabilities.

Background

National data indicate that people with disabilities have higher rates of chronic diseases, report lower perceived mental and physical health status, and experience more comorbidities than those without disabilities (Carroll et al., 2014; Dixon-Ibarra & Horner-Johnson, 2012). The U.S. Census Bureau estimates there are approximately 57 million adults and children living with a disability (Brault, 2012) and national survey data indicate the prevalence of disability is increasing (Hinton et al, 2017). The prevalence of disability increases with age (Krahn et al., 2015), yet most people with disabilities are between the ages of 18 and 64 years (Carroll et al., 2014). This population is at greater risk for chronic disease and other adverse health outcomes compared to those without disabilities (Dixon-Ibarra & Horner-Johnson, 2012; IOM, 2007; Krahn et al., 2015). In 2006, disability-associated healthcare expenditures were estimated at nearly $400 billion (Anderson et al., 2010) and medical costs for people with physical and cognitive disabilities were 4.3 and 4.8 times higher than those without disabilities, respectively. Given the current and expected increase of the prevalence of disability, health disparities experienced by this population, and associated medical expenditures, we should further examine the relations between disability and health disparities so that effective public health programs and policy changes can be implemented.

Two decades ago, public health considered disability as an outcome to be prevented rather than a demographic variable which may contribute to poor health outcomes (Krahn et al., 2015; Office of the Surgeon General, 2005). Today, we know that people with disabilities are more likely to live in poverty, be under- or unemployed, lack sufficient access to accessible transportation, live in substandard housing, and experience a variety of physical, programmatic,

communication, and societal barriers when accessing public health and medical services (Lollar & Andresen, 2011). Disparities in health experienced by this population have been documented using both national health survey data and community-based research (Reichard et al., 2011; Dixon-Ibarra & Horner-Johnson, 2014).

Reichard et al. (2011) used 2006 Medical Expenditure Panel Survey data to determine that people with cognitive and physical disabilities had significantly higher rates of arthritis, asthma, cardiovascular disease, high blood pressure, high cholesterol, and stroke when compared to a reference group with no disability. Adults without disabilities were 2.7 and 3.4 times more likely to rate their health as excellent as those with physical disabilities and those with cognitive disabilities, respectively (Reichard et al., 2011). Similarly, Dixon-Ibarra and Horner-Johnson (2014) examined National Health Interview Survey data from 2006 to 2012 and found that adults with lifelong disabilities had increased odds of heart disease, hypertension, diabetes, cancer and obesity. A commonly cited challenge to disability and health research is that it is difficult to disentangle the temporal relationship between disability and chronic disease. Dixon-Ibarra and Horner-Johnson (2014) only included people who had a lifelong disability, thus showing that people with disabilities are at increased risk of developing a chronic condition after disability onset. Carroll et al. (2014) also examined National Health Interview Survey Data and found that people with hearing, vision, cognitive and mobility limitations were move likely to report diabetes, cancer, stroke and heart disease than those who did not report a disability, with all four functional disability groups significantly ($p < .001$) more likely to report more than one chronic condition than those without disabilities.

Community-based research also indicates that people with disabilities experience health disparities. Havercamp et al. (2004) used the North Carolina BRFSS data to compare health status, health risk behaviors, chronic health conditions, and utilization of medical care among those without a disability, with a disability, and with a developmental disability, and found that adults with developmental disabilities were more likely to report fair or poor health and had a similar or greater risk of having four of five chronic conditions compared to non-disabled adults (Havercamp et al., 2004). Studies focusing on disparities in secondary conditions have been documented among women with disabilities (Coyle et al., 2000; Kinne et al., 2004; Nosek et al., 2006), and adults with disabilities served by independent living centers in a rural state (Seekins et al., 1994). Additional community-based studies have reported health disparities between adults with intellectual disabilities and those without across a range of health outcomes, including oral health care (Cumella et al., 2000) and quality of health care (Lewis et al., 2002).

Until 2012, the BRFSS included two questions about activity limitations and use of special equipment to identify disability among respondents. With these two questions researchers were able to compare the health status and risk of those with and without disabilities, but the questions did not indicate the type of functional limitation experienced by the respondent (Drum et a., 2009). In 2013, the BRFSS added five of the six disability questions now common across several national surveys, including the American Community Survey (ACS) (Gettens et al., 2015), the National Health Interview Survey, and the Current Population Survey. The new disability questions are located within the demographics section and are designed to identify not only disability status, but also the type of functional limitation (e.g., mobility, vision, independent living, cognitive, and self-care) (Courtney-Long et al., 2015), allowing researchers an opportunity

examine health outcomes across national surveys and functional disability domains (Gettens et al., 2015).

The purpose of this study is to examine the perceived health status and rates of chronic diseases across five functional disability groups using 2013 Texas BRFSS data. The study examines two hypotheses: (a) across the five functional disability groups, people with disabilities will report significantly higher rates of chronic diseases, and fair/poor health status compared to those without disabilities, and (b) across the five functional disability groups, people with disabilities will report more days that their physical and mental health were not good, and more days that poor physical or mental health prevented usual activity compared to those without disabilities.

Methods

Study Design

This cross-sectional study will use data from the 2013 Texas BRFSS, a survey of the adult, non-institutionalized population. The purpose of the BRFSS is to collect information on demographics, health-related risk behaviors, chronic health conditions, and use of preventive services to inform health-related program and policy development (CDC, 2018). In this study, BRFSS data were used to quantify estimated differences in rates of chronic diseases and health status between those without disabilities, with multiple disabilities, and across disability subgroups. In addition, we use a broad definition of disability consistent with the categorization of the International Classification of Functioning (WHO, 2001), in which disability is characterized by activity limitations and participant restrictions resulting from impairments that limit body functions. Functional disability status is based on respondents' endorsement of one of five functional disability questions.

Data Source

Developed by the CDC in 1984, the BRFSS is a state-based public health random digit telephone survey. The BRFSS survey methods and questionnaires are standardized across all states, Washington D.C., and US territories, allowing for comparisons across sub-regions, states, and to the nation (CDC, 2018). In addition, BRFSS survey interviewers complete standardized training to ensure consistent collection of comprehensive demographics, health, behavioral health risk, and preventive health data. The BRFSS uses a disproportionate stratified sample (CDC, 2018) and data are subsequently weighted to reflect the complex sampling methods and nonresponse bias of the final sample (Gettens et al., 2015).

Prior to the 2013 BRFSS, only two questions were used to determine disability status of the respondent: 1) “Are you limited in any way in any activities because of physical, mental, or emotional problems?” and 2) “Do you now have any health problems that requires you to use special equipment, such as a cane, wheelchair, a special bed, or a special telephone?” Respondents who answered “yes” to either question were considered to have a disability and those who answered “no” to both questions were considered to not have a disability. In 2013, the CDC added five questions to determine functional disability status by assessing serious difficulty in vision, cognition, ambulation, and any difficulty in self-care or independent living. The newly added five disability questions are a subset of a six-question set recommended by U.S. Department of Health and Human Services for inclusion in population-based health surveys (Burkhauser et al., 2014). The sixth question assesses serious difficulty hearing and was omitted from the 2013 BRFSS due to concerns about variation in survey methods due to use of an interpreter or relay service.

Survey Sample

In 2013, the BRFSS used a random digit dialing method to select survey respondents by calling either cellular or landline telephones (CDC, 2018). Businesses and nonworking telephone numbers were omitted (CDC, 2018). Only one adult, aged 18 or older, from each household completed the survey. The 2013 survey marked the first year BRFSS questions included the new disability questions. Individuals under the age of 18 years, those living in an institutionalized setting, and those who were deaf or hearing impaired were excluded from the survey (CDC, 2018). This study also excluded respondents with missing, "refused", or "don't know" responses to any of the five functional disability questions or chronic disease or health status questions of interest.

Survey Items

Independent Variables

The independent variable in this study was functional disability status. Respondent answers to the five disability questions were used to create seven mutually exclusive disability groups: "no disability", "multiple disabilities", "mobility disability", "cognitive disability", "vision disability", "self-care disability", and "independent living disability". Respondents were assigned to one group only. Those who reported more than one disability type were assigned to the multiple disabilities group. Those who answer *no* to all five of the functional disability questions were assigned to the "no disabilities" group. Table 1-1 provides more information about the questions used to define disability groups. In a previous study Brault (2013) determined that the disability measures had relatively moderate to low reliability with coefficients ranging between 0.414 (vision difficulty) and 0.638 (ambulatory difficulty) and remained relatively stable over a year (r=0.937).

Table 1-1: Descriptions of questions used to define disability status and total number of disabilities

Independent Variables	BRFSS Question	Survey Question and/or Calculation	Scale	Source Reliability/ Stability (1yr)
Mobility disability	C08Q27	Do you have serious difficulty walking or climbing stairs? And "No" to C08Q25-C08Q26 and C08Q28-C08Q29	Yes = 1 No = 2	Brault, 2007 0.638 0.918
Cognitive disability	C08Q26	Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions? And "No" to C08Q25 and C08Q27 - C08Q29	Yes = 1 No = 2	Brault, 2007 0.560 0.906
Vision disability	C08Q25	Are you blind or do you have serious difficulty seeing, even when wearing glasses? And "No" to C08Q26 - C08Q29	Yes = 1 No = 2	Brault, 2007 0.414 0.868
Self-care disability	C08Q28	Do you have difficulty dressing or bathing? And "No" to C08Q25 - C08Q27 and C08Q29	Yes = 1 No = 2	Brault, 2007 0.490 0.870
Independent living disability	C08Q29	Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping? And	Yes = 1 No = 2	Brault, 2007 0.594 0.908
Multiple disabilities		"Yes" to ≥ 2 of C08Q25 - C08Q29	Yes = 1 No = 2	
No disability		"No" to questions C08Q25 thru C08Q29	Yes = 1 No = 2	
Total number of disabilities		Combined number of positive responses to questions C08Q25 - C08Q2	1 to 5	

Dependent variables

There were ten dependent variables of interest including five chronic disease and four health status variables. The chronic condition dependent variables were dichotomous ("yes"/"no") and included "diabetes", "cancer", "heart disease", "respiratory disease", and "stroke". People who reported being told by a health professional they have or have had diabetes were assigned a "yes" for the variable "diabetes". Women who reported a diabetes diagnosis only while pregnant (e.g., gestational diabetes) were excluded, as these cases are temporary. Respondents who indicated they have had skin, or any other type of cancer were marked as "yes" for "cancer". People who had ever been told they had angina, coronary heart disease or a heart

attack were assigned a “yes” for the variable “heart disease”. Respondents who report having been told by a health professional that they have or have had chronic obstructive pulmonary disease, emphysema, or chronic bronchitis were coded as a “yes” for “respiratory disease”. Lastly, those who reported they were ever told by a healthcare professional they had a stroke were assigned a “yes” for “stroke”. Table 1-2 includes survey questions, calculations, and respective survey scales.

The study included six dependent variables to examine the association between functional disability status and health status based on responses to the BRFSS Healthy Days Module. The first health status variable “fair/poor health” was determined by responses to a question about general health status, with responses *poor* and *fair* being combined as a “yes” response. The responses options *excellent*, *very good*, and *good* were combined as a “no” response. The CDC four-item Healthy Days measure (CDC, 2000.) was used for the remaining health status variables. The Healthy Days Module (also called “health related quality of life” or “HRQoL”) has standardized survey and scoring methods and comparative population norms (CDC, 1994; CDC 1995). A previous study found excellent test-retest reliability for the health status measure (0.75), and moderate reliability for the remaining measures (0.58 to 0.71) (Andresen et al., 2003). These variables were continuous, as respondents provided a numeric value between 0 and 30 to report on questions about the number of days that physical health was not good, number of days mental health was not good, and number of days physical or mental health prevented usual activity in the previous month. A fifth continuous variable, “combined unhealthy days” was calculated by combining the number of days physical and mental health were not good. A *none* response for any of these questions was assigned a value of “0”.

Lastly, the variable "> 14 combined unhealthy days" was dichotomous and assigned "yes" if the combined number of poor mental and physical health was greater than 14 days and "no" if less than or equal to 14 days.

Covariates

Demographic variables of interest included self-reported sex (*male*, *female)*, age, body mass index (BMI) (self-report weight (kg)/height(m) squared), health insurance coverage (*yes*, *no*), race/ethnicity (*Non-Hispanic white*, *Black*, *Hispanic*, *other*), education level (*less than high school*, *high school*, *some college*, *college graduate*), employment status (*employed at least part time* or *not employed*), and income category (*<$15,000, $15,000-<$25,000, $25,000 -<$35,000, $35,000 -< $50,000, $50,000+*). These demographic variables were used in previous studies with similar analysis (Froehlich-Grobe et al., 2016). An additional covariate, total number of disabilities, was calculated by summing the number of affirmative answers to the disability questions.

Table 1-1: Description of questions used to determine measures of chronic disease and health status

Table 2: Description of questions used to determine measures of chronic disease and health status

Independent Variables	BRFSS Question	Survey Question and/or Calculation	Scale	Reliability / Source
Heart disease	C07Q01	Has a doctor, nurse, or other health professional ever told you that you had a heart attack, also called a myocardial infarction?	Yes = 1 No = 2	
	C07Q02	Has a doctor, nurse, or other health professional ever told you that you had angina or coronary heart disease?		
		"Yes" to either C07Q01 or C07Q02		
Stroke	C07Q03	Has a doctor, nurse, or other health professional ever told you had a stroke?	Yes = 1 No = 2	
Diabetes	C07Q12	Has a doctor, nurse or other health professional ever told you that you have diabetes? Yes; Yes, but female told only during pregnancy; No; No, pre-diabetes or borderline diabetes; Don't know/ Not sure If "Yes" to C07Q12	Yes = 1 No = 2	
Cancer	C07Q06	Has a doctor, nurse, or other health professional ever told you that you had skin cancer	Yes = 1 No = 2	
	C07Q07	Has a doctor, nurse or other health professional ever told you that you had any other types of cancer?		
		"Yes" to either C07Q06 or C07Q08		
Respirtatory Disesae	C07Q08	Has a doctor, nurse or other health professional ever told you that you have COPD chronic obstructive pulmonary disease, emphysema, or chronic bronchitis?	Yes = 1 No = 2	
Poor/Fair Health	C01Q01	Would you that in general your health is... Excellent , Very good, Good, Fair, Poor , Don't know/Not sure, Refused If "fair" or "poor" then	Yes = 1 No = 2	.75 Andresen et al., 2003
Days physical health not good	C02Q01	Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?	Number of days = __	.71 Andresen et al., 2003
Days mental health not good	C02Q02	Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?	Number of days = __	.67 Andresen et al., 2003
Combined unhealthy days		C02Q01 + C02Q02	Number of days = __	
Days kept from usual activity	C02Q03	During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?	Number of days = __	.57 Andresen et al., 2003
≥5 days physical health not good		If days physical health not good is 5 or greater, then yes = 1	Yes = 1 No = 2	
≥5 days mental health not good		If days mental health not good is 5 or greater, then yes = 1	Yes = 1 No = 2	
≥5 days kept from usual activity		If days not physical or mental health prevented usual activity is 5 or greater, then yes = 1	Yes = 1 No = 2	
>14 combined unhealthy days		If total combined unhealthy days is greater than 14, then yes = 1	Yes = 1 No = 2	

Data Analysis

Associations between functional disability status (independent variable) and chronic conditions and health status (dependent variables) were analyzed using SAS Studio (University Edition/San Antonio, TX). This study examined demographic variables, chronic conditions, and health status, comparing each functional disability group to the no disability group. Demographic characteristics, chronic conditions, and health status measures were examined using descriptive statistics. Mean and standard deviation were calculated for continuous variables (e.g., "age", "BMI", "days with poor physical health", "days with poor mental health", "combined unhealthy

days", and "days poor health prevented usual activity") and proportions for categorical variables (e.g., "fair/poor health", "heart disease", "stroke", "cancer", "diabetes", and "respiratory disease"). Next, t-tests and chi-square analysis were conducted to examine whether significant differences in health status measures and chronic conditions existed between each of the six disability groups and the no disability group.

Linear regression examined possible associations between disability categories and reported number of days physical and mental health were not good and number of days poor health prevented usual activity, while adjusting for covariates. Similarly, logistic regression analysis examined possible associations between functional disability status and chronic health conditions while adjusting for the same demographic variables.

Logistic regression examined possible associations between disability and chronic health condition, as well as self-reported status of mental and physical health. For this analysis, functional disability groups were stratified into three levels: those with only the disability of interest, those with multiple disabilities, and those with no disability. The analysis controlled for demographics characteristics and total number of disabilities. Total number of disabilities was determined by the number of affirmative responses to the five questions assessing disability status and accounts for the possible effects of having multiple disabilities on health.

Results

Table 1-3 provides information regarding demographic characteristics of the 2013 BRFSS sample. The 2013 Texas BRFSS sample included 10456 respondents, of which 47.9% were Caucasian-non-Hispanic, 35.6% were Non-Caucasian Hispanic, and 11.8% were Black. Of the

respondents, 78.9% indicated no disability, 5.3% reported a mobility disability, 1.9% a vision disability, 3.9% a cognitive disability, 0.3% a self-care disability, and 8.9% two or more disabilities. There were no respondents who reported only an independent living disability; therefore, this group was omitted from further analyses. The self-care disability group included just 29 respondents and was the smallest group included for analysis.

Those reporting to experience disability, except for those with a cognitive disability, were significantly older than the no disability group, with mean ages ranging from 40.0 (1.4) (cognitive) to 61.5 (0.9) years (mobility). Women were more likely to report disability in each of the categories, except self-care, where 63% were men. Non-Hispanic Whites accounted for the highest proportion of respondents within the mobility (63.0%), cognitive (53.3%), self-care (72.1%), multiple disabilities (48.8%), and no disability groups (47.6%). Hispanics made up the highest proportion of those reporting a vision disability (39.5%) and the second highest proportion of those reporting a mobility (19.9%), cognitive (33%), self-care (30.8%) and multiple disabilities (29.9%). Individuals across all disability groups reported significantly higher BMI, with values ranging from 27.9 (± 0.6) (cognitive) to 31.3 (± 0.5) (multiple disabilities group) than individuals without a disability 27.6 (±0.11).

There were significant differences between those without and with disability related to educational attainment, income, and employment. Those reporting a disability were less likely to complete high school and less likely to earn a college degree or higher. Notably, about twice as many respondents with multiple disabilities reported less than a high school education (34.1%) than those without a disability (10.1%). Further, employment rates were higher among those without a disability (64.1%) than for each of the disability groups, although this was only

significant for those with a mobility or multiple disabilities (35.0% and 15.8% respectively). Annual income varied significantly between those without a disability and each of the six disability groups, in a pattern reflecting that those with a disability earned less money. The prevalence of a reported income of less than $15,000 was nearly four times higher for those with multiple disabilities, and two to three times higher for those in the vision, mobility, and cognitive disability groups. All of groups, except for the cognitive disability group, were more likely to have healthcare insurance compared to those without a disability, although for the vision group, the results were not significant.

Those reporting with any disability reported significantly higher prevalence of chronic conditions than those without disability. Table 1-4 includes weighted prevalence rates and weighted means from chronic disease and healthy days analysis. Prevalence rates for diabetes, cancer, heart disease, respiratory disease, and stroke were significantly higher among those with mobility and multiple disabilities compared to the no disability group. The most commonly reported chronic condition by all Texans BRFSS respondents was diabetes, with the highest prevalence reported among those with multiple disabilities (33.6%), followed by the mobility disability group (24.6%). Respondents in the self-care disability group reported a significantly higher prevalence respiratory disease (33.7%), which was nearly 11 times higher than reported by those without disability. While not significant, diabetes (13.4%) prevalence among the vision disability group was nearly twice the amount of those without a disability (7.5%). Additionally, respondents in the cognitive group were twice as likely to report respiratory disease (7.4%) compared to those without disability (3%). Stroke was the least commonly reported chronic

condition across all disability groups and among those with no disabilities, with prevalence rates ranging from 0.6% (vision) to 12.3% (multiple disabilities.

