2017

RELIABILITY AND STABILITY OF THE SIX QUESTION DISABILITY MEASURE IN THE CURRENT POPULATION SURVEY: WHAT THE DATA CAN AND CANNOT TELL US ABOUT DISABILITY AND LABOR FORCE PARTICIPATION

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Acknowledgements

I would like to express my deepest gratitude to my dissertation committee, comprised of Drs. Amy Armstrong, Paula Kupstas, Brian McMahon, and Richard Feinn, for their supportive guidance throughout my academic research. Their thoughtful reviews and advice made important contributions to the quality of this research.

Beyond my dissertation committee, I must extend my gratitude to the Dean's office and doctoral program staff including Monica White, Wanda Tomlin, Amy Ewing, and Gerald Clarke who all provided an immeasurable contribution to my success. Their support ensured that all the candidates participating in the Doctoral Program in Health Related Sciences had the very best experience possible.

Finally, I must acknowledge my wife Maria who remained eternally loving and supportive in all my endeavors, including the most significant academic challenge in my life. Without her support and encouragement, this academic journey could not have been possible. I remain eternally thankful for her love and companionship.

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Abstract

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Health Related Sciences—Rehabilitation Leadership at Virginia Commonwealth University.

Virginia Commonwealth University, 2017

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The Current Population Survey (CPS) has been a major source of disability data for public policy and disability research for more than 30 years. Use of this same data, however, has been a source of criticism in forensic vocational rehabilitation settings when making claims about persons with disabilities and the nature of labor force participation. The aim of this study was two-fold. First, the study examined the six disability measures added to the CPS in 2008 to determine if they are both a reliable and stable method of describing disability over a period of two survey administrations in a 12-month period. Second, this study then assessed the impact of disability upon labor force participation. The findings demonstrate that the measures are effective, stable, and predictive.

This research used a subset of the respondents to the longitudinal CPS Annual Social and Economic Supplement (more commonly known as the March Supplement); it included (N=11,721) respondents who indicated a positive answer to the disability questions in both

survey months that the disability variables were measured. Descriptive analysis of expected demographic variable distributions supported the construct reliability of the measures, as well as provided some surprising results regarding higher-than-expected levels of income and wages among some persons with disabilities.

Correlation analysis utilizing Kappa coefficients demonstrated that all six measures of types of disability in the CPS are stable across time, and Fisher Z transformations show that, among the six, measures of physical and mobility difficulties were the most stable. Measures of visual difficulties, while stable, are significantly less stable than the other disability measures. Logistic regression analysis indicated that all six disability measures have a significant predictive effect on the likelihood of employment of persons with disabilities, and a fully-controlled model including contextual variables (demographic characteristics) supported the conclusion that four of the six types of disability (physical disability and difficulties with remembering, mobility and vision) have independent statistically significant effects on employment.

This study addresses some key criticisms of previous aggregate disability studies that relied on cross-sectional data, such as the widely-accepted criticism that cross-sectional studies over report the instance of long-term disability by capturing short-term impairment as well within a single survey administration. The findings reported of this research also contribute to the understanding of the statistical value of the aggregate measurement of disability and its potential usefulness to the field of forensic vocational rehabilitation.

Chapter 1: Introduction

The intended purpose of this study is to determine if the six disability-related questions found in the United States Census Bureau's Current Population Survey (CPS) are a stable and a reliable source of information regarding functional impairment and labor force participation of persons with disabilities. This is timely research given the ongoing demand for a reliable and widely accepted measure of the incidence of disability and labor force participation in forensic vocational rehabilitation settings (Brookshire, 2014; Ireland, 2006). The CPS has been among the most commonly utilized sources of information regarding employment characteristics based upon education, gender, race, and ethnicity for more than 30 years. It has also been a widely-utilized survey because of its longitudinal characteristics—the ability to match households with eight surveys covering a 16-month period. The CPS also offers an opportunity to match individual household survey responses over a period sufficient to differentiate short-term impairment from more permanent disability. Consequently, the CPS's employment focus combined with the ability to measure the incidence of disability provides an opportunity to study labor force participation of persons with disabilities. As will be discussed in detail the distinction between impairment and disability is not a straight forward process. The CPS disability measure attempts to capture the incidence of functional limitations in three domains, including sensory, cognitive and mobility. The United States Census Bureau published a study evaluating the reliability and stability of this six-question disability measure as found in the Survey of Income and Program Participation (Brault, 2013). Brault (2013) found a low to moderate reliability of

these six questions across three survey administrations over a period of eighteen months. The aim of this current study is two-fold. First, this study will examine the disability measure as found in the CPS and determine if it is both a reliable and stable method of describing disability over a period of two survey administrations in a 12-month period. Second, this study will then assess the impact of disability upon labor force participation.

Nearly 57 million people report having a disability in the United States (US Census Bureau, 2014); it has been well studied and accepted that people with disabilities have a demonstrably lower labor force participation rate than people without disabilities (Fujita, 2014). The impact of race, gender, and education upon labor force participation is well known (BLS, 2014a; Fujita, 2014; McMenamin, Hale, Kruse, & Kim, 2005). For example, research consistently reveals that persons with college degrees generally work more and much longer than individuals with high school education or less (Bureau of Labor Statistics, 2014a, Burkhauser & Houtenville, 2006). The impact of disabilities on labor force participation, however, is much less widely studied even though disability is also an important factor in both how often and how long individuals will work (Bureau of Labor Statistics, 2014b). In fact, disability status has a much greater impact upon employment than any other demographic characteristic (Burkhauser, Houtenville, & Tennant, 2014). Economists, policy makers, and the media largely focus on two discrete variables within labor force participation—employment and unemployment. Persons are categorized as either active or inactive in the labor force (Bureau of Labor Statistics, 2014b). An active status includes those who are currently working or looking for work. An inactive status includes those persons who are not currently working and are not looking for work.

There are many diverse reasons for labor force inactivity. These include school, family care, and retirement (Bureau of Labor Statistics, 2014b, Burkhauser & Houtenville, 2006).

Traditionally, those experiencing chronic illness or disability were counted as among the inactive category. However, disability is a much more difficult construct to define. The impact of a disability on labor force participation is often hard to gauge given that variables such as the level of functioning (degree of impairment), the restorative effects of rehabilitation or environmental accommodation and an individual's level of motivation are often difficult to measure. Customarily persons with significant functional limitations who also work (with or without social or environmental adaptations) were categorized as not having a disability (Ireland, 2006). This notion does not reflect the modern reality that many persons with disabilities can and do work.

This research will use the longitudinal data within the CPS Annual Social and Economic Supplement (more commonly known as the March Supplement) to examine the reliability and stability of the CPS disability measure as an indicator of disability to make reasonable conclusions about labor force participation of persons with disabilities. The six questions of interest were added to the CPS in 2008 and continue to be used in their original form. The analysis is possible because the CPS has a matched sample over a 16-month period; consequently, this practice produces longitudinal data. These 6 questions have also been used in the American Community Survey (ACS) since 1999 and the Survey of Income and Program Participation (SIPP) from 2008-2013 (Brault 2013; Erickson, 2012). While both surveys offer opportunities to study disability specific data on a household level, they have clear limitations as well. The ACS panels are matched in the first and fifth year—a period too great to be useful for this study. Over longer periods, households begin to drop naturally out of the panels and are not followed by surveyors. The SIPP survey has three fundamental limitations. First, the SIPP is predominantly a survey of program participation and health status rather than an employment

survey; consequently, persons tend to respond differently to work-related questions on such questionnaires (Burkhauser et al., 2014). Secondly, it is a very long survey with the six disability related questions occurring approximately 30 minutes into the survey making respondents subject to survey fatigue. Lastly, the SIPP discontinued the six disability-specific questions in the 2013 panel, making comparisons with the most current data difficult.

The Current Population Survey is at present the best available of matched samples (households) of disability data over time among employment-focused surveys. Specifically, the CPS surveys the same housing unit over a period of sixteen months with the six disability related questions being asked during the first and the thirteenth month. Because the CPS follows each household across a sixteen-month panel, it is feasible to construct a limited longitudinal profile for each household. Similar to other national surveys, the CPS utilizes a rotating panel model. Each household is surveyed over four successive months, and then removed from the rotation for eight consecutive months before being surveyed four additional months. For example, data are obtained by matching housing units from month-in-sample one to month-in-sample five a year later to obtain longitudinal information (US Census Bureau, 2006). Data sets of this type have been used to study and attempt to answer a broad range of social and economic issues (Burkhauser & Houtenville, 2006).

Study Background

There are many definitions of disability in the United States which often compete or conflict with one another depending upon the context in which they are utilized. Legislation and government entitlement programs offer a diverse spectrum of disability definitions. Definitions are both structural and individual. Structural definitions are often linked with government entitlement programs—such as Social Security Disability (Burkhauser & Houtenville, 2006;

Feldblum, 2000). These definitions of disability vary widely and the validity of any definition is dependent upon the reason for which it is used. The literature review by Mashaw and Reno (1996) documented more than twenty definitions of disability utilized for different purposes such as entitlements, government services, and statistical research.

In terms of individual definitions of disability; how individuals define themselves also adds additional complexity for researchers. For example, disability is often defined in terms of the environmental accommodation of the impaired person. Two persons with the same impairment, in terms of a structural definition, may not be similarly disabled or share the same perception of their impairment. The problem of having uniformity in how persons with disabilities are identified becomes apparent. Both structural and individual definitions change with time and situation and thus any firm definition of a disability is very problematic.

The Americans with Disabilities Act (ADA) states that a disability is "a physical or mental impairment that substantially limits one or more of the major life activities of an individual," a "record of such an impairment," or "being regarded as having such an impairment" (Feldblum, 2000). The ADA is predominantly a civil rights law that treats disabilities in much the same manner that race, gender, religion and ethnicity are treated under the Civil Rights Acts of 1964 (Feldblum, 2000). Just like race, gender and ethnicity, the civil rights laws regard disabilities as irrelevant for determining employment, access, and provision of essential resources and services. However, unlike race, gender, and ethnicity, disability is a fluctuating characteristic that depends upon a complex interaction between health status, functional abilities, and environmental barriers.

The treatment of persons with disabilities has been a difficult topic for society to address and has an often-controversial history in the United States. At times, people with disabilities

were treated with distain (Hale, 2001). As technology and medical science improved, however, the feelings of pity were supplanted by a desire to rehabilitate and cure. While an improvement, this led to the Medical Model of Disability which attributes the cause of disability to an anatomical or physiological context that departs from the norm (Hale, 2001). An essential feature of this model is the role of professionals who diagnose and treat the disabling conditions. Public attitudes regarding disabilities mirrored largely how the government viewed disability. These opinions ultimately lead to the development of entitlement programs and services for people with disabilities (Feldblum, 2000).

As society has changed, so has the acceptance of people with disabilities and the desire to address their unique needs. There is a much wider range of support today, including medical and rehabilitative support, technological and environmental adaptation, and services fostering social support and inclusion. While the labor force participation rate of persons with disabilities remains quite low, it has become increasingly more common for people with disabilities to work (Bureau of Labor Statistics, 2014a; Burkhauser & Houtenville, 2006). It is the labor force participation of persons with disabilities that this research will examine.

Statement of the Problem

While disability data have proved useful for researching broad government policies and services, their reliability for other applications, particularly forensic vocational rehabilitation settings, is embattled. There are two main issues. First, the data have been widely criticized to the point that they are considered unreliable (Ireland, 2006). Critics of such data opine that the questions are flawed and survey respondents are incapable of differentiating temporary acute medical conditions from long-term disability or chronic illness (Ciecka, & Skoog, 2001; Ireland, 2006; McNeil, 2000). Second, a lack of a generally accepted definition of disability continues to

be the subject of further debate (Brault, 2013; Mashaw & Reno, 1996; Nagi, 1964; World Health Organization, 2002). Thus, there is not a widely-accepted methodology for estimating the labor force participation of persons with disabilities in forensic rehabilitation settings. In part this is due to a lack of consensus concerning the definition of disability as well as concerns about data quality. A disability may interfere with a person's ongoing activity in the labor market causing periods of interruption or inactivity. Disability researchers and rehabilitation providers are acutely aware of this phenomenon. A 2010 Bureau of Labor Statistics report clearly demonstrates strong correlation between disability and discontinuous or decreased participation in the labor force (Bureau of Labor Statistics, 2014a). The report indicates that for all ages the employment rate was significantly lower for persons with disabilities when compared to those persons without disabilities. Furthermore, the unemployment rate of people with disabilities was much higher than the rate of those with no disability. Persons over the age of 65 were three times as likely to experience a disability as those below the age of 65. In addition, almost one third of workers with a disability were employed part-time compared with about one fifth of those without disability (Bureau of Labor Statistics, 2014a).

An individual's participation in the labor force is even less apparent when the impairment changes in severity. Clearly, an exacerbation of symptoms or a consequential change in function may lead a person to experience periods of intermittent or decreased work activity over his or her remaining work life. For example, a person may be medically limited to part time work of four hours per day because of a severe orthopedic injury to the lumbar spine. As a result of this injury the person may also be more medically predisposed to a degenerative disease and therefore leave the labor force earlier than he or she would have otherwise.

Disability status is the most significant demographic characteristic in terms of impact upon employment status and earnings than any other demographic characteristics including gender and educational attainment (Bureau of Labor Statistics, 2014a). While it is widely accepted within the field of vocational rehabilitation that persons with disabilities are far less likely to engage in work or are limited to part-time work, as well as lesser skilled work, a widely-accepted method of estimating labor force participation for persons with disabilities would be useful.

Data sources. Disability statistics and data are derived from two primary sources: 1) administrative information; and 2) survey data. Administrative information or data are usually gathered from governmental databases. These sources include the application for services, outcome measurement, as well as other internal data on each person, program or department. Administrative data are utilized to derive benchmarks that describe participants and to evaluate program outcomes. Survey information is also used to produce descriptive data for target populations such as persons applying for Social Security Disability or Workers Compensation benefits (Burkhauser & Houtenville, 2006). There are many regional and national efforts to collect both types of data. The Survey of Income and Program Participation (SIPP), the American Community Survey (ACS), and the Current Population Survey (CPS) are among the most commonly cited surveys among the social policy advocates, researchers, and the media. The SIPP is a very large national survey and is a popular choice among those interested in the incidence of disability in the United States. It also has an advantage because of the capacity to match households over an eighteen-month period. In 2013, a paper by Mathew Brault of the US Census Bureau studied the reliability and stability of the six-question disability measure. One

clear limitation is that the SIPP is not an employment-focused survey and not a common tool for making labor force participation estimates.

The ACS is a very large national survey with an employment focus. It is among the most commonly utilized surveys of labor force participation in the United States. It also includes the six-disability questions. The foremost limitation is the inability to match individual households over a time period as each household is only surveyed once every five-year period.

The CPS is also a large nationally representative sample of 60,000 households. Like the ACS, it is an often-cited survey for labor force participation in the United States. Unlike the ACS, however, it does have longitudinal qualities in that it is possible to match household survey responses from one year to the next. The six disability-related questions are asked during the first and thirteenth months of the survey administration. Because of its employment-focus and ability to match households over a reasonable period, the CPS is the intended data source for this research.

Disability prevalence. As of the most recent Decennial Census in 2010, nearly 57 million persons residing in the United States reported having a disability in 2010 (Brault, 2012). This comprised nearly19 percent of the 304 million persons among the non-institutionalized population that year. Of these persons, 13 percent or 38 million people reported having a "severe" disability. The incidence of disability increased by 2.2 million since 2005 (Brault, 2014 The risk of acquiring a disability increases significantly as a person ages (Brault, 2014; Burkhauser, Fisher, Houtenville, & Tennant, 2014; Burkhauser & Houtenville 2006). Persons aged 80 years and older were approximately eight times more likely to experience a disability children less than 15 years of age (Brault, 2013).

Forensic vocational rehabilitation consultants often evaluate an individual's employment and earning capacity because of illness, injury, or disability to accurately reflect the individual's economic losses. While there have been attempts to estimate labor force participation (Ciecka & Skoog 2001; Gamboa & Gibson 2010; Millement, Nieswiadomy, Ryu, & Slottje, 2003), these various methodologies are often criticized as either lacking relevant detail to specific disabilities or being unreliable due to the nature of the survey data.

The CPS and the ACS serve as the primary data sources for labor force participation rates for persons with disabilities in the United States. The CPS data are utilized widely by policy makers, government agencies, and researchers to evaluate institutional programs, and financial wellbeing and activities of both individuals and housing units (Burkhauser & Houtenville, 2006). The CPS March Supplement has attempted to identify all sources of individual income; these include government entitlement programs focused on working-age people with disabilities such as Social Security Disability Insurance (SSDI), Supplemental Security Income (SSI), as well as State rehabilitation programs. To better identify labor force participation among persons with disabilities, a work-related disability (limitation) question was first added to the CPS March Supplement in 1981. It was intended to function as a screening question to identify sources of income rather than provide detailed information about functional impairment. Since the year 2000, the Census Bureau has markedly improved the information about the incidence of disability with the development of a new set of six disability-related items added ACS and CPS.

The six disability questions in ACS, SIPP and the CPS utilize the International Classification of Functioning, Disability and Health (ICF) as the theoretical foundation (Erickson, 2012). A requirement for each of these constructs is the presence of an illness because of a disease, injury, or health disorder. Impairment is defined as "significant deviation or loss in

body function or structure" (Anner, Schwegler, Kunz, Trezzini, & Boer, 2012; Erickson, 2012; World Health Organization, 2002). For example, a hearing loss or a loss of body structure or function may be considered an impairment.

The ICF defines a limitation as " a difficulty an individual may have in executing activities" (Anner et al., 2012; Erickson, 2012; World Health Organization, 2002). For example, an individual who experiences difficulties with activities of daily living (ADLs) such as dressing, bathing or other self-care activities is said to have an activity limitation.

The ICF defines a participation restriction as a significant difficulty that a person experiences in major life activities such as employment (Anner et al., 2012; Erickson, 2012; World Health Organization, 2002). For example, the impaired person may have difficulty maintaining a job due to a lack of social acceptance such as negative bias toward persons with disabilities or an environmental barrier such as lack of suitable transportation. The Bureau of Labor Statistics uses the term "disability" when there is an instance of impairment, activity limitation or participation restriction (Anner et al., 2012; Erickson, 2012; World Health Organization, 2002).

Part of the difficulty defining what constitutes a disability is that these constructs would appear to follow a linear progression—impairment leads to an activity limitation which leads to participation restriction such as work, resulting in a "disability." Critics of these data for any labor force estimates astutely point out that many people's conditions constituting a disability are temporary in nature and improve over time through medical or rehabilitative care (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000;). They also argue that people with a significant impairment who do work because of an employer accommodation are not disabled. As previously mentioned, individuals may experience a decline in their level of functioning as aging

and pathology contribute to increased difficulty in engaging in activities of daily living and employment. Additionally, adverse events such as accidents and occupational injury may result in disablement. Alternatively, advancements in medical treatment and environmental and employer accommodations can mitigate functional impairment thereby reducing disability. Despite its dynamic nature, disability is usually regarded as stable over periods of time in longitudinal studies (Brault, 2013). If an individual answers affirmatively to a disability question, it is assumed to be static over the remaining interviews (Brault, 2013; Burkhauser et al., 2014).

The current disability questions used in the 2008-2016 Current Population Survey are provided An affirmative response to any of the six questions suggests that the person has a disability. The CPS utilizes the following format (US Census Bureau, 2015, pp. C3 40-43):

> This month we want to learn about people who have physical, mental, or emotional conditions that cause serious difficulty with their daily activities. Please answer for household members who are 16 years old or over.
>
> 1. Is anyone deaf or does anyone have serious difficulty hearing?
> 2. Is anyone blind or does anyone have serious difficulty seeing even when wearing glasses?
> 3. Because of a physical, mental, or emotional condition, does anyone have serious difficulty concentrating, remembering, or making decisions?
> 4. Does anyone have serious difficulty walking or climbing stairs?
> 5. Does anyone have difficulty dressing or bathing?
> 6. Because of a physical, mental, or emotional condition, does anyone have difficulty doing errands alone such as visiting a doctor's office or shopping?

While a casual analysis reveals that these questions will not parse out specific pathologies such as glaucoma, schizophrenia, or a missing extremity, they still offer important insight into functional impairment and subsequent disability.

A working paper by Matthew Brault (2013) specifically examined the stability and reliability of the six-question disability measure on the Survey of Income and Program Participation (SIPP). Brault (2013) found that upon three administrations over 18 months that the

aggregate data were generally stable; however, when he examined the consistency of the individual responses he found a low to moderate relationship depending on the type of functional impairment. The strongest relationship was for physical and mobility impairments while the weakest ones were for mental and cognitive impairments (Brault, 2013).

The six questions can be grouped into three categories: communicative domain; mental domain; and, physical domain. While characteristics of individuals with disabilities in an area may be heterogeneous the domains may group individuals with some shared experiences. Because people can have more than one type of disability they also may be identified as falling in multiple domains.

Persons who have an impairment or disability in the communicative domain reported one or more of the following: blindness or difficulty seeing (question #1); deafness or difficulty hearing (question #2); and difficulty with speech (question#3). Persons reporting disability in the cognitive domain had trouble making decisions or concentrating due to a mental condition (question #4). Impairment or disability in the physical domain was reported when one or more of the following were present: need for a wheelchair, cane, crutches, or walker; difficulty walking a quarter of a mile, climbing flight of stairs, or lifting something more than 10 pounds, grasping or handling objects, or getting out of bed (question #5) Finally, a disability in the participation domain was reported when an individual expressed difficulty accessing important services in in the community such as a doctor's appointment (question #6).

Purpose of Study

The purpose of this research is to determine if the six questions that constitute the CPS disability measure is both a stable and reliable measure of disability status of persons in the United States. While researchers have conceded that impairment and disability are continually

changing characteristics (Verbrugge, Remoma & Guber-Baldini 1994; Wolf & Gill, 2007), these constructs are often regarded as constant over short increments of longitudinal studies. For example, in determining disability status, respondents' answers are often presumed to remain the same across subsequent monthly surveys or for the entirety of the panel. For example, Census Bureau reports disability data in the CPS's basic monthly sample. The six disability questions are only asked during the first and fifth months of the survey as a time-saving tool on subsequent administrations. The Census Bureau then preserves the survey respondent's disability status across month-in-sample 2, 3, 4 and 6, 7, 8 (Brault, 2013) without attempt to collect updated information. While these relatively short "snapshots" of health status might be a good measure of short-term impairment, they may not reflect long term disability. Recent additions to the CPS, namely the six-question disability measure with matched households across a twelve-month period, offer a new opportunity to measure the relative stability of respondents' impairment status over a longer period. This clearly helps to address a fundamental criticism of longitudinal disability data, i.e. those persons with short-term impairments were captured in disability and work-disability statistics. The study results will thus assist disability researchers in better describing the nature of disability and its impact upon work.

Significance of Study

This examination of the stability and reliability of disability measures in the CPS is consequential because the use of past CPS disability measures has been contested (Ciecka, & Skoog, 2001; Ireland, 2009; McNeil, 2000). As a result, an improved source of nationally representative disability data has important implications in forensic vocational rehabilitation settings. The use of disability data in forensic settings has been an area of argument as some experts criticize the generalized nature of the survey data on which labor force participation and

work life expectancy data relies. This contention led the Census Bureau and the Bureau of Labor Statistics to remove the long embattled single question about work disability in favor of the new set of six disability questions. While these questions are generally regarded as an improvement, there has not been general agreement as to their reliability. This study has broader applications because other surveys such as the Survey of Income and Program Participation (SIPP), and the American Community Survey (ACS) have adopted the new six-question disability measure and make similar assertions (Brault, 2013). The significance of this study is that if nationally representative disability data were determined both stable and reliable, it would prove a valid and useful measure to estimate labor force participation of persons with disabilities in the United States. In turn, such data, serves as the keystone of other statistics widely utilized and often vigorously debated about disability such as labor force participation and work life expectancy (Ciecka & Skoog, 2001; Gamboa & Gibson, 2010; Gibson & Tierney, 2000; Gluck, 1996; Ireland, 2009; McNeil, 2000).

While the additional CPS disability measure offers an opportunity to study the nature of disability within the general population the actual usefulness of the data in forensic settings has been vigorously debated. Proponents argue that the data from the CPS, ACS, and SIPP offer the best opportunity to study the impact of disability upon employment and its effects upon labor force participation (Ciecka & Skoog, 2001; Gibson & Tierney, 2000; Gamboa & Gibson, 2010; Gluck, 1996). Those who argue against such inclusion of data in forensic settings argue that the CPS and ACS data were never intended for such use; the data are still too general to make accurate predictions about specific individuals, and, are furthermore unreliable (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000).

While these data have been widely used to estimate labor force participation and work life expectancy of persons who have disabilities and are not working, its use to characterize people with disabilities who continue to work is criticized. Some argue that disability-specific data is so thoroughly flawed that it is of no use in estimating the labor force activity of persons with disabilities (Ireland, 2009; McNeil, 2000). These criticisms date back to the original single-question about work disability introduced by the Census Bureau in 1981. Others acknowledge the limitations in the data and advise caution in its use, particularly in forensic vocational rehabilitation settings (Gibson & Tierney, 2000; Gluck, 1996). In practice, most forensic vocational rehabilitation experts acknowledge that people with disabilities do work. In fact, several authors have developed work life expectancy tables of persons who acquire disabling conditions (Gamboa & Gibson, 2010). In forensic settings, it is important to note that to exclude data on people with work disabilities who are active in the labor force tends to reduce damage estimates. For example, an electrician who sustains a permanent and severe orthopedic injury to the right upper extremity and returns to work with serious difficulty would be considered as "not disabled" and therefore would not be expected to incur shortened work life expectancy. Vocational rehabilitation theory and practice suggest differently.

There have been attempts to describe the work life expectancy of persons with disabilities who continue to work. The US Census Bureau first published Worklife Expectancy tables for individuals with disabilities in 1983. This data was published again in 1986; however, it was discontinued at that point with no explanation. It has been theorized that the US Census Bureau discontinued the publication of the data due to cutbacks in the Reagan Administration (Burkhauser & Daley, 1996) and that this data was being used in litigated settings (Ciecka & Skoog, 2001; Gamboa & Gibson, 2010; Robinson, 2014).

Another reason the use of this data in forensic settings is criticized is that there are numerous reasons why persons who are eligible to participate in the labor force choose not to participate. These reasons can be either voluntary such as the choice to take care of a child or an elderly parent, or involuntary such as a company-wide layoff. While there are seemingly limitless number of variables—either voluntary or involuntary—there are two key ones—namely school and retirement. By limiting the sample to ages 25-61, the study can exclude much of the "noise" caused by those persons early in their careers who are engaged in school as well as those who retire early because they have the financial means to do so. Prior research on the impact of disability on labor force participation also limits sample ages for this reason (Burkhauser et al., 2014).

Research Questions and Hypotheses

This study was guided by five research questions and associated hypotheses. Research questions four, and five form model development.

Preliminary questions.

Research question 1. Are individuals' responses to the new CPS disability questions stable over time?

Hypothesis 1. Individuals' responses to the new CPS disability questions are stable over time.

This study first conducted a test-retest reliability analysis using the Kappa correlation coefficient as the measure of the degree of reliability.

***Research question 2*.** Is there a statistically significant difference in the reliability of individuals' responses to the CPS disability questions among those with sensory, cognitive, physical and mobility impairments?

Hypothesis 2. There is a statistically significant difference in the reliability of individuals' responses to the CPS disability questions among those with sensory, cognitive, physical and mobility impairments.

This analysis tested the difference between independent Kappa correlations. The correlation between month-in-sample one and month-in-sample five (12 months later) for a single disability (i.e. sensory disability) was compared with the overall correlation of all other disabilities, (not including sensory), between periods.

Research question 3. Is there a statistically significant relationship between individuals' responses to the CPS disability questions and their employment status (and/or labor force participation status)?

Hypothesis 3. There is a statistically significant relationship between individuals' responses to the CPS disability questions and their employment status.

A general estimation equation (GEE) utilized a logistic model with a binomial link function. The hypothesis was tested for two levels of labor force participation—employed and unemployed. The null hypothesis was that there is no relationship between functional impairment and employment status.

Model development.

Research question 4. Does knowledge of the full set of employment status (or labor force participation status) predictors (e.g. age, sex, educational attainment, race, ethnicity, marital status, and disability) make a difference in predicting employment status over time?

Hypothesis 4. Knowledge of the full set of employment status predictors does make a difference in predicting employment status over time.

