

**THE IMPACT OF SOCIAL POLICY AND SOCIAL NETWORKS ON THE EMPLOYMENT  
STATUS OF PERSONS WITH DISABILITIES**

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## **ABSTRACT**

Julie Hayes Seibert: The Impact of Social Policy and Social Networks on the Employment Status of Persons with Disabilities  
(Under the direction of Marisa Domino)

This dissertation studied the impact of social policy and social networks on the employment status of persons with disabilities by analyzing 1) the impact of the Americans with Disabilities Act (ADA) on the employment of persons with disabilities and 2) analyzing the association of social networks on employment of persons with disabilities. Using National Health Interview Survey data for the years 1988 through 2001 and a difference in difference model, I found that among men and women ages 18 through 64, employment declined after the implementation of the ADA, regardless of how disability was defined. The only population that appeared to have improved employment outcomes after implementation of the ADA was men with mental retardation. Using the National Health Interview Survey Disability Follow-Up data while employing a two stage residual inclusion (2SRI) model to control for endogeneity, I found that the presence of social networks was associated with positive employment outcomes for men and women with disabilities. I also found that the type of social network was associated with employment outcomes. There was a positive association between the presence of networks comprised predominantly of friends or networks comprised predominantly of family members and employment among women with disabilities and a positive association between the presence of social networks comprised of a mixture of family and friends and employment among disabled men. These results imply that the ADA did not achieve its intended goal. Future research is required to see how alternative strategies such as enhancing social networks can be used to increase employment opportunities for persons with disabilities.

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## CHAPTER 1: INTRODUCTION

In the United States, persons with disabilities represent a large proportion of the population. An estimated 18.1 percent of noninstitutionalized civilians in the United States, totaling 51.2 million people, have a disability (Survey of Income and Program Participation, 2001). While the majority of disabled individuals are over the age of 65 and are not considered to be potential members of the workforce, there are a substantial number of disabled individuals who fall within the working-age population (ages 16 to 64). Specifically, 17.4 million working-age people (or 9.4 percent of the total population) report a disability.

While there are many American citizens who have disabilities that pose barriers to employment, many would and could like to participate in the labor force. Employment is considered to be a key domain in the quality of life of persons with disabilities in that it provides meaning and structure to the lives of persons who are disabled as well as contributes to their economic self-sufficiency. (National Institute on Disability and Rehabilitation Research (NIDRR), 2006). Additionally, research has shown that employment positively impacts various measures of well-being for persons with disabilities. Research has shown that paid employment has a positive impact on the self-esteem and quality of life of persons with disabilities (Robinson, 2000). One study indicated that persons with and without visual impairments viewed employment as equally important in their lives (Gillies et al., 1998). Also, a study of persons who were homeless and mentally ill found that employment was a correlate with improved well-being (Lam & Rosenheck, 2000).

The United States government is also committed to supporting persons with disabilities in achieving economic self-sufficiency. While the Social Security Administration



currently spends over \$55 billion dollars annually on disabled beneficiaries, there have been several efforts to promote self-sufficiency among the disabled (SSA, 2000). Over two billion dollars in federal funds are provided to states annually to assist persons with disabilities obtain and maintain jobs (U.S. Department of Education, Rehabilitation Services, FY2007 budget). Also, NIDRR places a substantive focus on supporting research efforts regarding the participation of persons with disabilities in the labor force (NIDRR, 2006). Additionally, there have been a number of national legislative efforts- including the Rehabilitation Act of 1974, the Americans with Disabilities Act (ADA) of 1990 and the Ticket to Work and Work Incentives Improvement Act (TWWIIA) of 1999 - all designed with the intention of supporting persons with disabilities in the workforce.

Despite these governmental efforts, there is an employment gap for persons with disabilities. Employment related studies of persons with disabilities show that, in general, disabled persons experience poorer labor market outcomes compared to the general population. For example, individuals with disabilities have experienced decreased labor force participation compared to persons without disabilities (Stern, 1989; Bound et al., 1995). Studies have also demonstrated wage disparities between some persons with disabilities and persons without disabilities. Research has revealed decreased wages for women with disabilities as compared to women with no reported disabilities (Baldwin et al., 1994; Barnartt & Altman, 1997) and decreased wages for men in some specific disability groups such as individuals with mobility impairments (Baldwin et al., 1994; DeLeire, 2000).

The problem of obtaining and maintaining gainful employment for persons with disabilities is multi-faceted and complex. Previous research has highlighted various reasons contributing to the employment gap with much of the research focusing on how social policies such as the ADA and social security payments impact the employment process (DeLeire, 2000). Disability employment research has also focused on how disability type, gender, race, education and societal attitudes have differential effects on the labor force

participation of persons with disabilities (Baldwin et al., 1994; Barnartt & Altman, 1997; Baldwin & Johnson, 1994; Findley & Sambamoorthi, 2005; Zwerling et al., 2002). However, much of the previous research, particularly research focusing on the efficacy of the ADA, has been criticized due to inappropriate measures of disability with many researchers criticizing the use of self-defined work impairment as an insufficient measure of disability (Kirchner, 1996; Jette & Badley, 2000; Hale, 2001). As a related issue, previous research has been criticized in its neglect to account for the heterogeneity of the disabled population with much of the research using disability measurement categories that collapse disparate disability types thereby obfuscating results (Altman, 2005). Additionally, previous research on the ADA has been uni-dimensional and has neglected to focus on additional employment outcomes such as increased diversity in occupational opportunity and increased employment opportunity for specific disability types (Randolph & Andresen, 2004).