Between one in three to one in five respondents with any type of disability reported fair or poor compared to about 1.1 in 10 of those without disabilities. Similarly, people without a disability reported the fewest days that poor physical or mental health were not good or that kept them from doing their usual activities, while those with multiple disabilities reported the highest number of days in all three categories. Across the unique disability groups, the results varied. The self-care disability group reported the most days of poor physical health (13.7 ±3 .8 days), fewest days of poor mental health (2.4 ± 3.8 days), and the most days poor physical or mental health kept them from usual activities (16.2 ± 4.8). People with multiple disabilities reported poor mental health 10.2 (± 0.6) days, followed by those with a cognitive disability who reported 10.0 (± 0.8) days. The other disability types reported ranges varying from 2.4 to 3.8 days that mental health was not good, yet all were significantly higher than those without disability.

Table 1-2: Weighted estimates of socio-demographic characteristics by disability group type: Texas BRFSS, 2013

	No disability		Multiple Disabilities		Mobility Disability Only		Cognitive Disability Only		Vision Disability Only		Self-Care Disability Only	
sample *n*	*n* =7671		*n* =1272		*n* =855		*n* = 366		*n* =195		*n* =29	
	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)
Demographic Variables												
Weighted frequency	78.94 (0.58)	F=1645.3***	8.9 (0.4)	F=3375.18***	5.32 (0.29)	F=4845.76***	3.94 (0.29)	F=3751.74***	1.93 (0.23)	F=3355.49***	28 (0.08)	F=4528.88***
Age	42.97 (0.26)	t=165.50*** (42.47-43.48)	55.27 (0.82)	t=67.74*** (53.67-56.87)	61.52 (0.93)	t=65.83*** (59.68-63.35)	39.99 (1.38)	t=28.95*** (37.28-42.70)	45.6 (2.38)	t=19.18*** (40.93-50.26)	53.49 (3.35)	t=15.95*** (46.91-60.06)
Male	51.75 (0.88)	F=50.74***	36.5 (2.27)	F=30.57***	38.79 (2.71)	F=14.08**	39.84 (3.67)	F=6.28*	47.53 (6.02)	F=.06	63.1 (13.93)	F=.97
Race/ethnicity												
White	47.58 (0.87)		48.77 (2.37)		63.02 (2.75)		53.3 (3.78)		30.46 (4.8)		72.06 (12.25)	
Black	10.53 (0.62)	F=9.68***	18.13 (2.09)	F=6.94***	15.88 (2.3)	F=18.66***	11.78 (2.49)	F=1.59	17.18 (4.83)	F=5.14*	14.92 (11.69)	F= 1.94
Hispanic	37 (0.88)		29.92 (2.1)		19.88 (2.22)		33.03 (3.5)		39 (5.8)		11.28 (5.7)	
Other	4.9 (0.4)		3.19 (0.89)		1.22 (0.42)		1.89 (0.8)		13.36 (5.55)		1.73 (1.77)	
BMI[b]	27.56 (0.11)	t=245.53*** (27.78-27.78)	31.33 (0.45)	t=69.36*** (30.45-32.22)	30.98 (0.55)	t=56.04*** (29.9-32.06)	27.88 (0.62)	t=28.95*** (26.66-29.09)	28.17 (0.87)	t=32.237*** (26.45-29.89)	29.8 (1.64)	t=18.20*** (26.59-33.01)
Employed	64.14 (0.84)	F=309.14***	15.82 (1.56)	F=414.92***	35.01 (2.78)	F=59.71***	53.17 (3.84)	F = 1.07	53.18 (6.01)	F=.42	56.79 (13.47)	F=0.00
Health coverage	71.18 (0.84)	F=5.62*	76.44 (2.1)	F=4.24*	85.23 (2.21)	F = 23.17***	34.74 (3.57)	F=4.30*	65.1 (5.81)	F=1.66	92.77 (4.06)	F=8.68**
Education												
<High school	17.7 (0.79)		34.09 (2.36)		22.53 (2.53)		19.3 (3.06)		28.41 (5.67)		11.51 (5.74)	
High school	25.26 (0.77)	F=30.26***	28.18 (2.02)	F=30.93***	27.74 (2.46)	F=1.74	29.3 (3.36)	F=2.7148*	26.95 (5.69)	F=1.34	27.45 (11.17)	F=3.73*
Some college	31.07 (0.84)		26.99 (2.11)		31.46 (2.52)		36.07 (3.8)		23.99 (4.55)		57.69 (12.95)	
College graduate	26 (0.65)		10.74 (1.16)		18.26 (1.94)		15.32 (2.15)		20.65 (4.5)		3.35 (2.25)	
Income												
<$15,000	10.1 (0.6)		38.08 (2.6)		17.24 (2.45)		21.21 (3.22)		27.37 (5.62)		6.39 (4.32)	
$15,000-<$25,000	18.89 (0.77)		28.76 (2.43)		27.26 (2.77)		22.37 (3.26)		26.06 (5.02)		0.86 (0.89)	
$25,000-<$35,000	10.64 (0.61)	F=63.95***	12.4 (1.94)	F=63.97***	15.91 (2.3)	F=6.27***	10.35 (2.45)	F=2.069	9.66 (3.47)	F=4.06**	6.36 (5.58)	F=2.96*
$35,000-<$50,000	14.32 (0.71)		9.2 (1.53)		10.61 (1.75)		12.73 (2.6)		15.63 (5.02)		18.86 (9.04)	
$50,000+	46.1 (0.94)		11.56 (1.6)		28.98 (2.72)		33.34 (4.25)		21.28 (4.7)		67.54 (12.18)	

[5]Indpendent living disability, n=0, sample excluded from analysis

*p<.05, **p<.005, ***p<.0001

[a] Standard error, [b] BMI = (weight(kg)/(height)(m))2

Table 1-4: Weighted means and weighted prevalence of chronic conditions and health status measures by disability group type

	No disability		Multiple Disabilities		Mobility Disability Only		Cognitive Disability Only		Vision Disability Only		Self-Care Disability Only	
sample *n*	*n* =7671		*n* =1272		*n* =855		*n* = 366		*n* =195		*n* =29	
	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)
Health Conditions												
Diabetes	7.47 (0.13)	F=201.91***	33.56 (2.32)	F=236.50***	24.59 (2.34)	F=63.06***	10.62 (2.28)	F=.032	13.4 (2.93)	F=.71	6.45 (4.68)	F=0.59
Cancer	7.1 (0.36)	F=102.59***	17.51 (1.71)	F=48.37***	23.26 (2.17)	F=97.51***	8.99 (2.12)	F=.0012	11.25 (2.99)	F=.63	1.11 (0.81)	F=12.79**
Heart disease	3.25 (0.28)	F=195.33***	19.76 (1.88)	F=2000.9***	16.56 (1.8)	F=95.59***	3.52 (1.11)	F=2.28	5.73 (1.93)	F=.002	8.97 (6.77)	F=.37
Respiratory	3 (0.28)	F=196.66***	20.47 (1.71)	F=227.28***	10.91 (1.46)	F=26.89***	7.43 (1.79)	F=1.77	3.84 (1.66)	F=.69	33.73 (13.41)	F=19.6***
Stroke	0.94 (0.13)	F=218.97***	12.28 (1.55)	F=215.82***	7.74 (1.33)	F=45.32***	4.14 (1.28)	F=2.89	0.64 (0.36)	F=6.82*	1.59 (1.63)	F=0.21
Health Status Measures												
Days physical health not good	1.77 (0.09)	t=19.05*** (1.59-195)	14.95 (0.59)	t=25.23*** (13.78-16.11)	6.71 (0.52)	t=12.81*** (5.68-7.74)	5.08 (0.57)	t=8.94*** (3.97-6.2)	2.33 (0.52)	t=4.50*** (1.32-3.34)	13.69 (3.81)	t=3.59** (6.22-21.16)
Days mental health not good	2 (0.11)	t=18.41*** (1.78-2.21)	10.19 (0.55)	t=18.43*** (9.11-11.28)	2.7 (0.34)	t=7.91*** (2.03-3.37)	9.66 (0.83)	t=11.7*** (8.04-11.28)	3.8 (0.93)	t=4.10*** (1.99-5.63)	2.38 (1.47)	t=1.62 (-.5-5.26)
Combined unhealthy days	3.73 (0.15)	t=24.84***	25.35 (0.97)	t=26.08*** (23.44-27.25)	9.47 (0.7)	t=13.57*** (8.1-10.84)	15.03 (1.09)	t=13.8*** (12.9-17.17)	6.29 (1.13)	t=5.56*** (4.1-8.5)	16.19 (4.8)	t=3.37** (6.78-25.59)
Days kept from usual activity	1.95 (0.16)	t=12.10*** (1.63-2.26)	13.76 (0.66)	t=20.96*** (12.47-15.04)	5.47 (0.56)	t=9.76*** (4.37-6.57)	5.35 (0.62)	t=8.62*** (4.13-6.57)	4.01 (1.28)	t=3.15** (1.52-6.54)	8.59 (4.81)	t=1.78 (-.84-18.03)
Poor/Fair Heath	11.06 (0.57)	F=577.40***	65.54 (2.29)	F=644.01**	40.83 (2.73)	F=101.71***	29.41 (3.36)	F=13.2**	21.55 (3.95)	F=.39	27.55 (10.59)	F=0.79
≥5 days physical health not good	10.52 (0.54)	F=617.62***	67.24 (2.22)	F=804.48***	33.97 (2.61)	F=54.57***	31.47 (3.47)	F=21.13***	11.37 (2.68)	F=4.63*	62.39 (13.26)	F=17.19***
≥5 days mental health not good	11.92 (0.6)	F=328.9***	49.2 (2.42)	F=311.53***	15.75 (1.93)	F=.87	53.83 (3.85)	F=162.63***	20.41 (5.95)	F=.27	15.62 (10.13)	F=0.03
≥ 5 days poor health kept from usual activity	4.92 (0.39)	F=624.97***	55.63 (2.4)	F=856.76***	0.17 (2.03)	F=11.39**	28.52 (3.83)	F=41.48***	13.08 (4.95)	F=.13	19.84 (11.62)	F=0.79
>14 combined unhealthy days	9.64 (0.53)	F=586.71***	58.99 (2.31)	F=603.28***	25.2 (2.24)	F=17.09***	42.84 (3.71)	F=84.92***	22.01 (5.76)	F=.90	44.91 (13.9)	F=6.8**

[a]Independent living disability, n=0, sample excluded from analysis

*p<.05, **p<.005, ***p<.0001

[a] Standard error

Table 1-3: Regression analysis, chronic conditions, and health status by disability type: Texas BRFSS, 2013

	Multiple Disabilities				Mobility Disability				Cognitive Disability				Vision Disability				Self-Care Disability			
	Estimate	SE[$]	AOR	p value 95% CI	Estimate	SE[$]	AOR	p value 95% CI	Estimate	SE[$]	AOR	p value 95% CI	Estimate	SE[$]	AOR	p value 95% CI	Estimate	SE[$]	AOR	p value 95% CI
Chronic Conditions																				
Diabetes	-0.03	0.09	0.97	.81-1.16	0.02	0.13	1.02	.78-1.32	-0.01	0.11	0.99	.8-1.23	0.001	0.11	1	.80-1.24	0.01	0.1	1.01	.82-1.24
Cancer	0.004	0.09	1.01	.84-1.2	0.07	0.15	1.07	.80-1.43	-0.01	0.11	0.99	.79-1.23	-0.03	0.11	0.98	.78-1.21	0.02	0.11	1.02	.83-1.27
Heart disease	0.14	0.09	1.15	.96-1.39	-0.04	0.15	0.96	.71-1.3	0.18	0.12	1.2	.95-1.52	0.16	0.12	1.18	.93-1.48	0.15	0.11	1.17	.93-1.45
Respiratory Disease	0.32	0.11	1.37	** 1.11-1.69	0.45	0.16	1.57	** 1.15-2.15	0.43	0.14	1.54	** 1.17-2.01	0.48	0.13	1.56	** 1.21-2.02	0.36	0.12	1.43	** 1.12-1.83
Stroke	0.38	0.14	1.46	* 1.12-1.90	0.35	0.19	1.4	.10-2.06	0.41	0.16	1.5	* 1.09-2.07	0.53	0.17	1.71	** 1.23-2.36	0.45	0.16	1.58	** 1.15-2.16
Health Status																				
Poor/Fair Heath	0.24	0.07	1.27	** 1.10-1.47	0.23	0.11	1.26	* 1.01-1.57	0.27	0.1	1.31	** 1.08-1.59	0.36	0.09	1.43	*** 1.20-1.7	0.29	0.09	1.34	** 1.12-1.59
≥5 days physical health not good	0.16	0.07	1.17	* 1.01-1.35	0.26	0.11	1.3	* 1.05-1.62	0.2	0.1	1.22	1.0-1.49	0.36	0.09	1.43	*** 1.19-1.71	0.2	0.09	1.22	* 1.02-1.46
≥5 days mental health not good	0.27	0.08	1.3	** 1.12-1.52	0.48	0.11	1.61	*** 1.3-2.0	0.13	0.11	1.14	.92-1.41	0.46	0.09	1.59	*** 1.32-1.91	0.36	0.09	1.43	*** 1.2-1.71
≥ 5 days poor health kept from usual activity	0.27	0.09	1.32	** 1.1-1.57	0.5	0.12	1.65	*** 1.3-2.09	0.27	0.11	1.31	* 1.1-1.62	0.54	0.11	1.72	*** 1.39-2.12	0.41	0.11	1.5	*** 1.22-1.85
>14 combined unhealthy days	0.3	0.07	1.35	*** 1.17-1.57	0.49	0.11	1.63	*** 1.33-2.00	0.27	0.09	1.31	** 1.07-1.59	0.5	0.09	1.65	*** 1.38-1.97	0.39	0.09	1.47	*** 1.24-1.74

[$] Independent living disability, n=0, sample excluded from analysis
*p<.05, **p<.005, ***p<.0001
[$] Standard error

Table 1-5 includes results from the regression analysis. The logistic regression results showed that those with a vision, cognitive, or self-care disability, and those who reported multiple disabilities, had significantly higher odds of reporting a stroke (AOR range1.46—1.71)-, respiratory disease (AOR range 1.37—1.56,), or reporting fair or poor health (AOR range 1.26—1.43) when compared to those with no-disability. As well, those with a mobility disability were significantly more likely to report a respiratory disease (AOR = 1.57, CI = 1.15—2.15) and fair or poor health (AOR = 1.26, CI = 1.01-1.57). Across disability groups, none were significantly more likely to report heart disease, diabetes, or cancer when compared to those without disability after controlling for the presence of other disabilities and sociodemographic characteristics.

Those with vision, mobility, self-care, and multiple disabilities reported significantly higher odds than those without a disability that their physical health (AOR range, 1.2 –- 1.4) and mental health (AOR range, 1.3 – 1.6) were not good for five or more days during the previous 30 days, as well as reporting that poor physical or mental health kept them from doing usual activities for five or more days (AOR range, 1.3-1.7). Respondents with a cognitive disability reported significantly higher odds than those without a disability that poor mental or physical health kept them from engaging in usual activities for five or more days in the previous 30 (AOR = 1.3, CI = 1.1—1.6).

Discussion

One in five Texans reported a disability, with the most commonly reported functional limitation being mobility. However, most respondents reported limitations in two or more domains. High prevalence rates of chronic conditions typically associated with disability were not consistently distributed across disability groups, yet, those with disability generally reported higher prevalence of nearly all chronic conditions than those without a disability. Those with disabilities, regardless of

type, were had significantly higher odds of reporting fair or poor health, five or more days poor health keeping them from usual activities, and at least a total of 14 unhealthy days during the previous month.

A previous study by Courtney-Long et al., (2015) using the same dataset did not create mutually exclusive groups, which resulted in disability prevalence rates that differed from this study. Whereas to yield mutually exclusive disability groups for this study we created a multiple disabilities group. While the pattern of the prevalence of impairment types was similar (13.1% mobility, 9.5% cognitive, 6.2% independent living, 5.0% vision, and 3.7% self-care) (Courtney-Long et al., 2015), this coding difference resulted in having no one in the independent living group and fewer respondents in each functional disability group. Additionally, creating mutually exclusive categories led to the multiple disabilities group being nearly 50% larger than the mobility group, which indicates that disabling conditions frequently result in multiple functional limitations.

Hispanic respondents made up the highest percentage of those in the vision disability group. A previous study using 2013 national BRFSS data also noted a higher prevalence of Hispanic ethnicity among those reporting a vision disability, and upon further examination identified a discrepancy in the translations between the Spanish and English versions of the vision disability question (Stevens et al., 2016). The English version of the question refers to a "serious" difficulty seeing, whereas the Spanish version translates to "some" difficulty seeing (???Es ciego o tiene alguna dificultad para ver, aun cuando usa lentes?”) The corrected Spanish translation was used starting in the 2015 BRFSS. The discrepancy between the English and Spanish translations of the vision disability question may account for much of the higher prevalence of Hispanic ethnicity in this study.

The cognitive disability question inquiries about “physical, mental, or emotional condition” that results in “serious difficulty concentrating, remembering or making decisions”, resulted in an affirmative response from individuals with mental illness (e.g., depression or anxiety), traumatic brain injury, cognitive (e.g., dementia) or developmental disabilities (e.g., Autism, cerebral palsy). The younger age of the cognitive disability group is consistent with other studies and likely reflects the higher levels of depression and anxiety found among young adults, especially because young adults are less likely to have a chronic condition that would contribute to multiple disabilities placing them in the multiple disabilities group (Taylor, 2018).

Respondents with disability generally reported worse measures of socioeconomic status compared to those without disability. Results from this study are consistent with previous studies which noted disparities in education, employment, and income among people with disabilities (Kessler Foundation, 2010). Barriers to education in the form of inaccessible facilities, lack of assistive technology, and limited school resources to provide accommodations make completing high school more challenging for youth with disabilities (Dunn, 2006). Additional barriers exist for those seeking higher educational opportunities, including social problems, discrimination, inaccessible facilities, and lack of social support (Stanley, 2000). People with disabilities also face employment challenges, including discrimination and fear of losing health or income through public assistance (NCD, 2017). A previous study which surveyed hiring managers revealed negative perceptions related to productivity, social maturity, and interpersonal skills (Chan, 2008). Public assistance programs, such as Medicaid, Social Security Disability Insurance (SSDI) and Supplemental Security Income (SSI), may disincentivize employment through income and employment-based eligibility criteria. Many adults and youth with disabilities have the desire and

willingness to work (NCD, 2017). Evidence to support this can be seen in states that implemented Medicaid expansion as part of the Affordable Care Act. People with disabilities, no longer concerned about losing health insurance, gained employment, significantly increases employment rates in for this population (Hall et al., 2017). Barriers to education and employment, compounded by public assistance programs which disincentivize generating personal wealth, contribute to a cycle of poverty and poor health. Addressing the societal factors and government policies which contribute to unemployment and poverty, must be part of an overarching strategy to improve health of people with disabilities.

Whether or not people with disabilities have adequate health insurance to meet medical needs Is dependent on employment status, personal income, and successful enrollment in public health insurance program. Findings from this study indicate that people with disabilities generally were more likely to have health insurance than those without disability. An exception included those reporting a cognitive disability. Respondents in the cognitive disability group were younger had a higher likelihood of working in industries, such as customer service or retail, which typically do not provide health insurance. Altman and Bernstein (2008) previously reported a gap in public health insurance coverage for people with emotional disabilities. In the U.S., health insurance is most often obtained through employment. Thus, people with disabilities, who experience unemployment at an amount nearly twice as high as those without disability, are more likely to obtain health care coverage through public programs (Altman & Bernstein, 2008). Passage of the ACA improved the quality and access to health insurance for people with disabilities by addressing limitations on coverage, removing cap on lifetime benefit, and through expansion of Medicaid program (Krahn et al., 2015).

Findings from this study are consistent with previous research documenting higher rates of chronic disease among people with disabilities. Although rates of chronic disease were not consistently distributed across disability groups, those with disabilities, regardless of type, generally reported higher rates of several chronic conditions than those without disability. Compared to the no disability group, respondents with mobility and multiple disabilities reported prevalence rates that were three and five times higher for diabetes, five and six times higher for heart disease, four and seven times higher for respiratory disease, and eight and thirteen times higher for stroke. While differences in prevalence rates for chronic conditions were not always significantly higher across the cognitive, vision, and self-care disability groups, there were significant differences across measures of self-reported health status. People with cognitive and self-care disabilities indicated that for at least two weeks out of the month, they experienced poor physical and mental health. The number of combined unhealthy days jumps to 25, which represents over 4/5^{ths} of the month, for people with multiple disabilities, considerably higher than the 4 days reported by those with no disability.