A general estimation equation (GEE) using a logistic model with a binomial link function was used. This hypothesis was tested in the same manner as research question three; however, the demographic variables were added to determine the impact of these characteristics upon employment.

Research question 5. After controlling for contextual factors (demographic characteristics), does type of disability further contribute to the prediction of labor force participation status among survey respondents?

***Hypothesis 5*.** After controlling for contextual factors, type of disability does further contribute to the prediction of labor force participation status among respondents.

Research question five built upon question four with use of a GEE but also added in the set of disability questions to the model.

Delimitations

The following delimitations were established to narrow the scope of this study:

1. Only persons who answered affirmatively to a work-disability on at least one of two administrations of the March Supplement were included in this study.

2. A working age population of 25-61 rather than the broader group of 16-65 was used to mitigate potential "noise" associated with going to school or early retirement for non-disability related reasons.

Assumptions

The following assumptions were made when conducting this study:

1. The Current Population Survey's March Supplement, including 200,000 households, is an appropriate and accurate representation of the entire non-institutionalized population of the United States.

2. The national scope and size of the CPS data is of sufficient size to make valid comparisons of all non-institutionalized persons within the United States.

3. The CPS is the best available source (compared to SIPP or ACS) of tracking labor force participation of individuals with impairments and disabilities because of its emphasis upon employment and its capacity to resample household disability data. The American Community Survey (ACS) is also employment-focused; however, it lacks the ability to resample household disability data. This is intended to address concerns that persons tend to answer impairment and disability related questions differently when taking a health-focused versus an employment-focused survey.

4. Respondents to the government survey responded to questions honestly and accurately, without the influence of secondary gain (not a precise accounting of disability seekers).

5. Respondents had the capacity to differentiate short-term impairment versus significant disability.

Organization of the Study

The remainder of this study is organized into four chapters as well as references and appendices. Chapter 2 presents an overview of disability in the United States, a conceptual framework of disability, and a review of the current literature related to the collection of disability and employment related date through national surveys. Chapter 3 delineates the study's research design and methodology and offers a description of the process of identifying the six disability-related questions in the CPS. Chapter 4 includes a data analysis with interpretation and discussion of study findings. Chapter 5 contains a study summary, concussions and recommendations based upon the research results.

Chapter 2: Literature Review

Introduction

The following literature review will address: (1) an overview of disability in the United States and the collection and uses of national disability and labor force participation data; (2) the conceptual framework of the disablement model; and, (3) prior efforts and methods to study reliability of self-reported disability and employment, including the use of matched panels in national longitudinal surveys.

Disability in the United States: An Overview

Persons with disabilities make contributions to both the economy and the labor force in the United States. In addition, they provide a large part of the domestic economy and represent more than $200 billion in discretionary spending (Brault, 2010). Federal programs such as Social Security and Medicare, as well as state programs, provide a broad range of health care, income, and services to individuals with disabilities. Health care expenses are a major portion in Medicare and Medicaid subsidies for the working-age persons with disabilities. In 2008, the Federal government spent approximately $357 billion on programs for working-age persons with disabilities, which represent 12 percent of total federal spending (Livermore, Stapleton, O'Toole, 2011). Most disability researchers agree that disability has strong social and economic costs in our society. Estimates of the size and characteristics of the population with disabilities depend upon the definitions used to classify disability as well as the methods used to collect the data (Brault, 2013).

Disability models. Disability scholars and advocates have classified disability into four models based on the historical and social context in Western culture. The models include: (1) the moral model, in which the disability is regarded a result of sin or character flaw; (2) the medical model, in which disability results from a pathology which can be cured using medical intervention; (3) the rehabilitation model, which is a refinement of the medical model, in which the disability is a deficiency that can be either wholly or partially restored; (4) the social disability model, in which the abnormality is centered not on the individual but rather on professionals and society at large who fail to acknowledge the unique contributions that persons with disabilities make; and (5) the biopsychosocial disability model, which encompasses elements of the medical and social disability models.

The moral model of disability is rooted in early American and European history and results in the most enduring perception of and treatment of persons with disabilities. While it is a less conventional view in the 21st century, society once assigned disabilities with stigma, sin, and character flaws of the individual and/or family. These feelings were sometimes based on cultural or religious norms or misunderstanding of the nature of the disability itself (Hale, 2001). Persons with disabilities were often segregated from their communities. Even in more enlightened times of the Victorian area--poor houses as they were known in England and America—were places where people “went” to be safe to engage in rudimentary care and work by either clergy or well-intentioned community volunteers. While well intentioned, this model tended to marginalize and separate people with disabilities from society. Being a person with a disability was associated with feelings of shame for the entire family. Historical accounts of people with hidden disabilities from public view are numerous (Hale, 2001). Social exclusion was often meant to keep the person out of school and denied him or her opportunity to become

an active participant in the community. Social ostracism and inequality are characteristics of the moral model (Hale, 2001).

With advances in medical treatment and scientific studies of pathology, disabilities began to be viewed differently in the late nineteenth and early twentieth centuries. The medical model is one where the physicians and medical science took on an enhanced role. While stigma and social exclusion through institutionalization remained common, the disability was no longer seen because of sin or a source of family shame. The family was neither blamed nor ostracized. In contrast, the problems associated with the pathology or illness were isolated to theindividual with the disability (Altman, 2003; Hale, 2001). It was widely believed that with the proper treatment, the person was cured of illness, and the associated barriers to work would dissipate. While an advancement from the moral model of disability, efforts were limited to the pathology with little consideration for social or community inclusion. Society continued to view persons with disabilities as assuming the roles of the sick waiting for recovery from their pathologies (Altman, 2003). The medical model continues to exert a strong influence on the provision of health services and public policy. For example, being "disabled" as defined by the Social Security Administration suggests that the individual is "…unable to engage in any substantial gainful activity because of a medically determinable physical or mental impairment . . . that is expected to result in death or that has lasted or is expected to last for a continuous period of at least12 months" (Social Security Administration, 2015, p. 5). Thus, the medical model results in many not working or being active contributors to society. Work incentives remain quite poor; once determined "disabled" only small percentages ever return to competitive work. Between 1996 and 2004, only 7.5 percent of disability insurance beneficiaries returned to work within five years of obtaining disability benefits (Ben-Shalon & Mamun, 2013). In April of 2015, the

unemployment rate for persons with disabilities was approximately 10 percent, which is more than two times the rate of persons without disabilities (US Department of Labor, 2015). This is due in large part to the fact that if an individual with a disability wants to work and increase his or her independence, he or she risks losing public benefits such as personal assistance services and health care coverage (Burkhauser et al., 2014).

The rehabilitation model is regarded as an extension of the medical model. This model gained acceptance in response to the multitude of veterans with disabilities who stood at the margins of society after World War II. A vocational rehabilitation system was instituted to reintroduce persons with disabilities into mainstream society (Burkhauser et al., 2014). The basic structures of the rehabilitation model can be seen today with the Veterans Administration and the State Vocational Rehabilitation Services. This model regards the person with disabilities as needing rehabilitation by professionals who provide treatment, counseling and training for rehabilitation before the individual may enter mainstream society. They are living on the margins until the individual obtains support and services which enable them to return to the mainstream by receiving rehabilitation training. Both the medical and the rehabilitation models have been regarded as oppressive by disability advocates because of the lack of emphasis on social acceptance and economic inclusion (Altman, 2003; Burkhauser et al., 2014; Hale, 2001; Kaplan, 2000). In contrast, the view by disability advocates is that although an individual with disabilities may require medical intervention from time to time, it is unfair to make medical intervention the locus of his or her treatment and to base most public policy around this model. It is a valid concern that despite considerable medical advancements and rehabilitation, people with disabilities often do not reach complete restoration of function. People with disabilities continue to be disenfranchised from society. Medical science will completely mitigate their disability so

they can fully participate in mainstream society (Kaplan, 2000). Both medical and rehabilitation models assume that persons with disabilities are incapable of taking part in society on their own. Kaplan (2000), however, argues that these models are discriminatory and socially ostracizing. He argues that most persons with disabilities are capable of performing well with limited support or completely on their own and can be productive members of society; therefore, their relegation to the role of the sick under the medical and rehabilitaiton models is not acceptable (Kaplan, 2000).

The social disability model was formed in reaction to the lack of emphasis placed on participation restrictions, advocacy and equality in prior views. As independent living and the disability rights movement gained pace in the early 1970s, there was growing support for regarding disability as a normal aspect of society and the aging process (Kaplan, 2000). The Social disability model suggests that disability is the result of social stigma and not a characteristic of the individual. In the social model, the fundamental problem is created by an unaccepting and unaccommodating environment enabled by the misaligned attitudes of society (Kaplan, 2000; World Health Organization, 2002). Social disability advocates claim that disability is not a variation from the norm and reject the notion of being disabled as being fundamentally defective.

The biopsychosocial model was an attempt on behalf of medical professionals to consider the perspectives of both the medical and social models of disability and was quite a bit more patient-centered, characterized by informed choice and independent decision making (Smith, Fortin, Dwamena, & Frankel, 2012). This was particularly well received in mental health settings and later became a cornerstone of evidenced based mental health treatment (Smith et al., 2012). The biopsychosocial has not fared nearly as well in organic medical care or under managed care systems (Schreter, R., 1993). Historical models of disability are outlined in Table 1.

Table 1

Historical Models of Disability

Models of Disability	Characteristics	Status
Moral	Viewed disability because of sin or character flaw	No longer a widely-held view in Western culture
Medical	Views disability because of a pathology, deficit or organic flaw. Treatment oriented toward full restoration or complete absence of the pathology	Still widely utilized and serves as the basis of most disability transfer programs (i.e. SSDI).
Rehabilitative	An extension of the medical model. Places more emphasis on adaptation to the environment.	Still widely utilized and serves as the basis of most vocational rehabilitation services.
Social	A consumer reaction to the medical and rehabilitation models. Views disability as society's inability (or unwillingness) to provide social and environmental adaptations.	Gaining wider acceptance mainly though the availability and use of universal accommodations through technology (i.e. accessibility features on computers) and community-based services (i.e. home attendant care)
Biopsychosocial	A combination of medial/rehabilitative, and social models of disability	Utilized in limited settings such as evidence based mental health treatment (i.e. Supported Employment and Assertive Community Treatment).

As a society, we have attempted to conceptualize disability through a series of models. We live in a time where we cannot completely shed the old from the new. Modern society finds fault with the moral model; however, stigma and discrimination of persons with disabilities still exists. The medical model shifted our focus to organic pathology, where medical advancements tend to emphasize the expertise of professionals over the subjective experiences of the individual (World Health Organization, 2002). The medical model remains widely accepted today—

particularly in the eligibility requirements for government entitlement programs such as Social Security Disability. The rehabilitation model extended the focus from a purely medical point of view to include individual choice and remains the cornerstone of most state and federal vocational rehabilitation programs. The social model of disability is a reaction to the medical and rehabilitation models. It normalizes the individual experiences and conditions of the individual and places fault on society's inability or unwillingness to accept persons with disabilities. The social model of disability is alive and well in many consumer-run organizations such as The National Alliance for the Mentally Ill (NAMI). Finally, the biopsychosocial model of disability was born from the field of psychiatry and mental health treatment. Like the rehabilitation model, it shifts the focus from a purely organic pathology to the individual, natural supports, and the community. The biopsychosocial model can be found in evidenced based mental health treatment such as Supported Employment (SE) and Assertive Community Treatment (ACT).

Theoretical Framework—Problems with Defining Disability

To adequately evaluate the population with disabilities, one must begin with a working definition of the population. Unlike other demographic characteristics, such as gender and age, that are comparatively easy to categorize, disability has proved far more difficult and often controversial to measure (Brault, 2013; Feldblum, 2000; Kaplan, 2000; Mashaw & Reno, 1996).

A universally accepted definition of disability may not only be impossible but also inappropriate depending upon the context. The uses range from the biosocial models, rights and advocacy, and even entitlement programs. In their research, Mashaw and Reno (1996) suggest that the accuracy of the varying array disability definitions hinges upon the context or intended purpose. For purposes of entitlement eligibility, statistical analysis, and government services they document over twenty definitions of disability. Because there is no consensus view on

disablement, this literature review examined two theoretical disablement models, namely the Nagi disablement model and the United Nation's ICF disablement model.

Nagi's disablement model. One of the most frequently applied models of disability in the field of vocational rehabilitation is attributed to Saad Nagi (1964. 1991). Nagi (1964, 1991) was among the first to recognize that the terms "impairment," handicap," and "disability" have been used in literature in many ways. In Nagi's (1964, 1991) disablement model, an individual's impairment is influenced by the socioeconomic environment. This is a dynamic process characterized by passage through four states of being: pathology, impairment, functional limitation, and finally, disability. Pathology, the first state, is the existence of a physical or organic condition that exists over a period of time. Nagi (1964, 1991) regarded mental impairment as secondary to organic pathology. The second impairment state occurs when the condition results in a difficulty or inability to ambulate within the individual's environment. Impairment also relates to limitations in self-care activities. Under Nagi's (1964, 1991) disablement model, impairment refers to a loss of the tissue, organ, or body system level. Therefore, active pathology usually results in some type of impairment. Not all impairments, however, are associated with active pathologies but rather with the residual impact from them. For example, a congenital disorder may lead to impairments later in life. Nagi (1964, 1991) further defined functional limitations attributed to impairments by considering difficulties in performing fundamental physical and/or mental activities in daily life.

The final phase of disability under Nagi's (1964, 1991) model is the inability or limitation in performing socially expected activities (Burkhauser et al., 2014). For example, an individual may have an orthopedic illness resulting in chronic pain and a reduced range of motion. Faced with serious mobility impairment, persons are unable to functionally climb stairs.

One clear flaw in Nagi's (1964, 1991) model is that if the functional limitation does not interfere with a socially expected activity such as work, then it does not constitute a disability. Those with a pathology that results in a cognitive or physical limitation but are still able to work (with or without accommodation) are not considered as having a disability (Burkhauser et al., 2014). Nagi (1964, 1991) argued that the individual can engage in work through accommodations in the work environment or access to rehabilitation. Persons with disabilities could, continue, he acknowledges, to experience difficulties with self-care activities because they live alone or lack the assistance of a care provider and therefore experience a disability even though they can work with accommodations. Figure 1 illustrates the interaction of the components of the model and disability within the context of the individual's environment.

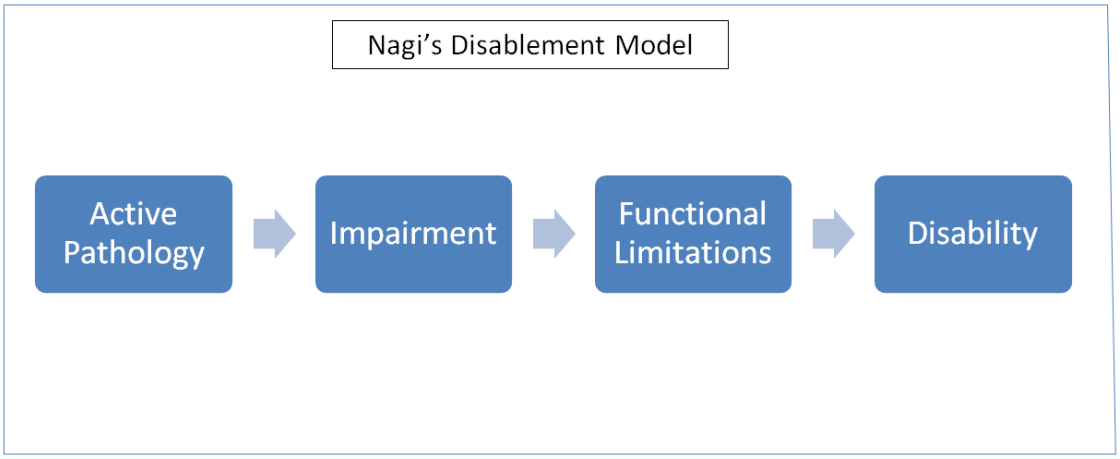


Figure 1. Nagi's Disablement Model

Among the most controversial aspects of Nagi's (1964, 1991) disablement model is the relative importance placed upon pathology which does not take into consideration the social or physical environmental factors or influences (Burkhauser & Daley, 1996). Disability advocates argue that people with disabilities are vulnerable to discrimination and are placed at a distinct disadvantage because their ability to compete with others is impaired or prevented by the work

environment or work practices. People with disabilities experience both physical and attitudinal barriers in much the same way racial or ethnic minorities and women experience prejudice in society (Burkhauser & Daley, 1996).

The dynamic interaction between the individual pathology and the socioeconomic environment is a somewhat less controversial and more widely accepted aspect of Nagi's (1964, 1991) disablement model. While Nagi's (1964, 1991) model is useful, many persons with disabilities do work and still experience appreciable socioeconomic barriers. These barriers commonly include labor force participation, choice of employment, potential loss of benefits, or even employer perceptions of disability. Surprisingly, labor force participation among persons with disabilities is far less than any other demographic group (Angel & Whitfield, 2007; Bound & Waidmann, 2000; Bureau of Labor Statistics, 2014a, 2014b; McMenamin et al., 2005). To suggest, as Nagi's (1964, 1991) model does, that the individual with an impairment who is accommodated by the employer no longer has a disability is somewhat lacking. For example, a person with chronic pain after spinal fusion might experience a marked improvement in quality of life with medically supervised opioid medications, even to the point where he or she returns to a physically demanding job with an accommodation. The underlying pathology, however, often continues to limit the individual, resulting in residual disability. They can develop medication tolerances, unpleasant side effects, or the medication can even contribute to secondary impairment (Berecki-Gisolf, Clay, Collie, & McClure, 2012; Kadzielski, Bot, & Ring, 2012).

Adaptations may include the addition of sociocultural characteristics such as the physical and social environment (World Health Organization, 2002) as well as the personal characteristics such as individual attitudes and lifestyles (Jette, 2006). This study asserts that a more complete and current model that accounts for these realities involving disability and work is necessary.

ICF disablement model. The World Health Organization's International Classification of Functioning, Disability, and Health model, more commonly referred to as the ICF model of disability, shares much in common with Nagi's (1964, 1991) model. The ICF model has four constructs and includes an impairment, an activity limitation, a participation restriction, and lastly, a disability (World Health Organization, 2002). Similar to Nagi's (1964, 1991) disablement model, a requirement of these constructs is the existence of a serious health problem, illness, or pathology. According to the ICF model, a psychological or physical impairment is defined as a "significant deviation or loss in body function or structure" because of a pathology (World Health Organization, 2002, p. 10). For example, an individual might experience symptoms of neuropathy associated with severe diabetes. An activity limitation is defined as difficulty a person has in participating in or carrying out activities of daily living. A person who experiences neuropathy in the hands and fingers may have difficulty handling and fingering small objects or participating in activities during temperature extremes. A participation restriction is defined as a barrier that an individual experiences in either the social or work environment (World Health Organization, 2002). For example, an individual with severe diabetes may have difficulty performing job tasks because of the physical or social environment. This can be due to a lack or unwillingness to provide employer job accommodations (physical) or through discrimination (social). In the ICF model, the term disability describes the presence of impairment and accounts for activity and/or participation restriction due to environmental and discriminatory factors (World Health Organization, 2002). A cursory view suggests these constructs follow a linear progression of impairment that contributes to limitation in an essential activity or an inability to fully participate in the community. However, this is not necessarily true in all circumstances. It is widely accepted among researchers that disability is not a linear

process and that an individual can experience a participation restriction without an activity limitation, impairment, or disability (Anner et al., 2012). For example, an individual with severe diabetes may experience a work-limitation; however, he/she may not experience serious limitations in other areas such as social functioning.

Figure 2 illustrates the relationship between these constructs. Note that while there is an overlap between these constructs, it is possible and likely that one of them can occur without a presence of the others due to the transient or cyclical nature of some pathology. People may experience relatively few symptoms at times yet experience persistent social, activity, or participation restrictions (such as work). Like Nagi's (1964, 1991) model, the ICF definition of disability is rooted in the contributing pathology. Disability occurs when any two of these three conditions of impairment, activity limitation, and/or participation restrictions intersect.

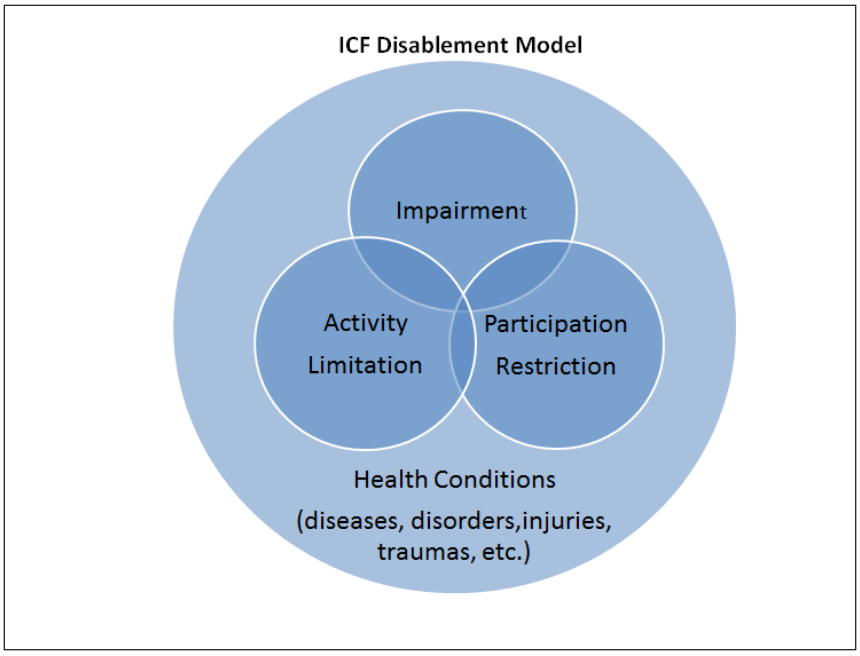


Figure 2. ICF disablement model Venn diagram. Adapted from "A guide to disability statistics from the current population survey: Annual social and economic supplement (March CPS)" by Burkhauser, R., & Houtenville, A. (2006) p. 5.

Nagi's (1964, 1991) disablement model and the ICF model differ in several important respects. The two disablement models vary in terminology and directionality of the relationship between characteristics.

Despite the differences between the Nagi (1964, 1991) and ICF disablement models, there are some clear commonalities and congruence. In both models, researchers must acknowledge that an individual moves from occurrence of a health condition to a point at which the pathology restricts activities that are socially expected of him or her and that this restriction is related to the environment in which the person lives (Burkhauser et al., 2002).

United Nations definition of disability. According to the United Nations (UN) and the World Health Organization (World Health Organization, 2002), most people will experience some level of disability during their lifetime. It is viewed as a naturally occurring process. They argue that disability should be recognized as an ordinary event during life and suggest a more common acceptance of disability and advocate greater social inclusiveness. This advancement in the perception of disablement should be taken one step further and allow society to reconstruct and design systems and the social environment in a way that is more accepting of disabilities. This broader view helps to normalize life for those with disabilities.

The World Health Organization (WHO) defines disabilities very differently from the definition given by the Americans with Disabilities Act and is regarded as more descriptively useful for purposes of this research. According to the WHO, there are two components of pathology---impairment and disability. Impairment occurs when there is a deviation from "normal" psychological or bodily structure or function. Disability is any restriction or lack of ability to perform an activity because of such impairment (World Health Organization, 2002). A disability is therefore simply regarded as a deviation from the norm because of a mental or

physical impairment. The WHO also defines the term "handicap," a term that has lost favor in the Unites States, particularly in the field of rehabilitation counseling. The WHO (2002) defines handicap as "a disadvantage for a given individual, resulting from an impairment or disability, that limits or prevents fulfillment of a role that is normal, depending on age, sex, social and cultural factors, for that individual" (p.10). A handicap is for this reason a construct between the person with the disability and their social and physical environment. Persons experience a handicap when they encounter cultural, physical, or social barriers that prevent full access within the environment and society. Therefore, a handicap is the limitation or complete loss of "opportunities to take part in the life of the community on an equal level with others" (Kaplan, 2000, p. 355).

WHO published its conceptual outline for disability and health in 2002 and is widely known as the International Classification of Functioning, Disability and Health (ICF). The ICF framework has been used in 191 member nations of the UN since 1980. The ICF departs from traditional views of disability (Hale 2001; Jette, 2006; Kaplan, 2000). Until 2002, it was assumed that the term "disability" applied only to a distinct group of people within society. The WHO changed this worldview and influenced policy makers towards a more inclusive policy making approach. The definition from the ICF also established a sought-after parity between physical and cognitive causes of disability. Until this time, mental and cognitive impairments were viewed as secondary to physical or organic pathology. ICF normalized disability by recognizing it as a universal human experience. Finally, the ICF's definition of disability called for the identification and removal of barriers that improved access and independence for people with disabilities. Figure 3 illustrates the ICF model of disability.

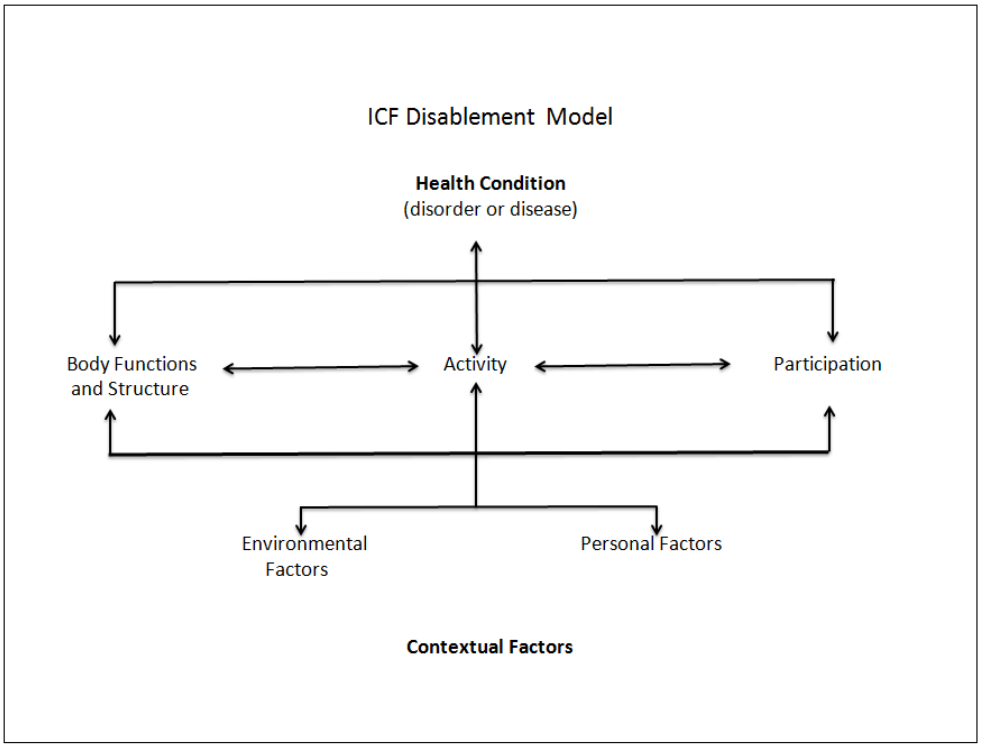


Figure 3. ICF disablement model conceptual framework. Adapted from "Towards a common language for functioning, disability and health" by The World Health Organization, 2002, p. 9.

Both the Nagi and ICF disablement models serve as useful constructs in understanding the dynamic nature of disability from the perspective of both organic, mental, and social functioning. They do not, however, offer any explanation as to how individuals understand and make decisions about their own health status. This is a particularly important phenomenon studied in the field of survey research.

Cognitive model of survey response. The cognitive model of survey response serves as the most well-accepted theoretical framework for self-reported health status data (Johnson, 2015). First developed by Roger Tourangeau in 1984, it has since served as the major basis for understanding measurement characteristics of survey questions and offers a robust theory of how individuals understand, process, and respond to subjective experiences such as their interpretation of health status (Johnson, 2015). The cognitive model of survey response segments

the process of answering a health-related question into four steps: comprehension; retrieval; judgment, and response (see Figure 4). These steps are generally understood to occur within just a few moments of encountering the survey question. They also generally occur in sequence; however, it is likely that respondents revisit prior steps depending upon how they interpret the question and the appropriateness of the response (Johnson, 2015; Ornstein, 2013; Tourangeau, Rips, & Rasinski, 2010).