This research focuses on two broad components that impact employment of persons with disabilities- social policy and social networks. The social policy component of the proposed study analyzes the impact of the Americans with Disabilities Act on the employment of persons with disabilities. While there are existing studies that address the impact of this policy, this study serves to further the existing literature by 1) refining the definition of disability and specific disability groups; 2) examining the long-term impact of the ADA by extending the timeframe for which the policy impact is studied; and 3) including portions of the population that have been excluded from some previous studies, specifically women.

The social network component analyzes the association of social networks with the employment status of persons with disabilities. While the association of the presence of social networks and positive employment outcomes of persons who do not report disabilities is well documented (Lin & Dumin, 1986; Phillips & Massey, 1999; Gabbay & Zuckerman, 1998), there are only three known studies that address the association of networks with the

employment status of persons with disabilities (Roy, Dimigen & Taylor, 1998; Evert et al., 2003; Jackson et al., 2006). These existing studies focus on specific disability groups, individuals with visual impairments, individuals with psychosis, and individuals with spinal cord injury and do not focus on the larger disabled population or provide comparisons of disability groups.

### Specific Aims of Study

The purpose of this research is to provide an analysis of specific policy-level and interpersonal-level factors that impact the employment of persons with disabilities. The specific objectives of this study are to:

- describe the initial and long-term impact of the Americans with Disabilities Act on employment of persons with disabilities, including
  - examining the differential effects of the policy on different disability groups, and
  - examining the differential effects of the policy on different genders, and to
- assess the association of social networks with employment of persons with disabilities, including
  - examining the different association of different types of networks and
  - examining the different association of networks with different disability groups.

## **CHAPTER 2: THE LONG-TERM IMPACT OF THE AMERICANS WITH DISABILITIES ACT ON LABOR FORCE PARTICIPATION OF PERSONS WITH DISABILITIES**

### **Introduction and Background**

#### Labor Market Issues for the Disabled

Historically, individuals with disabilities have faced barriers in a number of life domains including experiencing limitations in accessing appropriate educational services, housing, and participation in community events (Kennedy & Olney, 2001). The workplace has also been an arena in which individuals with disabilities have experienced barriers. Utilizing data from the National Health Interview Survey, Olney and Kennedy found that 10 percent of people with disabilities claimed to have experienced discrimination in the work force from 1990 to 1995, the five years immediately following the passage of the Americans with Disabilities Act. Further evidence of employment discrimination of the disabled is gained by reviewing U.S. Bureau of the Census data. According to 2002 CPS data, only twenty-one percent of individuals ages 18 to 64 who reported a work-limiting health problem or disability were employed compared to eighty-seven percent of able-bodied persons (Burkhauser, Houtenville, & Wittenburg, 2003).

Research conducted prior to the implementation of the ADA has shown that employment disparities for persons with disabilities existed in the form of decreased labor force participation (Stern, 1989; Bound et al., 1995) and lower wages (Altman, 1985; Baldwin et al., 1994; Burkhauser & Daly, 1994; Johnson & Lambrinos, 1985). Research has found that the labor force participation and income disparities found among those who are

disabled are similar to those found among gender and racial minority groups (Wilson, 1987; Tomaskovic-Devey, 1993; Blau, Ferber & Winkler, 1998).

Studies conducted by Baldwin and colleagues (1994) and Barnartt and Altman (1997) focusing on individuals with hearing, visual and mobility impairments showed that, in general, disabled individuals had lower wages than the nondisabled population. These studies also showed, however, that when disability groups were analyzed separately, that visually impaired and hearing impaired individuals had higher wages than individuals with mobility impairments. A governmental report sponsored by NIDRR echoed these findings by revealing disparities in employment rates and earnings are even greater for disabled individuals with the most significant disabilities (Stoddard, et al., 1998).

Furthermore, analysis from the Baldwin and Barnartt studies showed that women with disabilities who were in the workforce had significantly lower wages than their same sex peers in the general population and working disabled men. The results of their studies showed a significant interaction between gender and disability and associated lower wages.

Some studies conducted pre-ADA have shown that discriminatory attitudes were associated with lower wages for disabled persons. Baldwin and Johnson (1994) specifically looked at how prejudicial attitudes towards specific disabilities effected employment and wages of disabled men using data from the 1972 Social Security Survey of Disabled and Nondisabled Adults and the 1984 Survey of Income and Program Participation. Utilizing Tringo's measure of social distance (1970), this study showed that discriminatory wage differentials were greater for disabilities subject to prejudice (such as mental illness, mental retardation or cancer) than for men with disabilities toward which social attitudes are only mildly negative (such as heart disease, diabetes or arthritis.) Johnson and Lambrinos (1987) utilized data from the 1972 Social Security Survey of Disabled and Nondisabled Adults and found that wages for men with more severe or less socially desirable disabilities were lower than men with less severe disabilities. They did not find these discriminatory wage

differentials for women with disabilities. However, a later study utilizing data from the 1990 National Consumer Survey of People with Developmental Disabilities and their Families found that the social distance measure was not a good predictor of employment of persons with serious disabilities (Salkever & Domino, 2000).