After controlling for covariates and total number of disabilities, all groups of disability had significantly higher odds of reporting respiratory disease and fair or poor health; and all disability groups, except the mobility group, had a higher odds of reporting stroke. In this study, the relation between disability and heart disease, cancer, or diabetes does not appear to be strong. This is notable because previous studies consistently indicate that people with disabilities experience health disparities. There are several potential explanations. Research shows that chronic conditions are highly correlated to lifestyle choices, such as regularly meeting physical activity and nutrition recommendations (IOM, 2012). For people with disabilities, a population that experiences a variety

of infrastructure, societal, physical, and programmatic barriers to healthy choices, those factors may explain more of the disease distribution than the disability (Rimmer et al., 2014). Additional factors which influences health among the disability population include disability severity, temporality, and age of disability onset, which were not assessed in the BRFSS.

BRFSS is a cross-sectional study, therefore one cannot determine causality. Studies indicate that both respiratory disease and stroke may lead to functional limitations, and like disability, the occurrence of both increases with age. Stroke is the second leading cause of death in the world and one of the leading causes of long-term disability in the U.S. (Katan & Luft, 2018). One study found that 26% of those who experience a stroke have disability in basic activities of daily living and 50% experience some reduction in mobility (Kelly-Hayes et al., 2003). Given the long-term effects of stroke, it is not surprising that the multiple disabilities group had the highest prevalence of stroke. Additionally, this study may present an under-representation of stroke as those residing in institutional settings, including those with severe disabilities potentially caused by stroke, were excluded from the BRFSS (CDC, 2018). Further research should explore the contributing factors to respiratory disease across functional disability groups so that interventions that focus on prevention of disease or self-management symptoms can be developed and implemented.

While people with disabilities are at risk of developing chronic conditions, chronic conditions also lead to disability. The degree to which chronic disease and disability overlap empirically is unknown (Drum, XX). Having a disability does not cause chronic conditions the same way that chronic conditions may cause a disability. The same factors which contribute to chronic conditions among people without disabilities contribute to chronic conditions in people with disabilities - genetics, social determinants, and health behaviors. However, research indicates that people with

disabilities are disproportionately impacted by the social mediating factors that lead to chronic conditions and are more likely to experience the onset chronic disease earlier (Dejong et al., 2002), live with multiple chronic conditions, and are more likely to die as a result of chronic disease (Drum et al., 2005). Thus, more research is needed to disentangle the two concepts so that we have a better understanding of the degree to which chronic conditions result in disability and the contributing factors to the development of chronic condition among people with disabilities (Drum & Horner-Johnson, 2014). One way to achieve this is the use of disability and health research which limits the focus to people with long term disabilities who go on to develop chronic conditions is needed.

Despite the overall lack of significantly higher odds of reporting the surveyed chronic conditions, all disability groups were significantly more likely to report poor health on at least three of the five health status measures used in the regression analysis. After controlling for covariates and total number of disabilities, the disability groups were 1.26 to 1.43 times more likely to report fair or poor health, and 1.3 to 1.7 times likely to report a combined total of at least 14 days that their physical or mental health was not good the previous month. These results may indicate the presence of other chronic conditions (e.g., arthritis, high blood pressure) not examined in this study. Regardless, the presence of a disability increased the respondents' risk for chronic conditions and poor self-reported health, even after controlling for demographic characteristics known to be risk factors for poor health (e.g., socioeconomic status, race, insurance). It is important that health and disability researchers begin to disentangle the factors which contribute to these disparities. Efforts to provide accessible public health interventions to increase healthy behaviors among people with disabilities and addressing environmental and financial barriers are critical next steps.

Poor health status among people with disabilities may be related to barrier to accessing health services, and subsequent impacts on quality and quantity of healthcare. Despite passage of the ADA three decades ago, healthcare facilities and services are not fully accessible. A 2010 survey of healthcare facilities in California found that less than half met ADA accessibility requirements (Mudrick et al., 2012). In additional to lacking accessible design features, healthcare care facilities may not have accessible equipment, including exam tables, diagnostic equipment, and weight scales, or provide adequate translation services for people with hearing disabilities. People with disabilities experience financial barriers to healthcare as well. Adults with disabilities are over 2.5 times more likely to forego or postpone healthcare due to cost (Altman & Bernstein, 2008; CDC, 2010). This is particularly concerning because those with multiple disabilities and/or chronic conditions often require more complex management of their health, and the consequences of delaying or forgoing care can be more detrimental to overall health (Krahn et al., 2015).

Like challenges related to accessible healthcare facilities and services, public health programs and interventions are fraught with access barriers. Public health workers often lack general knowledge of providing disability accommodations, activity sites are often not accessible, and health promotion materials are typically not available in alternate formats (e.g., Braille, large print) nor do they accommodate people with cognitive limitations (Drum et al., 2009, Rimmer et al, 2014). Other publications have documented strategies to improve the health of people disabilities, to include augmenting the curriculum within schools of public health and for the public health workforce to include disability-specific trainings (Lollar & Andresen, 2007; Krahn et al., 2015) improve disability specific public health data collection and research coordination, and adapting evidence-based interventions to not only be programmatically and physically accessible, but also to

include content specific to the context in which people with disabilities make health decisions (Drum et al., 2009; Rimmer et al., 2014). Improving rates of chronic conditions and overall health status among people with disabilities requires a multi-level approach, including strategies which target individual-level behaviors which contribute to poor health, environmental barriers that restrict access, and policies that require disability inclusion and accessibility throughout the continuum of public health research and practice.

This study has several limitations. First, BRFSS telephone survey may underestimate the prevalence of disability as it excludes people living in institutions and those whose disability may prevent them from answering the phone. Alternately, the BRFSS telephone survey might overstate the prevalence of disability because it does not distinguish between disabling conditions that are permanent or temporary. Second, BRFSS relies on self-report data that can be biased. Third, cross-sectional studies cannot establish temporal precedence. Thus, it is unknown if the chronic condition led to the disability or if functional limitation contributed to development of a chronic condition. Lastly, the discrepancy in translation from English to Spanish for the wording of the question to determine vision disability status may not only have resulted in a higher number of people with a Hispanic ethnicity but may also mean these results may not be generalizable to those with serious vision limitation.

Conclusion

This study contributes to the growing body of literature documenting worse measures on determinants of health, self-rated health status, and chronic disease health disparities among people with disabilities. While there were differences in rates of chronic disease across disability types, perceived health status was substantially worse among every group reporting a disability than

those without disabilities. People with disabilities experiences lower rates of education, employment, and income which impact health in profound ways, thus further action is needed to improve educational and employment opportunities for people with disabilities enabling them to earn higher wages and maintain adequate healthcare coverage. Improving the health of people with disabilities requires a multi-level approach which includes both accessible public health interventions and strategies to address environments barriers to health, education, and employment opportunities.

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Journal Article

Access to Health-Promoting Environments and Select Health Behaviors among Persons with Disabilities in Texas

Targeted Journal: Disability and Health Journal

Abstract

Background: The prevalence of disabilities is rising steadily, reflecting an aging population and an increasing burden of chronic conditions affecting quality of life. Studies show that people with disabilities are less likely to participate in health promoting activities, but there is limited information on how behaviors or access to health promoting environments vary across disability types. This information is critical to tailoring interventions for improving health and eliminating health disparities among those with disabilities.

Objective: The purpose of this study was to examine the relation between functional disability type and health behavior and access to health promoting environments.

Methods: Functional disability data from the 2013 Texas BRFSS, a statewide telephone survey examining health-related behaviors, were analyzed. The prevalence of meeting physical activity, consuming one or more fruits and vegetables, smoking, and access to health promoting environments by disability type were obtained and adjusted with sampling weights. Average number of fruits and vegetables eaten per day were compared across disability groups. Logistic and linear regression analysis were used to examine the relation between disability type and health behavior and environment while controlling for covariates.

Results: Prevalence of meeting physical activity recommendations were varied across disability groups. After controlling for demographic variables and total number of disabilities, all groups reported higher odds of smoking (AOR range 1.3—1.4), and lower odds of living in a home environment without smoking rules (AOR range .57—.62), eating one or more vegetable per day (AOR range .77—.8), and access to affordable fruits and vegetables (AOR range .48—.68). Additionally, the vision disability group reported lower odds of eating one or more fruit per day (AOR=.84).

Conclusion: Differences in health behavior and access to health promoting environments exist across functional groups of disability demonstrating that disability type should be considered a demographic variable in health research. A better understanding of the relation between health behaviors and disability type, and the environments that facilitate or inhibit healthy behaviors, is critical to understanding and addressing health disparities among people with disabilities. More research is needed to determine how disability type, social determinants of health, and disabling barriers interact to influence health outcomes among this growing population. Public

health interventions should be designed to be universally accessible so that all people, regardless of disability type, have equal access to health promoting opportunities.

Background

As of 2015, there were more than 85.3 million people living with a disability in the U.S. (Courtney-Long et al., 2015.) Because of advances in medicine and the aging "baby boomer" population, this number is expected to increase (Hinton et al., 2017; IOM, 2007). Research consistently indicates that people with disabilities experience poor health outcomes compared to the general population (Carroll et al., 2014; Dixon-Ibarra & Horner-Johnson, 2012). Specifically, persons with disabilities are significantly more likely to report diabetes, cancer, stroke and heart disease, and are also more likely to report having one or more chronic diseases (Carroll et al., 2014).

As well, people with disabilities are less likely to engage in physical activity, more likely to have obesity, and more likely to smoke than those with no disabilities (Altman & Bernstein 2008; Gulley et al., 2011). Carroll et al. (2014) found that that rates of inactivity were nearly two times higher for people with disabilities compared to those with no disabilities, a concerning statistic because physical inactivity contributes to the development of chronic diseases, such as cardiovascular disease, diabetes, and cancer (Mathers, Stevens & Mascarenhas, 2009). Similarly, studies found that people with cognitive limitations or physical disabilities are more likely to have obesity and have significantly higher BMI values than those with no disabilities (Froehlich-Grobe et al., 2013; Reichard et al., 2011).

In 2011, the smoking prevalence was higher among individuals who reported having a disability (25.4%) compared with those who reported no disability (17.3%) (Agaku et al., 2012).

Using data from the Florida Behavioral Risk Factor Surveillance Survey (BRFSS) from 2007-2009, Hall and colleagues (2013) found people with disabilities were significantly more likely to smoke cigarettes and be exposed to secondhand smoke.

Recent studies highlight that built and social environmental barriers play an important role in whether people with disabilities participate in health promoting behaviors (Drum et al., 2009; Rimmer, Riley, Wang, Rauworth & Jurkowski, 2004). Several studies have documented the barriers to physical activity that people with disabilities encounter, ranging from physical barriers, such as no curb cuts, to encountering staff who are unable to provide instructions on how to use the exercise equipment. Low income neighborhoods are less likely to provide access to affordable fresh produce (Khan et al., 2009), and people with disabilities are more likely to live below the poverty threshold (Krahn et al., 2014).

In the past two decades, the field of disability within public health has increasingly received more attention (Krahn et al., 2014). The concept of disability has shifted from being viewed as a failed public health outcome to a descriptor of a minority population that, in comparison to the general population, experiences a variety of health disparities (Krahn et al., 2014). Furthermore, the field of public health now recognizes that people with disabilities can, and often do, experience fulfilling, healthy lives and similar to people without disabilities, are at risk of chronic conditions, and benefit from the same health promotion activities (CDC, 2013).

The paradigm shift of disability within public health is consistent with recent changes on how disability is viewed internationally (Krahn et al., 2015; Iezzoni & Freedman, 2008). In 2001, the World Health Organization (WHO) formally adopted the International Classification of

Functioning and Disability (ICF) as the framework through which disability is viewed and conceptualized. Within the ICF framework, disability includes bodily impairments, activity limitations, and participant restrictions that relate to health, but is not considered to be a condition that can only be addressed through medical intervention. This is a shift from the previously dominant medical model of disability in which disability was considered to be a condition to be prevented or cured (Iezzoni, 2011). Instead, the ICF highlights the need to maximize the function and well-being of people with disabilities by conceptually reframing disability as the gap that results from the interaction between activity limitations and either personal or environmental factors (WHO, 2001). In this manner, a disability can be mitigated through an accessible environment, modifications, or accommodations. Thus, disability is dynamic and situation-dependent and the impact on an individual's employment, social life, education, and health opportunities vary greatly. Examining health across different disabilities, or functional limitation types, provides a better understanding of how people with various types of disabilities engage in health promoting behaviors, and what environmental barriers or facilitators they might encounter.

Examining population-level health outcomes across different disability types (e.g., mobility, cognitive, vision, self-care, independent living) is now possible after recent changes to national health surveys. The Affordable Care Act required that federally funded surveys standardize disability-related questions (Stevens et al., 2016), resulting in changes to state level BRFSS questions.

Prior to 2013, the BRFSS included two questions about use of special equipment and activity limitations to determine if a respondent had a disability. There are now five additional

questions which are located within the demographics section and are designed to identify not only disability status, but also the type of functional limitation (e.g., mobility, vision, cognitive, self-care and independent living) (Courtney-Long, 2014). A better understanding of the relations between functional disability status and health behaviors and environments will allow public health practitioners and policy makers to develop and implement public health programs that are tailored to the specific needs of disability subgroups (Gettens et al., 2015).

The objective of this study was to examine the relation between functional disability status and access to health-promoting behaviors and environments. This study hypothesized that Texans with disabilities report significantly lower consumption of fruits and vegetables, engagement in physical activity, and more smoking compared to adults without disabilities. Second, I hypothesized that Texans with disabilities were significantly more likely to report lower neighborhood access to physical activity-promoting environments, lower access to fruits and vegetables, and greater exposure to secondhand smoke.

Methods

Study Design

Data for this cross-sectional study were collected as part of the 2013 Texas BRFSS. The purpose of the BRFSS is to collect information on demographics, health-related risk behaviors, chronic health conditions and use of preventive services to inform health-related program and policy development (CDC, 2018). In this study, Texas BRFSS data was used to quantify estimated differences in select health behaviors and health-promoting environments between groups of functional disability or multiple disabilities and those without a disability.

Data Source

The BRFSS is a state-based public health random digit telephone survey, developed by the CDC in 1984. Survey methods and questionnaires are standardized across all states, Washington D.C., and US territories, allowing for comparisons across sub-regions, states, and to the nation (CDC, 2018). BRFSS survey interviewers complete standardized training to ensure consistent collection of comprehensive demographic, health, behavioral health risk, and preventative health data. The BRFSS uses a disproportionate stratified sample (CDC, 2018) and data are subsequently weighted to reflect the complex sampling methods and nonresponse bias of the final sample (Gettens, Lei, & Henry, 2015).

Prior to 2013, there were only two disability-related questions in the core set of BRFSS questions: 1) "Are you limited in any way in any activities because of physical, mental, or emotional problems?" and 2) "Do you now have any health problems that requires you to use special equipment, such as a cane, wheelchair, a special bed, or a special telephone?" An affirming response to either question indicated disability, while a negative response to both questions were coded as not having a disability. In 2013, the CDC added five of a six question series recommended by U.S. Department of Health and Human Services designed to indicate functional disability status by assessing serious difficulty in vision, cognition, ambulation, and any difficulty in self-care or independent living (U.S. HHS, 2011). The sixth question assesses serious difficulty in hearing and was not included in the 2013 BRFSS due to concerns about variation in survey methods resulting from use of an interpreter or relay service. The new disability questions are consistent with the conceptualization of disability as outlined in the ICF and are currently

used in the American Community Survey, National Health Interview Survey, and among other population-level surveys (Ward et al., 2017).

Brault (2013) examined the reliability and stability of the 6-question disability measures as presented in the Survey of Income and Program Participation and determined that the disability measures had relatively moderate to low reliability with coefficients ranging between 0.414 (vision difficulty) and 0.638 (ambulatory difficulty) but remained relatively stable over a year (r=0.937).

Survey Sample

The BRFSS uses a random digit dialing method to select survey respondents by calling either cellular or landline telephone, omitting business and nonworking telephone numbers (CDC, 2018). Only one adult, aged 18 or older, from each household may complete the survey. Along with individuals under the age of 18, those living in an institutionalized setting and those who are deaf or hearing-impaired are excluded from the survey (CDC, 2018). This study excluded respondents with missing, “refused”, or “don’t know” responses to any of the five functional disability questions or health behavior or environmental questions of interest.

Human Subjects

The University of Texas Health Science Center (UTHealth) Committee for the Protection of Human Subjects approved an IRB exemption because publicly available de-identified data was used for the study.

Survey Items

Independent Variables

Prior to 2013, there were only two disability-related questions in the core set of BRFSS questions: 1) “Are you limited in any way in any activities because of physical, mental, or

emotional problems?" and 2) "Do you now have any health problems that requires you to use special equipment, such as a cane, wheelchair, a special bed, or a special telephone?" An affirming response to either question indicated disability, while a negative response to both questions were coded as not having a disability. In 2013, the CDC added five of a six question series recommended by U.S. Department of Health and Human Services designed to indicate functional disability status by assessing serious difficulty in vision, cognition, ambulation, and any difficulty in self-care or independent living (U.S. HHS, 2011). The sixth question assesses serious difficulty in hearing and was not included in the 2013 BRFSS due to concerns about variation in survey methods resulting from use of an interpreter or relay service. The new disability questions are consistent with the conceptualization of disability as outlined in the ICF and are currently used in the American Community Survey, National Health Interview Survey, and among other population-level surveys (Ward et al., 2017).

The independent variable is functional disability status as determined by responses to the following five disability questions: 1)Are you blind or do you have serious difficulty seeing, even when wearing glasses?, 2) Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?, 3)Do you have serious difficulty walking or climbing stairs?, 4)Do you have difficulty dressing or bathing?, 5) Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping? Response options include *yes*, *no*, *don't know*, and *refuse to answer*. Responses were dichotomized into yes or no responses, to form six mutually exclusive functional disability groups: "multiple disabilities" "mobility disability", "cognitive disability", "vision disability", "self-care disability" and "independent living disability". Those who answer

yes to only one of the functional disability questions were placed in their respective category, while those who self-report multiple disabilities were in the "multiple disabilities" group. Those who answer *no* to all five of the functional disability questions were in the "no disability" group. Table 2-1 includes information about the specific questions, scoring of the items, and reliability scores.

Brault (2013) examined the reliability and stability of the 6-question disability measures as presented in the Survey of Income and Program Participation and determined that the disability measures had relatively moderate to low reliability with coefficients ranging between 0.414 (vision difficulty) and 0.638 (ambulatory difficulty) but remained relatively stable over a year (r=0.937).

Table 2-1: Description of questions used to define disability status and total number of disabilities

Independent Variables	BRFSS Question	Survey Question and/or Calculation	Scale	Source Reliability/ Stability (1yr)
Mobility disability	C08Q27	Do you have serious difficulty walking or climbing stairs? And "No" to C08Q25-C08Q26 and C08Q28-C08Q29	Yes = 1 No = 2	Brault, 2007 0.638 0.918
Cognitive disability	C08Q26	Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions? And "No" to C08Q25 and C08Q27 - C08Q29	Yes = 1 No = 2	Brault, 2007 0.560 0.906
Vision disability	C08Q25	Are you blind or do you have serious difficulty seeing, even when wearing glasses? And "No" to C08Q26 - C08Q29	Yes = 1 No = 2	Brault, 2007 0.414 0.868
Self-care disability	C08Q28	Do you have difficulty dressing or bathing? And "No" to C08Q25 - C08Q27 and C08Q29	Yes = 1 No = 2	Brault, 2007 0.490 0.870
Independent living disability	C08Q29	Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping? And	Yes = 1 No = 2	Brault, 2007 0.594 0.908
Multiple disabilities		"Yes" to ≥ 2 of C08Q25 - C08Q29	Yes = 1 No = 2	
No disability		"No" to questions C08Q25 thru C08Q29	Yes = 1 No = 2	
Total number of disabilities		Combined number of positive responses to questions C08Q25 - C08Q2	1 to 5	

Dependent Variables

Measures of health behavior include meeting minimum physical activity and fruit and vegetable intake recommendations and smoker status. Physical activity was measured using the following two dichotomous variables: “met aerobic recommendations” and “met strength training recommendations” and was calculated based on the reported type, frequency, and duration of physical activity. If the respondent engaged in at least 150 minutes per week of moderate-intensity activity, or at least 75 minutes per week of vigorous-intensity activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity, then “met aerobic recommendations” was coded as *yes*. If the respondent indicated they performed non-aerobic exercises to strengthen muscles, such as push-ups, free weights, or elastic bands, two or more times in a week, “met strength training recommendations” was coded as *yes*. Calculations to determine if respondents met aerobic and strength training recommendations were based on published physical activity guidelines (2018 Physical Activity Guidelines Advisory Committee, 2018). BRFSS physical activity measures of recommended aerobic activity and strength training have been found to have moderate reliability (***k*** = .67-.84) and (***k*** = .85-.92) and low to moderate validity (***k*** = .19-.41) and (***k*** = .40-.52). Despite low to moderate validity scores, previous findings suggest that this instrument is appropriate for classifying adults into recommended levels of physical activity (Yore et al., 2007).