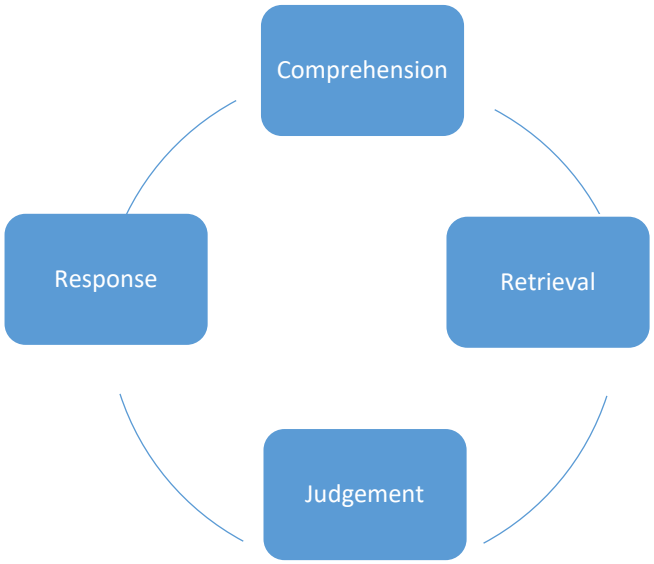


Figure 4. Cognitive model of survey response

Comprehension, the first step, occurs when the survey respondent understands the question by identifying the key concepts and determining what the surveyor is asking. Much effort is made to design, test, and re-test new survey questions (US Census Bureau, 2006; Wittenburg & Nelson, 2006). Question comprehension requires the respondent to understand health as a concept as well as the response measure utilized—such as a Likert-type scale (Johnson, 2015; Tourangeau et al., 2010). For example, when responding to a question about physical wellbeing, the individual must assess his or her health against an unfamiliar measure. The person's capacity to comprehend health status is a critical component to understanding this

cognitive step. How one person defines his or her own health status may vary meaningfully from how another person defines it. Language and cultural compatibility are important considerations for any survey design. Well-worded questions are often subject to several rounds of focus group testing to mitigate confusing concepts or unusual wording. The development of the cognitive model of survey response shifted the focus from how the question was designed to the ability of the individual to reliably answer the question. The cognitive model provides the concept and language to describe how respondents answer questions. To ensure accurate question comprehension, most researchers organize formal studies of test item-response for new survey questions prior to widespread implementation (Brault, Stern, & Raglin, 2007; US Census Bureau, 2006; Wittenburg & Nelson, 2006). These studies can correct confusing language or even result in omitting certain questions from surveys.

The survey respondent then moves to the retrieval step by recalling the relevant information from memory. A question elicits either a very narrow or broad collection of memories—depending upon how well the respondent comprehends the question. Judgment occurs when the survey respondent formulates an answer based on the comprehension and retrieval of the information. In short, from his or her accumulation of memories, he or she determines what information best fits the question. Finally, in the response step, the respondent expresses the answer in the best way he or she is able within qualitative surveys or within the correct categories within in quantitative surveys.

Even with well-designed questions, it is often difficult to illicit reliable responses from individuals. A survey respondent may not go through the steps in a perfectly linear order, depending on a variety of known and unknown factors (Tourangeau, 2010). For example, if an individual does not understand the question (comprehension), he or she cannot recall the relevant

information about his or her health condition from long term memory. In instances of low educational attainment or cultural differences, the respondent may reinterpret the question in terms he or she can answer. In the brief moments that respondents need to answer a typical health question, the four steps may even overlap.

Two competing theories have emerged from the literature that suggests how individuals interpret health status questions in national surveys (Bailis, Segall, & Chipperfield, 2003). The first theory considers health as an enduring status that is stable over time. That is, once an individual responds affirmatively to having a disability—such as impairment related to vision loss—the condition is assumed to remain constant over the life of the panel. There is also a second issue with this view. Contrary to what one might expect, the literature suggests that serious medical problems do not necessarily lead individuals to lower the assessment of their health status (Bailis et al., 2003; Johnson, 2015; Lee, 2014; Wilcox, Kasl, & Idler, 1996). Often people compare their health status with their peers—such as an elderly person comparing their functional abilities not with how they used to function but rather how they function compared to persons their same age. The notion that objective heath measures cannot completely explain subjective health status suggests that an individual's perception of health is more enduring than acute events, such as accidents and injuries, and help ensure consistent responses over time (Bailis et al., 2003; Johnson, 2015; Lee, 2014; Wilcox et al., 1996).

A contrasting theory of health status reflects a current self-assessment snapshot of one's health based upon the unique subjective experiences of the individual (Johnson, 2015; Ornstein, 2013). In this view, individual thoughts or assumptions about past or future illness do not influence how people evaluate their health status at the time of the survey (Baillis et al., 2003). This theory suggests that health status is a transitional state rather than an enduring trait or

characteristic. While the Cognitive Model of Survey Response has many qualities, there are some noteworthy limitations. First, the model does not take into consideration the effect of an interviewer or method of administration on a respondent's answers. It also does not measure the respondent's cognitive ability to understand a question or the level of motivation (Johnson, 2015; Ornstein, 2013). Interviewers may vary in how they read the question, deal with respondent queries, and prompt a slow or reluctant respondent. They may also have varying presences in an interview that can affect responses. The respondent's motivation in answering questions can affect how well he/she understands the question, and his/her ability to retrieve relevant information, as well as judgment of their health status. Effects of social stigma could influence the respondent to modify the answer considering the interviewer's presence or to appear in a better light (Schwarz, 2007). For example, a survey respondent may indicate that he or she obtained a job when in fact they did not, simply to avoid the uncomfortable feeling he or she has explaining to a stranger that he or she remains unemployed.

The model proposed by the World Health Organization describes health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 2002). While this view is attractive, it has not found it's way into national survey designs. National surveys are full of "yes" or "no" answers which shortens administration time and improves uniformity. Indeed, an equivalent survey with likert-type responses would be too lengthy and burdensome for the average survey respondent.

National Data Sources of Disability

Administrative records and survey data are among the most commonly studied sources of disability data in the United States. Administrative records, such as applications for Social Security Disability benefits or State Vocational Rehabilitation services, are gathered from

application and outcome records that are collected for each person. Program evaluators and disability policy makers generate statistics to monitor outcome data over time. For purposes of this research, the focus will be on the most common survey data-gathering efforts. Survey data are utilized to produce statistics for targeted groups and usually associated with indicators such as unemployment, program participation, or health status. Some survey data focus on participation in specific programs or services, while others are intended to describe the general population or specific subgroups. There are efforts to match survey data with administrative records. For example, information about an individual's health status before and after the provision of state vocational rehabilitation services offers useful insights about the efficacy of such programs. While the possibilities are near inexhaustible, obtaining matching administrative and survey data is often difficult. Beyond the obvious methodological differences in data collection, individuals tend to answer survey questions differently, particularly when they are seeking specific services. For example, a study of people who participate in state vocational rehabilitation services will tend to emphasize medical or mental impairment as the most important contributor to unemployment versus other factors such as economic conditions or educational attainment.

There are four main data sources, each offering unique strengths and weaknesses. These include: primary subject matter such as health, employment, or housing status; target population and the type of disability; geographic trade-offs involving national versus local data; and frequency of data collection (Burkhauser & Houtenville, 2006).

Circumstances for data collection are rarely ideal, and the researcher is often faced with many limitations. An ideal source of data might include detailed information about health status, disability, income, labor force participation and demographic information. Furthermore, the

individual is surveyed monthly and compared with administrative and employment records to give a real-time estimate of the general well-being of the population at large. Gathering such information would be an enormous undertaking even for the Federal government and burdensome for those surveyed. Since this type of database does not exist due to obvious political, economic, and social constraints, a combination of data sources is often considered in disability research. One data source may provide only general information in the local geographic area about employment statistics, while another may provide information on a national level.

Counting working-age people with disabilities. Using health-related questions about disability, the medical model is widely applied to national health surveys such as the Survey of Income and Program Participation (SIPP), the American Community Survey (ACS), and the Current Population Survey (CPS). Traditionally, good health is defined as the complete absence of illness or disability (Lee, 2014). After an appropriate and expected period of recovery, persons are again completely restored. However, illness and disability are much better characterized by a continuum where being in "good health" might fall within a relatively wide range of possibilities (Baillis et al., 2003; Lee, 2014). An individual's capacity to understand this concept in a health survey question is therefore crucial.

The task of counting people with disabilities is an enormous and often difficult undertaking. "For decades, disability policymakers, administrators, researchers, advocates, and people with disabilities themselves have been frustrated with the lack of quality, comprehensible data and statistics about people with disabilities" (Houtenville et al, 2009, p. 394). While it may seem a straight-forward process, accumulating the subjective experiences from a representative sample and then applying those results to public policy and decision making has proven itself to

be an extremely challenging task. More informed policy decisions would permit people with disabilities to better utilize services with the goal of ultimately living more productive and fulfilling lives. Better data and examination of surveys in study could lead to improved understanding of impairment and disability.

Disability can be a fluid and complex construct to examine. It is not necessarily true that someone will always have a disability. Conversely, if a person is born without a disability it does not mean that the person will never have one. With the inherent complexity of disabilities noted in this research, this literature review will examine the four main surveys that attempt to account for persons with disabilities. Those four are: The Decennial Census; the American Community Survey (ACS); the Survey of Income and Program Participation (SIPP); and the Current Population Survey (CPS) and related CPS March Supplement.

The decennial census. The Decennial Census is collected in years ending in zero and has been conducted since 1790. This makes it one of the oldest regularly administered censuses in the world. The original census was quite simple as there were only 6 questions (US Census Bureau, 2006). The major reason for the original census was simply to count the population. Thus, the Decennial Census aims to count every American citizen. In 2010, it counted 308 million people. It is with this data that the U.S. estimates its total population. Before 2010 the Census had a short and a long form. The short form asks basic demographic information: age, sex, location, etc. The long form is given to 1 in 6 people and asks more in-depth questions, including questions about disability status (US Census Bureau, 2006). In 2000, the Census Bureau added two additional questions on disability. The questions were as follows (US Census Bureau, 2006):

1. Does this person have any of the following long-lasting conditions?
    a. Blindness, Deafness, or severe vision or hearing impairments?
    b. A condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying?
3. Because of a physical, mental or emotional condition lasting 6 months or more, does this person have any difficulty in doing any of the following activities?
    a. Learning, remembering, or concentrating?
    b. Dressing, bathing, or getting around inside the home?
    c. Going outside the home alone to shop or visit a doctor's office?
    d. Working at a job or business?

As of 2010 the census was divided into two parts: the original census and the American Community Survey (ACS) that replaced the long form (more information on the ACS follows). The questions remain like the above noted questions.

Currently, the Decennial Census serves as the basis for data on persons with disabilities and is administered at every ten years in the United States (Bruyere & Houtenville, 2006). This effort collects data on one million households in the United States every ten years and serves as a primary source of information for public policy makers and researchers. The 2010 Census data in the field of forensic vocational rehabilitation is quite useful in that it provided population data at the local levels that are useful to quantify the impact of local wages, income, employment, educational attainment, and economic hardship among persons with disabilities (Bruyere & Houtenville, 2006). The Decennial Census has two obvious limitations: (1) the frequency of collection limits its usefulness, and (2) matching household information over two administrations

turns out to be impractical and often inaccurate. Thus, while the Decennial is the longest running source of data with regards to disability, it is also quite limited.

American Community Survey (ACS). The goal of the American Community Survey (ACS) was to remedy some of the Decennial survey's shortcomings. The Decennial survey is only conducted every ten years. The ACS, by contrast, is administered annually. The American Community Survey is regarded as "the survey with the most extensive coverage of the entire population" (Houtenville et al, 2009, p. 394). Thus, the AC) addresses one of the most central issues of the Decennial Census: the issue of frequency. The ACS is the intended replacement for the Decennial long form (US Census Bureau, 2006).

The ACS collects data on 3 million households per year located across all fifty states and has been conducted annually since the year 2000 (US Census Bureau, 2006). One valuable characteristic of the ACS is that it collects a sample of 2.5% of the population residing in institutional settings such as long-term care facilities and prisons. The ACS is thought to be an important measure to decrease the incidence of institutionalization of persons with disabilities. It contains an additional six questions regarding disability. The Census Bureau also refined the existing questions about disability. For the years 2000 through 2002, the ACS contained problems with the "go-outside-home" and "employment disability" questions, but the 2003 revision reduced these errors (Stern & Brault, 2005). The potential utility is that the ACS provides an annual measure in the economic and social characteristics of the population with disabilities in the United States. The six disability-related questions of the ACS were subsequently duplicated in other national surveys such as the Survey of Income and Program Participation and the Current Population Survey.

While the sample size and employment focus is attractive for disability research, the ACS has an obvious limitation. It has a very limited longitudinal capacity. The ACS matches housing units only once every five years—a period far too long to be useful in this research. Therefore, while it is possible to generate descriptive statistics about the prevalence of disability at a single point in time, it is not feasible to measure stability of disability over longer periods as this research proposes.

The Survey of Income and Program Participation (SIPP). The Survey of Income and Program Participation (SIPP) is a large sample of household data with an emphasis on health status and service utilization in the United States. It serves as a major source of information for national policy decisions regarding Federal programs and initiatives. It is also attractive because of its longitudinal properties over a multiyear period lasting approximately four years (US Census Bureau, 2014). The SIPP is a very in-depth source of data. The panel design allows for levels of analysis that cannot be found in other surveys. Following the same person or household through time allows a researcher to infer many implications that are not possible with non-panel data. The SIPP therefore allows for analysis of interactions between many government policy variables, such as tax rates, welfare programs, income distribution, and disability status.

The SIPP is a longitudinal-type survey administered jointly by the Census Bureau and the Bureau of Labor statistics, and encompasses multiple panel sizes up to 95,000 non-institutionalized persons. The SIPP is a widely-utilized source of disability and health information, as each panel is tracked for two years. The SIPP also gathers data about employment limitations on a quarterly basis. In 2006, it added the same six disability questions found in the American Community Survey. Unlike the ACS, the SIPP does offer an opportunity to match individual households over three administrations. A study by Brault (2013) at the US

Census Bureau, utilized the SIPP to measure the stability and reliability of these disability measures over time. He found that there was a moderate to low stability and reliability of disability-related responses over three survey administrations over a period of 18 months. Brault (2013) indicated that one major limitation in the study was that disability was not necessarily a linear process, meaning that persons perception of health status ebbs and flows depending upon a variety of complex characteristics over time (Burkhauser, Fisher et al., 2014). While the SIPP appears to offer an excellent opportunity to measure disability longitudinally, it discontinued the use of these questions in 2013, making comparisons to later years challenging. Unlike the ACS, the SIPP is not an employment focused survey.

The Current Population Survey (CPS). The Current Population Survey (CPS) is a combined effort between the US Census Bureau and the Bureau of Labor Statistics and one of the most widely utilized in survey research (Drew, Flood, & Warren, 2014, p. 121). The CPS is a monthly survey of 60,000 households. It is both employment-focused and has some longitudinal qualities that make it possible to match households over sixteen months. It also added the same six disability questions validated for use in the ACS and SIPP in 2009. The CPS collects labor force information for non-institutionalized persons aged 16 and older in the United States. Its basic monthly survey is a probability sample of 60,000 households and is representative of the US population (US Census Bureau, 2006). Persons in mental and penal institutions, as well as those serving in the Armed Forces, are excluded from the sample. Participation is voluntary; however, only about four percent of those surveyed refuse to participate (US Census Bureau, 2006). Each housing unit is surveyed once per month for four consecutive months. They are then dropped from the survey for eight consecutive months, and then surveyed again for four

subsequent months in the following calendar year. Table 2 illustrates how a single 16-month panel overlaps 2013 through 2014.

Table 2

CPS Panel Rotation Example

	2013												2014			
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Month-in-Sample	1	2	3	4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	5	6	7	8

In March of every year, the Census Bureau supplements the basic monthly survey with additional survey questions. This is known as the Annual Social and Economic Supplement (more commonly referred to as the March Supplement) to the CPS. The March Supplement is a survey of comprised of 200,000 persons in non-institutional settings within the United States. It is an expanded survey administered to all households in the panel. This data rich survey offers additional opportunities to study the impact of disability upon employment. Because of the additional data, researchers tend to use the March Supplement when matching households to the following survey year.

The six disability questions from the American Community Survey were also included in the Current Population Survey in 2008. Prior to their current form, the Census Bureau field tested a variety of questions dealing with the sensory, mental, and mobility impairments, as well as a work disability questions. The six questions, to be more precise, asked respondents to indicate if they have trouble with any of the following: seeing, hearing, remembering things, walking or going up and down stairs, visiting the doctor or shopping alone, and dressing or

bathing. They found that the six disability-related questions were reasonably reliable. However, the Census Bureau discontinued the use of the work-disability questions in both the ACS and CPS due to varied responses by test subjects (Brault et al., 2007).

As discussed, gathering reliable data with regards to disability has been and continues to be a daunting challenge. If disability is regarded as a fluid concept, as is increasingly the case by researchers and policy makers, it inherently makes for even greater challenges. This, in conjunction with the unavailability of a single survey that specifically tracks disability accurately over time, makes policy decisions with regards to disabilities difficult, to say the least. However, reliable data can be obtained by a combination of the above noted surveys. While the data within all the surveys is still imperfect it remains a valuable source of information for both public policy and forensic rehabilitation purposes. It allows policy makers to get a general feel for the prevalence of disabilities in the United States so that they can make better policy decisions with respect to a populace. With that said, there is clearly much room for improvement.

Rationale for a Revised Definition of Disability

As previously noted in this literature review, the definition of disability tends to change, depending upon the setting and reason for use. The lack of specificity tends to be problematic in forensic vocational rehabilitation settings where the determination of disability is of the utmost importance. The new six disability questions are now found in the Current Population Survey and offer an opportunity to measure the impact of disability across vision, hearing, cognitive, physical, community access, and self-care domains.

The CPS ASEC offers limited longitudinal properties compared to other national surveys. However, the capacity to match individuals over a period of one year is ideal for this research

because it is enough time to differentiate short-term impairment from disability without suffering from the increased incidence of household dropouts as time passes.

Most disability statistics are based upon responses from a single survey administration (Burkhauser & Houtenville, 2006; Erickson, 2012). While this is a straightforward method of counting the incidence of disability, it may in fact, overestimate the incidence of disability by including persons with short-term impairments that improve over subsequent surveys within the panel. Disability researchers are also interested in distinguishing short-term medical impairment from more persistent pathology that is associated with disability. Research by Burkhauser and Daly (1996) and Burkhauser and Wittenburg (1996) excluded individuals whose health conditions were short-term as evidenced by an affirmative response on only one survey administration. They argued that persons who report a health limitation in two consecutive survey administrations (over a period of at least one year) forms a reasonable basis for differentiating short term impairments from disability.

The Social Security's definition of disability also has long established that a period of one year as a demarcation between short-term and long-term health conditions. The SSA definition of disability states than an individual must be "unable to engage in any substantial gainful activity because of a medically determinable physical or mental impairment . . . that is expected to result in death or that has lasted or is expected to last for a continuous period of at least12 months" (Social Security Administration, 2015, p. 5).

Another reason to support the use of the two-survey method of estimating disability (as opposed to less than one year or more than one year), is the incidence of household dropout rates. Drop-out rates as households move or do not complete either the first or second administration of the survey in the Current Population Survey are overall quite low (US Census

Bureau, 2006). However, certain segments of the US population—such as persons with lower incomes and minority groups--tend to move more frequently than others (Burkhauser & Houtenville, 2006; Erickson, 2012). Persons with disabilities—the intended subject of this research is among this group.

Labor Force Participation Rate

The Bureau of Labor Statistics (2015a) defines the Labor Force Participation Rate (LFPR) as the percentage of the civilian non-institutional population either working or actively seeking work. The LFPR serves as the basis of many well-cited statistics, including estimates of national unemployment. Persons participating in the labor force include both the employed as well as persons who are unemployed but also seeking work. Those people who are eligible for employment but are not actively seeking work, such as discouraged workers, are not included in this statistic.

Core demographics. The correlations that persist with regards to labor force participation rate (LFPR) for key demographic populations in the United States are of considerable interest. The Department of Labor defines the labor force participation rate as the percent of civilian citizens over the age of 16 who are in the labor force (Bureau of Labor Statistics, 2015a). The LFPR rate has experienced considerable variation over time (see Figure 5). Prior to 1960, the LFPR of all Americans was below 60% and increased gradually until it reached a high of approximately 68% in the year 2000. Women entering the labor force were the single largest contributor to the increase. During this time, the LFPR for men has declined somewhat. Since then the trend has reversed and the rate has subsided to its current level of approximately 63%.

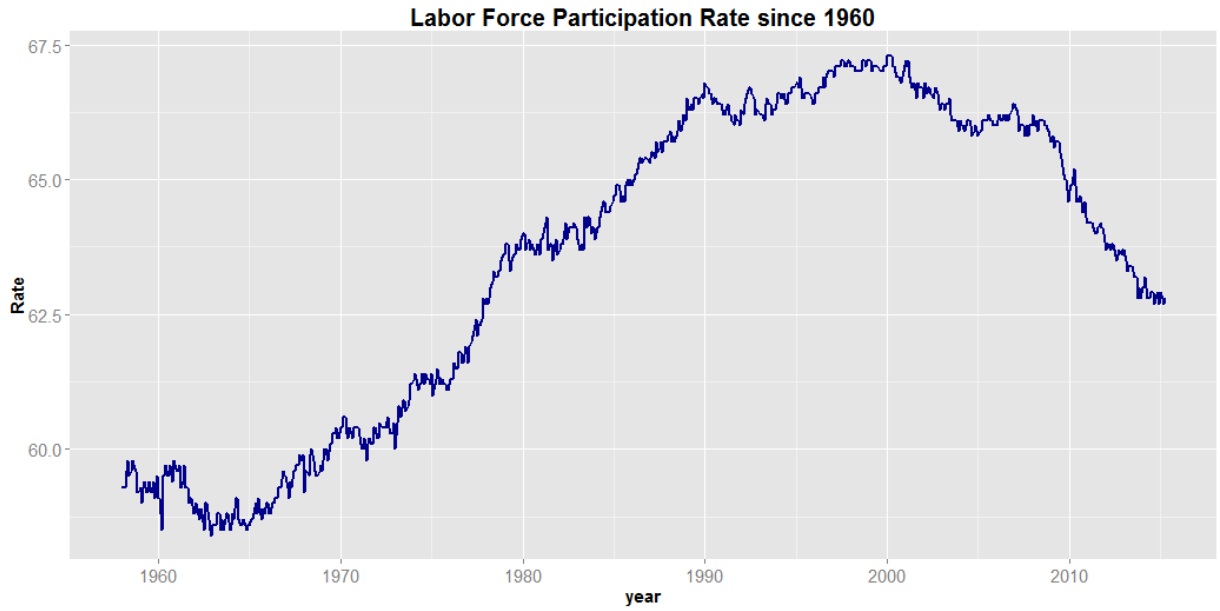


Figure 5. Historical Labor Force Participation Rate. Adapted from United States Department of Labor, 2014. women (Bureau of Labor Statistics, 2014b).

One of the significant differences in the LFPR is the difference between men and women. Currently 57.2% of eligible women are considered active in the labor force compared to 69.7% of eligible men (Bureau of Labor Statistics, 2014b). Men have had a higher LFPR since the statistic was first compiled; however, this trend has been reversing in more recent years. The main driver of this trend is the increase in households with dual wage earners and unmarried as can been seen in the Figure 6, the LFPR for men and women is getting much narrower. In the 1970's the difference was almost double: close to 40% for women and almost 80% for men.

Labor force participation by age is also undergone much change. In recent years, young adults have been delaying employment in favor of continued education. The highest recorded LFPRs occur between the ages of 25 to 54. Perhaps the only irregularity is that women between the ages of 16-19 have a higher LFPR than men but then are lower at every other age group (US Department of Labor, 2014).

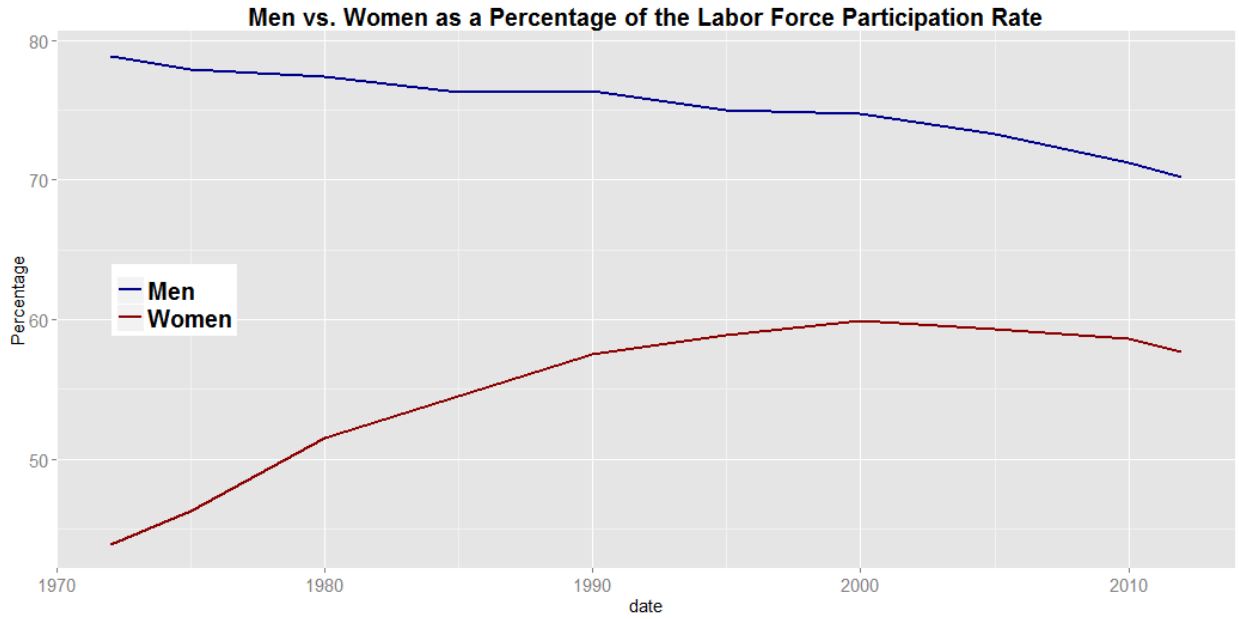


Figure 6.: Labor force participation of men compared to women. Adapted from United States Department of Labor, 2014.

A noteworthy trend that has been noticeable for nearly 20 years is a decline in the LFPR among citizens aged 16-25 and an increase in the rate for citizens aged 65 and over (Bureau of Labor Statistics, 2014). From 1992 to 2012 the LFPR rate for those aged 16-25 dropped from 66.1% to 54.9%. Furthermore, over the same period the LFPR rate for those aged 65 and over increased from 11.5% to 18.5%. This seems to be a persistent trend and is expected to continue as the life expectancy of the population increases. The Bureau of Labor Statistics (2014a) predicts that the rate for 16-25-year old's will drop to 49.6% by the year 2022 and rise to 23% in the same year for those 65 and older. This trend represents an observable shift in the labor force; young people are taking longer to enter and older people are taking longer to leave. There are many causes for this phenomenon but the main ones are the following: improvements in health and longevity are allowing older people to work longer, and increased demand for highly skilled labor incentivizes younger people to gain more education before entering the work force (Bureau of Labor Statistics, 2014a).

There are considerable and persistent differences by race and ethnicity in LFPRs. In 2012, the LFPR of black men was 63.6% percent; this is considerably lower than the overall male rate of 70.2%. On the other side, Hispanic men had a LFPR of 76.1%, in 2012, which is considerably higher than the overall rate for men. Interestingly, women have much less variation. The highest rate among women, in 2012, was for black women who had a LFPR of 59.8%; this is only slightly higher than the overall rate for women at 57.7% (Bureau of Labor Stastics, 2014b).

Finally, educational attainment impacts the labor force participation rate. That is, persons with higher levels of education work more on average than those with limited educational attainment. According to the Bureau of Labor Statistics (2014b) in 1970 the LFPR for men who did not graduate from high school was 37.5%; by 2012 it had fallen to only 27.5%. For women, the LFPR for those who did not graduate from high school was 33.5% in 1970 and had fallen to 6.8% by 2013 (Bureu of Labor Stastics, 2014b).