This overwhelming evidence of employment discrimination faced by disabled individuals served to lay the groundwork for legislative protection for disabled persons in the form of the Americans with Disabilities Act.

### Educational Attainment of Persons with Disabilities

In the general population, there is a long-standing and well-established link between educational attainment and employment and occupational attainment (Blau & Duncan, 1967; Becker, 1964). While studies have documented an association between educational attainment and employment among individuals with generally defined disabilities (Berry, 2000) and specific disabilities such as schizophrenia (Salkever et al., 2003) and multiple sclerosis (Roessler et al., 2004), educational attainment and subsequent employment outcomes can be affected by the presence of a disability, particularly disabilities that manifest themselves before school age or during the years associated with school attendance. Statistics from the 2000 National Organization of Disability Harris Survey of Americans with Disabilities show differences in the education of persons with disabilities and those without disabilities. This survey shows that 22 percent of persons with disabilities did not complete high school compared to nine percent of people without disabilities. Differences also extend to college education. Twelve percent of persons with disabilities have graduated from college compared to 23 percent of non-disabled persons. It should be noted that it is not known if these data are age adjusted; therefore, results may contain cohort effects. Additionally, these data do not provide information on whether the respondent's disability was present before the respondent reached school age or if the

disability occurred at a later time which could have a differential impact on educational attainment.

Research also shows that individuals with disabilities that specifically limit their ability to work have limited educational attainment levels compared to those with no reported work limitations. A study by Horvath-Rose and colleagues (2004) using Current Population Survey data from the years 1982 to 2000 compared a group of youth (ages 15 to 21) and young adults (ages 22 to 29) with and without work limitations. Their analysis showed that youth and young adults with work limitations were more likely to have no formal education, less likely to have a high school degree, and less likely to have attended college or to have a college degree than youth and young adults with no reported work limitation.

There are several reasons that educational levels are lower among persons with long-standing disabilities compared to that of the general population. First, youth with identified disabilities are more likely to be educated in special education programs. Research has shown that youth in special education programs are more likely to drop out of school and less likely to enter postsecondary education compared to youth in general (Wagner & Blackorby, 1996). Additionally, some disabilities, such as Down Syndrome, cerebral palsy, and spina bifida may include intellectual disabilities that can impact educational attainment.

#### Public Policy Impacting Employment of Persons with Disabilities

To date there have been several laws that have attempted to impact the labor force participation of persons with disabilities. Laws intended to specifically target the disabled population include the Rehabilitation Act of 1973, the Americans with Disabilities Act of 1990 and the Ticket to Work and Work Incentives Improvement Act of 1999. While the ADA is the specific focus of this study, the Rehabilitation Act of 1973 and the Ticket to Work and Work Incentives Improvement Act of 1999 and their impact on employment of the disabled is discussed briefly below.

The intent of **the Rehabilitation Act of 1973** was to develop coordinated and comprehensive vocational rehabilitation and independent living programs for persons with disabilities. The Rehabilitation Act, as amended, prohibits employment discrimination on the basis of disability in programs and activities that receive federal financial assistance and in federally conducted programs. Studies of the effect of the Rehabilitation Act and employment outcomes of federal workers with disabilities provide mixed results. One study of the impact of this law revealed that while the number of disabled federal employees increased after implementation of the law, disabled employees were more likely to secure and maintain jobs in lower pay grades than non-disabled employees (Lewis & Allee, 1992). The authors of this study also reported that disability proved to be a greater obstacle to promotion than being a woman or a racial/ethnic minority. Two parallel surveys conducted with federal agency human resource representatives (Bruyere and Horne, 1999) and federal agency supervisors (Bruyere et al., 2002) focused on a number of issues related to the employment and advancement of persons with disabilities. While these studies did not focus specifically on the impact of the Rehabilitation Act, they focused specifically on employment of individuals who are affected by the Act- federal workers with disabilities. Both studies showed that the most common barriers to the employment and advancement of persons with disabilities included attitudes and stereotypes regarding those with disabilities, lack of related job experience and lack of job skills and training on the part of the employee with disabilities, and the supervisors' lack of knowledge about job accommodations.

The **Americans with Disabilities Act**, a federal law enacted in July 1990 and implemented in 1992, was an effort to end employment discrimination against persons with disabilities. The ADA has two broad employment goals. One goal is to ensure individuals with disabilities have access to types of employment from which they had historically been



excluded. The second goal is to increase employment opportunities for persons with disabilities. The employment-related provisions of the ADA consist of two parts:

- Section 101 (8) prohibits wage and employment discrimination against “qualified individuals with a disability.” A qualified individual with a disability is “an individual with a disability who, with or without reasonable accommodation, can perform the essential functions of an employment position.”
- Section 101 (9) requires an employer to make “reasonable accommodations”- which are changes or enhancements to the work environment that permit a level playing field or equal employment experiences for persons with disabilities.