A total of four variables were used to examine fruit and vegetable consumption: two continuous variables (“median number of fruit eaten” and “median number of vegetables eaten”), and two dichotomous (“consumed $\geq$ 1 fruit per day” and “consumed $\geq$ 1 vegetables per day”). The variable “median number of fruits eaten” was calculated based on responses to

two questions assessing how often the respondent ate fruits or drank fruit juice. The variable "median number of vegetables eaten" was determined based on responses to four of the questions assessing number of times per month the respondent ate: 1) beans, tofu, or lentils; 2) dark green vegetables; 3) orange-colored vegetables; and 4) other vegetables not previously mentioned. Responses to the previously described questions was used to dichotomize the two variables "consumed $\geq$ 1 fruit per day" and "consumed $\geq$ 1 vegetable per day". Fruit and vegetable consumption measures have been used in previous health and nutrition studies. While the current BRFSS fruit and vegetable module has not been directly evaluated, a slightly adapted module has been shown to be moderately valid and reliable (***r***= 0.33 - 0.77, ***k***= 0.19 - 0.47) (Nelson, Holtzman, Bolen, Stanwyck, & Mack, 2001). To examine smoking behavior, one variable, "current smoker", was dichotomized to identify those who report smoking at least 100 cigarettes in their lifetime and currently smoking cigarettes *some days* or *every day*. Table 2-2 provides information about the questions used to determine measures of health behavior.

Six variables were used to examine access to environments that promote physical activity, nutritious eating, and protection from secondhand smoke. The variable "bike/walk access" was determined by responses to a question about living in a neighborhood that includes at least one safe place to walk, jog, or bike. BRFSS defines "neighborhood" as the area within 1 mile of the respondent's primary residence (BRFSS, survey questions).

Access to fruits and vegetables was measured by three dichotomous variables specific to grocery store access and fruit and vegetable availability and affordability. The variable "fruit and vegetable access", was determined by the *yes*/*no* response regarding ease of getting to a store that sells fruit and vegetables. Respondents who indicate that fruits and vegetables are *very*

available was coded as a "yes" for "fruit and vegetable availability", and respondents who report that fruits and vegetables are *not expensive* was coded as "yes" for "fruit and vegetable affordability".

Secondhand smoke exposure was measured by two variables, "workplace smoke rules" and "home smoke rules", each determined by questions about the presence of rules or policies prohibiting smoke in the workplace or home. Table 2-3 provides information about the questions used to determine measures of access to health-promoting environments

Table 2-2: Description of questions used to define health behavior measures

Dependent Variables	BRFSS Question	Survey Question and/or Calculation	Scale	Reliability/ Validity
Physical Activity				
Meets physical activity recommendations (BRFSS calculated variable)	C12Q01	During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?	Yes = 1 No = 2	Yore (2007) k = .67-84 k = .19-.41
		If "yes" then proceed to question C12Q02, If "no" then skip to C12Q08		
	C12Q02	What type of physical activity or exercise did you spend the most time doing during the past month? _____ (type of activity)		
		If "don't know/not sure" then skip to question C12Q08, If "refused" then skip to C12Q08		
		Interviewer codes activity based on a list of 76 possible types of activity/exercise.		
		See Figure 1: BRFSS Activity Code List		
	C12Q03	How many times per week or per month did you take part in this physical activity or exercise during the past month? ___ times		
	C12Q04	And when you took part in this activity, for how many minutes or hours did you usually keep at it? ___ hours and minutes		
	C12Q05	What other type of physical activity gave you the next most exercise during the past month? If "no other activity" then skip to C12Q08		
		Interviewer codes activity based on a list of 76 possible types of activity/exercise.		
		See Figure 1: BRFSS Activity List		
	C12Q06	How many times per week or per month did you take part in this physical activity or exercise during the past month? ___ times		
	C12Q07	And when you took part in this activity, for how many minutes or hours did you usually keep at it? ___ hours and minutes		
		If ≥ 150 per week of moderate-intensity aerobic activity, or ≥ 75 minutes of vigorous-intensity aerobic activity (where vigorous-intensity minutes are x 2), or an equivalent combination, then		
Meets strength training recommendations (BRFSS calculated variable)		During the past month, how many times per week or per month did you do physical activities or exercises to strengthen your muscles? Do NOT count aerobic activities like walking, running, or bicycling. Count activities using your own body weight like yoga, sit-ups or push-ups and those using weight machines, free weights, or elastic bands. ___ times, If more than 2 times per week, then	Yes = 1 No = 2	Yore (2007) k = .85-.92 k = .40-.52

Dependent Variables	BRFSS Question	Survey Question and/or Calculation	Scale	Reliability/ Validity
Fruit and Vegetable Consumption				
Median fruits eaten per day (BRFSS calculated variable)	C11Q01	During the past month, how many times per day, week or month did you drink 100% PURE fruit juices? *Do not include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to. Only include 100% juice /juice blends.* ___times	1 to 99	
	C11Q02	During the past month, not counting juice, how many times per day, week, or month did you eat fruit? *Fresh, frozen, and canned fruit are included.* ___times		
		C11Q01 + C11Q02 = total servings of fruit eaten per day		
Median vegetables eaten per day (BRFSS calculated variable)	C11Q03	During the past month, how many times per day, week, or month did you eat cooked or canned beans, such as refried, baked, black, garbanzo beans, beans in soup, soybeans, edamame, tofu or lentils. ____times	1 to 99	
	C11Q04	During the past month, how many times per day, week, or month did you eat dark green vegetables for example broccoli or dark leafy greens including romaine, chard, collard greens or spinach? __times		
	C11Q05	During the past month, how many times per day, week, or month did you eat orange-colored vegetables such as sweet potatoes, pumpkin, winter squash, or carrots? __times		
	C11Q06	Not counting what you just told me about, during the past month, about how many times per day, week, or month did you eat other vegetables? ____times		
		C11Q03 + C11Q04 + C11Q05 + C11Q06 = Total number of servings of vegetables/beans eaten per day		
Consumed ≥ 1 fruit per day		If C11Q01 + C11Q02 ≥ 1 then	Yes = 1 No = 2	
Consumed ≥ 1 vegetable per day		If C11Q03 + C11Q04 + C11Q05 + C11Q06 ≥ 1 then	Yes = 1 No = 2	
Smoking				
Current smoker	C09Q01	Have you smoked at least 100 cigarettes in your entire life? Yes = 1 , No = 2, Don't Know/Not at all = 7	Yes = 1 No = 2	
	C09Q02	Do you now smoke cigarettes every day, some days, or not at all? Every day, Some days, Not at all, Don't Know/Not sure, Refused		
		If C09Q01=1 and C09Q02 ="every day" or "some days" then		

Table 2-3: Descriptions of questions used to define health promoting environments

Table 3: Dependent Variables - Questions used to determine health promoting environmental measures of interest

Dependent Variable	BRFSS Question	Survey Question and/or Calculation	Scale
Access to health-promoting environments			
Bike/walk access	TX06Q01	In your neighborhood, do you have access to any sidewalks, shoulders of the road, trails or parks where you can safely walk, run, or bike?	Yes = 1 No = 2
Fruit and vegetable access	TX05Q01	Is it easy for you to get to a store that carries fresh fruits and vegetables or a farmer's market from your home?	Yes = 1 No = 2
Fruit and vegetable availability	TX05Q02	How would you rate the availability of fresh fruits and vegetables in the stores in your community? *Very available, somewhat available, not available* If "very available" then	Yes = 1 No = 2
Fruit and vegetable cost	TX05Q03	How would you rate the cost of fresh fruit and vegetables in the stores in your community? *Very expensive, somewhat expensive, not expensive* If "not expensive" then	Yes = 1 No = 2
Smoke-free home rules	TX10Q01	Which of the following best describes the rules about smoking inside your home? *Smoking is not allowed anywhere inside your home , smoking is allowed in some places or at sometimes, smoking is allowed anywhere inside your home, or there are no rules about smoking inside your home* If "smoking is not allowed anywhere inside your home" then	Yes = 1 No = 2
Smoke-free work rules	TX10Q03	Which of the following best describes your place of work official smoking policy for indoor public or common areas, such as lobbies, rest rooms and lunchrooms? *Not allowed in any public places, allowed in some public places , allowed in all public places, no official policy* If "not allowed in any public places" then "yes"	Yes = 1 No = 2
	TX10Q04	Which of the following best describes your place of work official smoking policy for work areas? *Not allowed in some work areas, allowed in some work areas, allowed in all work areas, no official policy* If "not allowed in any work areas" then "yes"	
		If "yes" to TX10Q03 and "yes" to TX10Q04 then	

Covariates

Demographic variables were self-reported. There are eight demographic variables of interest: sex (male, female), age, Body Mass Index (BMI), health insurance coverage (yes, no), race/ethnicity (Non-Hispanic white, Black, Hispanic, Other), education level (less than high school, high school, some college, college graduate), employment status (employed at least part time or not employed), and income category (<$15,000, $15,000-<$25,000, $25,000 -<$35,000, $35,000 -< $50,000, $50,000+). BMI was calculated by using a standard formula (weight (kg)/height(m) squared) from self-reported height and weight. Previous studies using BRFSS data categorized the demographic variables in similar ways (Froehlich-Grobe et al., 2016).

Data Analysis

Associations between functional disability status (independent variable) and health behaviors and access to health-promoting environments (dependent variables) were analyzed using SAS Studio (University Edition version 9.4, San Antonio, TX). This study examined demographic variables, health behaviors, and access to health promoting environments, comparing each functional disability group to the no disability group. Demographic characteristics, health behavior, and environment access measures were examined using descriptive statistics. Mean and standard deviation were calculated for continuous variables (e.g., “age”, “BMI”, “median fruits eaten per day”, “median vegetables eaten per day”) and proportions for categorical variables (e.g., “bike/walk access”, “fruit and vegetable access”, “fruit and vegetable availability”, “fruit and vegetable affordability”, “workplace smoke rules”, “home smoke rules”, “met aerobic recommendations”, “met strength training recommendations”, and “current smoker“). T-tests and chi-square analysis were used to determine if there were significant differences in health behaviors and environment access measures between each functional disability group and the “no disability group”.

Logistic regression analyses examined possible associations between the disability groups and health behaviors, as well as environmental factors related to health living. For this analysis, functional disability groups were stratified into three levels: those with only the disability of interest, those with multiple disabilities, and those with no disability. These analyses were adjusted for age, sex, BMI, race/ethnicity, income, education, health insurance coverage and total number of disabilities. Total number of disabilities was determined by the number of positive responses to five questions pertaining to functional disability status and accounted for the possible impact of living with multiple disabilities.

Results

Table 4 provides demographic information about the 2013 Texas BRFSS sample. Among the 10,456 respondents, 78.9% were classified as having no disability, 8.9% as having multiple disabilities,

5.3% as having only a mobility disability, 3.9% as having only a cognitive disability, 1.9% as having only a vision disability, and 0.3% as having only a self-care disability. The independent living group was excluded from further analysis because zero respondents in this group. The majority of respondents reported an ethnicity of Caucasian-non-Hispanic (47.9%), followed by Non-Caucasian Hispanic (35.6%), and then Black (11.8%).

Respondents in all disability groups, except cognitive, were significantly older than the no disability group, with average ages ranging from 40.0 (± 1.4) (cognitive) to 61.5 (± 0.9) years (mobility). The majority of all groups were women, except the self-care group. Across categories of disability, respondents reporting a disability, except vision, were mostly Non-Hispanic White. Hispanics made up the highest proportion of those reporting a vision disability (39.5%) and the second highest proportion of those reporting multiple disabilities (29.9%), mobility (19.9%), cognitive (33%), and self-care disability (30.8%).

There were significant differences across measures of socioeconomic status between respondents with and without disabilities, with generally lower income, education, and employment reported by those with disabilities. People with multiple disabilities or a mobility disability were less likely to report employment (15.8% and 35% respectively). The majority of respondents with multiple disabilities and vision disability reported an income of <$15,000 (38.1% and 27.4% respectively). Respondents indicating disability, except for the cognitive, were more likely report healthcare insurance, although for the vision group, the results were not significant. The majority of respondents reporting disability did not graduate college, although for the vision group the results were not significant. The majority of those reporting a vision disability had less than a high school education. Respondents with disability reported significantly higher measures for BMI than the no disability group (27.6±.1), with values ranging from 27 (±.9) (cognitive) to 31.3(±.5) (multiple disability).

Table 5 includes results from T-test and Chi-square analyses. There significant differences between those with and without disability across measures of physical activity. Across groups of disability, respondents reported lower prevalence rates of meeting physical activity recommendations, although results were only significant for the mobility and multiple disabilities groups. Compared to those without a disability, the prevalence rates of meeting aerobic (22.5%) or strength training (18.1%) recommendations at roughly half of the prevalence rates reported by people with no disability (45.7%. and 31.2% respectively). As well, respondents in the cognitive disability group were significantly less likely to report meeting strength training (19.9%) recommendations when compared to those without a disability (31.2%). Except for the cognitive group, respondents across disability groups, reported lower odds of meeting strength training recommendations, although none were significant after controlling for covariates. Respondents with disabilities reported higher odds of meeting physical activity recommendations, with AOR ranging from 1.1—1.3, but none were significant.

Compared to those with no disability, respondents with any disability generally reported less fruit and vegetable consumption. Respondents without disability reported higher prevalence rates of eating one or more servings of fruit (57.9%) or vegetables (79.7%) than respondents in all groups of disability, although results were only significant for the self-care group >1 fruit measure (30.8%) and the cognitive disability group > vegetable measure (70.3%).All disability groups reported lower odds for eating one or more pieces of fruit per day when compared to the no disability group, but the results were only significant for the vision disability group (AOR = 0.84, CI = 0.72—0.99). All groups reported significantly lower odds of eating more than one vegetable per day compared to the no disability group; with AOR ranging from 0.77 to 0.80. Table 2.6 provides adjusted odds ratios and confidence intervals from the regression analysis.

Respondents reporting disability indicated significantly higher odds of smoking compared to the no disability group, with AOR ranging from 1.3—1.4,

Respondents reporting disability generally reported less access to a safe place to bike or walk, but only those with multiple disabilities reported significantly lower prevalence compared to those without disability (65.7% vs 76.3% respectively) However, after controlling for covariates and number of disabilities, odds of living near a bike or walk for those reporting disability were mixed, and none were significant compared to those reporting no disability.

Across categories of disability, respondents generally reported more difficulty accessing fresh fruits and vegetables. Among those without a disability, 81.5% reported that fruits and vegetables were available in community grocery stores, a significantly higher percentage than those with a vision disability (63.6%) and self-care disability (48%), but significantly fewer than respondents in the mobility disability (87.5%). For the regression analysis, no significant differences remained in fruit and vegetable availability after controlling for covariates and total number of disabilities. Compared to those without a disability (92%), respondents with a cognitive disability (97%), were significantly more likely to report that fruits and vegetables were accessible, but those with multiple disabilities (88.6%). were significantly more likely to report fruits and vegetables were not accessible. After controlling for covariates and total number of disabilities, respondents with multiple disabilities had significantly higher odds of reporting fruit and vegetable accessibility (AOR = 1.4, CI = 1.01—1.94). Respondents in both the mobility and multiple disabilities groups were significantly less likely to report that fruits and vegetables were affordable (10.8% and 11.3% respectively) compared to the no disability group (23%). However, after controlling for covariates and total number of disabilities in the regression analysis, disability groups which had significantly lower odds of reporting fruit and vegetable affordability included those in the vision (AOR = 0.55, CI = 0.38—0.81), mobility (AOR = 0.48, CI = 0.3—0.76), cognitive (AOR = 0.6, CI = 0.39—0.92), self-care (AOR = 0.58, CI = 0.41—0.83), and multiple disabilities (AOR = 0.68, CI = 0.48—0.81) groups.

People without a disability (13.6%) were significantly less likely to report current smoker status compared to those in the multiple disabilities (26.6%), cognitive (26.5%), and vision (25.9%) disability groups. After controlling for covariates and total number of disabilities, all disability groups reported significantly higher odds of current smoker status, ranging from 1.29 (multiple disabilities) to 1.44 (mobility). The percentage of those who reported living in a smoke-free home ranged from 51.8% among those with a self-care disability to 78.2% among those with multiple disabilities. Among the no disability group, 89.9% reported living in a smoke free home, significantly more than all disability groups except the cognitive group (80.7%). After controlling for covariates and total number of disabilities, all disability groups, including the cognitive group, had significantly lower odds of reporting a smoke free home. However, there were no significant differences between disability groups and the no disability group in prevalence or odds ratios regarding workplace smoke rules.

Table 2-4: Weighted estimates of socio-demographic characteristics by disability group type: Texas BRFSS, 2013

	No disability		Multiple Disabilities		Mobility Disability Only		Cognitive Disability Only		Vision Disability Only		Self-Care Disability Only	
sample *n*	*n* =7671		*n* =1272		*n* =855		*n* = 366		*n* =195		*n* =29	
	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)	Weighted % or Average (SEa)	F / t value p value (95% CI)
Demographic Variables												
Weighted frequency	78.94 (0.58)	F=1645.3***	8.9 (0.4)	F=3375.18***	5.32 (0.29)	F=4845.76***	3.94 (0.29)	F=3751.74***	1.93 (0.23)	F=3355.49***	28 (0.08)	F=4528.88***
Age	42.97 (0.26)	t=165.50*** (42.47-43.48)	55.27 (0.82)	t=67.74*** (53.67-56.87)	61.52 (0.93)	t=65.83*** (59.68-63.35)	39.99 (1.38)	t=28.95*** (37.28-42.70)	45.6 (2.38)	t=19.18*** (40.93-50.26)	53.49 (3.35)	t=15.95*** (46.91-60.06)
Male	51.75 (0.88)	F=50.74***	36.5 (2.27)	F=30.57***	38.79 (2.71)	F=14.08**	39.84 (3.67)	F=6.28*	47.53 (6.02)	F=.06	63.1 (13.93)	F=.97
Race/ethnicity												
White	47.58 (0.87)		48.77 (2.37)		63.02 (2.75)		53.3 (3.78)		30.46 (4.8)		72.06 (12.25)	
Black	10.53 (0.62)	F=9.68***	18.13 (2.09)	F=6.94***	15.88 (2.3)	F=18.66***	11.78 (2.49)	F=1.59	17.18 (4.83)	F=5.14*	14.92 (11.69)	F= 1.94
Hispanic	37 (0.88)		29.92 (2.1)		19.88 (2.22)		33.03 (3.5)		39 (5.8)		11.28 (5.7)	
Other	4.9 (0.4)		3.19 (0.89)		1.22 (0.42)		1.89 (0.8)		13.36 (5.55)		1.73 (1.77)	
BMI[b]	27.56 (0.11)	t=245.53*** (27.78-27.78)	31.33 (0.45)	t=69.36*** (30.45-32.22)	30.98 (0.55)	t=56.04*** (29.9-32.06)	27.88 (0.62)	t=28.95*** (26.66-29.09)	28.17 (0.87)	t=32.237*** (26.45-29.89)	29.8 (1.64)	t=18.20*** (26.59-33.01)
Employed	64.14 (0.84)	F=309.14***	15.82 (1.56)	F=414.92***	35.01 (2.78)	F=59.71***	53.17 (3.84)	F = 1.07	53.18 (6.01)	F=.42	56.79 (13.47)	F=0.00
Health coverage	71.18 (0.84)	F=5.62*	76.44 (2.1)	F=4.24*	85.23 (2.21)	F = 23.17***	34.74 (3.57)	F=4.30*	65.1 (5.81)	F=1.66	92.77 (4.06)	F=8.68**
Education												
<High school	17.7 (0.79)		34.09 (2.36)		22.53 (2.53)		19.3 (3.06)		28.41 (5.67)		11.51 (5.74)	
High school	25.26 (0.77)	F=30.26***	28.18 (2.02)	F=30.93***	27.74 (2.46)	F=1.74	29.3 (3.36)	F=2.7148*	26.95 (5.69)	F=1.34	27.45 (11.17)	F=3.73*
Some college	31.07 (0.84)		26.99 (2.11)		31.46 (2.52)		36.07 (3.8)		23.99 (4.55)		57.69 (12.95)	
College graduate	26 (0.65)		10.74 (1.16)		18.26 (1.94)		15.32 (2.15)		20.65 (4.5)		3.35 (2.25)	
Income												
<$15,000	10.1 (0.6)		38.08 (2.6)		17.24 (2.45)		21.21 (3.22)		27.37 (5.62)		6.39 (4.32)	
$15,000-<$25,000	18.89 (0.77)		28.76 (2.43)		27.26 (2.77)		22.37 (3.26)		26.06 (5.02)		0.86 (0.89)	
$25,000-<$35,000	10.64 (0.61)	F=63.95***	12.4 (1.94)	F=63.97***	15.91 (2.3)	F=6.27***	10.35 (2.45)	F=2.069	9.66 (3.47)	F=4.06**	6.36 (5.58)	F=2.96*
$35,000-<$50,000	14.32 (0.71)		9.2 (1.53)		10.61 (1.75)		12.73 (2.6)		15.63 (5.02)		18.86 (9.04)	
$50,000+	46.1 (0.94)		11.56 (1.6)		28.98 (2.72)		33.34 (4.25)		21.28 (4.7)		67.54 (12.18)	