Labor force participation and health status. Health status is the second most significant predictor of labor force participation after age, followed by race and ethnicity (Brown & Warner, 2008). Women are much more likely to exit the labor force before age 62 than men (Warner & Hofmeister, 2006) and women with health problems are more likely to retire earlier (Flippen, 2005). Women and other minorities are more likely to report the presence of a chronic health condition or disability than white men (Angel & Whitfield 2007; Luo & Waite 2005). Certain ethnic groups are also more likely to report serious health problems. For example, African American and Hispanic women between the ages of 50 and 80 are two times as likely to have a work disability as whites (Brown & Warner, 2008). Health problems are a telling precursor to early retirement (Miah & Wilcox-Gok 2007), as well as of unemployment (Burr &

Mutchler, 2007; Schur, 2002). Persons experiencing poor health are more likely to be unemployed or underemployed (Gueorguieva et al., 2009).

Labor force participation: Persons with disabilities. Since the early 1980s, the federal government has been very interested in the labor force participation of persons with disabilities, and a single work disability question was added to the Current Population Survey in 1982. The rate of a work disability among all people from 16 to 64 years of age was 8.9%. However, the prevalence rate varied appreciably among minorities and economic subpopulations such as African Americans and the poor (US Census Bureau, 2000). The rate of work disability among males was higher than the rate of work disability among females. Demographic characteristics significantly related to the likelihood of having a work disability included age, level of education, and race (US Census Bureau, 2000). While there is a broader awareness of persons with disabilities who work, our knowledge of the rate of employment among people with disabilities has not improved much. In 2013, 17.6% of persons with a disability were employed (Bureau of Labor Statistics, 2014), changing little from the prior year.

Labor force participation drops steeply after age 65 due to retirement; therefore, most studies of disability tend to focus on persons below the customary retirement age (Burkhauser et al., 2014). Disability has a major impact on the probability of labor force participation. Furthermore, among those individuals working, the presence of a work disability was strongly correlated with a greater probability of lower earnings and intermittent employment (Brault et al., 2006; Bruyere & Houtenville, 2006). The CPS data shows, however, that work disability is, in fact, a significant determinant in explaining the labor force behavior of seniors since those in better health tend to remain in the labor force longer (Burkhauser et al., 2014). Disability researchers are also interested in distinguishing short-term medical impairment from more

persistent pathology that is associated with disability. Research by Burkhauser and Daley (1996) and Burkhauser and Wittenburg (1996) excluded individuals whose health conditions were short-term as evidenced by an affirmative response on only one survey administration. They argued that persons who report a health limitation in two consecutive survey administrations (over a period of at least one year) forms a reasonable basis for differentiating short term impairments from disability.

Self-Reported Measures of Disability

In most surveys of employment and earnings, the data on disability are usually gathered from a small number of questions that ask respondents to determine if their medical or mental condition limits their capacity to work. Some surveys ask individuals to rate their health status compared to others in their age or demographic group. Vocational Rehabilitation experts have been cautioned in using such global self-reported health measures in forensic settings for numerous reasons (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000; Robinson, 2014;). First, it is asserted by some that self-reported health is a subjective measure that is not comparable across survey respondents. Second, individual responses cannot be exclusively independent of each other, based on observed variables such as income, employment status, or demographic characteristic (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000). That is, it is difficult to differentiate the impact of poor health from that of some other demographic characteristic such as educational attainment upon labor force participation. Third, older displaced workers may be more likely to tell others they retired early rather than from an inability to secure comparable work. Since society continues to stigmatize individuals who leave the labor force before customary retirement age due to macroeconomic conditions such as high unemployment or employer downsizing, healthy persons who left the labor force sooner than planned may use poor

health as their excuse (Angel, 2007; Flippen, 2005; Fujita, 2014). Finally, in the United States, entitlements and transfers such as Social Security Disability Insurance (SSDI) and Supplemental Security Income (SSI) are available only to those determined unable to perform any substantial gainful activity, therefore persons applying for benefits or who have some limited health conditions may have a financial incentive (moral hazard) to identify themselves as disabled and unable to work (Autor, Duggan, & Gruber, 2012).

Misclassification of self-reported health status can result in an overestimate of the number of persons with disabilities as well as the negative effects of health impairments on employment and income. Such problems with self-reported health can skew employment and economic data when these measures are utilized to monitor differences in the population with disabilities over time (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000).

The limitations of self-reported health status have led some researchers (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000) to declare that no reliable information can be gained from the consideration of such data. This criticism is rooted in the belief that individuals are either too biased or too unaware to make accurate and reliable assessments of their health status. While this concern is understandable, research suggests that self-reported health measures are strongly associated with clinical measures. Research by Nagi (1969) found that self-assessed health status data is strongly correlated with objective findings by medical and rehabilitation providers. Health or disability status is highly correlated with medically determined health or disability status. In tandem, disability is a social construct and the result of and interaction with complex social-economic characteristics (Haber & Smith 1971; Oliver 1990). Given that health status is subjective and, in part, a function of work, some critiques conclude that an individual's self-perceived health status is impacted by labor market conditions. When employment is less secure,

self-reported disability is anticipated to increase (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000). National trends in the application for disability entitlement and transfer programs provide some support for this notion. At the beginning of the most recent economic recession in 2008, the number of persons applying for disability entitlements increased substantially by nearly 750,000 applications (SSA, 2010). Individuals applying for entitlements are far more likely to be unemployed or underemployed (Erickson, Lee, & von Schrader 2010; SSA 2010).

Prior Efforts to Match Households in National Longitudinal Surveys

Matching household data from one year to the next has been utilized in numerous employment and disability-related studies. As noted earlier in the literature review, the SIPP and Current Population Survey (CPS) are among the most utilized because of their longitudinal properties. Due to the focus upon employment of this research, the remainder of this study will focus on efforts to utilize the CPS to match household panel data. Another reason for studying the CPS survey is mainly due to the relatively recent addition of the six disability-related questions in 2006. The CPS provides an opportunity to explore the incidence of self-reported disability and labor force participation over one year, a relatively manageable period.

Reliability and Stability of the CPS Disability Measures

Research by Acemoglu and Angrist (2001) utilized matched household data in the CPS to estimate the net effect on employment of the Americans with Disabilities Act (ADA). They hypothesized that the direct impact of the protection laws should lead to a better work environment and more equitable treatment for those who are disabled. However, the indirect effect would be that the expenses forced on the employer would make it less likely he or she would hire a person with a disability. To answer their question of interest, they used the March Supplement to the CPS and matched individuals across surveys. After matching the data, they

found the ADA had a small adverse effect on employment status. Acemoglu and Angrist use a very similar approach to the one proposed in this research. They built a model to explain a change in employment status as it relates to the implementation of the ADA along with a set of control variables, using an Ordinary Least Squares regression and performed a t-test of the coefficient.

There are known limitations in using CPS data to match households. Research by Helpern-Manners and Warren (2012) studied the impact of panel conditioning, the tendency for individuals to purposely change their responses on subsequent survey administrations. Their research demonstrates that there is potential for error in the CPS matched household panel data. They consider possible bias in the CPS survey. Specifically, the estimate of the unemployment rate has a downward bias. Of note is that after spending time in the survey, existing respondents are more likely to answer they are employed versus new respondents. Helpern-Manners and Warren (2012) hypothesize two reasons. First, they believe that it is embarrassing or socially stigmatizing to keep answering 'I am unemployed' so that after a year, many respondents tend to lie and say he or she is employed when they are not. People who are unemployed are also more likely to miss the second survey administration since he or she is more likely to move their place of residence. Their best estimate is that the unemployment rate is underestimated by as much as .75 percentage points. The authors suggest that the effect of “panel conditioning” would be strongest for non-normative questions; that is, people are likely to change their answers to questions viewed as stigmatizing. If the respondent feels they will be judged negatively, they are more liable to lie or answer differently than they should. There is no mention of this related to disabilities but it could certainly be suggested there might be an effect. People might also overstate having a health condition as this gives them a socially acceptable excuse or reason for

being unemployed. While Helpern-Manners and Warren (2012) found some tendency for individuals who were unemployed for long periods of time to be untruthful on CPS surveys, they found errors were not so severe as to leave the research work in doubt.

A working paper by Burkhauser et al. (2014) examined the usefulness of disability data in national surveys for the purposes of accurately estimating the number of persons with disabilities. The findings by Burkhauser and Houtenville (2014) suggest that using the six disability questions alone potentially underestimates the total number of persons with disabilities; it does not, however, preclude their use of the six disability questions in their research. They examine the matched household data from the Current Population Survey and administrative records of the Social Security Administration and specifically considered the usefulness of the six disability-related questions in capturing the incidence of disability. They suggested that the six questions "captures only 66.3 percent of those whom administrative records confirm are receiving social security benefits based on their disability" (Burkhauser & Houtenville, 2014, p.7). If true, a substantial portion of those with disabilities are unaccounted for by the six questions. They recommend adding work activity questions that will decrease the number of false negatives. The paper goes on to discuss that disability is a fluid concept that it not black and white and thus difficult under any circumstance to accurately gauge in a single questionnaire.

Douglas Wolf and Thomas Gill (2007) discussed the limitations of measuring events like disabilities that occur a year apart. Clear differences are demonstrable between monthly versus yearly panels. For example, they cite that surveys taken at the 1st and 13th months vary considerably from monthly surveys. They also note, for example, that Hardy and Gill's (2004) analysis of data from the Precipitating Events Project (PEP), which assessed disability at one

month intervals, indicated that the majority or approximately 65 percent of new instances of self-reported disability ended after only two months (p.5). This suggests that a survey that asked participants about disability status a year apart might help differentiate short-term impairment from disability. Wolf and Gill (2007) further opined "most applied research on disability dynamics and active life expectancy assumes that disability dynamics are Markovian" (p.9). The authors follow this quote by quickly stating that: "We suspect that most researchers whose work adopts the Markov assumption would readily admit that disability dynamics are non-Markovian, but that the assumption represents the best that can be done in view of the deficiencies of data available for studying disability" (Wolf & Gill, 2007, p.9).

While Wolf and Gill (2007) noted limitations in using matched panel data a year between survey administrations, their findings are not likely going to impact the objectives of this research mainly since they describe changes in short-term health status and focus on disability status of a period of one year. Their study considers responses to disability questions of a period of less than one year more akin to temporary impairment. By focusing on a period of at least a year, the data would provide a more conservative estimate of the numbers of persons with disabilities.

Madrian and Lefgren (1999) discuss the problems of merging CPS data and getting type I and II errors in their technical paper. There is a high rate, about 30% of people who disappear for various reasons (on holidays, mortality, non-response, moved, or other). Consequently only 70% of the data can be matched; however, this also has errors. Reasons for this may be attributed to some people are incorrectly matched (i.e. they are matched even though they are not the same individuals). Researchers could remove this error by controlling for age, sex, and race to better ensure that matching data is accurate. This effort, however, also opens the possibility of a second

error; some of the people that do not match based on age, sex, and race will be the same people given a recording error. While these are known limitations in the data, it does not preclude its use.

The Census Bureau has unique identifiers for each variable. They have two identifiers to correctly identify a household (HHID & HHNUM) and one for a specific individual (LINENO) within a household. Merging data based solely on these three identifiers is known as a "naive merge rate" since it does not consider what was discussed in the previous paragraph, namely controlling for age, sex, and race. This technique merges people based on their HHID – the Household Identifier and the LINENO that is the individual identifier. Between these two methods there is only one problem with accurately identifying the same person: if the household moves and someone else moves in. In this case, the HHNUM variable is used; the HHNUM is designed just for these situations. The HHNUM is equal to 1 and stays 1 unless the interviewer is replaced by another in which case it is incremented to 2. Accordingly, with these three variables, researchers can match households or track the households that stay in the survey. The problem of recording error persists but as discussed in the Madrian paper is not significant enough for the purposes of studies like the one undertaken in this research.

A review of the literature revealed that while the incidence of disability is well—acknowledged from a public policy perspective, its reliability for use in forensic settings is much less understood. This represents a major gap in in the literature. Only one study (Brault, 2013) considered the reliability of household-level disability responses over time. Brault (2013) found that there was a low to moderate reliability in the survey responses in the six-question disability measure over three survey administrations of the Survey of Income and Program Participation (SIPP). At face value, his finding suggests that household level responses are not consistent or

stable over time. However, a deeper understanding is needed. Prior research assumed that disability was a perfectly stable characteristic, like gender, over time and measured accordingly. Disability and health status in general are inherently non-linear as symptoms or environmental conditions change. Researchers acknowledged that the use of the Markov statistical model created a clear limitation in the measurement of disability, mainly because the Markov reliability estimates assume that disability is a perfectly stable characteristic (Brault, 2013; Burkhauser, 2014; Hardy & Gill, 2004). That is, once an individual on a survey affirms that he or she has "mobility impairment," that condition or perception of condition will remain the same over the two remaining survey administrations. Other researchers (Burkhauser, 2014) also opined that Markov models are not particularly effective at measuring the cyclical nature of disability.

The impact relationship of the six question disability questions and labor force participation are not well understood, representing a second gap in the literature. There are numerous efforts that study the relationship of work-disability questions (a separate set of questions differentiating work disability, non-severe, and severe disability has been used on the ACS since 2000 and CPS since 1981). No efforts to date have been made to use matched survey data that link the affirmative responses across two survey administrations to labor force participation (Brault, 2013). This study intends to address these two gaps in the literature, thereby fulfilling a long-sought need to establish the reliability of such data in forensic settings by using empirically supported data.

Validity of Using Current Population Survey Matched Data

There are clearly ample instances of researchers matching data across CPS questionnaires. There is reasonable concern with regards to issues arising that could affect the validity of results. Like most research that uses large data sets, there is no ideal way to reconcile

the convenience of using large data sets with potential errors and inaccuracies as a result. At this juncture, there is a trade-off. Disability is a difficult construct to measure on national surveys but researchers must weigh this phenomenon against the important inferences that can be drawn from it. It appears reasonable that valid results can be considered if one is willing to contemplate the results with a modest degree of caution. While errors and inaccuracies exist, there is no evidence that they are large and persistent enough that one should disregard the results.

Perhaps the most thorough example of the trade-offs inherent with using CPS matched data is in the study undertaken by Madrian and Lefgren (1999). They wrote:

> Because there is some measurement error in both the variables used to identify individuals over time and in the characteristics of individuals at any point in time, any procedure used to match CPS respondents has the possibility of both generating incorrect matches and failing to generate potentially valid matches. (p. 19)

The final remark the authors made in the paper was that if researchers matched data based on household (HHID) and individual numbers (LINENO) then matched this data with the variable HHNUM, which indicated if the household is different between questionnaires, the error rate should be relatively small to successful matches and results should be robust. Therefore, if one controls for households that moved and were not the same across questionnaires, the error rate is dramatically reduced.

The above paragraph discussed the issue of matching CPS data across surveys. However, there are other issues beyond just the issues of getting correctly matched participants. For example, Burkhauser et al. (2014) raised the concern that the CPS understates the number of people with disabilities. If the people identified as having a disability can be accurately associated with other characteristics such as income, employment status, etc., then inherent weaknesses of the CPS become far less important. In short, if the CPS could correctly and better

identify a much larger set of peoples with disabilities that accounted for its gaps, there would be a larger sample size to draw from to produce more accurate and robust data.

In addition, issues like the ones discussed by Helpern-Manners and Warren (2012) with regards to "panel conditioning" or "time in sample" effects need to be considered. These phenomena relate to people either dropping out of the survey if they are unemployed or potentially lying and saying they are employed when they are not (Floor & Warren, 2013). The net effect results in a bias that underestimates the unemployment rate. Again, while this is a serious issue for the CPS it should not be a primary concern for purposes of this research if the focus is on the connections or associations between people with disabilities and other characteristics. There is no evidence that the bias would specifically impact those with disabilities more than those without a disability. If this effect exists there is no reason to believe it would systematically add bias to the connections between answers to employment status and disability responses.

Additionally, unemployment rates are not the primary concern of this research but rather the relationships between variables of people with disabilities to derive a more robust and conclusive set of data. It could be hypothesized that persons with disabilities would be more honest and drop out of the survey less if their reason for being unemployed were not as socially stigmatizing. This is a claim that cannot be verified, but the broad point is there is no reason to believe current unemployment statistics should leave this research in doubt. This research focuses only indirectly on the unemployment rate and, at most, is no more biased than all other studies in this respect.

One of the challenges posed by this study was the shortcomings of the CPS data as pointed out by Wolf and Gill (2007). The authors documented that the severity of health

conditions can change quite regularly. Indeed, it would be possible within a year for someone to answer they are not disabled, get a disability and not work most of the year, then come back to work and again answer that they do not have a disability. While this is certainly something the CPS should consider considering, it should not overly affect this research. The reason is simple: these imperfections should balance out when considering all available factors. While it is almost certainly true that the persistence of disabilities is more sporadic than the once a year CPS survey can account for, it is also true that this would not lead to any general bias because people who experience long term disabilities generally are less likely to work.

The major issue related to this paper is the problem of accurately matching participants across CPS surveys. If it can be confidently assumed that the number of false matches is small and not significant enough to dramatically change the results. The models being considered are very similar to models conducted by Acemoglu and Angrist (1998). If the matching is reasonably accurate, there is sufficient published research to validate the aspects such as regression, and ordinary least squares, to build models to predict labor force participation as it relates to the presence of a disability (Wolf & Gill, 2007). Therefore, there is a reasonable basis to substantiate the methods used to answer the questions posed in this study.

Bound and Burkhauser (1999) suggested that respondents who report two years of consecutive health-related limitations are generally in much poorer health and are more likely to be unemployed than those who either report no health impairments or only report health problems during one survey administration. In addition, an examination of the labor force participation and income of such persons with long term health-related work limitations are less likely to work and to earn less than other groups. These trends remain consistent for both males and females (Burkhauser & Daly, 1996). This study supports the position that estimating the

prevalence of disability based on self-report health status questions, while not perfect, identifies segments of the population with substantial differences health status. The Department of Labor defines working age population as those between the age16-65. Prior research found other efforts to capture a narrower age range (ages 25-61) to mitigate the impact of younger individuals' intentionally delaying work in favor of more education or those persons who retire early (Burkhauser et al., 2014; Burkhauser & Daly, 1996; Stern, 2000).

There are many issues with matching participants across months of the CPS. The first major problem is that the household identifier number is not unique. This is the major tool most researchers used to link individuals; however, the flaw is that it links the same household location but not necessarily the same people. The household could change members for many reasons. The most common reasons a household would not have the same members when resurveyed are: mortality, migration, and data recording error. These problems make the household identifier number an imperfect tool for matching the same participants across surveys. This problem was partially solved when a person level identification numbers was added in 1994. Thus, the CPS surveys before 1994 are not as reliable for matching as the surveys post 1994.

Even with a unique combination of household identification numbers and a personal identification numbers, post 1994, problems with matching remain. "Because of migration, mortality, non-response, and recording errors, linkages based solely on housing unit and individual identifiers sometimes result in erroneous links or missed links, even in the most recent sample" (Drew et al., 2014, p. 140). Because of problems that remain, researchers often also match based on age, sex, race, and ethnicity. The idea being that these variables either should not change or should only change by 1. Age is complex because it is possible given timing that it

will change by either 0 or 2 years. However, if the age differs by greater than two years, then clearly it is not the same person. With sex, race, and ethnicity the response should not change. However, even these results can be confusing; it is possible for someone to change how they identify themselves. With this noted these events are very rare and, for the most part, can be overlooked. Thus, with the household identifier, the individual identifier, and matching based on age, sex, race, ethnicity a researcher can be reasonably confident that all matches are correct.

Problems remain with matching people based on the above noted criterion. The CPS has changed categories many times over its implementation. For example, in 2003 the race and ethnicity choices were expanded from four to twenty-one categories (US Census Bureau, 2006). Thus, matching based that considers race before and after 2003 has many associated problems. Furthermore, a problem remains as there is no generally accepted set of criteria that all researchers use (Drew et al., 2014). One study may match based on household number, individual identifier, race, age, and sex, while another may match based only on household number and individual identifier. This leads to obvious problems comparing results. The problem is straightforward and relates to basic type I vs. type II errors. Matching based on the entire criterion will inevitably leave people out even though there was a true match. On the other hand, matches based only on the household identifier will almost certainly have a sizable portion of matches that are not the same people.

Drew et al. (2014), at the Integrated Public Use Microdata Series (IPUMS) of the University of Minnesota, developed a set of criteria for matching individual's and households. That match is based on household number, personal identifier, age, sex, race, and ethnicity, was first put forward by Madrian and Lefgren (1999). Further, methods were also proposed that used scoring matrices and others that suggested using more variables and a Bayesian approach. The

paper then illustrates seven different possible research designs and how the new IPUMS identifiers assist with utilizing longitudinal data. Finally, the paper concludes with possibilities for using this data in the future and problems that may arise.

Reliability of CPS Response Data

According to the Bureau of Labor Statistics (2012), statistics derived from national surveys—such as the Current Population Survey--are subject to both sampling and non-sampling error. When a sample is gathered from a wider population, there is at least a small probability that these estimates will differ in some identifiable way. The sample may vary because of a sampling error--that is, some characteristic of the sample differs in a statistically meaningful way. The variability of sampling error is expressed with a standard error of measurement. The Bureau of Labor Statistics estimates are at the 90 percent confidence interval (BLS, 2012). The Bureau of Labor Statistics (2012) states that a sample will differ no more than 1.6 (90% confidence interval) standard errors from the broader population.

CPS estimates are also influenced by non-sampling error. According to the BLS, there are many known contributors to non-sampling error, including the inability to survey a portion of the population (such as Metropolitan Statistical Areas) or failure to interview all respondents in a sample (household movement and non-participation of survey respondents), and finally, errors in collecting information (such as miscoding a demographic characteristic). Nonresponse to survey questions has historically been a concern for researchers (Hendershot, 2004). For the CPS March Supplement, the non-response rate ranges from 8% to 11%. According to the US Census Bureau (2015), the reasons for non-response are quite diverse including: no one being at home, language difficulties, and an inability to contact the household. Despite the challenges, the US Census

Bureau was successful in surveying 200,000 households during the March Supplement. It is widely regarded as reliable and sought after for its longitudinal qualities.

Considerations in Variable Use

The Nagi model was innovative and provided a conceptual framework for disability. More recent models of disablement, however, have further refined and added to the Nagi model in an effort develop a broader understanding of disability, particularly the external contextual factors or variables that influence disablement. For example, Wang, Bradley, and Gignac (2006) defined contextual factors into three categories: the physical environment, the sociocultural circumstances, and the resources available to individuals. Contextual factors can be categorized into four types of variables depending on how they influence disability (Wang et al., 2006). The four types of variables are moderating, mediating, independent, and confounding contextual factors. A moderating variable can be either qualitative, such as sex or race, or quantitative, such as level of pay (Barron & Kenny, 1986). A moderating variable changes the strength of relationship or effect between two variables and indicate when or under what conditions the influence can be expected.

A contextual factor is said to serve as a moderator when the impact of the activity limitation on participation depend upon the contextual factor's presence or level (Wang et al, 2006). For example, labor force participation of a person with a disability might also be influenced by the level of educational attainment. In this example, persons with higher levels of education who also have a disability are more likely to participate in the labor force. In those persons with lower levels of education, the impact of disability on labor force participation is more pronounced.

A mediating variable helps explain the relationship between the dependent and independent variables. A classic case of mediating variables is considering the relationship between work stress and drinking problems for individuals with avoidant coping styles (Cooper, Russell, & Frone, 1990). Work stress was thought to be the mediating variable in a study of the relationship between work pressure and drinking behavior and (Cooper et al, 1990). In circumstances where the change in the level of the independent variable--such as level of education--significantly accounts for the changes in the other variable, it is considered the mediating variable. In this example, work distress is the mediating variable and explains how work pressure and lack of control may be associated with drinking behavior. Conversely, if the mediating factor has little weight, then the change is attributed to some other (often unknown) factor.

Contextual factors with a mediating characteristic are variables that influence the activity limitation and participation restriction variables. In other words, the mediating effect occurs when a contextual factor is caused by an activity limitation and, in turn, affects the level of participation (Wang et al., 2006). For example, a person with an activity limitation due to severe mobility impairment might forego additional education or training and, as a result, miss further opportunities for employment or job advancement.

Contextual factors can also have a confounding effect upon participation activities. In these instances, the relationship between the variables is less clear (Wang et al., 2006). For example, age is a well-known predictor of labor force participation (Brown & Warner, 2008, Burkhauser & Daley, 1996). It becomes difficult to determine the primary cause of an unemployed person aged 65 who also experiences serious mobility impairment. It may be that at

age 65 this person would have dropped out of the labor force due to the availability of retirement benefits rather than specifically the impact of the disability.

Wang et al. (2006) noted that contextual factors do not necessarily have to be related to the disability process. For example, macroeconomic conditions such as the unemployment rate may impact all persons in the labor market—even though it might have a particularly detrimental effect upon persons with disabilities.

Researchers generally utilize the Census Bureau's core demographic characteristics as independent variables. While researchers debate the relative influence of socio-demographic characteristics has upon employment, four are among the most commonly utilized. These are age, sex, educational attainment, and race. The Current Population Survey was comprised of persons 15 years or older at the time of their last birthday (US Census Bureau, 2014). The CPS defines education educational attainment as participation in regular public and private primary and secondary school settings as well as colleges and universities (US Census Bureau, 2014). The literature reviewed clearly demonstrated that among these four characteristics, age was by far the strongest predictor of labor force participation followed by educational attainment and sex. Those who did not work were typically older and were female (Houtenville et al., 2009). The labor force participation of women has remained relatively stable at approximately 60% since 1999, after rising considerably since 1950 (DiCecio, Engemann, Owyan, & Wheeler 2008). Conversely, the labor force participation rate for men declined to approximately 75% during the same period (DiCecio et al. 2008).

Hispanic men tend to have a higher labor force participation rate than either white men or African Americans with an LFPR of 80.5 percent compared to 76.8 percent of white men and 70.1 percent of African American men (DiCecio et. al, 2008).

The US Census Bureau (2014) utilizes six categories of race and, beginning in 2003, allowed surveyed participants to select more than one category of race. The six categories of race are: white, African American or black, American Indian or Alaskan Native, Native Hawaiian, Pacific Islander, and Other. The marital status variable has four primary categories: single, married, widowed, and divorced at the time of the survey (US Census Bureau, 2014).

Population of Interest

This paper is principally interested in individuals at the household level who respond affirmatively to the same questions over a 12-month period. This period would serve as a reasonable demarcation between short-term impairment (1 affirmative response) and disability (impairment of 12+ months). It is understood that the number of persons reporting short-term impairment will be much greater than those who respond affirmatively on two occasions. The analysis will likely reveal a third phenomenon—the tendency for some individuals to respond affirmatively to more than one disability-related question at each survey administration. For example, an individual might answer affirmatively to both a mobility restriction and participation restriction. Indeed, this is certainly not only possible but also expected. While this study may provide some descriptive statistics on this phenomenon, measurement of those who respond to two or more questions is not the major focus of this study.

Implications for Forensic Vocational Rehabilitation Settings

An improved source of nationally representative disability data has important implications in forensic vocational rehabilitation settings. This has been an area of contention in the estimation of the impact of disability upon employment and work life expectancy. The use of such data has been criticized due to the generalized nature of disability-related questions in national surveys. Prior efforts to captured work disability and disability severity by relying upon

a few broad questions about: veterans or social security disability status; wheelchair or cane use; or labor force exit due to health reasons (Gamboa, 2010).

The use of disability data in forensic vocational economic settings has been an attractive notion. It has been both used and misused in forensic vocational rehabilitation settings. The data on one hand can suggest a reduced work life expectancy where none exists and conversely suggest that no disability has occurred despite obvious medical findings. As a result, forensic settings tend to use the data to either prove or disprove the likely impact of disability when estimating loss of earning capacity and economic damages. As the data suggests, persons with disabilities are less likely to be employed, more likely to experience multiple periods of labor force entry-exits, and more likely to permanently leave the labor force at an earlier age than persons without disabilities. There are multiple reasons for this phenomenon. It is believed that labor force participation and work life expectancy are outcomes based on a variety of individual and labor market variables (Robinson, 2014). Human choice is regarded among the most influential of these characteristics. For example, and individual may voluntarily exit the labor force in favor of continuing education, caring for a family member, or engage in early retirement.

Another criticism of work life expectancy data in forensic vocational rehabilitation settings is the notion that the probability of entering, exiting, or remaining in labor force participation remains constant with those observed over the past year (Foster & Skoog, 2004). This assumes that the probabilities will not change in the future and that the probability of remaining in the labor force is identical for an individual who has remained in the labor force for twenty years with an individual who has only recently entered the labor force (Robinson, 2014).

While work life expectancy data is widely utilized in forensic vocational rehabilitation settings, it is not without its weaknesses. All work life expectancy data have similar flaws since

they assume the plaintiff being evaluated is identical to a set of aggregated statistics. Care must be taken as the disability questions in use to data cannot account for a seemingly infinite number of possibilities (specific health conditions, impairments, and disabilities) of the plaintiff. The new six disability-related questions offer an improvement over past data.