Therefore, the specific intent of the ADA is to prohibit businesses from discriminating against qualified persons with disabilities in the recruitment and hiring process. Additionally, the law requires employers to provide reasonable accommodations to assist disabled individuals to do their jobs once hired. Accommodations must also be provided to disabled persons who already employed when their disability occurs. Examples of reasonable accommodations for disabled employees include providing sign language interpreters for business meetings involving employees who are deaf, building ramps or elevators for persons with mobility impairments and providing modified work schedules for employees who are mentally ill.

Some researchers have hypothesized that employers’ perceived cost of accommodations could contribute to decreased labor force participation for persons with disabilities as well as decreased wages (Sims, 2001). While there has been one study that reviews the impact of the ADA on accommodation rates for persons who are employed and later become disabled (Sims, 2001), there is presently little evidence of the cost of accommodation and its impact on labor force participation and wages for the disabled who are seeking employment.

Two major studies have analyzed the impact of the ADA on labor force participation for disabled persons. Using data from 1986 through 1995 from the Survey of Income and

Program Participation, DeLeire (2000) found that controlling for demographic and occupational characteristics; the employment rate fell for disabled men after the ADA was approved. In general, he found that employment for disabled men fell 7.2 percent compared to the employment rate of nondisabled men. Additionally, he found that men with physical disabilities experienced an 8.9 percent decrease in labor force participation and men with mental disabilities experienced an 8.5 percent decrease in employment compared to the general population of men.

Acemoglu and Angrist (2001) utilized data from the Current Population Survey from 1988 to 1997 to estimate the impact of the ADA on disabled individuals. They also found an overall decline of employment for the disabled; however, their analysis of firm size warrants review. They found that the odds of a disabled person working in a mid-size firm (25-99 employees ) was decreased compared to the odds of working in small or large size firms after implementation of the ADA. This finding supported their expectation that the ADA had the “largest effect on employment in firms that are sufficiently large to be covered by the ADA provisions but small enough to be vulnerable to an increase in costs.”

There are some limitations of the existing ADA studies. Limitations of the DeLeire study include a 1) short sample period, 2) an inadequate mechanism to operationalize disability, 3) an inappropriate interpretation of analysis results and 4) the exclusion of women from the study. DeLeire’s study includes data from the years 1986 through 1995; however, some accommodations required by the ADA, such as structural building changes, could take several years to implement. The proposed analysis will include data four years prior to the implementation of the law (1988) through nine years after implementation of the law (2001). DeLeire also used self-reported work impairment and self-reported health diagnoses to identify persons with disabilities in his sample. Disability is a complex concept and for reasons cited later in this document a refined definition of disability will be used for the proposed study. For his analyses, DeLeire used a difference in differences econometric

model in which he defined pre-ADA as the years prior to 1989 and post ADA as years after 1989; however, while the ADA was passed in 1990, it was not implemented until 1992. The proposed study will utilize a similar econometric model utilizing the appropriate implementation date of the law. Finally, DeLeire excluded women from his analyses. While labor force rates may differ for women due to gender-based roles such as caring for young children in the home, women constitute an increasingly larger portion of the labor force. The percentage of all women over the age of 16 participating in the United States labor force has grown from 46 percent in 1975 to a projected 62 percent in 2007 (BLS). Women now also account for 47 percent of the entire labor force (BLS). Therefore, it is important to see how the ADA impacts labor force participation of women with disabilities.

Limitations of the Acemoglu and Angrist study also include an inadequate mechanism to operationalize disability and a short sample period. This study uses self-reported work limitations to identify persons with disabilities and uses CPS data from 1988 to 1997. While this study uses a longer time span than that of the DeLeire study, it still falls short of the time frame in this proposed analysis. Additionally, this study uses weeks worked as the dependent variable. There is speculation that this is the best measure of the impact of the ADA on labor force participation of persons with disabilities. Since the ADA is intended to prevent discriminatory hiring and support the provision of accommodations in the workplace for persons with disabilities, it is theorized that the binary dependent variable employed versus not-employed is a better indicator of labor force participation. Weeks worked could be affected by other issues such as seasonality of occupation, other family income sources, or health status. Also, working on a part-time basis or a reduced schedule could be an accommodation selected and agreed upon by the worker and their employer. The dependent variable weeks worked could serve to mask this appropriate use of the ADA.