[5]Indpendent living disability, n=0, sample excluded from analysis

*p<.05, **p<.005, ***p<.0001

[a] Standard error, [b] BMI = (weight(kg)/(height)(m))2

Table 2-5: Weighted prevalence and weighted means of select health behaviors and environmental factors by disability group type: Texas BRFSS, 2013

	No disability		Multiple Disabilities		Mobility Disability		Cognitive Disability		Vision Disability		Self-Care Disability	
	Average or Weighted % (SE)	t or F value (95% CI.)	Average or Weighted %(SE)	t or F value (95% CI)	Average or Weighted %(SE)	t or F value (95% CI)	Average or Weighted %(SE)	t or F value (95% CI)	Average or Weighted %(SE)	t or F value (95% CI)	Average or Weighted %(SE)	t or F value (95% CI)
sample *n*	*n* =7671		*n* =1272		*n* =855		*n* =366		*n* =195		*n* =29	
Health Behaviors												
Met aerobic recommendations	45.65(0.93)	F=71.48***	22.50(1.97)	F=77.38***	32.0(2.62)	F=13.74**	39.31(3.8)	F=0.57	37.04(5.74)	F=.77	20.95(12.89)	F=1.84
Met strength training recommendations	31.24(0.86)	F=46.03***	18.08(1.95)	F=23.27***	21.02(2.45)	F=7.95**	19.89(2.9)	F=7.15**	18.26(5.34)	F=2.75	29.54(14.4)	F=.01
Consumed fruit 1 or more times per day	57.91(0.92)	F=2.1	56.44(2.45)	F=.14	54.19(2.91)	F=1.19	52.24(3.9)	F=1.83	54.5(6.45)	F=.19	30.87(11.33)	F=4.76*
Consumed vegetables 1 or more times per day	79.69(.8)	F=13.97**	75.09(2.13)	F=2.88	73.77(2.76)	F=3.41	70.29(3.56)	F=6.94**	76.59(5.02)	F=.15	70.11(12.3)	F=.58
Median fruit consumed per day	1.29(.02)	t=52.28*** (1.24-1.33)	1.31(.08)	t=16.09*** (1.15-1.47)	1.22(.07)	t=17.09***	1.22(0.12)	t=9.77*** (1.1-1.36)	1.11(.09)	t=11.89*** (.93-1.3)	.79(.12)	t=6.48*** (0.55-1.03)
Median vegetables consumed per day	1.94(.02)	t=78.49*** (1.89-1.99)	1.84(.08)	t=22.58*** (1.68-2.0)	1.61(.05)	t=30.45*** (1.5-1.72)	1.68 (0.11)	t=15.52*** (1.1-1.36)	1.83(.14)	t=13.35*** (1.56-2.1)	2.33(.64)	t=3.65*** (1.08-3.59)
Current smoker	13.59(.59)	F=55.05***	26.62(2.17)	F=41.03***	16.95(2.16)	F=.31	26.51(3.56)	F=15.67***	25.89(5.16)	F=5.54*	21.6(11)	F=.35
Environmental Factors												
Neighborhood access to safe bike & walk trail	76.34(1.2)	F=7.28*	65.69(3.49)	F=8.72**	68.90 (3.82)	F=2.71	73.94(6.53)	F=.01	78.01(8.11)	F=.16	68.61 (17.89)	F=.13
Fruit & vegetables available	81.48(1.12)	F=2.69	78.11(2.73)	F=.99	87.47 (2.27)	F=6.41*	77.72(4.6)	F=.47	63.58(9.2)	F=5.16*	47.95(20.36)	F=4.12*
Fruit & vegetables accessible	92.13(.82)	F=0.01	88.61(2.83)	F=11.78**	94.23 (1.88)	F=.99	96.65(1.58)	F=3.87*	93.33(3.54)	F=.12	93.74 (5.53)	F=.07
Fruit & vegetables affordable	23.01(1.21)	F=28.91***	11.3(2.17)	F=11.78**	10.83 (2.29)	F=10.37**	13.90(3.89)	F=2.11	11.63(4.99)	F=1.9	43.17 (22.94)	F=1.53
Smoking rules at home	89.86(.78)	F=47.44***	78.19(2.81)	F=14.83***	77.54 (3.99)	F=8.45**	80.68(5.03)	F=2.18	65.48(10.19)	F=8.81**	51.79 (19.52)	F=6.96*
Smoking rules at work	68.14(2.14)	F=0.02	75.52(8.29)	F=.67	70.16 (8.91)	F=.05	64.47(8.42)	F=.21	78.48(9.78)	F=.84	100 (0)	

§Independent living disability, n=0, sample excluded from analysis
*p<.05, **p<.005, ***p<.0001

Table 2-6: Regression analysis, health behaviors, and environmental factors by disability type: Texas BRFSS, 2013

	Multiple Disabilities			Mobility Disability			Cognitive Disability			Vision Disability			Self-Care Disability		
	Estimate	AOR	95% CI	Estimate	AOR	95% CI	Estimate	AOR	95% CI	Estimate	AOR	95% CI	Estimate	AOR	95% CI
Health Behaviors															
Met aerobic recommendations	0.13 (.07)	1.14	.99-1.32	0.21 (.12)	1.23	.98-1.54	0.19 (.1)	1.2	.99-1.46	0.11 (.09)	1.12	.93-1.35	0.18 (.09)	1.2	1.0-1.43
Met strength training recommendations	-0.08 (.08)	0.92	.78-1.1	-0.15 (.12)	0.86	.69-1.08	0.05 (.11)	1.06	.85-1.31	-0.01 (.1)	0.99	.81-1.2	-0.07 (.09)	0.94	.78-1.13
Consumed ≥ 1 fruit per day	-0.1 (.07)	0.91	.8-1.04	-0.12 (.1)	0.89	.73-1.1	-0.14 (1)	0.87	.73-1.03	-0.17 (.08)	0.84	* .72-.99	-0.12 (.08)	0.89	.76-1.04
Consumed ≥ 1 vegetables per day	-0.22 (.08)	0.8	* .69-.94	-0.26 (.11)	0.77	* .62-.97	-0.23 (.11)	0.8	* .65-.98	-0.27 (.1)	0.77	* .63-.93	-0.24 (.09)	0.79	* .65-.95
Current smoker	0.25 (.08)	1.29	** 1.1-1.51	0.36 (.11)	1.44	** 1.15-1.79	0.29 (.11)	1.34	* 1.09-1.65	0.26 (.1)	1.3	* 1.07-1.57	0.31 (.09)	1.36	** 1.13-1.63
Environmental Factors															
Neighborhood access to safe bike & walk trail	0.02 (.13)	1.02	.8-1.31	-0.01 (.2)	0.99	.68-1.46	0.05 (.14)	1.05	.80-1.38	-0.03 (.15)	0.97	.72-1.31	0.01 (.15)	1.01	.76-1.35
Fruit & vegetable availables	-0.09 (.12)	0.91	.72-1.16	-0.19 (.17)	0.82	.59-1.16	-0.23 (.16)	0.79	.58-1.09	-0.05 (.15)	0.95	.71-1.26	-0.07 (.14)	0.93	.71-1.22
Fruit & vegetables accessible	0.33 (.17)	1.4	* 1.01-1.94	0.22 (.21)	1.25	.84-1.86	0.18 (.2)	1.2	.82-1.78	0.31 (.18)	1.36	.95-1.94	0.29 (.17)	1.37	.95-1.88
Fruit & vegetables affordability	-0.39 (.15)	0.68	* .5-91	-0.74 (.24)	0.48	** .3-.76	-0.52 (.22)	0.6	* .39-.92	-0.59 (.19)	0.55	** .38-.81	-0.54 (.18)	0.58	** .41-.83
Smoke free home	-0.47 (.13)	0.62	* .48-.81	-0.52 (.2)	0.59	* .40-.88	-0.57 (.18)	0.57	** 4-81	-0.51 (.16)	0.6	** .43-82	-0.52 (.16)	0.6	** .44-.81
Smoke free workplace	-0.23 (.22)	0.79	.52-1.21	-0.35 (.3)	0.7	.39-1.27	-0.16 (.32)	0.85	.46-1.58	-0.34 (.28)	0.71	.41-1.24	0.22 (.55)	0.74	.44-1.25

[3]Independent living disability, n=0, sample excluded from analysis
*p<.05, **p<.005, ***p<.0001
* Standard error

Discussion

Findings from this study indicate that disability is strongly associated with poorer health behaviors, specifically, failure to meet recommendations for physical activity, fruits and vegetable consumption, and smoking. Association between disability and access to health promoting environments was not as strong, but findings suggest that experiencing disability, particularly multiple disabilities, increases risk for disabling barriers to nutritious food and physical activity, as well as exposure to secondhand smoke in residential settings.

Results from this study are consistent with previous research documenting higher rates of inactivity among people with disabilities (Carroll et al., 2014; Dixon-Ibarra & Horner-Johnson, 2012). Among respondents with multiple disabilities or self-care disability, prevalence rates for meeting aerobic recommendations were nearly half of the no disability group. In comparing measures of strength training, most respondents reporting disability were 10 to 15 percentage points lower than those reporting no disability. Many publications have documented a wide variety of social, programmatic, and structural barriers that people with disabilities encounter while participating in physical activity. Disabling barriers to physical activity include lack of accessible public transportation, activity sites that do not meet ADA accessibility requirements, lack of accessible exercise or recreational equipment, and staff without knowledge or skills to adapt program components or provide accommodations for people with disabilities (Martin Ginis et al., 2016). People with disabilities experience disability-specific barriers, in addition to the more traditional reasons for not engaging in exercise, such as lack of motivation, fatigue, and time constraints. This is particularly concerning for the disability population, because meeting

established physical activity recommendations mitigates risk of obesity and chronic diseases, conditions that people with disabilities experience at disproportionate rates (Krahn et al., 2015).

While respondents across disability groups reported a lower prevalence of meeting physical activity recommendations than those without a disability, significant differences did not remain after controlling for covariates in the regression analysis. People across disability groups reported worse measures of socioeconomic status, factors that are known to be associated with poor health. This is likely caused by strong associations between health behaviors and socioeconomic status measures of education, employment, and income, making it difficult for the analysis to identify associations between functional

Previous studies identified a smoking prevalence of about 25% among those with any type of disability (Agaku et al., 2012; Froehlich-Grobe et al., 2016). This is consistent with results from this study for respondents in the vision, cognitive, and multiple disabilities groups, but not for those with a mobility or self-care disability. The higher prevalence of smokers in the cognitive disability group may be due to the average younger age, and possible underlying conditions of mental illness (e.g., depression and/or anxiety) (Jiang et al., 2014) as smoking is often a coping mechanism to environmental stressors and anxiety (Grant et al., 2004). Across disability groups, respondents were significantly more likely to report living in a home which did not have rules about smoking indoors. Only about 50% of respondents with a self-care disability reported living in a home where smoking is not allowed. An interesting note, a previous study using the same dataset found that respondents who indicated disability, regardless of type, also reported significantly hire odds of respiratory disease after controlling for demographic variables and number of disabilities (pre-publication, Sanches, 2020).

Nutritious eating is a cornerstone of good health, yet food insecurity was previously reported to be associated with functional impairment among older adults (Lee & Frongillo, 2001). Disability status may impact accessing food in a number of different ways. Grocery shopping can be a complex process which requires adequate financial and transportation resources, and the cognitive ability to locate, plan, and carry out accessing food. Older adults and adults with a disability may have more difficulty accessing food due to physical limitations (Wolfe et al., 2003), inability to drive, financial limitations, and environmental limitations. To date there are few studies that explore how the built environment impacts the ability of adults with a disability to access food (Haung et al, 2012). Thus, more research is needed to better understand how the availability, affordability, accessibility of fruits and vegetables impacts eating choices among those with different types of disabilities.

Household food insecurity is associated with adverse health outcomes such as poor mental health, nutritional deficiencies and chronic disease such as diabetes and heart disease (Gunderson & Ziliak, 2015). Previous research has noted that along with low-income families, single parent families, and minorities, people with disabilities are also at increased risk for household food insecurity (Gorton et al., 2010). Shwartz et al. 2016 argue that previous studies examining food access, food insecurity and disability failed to recognize more nuanced environmental barriers that people with disabilities encounter when accessing public transportation (e.g., shaded bus stops with seating, unfavorable weather, long wait times, limited routes, unable to transport more than a few grocery bags), navigating the retail destination (e.g., entering store, moving around the store, reaching items on shelves), purchasing food (e.g., high cost of specialized diets, tube feeding supplies), and preparing nutritious food (e.g., inaccessible

kitchen equipment, lack of knowledge or skills to prepare food). Results from this study indicate there are differences in environmental factors that impact nutritious eating and further demonstrate that additional research is needed to better understand the relation between disability type, fruit and vegetable access, availability, and affordability.

Public health researchers studying disability and health have acknowledged the need for measurement tools that are inclusive of people with different types of disabilities (Drum et al, 2009). For this study, the measure used to gauge neighborhood access to a safe place to bike or walk is clearly a singular measure that is inadequate to capture the full extent to which neighborhood characteristics impacts physical activity across disability types. However, inclusion of this measure does three things that are worth noting. First, study results reveal differences, although most were not significant, in prevalence rates indicating that people with different types of disabilities may live in neighborhoods that provide different levels of access to opportunities to engage in physical activity. Second, the wording of the question, "In your neighborhood, do you have access to any sidewalks, shoulders of the road, trails or parks where you can safely walk, run, or bike?" provides an opportunity to highlight how language can be exclusive of people with disabilities. A person who uses a wheelchair may respond "no" to this question simply because they are unable to "walk", "run", or "bike" and believe the question does not apply to them. Similarly, they may not have the relevant experience to answer the question correctly. This is an example of how public health research is often not inclusive of people with disabilities. If consulted during the development of this question, a person with a disability might suggest rephrasing the question to be "*In your neighborhood, do you have access to sidewalks, shoulders of the road, trails or parks where you can safety walk, run, bike, play*

sports, or engage in other types of physical activity?". Third, this question provides an opportunity to highlight that when referring to "safe" sidewalks or shoulders of the road, people with disabilities experience additional types of safety concerns that should be considered in this research. Lack of curb cuts, steep inclines, broken sidewalks, untrimmed tree limbs, and loose gravel or rocks are just a few features of the neighborhood environment that cause additional safety concerns for those navigating the road with a wheelchair, motorized scooter, walker, or who have some difficulty ambulating (Rimmer et al., 2014).

People with disabilities, regardless of type, benefit from public health programs that promote healthy lifestyle choices and aim to reduce chronic disease (IOM, 2012). These public health programs should be inclusive and accessible to people with disabilities regardless of type. This is achieved through universal design, program modifications, and the provision of accommodations when necessary. Public health programs funded by governmental entities are legally required to ensure equal accessibility through Title II of the Americans with Disabilities Act, but this is often not the case (Rimmer et al., 2014). Evidence-based, yet inclusive and accessible, public health interventions begin with public health research that is inclusive of people with disabilities. Too often, people with disabilities are either systematically or deliberately excluded from public health research for reasons ranging from inaccessible facilities, narrowly defined inclusion criteria., inaccessible program materials, inadequate measurement tools, or concern for research integrity (Rimmer et al., 2014).

To successfully develop and implement public health interventions that are not only accessible to people with disabilities, but also contain intervention elements tailored to the disability experience, we must continue to elucidate how societal, structural, and policy barriers

and low socioeconomic status impact environments in which health decisions are made. For example, public health efforts to improve physical activity, obesity, and overall health status among people with disabilities requires strategies that address individual and environmental influences on health decisions. Implementing policy and design changes to make sidewalks, streets, public transportation, and community resources more accessible increases opportunities to engage in health promoting activities. Communities can address barriers associated with social environments and perceptions of discrimination and isolation by including people with disabilities, family members, and disability service providers in wellness coalitions, public health projects, and other community initiatives to target obesity, chronic conditions, and overall improved health status (CDC, 2013; Hinton et al., 2018). Lastly, public health interventions will be more effective if concurrently, communities work to address financial barriers and improve participation in employment and education opportunities.

Public health research often examines the influence of macro (e.g., poverty, income inequality), micro/interpersonal influences (e.g., social networks, social support) and individualistic characteristics (e.g., race, gender, and SES) on health, but how and to what degree the influence of these factors differs across disability groups is seldom considered (Lollar & Andresen, 2011). Additional research is needed to differentiate the influences of macro, micro, and individual characteristics on health through a lens of disability. This information is critical to developing public health interventions that are not only accessible to people with different types of disabilities but that also addresses specific disabling barriers.

The criticality of government bodies, community organizations, and public health entities implementing measures to address societal, programmatic, environmental barriers so that

people with disabilities may participate in health promoting opportunities, particularly activities that reduce obesity and chronic disease, cannot be overstated. The prevalence of disability is increasing, and the demand for healthcare resources from an already overtaxed healthcare system will increase as well.

This study has several limitations. First, BRFSS telephone survey may underestimate the prevalence of disability as it excludes people living in institutions, those whose disability may prevent them from answering the phone, and people who live in homes without a telephone or cell phone. Alternately, the BRFSS telephone survey might overstate the prevalence of disability because it does not distinguish between disabling conditions that are permanent or temporary. Second, BRFSS relies on self-report data that can be biased. Third, cross-sectional studies cannot establish temporal precedence. Thus, it is unknown if the chronic condition led to the disability or if functional limitation contributed to development of a chronic condition. Results pertaining to the self-care disability group may not be generalizable to other communities as the sample size included only 29 respondents. Lastly, discrepancy in the translation of the English word "serious" in the question assessing vision disability to the Spanish word for "some", (i.e. "serious difficulty" in English translated to "some difficulty" in Spanish) may have resulted in an under representation of Spanish speaking people with serious vision difficulty, limiting how these results can be generalized to other communities and across survey years.

Conclusion

We need further exploration of the health behavior differences across disability groups to inform public health researchers and policy makers implementing community-based programs to promote health and wellness. One cannot begin to examine or address health disparities

among those with disability, without considering the role of education, income, and employment status in accessing and benefiting from health resources. Across disability groups, there are differences in social determinants of health and further research is needed to determine how and to what degree these characteristics impact health behaviors and associated environmental barriers.

Most studies focusing on this topic group people with disabilities into groups that are too narrowly (e.g., etiology) or too broadly defined (e.g., requires assistance/uses assistive device), leaving us without a clear understanding of how health behaviors and environmental components that may influence those behaviors, differ across this diverse population. This specificity is necessary to develop and implement interventions or policy changes that will address the unique barriers and promote specific facilitators and ultimately improve the health in this expanding population.

To date, there are no published studies which use Texas BRFSS data to examine health behaviors and related environmental characteristics across functional disability groups. Health and disability researchers have called for more in-depth research to identify the specific causes of these disparities and develop interventions to address the barriers faced by this group (Horner-Johnson et al., 2014; Krahn et al.,2014). The public health significance of this study is that it seeks to examine important modifiable risk behaviors and environmental characteristics across functional disability groups to gain a better understanding of the barriers experienced by people in Texas with different functional limitations, thus allowing public health practitioners to develop interventions that address barriers.