Conclusion

There are nearly57 million persons with disabilities in the United States (US Census Bureau, 2014), which comprises a pronounced proportion of the population and economy. Researchers and policy makers have been studying the impact of disability and employment for more than 40 years. While there is not a universal definition of disability it often varies depending upon agency mission, entitlement benefit, or social context. Nagi's Disablement Model was the first attempt to define impairment and disability with a modern understanding. Nagi noted that pathology, impairment, and (1964) were necessary conditions of disability. The World Health Organization (2002) later refined Nagi's model to include activity limitations and participation restrictions.

There are several nationally representative surveys conducted by the US Census Bureau and the Bureau of Labor Statistics that survey households about health status, disability, and employment. The CPS ASEC (March Supplement) is an employment focused survey and serves as a major source of longitudinally matched data at the household level. It is ideal for this study because its longitudinal qualities (i.e. capacity to match households across two years of panel data) and its employment focus surveys of self-reported health status have their strengths and weaknesses. Critics, however, have commented that the use of self-reported health (disability) data is inherently unreliable and therefore not useful in forensic settings (Ciecka & Skoog, 2001; Ireland, 2006; McNeil, 2000). The Cognitive Response Model of Survey Response is the major

foundation of health survey research today and is a useful tool for understanding the expected variation of survey responses (Johnson, 2015; Ornstein, 2013; Tourangeau et al., 2000).

While the new six disability questions in the Current Population Survey offer a clear improvement in prior questions, several limitations remain. First, the six disability questions still lack data about specific health conditions and pathology. For example, the data identifies persons who have difficulty seeing or those with mobility impairments but gathers no information about diagnoses or severity. Second, the data relies upon the ability of survey participants to respond accurately and honestly about their health status. It is possible that either under reporting or over reporting of disability and the exact extent of which remains unknown. Third, use of this data in forensic vocational rehabilitation settings requires careful consideration and specialized training by qualified rehabilitation and medical providers. Use of this data by economists and others with appropriate clinical training can lead to improper application. While these limitations remain, this research is timely and offers an opportunity to validate the use of such data in forensic vocational rehabilitation settings.

This research attempts to address two gaps in the current body of literature. The first gap this research examines is if the responses to the six disability-related questions are stable on two survey administrations over a twelve-month period and therefore, a reliable distinction between short-term and long term impairments. The second gap this research examines is the level of labor force participation of persons with disabilities using this new criterion. This research is timely since US Census data is increasingly considered in forensic vocational rehabilitation settings when estimating the impact of disability upon employment and earning capacity.

Chapter 3: Methodology

Introduction

The research design and specific procedures utilized to conduct this CPS disability measure reliability study are described within this chapter. This study utilized publicly available Current Population Survey data retrieved from the University of Minnesota's Integrated Public Use Microdata Series (IPUMS). IPUMS is one of several public data clearing houses that the Census Bureau recommends. Data includes the annual CPS March Supplement from years 2009 through 2014. This is a retrospective study with limited longitudinal properties, namely matched household panels 2012-2013 and 2013-2014. As previously stated, the principle goal of this research is to determine if responses to the six-disability related questions are reliable within each matched panel and stable over longer periods of time. Additionally, this research also tested the impact of disability status on employment and income among persons who answer affirmatively to any one of these six disability-related measures on two matched surveys. This chapter also includes detailed description of the data collection methods, variable descriptions, statistical methodology, adequacy of dataset sample size, and limitations. SPSS version 23.0 will be utilized in this analysis.

Research Questions and Hypotheses

This study was guided by five research questions and associated hypotheses. The first three research questions were preliminary questions for the study. Research questions four and five form model development.

Preliminary questions.

Research question 1. Are individuals' responses to the new CPS disability questions stable over time?

Hypothesis 1. Individuals' responses to the new CPS disability questions are stable over time.

Research question 2. Is there a statistically significant difference in the reliability of individuals' responses to the CPS disability questions among those with sensory, cognitive, physical and mobility impairments?

Hypothesis 2. There is a statistically significant difference in the reliability of individuals' responses to the CPS disability questions among those with sensory, cognitive, physical and mobility impairments.

Research question 3. Is there a statistically significant relationship between individuals' responses to the CPS disability questions and their employment status (and/or labor force participation status)?

Hypothesis 3. There is a statistically significant relationship between individuals' responses to the CPS disability questions and their employment status.

Model development.

Research question 4. Does knowledge of the full set of employment status (or labor force participation status) predictors (e.g. age, sex, educational attainment, race, ethnicity, marital status, and disability) make a difference in predicting employment status over time?

Hypothesis 4. Knowledge of the full set of employment status predictors does make a difference in predicting employment status over time.

Research question 5. After controlling for contextual factors (demographic characteristics), does type of disability further contribute to the prediction of labor force participation status among survey respondents?

Hypothesis 5. After controlling for contextual factors, type of disability does further contribute to the prediction of labor force participation status among respondents.

Research Design

Type of research. This is a retrospective study with limited longitudinal properties, namely matched household panels 2012-2013 and 2013-2014 (Census Bureau release years 2013-2015). This research used the longitudinal data within in the CPS Annual Social and Economic Supplement (more commonly known as the March Supplement) to examine if the six-question CPS disability measure is a sufficiently stable and reliable indicator of disability to make reasonable conclusions about labor force expectancy of persons with disabilities. The six questions of interest were added to the CPS in 2008 and continue to be used in their original form. The analysis made here is possible because the CPS has a matched sample over a 13-month period where the disability-specific questions are asked during the first and thirteenth survey administrations; consequently, this practice produces longitudinal data.

Rationale for selection. The CPS disability measure has been utilized in other surveys; the Current Population Survey is at present the best source of matched samples (households) of disability data over time. Specifically, the CPS surveys the same housing unit over a period of sixteen months with the six disability related questions being asked during the first and the thirteenth month. Since the CPS follows the same household for 16 months, researchers can develop a longitudinal profile for that housing unit. Each household is surveyed for four consecutive months, dropped from the rotation for eight months before being surveyed four

additional months. Data are obtained by matching housing units from month-in-sample one to month-in-sample five a year later to obtain longitudinal information (United States Census Bureau, 2006). Data sets of this type have been used to study and attempt to answer a broad range of social and economic issues (Burkhauser & Houtenville, 2006).

Appropriateness of research. For month-in-sampel one and month-in-sample five, the survey retains the person's disability status for months 2 through 4 and 6 through 8 respectively (Brault, 2013). While these relatively short "snapshots" of health status might be a good measure of short-term impairment, they may not reflect long-term disability. Recent additions to the CPS, namely the six-question disability measure with matched households across a twelve-month period offer a new opportunity to measure the relative stability of respondents' impairment status over a longer period. This helps to address a fundamental criticism of longitudinal disability data, i.e. those persons with short-term impairments were captured in disability and work-disability statistics. The study results will thus assist disability researchers in better describing the nature of disability and its impact upon work.

Population and sample.

Sample size. The CPS March Supplement is a probability sample and representative of the non-institutionalized households of the US population (US Census Bureau, 2006). The March Supplement is a cross-sectional survey of approximately 200,000 non-institutionalized civilians. It is an expanded survey administered to all households in the panel. Because of the additional data, researchers tend to use the March Supplement when matching households to the following survey year. Persons in mental and penal institutions, as well as those serving in the Armed Forces, are excluded from the sample. Participation is voluntary; however, only about four percent of those surveyed refuse to participate (US Census Bureau, 2006).

Criterion for inclusion. Only persons who answered affirmatively to one of the six disability-related questions on at least one of two administrations of the March supplement were included in this study. One affirmative response suggests presence of impairment. Two affirmative responses over month-in-sample one and five, suggests disability.

A working age population of 25-61 rather than the broader group of 16-65 was used to mitigate potential noise associated with going to school or early retirement for non-disability related reasons. This study can account for two very key factors—namely school and retirement. By limiting the sample to ages 25-61, the study excluded much of the "noise" that those persons early in their careers who are engaged in school as well as those who retire early because they have the financial means to do so. Prior research on disability and employment also limit sample ages for this reason (Burkhauser et al., 2014).

Data collection procedures. Data were obtained from the University of Minnesota's Integrated Public Use Microdata Series (IPUMS) and is recommended by the Census Bureau as a reliable source of public use data (US Census Bureau, 2014). IPUMS obtains the data directly from the Census Bureau after public release and converts it into a format compatible with SPSS. It is peer reviewed and the data is widely utilized and cited in public research (King et al., 2010). In some instances, IPUMS combined or renamed the Census Bureau universal codes. A detail of code identifiers for variable use is included in the following section.

Variable description. Table 3 lists the independent and dependent variables included in this study.

Independent variables. The six-disability related factors are derived directly from the CPS data. Each data point has a unique identifier with three mutually exclusive code values (see Table 4). Potential responses are yes (1); no (2); or -1 (not asked). According to the US Census

Table 3

Variables

Independent Variables		Dependent Variables
Disability Related Factors	Individual Factors	Labor Force Participation
Hearing	Age	Employed
Seeing	Sex	Unemployed
Remembering	Education	
Physical	Race & Ethnicity	
Access	Marital Status	
Self Care	Individual Income	
	Wages	
	Hours Worked	

Bureau (2006), households are not asked the question on the second administration (month-in-sample 5) of the survey question if they had answered "No" to the first administration (month-in-sample 1). This was introduced as a time saving feature in survey administration.

*Sensory impairment***.** Two of the six-disability related questions deal with sensory impairments—namely difficulty seeing or hearing. The Census Bureau universal codes are Pedisear (hearing) and Pediseye (Seeing)**.** The presence of such impairment is noted with an affirmative response to either of the following two questions:

1. Is anyone deaf or does anyone have serious difficulty hearing?
2. Is anyone blind or does anyone have serious difficulty seeing even when wearing glasses?

Table 4 provides a brief explanation of the six disability codes and related definitions.

Cognitive impairment. One of the six-disability related questions deals with thinking or emotional difficulties. This single question encompasses a potentially broad range of cognitive or emotional pathologies. The Census Bureau's universal code for cognitive impairment is

Table 4

CPS Universal Codes for the Six Disability Related Questions

Pedisear: "Is participant deaf or does participant have trouble hearing". If yes then 1, If no then 2, -1 represents NIU for not in the universe or Not asked.
Pediseye: "Is participant blind or does participant have serious difficulty seeing even when wearing glasses?" 1 if yes, 2 if no, -1 if not asked.
Pedisrem: "Because of a physical, mental, or emotional condition, does participant have serious difficulty concentrating, remembering, or making decisions?" If yes then 1, if no then 2, if -1 then not asked.
Pedisphy: "does participant have serious difficulty walking or climbing stairs?" If yes then 1, if no then 2, if -1 then not asked.
Pedisdrs: "Does participant have difficulty dressing or bathing?" If yes then 1, if no then 2, if -1 then not asked.
Pedisout: "Because of a physical, mental, or emotional condition, does participant have difficulty doing errands alone such as visiting a doctor's office of shopping?" If yes then 1, if no then 2, if -1 then not asked.

PEDISREM. The presence of such impairment is noted with an affirmative response to either of the following question:

3. Because of a physical, mental, or emotional condition, does anyone have serious difficulty concentrating, remembering, or making decisions?

Potential responses are yes (1); no (2); or -1 (not asked). As with prior questions, if the individual does not answer affirmatively on the first survey administration then the question is not asked again until month-in-sample five.

Physical impairment. Three of the six questions may be ascribed to the experience of physical disability. They are as follows: ambulating; dressing & bathing; and difficulty performing errands. The first question encompasses a potential broad range of walking and climbing activities within the respondent's environment. The Census Bureau's universal code for

difficulties ambulating is PEDISPHY. The presence of such impairment is noted with an affirmative response to either of the following question:

4. Does anyone have serious difficulty walking or climbing stairs?

Potential responses are yes (1); no (2); or -1 (not asked). As with prior questions, if the individual does not answer affirmatively on the first survey administration then the question is not asked again until month-in-sample five.

The Census Bureau's universal code for difficulties with self-care activities is PEDISDRS. The presence of such impairment is noted with an affirmative response to either of the following question:

5. Does anyone have difficulty dressing or bathing?

Potential responses are yes (1); no (2); or -1 (not asked). As with prior questions, if the individual does not answer affirmatively on the first survey administration then the question is not asked again until month-in-survey five.

A final question deals with the ability to access necessary community resources such as attending medical appointments for shopping. The presence of such impairment is noted with an affirmative response to either of the following question:

6. Because of a physical, mental, or emotional condition, does anyone have difficulty doing errands alone such as visiting a doctor's office or shopping?

Potential responses are yes (1); no (2); or -1 (not asked). As with prior questions, if the individual does not answer affirmatively on the first survey administration then the question is not asked.

Contextual variables. A set of demographic measures from the CPS data set will be utilized to provide a fully controlled model. Table 5 lists the variables.

Table 5

Demographic Characteristics

A_age: age of the participant
A_sex: 1 For male. 2 for Female
EDUC: 36 different three digit codes from 000 to 999, indicating level of educational attainment
RACE: 5 different racial categories (not mutually exclusive). These include: white; black; American Indian/Eskimo/Aleut, Asian or Pacific Islander, and other. After 2003, individuals were free to self-identify with more than one category
A_maritl: Marital status of the participants. 1 married. 2 married but spouse absent. 3 Widowed. 4 Divorced. 5 Separated. 6 Never married

Age. Age is among the core demographic variables at the "person" level collected by the Census Bureau (2006). This variable is identified by the universal Census code A_AGE. Age is reported by the respondent during the month in which they participated in the survey and is reported in whole numbers. When this data is matched longitudinally from one year to the next, it is possible that the individual's reported age will vary by two years. Instances where age varies by either 0 or greater than 2 were excluded from the analysis as this might suggest a mismatched individual within the household.

Gender. Gender is among the core demographic variables at the "person" level collected by the Census Bureau (2006). This variable is identified by the universal Census code A_SEX and is comprised of two mutually exclusive values: Male (1) or Female (2). Beyond the basic descriptive function, researchers have utilized this category as a method for screening out bad or incomplete data in instances when the two survey administrations yielded two different responses (i.e. male then female on subsequent administrations). In instances where there were inconsistent responses, the data for that household was excluded. In most studies, the impact of

inconsistent responses to this question was quite small and had negligible impact upon the study results. This study screened out household data for inconsistent responses.

Education. Education is among the core demographic variables at the "person" level collected by the Census Bureau (2006). In this instance, IPUMS combined two Census Bureau universal codes for education HIGRADE & EDUC99 that measure educational attainment from no schooling through a doctoral degree. EDUC has 36 three digit variables and includes the code "000" for no schooling and the code "999" for missing/unknown. For purposes of this analysis, the study excluded households with missing/unknown information.

Race. Race is among the core demographic variables at the "person" level collected by the Census Bureau (2006). The data is identified by the RACE universal Census code. In 2003, the Census Bureau expanded the category to include five non-mutually exclusive races. These are: white, black, American Indian/Eskimo, Aleut, Asian or Pacific Islander, and other). As previously noted, these are not mutually exclusive categories, and the Census Bureau permits individual to self-identify with more than one category.

Ethnicity. In 2003, the Census Bureau developed a set of new questions designed to identify persons of Hispanic or Latino origin. The Census Bureau considers Hispanic or Latino origin as part of an individual's ethnicity rather than race (Bowler, Ilg, Miller, Robison, & Polivka, 2003). The survey permits individuals to self-identify as Mexican, Chicano, Puerto Rican, Cuban, Central or South American, or Other Hispanic (US Census Bureau, 2006). Race and ethnicity are not mutually exclusive. For example, individuals may first identify themselves as Black (Race) and then Puerto Rican (Ethnicity). To avoid double counting, the Census Bureau separates these identifiers into either Black or Hispanic/Latino categories when reporting on demographic statistics (US Census Bureau, 2006).

Marital status. Marital status is among the core demographic variables at the "person" level collected by the US Census Bureau (2006). The data is identified by the IPUMS code MARST.

Income. Measurement of individual income is among the most common demographic variables tracked and is a key indicator of poverty in the United States. The March CPS collects income data on each person in a housing unit through 23 possible sources (US Census Bureau, 2006). These can be found in the Table 6.

Table 6

US Census Income Categories

• labor earnings,	• dividends
• self-employment income	• interest income
• farm income	• rental income
• public assistance	• alimony
• unemployment compensation	• child support
• workers' compensation	• two sources of private retirement income
• veterans' benefits	• two sources of private disability income
• Supplemental Security Income	• two sources of private survivor's income
• Social Security Old Age, Survivors, and Disability Program	• income support from outside the household
• educational Assistance	• any other income

The presence of income in any of the twenty-three categories is expressed in whole numbers from 0 to $99,000 and greater than $99,000. For example, if an individual stated they earned $500 in employment income that month, the value would be coded "500."

Wages. Wages reflected employment related income, including self-employment income. Wages are expressed in whole numbers from 0 to $99,000 and greater than $99,000. As with income, missing values are excluded from the analysis.

Hours worked. Hours worked is expressed as a continuous variable from 0-60+. It reflects the number of hours worked during the prior week of the survey administration. For purposes of the analysis, hours worked will be categorized into either part-time (1-34 hours) or full-time work (35 or greater) which is consistent with the Department of Labor definition of both categories (DOL, 2014).

Dependent variable.

Labor force participation. Labor force participation rate considers those persons presently employed, the unemployed but seeking work, and the unemployed (discouraged worker, retiree, student, and stay-at-home parent). For purposes of this analysis, the levels of labor force participation have been reduced from three to two (employed and unemployed) to make full use of a logistic regression model. The variable is identified using the CPS universal code EMPSTAT.

Practical considerations. According to Tabachnick and Fidell (2007), there are relatively few limits to the analysis of a mix of predictors—whether they are continuous, discrete, or dichotomous. The outcome/dependent variables do need to be discrete. There are, however, several practical considerations relating to variables as noted by Tabachnick and Fidell (2007). These relate to the following: the ratio of cases to variables; the adequacy of expected frequencies of power; the linearity in the logit; the absence of multicollinearity; the absence of outliers in the solution; and finally, the independence of errors.

Regarding the ratio of cases to variables, a research study should have a minimum of at least 10 outcome events per variable to avoid the problems associated with small datasets. These potential problems with small datasets include low statistical power and high variability

associated with large parameter estimates and standard errors (Harrell, Lee, Califf, Pryor, & Rosati, 1984; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996).

Regarding frequencies of power, variable frequency will need to be checked to determine if having too few cases are a concern. Instances where frequencies were less than one or more than five would be identified to obtain interpretable goodness-of-fit test results (Tabachnick & Fidell, 2007). In such cases, adjustments such as collapsing categories for variables with more than two levels would need to be made.

Regarding the linearity of the logit, it is assumed that there is a linear relationship between continuous predictors and the logit transformed outcome/independent variable. This is not a concern because all the dependent/outcome variables are categorical. The linear assumption should not be considered an assumption that can be violated. Each coefficient represents the probable increase in the outcome variable given a one unit or category change in the predictor variable (Tabachnick & Fidell, 2007). Regarding the absence of multicollinearity, instances of extremely high correlations among independent variable might suggest that the predictors are redundant. In these instances, predictors with a bivariate correlation of .90 or higher were not included in the analysis. The variable that has less theoretical justification for causing a change in the predictor/independent variable was dropped.

As far as the absence of outliers in the solution, a residuals analysis will be performed to detect outliers having an absolute value greater than three (Tabachnick & Fidell, 2007). Regarding the independence of errors, variables from month-in-sample one and five were used, and then the household was dropped from the panel. This ensures that the information gathered is from separate households, and therefore, unrelated to one another (Tabachnick & Fidell, 2007).

Methodology

Preliminary questions.

Research question 1. Are individuals' responses to the six CPS disability questions stable over time?

Hypothesis 1. Individuals' responses to the six CPS disability questions are stable over time.

This study conducted test-retest reliability analysis using the Kappa correlation coefficient as the measure of the degree of reliability. The Brault (2013) study found that there was a low to moderate positive correlation coefficient range across three administrations on the SIPP. It was anticipated a stronger relationship over two matched surveys. While the possible values of the correlation coefficient range from -1.00 to +1.00, it was anticipated a moderate positive correlation of .50-.60 across two survey administrations.

The methodology for this question is straightforward. A simple Kappa correlation between having a disability in month-in-sample 1(MIS 1) and continuing to have the disability one year later in month-in-sample 5 (MIS 5). The Kappa correlation was developed as a measure of agreement. Thus, in this instance it will be a measure of agreement being having the disability in period one and continuing to have it is period two. The formula for the Kappa correlation is:

$$\kappa = \frac{p_o - p_e}{1 - p_e} = 1 - \frac{1 - p_o}{1 - p_e},$$

Where P_o is the percentage agreement between the two periods; that is the percentage of people that say yes to a disability in the first period who also say they have the disability in the second period. P_e is the probability that the groups will agree by chance. Thus, it is the hypothetical probability that there is an error in MIS 1 and respondent says yes and an error in MIS 5 as well where they respond yes.

Variables such as sex, race, and ethnicity were expected to remain the same from one survey to the next. When they were not, that household was excluded as suggested by the methods proposed by Drew et al. (2014). Another variable that was utilized to ensure a properly matched individual within a household is age. Age is a somewhat more problematic because it is technically possible given the survey is not administered on the same date a year apart that a participant's age could differ by 0 or 2 years and be correct. However, this was adjusted for by adding a small error rate in line with the probability of the above event occurring. Taken together these variables were used to construct a reliability coefficient.

Research question 2. Is there a statistically significant difference in the reliability of individuals' responses to the six CPS disability questions among those with sensory, cognitive, physical and mobility impairments?

Hypothesis 2. There is a statistically significant difference in the reliability of individuals' responses to the six CPS disability questions among those with sensory, cognitive, physical and mobility impairments.

It is not feasible to accurately compare the mean of one group to the overall mean because it contains the mean of the subgroup; and therefore, the groups would not be independent (Tabachnick & Fidell, 2007). This test of the difference between independent Kappa correlations avoids that complexity as it tests the subgroup mean versus the mean of all other groups.

This was done by testing the difference between independent Kappa correlations. The correlation between month-in-sample one and month-in-sample five (12 months later) for a single disability (i.e. sensory disability) were will be compared with the overall correlation of all other disabilities, (not including sensory), between periods.

The study converted the correlations to a Fisher Z table and adjusted for degrees of freedom changes.

- $(Z_1 – Z_2)$/ s.e. Where the s.e. is the standard error and is computed with

$$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}$$

For each correlation, the correlation coefficient was tested against any significant difference with all other coefficients. This is done by simply subtracting one coefficient from another then dividing by the standard error. Given the degrees of freedom are quite high the basic rule can be applied that the if the Fisher Z score is greater than 2 in absolute value the correlations will be deemed as significantly different.

The null hypothesis is that the population means (i.e. the reliability measures) for impairment group will be the same. However, it was anticipated that this null hypothesis would be rejected in favor of the alternative hypothesis of an inequality of the population means. Specifically, a physical impairment is more stable than sensory or cognitive impairments.

Research question 3. Is there a statistically significant relationship between individuals' responses to the six CPS disability questions and their employment status?

Hypothesis 3. There is a statistically significant relationship between individuals' responses to the six CPS disability questions and their employment status.

For this question 7 basic logistic regressions were conducted using general estimation equations (GEE). The depended variable is discrete and binary, that is 0 for employed and 1 for unemployed. A link function was employed to link the first and second observation of each participant. The link function in many ways works the same a panel data. General estimation equation functions are often used in medical and social science research where comparisons of

two points in time are necessary (Hanley, Negassa, Edwardes, Forester, 2003). The hypothesis was tested by direct logistic regression testing for two levels of labor force participation—employed and unemployed. Tabachnick & Fidell (2007) suggested that there may be two or more outcome groups in logistic regression and may or may not have an order as is the case with demographic characteristics. Since there is no order a direct logistic regression was used. These variables are discrete. Logistic regression controlled for demographic variables such as age, gender, and level of education. The null hypothesis is that there is no relationship between functional impairment and employment status. It was anticipated that there will be an inverse relationship in that those who do not identify as having functional impairment will, on average, be more likely to be employed than those who do identify as having functional impairment. A comparison of the effect size was conducted (pseudo R-squared measure such as Nagelkerke's R-squared) of the model with only the control variables and then with the disability status variable. The difference between the two suggested the influence of disability status on employment status after accounting for all non-medical variables.

The regression analysis was conducted on cross sections of the CPS data from years 2012-14 (release years 2013-2015). The basic model is as follows:

$$E_i = \alpha + \beta \textit{ (disability status of person i)}$$

Where:

- E_i is the employment status of person i: 1 if employed and 0 if not.
- α is an intercept term to be estimated (y intercept)
- β is the coefficient to be estimated representing the effect of having a disability on employment status. Disability of person i will be 1 if he or she answered yes to any of the six disability related questions and 0 if they answer no to all the questions.

The employment status variable is a discrete and binary variable and therefore a logistic regression was conducted. With a logistic regression, the coefficients have the interpretation of increases (or decreases) in the probability of a given person being employed or not. To be precise the coefficients have the interpretation as the effect on the log odds ratio; which can be transformed into a statement about probability. It is possible to not use logistic regression and use ordinary least squares regression; however, this results in some unwanted properties. The fitted model is not bounded between 0 and 1. This is problematic if one wanted to interpret the model as estimating probabilities. The logit transformation ensures the fitted model is bound by 0 and 1 in its predictions or fitted values; therefore, one can make meaningful statements about probability. The coefficients direct interpretation is the effect of the independent variable on the log odds ratio of the dependent variable. The output was then converted to a probability. For example, in the instance where the coefficient estimated is 0. Under normal regression model this would indicate no effect; however, it is not true under a logistic regression. The logit transformation is:

$$Log\ (p/1\text{-}p)$$

Where p is the value of the dependent variable, which is either 0 or 1, and log, represents the natural logarithm; all values of the dependent variable undergo this transformation before the regression is conducted. Provided the coefficient was 0; ignoring the constant and other variables. By first taking the exponential of both sides the outcome is expected to be $p/1\text{-}p = 1$ (as e of 0 is 1). If the method then solves for p the result is $p = 1/2$. Thus, the probability associated with a coefficient of 0 is ½; if the independent variable increases by 1 the probability of the dependent variable occurring (or being 1) is 50% greater.

Because of estimating this model, it was anticipated to gain insight into how having a disability increases (or decreases) the likelihood of being employed. If for example the test finds that the β estimated is equal to -1.1 this would be converted from the logs odds to a probability of .25. Thus, the test would estimate that having answered yes to one of the disability questions increases the probability of that person being unemployed by 25%. With these estimated coefficients, an overall F test will be conducted for statistical significance of the model and t tests for each disability coefficient. As stated, the hypothesis is that each coefficient will have a statistically significant negative effect on the probability of being employed.

Model development.

Research question 4. Does knowledge of the full set of employment status [or labor force participation status] predictors (e.g. age; sex; educational attainment; race; ethnicity; marital status; type of functional impairment) make a difference in predicting employment status over time of CPS respondents?

***Hypothesis 4*.** Knowledge of the full set of employment status predictors does make a difference in predicting employment status over time of CPS respondents.

A general estimation equation is utilized. The hypothesis was evaluated by using binary logistic regression. This is an appropriate statistical analysis given that the set of predictor variables may be continuous, discrete, dichotomous or a mix (likely mostly discrete) and that the outcome is discrete and ordinal (i.e. employed or unemployed) (Tabachnick & Fidell, 2007). Prior research suggests that labor force participation status is a complex construct that is associated with a multitude of medical and contextual (i.e. non-medical) variables, including but not necessarily limited to the set of predictors listed in this study. Therefore, it was anticipated that a full model (i.e. a model including all predictors) will have a statistically significant

relationship with the outcome variable. This was determined by comparing the full model to a constant-only model. An effect size measure (pseudo R-square) was also provided as an indication of the magnitude of the relationship between the full set of predictors and the outcome. Significance of each independent variable in this model was tested by conducting a Wald's test (Tabachnick & Fidell, 2007, p. 459).

Again, given the use of a logistic regression, the coefficients have the interpretation as an effect on the probability of a change in employment status. With this model insight was gained into the effect having a disability has on the probability of a change in employment status over the year in the survey. As predicted, people with disabilities are much more likely to have a change in employment status over the prior year. The model will again be tested for overall significance using an F-test and the individual coefficient will each be tested for statistical significance using a standard *t* test.

***Research question 5*.** After controlling for contextual factors (demographic characteristics), does type of functional impairment further contribute to the prediction of labor force participation status of CPS respondents?