The **Ticket to Work and Work Incentives Improvement Act** is one of the most recent national legislative efforts intended to impact the employment of persons with

disabilities. While the study period for the proposed analysis is constructed to preclude the implementation timeframe of the TWWIIA in an effort to decrease threats to internal validity, a description of the Act and preliminary evaluation results are included to provide a more complete picture of legislation affecting employment of persons with disabilities. The intent of the TWWIIA was to provide the beneficiaries of Supplemental Security Income (SSI) or Social Security Disability Income (SSDI) incentives and supports in the workplace. The intent of this policy was to expand the number of rehabilitation and employment service providers available and to create a more comprehensive network of supports for people with disabilities considering work. Implementation of this policy is still fairly recent as Phase 1 was implemented in February 2002 and the third and final phase was implemented in January 2003; therefore, there are no peer-reviewed studies of the efficacy of TWWIIA to date (Kilbane, 2003). There has been an initial and three follow-up evaluations of the program conducted by Mathematica Policy Research Inc, in conjunction with the Cornell Center for Policy Research (Thornton et al., 2004; Thornton et al., 2006; Thornton et al., 2007; Stapleton et al., 2009). The main findings of these evaluations are that while the program has been successfully implemented, the number of participating beneficiaries and employment and rehabilitation service providers remains low.

#### Issues with Definition of Disability

Disability is a somewhat complex concept to define. Historically, disability has been conceptualized under a medical model which posits that a disability is a deficiency within an individual (Brisenden, 1986). This model has been replaced by more current models which view disability as an interaction between an individual's functional limitations and their environment. While there are over 20 different documented conceptual frameworks for disability, there are currently two main ones: the disability model developed by Saad Nagi (1965, 1979) and the World Health Organization's International Classification of Functioning, Disability and Health (ICF) (WHO, 2001). Both of these conceptual models recognize

disability as a dynamic process that involves the interaction of a person's health condition, personal characteristics, the physical environment and the social environment.

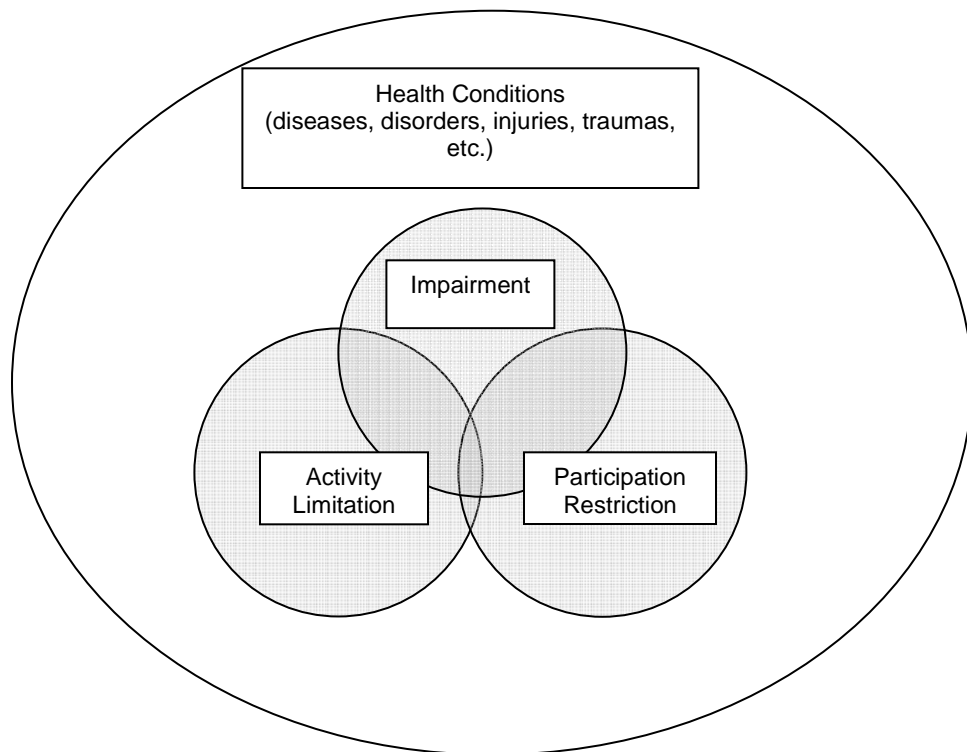
Additionally, due to complications experienced by researchers in operationalizing the variable "disabled" in the past, the definition of disability, as well as the manner in which it is operationalized, warrants discussion. As previously stated the existing ADA research has utilized self-reported work impairments to indicate disability (DeLeire, 2000; Acemoglu & Angrist, 2001). This is problematic for three major reasons including confusion around the terms impairment and disability, under-reporting disability due to psychological or cultural reasons and the concern that questions regarding work-impairment utilizing circular logic.

First, while the terms disability and impairment are often used interchangeably, the two terms have very different meanings. The World Health Organization (2001) defines *disability* as an impairment, an activity limitation and/or a participation restriction. *Impairment*, which according to the WHO definition can be a subset of the term disability, is specifically defined as a significant deviation or loss in body function or structure. Examples of impairments include loss of a limb or a hearing loss.

The ICF framework also includes the additional concepts of *activity limitation* and *participation restriction* as potential subsets of the term disability. An *activity limitation* is defined as a difficulty an individual may have in executing activities. An example of a person with an activity limitation is a person who experiences difficulty in dressing, bathing or performing other activities of daily living due to a health condition. A *participation restriction* is defined as a problem an individual may experience in life situations. An example would be an individual of working age who has a severe health condition and experiences an inability to work due to issues in the physical environment (e.g., lack of work accommodation) and/or social environment (e.g., employer attitude or discrimination).