Leaders among the fields of public health and disability should work with local community leaders and policy makers to ensure equitable opportunities for healthy promoting behaviors. It is important to inform policy makers and community leaders so that environmental and infrastructure decisions do not have unintended consequences of reducing accessibility (e.g., accessibility challenges, transportation and safety issues, caregiver accommodations, etc.)

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Journal Article

Inclusion and Accessibility Assessment of Health-Promoting Senior Centers in San Antonio

Target Journal: BMC Public Health Journal

Abstract

Background: People with disabilities experience higher rates of chronic disease and poor health status compared to those without disability. People with disabilities do not participate in community health programs to the same degree as those without disability due to social, programmatic, and environmental barriers. The Community Health Inclusion Index (CHII) is a community health assessment tool which evaluates the degree to which community-level health promoting opportunities to promote nutrition and physical activity are inclusive and accessible to people with disabilities. The CHII assess barriers to inclusion across five domains: build environment, equipment, program/services, staff, and policies.

Objective: The purpose of this study was to use the CHII to assess the inclusiveness and accessibility of nine San Antonio senior centers which provide nutrition and physical activity programs to local seniors and identify the barriers and facilitators to inclusion of seniors with disabilities.

Methods: Assessment of CHII survey items related to the built environment and equipment was conducted through an observational audit of the nine senior centers. Survey items under the domains of program and services, staff, and policies were completed through interviews with a City leadership and community organizations which provide services to people with disabilities. Pilot data on the usability and feasibility of the CHII survey tools were collected.

Results: The top barriers to inclusion included a lack of health promotion materials available in accessible formats, lack of accessible equipment in healthcare exam rooms, and neighborhood characteristics that make travel to the sites on foot unappealing. Top facilitators to inclusion included a robust nutrition and transportation program available at no cost to qualifying seniors, accessible site layouts, and an organization and community willingness to identify and improve inclusion and accessibility for people with disability in the San Antonio.

Conclusion: San Antonio senior centers provide an array of services with the majority being inclusive of seniors with disabilities. Partnerships with local transit, food bank, and YMCA/YWCA organizations help ensure nutrition and physical activity programs are inclusive and accessible to local seniors. Future considerations include adding questions to assess leisure/recreational activities. Future initiatives to improve accessibility and make health-promoting opportunities more inclusive of people with disabilities should use an established framework such as Guidelines, Recommendations, Adaptions Including Disabilities (GRAIDs).

Background

Approximately 85.3 million people in the U.S. have a disability (Taylor, 2018) with roughly 3.2 million of those individuals residing in Texas (U.S. Census Bureau, 2018). People with disabilities are a diverse segment of the population who experience limitations in cognition, mobility, and/or sensory function. Those living with disability have reported worse health across several measures (Office of the Surgeon General, 2005; Dixon-Ibarra & Horner-Johnson, 2012; IOM, 2007). Specifically, they are less likely to meet physical activity or body mass index (BMI) recommendations, more likely to smoke, and less likely to receive preventive screenings or vaccines (Froehlich-Grobe, et al., 2016; Stevens et al., 2014; Xu et al., 2017). People with disabilities are more likely to experience a chronic condition, including cancer, diabetes, heart disease, and stroke, and are more likely to have two or more chronic conditions than their nondisabled peers (Carroll et al., 2014). And, as with their nondisabled peers, people with disabilities are not immune from the negative health impacts typically associated with low socio-economic status (Reichard et al., 2014). This is particularly concerning because people with disabilities are more likely to live below the poverty threshold, be under- or unemployed, and less likely to complete high school or college or own a home (Krahn, Reyes, & Fox, 2014).

Over the past two decades the focus of disability within the field of public health has increasingly received more attention (Drum et al, 2009), with the concept of disability shifting from a failed public health outcome to a demographic variable that impacts one's health (Krahn et al., 2015; Office of the Surgeon General, 2005). Subsequently, there has been an increase in public health interventions targeting people with disabilities (Rimmer et al., 2014) and calls for

public health practitioners to design public health programs that are universally accessible to all members of the community (Drum et al., 2009).

Despite the recent focus on health disparities among people with disabilities, studies indicate that people with disabilities experience a variety of unique environmental, programmatic, and policy barriers when accessing health-promoting activities, including routine health care (Horner-Johnson et al., 2011), public health interventions (Drum et al., 2009), and neighborhood recreation and/or health centers (Rimmer, Riley, Wang, Rauworth & Jurkowski, 2004; Rimmer, 2005). Barriers experienced by people with disabilities include inadequate communication modalities, such as lack of Braille, electronic or large-print materials for people with vision deficiencies; inaccessible facilities and equipment; and lack of training by professionals to understand and address the needs of people with disabilities (Iezzoni, 2011). Researchers also note that persistent and stigmatizing societal attitudes influence the health and well-being of people with disabilities (Yee & Breslin, 2010; Iezzoni & O'Day, 2006).

The impact of policy, systems, and environment (PSE) on health behavior has been highlighted by state and federal initiatives relying on community-level approaches to promote healthy eating, physical activity, and reduce tobacco use and exposure to secondhand smoke (Kumanyika et al., 2008). Through a PSE approach, communities work together to change policies (e.g., increase taxes on tobacco sales), organizational systems (e.g., require training that supports new policy), and environmental factors (e.g., improve sidewalks and walking trails) to make the healthy options more accessible and available (Honeycutt et al., 2015). The PSE approach is consistent with the Social-Ecological Model (SEM), which posits that complex social and environmental system in which individuals exist, and how the concentrically larger systems in

which they regularly move, affect individual behavior (Glanz et al., 2008). Like the PSE approach, the SEM considers the multiple layers of influence and promotes a comprehensive approach to addressing public health issues.

Researchers who study disability and health recognize that strategies to promote health behavior at the community level may not address the social or physical barriers experienced by people with disabilities (Eisenger et al., 2015). Drum et al. (2009) developed guidelines for designing community-based health promotion programs for people with disabilities which include addressing physical, programmatic, process, communication, and transportation barriers; employing staff familiar with disability issues; and providing accommodations when necessary. Understanding health behaviors requires consideration of environmental barriers, yet the existence of reliable and validated measurement tools to assess environmental barriers is limited. To address this gap, public health researchers at the Center for Health Promotion Research for People with Disabilities at the University of Illinois at Chicago developed the Community Health Inclusion Index (CHII) to integrate disability-related items into a multi-level survey tool to assess ongoing healthy, active living initiatives in communities (Eisenberg et al., 2015). Through partnership with the National Center on Health, Physical Activity and Disability (NCHPAD), the CHII is promoted to those interested in improving community health opportunities for people with disabilities. Information about the CHII, including user guidance documents, an electronic dashboard to record CHII surveys results in a community-specific inclusion profile, and recommendations and resources for addressing areas of improvement based on the Guidelines, Recommendations, Adaptations Including Disability (GRAIDS) framework. The GRAIDS framework was developed to provide criteria and methods for adapting

obesity prevention interventions for individuals with physical and developmental disabilities (Rimmer, et al., 2014).

Within the CHII, and for this study, inclusion is defined as "a broad range of access to community-level health, and active living opportunities for people with a range of functional limitations" (Eisenberg, et al., 2015, pg. 3). Within the CHII Organization Assessment, inclusion is described as when "all community members 1) are presumed competent, 2) are recruited and welcome as valued members of their community; 3) fully participate and learn with their peers; and 4) experience reciprocal social relationships" (CHII Organizational Assessment, pg. 2). To date, there is no published literature detailing a study that used the CHII tool to assess the inclusion and accessibility of senior centers.

The City of San Antonio promotes physical activity and healthy eating through activities at neighborhood senior centers. Health promotion opportunities at senior centers, including cooking and exercise classes, are free of charge and open to all San Antonio seniors (60+ years); however, inclusiveness of community health programs that promote nutritious eating and physical activity in this population had not been measured. The purpose of this study was to utilize the Community Health Inclusion Index (CHII) survey tool to assess the physical and programmatic accessibility of San Antonio senior centers and identify the most prevalent facilitators and barriers (e.g., programmatic, physical, transportation, etc.) to inclusion.

Methods

Study Design

This cross-sectional study used the Community Health Inclusion Index (CHII) tool (Eisenberg et al., 2015) to assess the physical and programmatic accessibility of nine city-

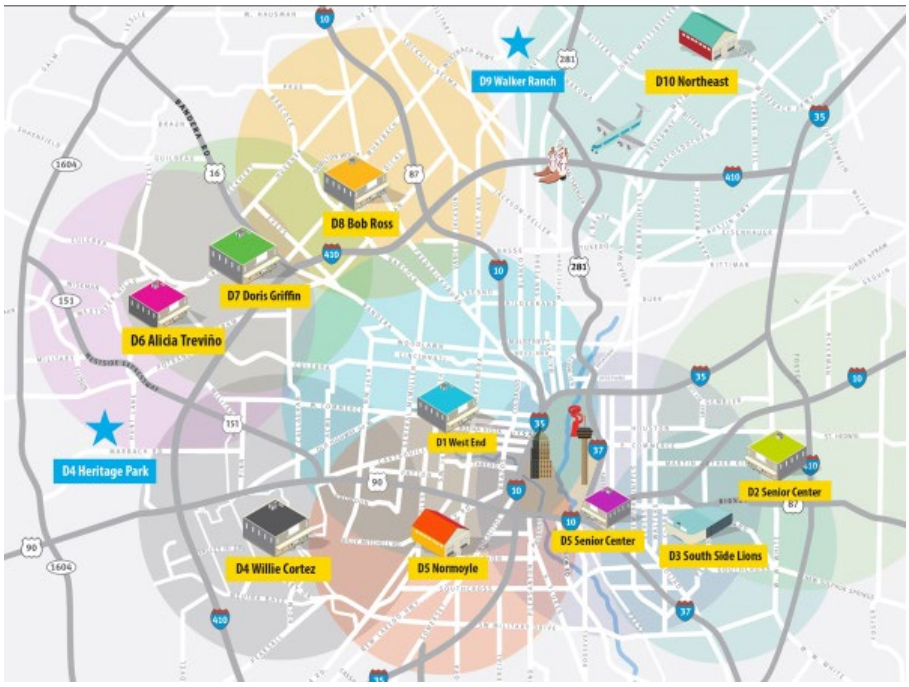
managed senior centers in San Antonio, Texas. The CHII is a mixed-method series of three surveys designed to be completed in collaboration with a community partner and serve as a tool of practical application for identifying and addressing accessibility and/or inclusion issues (Eisenberg et al., 2015). Results from this pilot study will be provided to the City of San Antonio for consideration during future inclusion or accessibility planning.

This study was the result of a collaborative effort between the City of San Antonio Disability Access Office, Human Services Department, and Metro Health Equity Office. The Disability Access Office served as the City's point of contact, by facilitating and organizing group meetings and ensuring ongoing City engagement and collaboration. The Human Services Department obtained permission from their leadership, facilitated scheduling the assessments, and dedicated staff time to complete survey questions and follow-up meetings. The Metro Health Equity Office played a nominal role but may use completed assessment data in ongoing or future City equity initiatives.

Survey Sample

The survey sample consisted of 9 senior centers which provide health services and are managed by the San Antonio Human Services Department (HSD) (Figure 1). The HSD also provides limited services to seniors in 78 additional locations through partnership with State or local organizations. These locations were excluded from the study because no HSD staff worked there, the facility was not City-owned, or few health services were offered, resulting in limited ability of the City to make potentially recommended changes to address accessibility and inclusion issues identified through the assessment. One additional senior center was also omitted from the sample, because a final evaluation was not allowed due to the coronavirus pandemic.

Figure 1: Map of San Antonio Senior Centers



Reference: San Antonio Human Services Department, About Senor Services Division presentation, March 2019

Center program and activities included congregate meals, exercise and dance classes, art and computer classes, health screenings, wellness education, and recreational activities (e.g., Bingo, table tennis, billiards games, etc.) provided by a mix of City staff and community organizations such as YMCA and San Antonio Food Bank. WellMed, a physician-led healthcare delivery system that specializes in serving older adults, provided health and wellness services at each of the senior centers. According to recent HSD report, on an annual basis, the City has served 23,000 seniors, providing 620,000 meals, 111,300 one-way trips, and 8,500 programming activities across the 10 centers (HSD, 2019). HSD reported that, of the seniors who participate in senior center activities, 28% live in poverty, 25% are married, 20% widowed, and 34% report having a disability (HSD, 2019). The majority of the participants identify as being Hispanic (57%), with the remaining being White (26%), Black (10%), Asian (3%), and other (4%).

Human Subjects

IRB approval was obtained from the University of Texas Health Science Center at Houston (UTHealth) Committee for the Protection of Human Subjects (HSC-SPH-19-0705).

Community Health Inclusion Index (CHII)

The CHII was designed to help communities collect information about the extent to which healthy-living resources are inclusive of people with disabilities. The CHII was developed through an extensive process that included a systematic literature review, focus groups, and field-testing, in collaboration with disability stakeholders, including both people with disabilities and people working for disability service organizations (Eisenberg et al., 2014). Across its three survey tools, the CHII is comprised of inclusion questions that assess nutrition-focused activities (14 questions), physical activity (8 questions), accessible program materials (e.g., Braille, large print), staff training (5 questions), health and wellness promotion/coalitions (3 questions), healthcare (4 questions), and readiness for change (7 questions). Specifically, the nutrition and health eating questions assess nutrition programs and materials, healthy food pricing and promotion vending, wellness committee/coalitions, healthy eating/food policies, and nutrition standards for meals and snacks. Physical activity inclusion questions include physical activity programming, adapted programs, equipment and materials, physical activity policies, and walking/biking/rolling to school. Questions regarding the inclusive staff policies include disability awareness training and policies, incentives for engaging in healthy lifestyle practices, and modeling healthy behaviors.

Field testing indicated a Cronbach's alpha ranging from 0.70 to 0.97, depending on the subscale, with an inter-rater agreement indicating that 14 of 15 venues for physical activity or healthy eating had strong agreement (0.81-1.00), while one venue had substantial agreement (0.61 – 0.80) (Eisenberg et al., 2015).

The first survey, the *CHII Onsite Assessment,* focuses on the accessibility of the built environment and includes both questions that require direct observation or measurement and follow-up or open-ended answers. The *CHII Organization Assessment* focuses on programmatic accessibility and policies that promote inclusion and requires face-to-face interviews with staff or other personnel representing the organization. The *CHII Macro-Community Assessment* highlights the impact of City practices and policies regarding transportation, infrastructure, and community planning.

Structure

The CHII was designed in a hierarchical structure with five levels: Level 1 is the most distal (community sectors) and Level 5 is the most proximal (items that measure a common accessibility-related theme) (Table 3-1). Community sectors in Level 1 (i.e. schools, worksites, healthcare sites, community organizations/institutions, and the community-at-large) were identified by the CDC as representing a common framework for examining a community's healthy living resources (Honeycutt et al., 2010) and have been used in similar studies (Kim et al., 2010). In this study, senior centers operated by the City of San Antonio were assessed; thus, the community sectors of interest are community organizations/institutions and the community-at-large focused on senior centers.

Level 2 of the CHII includes venues related to physical activity, healthy eating, or community design that may be present across sites in multiple community sectors. Level 3 consists of "inclusion domains," that apply across all venues, and include the built environment, equipment, programs/services, staff, and policies. Level 4 consists of the constructs that are grouped by inclusion domains. For example, for the built environment domain, there are multiple

constructs such as “entrances” and “path accessibility”. Each construct is determined by one or more items that can be objectively measured by a tape measure, push-pull door pressure gauge, smart level, or presence of specific object/service (e.g., automatic doorway). The items that determine how the construct is scored comprise Level 5. For example, “path accessibility” was determined by responses to three items/questions regarding: a) width, slope, and surface of paths, b) presence and location of curb cuts, and c) slope and quality of curb cut.

Table 3-1: Community Health Inclusion Index (CHII) Hierarchy

Level 1: Sectors	**Level 1: Schools, Healthcare, Work Sites, Community Institutions/Organizations, Community-at-Large**				
Level 2: Venues	**Physical Activity (e.g.,** fitness/recreation room, pool, sports field) **Healthy Eating** (e.g., community garden, cafeteria, farmer's market) **Community Design:** (e.g., transportation, paths)				
Level 3: Inclusion Domains	Built environment	Equipment	Programs/Services	Staff	Policies
Level 4: Constructs (examples)	• Appealing walking/rolling features • Entrances	• Exercise equipment • Nutrition Class Equipment • Playground equipment	• Adaptive programming • Promotional materials in alternative formats	• Staff Training	• Healthy Eating Policy • Wellness Coalition
Level 5: Items (example items within each domain)	Are paths to the site free of obstacles or hazards that are difficult to traverse? Are auditory crossing signals present at intersections near the site?	Is adapted equipment available at the community garden? Is there elevated playground equipment with ramps or transfer?	Is the program designed so that people with disabilities and without disabilities participate equally?	Are people with disabilities involved in providing training to staff?	Does the wellness committee set goals that are geared towards people with disabilities? Is it standard practice to put nutrition goals in students' individualized education program?
Survey tool used in the field	On-site Assessment		Organization assessment & Macro Community-At-large assessment		

Source: Eisenberg et al., 2015

Constructs

CHII On-Site Assessment

The On-site Assessment provides 23 constructs related to the accessibility of the built environment and availability of equipment or resources to provide accommodations to people

with disabilities (Table 3-2). There were five constructs covering accessible transportation, appealing or negative walking features, clear paths of travel and accessible intersections. The built environment was assessed with four constructs: parking spaces, building entrance, restrooms, and the front desk. Three constructs assessed the accessibility of menus and food venues, including community gardens. Seven constructs covered the availability of adaptive exercise and accessibility of the locations that support physical activity, including pools, locker rooms, and walking trails, while two constructs assessed the inclusiveness of health promotion materials and navigational signage. Lastly, two constructs measured the accessibility of healthcare exam room and waiting rooms. Five constructs, such as "playground" and "farmers market" were excluded from this study because they were not included in scope of services offered by the senior centers. All constructs were scored as percentages of the affirmative responses to options listed for each question (%=sum/yes responses to items) and were based on one or several questions.

CHII Organizational Assessment

The CHII Organizational Assessment provided 12 inclusion-related constructs: three were nutrition-related, two considered program affordability, one examined features of the physical activity program, two evaluated components of staff training, one looked at transportation, and three covered policies related to employee health, wellness coalition, and organizational readiness for change (Table 3-3).