Hypothesis 5. After controlling for contextual factors, type of functional impairment does further contribute to the prediction of labor force participation status of CPS respondents.

A general estimation equation uses a logistic model with a binomial link function. This hypothesis was tested in the same manner as research question four; however, the demographic variables were added to determine the impact of these characteristics upon employment. The hypothesis was evaluated by using binary logistic regression. This is an appropriate statistical analysis given that the set of predictor variables may be continuous, discrete, dichotomous or a mix (likely mostly discrete) and that the outcome is discrete and ordinal (i.e. employed or

unemployed) (Tabachnick & Fidell, 2007). Prior research suggests that labor force participation status is a complex construct that is associated with a multitude of medical and contextual (i.e. non-medical) variables, including but not necessarily limited to the set of predictors listed in this study. The employment status variable is a discrete and binary variable and therefore a GEE logistic regression was conducted. With a GEE logistic regression, the coefficients have the interpretation of increases (or decreases) in the probability of a given person being employed or not. To be precise the coefficients have the interpretation as the effect on the log odds ratio; which can be transformed into a statement about probability.

All contextual predictors were entered into the model as an initial step to control for their influence on the outcome. Then, the study's only medical predictor (type of functional impairment) was entered. The difference between the first model (i.e. without a medical predictor) and the second model (i.e. with a medical predictor) was then evaluated to determine whether type of functional impairment adds to the prediction of labor force participation status beyond what is already explained by this study's contextual predictors. This question is very similar to research question 4 but the test first differentiated between the various disabilities by first running a reduced model.

Model 5.1.

$$E_i = \alpha + \theta\ (Set\ of\ control\ Variables) + e_i$$

After differentiating for individual disability types, the full model considering the impact of disability in general.

Model 5.2.

$$E_i = \alpha + \beta\ (type\ of\ disability\ of\ person\ i) + \theta\ (Set\ of\ control\ Variables) + e_i$$

Where:

- β represents a set of six coefficients to be estimated representing the effect of each disability on employment status. There are six-disability questions; therefore, six coefficients will be estimated. Each disability variable will be 1 if the respondent answered yes to the specific disability question and 0 if he or she answered no.
- θ represents a set of control variable coefficients to be estimated. The set of control variables will include: age, sex, education, race, ethnicity, and marital status.

All the variables are the same as question 3; however, the β coefficients are a set of effects for each distinct disability type as related to one of the 6 questions. First, a test for a significant difference in the predictive ability of Model 5.1 versus Model 5.2 was performed. It was predicted that model 5.2 will outperform, or explain significantly more variation, than model 5.1.

Methodological limitations. Circumstances for data collection are rarely ideal, and the study was faced with some limitations. While the CPS ASEC (March Supplement) is comprised of 200,000 individual households, the actual sample size is expected to be substantially lower.

Drop-out rates as households move or do not complete either the first or second administration of the survey in the Current Population Survey are overall quite low (US Census Bureau, 2006). However, certain segments of the US population—such as persons with lower incomes and minority groups--tend to move more frequently than others (Erickson, 2012; Burkhauser & Houtenville, 2006). Persons with disabilities—the intended subject of this research is among this group.

The CPS collects data on individuals aged 16 through 75 and older. Since this research is principally interested in those persons with disabilities who work, the age ranges will be reduced to 25 to 61 years of age and is consistent with prior research (Burkhauser & Houtenville, 2006).

Individuals below the age of 25—more so than any other group--are also more likely to delay labor force participation to pursue educational opportunities (BLS, 2014a).

Customary retirement age is presently between ages 62 and 67. Labor force participation drops markedly after age 65 due to retirement: therefore, most studies of disability tend to focus on persons below the customary retirement age (Burkhauser & Houtenville, 2006). Prior research in the study of disability and employment focused on labor force participants up to 62 years of age for this reason.

It is understood that not all persons with disabilities will answer affirmatively to the six disability-related questions on two consecutive survey administrations. They may even answer affirmatively to two different types of questions (i.e. sensory impairment versus mobility impairment). Disability is not a strictly linear or static process and its true scope may not be completely captured on national longitudinal surveys. It is understood that disability is often cyclical in nature as pathology and corresponding functional limitations wax and wane.

Research by Burkhauser and Daly (1996) and Burkhauser and Wittenburg (1996) excluded individuals whose health limitations are short-term (one survey administration). They argued that persons who report a health limitation in two consecutive survey administrations (over a period of at least one year) forms a reasonable basis for differentiating short term impairment from disability. This study excluded inconsistent responses or those who only answered affirmatively during one survey administration in an effort reduce the potential of error. This likely excluded some individuals who have legitimate disability but strengthened the validity of the remaining data.

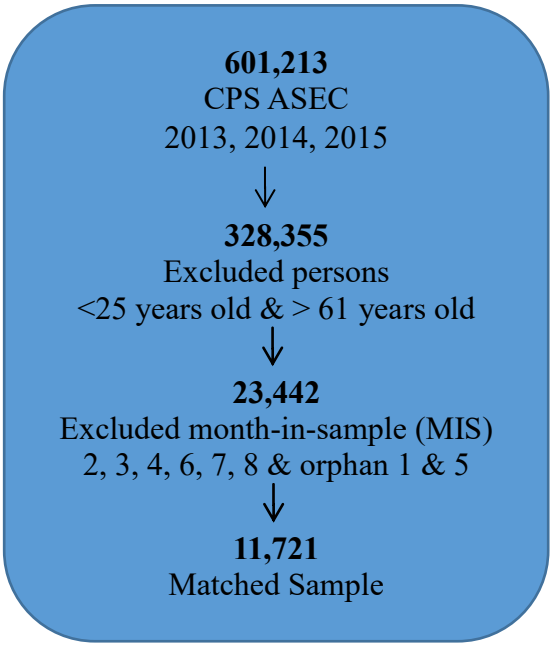
Chapter 4: Analysis

Introduction

The data for this study were selected from the US Census Bureau's ASEC data release for 2012, 2013, and 2014 (actual data release dates 2013, 2014, and 2015 respectively). The final sample utilized 11,721 valid individual survey respondents A. The process of identifying these respondents is listed below (see Table 7).

Table 7

Data Flow Chart



The initial data files from IPUMS included 601,213 individuals surveyed over the three-year period. The population of primary interest for this study was the working age population;

individuals younger than age 25 and older than age 61 were further excluded, leaving 328,355 survey respondents. As described in Chapter 3, this study considered only the matched surveys in Month-in-Sample 1 (MIS 1) and Month-in-Sample 5 (MIS 5) the following survey year. It was necessary to exclude data related to survey MIS 2, 3, 4, 6, 7 & 8. It was also necessary to exclude orphan or unmatchable respondents for MIS 5 in 2013 (since its appropriate match was MIS 1 in release year 2012) and for MIS 1 in 2015 (since its appropriate match was MIS 5 in release year 2016). This reduced the available data points considerably to 23,442 individual surveys. After excluding surveys with missing values and gender and age mismatches as discussed in the literature review (Drew, Flood, & Warren, 2014), the basic demographic sample consisted of 18,721 valid individual surveys that responded affirmatively to at least one disability question on either or the two remaining survey months. Of the individuals surveyed, there were 11,721 matched (MIS 1 & MIS 5) respondents to the disability-specific questions. This sample was used to describe the basic demographic characteristics of the study and to conduct the analysis.

The study population of 11,721 is a reasonable size to adequately identify the incidence of disability and employment among respondents. In comparison, the study by Brault (2013) comparing responses to these six-disability questions in the Survey of Income and Program Participation—a much larger survey—produced 41,328 valid interviews.

This chapter includes the descriptive statistics outlined in Chapter 3, including demographic and disability related variables related to the study. Instances where variables were combined (such as race/ethnicity, employment status, educational attainment, etc.) were appropriately described in the body of the chapter. As outlined in Chapter 3, the analysis was guided by five research questions and corresponding hypotheses. The results and corresponding

interpretations of each were also included. Where appropriate, comparisons with findings in the literature review served to ground the results in the wider body of research.

Descriptive Statistics

All study variables were discrete except for individual income and wages, and are described here through frequency (n) and relative frequency (%) distributions. The following sections and tables describe the distribution of the population with disabilities across each study variable, including seven individual contextual or demographic factors (sex, age, race, marriage, education, income, and wage), and six disability types (hearing, vision, remembering, physical, mobility, and self-care). Note that a seventh disability category of ANY was also included in terms of descriptive statistics and is useful in counting total numbers of persons with disabilities.

Sex. Table 8 reveals that, of the 11,721 valid matched households in the study, 5,620 respondents were male (47.9%) and 6,101 were female (52.1%). The distribution suggested that females were somewhat more likely than males to report some type of disability.

Table 8

Sex

Sex	Frequency	Percent
Male	5620	47.9
Female	6101	52.1
Total	11721	100.0

Age. As described in Chapter 3, the sample is limited to persons aged 25-61 with the intention of capturing the largest segment of the working age population while mitigating much of the impact of delayed labor-force entry (i.e. school) or early labor-force exit (i.e. retirement). This is consistent with practices identified within the literature review (Burkhauser, Houtenville,

et al., 2014) and serves as a reasonable basis for capturing a representative sample of most of the working age population in the United States.

The ranges of working-age persons with disabilities were divided somewhat evenly in 10-year increments except for the 55-61 category, which covers fewer years than the others (see Table 9). The largest single group (45-54) comprised 28.9 percent of the sample. However, the first three groups (25-34; 35-44; 45-54) were somewhat evenly distributed. There were 2,191 persons aged 55-61, comprising 18.7 percent of the sample. After accounting for the narrower range of years in this demographic group (7 years versus 10 years), the incidence of disability does appear to increase with age and is consistent with findings highlighted in the literature review (US Census Bureau, 2006). See Table 9 for the distribution of the sample by age ranges.

Table 9

Age

Age by Group	Frequency	Percent
25-34	2909	24.8
35-44	3119	27.6
45-54	3391	28.9
55-61	2191	18.7
Total	11721	100.0

Race. As described in Chapter 3, the US Census Bureau has 28 different race categories and 15 different Hispanic ethnicity categories. For purposes of this descriptive analysis, race/ethnicity was condensed into five categories (see Table 10). To avoid double counting, persons identifying as ethnically Hispanic where separated from whites, blacks, Asian, and Other. Table 11 illustrates the distribution of race/ethnicity of the sample.

Table 10

Race

Race	Frequency	Percent
White	7043	60.1
Black	1098	9.4
Hispanic	2578	22.0
Asian	675	5.8
Other	328	2.8
Total	11721	100.0

Not surprisingly, persons identifying as White in the sample (60.1%) was by far the largest single category. Hispanics comprised the second largest category with 2,578 (22%) of the sample population. Respondents identifying as Black comprised 1,098 (9.4%) of the population sample followed by Asians with 675 (5.8%). The smallest group was Other with 328 (2.8%) respondents.

Marital status. The US Census Bureau has six distinct categories (i.e. married-spouse present, married-spouse absent, separated, divorced, widowed, and never married/single). The categories are outlined in Chapter 3. For purposes of this descriptive analysis, the categories were reduced into two discrete categories—married and not married. See Table 11 for the distribution of marital status of the sample.

Of the 11,721 valid matches of persons with a disability, 7,577 (64.6%) identified as being married and 4,144 (35.4%) identified as not being married. This compares to approximately 56% of the adult U.S. population who are married (US Census Bureau, 2014).

Table 11

Marital Status

Marital status	Frequency	Percent
Not married	4144	35.4
Married	7577	64.6
Total	11721	100.0

Education. The US Census Bureau has 34 distinct categories for educational attainment, ranging from no education to a doctorate degree. The educational attainment categories were outlined in Chapter 3. For purposes of this analysis, these categories were consolidated into five discrete categories (less than high school, high school, some college, bachelor's degree, and graduate degree). This method is consistent with a wide body of literature (US Census Bureau, 2014).

Table 12 describes the educational distribution of the sample. As expected, high school graduates were the largest category with 3,300 (28.2%) of the sample population followed closely by respondents who completed "some college" (27.2%). It is apparent based upon the surveyed results, that a college degree is not necessary for most jobs in the United States as only 34.8% of all job holders earned either a bachelors or graduate degree. Finally, those with less than a high school education comprised 1,153 (9.8%) of the sample population. See Table 13 for the distribution of educational attainment of the sample.

Educational attainment levels were stable through both reporting periods. An analysis of the change in educational attainment between MIS 1 and MIS 5 (12 months later) was conducted. Ninety-three percent (93.4%) of persons reported the same level of education in both periods. An additional 3.7% of respondents increased their level of educational attainment in the second period. Based upon these characteristics, responses to educational attainment appear to

Table 12

Educational Attainment

Education	Frequency	Percent
Less than high school	1153	9.8
High school	3300	28.2
Some college	3189	27.2
Bachelors	2589	22.1
Graduate	1490	12.7
Total	11721	100.0

Table 13

Income

Income by Group	Frequency	Percent
Less than $10,000	2503	21.4
10,001-$25,000	2410	20.6
25,001-$50,000	3212	27.4
50,001-$99,999	2493	21.3
Over $100,000	1099	9.4
Total	11721	100.0

offer another aspect of reliability and consistency of responses since 97.1 % persons responded in a theoretically feasible way. Alternatively, 2.9% of persons reported lower levels of educational attainment in the second period. This is obviously not possible and can be attributed to some type of misreporting or recording error.

Income. The income measure was derived from the US Census Bureau's total personal income (INCTOT) category. It included wages as well as other forms of income such as disability transfers, child, or spousal support (see Table 13). Most respondents (27.4%) reported personal income between $25,001 and $50,000 per year. In contrast, however, there were 1,099 persons (9.4%) who reported personal income greater than $100,000 per year. This suggests that disability does not have as uniform an impact upon family income as one would expect. See Table 14 for the distribution of income by the sample.

***Wages*.** Wages reflected all work-related activity for pay or profit by each survey respondent. The variable was identified by the CPS universal code of WAGE. The largest single category was persons reporting earnings of less than $10,000 per year. As anticipated based upon the discussion of personal income, there were 955 persons (8.1%) who reported employment income (wages) greater than $100,000. This suggests that in these high-income individuals (comparing with Table 13), that wages were the major source of individual income.

Persons with disabilities with above average wages were an unexpected characteristic of this data. A common belief about persons with disabilities is that they are not high wage-earners. In fact, 36% of the sample who responded positively to the disability questions earned above-average annual wages. See Table 14 for the distribution of wages of the sample.

The average part-time and full time wages were $20,241 and $42,741 respectively. According to the US Census Bureau (2014), the average part-time earnings reported on the Current Population Survey were $12,480 and the average full-time earnings were $41,132. While full-time wages were comparable, it appears the sample's average earnings for part-time workers with disabilities were unexpectedly high. This appears to be an unusual characteristic of the data as it is inconsistent with expectations as well as nationally reported statistics (Census, 2014).

Table 14

Wages

Wage by Group	Frequency	Percent
Less than $10,000	3655	31.2
10,001-$25,000	1992	17.0
25,001-$50,000	2991	25.5
50,001-$99,999	2128	18.2
Over $100,000	955	8.1
Total	11721	100.0

Hours worked. The hours worked category reflected work activity in the prior week of the survey administration. The Department of Labor defined part-time employment as working between 1 and 34 hours per week and full-time employment as working 35 or more hours (Bureau of Labor Statistics, 2014). Based upon the data, 7,093 persons or 60.5% of the sample, worked either in MIS 1 or MIS 5. The labor force participation in this sample was thus similar to the labor force participation rate of 63% in national population identified in the literature review (Bureau of Labor Statistics, 2014). Table 15 shows comparisons of part-time and full-time work.

Table 15

Part-time Versus Full-time Work

			Work MIS 5		
			Part time	Full time	Total
Work MIS 1	Part time	Count	366	310	676
		% of total	5.2%	4.4%	9.5%
	Full time	Count	329	6088	6417
		% of total	4.6%	85.8%	90.5%
Total		Count	695	6398	7093
		% of Total	9.8%	90.2%	100%

Of interest, was the change in labor force participation from full-time to part-time and vice versus (see Table 15). Approximately 91% worked either part-time or full-time in both periods while 9% changed from either part-time to full-time or full-time to part-time over the same period. A little less than half of all part-time workers in MIS 1 increased their labor force participation to full-time work by MIS 5 while just a small percentage (4.6%) reduced their labor force participation from full-time to part-time work. In both instances, the data suggests that persons who are working tend to remain active in the labor force; and therefore, can be regarded as reasonably stable demographic characteristic—at least over a period of one year.

Census occupational categories. The US Census has more than 700 occupational codes. This data is gathered at the individual level within each household. Respondents were asked to identify the job they held the longest over the past year. The Census Bureau does not collect job title information on second (or more) jobs—merely the longest job held—so interpretation of this statistic much be taken with care. The incidence of disability among occupations was computed. Table 16 shows occupations where 15 percent (or greater) of persons reported the incidence of disability at the time of the survey. Again, the data reveals that persons with disabilities participate in the labor force in a variety of occupations. See Table 17 for the distribution of the most frequently occurring occupations held by persons with disabilities.

It is necessary to note that while some occupational categories such as proof readers and copy markers report notably high incidence of disability (55.2%), they often represent a very small proportion of the labor force (well under 1%). In comparison, motor vehicle operators and health diagnosing and treating practitioners are far more common within the labor market. This descriptive data of persons with disabilities, along with employment and demographic information, provided the means for testing the hypotheses laid out in Chapter 3. The remainder

Table 16

Census Occupational Categories

Occupations with the Highest Percentage of Disability	Any Disability	No Disability
Proofreaders and copy markers	55.2	44.8
Cleaning, washing, and metal pickling equipment operators and tenders	31.4	68.6
Lathe and turning machine tool setters, operators, and tenders, metal and plastic	30.8	69.2
Motor vehicle operators	28.2	71.8
Shoe and leather workers and repairers	27.5	72.5
Textile knitting and weaving machine setters, operators and tenders	24.0	76.0
Agricultural inspectors	23.5	76.5
Explosives workers, ordnance handling experts, and blasters	20.9	79.1
Dancers and choreographers	18.7	81.3
Ship and boat captains and operators	18.7	81.3
First-line supervisors/managers of firefighting and prevention workers	18.5	81.5
Health diagnosing and treating practitioners	17.5	82.5
Coin, vending, and amusement machine servicers and repairers	17.5	82.5
Electronic equipment installers and repairers, motor vehicles	17.3	82.7
Molders, shapers, and casters, except metal and plastic	16.6	83.4
Financial examiners	15.5	84.5
Textile cutting machine setters, operators and tenders	15.4	84.6
Structural metal fabricators and fitters	15.1	84.9
Other installation, maintenance and repair workers	15.0	85.0

Table 17

Disability Correlations

Disability type	Kappa	No disability both times	Disability both times	Reported different
DIFFHEAR	.407	97.7%	.6%	1.7%
DIFFEYE	.288	98.4%	.3%	1.3%
DIFFREM	.415	95.7%	1.2%	3.1%
DIFFPHYS	.523	93.8%	2.3%	3.9%
DIFFMOB	.475	96.1%	1.3%	2.6%
DIFFCARE	.400	97.8%	.6%	1.6%
DIFFANY	.535	89.4%	4.2%	6.3%

of the chapter involves the analysis of the reliability and predictive value of the six CPS disability measures.

Analysis of research question 1.

Research question 1. Are individuals' responses to the six CPS disability questions stable over time?

Hypothesis 1. Individuals' responses to the six CPS disability questions are stable over time.

Table 18 lists the correlations between having a disability in the first period and continuing to have the same disability in the next period. The explanations for each disability are taken from Integrated Public Use Microdata Series. There are two sensory disabilities

Table 18

Strength of Correlations

Disability type	Kappa	Strength
DIFFHEAR	.407	Moderate
DIFFEYE	.288	Fair
DIFFREM	.415	Moderate
DIFFPHYS	.523	Moderate
DIFFMOB	.475	Moderate
DIFFCARE	.400	Fair
DIFFANY	.535	Moderate

(DIFFHEAR & DIFFEYE), one cognitive disability (DIFFREM), one physical disability (DIFFPHYS), one mobility disability (DIFFMOB) and one self-care disability (DIFFCARE). The DIFFHEAR variable indicates whether the respondent is deaf or has serious difficulty hearing. The DIFFEYE variable indicates whether the respondent is blind or has serious difficulty seeing even with corrective lenses. The DIFFREM variable indicates whether the respondent has cognitive difficulties (such as remembering, concentrating, or making decisions) because of a physical, mental, or emotional condition.

The DIFFPHYS variable indicates whether the respondent has serious difficulty walking or climbing stairs. The DIFFMOB variable indicates whether the respondent has any physical, mental, or emotional condition lasting six months or more that makes it difficult or impossible to perform basic activities outside the home alone. This does not include temporary health problems, such as broken bones or pregnancies. The DIFFCARE variable indicates whether respondents have any physical or mental health condition that has lasted at least six months and

makes it difficult for them to take care of their own personal needs, such as bathing, dressing, or getting around inside the home. Finally, the DIFFANY variable indicates whether a respondent answered yes to any of the preceding six-disability questions. It was not a separate disability question but was seen in the following table for illustrative purposes. The variable was not considered in subsequent analysis in research questions two through five because a predictor variable should not be linear combination of the other predictor variables in the model, which is why DIFFANY is excluded (Tabachnick & Fidell, 2007).

As discussed in the literature review, most disability statistics in other studies are based upon a single survey administration (Erickson, 2012; Burkhauser & Houtenville, 2006), which explains why the incidence of disability in this dataset appears low in comparison to published statistics. However, the value of this data set lies in its ability to test for the stability of the disability measures from one survey administration to the next.

Table 17 reflects the Kappa—the degree of agreement between responses to disability questions in MIS 1 and MIS 5 (12 months later)—for each disability variable. The results indicate that 89.4% of respondents reported at least one disability during either survey administration while just 4.2% reported disability during both administrations. Of those persons who reported ANY disability, 6.3% reported different disability types. The reported incidence of hearing, vision, and self-care disabilities were less common than the other disability types. As expected, physical disabilities were the most frequently reported category. See Table 17 for the relative strength in the relationship between responses in MIS 1 and MIS 5. The Kappa values were higher when disability was reported for both time periods. For example, 2.3 % reported physical disability both times with a Kappa of .523 while 0.3% reported vision disability at both times with a Kappa of only .288.

Interpretation of hypothesis 1 results. This study first conducted a test-retest reliability analysis using the Kappa correlation coefficient as the measure of the degree of reliability. The Brault (2013) study found that there was a low to moderate positive correlation coefficient range across three administrations of the Survey of Income and Program Participation.

This study anticipated a moderate positive correlation of .50-.60 across two survey administrations. It is very difficult to reach a Kappa correlation of 1.00 in social science research. One reason the Kappa correlation appeared low was because greater than 97% reported disability in both MIS1 and MIS5. According to Viera and Garrett (2005), Kappa values between .21 and .40 suggest fair agreement and values between .41 and .60 suggest moderate agreement. There were no values in the substantial agreement range of .61-.80. Table 18 describes the relative strength (KAPPA) of each disability type.

The results closely paralleled the findings of Brault (2013). Physical disability as well as having any disability had the strongest Kappa correlations at .523 and .535 respectively. Difficulty hearing, mobility, remembering, and self-care all had moderate positive Kappa findings, while vision had the weakest positive Kappa of .288.

As expected, the correlations were all positive and suggest that measures of disability are stable over time. That is, if a person has a disability in MIS1 they are likely to report the same disability in period MIS 5--one year later. Furthermore, the results for measures DIFFPHY and DIFFANY revealed a strong correlation between .5 and .6. Most of the Kappa values for the remainder of the measures, although not as strong as hypothesized, were at least moderate. These findings appear to validate the use of these six questions as a measure of disability within national surveys such as the Current Population Survey, the American Community Survey and the Decennial Census.

Analysis of research question 2.

Research question 2. Is there a statistically significant difference in the reliability of individuals' responses to the six CPS disability questions among those with sensory, cognitive, and physical impairments?

***Hypothesis 2*.** There is a statistically significant difference in the reliability of individuals' responses to the six CPS disability questions among those with sensory, cognitive, and physical impairments.

This analysis tested the difference between independent Kappa correlations. The correlation between month-in-sample one and month-in-sample five (12 months later) for a single disability (i.e. sensory disability) was compared with the overall correlation of all other disabilities, (not including sensory), between periods. The study converted the correlations to a Fisher Z table and adjusted for degrees of freedom changes. The null hypothesis was that the population means (i.e., the reliability measures) for impairment groups were the same. Table 19 shows the p values from testing if the Kappa correlations differ between disabilities. As anticipated in Chapter 3, Table 20 demonstrates that the null hypothesis was rejected in favor of the alternative hypothesis of an inequality of the population means. Specifically, the measurements for physical, mobility, and self-care impairments were more stable than sensory or cognitive impairments. As noted in research question one, DIFFANY was removed because it is a linear combination of the remaining six disability variables.

***Interpretation of hypothesis 2 results*.** Of the fifteen potential differences between correlations, twelve were significantly different. Of those that were significantly different several of the p-values were very low and therefore highly significant. There was very strong evidence that some of the correlations were more significantly different than others. There was also strong

Table 19

Significance Values

Variable	Hear	Eye	Rem	Phys	Mob	Care
Hear	-					
Eye	<.001	-				
Rem	0.308	<.001	-			
Phys	<.001	<.001	<.001	-		
Mob	<.001	<.001	<.001	<.001	-	
Care	0.285	<.001	0.143	<.001	<.001	-

Table 20

Stability

Level of Stability	
Most Stable	DIFFPHYS
	DIFFMOB
	DIFFCARE, DIFFEAR, DIFFREM
Least Stable	DIFFEYE

evidence that not all the disability categories have the same stability over time. In particular, DIFFPHYS was significantly more stable than all the others, and DIFFMOB was significantly more stable than all the other variables except DIFFPHYS. It appeared that DIFFEYE was the least stable over time and was significantly less stable than all the other variables. The null hypothesis was that there were no significant differences in terms of stability over time for each variable. Thus, results strongly rejected the null hypothesis for these variables.

In contrast, when considering DIFFREM, DIFFCARE, and DIFFHEAR the results cannot reject the null hypothesis. These variables were not significantly different in terms of stability over time with respect to each other such as remembering/hearing, self-care/hearing, and self-care/remembering. The disability categories from most stable to least stable are expressed in Table 20.

It is noteworthy that differences in stability among difficulty with self-care, hearing, and remembering were not statistically significant, which is why they appear on the same line. Referring to the results for Hypothesis 1, those results showed that all six survey measures of disability are reasonably stable. Here, in testing differences in stability among them, the results show that survey measurement of both physical disability and mobility disability are significantly more stable than even the other survey-based measures. This strongly reinforces the notion that these are useful measurements of disability within a population.

Analysis of research question 3.

Research question 3. Is there a statistically significant relationship between individuals' responses to the six CPS disability questions and their employment status?

Hypothesis 3. There is a statistically significant relationship between individuals' responses to the six CPS disability questions and their employment status.

To test this hypothesis, a general estimation equation (GEE) utilized a logistic model with a binomial link function. The hypothesis was tested for two levels of labor force participation—employed and unemployed. The null hypothesis was that there is no relationship between functional impairment and employment status. As anticipated there was an inverse relationship in that those who do not identify as having a disability were more likely to be employed than those who did identify as having a disability.

The employment status variable was a discrete and a binary variable; therefore, a GEE logistic regression was conducted. With a GEE logistic regression, the coefficients serve as a log odds ratio; which could be transformed into a statement about probability. DIFFANY was not included in the analysis, because the study sought to identify the predictive value of the specific disability types upon employment. It was noteworthy that all disabilities were statistically significant predictors of being unemployed. Tables 22 through 27 present the results for each disability.

Hearing. The analysis of hearing difficulties on employment status indicated that the odds of not working were 31.9% greater for persons with a hearing disability than those without a disability. These results are statistically significant (p <.001). See Table 21 for relevant data.

Table 21

Results for DIFFHEAR

	Dependent variable: Employment Status			
	Coefficient	Standard Error	Odds Ratio	Wald's 95% Confidence Interval
DIFFHEAR	0.277***	0.035	1.319	(1.230-1.415)
Intercept	0.49***	0.036	1.632	(1.522-1.750)
Observations	18,721			
Wald Chi Square (df=1)	60.015, sig<.001			

Note. *p<0.1; **p<0.05; ***p<0.01

Seeing. The analysis of vision difficulties on employment status indicated that the odds of not working were 57.6% greater for persons with a vision difficulty than those without a disability. These results were also statistically significant (p. <.001). Compared with the findings

of Table 21, persons reporting vision difficulties are almost twice as likely to be unemployed than persons with hearing difficulties. See Table 22 for the relevant data.