Figure 1 provides a summary of the ICF concepts. It demonstrates that while these concepts are overlapping, it is possible to have one of them occur in the absence of the others. The shaded area illustrates the ICF concept of a disability.

**Figure 1.** Simplified Model of Disability Using ICF Concepts



The definition of disability found in the Americans with Disabilities Act appears to be comparable to the definition of disability espoused by the World Health Organization. The ADA's definition of disability requires a person to be "substantially limited" in a major life activity. The specific definition of disability found in Title I of the ADA is as follows:

- a) a physical or mental impairment that substantially limits one or more of the major life activities of such individual;
- b) a record of such an impairment; or
- c) being regarded as having such an impairment.

Like the ICF definition, the ADA definition encompasses a broader definition of disability than a self-reported work impairment. It also includes limitations in major life activities which can include walking, seeing, hearing, speaking, breathing, and learning. The ADA definition also includes items such as difficulty in performing manual tasks, caring for oneself and working. While these items are considered limitations in major life activities under the ADA model of disability, they are considered to be participation restrictions under the ICF model (WHO, 2002).

A second reason that using self-reported work impairments or limitations is problematic is that there are cultural definitions of specific disabilities that weigh in on how a member of a specific disability group views themselves. For example, many individuals who are pre-lingually deaf consider themselves to be members of a sub-culture, with a different language (American Sign Language) and different cultural norms than those that exist in the “hearing world” (Lane, 1984, 1992; Sacks, 1989). Persons who are culturally Deaf often do not view themselves as disabled and do not consider their hearing loss to be a medical condition or impairment<sup>1</sup>. This can cause measurement error in surveys requesting self report of impairment or disability. An individual may report a medical condition, yet may not report it as a limitation or disability. This phenomenon can be found in other groups of persons who are perceived by the public to be disabled. For example, in analyzing data from the Survey on Disability and Work, Stern (1989) found that many individuals who were blind did not report any limitations in work despite their inability to perform any work that requires sight.

The ADA definition of disability includes the component “being regarded as having such an impairment”. This is applicable to individuals who have conditions that they

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<sup>1</sup> The “D” in Deaf culture is capitalized here to indicate the differences in persons who are “small d” deaf and persons who are “Big D” Deaf. Persons who are deaf consider deafness a hearing loss while persons who are Deaf identify themselves as being culturally deaf and have a strong deaf identity. Persons who are Deaf tend to use American Sign Language, attend programs/schools for the deaf and mainly socialize with others in the Deaf community.

themselves do not perceive as disabling, but may be considered disabled by society and would therefore fall under the auspices of the ADA.

A third reason that using self-reported work limitations is problematic is that the language used in many surveys to elicit information about work-related impairments seems to promote some circularity in reasoning. For example, the CPS contains the following question regarding work limitations: “Do you have a health problem or disability which prevents you from working or which limits the kind or amount of work you can do?” An individual with a disability covered under the ADA who was gainfully employed in a job with accommodations would likely not reply “Yes” to this question. Therefore, it would be difficult to capture the impact of the ADA on such an individual by merely identifying disabled individuals by self-reported work limitations.

#### Significance of Topic to Occupational Safety and Health

While there are many individuals with pre-existing disabilities who seek gainful employment in the United States, there are also a number of workers who are disabled on the job. In 2001, private industry reported 5.2 million nonfatal occupational injuries and illnesses with 1.54 million cases resulting at least one day away from work (NIOSH, 2004). Although Bureau of Labor Statistics data from 1992 to 2001 has shown a 34 percent decrease in the number of injuries and illnesses resulting in time away from work, the issue of workers who are injured and disabled on the job remains an area of national concern (NIOSH, 2004). Despite the many employer and insurer-sponsored programs and policies, in addition to the ADA, that exist to reintegrate workers disabled on the job into the workplace, many workers disabled on the job never return to work. Annually, more than half a million workers in the United States incur injuries or illnesses that disable them for at least 5 months. Almost half of these individuals never return to work (Tate, 1992). A clearer understanding of social policies and interpersonal attributes that impact successful



employment of persons who are disabled could serve to increase the number of workers who are disabled on the job who then return to employment.