Table 3-2 – Descriptions of *CHII Onsite Assessment* Constructs

Construct	Description	Value Labels	Scoring
Transit Accessibility	Four questions about the frequency of transportation during peak and non-peak hours, and the accessibility of the vehicle, pick-up location, service, and communication material (e.g., ramp to board or lowered vehicle, auditory announcements, etc.)	2 Questions | 3 Options less time = 2, mid=2, more time= 0 2 Questions | 3 & 6 Item Checklist Response Option: No = 0, Yes = 1	%=sum/13
Appealing Walking Features	One question about the observable characteristics of the near-by walking areas that make walking or rolling up to the facility appealing (e.g., buffer between sidewalk and street, seating area, shade, etc.)	1 Question | 6 Item Checklist None = 0, Some = 1, Many = 2, All = 3	%=sum/18
Negative Walking Features	One question regarding presence of features that would make walking or rolling to the facility not appealing (e.g., people loitering, graffiti, litter, etc.)	1 Question | 5 Item Checklist None = 3, Some = 2, Many = 1, All = 0	%=sum/15
Path Accessibility	Three questions regarding observed characteristics of the paths, street crossings, driveways and curb cuts which impact accessibility (e.g., 5 ft. width, smooth surfaces, proper slope, free of barriers, smooth transition area at curb cut, etc.)	1 Question | Yes=1, No=0 2 Questions | 4 item checklist Response Options: None = 0, Some = 1, Many = 2, All= 3	%=sum/25 OR %=sum/13 if no curb cuts
Intersection Accessibility	Two questions about observed characteristics of the intersection(s) and traffic signals that impact accessibility (e.g., well-marked with paint/bricks, free of obstacles, presence of curb cuts, visual countdown, signals that provide adequate time to cross, etc.)	2 Questions | 3 Item Checklist Response Options: None = 0, Some = 1, Many = 2, All = 3	%=sum/18 OR %=sum/9 if no signal
Parking Lot Accessibility	One questions about observed parking lot characteristics that impact accessibility (accessible parking sign, access aisles, van parking, etc.)	1 Question | 3 Item Checklist Response Option: No = 0, Yes = 1	%=sum/3
Entrances	Seven questions regarding observed characteristics of building entry points (e.g., automatic door, <5lb of force to open, usable door handles, door width, level threshold, etc.)	7 Questions | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/7
Promotional Materials	Two questions about availability of promotional/educational materials in alternative formats (e.g., electronic, Braille, etc.) and if the materials include photos of or mention services for people with disabilities	2 Questions | 1 & 3 Item Checklist Response Option: No=0, Yes=1	%=sum/4
Front Desk	One question about the height of the front desk (34" or lower)	1 Question | No = 0, Yes = 1	%=sum/1

Construct	Description	Value Labels	Scoring
Restrooms	Five questions about observed characteristics of the restrooms that impact accessibility (e.g., door width, usability of door handles, force required to open door, accessible stalls, etc.)	1 Question | 3 Item | Response Option: No = 0, Yes =1 4 Questions | No = 0, Yes = 1	%=sum/7
Navigation	Two questions regarding observed characteristics that would make navigation around the facility easier (e.g., accessible signage, accessible path to other areas)	2 Questions | 1 & 4 Item Checklist Response Option: No = 0, Yes = 1	%=sum/5
Menus	One questions about the availability of menus in alternative formats (e.g., electronic, large print, pictogram, etc.)	1 Question | 3 Item Checklist Response Option: No = 0, Yes = 1	%=sum/3
General Food Site Accessibility	Three questions about observable characteristics of the common eating area that impact accessibility (e.g., clear paths of travel, path width min 3', counter height max 34", etc.)	1 Question | 1 Item Checklist Response Option: No = 0, Yes = 1 2 Questions | 1 & 2 item checklist Response Options: None = 0, Some = 1, Many = 2, All=3	%=sum/10
Community Garden	One question regarding accessibility and inclusive policies of the Community Garden (e.g., raised garden bed, availability of adapted equipment, assistance available, subsidized membership, etc.)	1 Question | 4 Item Checklist Response Option: No = 0, Yes = 1	%=sum/4
Locker Rooms	One questions regarding observed characteristics of the locker rooms that impact accessibility (e.g., entrance width, usable door handles, clear paths of travel, etc.)	1 Question | 5 Item Checklist Response Option: No = 0, Yes = 1	%=sum/5
Showers	One question regarding observed characteristics of the shower (e.g., grab bars, stable seat, level threshold, handheld spray hose, etc.)	1 Question | 4 Item Checklist Response Option: No = 0, Yes = 1	%=sum/4
Equipment	Three questions regarding the availability of adapted aerobic and strength training equipment and aids for using the equipment (e.g., foot straps, adaptive handles, etc.)	3 Questions | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/3
General Physical Activity (part 1)	One question assessing if none, some, many, or all the paths of travel to the physical activity area are at least 3 ft wide and free of obstacles	1 Question | 2 Item Checklist None = 0, Some = 1, Many = 2, All = 3	%=sum/6
Pool	One question regarding observable pool characteristics that impact accessibility (e.g., accessible entrance, flotation devices, nonslip path, etc.)	1 Question | 4 Item Checklist Response Option: No = 0, Yes = 1	%=sum/4
Multi-use Trail	One question regarding the multi-use trail characteristics that impact accessibility (e.g., presence of benches or rest area, smooth-surface path, 5 ft width path, clear path of travel, navigational aids, etc.)	1 Question | 6 Item Checklist Response Option: No = 0, Yes = 1	%=sum/6

Table 3-3: Description of *CHII Organizational Assessment* Constructs

Construct	Question/Item	Scale	Score
Healthy Eating policy	Six questions about polices regarding prices of healthy foods, nutrition standards, availability of healthy items, stakeholder involvement, food options, and staff serving as healthy eating role models	6 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/6
Healthy Eating Programs	Four questions regarding accessibility characteristics of the nutrition (e.g., accessible location, adaptive equipment available, accommodations such as allowing caregiver attendance, etc.)	4 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/4
Affordability (pt. 1)	One question about the availability of financial assistance to make nutrition program more affordable for low-income individuals	1 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/1
Affordability (pt. 2)	One question regarding policy to provide discounted memberships or reduced program fees	1 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/1
Physical Activity Programs	Four questions regarding accessibility features of physical activity programs (e.g., accessible location, program modifications, availability of adaptive equipment, accommodations such as caregiver attendance)	4 Questions | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/4
Program Material Accessibility	One question regarding availability of Instructional/Educational materials in alternative formats (e.g., Braille, electronic, large print, pictograms, etc.)	1 Question | 6 Item Checklist Response Option: No = 0, Yes = 1	%=sum/6
Staff Training	Two questions regarding the content of disability training (modifying services, adapting environment, etc.) and the policies that govern who takes the training, if it's required, and the involvement of persons with disabilities i	2 Questions | 3 Item & 4 Item Checklist Response Option: No = 0, Yes = 1	%=sum/7
Staff PA training	One question about whether staff are provided training on the specifics of working with people with different types of disabilities (e.g., using materials in alternative formats, tailor exercise program to individual, teaching how to use adaptive exercise equipment)	1 Question | 3 Item Checklist Response Option: No = 0, Yes = 1	%=sum/3
Wellness Coalition	Two questions regarding the wellness committee's goals (e.g., healthy eating, physical activity, health promotion goals) and in what ways the committee promotes participation of people with disabilities (other members with disability, meetings in accessible location, relatable goals)	2 Questions | 3 Item Checklist Response Option: No = 0, Yes = 1	%=sum/6
Transportation	One question regarding the accessibility features of any organization-provided transportation (e.g., ramp or lift for entering the vehicle, wheelchair securement system)	1 Question | 2 Item Checklist Response Option: No = 0, Yes = 1	%=sum/2
Employee Health	One question about the various types of incentives the organization might use to promote employee health (e.g. providing work-breaks to exercise, small cash prizes, time off, healthy lifestyle resources, financial assistance)	1 Question | 7 Item Checklist Response Option: No = 0, Yes = 1	%=sum/7
Organizational Readiness for Change	Five questions about the organization's readiness to implement inclusion-related changes; two questions focus on the degree of awareness and concern of the need to include people with disabilities (scale of 1/not at all to 5/very), and three yes/no questions asses leadership support, ongoing efforts to promote inclusion, current plans to improve building accessibility)	2 Questions|1-5 scale 3 questions | No = 0, Yes = 1	%=sum/13

Macro- Community Assessment

The Macro-Community Assessment assessed transportation services and policies, community design policies and programs, and community wellness initiatives and was designed to be completed one time by representatives of community-level organizations or City departments involved with transit services and community planning and design.

Table 3-4: Description of *Macro-Community Assessment* Constructs

Construct	Question/Item	Scale	Score
Public Transit Availability	One question about the availability of at least one form of public transportation.	1 Questions | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/1
Travel Training	One question assessing the availability of an educational training regarding use of public transportation by people with disabilities.	1 Questions | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/1
Transit Affordability	Three questions about the availability of subsidies for people 65 years or older, people with disabilities, or people with low incomes.	3 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/3
Transit Information Accessibility	Two questions regarding the availability of information specific to the accessibility features of the public transit system.	2 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/2
Disability Awareness Training	Three questions about the availability of disability awareness training for public transit staff, curriculum content (e.g., effective communication, ADA requirements, and person-first language) and applicable policies (e.g., person with disability involvement, who is required to take the training).	1 Question | 1 Item Checklist Response Option: No = 0, Yes = 1 2 Questions | 4 Item Checklist Response Option: No = 0, Yes = 1	%=sum/4
Alternative Accessible Transportation	One question regarding availability of alternate transportation services for people with disabilities (e.g., paratransit, volunteer-run, wheelchair accessible taxis) with option to add a service type not listed.	1 Question | 3 Item Checklist Response Option: No = 0, Yes = 1	%=sum/3
Complete Streets Policies	Two questions regarding established policies or regulations addressing the development of biking/walking/rolling infrastructure (i.e. Complete Streets) and efforts to improve infrastructure in areas with a higher percentage of people with disabilities.	2 Questions | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/2
Transit-Oriented Development	Two questions regarding established policy or regulation on transit-oriented development and provisions that would make development' housing units inclusive of people with disabilities.	2 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/2
Wayfinding	Two questions regarding the established policies or programs to ensure wayfinding signage posted in the community is accessible to those with disabilities (e.g., large-print, Braille, pictograms).	2 Questions | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/2
Community Accessibility	Three questions regarding established programs to maintain and improve sidewalk and curb cut accessibility and if the municipality has completed an ADA transition plan.	3 Question | 1 Item Checklist Response Option: No = 0, Yes = 1	%=sum/3
Safe Routes to School	Two questions about established or plans to establish a Safe Routes to School program and established policies to ensure the program is inclusive of students with disabilities.	1 Question | 2 Item Checklist Response Option: No = 0, Yes = 1	%=sum/2
Community Coalition	Two questions regarding an established wellness/healthy living coalition/committee/work group and if the coalition promotes the participation of people with disabilities.	2 Questions|1 Item & 6 Item Checklist Response Option: | No =0, Yes =1	%=sum/6

The survey provided 12 constructs which assessed the availability and affordability of accessibility public transportation, transit staff training requirements, and policies that promote disability inclusion in housing, infrastructure, and health coalitions (Table 3-4).

CHII Pilot Data

Pilot data were collected for dissemination to the CHII development team at the National Center on Physical Activity, Health, and Disability (NCPAHD). Pilot data consisted of general information about the feasibility of using the CHII survey tools and supporting NCPAHD material in future health equity initiatives and was collected from the Disability Access Office at the completion of the project.

Data Collection

The field assessment portion of the *CHII Onsite Assessment* was completed during one to two sites visits to each senior center. A structured interview was held with City Human Services Department leadership and staff who oversee the City's senior nutrition and health services programs to complete the PROGRAM/POLICY portion of the *Onsite Assessment* and the full *Organizational Assessment.* The Disability Access Office arranged and facilitated a meeting with community health and transportations partners in which the *Macro-Community Assessment* was completed. To encourage participation in the *Macro-Community Assessment*, participants were provided refreshments and had the option of having their parking fees reimbursed. Teleconference accommodations were provided so that attendees with disabilities could enjoy equal participation.

Data Analysis

Data were analyzed according to guidelines provided by the National Center on Health, Physical Activity and Disability (NCHPAD) (personal communication, February 2019). Constructs were scored by dividing the sum of reported items by total possible sum and presented as a percentage. For all constructs, higher scores or percentages indicate more inclusive or accessible features. Additionally, data from across all sites were analyzed to identify trends or outliers, including the qualitative data gathered during the assessments as answers to open-ended or follow-up questions

Results

Onsite Assessment

Field measurements for the *Onsite Assessment* occurred between June 2019 and July 2020. Of the nine senior centers assessed in this study, two had pools, two had community gardens, two had multi-use trails, and four included locker rooms. Table 3-5 includes summary data for each construct, including the range of scores, as well as average, and median scores. At the time of assessment, all senior centers provided accessible transportation for pick up/drop off of seniors who live within five miles of that facility. Center staff promoted and facilitated use of San Antonio paratransit services for seniors with disabilities who lived beyond the 5-mile radius. Lastly, all seniors could travel to the center via regular transportation because all centers were within located within 3 blocks of a transit stop. However, the accessibility of each transit stop (*Transit Accessibility* – 33.3%-100%), sidewalks (*Path Accessibility,* 72%-100%), cross walks (*Intersection Accessibility*, 33.3%--83.3%) and other features (*Negative Walking Features*, 86.7%--100) varied from location to location. The parking lots for all senior centers scored 100% on van

accessible parking, 5 feet access aisles, and use of approved parking signs. With the exception of one, all centers had accessible entrances and doorways throughout the facility (*Entrances*, 85.7%--100%). One senior center had an automatic door that was out of order. All senior centers score 100% on measures of accessible *Front Desk*, *Navigation* signage and *Restrooms*. As well, all senior centers had a formal policy to maintain a "family style" or "caregiver" restroom, ensuring seniors accompanied by a caregiver had adequate space and privacy to attend to personal hygiene or toileting needs.

All senior centers included an area for seniors to pick up lunch and eat in a cafeteria type setting. Across the centers, seniors unable to carry their lunch due to a disability had the option of picking up a flag of some sort to indicate that staff needed to bring them a meal. All the cafeteria/eating locations were accessible to people with wheelchairs or walkers (*General Food Site Accessibility*, 100%). Throughout the eating areas, there were often healthy food promotional materials (e.g., table tents, wall posters, flyers) in bright contrasting colors, with a mix of large and small font or pictures of fruit and vegetables. All meals and snacks provided at the senior centers were free, therefore these questions related to Healthy Food Promotion were not applicable. Question to determine scores for the constructs *Grocery Store* and *Farmers Market* were also not applicable, due to the lack of these services near the centers. Two senior centers included a community garden, one of which was not accessible via sidewalk or smooth service. At the second location, only one section of the community garden was accessible via a sidewalk or smooth service. Adapted gardening equipment was also not readily available, but staff indicated an accommodation (e.g., assistance from staff) could be provided if needed (*Community Garden*, 50%--75%).

All senior centers scored a 66.7% on *Equipment*, as each had at least one cardio exercise machine designed specifically for people with disabilities, including an operator control panel with Braille labeling and foot straps when necessary (i.e. recumbent bike). However, no senior center had a strength training machine with roll-in wheelchair access. In some of the smaller facilities, exercise machines were not always positioned to permit 3 feet wide aisles (*General Physical Activity (pt.1)*, 83.3%-100%). Areas with exercise machines, indoor walking loops, and exercise classrooms were all accessible to people with disabilities as none had changes in surface levels or other physical barriers (*General Physical Activity (pt.2)* 100%--100%). Four of the senior centers had locker room areas, two of which were part of the pool facility. Locker room areas were generally accessible with only one location having a portion of the lockers blocked by a chair (*Locker Room*, 80%--100%). The only location to provide showers did not have flat transition surface into the shower, preventing a person with a wheelchair from accessing it (*Showers*, 75%). Of the two centers that included multi-use trails, neither had disability-navigational signage and the one included a trail/sidewalk made up of gravel and not smooth concrete (*Multi-use Trail,* 33.3%—75%).

All senior centers included a small healthcare clinic where seniors could receive basic healthcare screenings (e.g., blood pressure, temperature check, weight) and speak with a nurse about health and wellness, including advice on nutrition, physical activity and other health promoting behaviors. One of the center healthcare clinics had an exam chair with adjustable height, arm rests, and firm seat. Four of the center healthcare clinics had a scale with grab bars installed on the wall to assist seniors with difficulty standing. All but one of the healthcare clinics, and those with waiting rooms, had enough space for a person with a wheelchair to maneuver

(*Healthcare – Waiting Room*, 85.7%--100%. *Healthcare – Exam Room*, 33.3%-83.3%). The *Healthcare – Exam Room* construct included two questions to identify if the exam table was accessible (i.e. adjustable height) and if support to transfer to the exam table was available. However, none of the healthcare clinics had exam tables, as only basic health screenings were provided. Table 3-6 includes the top barriers and facilitators for disability inclusion and supplemental qualitative data relative to the constructs.

Organizational Assessment

The *Organizational Assessment* was completed in October 2019 during a structured interview with City of San Antonio Human Services Department (HSD) personnel who were in a position, or had the relevant experience, to provide information about programs and policies relative to human services training requirements, nondiscrimination policies, vendor contract requirements, partnerships with community organizations (e.g., San Antonio Food Bank, VIA Transit) and previous City initiatives to improve equity and accessibility. Informed consent was obtained from all participants prior to the interview.

Survey results indicated a score of 100% for both *Healthy Eating Policy* and *Healthy Eating Programs*. The food service vendor that provides senior lunches is contractually required to meet certain nutrition standards and worked with HSD nutrition staff to ensure ongoing program needs were met. Other department policies included requiring that food served at special events include healthy food options. To prevent the possible promotion of unhealthy foods, vending machines or other food sales were prohibited. While not an official written policy, HSD staff indicated that personnel working at the senior centers were encouraged to serve as role models by eating healthy foods themselves. At the time of assessment, HSD provided multiple nutrition

opportunities by collaborating with community partners including Texas AgriLife and the San Antonio Food Bank. These programs include nutrition education classes, cooking classes, weight loss support, label reading, and food shopping.

Similarly, a variety of physical activity programs (*Physical Activity Program,* 100%) were also offered and policies were in place to ensure exercise classes and equipment were accessible. HSD noted that, in the past, accessible cardio machines were purchased and distributed to the senior centers as part of an equity and accessibility initiative. Exercise classes were taught to different capability and fitness levels and included chair or other modifications when necessary.

Across the centers, there were examples of health promotion; however, a wide variety of alternate formats were not readily available at all locations (*Program Material Accessibility*, 80%). Staff noted the availability of health promotion materials that included table tents for nutrition, hard copies of menus with calorie information, and information about exercise classes and menus posted on their website. Staff also noted the availability of a Braille printer at one senior center, use of large print and pictograms in previous activities, and the ability to create health promotion materials using audio or in electronic formats.

On the measures of Affordability, HSD scored 100% because all activities and services are free to all qualifying individuals (60+ years).

Survey results indicated a score of 100% for both *Staff Training* and *Staff Physical Activity Training*. HSD indicated a previous partnership with San Antonio Disability Access Office (DAO) to offer disability awareness and inclusion trainings to HSD employees, vendors, contract staff, and volunteers. Also exercise instructors were required to have the skills and knowledge

necessary to modify exercise programs to meet the needs of seniors with disabilities. Prior to using any exercise equipment, including the accessible machines, seniors were required to meet with an exercise trainer for instruction on proper and safe use.

HSD staff indicated there is a San Antonio wellness coalition (*Wellness Coalition*, 66.7%) which sets health eating and physical activity goals to combat obesity. And while the coalition may include community groups that provide services to people with disabilities, and typically held meetings in accessible, it did not set goals geared specifically to disability. Lastly, on measures of *Transportation, Employee Health*, and *Organization Readiness for Change*, the responses to survey questions scored 100%. The senior service transportation program included an accessible bus or van with a ramp or lift and a wheelchair securement system. The San Antonio provided a number of incentives to promote employee health, including prizes, time off, discounted gym memberships, funds for weight loss programs, and health coaches.

Macro Assessment

The Macro Assessment occurred in October 2019 and was completed during a structured interview with community organizations that provide services to people with disabilities, including representatives from Ride Connect Texas, VIA Transit, Alamo Area Council of Governments, Texas Workforce Commission, Bexar County, CONNECT + ABILITY at Warm Springs, San Antonio Independent Living Services, and Workforce Solutions Alamo.

At the time of the assessment, San Antonio and Bexar County offered multiple forms of public transportation (*Public Transit Availability*, 100%), and subsidies were available for people with disabilities and seniors (65+ years) (*Transit Affordability*, 66.7%). However, the public transit agency did not offer training to people with disabilities on how to access public transportation

(*Travel Training*, 0%), nor was information about the accessibility of the transit system or transit stops posted on the agency's website (*Transit Information Accessibility*, 0%). Transit drivers were required to complete disability awareness training that covered ADA requirements, effective communication, and person-first language. However, disability awareness training was only required for operators and persons with disabilities were not involved in the delivery of the training (*Disability Awareness Training*, 57.1%).

The San Antonio and Bexar County community included transportation resources outside of public transit authority, including nonprofits, such as Ride Connect Texas and CONNECT + Ability at Warm Springs that provided door-to-door paratransit services and volunteer run services. Survey participants noted some, although limited, capacity of wheelchair accessible taxis (*Alternate Accessible Transportation*, 100%). Additional supportive aspects of the community's transportation resources included a long-range accessible transportation plan, Medicaid programs that reimburse for transportation cost to attend appointments, hospital programs that provide accessible transportation to patients, and a Bexar County transportation program to transport county residents to transit stops located within the city limits. Barriers to accessible transportation included long services times and limited service areas, a lack of public information about available resources, and in general, the number of accessible transit vehicles were not enough to meet the needs of San Antonio's population.