Table 22

Results for DIFFEYE

	Dependent variable: Employment Status			
	Coefficient	Standard Error	Odds Ratio	Wald's 95% Confidence Interval
DIFFEYE	0.455***	.0399	1.576	(1.457-1.704)
Intercept	0.312***	.399	1.366	(1.264-1.477)
Observations	18,721			
Wald Chi Square (df=1)	129.686, sig <.001			

Remembering. The analysis of cognitive difficulties on employment status presents an even less encouraging picture than found with sensory disabilities. Compared to persons without disabilities, the odds of not working were 80.7 % greater for persons with a cognitive difficulty. These results were also statistically significant (p. <.001). See Table 23 for the relevant data.

Table 23

Results for DIFFREM

	Dependent variable: Employment Status			
Coefficient		Standard Error	Odds Ratio	Wald's 95% Confidence Interval
DIFFREM	0.591***	.0198	1.807	(1.738-1.878)
Intercept	0.187***	.0196	1.205	(1.160-1.253)
Observations	18,721			
Wald Chi Square (df=1)	890.622, sig<.001			

Note. p<0.1; **p<0.05; ***p<0.01

*

Physical. The analysis of physical difficulties on employment status indicated that the odds of not working were 86.0 % greater for persons with a physical difficulty than those without a disability. These results were also statistically significant (p. <.001). See Table 24 for the relevant data.

Table 24

Results for DIFFPHYS

	Dependent variable: Employment Status			
	Coefficient	Standard Error	Odds Ratio	Wald's 95% Confidence Interval
DIFFPHYS	.621 ***	.0149	1.860	(1.806 -1.917)
Intercept	.167***	.0152	1.182	(1.148 -1.217)
Observations	18,721			
Wald Chi Square (df=1)	1667.051, sig=<.001			

Note. *p<0.1; **p<0.05; ***p<0.01

Mobility. The analysis of mobility difficulties on employment status indicated that the odds of not working were about 94% more likely for respondents with this disability type than those without a disability. This disability type had the strongest impact upon employment status when compared with all others. See Table 25 for the relevant data.

Self-care. The analysis of self-care difficulties on employment status indicated that the odds of not working were 92.4% greater for persons experiencing a self-care difficulty than those without a disability. These results were also statistically significant (p. <.001). See Table 26 for the relevant data.

Table 25

Results for DIFFMOB

	Dependent variable: Employment Status			
Coefficient		Standard Error	Odds Ratio	Wald's 95% Confidence Interval
DIFFMOB	.664 ***	0161	1.943	(1.882 -2.005)
Intercept	.115***	.0157	1.122	(1.088 -1.157)
Observations	18,721			
Wald Chi Square (df=1)	1711.076, sig<.001			

Note. *p<0.1; **p<0.05; ***p<0.01

Table 26

Results for DIFFCARE

	Dependent variable: Employment Status			
Coefficient		Standard Error	Odds Ratio	Wald's 95% Confidence Interval
DIFFCARE	.655 ***	.0209	1.924	(1.847 -2.005)
Intercept	.117 ***	.0207	1.124	(1.079 -1.170)
Observations	18,721			
Wald Chi Square (df=1)	976.609, sig<.001			

Note. p<0.1; **p<0.05; ***p<0.01

Interpretation of hypothesis 3 results. The question of interest asked if there was a relationship between answering yes to any of the six-disability questions and the respondents' employment status. In all instances, there was a significant relationship between disability status and unemployment. Given that the dependent variable, employment status, was binary, the estimated coefficient could be interpreted as an increase in the log odds ratio of being

unemployed; this could be converted directly to a percentage increase in the likelihood of being unemployed. Therefore, in every instance, having answered yes to one of the disability questions significantly increases the likelihood of being unemployed. The disability variable with the strongest effect on unemployment probability was DIFFMOB. Individuals who reported difficulties with mobility were 1.90 times more likely to be unemployed. Self-care and physical disabilities were the next strongest predictors of unemployment (highest odds ratios), followed by remembering and seeing. Hearing was the weakest and had the second lowest correlation (it also was one of the least stable). The model suggested that respondents with a hearing disability were 1.32 times (32%) more likely to be unemployed. In contrast, however, the odds of being unemployed were significantly greater for the remaining disability types.

Predictive strength. When comparing the confidence intervals (see Table 27), disabilities with no overlap reflected stronger evidence that the variable was a predictor of unemployment. For example, there was no overlap in confidence intervals for hearing (1.230-1.415) with self-care (1.847 -2.005), physical (1.806 -1.917), mobility, (1.882 -2.005) and remembering (1.738-1.878) which provided evidence that hearing was a significantly weaker predictor of unemployment. It was also noted that the confidence intervals for hearing and seeing did not overlap with each other.

Also noteworthy, the physical, mobility and self-care measures had very similar confidence intervals. This reflects the similarity in those disability constructs; persons with physical disabilities experienced barriers to engagement in everyday activities much the same way as persons with mobility and self-care disabilities. Pearson correlations were run between the six disability types and the highest correlations were between physical and mobility (r=.538), self-care and physical (r=.481), mobility and self-care (r=.568).

Table 27

Confidence Intervals

Disability Type	Confidence Interval	Predictive Strength
Hearing	1.230-1.415	Weaker
Seeing	1.457-1.704	Weaker
Remembering	1.738-1.878	Stronger
Physical	1.806-1.917	Stronger
Mobility	1.882-2.005	Stronger
Self-Care	1.847-2.005	Stronger

While there were some differences in the relative strength of the coefficients, it is important to note that all the variables were highly significant. Therefore, it can be stated that the findings were very strong and that the hypothesis in question three proved--if an individual has a disability, then they are significantly more likely to be unemployed. The results support the validity of these survey items in measuring the constructs of disability well, and show that disability is strongly related to lack of labor force participation.

Analysis of research question 4.

***Research question 4*.** Does knowledge of the full set of employment status (or labor force participation status) predictors (e.g. age, sex; educational attainment, race, ethnicity, marital status) make a difference in predicting employment status over time of CPS respondents?

***Hypothesis 4*.** Knowledge of the full set of employment status predictors does make a difference in predicting employment status over time of CPS respondents.

To test this hypothesis, a general estimation equation (GEE) using a logistic model with a binomial link function was used. This hypothesis was tested in the same manner as research question three; however, the demographic variables were tested to determine the impact of these characteristics upon employment. The hypothesis was evaluated using binary logistic regression. GEE logistic regression was an appropriate statistical analysis given that the set of predictor variables may be continuous, discrete, dichotomous, or a mix (likely mostly discrete) and that the outcome was discrete and ordinal (i.e. employed or unemployed) (Tabachnick & Fidell, 2007). Prior research suggested that labor force participation status was a complex construct associated with a multitude of medical and contextual (i.e. non-medical) variables, including, but not necessarily limited to the set of predictors listed in this study (Angel & Whitfield, 2007; Bureau of Labor Statistics, 2014a, 2014b; McMenamin et al., 2005; Bound & Waidmann, 2000).

Probability of employment. With a GEE logistic regression, the coefficients have the interpretation of increases (or decreases) in the probability of a given person being employed or not. To be precise, the coefficients can be interpreted as the effect on the log odds ratio, which could be transformed into a statement about probability.

Table 28 presents the results of the effects of sex, race, marital status, education and age on probability of employment of the survey respondents. There was a significant difference in employment status between men and woman (Chi Square =333; $p<.001$), and Caucasians and all other race/ethic groups (Chi Square=23.197; $p<.001$). Caucasians were more likely to be employed. There was also a significant difference in employment status between married and unmarried persons (Chi Square=24.5; $p<.001$). The findings suggest that married persons were more likely to be employed.

Table 28

Probability

Sources	Type III Wald Chi Square	Df	Sig
Intercept	261.315	1	<.001
Sex	332.592	1	<.001
Race	23.197	4	<.001
Married	24.500	1	<.001
Education	453.905	4	<.001
Age	31.751	1	<.001

Note. Dependent Variable: Employed. Model: Intercept, Sex, Race, Married, Education, Age

Predictors of employment. This question asks if the set of variables (age, sex, education attainment, race, ethnicity, and marital status) predicts employment status of survey respondents. White persons were the comparison group for race and ethnicity. Those with a high school diploma were the comparison group for educational attainment. The results of the coefficients from the full demographic model are shown in Table 29.

Interpretation of hypothesis 4 results. All results were consistent with expectations set forth in the literature review. The analysis revealed that gender (sex) was a contributing factor to employment status. The odds of being employed were 2.3 times more likely for males than females in the sample population of persons with disabilities. These results are consistent with a review of the literature, as women are more likely than men to drop out of the labor force because of a disability (Brown & Warner 2008). While this superficially may appear that women

Table 29

Predictors of Employment

	Dependent Variable: Employment Status			
	Coefficient	Standard Error	Odds Ratio	CI @ 95%
Sex (male)	.824***	.0452	2.279	.2086-2.490
Race (other)	-.314***	.131	.730	.506-.943
Race (black)	-.294***	.073	.745	.646-.859
Race (Hispanic)	.-.003	.058	.997	.886-1.118
Race (Asian)	-.163	.099	.850	.699-1.032
Marriage Status (not married)	-.228***	.0461	.796	.727-.871
Education (less than high school)	-.648***	.0741	.523	.452-.605
Education (some college)	.419***	.0572	1.521	1.359-1.701
Education (Bachelor)	.824***	.0655	2.280	2.005-2.592
Education (Graduate)	1.110***	.0849	3.034	2.569-3.584
Age	-.013***	.0022	.988	.628-.889
Intercept	1.974***	.1778	7.203	5.083-10.206
Observations	18814			
Wald Chi Square	19170.512			

Note. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

might experience a greater impact upon employment because of health problems, it more reasonably could be attributed to other factors. A possible contributing factor to women dropping out of the labor force may have more to do with marital status (since married couples have the potential for more than one wage earner) than health symptom severity, however, the data is insufficient to support this conclusion with certainty. The analysis does suggest that married persons were less likely to be unemployed. Unmarried persons were approximately 20% less likely to be employed.

The analysis of race demonstrated that the odds of being employed for the categories of blacks and "other" were significantly less than for white persons which was consistent with the literature (Bureau of Labor Statistics, 2014). Interestingly, the odds of working for Asian and Hispanics with disabilities were not significantly different from their white counterparts. For educational attainment, the reference group was those persons with high school diploma. As expected, those individuals with disabilities who had higher levels of educational attainment also enjoyed greater levels of labor force participation. For example, those with less than high school education were 48% less likely to be employed than those with a high school education. Those persons with some college were about 50% more likely to be employed than those with a high school level of educational attainment. Persons with a bachelor's degree were approximately 228% more likely to be employed than persons with a high school diploma. Finally, those with a graduate degree were about three times more likely to be employed than those with a high school diploma. Age was the only continuous variable. For every year increase in age, the odds of working decreased by 1.2%.

The hypothesis for question four was confirmed that knowledge of the full set of demographic characteristics does make a difference in predicting employment status. As

expected, not all demographic characteristics had an equal impact upon employment status; however, the data does provide a sufficient foundation to analysis the impact of each disability type upon employment status.

Analysis of research question 5.

Research question 5. After controlling for contextual factors (demographic characteristics), does the type of functional impairment further contribute to the prediction of labor force participation status of CPS respondents with disabilities?

Hypothesis 5. After controlling for contextual factors, the type of functional impairment does further contribute to the prediction of labor force participation status of CPS respondents. Research question five built on the prior model by adding in the set of disability questions. This model also built on the results from research question 3, which showed that type of disability influences employment status. The study hypothesizes in Question 5 that knowing the type of disability will add predictive value to the model. As with research question four, a general estimation equation (GEE) using a logistic model with a binomial link function was used to test the fully controlled model. This hypothesis was tested in the same manner as research question three; however, the demographic variables were tested to determine the impact of these characteristics upon employment. The analysis of fully controlled model found that after controlling for both the demographic characteristics (contextual factors) and disability; sex, race, education, hearing, seeing, remembering, physical and mobility were all significant predictors of employment status. Marital status and age were found not to be significant contextual factors while self-care was the only disability type found not to be significant. See Table 30 for variable significance.

Table 30

Variable Significance

Sources	TYPE III Wald Chi Square	Df	Sig
Intercept	5.935	1	.015
Sex	358.648	1	.<.001
Race	26.212	4	<.001
Married	.755	1	.385
Education	337.997	4	<.001
Age	4.272	1	.039
Hearing	.636	1	.425
Eye	.103	1	<.001
Remembering	20.286	1	<.001
Physical	43.847	1	<.001
Mobility	25.306	1	<.001
Self Care	1.736	1	.188

Dependent Variable: Employed

Model: Intercept, Sex, Race, Married, Education, Age, Hearing, Eye, Remembering, Physical, Mobility, Self Care

Tables 31 demonstrate that most of the disability questions have significant independent predictive value when controlling for the demographic characteristics. The analysis revealed that most characteristics were significant; the only disability variables that were not significant were hearing and self-care. While question four found that hearing and self-care were significant predictors of employment status, when all the disability predictors were added to the model in research question five, hearing and self-care no longer added any additional predictive value to

Table 31

Probability of Employment

	Dependent Variable: Employment Status			
	Coefficient	Standard Error	Odds Ratio	CI @ 95%
Sex (male)	.887	.047	2.428	2.215-2.662
Race (black)	-.334	.0746	.716	.619-.829
Race (Hispanic)	-.130	.0592	.878	.782-.986
Race (Asian)	-.252	.0997	.777	.639-.945
Race (Other)	-.262	.1380	.770	.587-1.09
Marriage Status (not married)	-.046	.0400	.955	.870-1.050
Education (less than high school)	-.628	.0766	.533	.459-.620
Education (some college)	.396	.0594	1.486	1.322-1.669
Education (Bachelor)	.681	.0671	1.977	1.733-2.255
Education (Graduate)	.958	.0867	2.607	2.20-3.09
Age	-.005**	.0023	.995	.991-1.000
Hearing	-.155	.1948	.856	.584-1.254
Eye	-.739***	.2711	.478	.281-.813
Remembering	-1.720***	.1575	.179	.131-.244
Physical	-2.132***	.1288	.119	.092-.153
Mobility	-1.258***	.2016	.284	.191-.422
Self-Care	-.389	.2887	.678	.385-1.194
Intercept	7.914	.4886	2736.20	1050-7130
Observations	18814			
Wald Chi Square	17650.281; p <.001			

Note. *p<0.1; **p<0.05; ***p<0.01

employment status. An analysis of the significance levels revealed that the DIFFREM (remembering), DIFFMOB (mobility), and DIFFPHYS (physical) variables had a significant effect on employment status. Survey respondents who indicated that they had difficulty remembering were about 5.5 times more likely to be unemployed. Persons with mobility difficulties were about 3.5 times more likely to be unemployed. Finally, survey respondents with physical disabilities were almost 8.4 times more likely to be unemployed. See Table 31 for the probability of employment based upon disability type.

The hypothesis was indeed confirmed for all six-disability questions; all disabilities measured by the survey had independent predictive value in the model. However, it was apparent that not all the disabilities had an equal effect on employment status. As noted, only the seeing, remembering, physical, and mobility variables had a significant impact. This was in line with findings in research question number two. Those findings suggested that the most stable disabilities were physical and mobility disabilities. Therefore, if the disabilities were stable they were more likely to impact an individual's ability to obtain employment. With this model, insight was gained into the effect of having a disability on the probability of a change in employment status over the year of the survey. The prediction was that persons reporting a disability were much more likely to have a change in employment status over that year.

Summary

The reliability and stability of survey measurements of disability have often been called into question in forensic vocational rehabilitation settings. Many critics claim that survey measures of disability are inaccurate, and that the data from these surveys is not helpful in predicting labor force participation status (Ciecka & Skoog, 2001, Ireland, 2006; McNeil, 2000). This study addressed those concerns by examining the stability and predictive value of the six

new disability questions in the Current Population Study. This data set is especially good for this purpose because the panel design allows for test-retest reliability measures to be estimated. It also makes it possible to test the effects of these measures on employment status. The descriptive analysis of the sample offered some interesting findings regarding the wage-earning capability of individuals with disabilities. The results of the descriptive analysis suggested that individual income and wages for persons with disabilities within the sample were by-and-large very similar to the national population. While these findings may seem counter intuitive, the sample did exclude persons older than age 61—who are considerably more likely to be impacted by serious health conditions and much less likely to work (US Census Bureau, 2014).

The findings from this chapter show that the measures are effective, stable, and predictive. The stability results did closely parallel the findings of Brault (2013) in an analysis of these same questions in the Survey of Income and Program Participation. All the disability indicators had positive Kappa correlations, showing their stability, and the measures for physical disability and having "any disability" had quite strong Kappa correlations. Further, through testing the differences in these Kappa values, physical disability and mobility disability are significantly more stable than the other four measures. These results show the reliability of the CPS disability survey items in capturing true long-term (one year) disability rather than simply capturing temporary impairment as critics have sometimes stated.

The predictive value of the disability questions on an individual's employment status was tested in several ways. First, it was determined that each of the six variables have a significant effect on likelihood of unemployment. Then, in a fully controlled model that included all the disability questions as well as important demographic controls, memory, mobility, and physical disabilities all had a significant independent effect on employment status.

These findings argue strongly for the utility of the CPS disability measures and answer many of the critics' contentions about the weaknesses of disability survey data. Chapter five will present a final summary of the study, including a review of the findings in relation to the literature. Unexpected findings, limitations, and implications for further research will also be discussed.

Chapter 5: Discussion

Relevance of the Study

The United States Census Bureau's Current Population Survey (CPS) includes six disability-related questions, and the purpose of this study was to determine if those questions are a stable and reliable source of information regarding functional impairment and labor force participation related to persons with disabilities. Given the growing demand for a reliable and widely accepted measure of the incidence of disability and labor force participation in forensic vocational rehabilitation settings (Brookshire, 2014; Ireland, 2006), this study was timely and pertinent. Historically, the CPS has been considered as being among the most important sources of information regarding employment characteristics based upon education, gender, race, and ethnicity, and this has been the case for more than 30 years. In addition, the CPS offers an opportunity to match individual household survey responses over a certain length of time that is sufficient to differentiate short-term impairment from disability. Consequently, the CPS's employment focus, combined with the ability to measure the incidence of disability, afforded an opportunity to study labor force participation of persons with disabilities.

The United States Census Bureau published a single study evaluating the reliability and stability of this six-question disability measure as found in the Survey of Income and Program Participation (Brault, 2013). Brault's (2013) study found a low to moderate reliability of these six questions across three SIPP survey administrations over a period of eighteen months. The aim of this study reported here was two-fold. First, this research built upon Brault's (2013) work by

examining the reliability of the same set of six disability measures as found in the CPS over a period of two survey administrations in a 12-month period. Second, this study then utilized the expanded CPS data set to assess the impact of disability upon labor force participation, an opportunity not afforded by the data used by Brault (2013).

While disability data have proved useful for researching broad government policies and services, their reliability for other applications, particularly forensic vocational rehabilitation settings, is embattled. There are two fundamental issues. First, the data have been widely criticized as unreliable (Ireland, 2006). Critics of such data opine that the questions are flawed and survey respondents are incapable of differentiating temporary acute medical conditions from long-term disability or chronic illness (Ciecka & Skoog, 2001, Ireland, 2006; McNeil, 2000). Second, a lack of a generally accepted definition of disability continues to be the subject of further debate (Brault, 2013; Mashaw & Reno, 1996; Nagi, 1964; World Health Organization, 2002). Thus, there is not a widely-accepted methodology for estimating the labor force participation of persons with disabilities in forensic rehabilitation settings.

In part, this is due to a lack of consensus concerning the definition of disability as well as concerns about data quality. A disability may interfere with a person's ongoing activity in the labor market, causing periods of interruption or inactivity. Disability researchers and rehabilitation providers are acutely aware of this phenomenon. A 2010 Bureau of Labor Statistics report clearly demonstrated strong correlation between disability and discontinuous or decreased participation in the labor force (Bureau of Labor Statistics, 2010). The report indicated that for all ages the employment rate was significantly lower for persons with disabilities when compared to those persons without disabilities. Furthermore, the unemployment rate of people with disabilities was much higher than the rate of those with no disability. Persons over the age

of 65 were three times as likely to experience a disability as those below the age of 65. Of those persons with jobs, persons with disabilities were significantly more likely to work part-time compared to persons without disabilities (Bureau of Labor Statistics, 2010).

A wide body of research supports the notion that impairment and disability are continually changing characteristics (Verbrugge et al., 1994; Wolf & Gill 2007); however, these constructs were often regarded as constant in longitudinal studies. While these relatively short "snapshots" of health status are a good measure of short-term impairment, they do not necessarily reflect long-term disability. Recent additions to the CPS, namely the six-question disability measure administered twice with matched households across a 12-month period, offered a new opportunity to measure the relative stability of respondents' impairment status over a longer period. This addressed a fundamental criticism of longitudinal disability data in forensic vocational rehabilitation settings (i.e. that those persons with short-term impairments were captured in disability and work-disability statistics). The study results will assist disability researchers in better describing the nature of disability and its impact upon employment.

Key findings and implications.

Stability of CPS measures. In testing Research Question 1, test-retest reliability analysis using the Kappa correlation coefficient demonstrates that all but one of the six disability questions are at least moderately stable from one survey administration period to another a year later, with the measures of "physical disability" and "any disability" being moderately stable. Only visual impairment showed a less-than-moderate reliability, indicating that this variable may be either more transitory or more difficult for respondents to define than the others.

These findings contribute to the evidence found by Brault's (2013) SIPP study, with strong reliability coefficients for physical disability, any disability, hearing, mobility,

remembering, and self-care and weaker stability for the visual impairment measure. Thus, these findings demonstrate that the CPS disability items are sufficiently stable survey measures of disabilities, dispelling prior concerns about their reliability (Ciecka & Skoog, 2001; Ireland, 2006; McNeil, 2000).

Implications for public policy. These results have strong implications for public policy research of disabilities using large-scale survey data, showing that the Census Bureau has achieved its stated objective of obtaining reasonably reliable and stable measures of disability within the general population of the United States (Census, 2006). Because the data serve as a reliable basis for counting persons with disabilities, they make an important contribution to our knowledge about the general proportion of disability types--- i.e. sensory, cognitive, physical, access, and self-care – across the U.S. population. In turn, this information can be used to provide an authoritative basis for decisions about resource allocation such as public funding, accommodations, and services for persons with disabilities.

Further, there are direct implications for survey administrators who must balance the need for reliable disability data with the burden on the survey respondents. Fricker and Tourangeau (2010) found that the probability of nonresponse increased when surveys were either too detailed or too complicated for respondents. These six disability questions, although lacking in absolute precision, provide a reasonable global picture of the general distribution of disabilities within the population, and of the impact of functional limitations on persons with disabilities (Brault, 2013; Fricker & Tourangeau, 2010; Houtenville et al., 2009) without creating an undue burden on respondents.

Implications for rehabilitation counseling. The results presented in this research also have implications for on-going and future research in the field of rehabilitation counseling. Because

this study has demonstrated that the CPS questions are generally reliable, efforts can be made to integrate those measures into other types of surveys. Presently, these questions can be found in the American Community Survey (ACS) and the Current Population Survey (CPS), both of which sample the general non-institutionalized population of the United States. Much stands to be learned by including the CPS measures into surveys of targeted subpopulations, such as those in institutional care settings or prisons, as well as other specialized areas of interest such as Native American reservations and remote/rural areas within the Appalachians. The information would be of immense value to better serving those with disabilities among these populations.

Implications for forensic vocational rehabilitation. This study also has implication to the general acceptance of such data in forensic settings. Furthermore, the results presented in this research suggest that forensic vocational rehabilitation experts can feel more secure in relying on statistics based upon the CPS disability questions. Of course, this does not mean that the expert can completely overlook individual differences of the person evaluated. Quite the contrary, a vocational expert is uniquely qualified to determine to what extent—if any—the evaluated resembles the statistical averages cited by the disability statistics just as they would for other demographic characteristics such as age, race or educational attainment. However, because at this juncture there remains much debate within the forensic vocational expert community over the use of this data, the results of this research should put at ease many of the forensic community's concerns about the stability and reliability of survey-based measures.

Critics continue to cite the irregular patterns of disability as people appear to fall in and out of disability (Ciecka & Skoog, 2001; Ireland, 2006; McNeil, 2000). Most of these criticisms arise from a perspective of the field of labor economics, which characteristically lacks a theoretical model that describes people with disabilities who also work. In contrast, the field of

vocational rehabilitation (as well as many others such as medicine and social policy research) has studied the relationship of work and disability. People with disabilities experience a range of functional limitations throughout their lifespan. Often these functional limitations change both rapidly and frequently.

Comparative stability of the six measures. This study's tests of Research Question 2 demonstrated that not only are all six CPS disability measures reliably stable, but that it is also possible to differentiate their levels of stability. As expected, some types of disability items are more stable over the long term than others. Physical disability and difficulties with mobility stood out as more stable when compared with the measures of sensory and cognitive difficulties

Implications for public policy. These results have key implications for public policy research because of their ability to distinguish the reliability of the measures and the findings of which types of disability demonstrate the most stability over time. This strongly reinforces the notion that both the physical and the mobility survey items are especially useful measurements of disability within a population.

Additionally, these results speak to the potential for finding a balance between competing public policy concerns that surveys such as the CPS either over count or under count persons with disabilities. The issue of accurately counting persons with disabilities is indeed the primary purpose of these six questions (Census, 2006), but critics have noted that a "total headcount" in this way may result in overestimating the actual number of persons with disabilities by also capturing those persons with short term impairments (Brault, 2013; Stern, 2000). Referring to the findings of chapter 4, this method might potentially overestimate the number of persons with disabilities by about 39% by also capturing short-term impairment. On the other hand, according to the leading models of disablement espoused by the World Health Organization (2002) and

Nagi (1964; 1991), impairment is a necessary component of disability, so while these questions may indeed overstate the total number of persons with disabilities (some persons with temporary impairments) this is preferable to undercounting persons with disabilities (excluding everyone who only answered affirmatively to one survey administration). The dangers of over counting are modest since the cost of many public policy decisions (e.g. reducing physical access barriers to services through architectural improvements to public buildings) does not vary much depending upon the number of persons with disabilities. However, the greater danger from a public policy perspective involves undercounting which would potentially lead to budget shortfalls and misallocation of scarce resources based upon disability type.

Balance between these two possibilities is needed, and this research offers support for the accuracy of disability data for public policy purposes, particularly for allocating scarce resources for specific disability populations. Along these lines, since the data suggest that persons with mobility impairments are more likely than persons with other types of disabilities to experience barriers over a longer duration of time, public resources can be more appropriately allocated to that group. For example, more emphasis can be placed upon public expenditures supporting architectural improvements of public facilities as well as additional funding for home modifications. Likewise, for disabilities that appear to have a weaker stability (i.e. lower kappa) such as sensory disabilities, more targeted public services such as technology innovation grants that improve access and accessibility can be provided.

Implications for forensic vocational rehabilitation. The comparative stability of these six disability questions also has clear implications for the general acceptance of such data in forensic settings. The results presented in this research, because they examine stability at a one-year interval, can further assist forensic vocational rehabilitation specialists in utilizing the types of

data most likely to distinguish short-term impairment from disability. It is widely accepted among researchers that disability is not a linear process and that an individual can experience a participation restriction without an activity limitation, impairment, or disability (Anner et al., 2012). Documented cases where the measurements taken with panels when the time between surveys is a year apart versus monthly would differ. For example, Anner et al. (2012) noted that surveys taken at the 1st and 13th months vary considerably from monthly surveys. The findings of Hardy and Gill's (2004) analysis of data from the Precipitating Events Project (PEP), which assessed disability at one-month intervals, indicated that the majority (approximately 65%) of new instances of self-reported disability ended after only two months (p.5). This suggests that a survey administered a year apart might help differentiate short-term impairment from disability.

Types of disability and employment. The results of testing Research Question 3 found that in every instance, having answered yes to one of the disability questions increases the likelihood of being unemployed, as measured by separate basic logistic regressions conducted using general estimation equations (GEE) for each disability variable. Comparing coefficients, difficulties with self-care had the strongest effect on the probability of unemployment, followed in order of strength by difficulty with mobility, physical disabilities, difficulty remembering, seeing and hearing. Despite interesting differences among the strength of these relationships, it can be unequivocally stated that if an individual has a disability, then he or she are more likely than others in the population to be unemployed.