### Significance of the Study

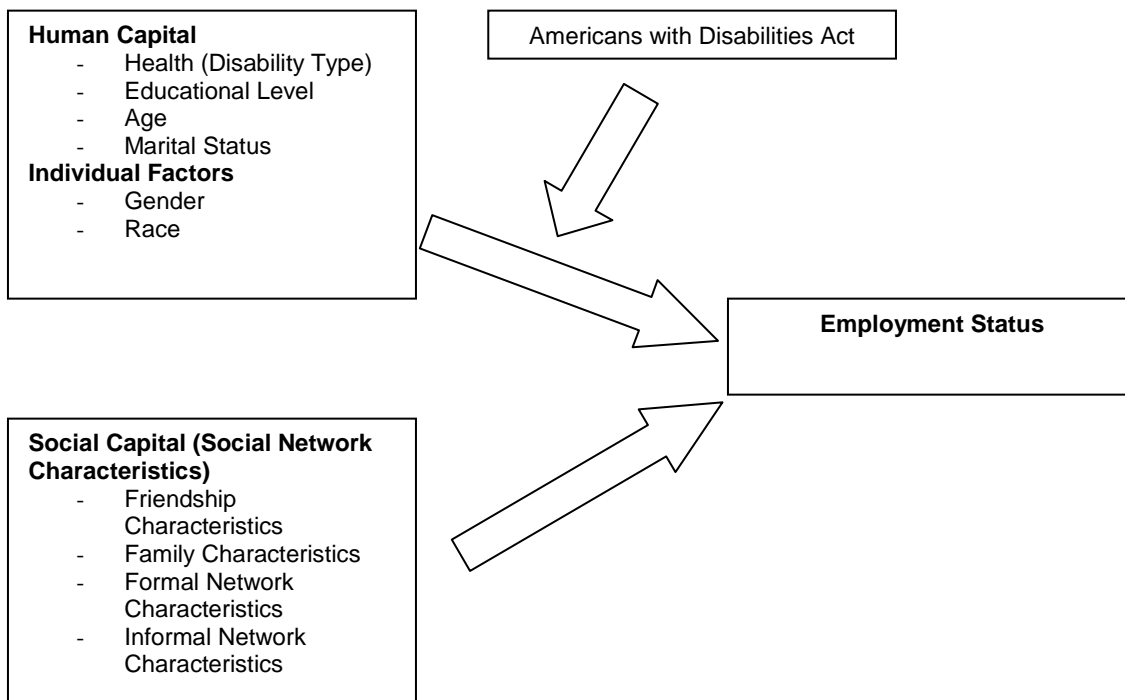
This research serves to fill in gaps in the literature in disability employment in several manners. First, the results from the policy-level component of this study will serve to inform policy makers on the long-term impact of the ADA. While there is existing research that measures the immediate impact of the ADA on labor force participation of persons with disabilities, longer-term impact is not known. It is likely that some changes brought about by the ADA have taken many years to implement. For example, structural building changes such as accessible elevators may not have been fully implemented when the existing ADA studies were conducted. Second, this component provides a clearer understanding of the short-term impact of the policy due to a refinement in the definition of persons with disabilities over the existing ADA research. As there has been criticism of the use of self-reported work impairment as a measure of disability, this research utilizes a broader definition of disability that more accurately mirrors the ADA definition. Third, this study analyzes the impact of the ADA on specific disability groups. There is a paucity of research that addresses the impact of the policy on groups with various disabling conditions. Finally, this research provides a better understanding of the impact of the ADA on women with disabilities. National statistics indicate the number of women in the workforce is increasing in general. The Bureau of Labor Statistics reports that while 46.4 percent of women ages 16 and older participated in the workforce in 1975, it is projected that 61.9 percent of women will be in the workforce by 2008 (BLS, 1999). However, there is little research that investigates the rate of labor force participation of disabled women or the impact of the ADA on disabled women.

## Theoretical Perspectives and Conceptual Framework

### Conceptual Framework

The conceptual framework of this study draws upon both economic and sociological theories of employment. The employment status of persons with disabilities is conceptualized to be a result of human capital, social capital and other individual factors (Becker, 1964; Bordieu, 1986). Additionally, occupational segregation theory and social network theory are included as components of the framework. The overall conceptual framework which encompasses both the ADA policy study and the social network study is depicted in Figure 2 below. While the conceptual framework for the ADA study is described below, the framework for the social network study is more fully described in Chapter 2

**Figure 2.** Conceptual Framework for the Impact of the ADA and Social Networks on Employment of Persons with Disabilities



### Human capital theory

Human capital, which can be broadly defined as the individual or collective knowledge and physical attributes of people used in producing goods and services, is used as one theoretical component of the proposed study (Schultz, 1963; Becker, 1964). Becker (1974) describes human capital as a production function by which individuals can invest in human capital via mechanisms such as education, training, and medical care expenditures and receive additional output via enhanced employment outcomes such as higher wages or prestigious occupations. There are numerous studies using human capital theory to describe the impact of various types of education on economic outcomes of individuals. Such studies include the analysis of formalized education in primary and secondary school (Cohn & Geske, 1990), informal education obtained at home or work (Schultz, 1981), on-the-job training and apprenticeships (Mincer, 1974), and specialized vocational training (Corazzini, 1967). While health has been included in the original human capital literature, Becker (2007) and Sweetland (1996) have noted its lack of presence in the past few decades with the exception of the major contributions of Grossman's model for the demand for health (1972, 1999). Grossman's work, however, focuses on how individuals allocate various resources to produce health and Grossman's model is typically utilized in the health care delivery literature.