Survey participants noted the City's community design policies which promote the development and maintenance of accessible biking, walking/rolling infrastructure (*Complete Streets Policies*, 100%)., particularly in areas with a higher percentage of older adults and people with disabilities. However, the community design policies did not include provisions to housing

developments inclusive of people with disabilities (*Community Design*, 50%). The community did not have a policy or program to install wayfinding navigation specific to people with disabilities as it was the responsibility of individual City departments or programs to post accessible signage (*Wayfinding*, 0%). In terms of *Community Accessibility* (33.3%), survey respondents indicated that the City has a program to clear inaccessible sidewalks, or funding for local businesses to increase accessibility features. At the time of assessment, the City was in the process of implementing their ADA Transition Plan, a plan detailing accessibility enhancement to infrastructure and city services. Lastly, the constructs *Safe Routes to Schools* and *Community Coalition* scored 50% and 20% respectively. The City had in the past adapted a Safe Routes program; however, it did not adopt any provisions to ensure the program was inclusive of students with disabilities. As with the wellness coalition discussed during the *Organizational Assessment*, disability stakeholder groups were part of the wellness coalition, but there were no goals, resources, or policies to promote the inclusion of people with disabilities.

Discussion

Results from the CHII identified the top facilitators to inclusion as a robust nutrition and transportation program available at no cost to qualifying seniors, accessible site layouts, and an organization and community willingness to identify and improve inclusion and accessibility for people with disability. Top barriers included a lack of health promotion materials available in accessible formats, lack of accessible equipment in healthcare exam rooms, and neighborhood characteristics that make travel to the sites on foot unappealing.

San Antonio seniors benefit from accessible transportation options, staff familiar with disability issues and who are capable providing accommodations, and City policies which alleviate

not only financial barriers to program participation but also to healthy eating. Prior research demonstrates that older adults with disability experience increased risk for food insecurity (Gunderson & Ziliak, 2015). Accessible transportation is commonly cited as a barrier to participation in community activities among people with disabilities (NCD, 2017). Addressing transportation barriers comes in the form of increasing accessible transportation options, providing financial assistance, to cover transportation costs, ensuring transit staff are familiar with disability issues, and ensuring community accessibility design standards (NCD, 2017). Inaccessible design features among parks and recreational facilities, such as community gardens without sidewalk access and lack of navigational aids along multi-use trails, serve as barriers to health promotion opportunities (Rosenberg et al., 2013). Neighborhood barriers, such as poorly maintained sidewalks, lack of crosswalks, or inaccessible transit stops, potentially present challenges to seniors that rely on fixed route transportation to travel to the center and require multiple City departments and community-level intervention to change (NCD, 2017).

Research has highlighted the need for multilevel strategies to improve the health disparities among people with disabilities (Eisenberg et al, 2015). This is particularly true for health programs seeking to improve nutritious eating and physical activity to combat obesity among the disability population. There are a number of assessment tools used to measure the accessibility of facilities, programs, or services impacting participation by people with disabilities. However, they typically focus on one disability subgroup, area of health promotion, or specific location in the community, such as fitness centers (e.g., AIMFREE) (Rimmer, Riley, Wang & Rauworth, 2004), grocery stores (e.g., HEZ-Grocery Checklist), or the pedestrian environment (e.g., Q-PAT and HAN-EAT) (Eisenberg et al., 2015). None provide a comprehensive, multi-level

assessment of inclusion among community health resources (Eisenberg et al., 2015). For communities interested in developing and implementing community health programs inclusive of people with disabilities, the CHII remains a tool worth having in the toolbox.

Health promotion programs should be socially, programmatically, and environmentally accessible to people with different types of disabilities. Previous literature has highlighted the inaccessibility of community health and wellness programs (Drum et al. 2009; Krahn et al., 2015). Ensuring accessibility includes employing effective communication strategies in various aspects of the health promotion program (CDC, 2013). Local health promoting entities should reach individuals with disabilities through the mechanisms they use for communication. People with vision disabilities often use screen readers to access information on the internet. This means information provided by local governments or community organizations such as pamphlets, calendar announcements, or videos, should be developed and posted with accessibility in mind. Videos should include closed captions or a sign language interpreter and accompanied by a transcript. Documents should meet accessibility standards outlined by Section 508 of the Rehabilitation Act (29 U.S.C. § 794, 1973), including the use of specific (non-serif) fonts, contrasting colors, navigational headings, and pictures with alt text descriptions. The content of health promotion materials should also be provided in "plain language" so that individuals with intellectual or developmental disabilities may understand the messaging (Drum et al., 2009). Health promotion materials in "plain language" also benefit those with limited English proficiency, low health literacy, and seniors with declining cognitive function. Posting alternate versions of health promotion materials, such as in large-print, Braille, or simply without the features that render the document inaccessible (e.g., animated graphics), meets ADA guidelines

so long as the content in the alternate format achieves the same purpose as the non-accessible version (ADA, 1990; W3C, 2018).

Staff who implement health and wellness programs should be adequately training in disability awareness and etiquette, effective communication, providing accommodations, disability rights, and issues related to personal choice (CDC, 2013, Hinton et al., 2018). Staff instructing on physical activity should be competent in modifying the exercises to accommodate any functional limitations of participants with disabilities (Rimmer et al., 2005). Additionally, staff should have access to equipment, such as modified exercise or adapted gardening equipment, designed specifically for people with disabilities to participate in those activities (Rimmer et al., 2005).

Consideration must be given to public health program process evaluation and outcome measures that are account for people with disabilities. Process evaluation usually emphases program monitoring, accountability, and quality assurance activities (Rossi & Freeman, 1993). Process evaluation considerations for people with disabilities include tracking costs, soliciting input from participants regarding satisfaction, gathering feedback using accessible surveys or methods, and incorporating necessary changes identified through participant feedback (Drum et al, 2009). Additionally, program outcome measures should take into consideration the functional limitations of participants with disabilities. For example, an outcome measure of an exercise program designed to increase physical activity should not only consider steps taken per day, as it would not be appropriate for people who use wheelchairs (Drum et al., 2009).

Considering the many social, environmental, and programmatic barriers that restrict participation by people with disabilities can be particularly overwhelming for individuals with limited disability experience. However, this task is feasible through the inclusion of the disability community in elements of program design, development, implementation, and evaluation (CDC, 2013; Hinton et al., 2018). Representation should vary by both segments of the disability community (e.g., people with disabilities, caregivers, and service providers) and by different type (e.g., hearing, vision, mobility, cognitive, and independent living) (Eisenberg, et al., 2015). Incorporating the disability community into all phases of public health program development and delivery provides public health researchers and practitioners the information necessary to not only identify the potential barriers to inclusion but also identify accessibility solutions and leverage existing community resources (CDC, 2013).

Most evidence-based programs are developed for people without disabilities (Rimmer et al., 2014). Additionally, few theoretical models of health behavior have been tested among people with disabilities (Drum et al., 2009). And while there has been an increase in health promotion programs developed for specific subgroups of the disability community, they are rarely sustainable long-term (Rimmer et al., 2014; Drum et al., 2009). Rimmer et al., (2014) posit that it is timelier and a more judicious use of resources to adapt existing evidence-based programs to a particular target population and tailor content based on needs and context than develop new ones.

There were several strengths to this study. This study was the first to utilize the CHII survey tools to assess city-managed senior centers which provide health services. Previous publications indicate the importance of collaborating with the disability community when

examining or promoting health among people with disabilities (CDC, 2013; Hinton et al., 2018). This study adhered to that principle by collaborating with the City's Disability Access Office and including disability advocacy organizations and service providers in the completion of the *Macro-Community Assessment*.

This study has several limitations. While the San Antonio senior centers assessed for this study represent various geographical areas of the city, results from the inclusion and accessibility assessments cannot be generalizable to community organizations providing similar services in other cities due to different demographics and community structure. Eisenberg et al. (2015) noted a potential self-report bias in that survey participants may fear repercussions should the survey results reflect poorly on the accessibility of the program or facilities.

Conclusion

Documented health disparities between those with and without disability highlight an urgent need to improve access to opportunities of health promotion for people with disabilities. Equal access to community health promotion opportunities targeting health behaviors which reduce obesity and prevent chronic disease is paramount to improving the health of people with disabilities. People with disabilities and seniors experience similar barriers to community participation and inaccessible building features (Christensen et al., 2010; NCPAHD, 2014).

One strategy for community health leaders dedicated to population health equity is to ensure that barriers commonly experienced by people with disabilities are addressed in community senior health initiatives (NCPAHD, 2014). As adults age, they experience increasing risk for functional decline, thus experiencing some form of sporadic, temporary, or continuous

disability increases (Brault, 2012). In fact, 50% of Texas seniors reported disability in 2018 on state surveys (U.S. Census Bureau, 2018). Seniors benefit from health promotion opportunities that address participation barriers recognized by people with disabilities, and that uses program features and design layouts which meet accessibility guidelines (NCHPAD, 2014)

Disability and public health experts recommend including the disability community in the planning, implementation, and evaluation phases of community health initiatives (CDC, 2013; NCPAHD, 2014). This practice was demonstrated in the CHII's development (Eisenberg, et al., 2015), and served as an example of how the disability community should –and can- be involved in developing and implementing disability-focused health initiatives. As well, this study demonstrated the practice of disability partnership to promote inclusion of people with disabilities in health research.

The CHII was developed as a tool for communities to evaluate local health programs and determine measures of disability inclusion and program accessibility. By identifying program, policy, and environmental barriers to disability inclusion, the CHII provides community leaders with a framework for improving access to health promotion opportunities for adults with disabilities. Additionally, the CHII highlights the extent to which community level decisions about housing, transit, and community design features impact the participation of people with disabilities in routine community activities.

Table 3-5: *Community Health Inclusion Index (CHII) Onsite Assessment* Survey Results Summary, San Antonio Senior Centers, 2019

***CHII Onsite Assessment* Constructs**	**# Senior Centers***	**Average Score (%)**	**Median Score (%)**	**Range**
Transit Accessibility	9	71.61	77.78	33.33 — 88.89
Appealing Walking Features	8	63.89	72.24	33.33 – 100
Negative Walking Features	8	95	100	86.66 – 100
Path Accessibility	8	83.84	74	72 – 100
Intersection Accessibility	8	60.43	66.7	33.33– 83.3
Parking Lot Accessibility	8	100	100	100 – 100
Entrances	9	98.41	100	85.71 -- 100
Promotional Materials	9	25	25	25 -- 75
Front Desk	9	100	100	100 – 100
Restrooms	9	100	100	100 – 100
Navigation	9	100	100	100 – 100
Menus	9	11.11	0	0 – 33
General Food Site Accessibility	9	100	100	100—100
Community Garden	2	62.5	50 & 75	50 – 75
Locker Rooms	4	93.33	100	80 – 100
Showers	1	75	75	75
Equipment	9	66.67	66.67	66.67
General Physical Activity (pt. 1)	9	98.14	100	83.33 – 100
Pool	2	75	50 & 100	50 – 100
Multi-use Trail	2	54.17	33.33 & 75	33.33 – 75
General Physical Activity (pt. 2)	9	100	100	100 – 100
Healthcare – Waiting Room	2	92.86	85.71 & 100	85.71 – 100
Healthcare – Exam Room	9	55.55	50	33.33 – 83.33
Affordability		n/a – services and activities free of charge		
Healthy food promotion		n/a – food sales not allowed		
Grocery Store		n/a – no grocery stores		
Farmers Market		n/a—no farmers markers		
Playground		n/a – no playground used for senior activities or services		

*Measurements only taken if the construct/question applied. (For example, no measurements were taken for the construct “Pool” if the senior center did not have a pool on site and include pool activities in services to seniors.)

Table 3-6: *Community Health Inclusion Index (CHII) Organization Assessment & Macro Assessment* Survey Results Summary with Facilitators (F) and Barriers (B), San Antonio Senior Centers, 2019

***Organization Assessment* Constructs**	**Score**	**Supplemental Information**
(F) Healthy Eating Policy	100	There are no vending machines or concession stands to limit unhealthy food consumption Nutrition standards part of food service vendor contract Used to be a "snack committee" made up of seniors who provided input on snack choices Policy about providing healthy food at events or celebrations
(F) Healthy Eating Programs	100	While adaptive equipment not widely available for people with disabilities participating in cooking/nutrition classes, staff would purchase equipment if requested. Nutrition classes can be tailored to needs of people with specific dietary needs (e.g., diabetes, renal disease). Meals that meet specific dietary requirements are available if requested in advance
(F) Affordability (pt. 1)	100	Senior Center activities and services were free for qualifying adults (60+ years)
(F) Affordability (pt. 2)	100	
(F) Physical Activity Programs	100	Acceptable for caregivers to accompany seniors to classes Instructors modify exercises as necessary
Program Material Accessibility	80	Videos with captions not available
(F) Staff Training	100	Disability awareness training was required of volunteers, but was not routinely scheduled Training was delivered through partnership with Disability Access Office (DAO) If YMCA or YMCA staff were on site then there was someone onsite who could assist with modifying exercises to accommodate a person with a disability, but were not always on site
(F) Staff Physical Activity Training	100	
Wellness Coalition	66.7	Coalition does not set goals that are specific to people with disabilities
(F) Transportation	100	Each senior center had one wheelchair accessible van
Employee Health	100	City uses a variety of incentives (e.g., prizes, discounts, time off) to promote employee health
Organizational Readiness for Change	100	City concerned about disability inclusion Leadership supports efforts to improve inclusion
Macros Assessment Constructs	**Score**	**Comments**
(F) Public Transit Availability	100	Services times and areas were a challenge, especially for those who live outside City Medicaid programs to reimburse for travel expenses to medical appointments "ConnectSA" long range multimodal transportation plan
(B) Travel Training	0	Needs to be public education about transit services available United Way used to fund a program that taught people with disabilities about using public transportation, but funding ran out and program quit

(B) Transit Information Accessibility	0	Information about transit accessibility features not readily available. People must phone the transit provider to find out if a transit stop is accessible
Disability Awareness Training	57.14	Persons with disabilities not involved in training Training required for drivers only
Transit Affordability	66.67	No public transit subsidies for low income population
(F) Alternative Accessible Transportation	100	Available services include paratransit, volunteer-run service, and wheelchair accessible taxis (although limited)
Complete Streets Policies	100	City initiated a 2012 San Antonio Complete Streets policy
Transit-Oriented Development	50	No policies to promote accessible housing units in transit-oriented development plans
(B) Wayfinding	0	Wayfinding navigation aids exist for those using regular transit routes It is up to individual programs if they want to include wayfinding navigational aids in their projects
Community Accessibility	33.33	No program to clear inaccessible sidewalks No funding to support businesses improve accessibility
Safe Routes to School	50	Previous Safe Routes to Schools program did not include policy to ensure inclusion of students with disabilities
Community Coalition	20	Does not fund programs inclusive of people with disabilities or allocate funding to training of inclusive fitness professional Does not set goals that ensure inclusion of people with disabilities

Table 3-7: Community Health Inclusion Index (CHII) Onsite Assessment - Prevalent Barriers and Facilitators

Top four barriers to inclusion	**Supplemental Qualitative Information**
Promotional Materials	a) Materials often included seniors, but not seniors with disabilities b) All centers posted a schedule of exercise classes, recreation activities, but few had health education material c)
Healthcare Exam Room	a) Many weight scales had grab bars, but none were accessible to someone who uses a wheelchair b) One had chair with adjustable height, some had chairs with no arm rests
Appealing Walking Features	a) Walking features varied greatly by location b) Some senior centers located in shopping centers with no green space or easy access to nearby sidewalks c) Sidewalks were not always maintained; telephone pole or other obstacle prevented adequate space for wheelchair to pass
Intersection Accessibility	a) Stop lights did not have auditory instructions b) Some locations did not have crosswalks c) Obstacles included dirt, gravel, grass growing over sidewalk and curb cut area
Menus	a) Menus often not readily available in large print or electronic format b) Some did not include nutritional information c) No pictograms
Top three facilitators to inclusion	**Supplemental Qualitative Information**
Transit	a) Free, accessible transportation is available to all seniors who live within 5 miles of that center b) Almost all the seniors use this service or get dropped off by a family member; few use public transit c) Drivers are trained in how to assist people with disabilities embarking/disembarking the vehicle
General Physical Activity	a) All activity areas are fully accessible to people with disabilities b) Senior centers provided an array of recreational opportunities for participants promoting both physical activity and social relationships. Activities included table tennis, arts and crafts, puzzles, library, computer classes, etc.
Navigation	a) In addition to traditional signage with pictograms and braille (i.e. restrooms, classroom names), many centers had additional signage to indicate indoor walking loop and other activity or service areas
Entrances, Restrooms, Parking	a) All senior centers met physical/structural accessibility requirements b) Practice of leaving classroom/bathroom doors propped open to ensure accessibility c) More accessible parking spaces than required

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Conclusion

Findings from this dissertation are consistent with previous reports indicating disparities in health outcomes between people with disabilities and those without. People with disabilities reported patterns of chronic disease, poor health status, and fewer healthy behaviors than those without disability. In order to address these challenges, there is a need for improved health disability data, an increase in evidence based public health and wellness programs effective for people with disabilities, and environmental enhancements and inclusionary policies which improves community access for people with disabilities.

Better disability health data is needed to inform policy and program development, prioritize areas of health research, and implement strategies to improve healthy behaviors, and reduce obesity and chronic disease. Federal agencies conducting health research and academic researchers studying disability should utilize the standard disability questions currently in use in the BRFSS, American Community Survey, and other national health surveillance programs. Disability status should routinely be included as a demographic variable in health research examining outcomes across target audiences. Examining health outcomes across functional disability type tells us not only if disability occurs more frequently in some demographic groups, but also sheds light on how social determinants of health and disability may interact to cause different outcomes across disability subgroups. This is critical information necessary to adapt or tailor evidence-based interventions targeting people with disabilities.

Public health researchers and community groups mobilizing towards a healthier community should seek out and include people with disabilities during the planning and on

through the evaluation phase. Including people with disabilities in community-based research requires that accessibility be considered from the inception. Using accessible meeting locations, developing accessible meeting materials, and providing accommodations to ensure effective communications should all be routine considerations. Disability stakeholders, including individuals with disabilities, their caregivers, and disability service providers, all provide valuable information about unforeseen participation barriers and untapped community inclusion assets. Data related to health outcomes across functional disability groups results in a better understanding of the unique needs/barriers experienced by different disability groups. Better disability health will inform effective, tailored public health interventions.

Federal health entities recognize the effectiveness of community level interventions which increase access to environments that promote physical activity, nutrition, and smoking cessation; ultimately, decreasing chronic disease. We need to increase the opportunities for people with disabilities to participate in community level health and wellness programs, which are not only accessible and inclusive to disability, but have been demonstrated to be effective among this population. Future development of community resources that support health and wellness should be designed and constructed within a framework of universal accessibility.

Truly addressing the health disparities of people with disabilities cannot occur without deliberate effort to improve public infrastructure and environmental design. Communities must be willing to address the systemic and structural barriers to education, employment, social and civic engagement help perpetuate a cycle of poverty, social isolation, and poor health among people with disabilities. Housing, transit, and community development plans should include accessibility requirements that provide people with disabilities equal opportunity for

sustainable housing and participation in community services and programs. Accessible community spaces allow people with disabilities to participate in civic engagements like voting, jury duty, attend a town hall, or enjoy recreational activities, take advantage of wellness programs. At the same time, community participation helps people maintain social support systems and reduces loneliness and isolation. Programs like Complete Streets and Livable Communities provide recommendations to build communities where people can age in place, all members of the community, regardless of disability, can equally participate in social, education, and employment opportunities.

Lastly, the public health workforce, healthcare administrators and providers, and government employees who interface with the public should obtain the knowledge and skills necessary to perform their job duties with appropriate consideration and awareness of disability accessibility and discrimination issues. For public health workers, fitness instructors, and health educators, this means providing accommodations, using effective communication strategies, and tailoring or modifying the program components to be culturally applicable. Hospital administrators should know how the ADA applies in a healthcare setting and be prepared to implement nondiscrimination policies (e.g., accept service dogs, provide sign-language interpreter, allow caregiver to accompany patient) and/or provide timely accommodations when necessary. Healthcare providers should not only provide the same health recommendations about weight loss, vaccinations, sexual health, injury prevention and smoking cessation to people with disabilities, but do so in a way that is applicable and culturally appropriate. As healthcare clinics complete remodels or upgrade their exam or diagnostic equipment, accessible designs should be chosen. This can be achieved through organization

policies to require disability awareness training and the inclusion of coursework in disability and health across professional disciplines including medical, vocational rehabilitation, government and community workers, physical fitness trainers, public health, mental health, nutrition/dietetics, education, etc.

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