Implications for public policy. The results have strong implications for public policy research. First, because they demonstrate in no uncertain terms that the existence of all types of disability affects employment potential; policymakers can feel confident in directing resources towards addressing the consequences of unemployment among persons with disabilities. For

example, the study findings suggest that only about half of all workers with disabilities increased their employment status from part-time to full-time compared to only 4.6% who reduced their labor force participation from full-time to part-time. Based upon this observation, policy makers can identify environmental, social or income (i.e. disability income) that creates barriers to full-time work. Second, because these results distinguish between the relative effects of each type of disability on unemployment, they can act as a clear guide to allocation of scarce resources toward each type of disability, with more targeted programming for each subpopulation of persons with impairments. Finally, since a strong relationship between measures of disability and measures of employment is supported by the findings the utility of the CPS measures in public policy research is noted.

Implications for rehabilitation counseling. The results also have implications in the field of rehabilitation counseling research. Rehabilitation counselors are often engaged in assisting persons to return to work. Since the study included nineteen occupational categories where 15 percent or more (of that occupational group) persons reported disability, efforts can be made to identify high-risk occupations. For example, 31.4% of cleaning, washing and equipment operators and tenders reported a disability compared to just 15.1 percent for financial examiners. In instances where an individual must return to the same occupation following an injury, rehabilitation counselors can then anticipate and potentially mitigate the potential barriers the individual will most likely experience.

Since some disability types are much more strongly correlated with unemployment—the vocational rehabilitation resources can be more accurately allocated toward severity of the disability type. It is important to note that the identification of disability types as having either low or high rehabilitation potential is not justification for denial of vocational rehabilitation

benefits. It would, however, act as a measure of rehabilitation potential and assist in the identification of barriers and/or supports within early rehabilitation planning.

Implications for forensic vocational rehabilitation. The results in this section of the study also address the general acceptance and utility of such data in forensic vocational rehabilitation settings. There is a notion among some forensic economists that survey data is inherently unreliable because persons answering disability questions may either misunderstand the question or overstate the impairment's impact upon employment, possibly for material gain (Ciecka & Skoog, 2001; Ireland, 2009; McNeil, 2000). While there is some evidence that surveys involving eligibility for disability benefits or those involving retirees might indeed overstate disability (Bound, 1990; McNeil, 2000), that has not been shown for national surveys such as the CPS; thereby, involving no secondary gain for the respondents. It is also important to note that the CPS data is widely relied upon in reporting unemployment rates (BLS, 2014). It seems disingenuous to categorically reject disability data while accepting unemployment data from the very same households. The results as presented show a clear relationship between the answers to disability questions and responses to items measuring employment, in a well-respected very general survey that does not clearly link the two in any potentially biased way. The impact of disability on labor force participation is clear. Those persons with disabilities are far more likely to be unemployed than those without.

***Comparative impact of disability and demographic characteristics*.** Because labor force participation status of individuals with disabilities is a complex construct associated with a multitude of medical and contextual (i.e. non-medical) variables, it was important to test the effects of various demographic variables on employment as reported in the CPS survey. The tests of Research Question 4 found that the key demographic factors of age, sex, educational

attainment, race, ethnicity, and marital status all have statistically significant effects on employment status of persons with disabilities; indeed, lower education, female gender, unmarried status, and older age are all significantly related to unemployment. Results confirm theoretical expectations that these contextual variables play a strong role in shaping the likelihood of employment of persons with disabilities.

Clearly, this provides another layer of evidence arguing for the utility of using CPS-style survey data to research disability. One advantage of survey data lies in its ability to accurately capture individual-level nuances of age, race, educational attainment, and other contextual variables. The large sample size of the CPS is advantageous to researchers who want to study smaller subpopulations of persons with disability. These results provide the kind of basic research findings that argue in favor of utilizing survey data for more targeted study of the effects of race, gender, age, etc. on the relationship between disability and employment.

Implications for public policy. An unexpected finding uncovered in the demographic results has implications for public policy research, specifically regarding a basis for disqualifying potentially erroneous individual survey responses. While this analysis did affirm the relationship of educational attainment and employment status, there was a small subset of theoretically impossible responses to the education panel questions. Educational attainment levels were stable through both reporting periods. An analysis of the change in educational attainment between MIS 1 and MIS 5 (12 months later) was conducted. Ninety-three percent (93.4%) of the sample reported the same level of education in both periods. An additional 3.7% of respondents increased their level of educational attainment in the second period. Based upon these characteristics, responses to educational attainment appear to offer another argument for the reliability and consistency of the CPS responses, since 97.1 % persons responded in a

theoretically feasible way. However, 2.9% of respondents reported a theoretically impossible result: lower levels of educational attainment in the second period as compared to the first. This can only be attributed to some type of misreporting or recording error. According to Drew, Flood and Warren (2014), excluding respondents with panel variance in demographic characteristics that generally do not change (such as sex, race, and ethnicity) is both a reasonable and recommended data management practice. The results of this study offer evidence to expand these recommendations. Exclusion of individual surveys based upon disagreement of educational attainment might offer an additional degree of precision for future researchers.

Implications for rehabilitation counseling. That these findings provide insight into the contributions of various demographic characteristics has important implications for rehabilitation counseling research. They demonstrate that it is the exception rather than the norm when demographic variable types alone are sufficient predictors of employment status. Individuals with disabilities are affected by a combination of factors, including demographic and socioeconomic characteristics, and these complex interactions should not be oversimplified in research or practice by failing to model the fullest set of contextual effects. Such findings strongly support prominent disablement models (Nagi, 1965; World Health Organization, 2002) which espouse that the extent of an individual's disability is attributable to an active pathology or health condition and is a function of the interaction between the individual and his or her environment.

Implications for forensic vocational rehabilitation. To extend that evidence further, this result has implications in forensic vocational rehabilitation practice. For example, educational attainment and race are among the two most commonly applied demographic characteristics when making predictions about employment status in forensic settings (Bureau of Labor

Statistics, 2014). Results clearly confirm that finding, providing additional justification for their use among vocational rehabilitation practitioners. However, the results also increase the scope of potentially important variables such as gender, income and earnings, ethnicity and marital status that also can be useful in prediction. Forensic practitioners can benefit from expanding their contextual model with strong support from these results.

Another unexpected finding with interesting implications for both policy and forensic work is that employment income was not necessarily impacted by disability status. Higher-than-expected levels of income and wages occurred in the sample among some persons with disabilities. For example, the average earnings for the sample of persons with disabilities who reported working (*n*= 6,260) was $53,147. Average part-time and full time wages were $20,241 and $42,741 respectively. According to the US Census Bureau (2014), the average part-time earnings for the general population reported on the Current Population Survey were $12,480 and the average full-time earnings were $41,132. Thus, it appears the sample's average earnings for part-time workers with disabilities are above that of the population at large, again dispelling the common assumption about persons with disabilities and employment income. It is certainly plausible that unemployment may be a lagging indicator of disability—that is, it takes a while for individuals with serious health conditions to completely drop out of the labor force. Possible reasons for this include the use of paid leave; employer accommodations; family medical leave; or short-term disability policies. This finding deserves further study. Since the CPS follows households over 16 months the inclusion of the disability questions during a longer period (more than one year) may indeed offer additional insight (US Census Bureau, 2006).

The findings discussed thus far lead directly into the final and most important part of this study's research. First, this study clearly demonstrates, with the findings from Research

Questions 1 through 3, the fact that labor force participation of persons without disabilities is different from that of persons with disabilities (Millimet et al., 2003). Second, the results of the demographic model show that by analyzing the labor force participation of specific disability types across other demographic characteristics we can better determine the impact of disability upon specific populations (i.e., those with low educational attainment or certain races). Overall, the study demonstrates that for persons with disabilities, as well as the general population, it is critical to understand the effect of demographic characteristics on probability of employment. The findings argue strongly for the inclusion of demographic characteristics into any full model of the effect of disability on employment. Research Question 5 attempted to create a full model that accounts for both medical (disability) and non-medical (demographic) correlates of unemployment.

The fully controlled unemployment model. For this last and most critical test, all contextual predictors previously discussed were entered into the employment prediction model as an initial step, to control for their influence on the outcome. Then, the study's medical predictors (the six types of disability measures) were entered. The results of testing Research Question 5 found that, after controlling for contextual factors (demographic characteristics); four of the six disability types have significant independent predictive value to employment status. Physical disability and difficulties with remembering, mobility and vision all significantly affected the probability of employment, even when demographic characteristics are considered. On the other hand, in the full model, difficulties with hearing and self-care dropped below significance levels. Strengthening the findings overall and relative stability of the different disability measures, the most stable variables (physical disability and difficulties with mobility) are also the most likely to affect employment.

The data may also suggest that unemployment may indeed be a lagging indicator; meaning that people who acquire disabilities continue to work for some time afterward before ultimately exhausting health and family leave benefits. Because of this data, there may be a better understanding of the relationship between disability types, employment income and unemployment.

Implications for public policy. The results for research question five have important public policy implications. They demonstrate conclusively that disability, and particularly mobility and physical disabilities, impact a person's employment regardless of their demographic characteristics. Disability alone makes it much more difficult for a person to sustain employment, whether he or she has the benefit of educational attainment or privileged racial or gender status. Further, the fact that demographics have significant independent impact on employment of persons with disabilities implies that policymakers should take such key variables as age, race and educational differences into account when allocating resources for persons with disabilities.

Age is a factor that will be critical for policymakers to consider, especially given the challenges the Social Security Administration faces due to the aging population of the United States. While this study purposely excluded persons aged greater than 61 years of age, it did demonstrate the impact of disability upon employment status among all researched age groups. The Social Security Administration estimates that by 2031, there will be approximately 2.1 workers for every social security beneficiary compared to 3.3 in 2007 (SSA, 2007). While this estimate includes persons on old-age retirement, it also includes younger individuals with disabilities who may need to compete for scarce resources. Since younger persons are both more likely to work and to experience fewer serious health impairments, national efforts are needed to promote employment of persons with disabilities among older workers. Since older persons will

likely need to remain in the workforce longer, strategies can be developed to promote more employment opportunities for this group.

Implications for rehabilitation counseling. The results in this section also highlight an implication for the field of rehabilitation counseling research. While many organizations serve persons on a first-come first serve basis, state agencies receiving federal funding have a mandate to serve persons with severe disabilities first under the Title 1 of the Rehabilitation Act (Hager, 2004). There are also similar mandates for persons with developmental disabilities and persons with visual impairments. Special interest groups can use this data to support arguments for increased funding based upon differences in the impact of each disability, as well as, other barriers to employment such as low educational attainment, age, or race. These characteristics do not impact all persons in the same way. For example, race or educational attainment (compared to disability type) may significantly contribute to poorer employment outcomes. As an example, a white-well-educated consumer with a severe disability may still have a better employment outcome than a Hispanic individual with a limited education but a less severe disability. Further research, exploring the relative impact of the demographic contextual factors on disability and employment will serve to advance the practice of rehabilitation counseling research.

Study Limitations

Circumstances for data collection are rarely ideal, and the researcher is often faced with many limitations. An ideal source of data to fully investigate the questions posed in this study might include detailed information about health status, disability, income, labor force participation and demographic information in every month of the survey. However, to ease the burden on survey respondents, the Census Bureau chose not to administer a full survey every month. The CPS respondents are surveyed eight times over a 16-month period, and they only

answer the six disability questions in month one and month 12. For the rest of the intervals, disability status is assumed to remain constant. These professional data-collection practices represent a practical and tested approach that unfortunately leaves some measurement gaps.

This study assumes, with attendant consequences, that individuals have the capacity to understand survey questions and are motivated to answer them honestly. The literature review cited a theoretical framework for the validity of health surveys (see especially Johnson, 2015). The Cognitive Model of Survey Response theory suggests that survey responses about health status reflects a current self-assessment snapshot of the respondent's health based upon the unique subjective experiences of the individual. Thus, in this model, which this study applies, health status is a transitional state rather than an enduring trait or characteristic that can be accurately captured using survey methodology.

Despite the obvious strengths of this model, it has some weaknesses. First, the model does not take into consideration the effect of an interviewer or method of administration on a respondent's answers. Second, it does not measure the respondent's cognitive ability to understand a question or the level of motivation (Johnson, 2015; Ornstein, 2013). Third, effects of social stigma such as joblessness could influence the respondent to modify the answer considering the interviewer's presence or to appear in a better light (Schwarz, 2007).

There is a further challenge in applying the Cognitive Model to this data, and that involves the reliability of the panel data. The Cognitive Model of Survey Response segments the process of answering a health-related question into four steps: comprehension; retrieval; judgment, and response (Johnson, 2015). These steps are generally understood to occur within just a few moments of encountering the survey question. The limitation for panel research is that as researchers, we really cannot determine if each respondent answered the questions using the

same cognitive process as a year prior. These limitations obviously must be taken as caveats in interpreting the results reported in this study.

The CPS is a national survey comprised of non-institutionalized households. This is a limitation as the data does not include persons serving in the armed forces, prisons, or long-term residential/hospital care facilities. The incidence of disability and its impact upon labor force participation of persons in institutional settings is therefore not represented. Researchers would need to consider alternative national surveys such as the American Community Survey (ACS) or the Survey of Income and Program Participation (SIPP) for institutional data.

There are also known limitations in using CPS data to match households. Research by Warren and Helpern-Manners (2012) studied the impact of panel conditioning, which is the tendency for individuals to purposely change their responses on subsequent survey administrations. Their research demonstrates that there is potential for error in the CPS matched household panel data. Specifically, the estimate of the unemployment rate has a downward bias. Of note is that after spending time in the survey, existing respondents are more likely to answer that they are employed versus new respondents. Clearly this type of survey error may bias the results of studies utilizing panel survey data to investigate the employment of persons with disabilities.

Wolf and Gill (2007) discuss another limitation of panel data: the difficulty of measuring events like disabilities that occur a year apart. Documented cases where the measurements taken with panels when the time between surveys is yearly versus monthly would differ in important ways. For example, they cite evidence that results from panel surveys measuring disability at the first and 13th months vary considerably from monthly surveys. They also note, for example, Hardy and Gill's (2004) analysis of data from the Precipitating Events Project (PEP), which

assessed disability at one-month intervals and indicated that the majority or approximately 65 percent of new instances of self-reported disability ended after only two months (p.5). Thus, this study may underestimate disability by utilizing panel measures taken a year apart. However, such an apparent shortcoming serves as an additional strength of this work, since it suggests that a survey that asked participants about disability status a year apart might help differentiate short-term impairment from disability.

Drop-out rates in panel studies represent another source of potential survey error. Specifically, Madran, and Lefgren (1999) discuss the problems of merging CPS data and getting type I and II errors in their technical paper. There is a high rate, about 30%, of respondents who disappear for several reasons (on holidays, mortality, non-response, moved, or other). Certain segments of the US population—such as persons with lower incomes and minority groups--tend to move more frequently than others (Erickson, 2012; Burkhauser & Houtenville, 2006). Despite this known limitation, the Census Bureau regards the available data as reliable (US Census Bureau, 2006).

Another limitation is the lack of specificity in the six disability questions. For example, a mobility limitation can be caused by a multitude of disability types. Also, some disabilities, such as substance abuse disorders may not be accurately represented. In forensic vocational evaluations, the vocational rehabilitation counselor must make reasonable conclusions using his or her clinical judgement about how the individual's functional limitations resemble (or do not resemble) aggregate data comprised from national survey data. This data will never satisfy all critics (Ciecka, & Skoog, 2001; Ireland, 2006; McNeil, 2000). Arguments against the use of such data generally benefit the defense rather than the plaintiff since it minimizes the impact of disability upon employment.

The Current Population Survey offers a comparatively small sample with limited longitudinal properties, compared with the Survey of Income and Program Participation this is more than 10 times the sample size and matches households over 18 months (compared to CPS 12 months). However, the study population of 11,721 was believed to be of a reasonable size to adequately identify the incidence of disability and employment among respondents. In comparison, the study by Brault (2013) comparing responses to these six disability questions in the Survey of Income and Program Participation—a much larger survey—produced 41,328 valid interviews.

When differentiating impairment (one survey administration) from disability (two survey administrations), the limited longitudinal qualities of the CPS may also lead one to underestimate the true number of persons with disabilities. For example, it is possible for an individual with a chronic health condition to answer affirmatively in MIS 1 but through treatment answer negatively in MIS 5 one year later. In this instance, the individual would incorrectly be counted as "impaired" versus "disabled." In contrast, the Census Bureau's current method of counting persons with disabilities may indeed overestimate the number of persons with disabilities (by capturing those persons with short-term impairments) since they do not require two affirmative survey administrations (Houtenville, 2009; Stern, 2000).

Another limitation of this study is the potential bias established by removing non-respondents. As outlined in Chapter 3, surveys that did not include any affirmative responses to at least one disability question were removed from the study. While an effort was made in Chapter 4 to compare similarities (as well as differences) between the population and the usable sample, there were some obvious anomalies. For example, average full-time wages for the

sample were higher than the national average. While there did appear to be some differences, the data appear to be of reasonable integrity to establish the study findings.

Another limitation of this study is the exclusion criteria of persons younger than age 25 and older than age 61 (Burkhauser, Houtenville, et al., 2014). This was conducted intentionally to avoid some of the reasons for delayed labor force entry among younger individuals (i.e. college) or early labor force exit (i.e. early retirement). In doing so, however, this study overlooks important segments of the population of persons with disabilities such as the "Transition" population (ages 16-24) who are moving from secondary educational to post-secondary vocational training and supported/customized employment. Likewise, older persons, those above age 61, clearly continue to work while remaining in reasonably good health. This study does not provide a descriptive analysis of this population. Given the limitations associated with this study, the results nonetheless contribute to existing research and have some utility in the field as discussed throughout Chapter 5.

Recommendations for Future Research

There is a need for future research to better establish the relationship between unemployment status, time and disability. According to a thorough review of the literature, Brault (2013) has been the only prior effort to measure the reliability and stability of the six question disability questions. Brault's (2013) findings, although encouraging, only study the efficacy of such measures in the Survey of Income and Program Participation (SIPP). While a very large national survey, the SIPP is a health-focused rather than an employment-focused survey. The Brault (2013) study did not evaluate the impact of disability status on labor force participation. It also did not consider the potential issue of differentiating short-term impairment (1 survey administration) versus disability (2 or more survey administrations).

While this research confirmed Brault's (2013) findings and identified the impact of various disability types upon labor force participation, further research is warranted. This research also raised the issue of over counting versus undercounting persons with disabilities depending upon the number of survey administrations. Future researchers will also need to address the potential challenges when estimating the incidence of certain disability types (i.e. sensory disabilities) and look for approaches to potentially improve the data. Perhaps future research could also evaluate and improve upon the sensory disability questions.

Since many of the limitations of this study related to the nature of the yearly panel measures, one area for future research would be to include the six disability items in a study with more frequent, ideally month-to-month, panel administrations. This could help to flesh out the problems of undercounting disability by identifying those whose entire cycle of impairment and resolution was shorter than one year. Further, more frequent panel administrations could resolve some issues of loss of respondents through death or relocation by obtaining more data points for these respondents. In an ideal world, such a survey could last for 18 rather than 12 months, providing the kind of longer panel participation that is obtained in the SIPP survey.

Along this same line, this research was necessarily limited to matched-samples in survey years 2012-2014. This offered an opportunity to examine enough data to answer the intended areas of interest. However, data is available from 2008-2014. Since most disability statistics in forensic vocational rehabilitation commonly rely upon 10 or more years of data, future researchers could conduct larger studies over longer periods of time to determine if the results of this study are replicated.

Additionally, a prospective rather than a retrospective study involving persons with these six disability types to determine the impact of disability on employment status would add to the

body of research. A final review of the literature revealed no identifiable prospective studies involving these six disability questions. Since this study, combined with Brault's (2013), have found that the six disability questions are generally reliable and stable, further research can help establish if the findings support a predictive estimate of disability type on employment status.

Another recommendation involves the findings that three of the six disability questions (seeing, hearing and cognitive) are measurably less stable than the other items. Lack of stability may well be attributable to a lack of specificity. For example, the cognitive impairments can be caused by a variety of known medical and mental health conditions with widely different etiology. As an example, dementia may be progressive and therefore less stable when compared with the effects of traumatic brain injury. Furthermore, cognitive difficulties with some forms of mental illness may be more episodic in nature. Additional research that included more specific survey items about the types of potentially related medical and mental health conditions would be fruitful. Providing policymakers and practitioners with a much better understanding of the types of disabilities that seem to be more difficult to measure by the CPS survey as well as more effective forms of support for persons with these disabilities.

In testing the relationship between the types of disability and probability of unemployment, we uncovered the finding that difficulties with self-care are quite strongly associated with unemployment. While this is a striking finding, the survey did not provide the opportunity to ferret out the root cause of such difficulties. Therefore, more study in this aspect would be beneficial. It may be that individuals who experience impairment in self-care by and large are simply too ill to work or there may be a simple lack of resources to address self-care needs. In the latter possibility, reallocation of publicly and privately available services could make the difference between an individual with a disability working and not working. The

possibility of long-term disability is regarded as one of the most pronounced factors in unemployment and poverty in the United States (Autor et al., 2012). This alone warrants more understanding of the relationship between the disability and its employment limitations.

While the internal validity of this research was established by demonstrating the stability of the six disability questions, the model's external validity was not. That is, this study did not assess the model's generalizability to populations that are not represented in the CPS sample—such as institutionalized populations. Future research is necessary to determine if these findings are representative of such populations.

Adding educational level logical consistency to agreement of age and gender as a list of characteristics to eliminate mismatched surveys (Drew et al., 2014) is a robust and useful way to validate survey samples. Doing this will add credibility to the use of survey data in characterizing the population of persons with disabilities. Clearly adding educational attainment to exclusion criterion is appropriate for future researchers to utilize since 97.1% of persons responded in a theoretically possible way. Additional research and further refinement are also recommended on the visual disability (seeing) where the reliability coefficient (kappa) expressed a low relationship between MIS 1 and MIS 5. It may be that sensory disabilities are in general both more transitory and therefore more cyclical than physical disabilities or simply are more difficult for persons to self-measure. Changes can be made by improvements in the surveyor instructions. The Census Bureau could differentiate this question better by use of the common terms of blind or visually impaired. This could be added to the surveyor instructions when administering the survey without changing the survey questions.

Conclusion

This research examined the reliability and stability of the six disability questions added to the Current Population Survey in 2008. This study extended and built upon the results found by Brault (2013) in the Survey of Income and Program Participation. The research is timely as a review of the literature revealed that this is the first attempt to study the reliability of these questions in the CPS. The research is also appropriate because the data is utilized in forensic vocational rehabilitation settings in estimating labor force participation and work life expectancy of persons with disabilities.

This study adds value to the current body of knowledge in the practice of rehabilitation counseling as it provides a greater understanding of the impact of disability status upon labor force participation. As rehabilitation professionals, we are expected to make reasonable predictions about an individual's probability of success while conducting rehabilitation planning. While we do not want aggregated statistics to dictate individualized planning, it does offer data for agency wide planning and for public policy purposes. The disability data is also useful in other venues, such as forensic vocational rehabilitation settings, where objective evidence is necessary when making reasonable predictions about individuals.

The six disability questions are based upon the ICF Disablement Model (World Health Organization, 2002). These questions represent an advancement in defining disability that can contribute to the field of rehabilitation counseling and public policy research. One of the most useful contributions of these six questions are their ability to provide a universal and standardized disablement language that does not rely upon mere diagnoses or pathologies but rather provides a more encompassing view of how individuals with disabilities live with their conditions and interact with their environment (Jette, 2006).

The research addressed a need to accurately and reliably measure disability across a broad spectrum of impairments. The study found that these six questions were both generally reliable and stable. As expected, physical and mobility disabilities had stronger reliability levels than cognitive and sensory disabilities. Labor force participation of persons with disabilities, using the stricter two affirmative responses to these six questions, was measurably lower than statistics widely reported. This was not at all unexpected as all government published disability statistics are based upon a single survey administration, and are subject to generally accepted criticism of over reporting of long-term disability. While a single survey method may be acceptable for public policy purposes and for allocating resources, it does not offer a perspective on how to effectively differentiate short-term from long-term disability. This study offers an alternative method and demonstrates the strength of a panel-study data set available in the CPS study.

Conducting longitudinal research of this nature is an enormous undertaking for dissertation research. However, with a sufficiently narrow focus and attention to recommendations by CPS researchers such as Drew, Flood and Warren (2014), it was a straightforward process. The study by Brault (2013) of these six questions in the Survey of Income and Program Participation marked the starting line for a more thorough analysis of the reliability and stability of these six disability questions. This study provided insight into the reliability and predictive value of these same six questions into a more employment-focused national survey such as the CPS.

A hallmark of modern vocational rehabilitation is individualized care where each person served is unique. As rehabilitation counselors, we hold expertise in this area. As a result, some forensic vocational experts have been reluctant to apply census data when making predictions

about work life expectancy and labor force participation of those they evaluate. For reasons outlined in the literature review, some forensic experts appear to doubt the reliability of responses to disability questions, yet embrace other responses on the very same survey. Since forensic vocational rehabilitation experts commonly rely on aggregate survey measures of educational attainment, race/ethnicity, and gender when making predictions about work life expectancy and labor force participation, the notion to discount the reliability of disability status on the same survey seems unnecessarily contradictory. Additionally, unemployment statistics are derived from the Current Population Survey (US Census Bureau, 2015), so there is a clear unmerited bias against the use of disability statistics in forensic vocational rehabilitation settings.

This study provides forensic vocational rehabilitation counselors with a much-needed response to the understandable concerns regarding the use of large scale survey data. Its reliability, stability, and utility have been shown to fit the reasonable expectations of data. The need for such information cannot be underestimated; along with Brault (2013), this study provides groundwork for the continuing use of survey methods to further explore the ways that persons with disabilities interact with the world of employment.

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Appendix A

Census Bureau Survey Identifier Definitions

h_idnum1: The first part of the household identification number.

h_idnum2: the second part of the household identification number. Along with h_idnum1 this variable is utilized to uniquely identify any household.

h_mis: this indicates the number of months the given participant has been in the survey. This will equal 1 to 4 if the participant is in the first stage of the survey. If the number is 5-8 then the participant is in the second and final stage.

Note: the CPS does a rotating panel. 4 months in the survey, then 8 months off, then 4 more months at which point their participation is completed.

A_lineno: This is short for "Line Number" which identifies the participants place in the household. If the household contains 4 members each will be assigned a unique line number.

H_hhnum: This is short for "Household Number". This is used as an identifier of households that have changed members over the duration of the survey. This might happen if someone moves out of a house and another family moves in during the survey. The number is equal to 1 if the household remains the same and 2 if the members have changed.

A_uslhrs: This question asks, "how many hours per week do you . . . Work at this job." If the participant answers yes to the employment question this is a follow up question that gauges how many hours a week the person works at the job in question.

A_sex: 1 For male. 2 for Female

Pedisear: Question "is participant deaf or does participant have trouble hearing." If yes then 1, If no then 2, -1 represents NIU for not in the universe or Not asked.

Pedisout: Question "Because of a physical, mental, or emotional condition, does participant have difficulty doing errands alone such as visiting a doctor's office of shopping?" If yes then 1, if no then 2, if -1 then not asked.

Pedisdrs: Questions "Does participant have difficulty dressing or bathing?" If yes then 1, if no then 2, if -1 then not asked.

Pedisrem: Question "Because of a physical, mental, or emotional condition, does participant have serious difficulty concentrating, remembering, or making decisions?" If yes then 1, if no then 2, if -1 then not asked.

Pediseye: Questions “Is participant blind or does participant have serious difficulty seeing even when wearing glasses?” 1 if yes, 2 if no, -1 if not asked.

Pedisphy: Question “does participant have serious difficulty walking or climbing stairs?” If yes then 1, if no then 2, if -1 then not asked.

A_age: age of the participant

A_maritl: Marital status of the participants. 1 married. 2 married. 3 married but spouse absent. 4 Widowed. 5 Divorced. 6 Separated. 7 Never married

Fwsval: Wage and family income. Total income of the family.

Vita

Jeffrey Dean Joy was born on August 16, 1969 in Salem Ohio. He graduated from Marlington High School, Alliance Ohio in 1988. He received a Bachelor of Arts in American Studies in 1993 from Kent State University, Kent Ohio. He received a Master's in Education from Kent State University with specialty in Rehabilitation Counseling in 1999. He later received a Master's in Business Administration in 2003 from Cleveland State University, Cleveland Ohio. He presently works in private practice as a rehabilitation counselor in Connecticut where he conducts forensic evaluations of employment and earning capacity.