In the proposed study, decreased employment outcomes historically experienced by persons with disabilities are conceptualized as a direct result of decreased human capital experienced by persons with disabilities as compared to persons without disabilities. There are two main mechanisms that impact the human capital of persons with disabilities. First, persons with disabilities by definition have physical and/or cognitive limitations that, without accommodation, can reduce their ability to produce goods and services in the labor market as compared to persons without disabilities, thereby reducing employment opportunities. Second, persons with disabilities may have experienced or perceived experiences of

discrimination in the job market; therefore, in response to this perception of discrimination they may invest relatively less in education and training. Because of discrimination, persons with disabilities perceive that their investments in human capital do not pay relative to others and they are less likely to invest in human capital. Because of this lower investment, discrimination may persist or increase causing a vicious cycle. This cycle has been observed in other groups that face job discrimination such as females and non-whites (Caputo, 2002).

The Americans with Disabilities Act, however, is conceptualized as an intervention in the marketplace which mitigates some of the effects of disability in the workforce, thereby reducing barriers to employment and providing indirect mechanisms for workers to increase human capital. Theoretically, the ADA is conceptualized to decrease barriers for disabled persons in investing in two components of human capital: health and education. The ADA impacts a disabled worker's health capital by decreasing barriers in obtaining and maintaining gainful employment which, in the United States, is inextricably linked to obtaining and maintaining health care. A worker with a disability who receives an accommodation and is able to maintain their employment will subsequently be able to pay for health care through wages and job-sponsored health insurance.

Specific examples of how the ADA decreases barriers to employment are provided by the Job Accommodation Network (1999). One example includes an attorney with cancer who experiences difficulty concentrating on her work due to medications. Her firm allows her uninterrupted work time and permission to work from home two days a week. A second example is an engineer who is diagnosed with multiple sclerosis. The engineer experiences heat sensitivity and is accommodated through the provision of a private office in which she could lower the room temperature. These accommodations allow workers to maintain employment and income which in turn allows them to pay for necessary health care to increase or maintain health capital.

Theoretically, the ADA could also serve to increase the human capital of workers by providing an impetus for persons with disabilities to increase educational attainment in anticipation of better employment opportunities. For example, persons with disabilities would be more willing to invest in additional education and training as they could anticipate a return on their investment in the result of a better chance of gainful employment or a more prestigious occupation. Additionally, vocational training programs targeting persons with disabilities could potentially be more willing to provide more support for a wider variety of training and educational programs for persons with disabilities.

### Occupational Segregation

The theory of occupational segregation has primarily been used to explain wage gaps among gender groups (Beller, 1982; Sorenson, 1989). Theorists have claimed that occupational segregation occurs due to varying mechanisms, such as early-life socialization and existing social controls. Due to these factors, women are channeled and segregated into female-dominated fields with low levels of occupational prestige (Epstein, 1988). A review of the representation of women in selected occupations supports this theory. Over 95 percent of some jobs in the health care professions, such as dental hygienists, registered nurses, licensed practical nurses, and dieticians, are filled by women (Tilly& Tilly, 1998). These jobs receive much lower pay and have much lower prestige than their male-dominated counterparts, dentists, doctors and orderlies. Segregation occurs in other sections of the service industry as well. The majority of secretaries (99%) and private household cleaners (96%) are female (Tilly& Tilly, 1998). These are traditionally low-paying jobs as well.

There is some evidence of occupational segregation occurring among persons with disabilities. Baldwin (1991) found similar patterns of occupational segregation with disabled men dominating occupations of skilled production and crafts and disabled women concentrated in clerical and service occupations. She found significant patterns of

occupational segregation among disabled women and while there was some evidence of occupational segregation among disabled men, the segregation was more pronounced among specific disability types.

Thoursie (2004) also found evidence of occupational segregation among disabled workers. In a study of disabled and non-disabled Swedish workers, he found that disabled workers worked in lower level occupations to a greater extent relative to non-disabled workers. However, the lower level occupations were explained by lower levels of educational attainment.

In this study, the employment outcomes historically experienced by persons with disabilities are conceptualized to be, in part, a result of occupational segregation experienced by persons with disabilities as compared to persons without disabilities. Occupational segregation for persons with disabilities is theoretically supported by both functional and historical logic. Functional reasons for segregation in specific low-paying, low-prestige occupations include disability-specific characteristics. For example, persons who are deaf are often hired to work in noisy factory environments as the noise is not bothersome to workers.

Historical reasons for occupational segregation can be related to occupational training programs and vocational rehabilitation legislation. Historically, pre-vocational training for persons with disabilities has been under the auspices of schools for the disabled or government-sponsored Vocational Rehabilitation programs. Schools typically provided specific vocational training that provided a pipeline to specific occupations and employers. For example, in the 60s and 70s, schools for the deaf provided vocational training for young men in printing and wood working, thus funneling deaf men to jobs in these specific areas. Women were provided training as sewing machine and key-punch operators, thus reinforcing disability and gender occupational segmentation.

Vocational Rehabilitation programs additionally provided very narrow, specific job training to persons who were post-vocationally disabled. For example, watch repair and broom-making were skills taught to persons who were mobility impaired and visually impaired, respectively (Ohio Rehabilitation Services, 2002). However, the ADA has provided the legal impetus for Vocational Rehabilitation programs to encourage and ensure consumer choice in career opportunities and thus provide variation in occupational training programs.

In this study, the Americans with Disabilities Act is a policy theorized to serve as a lever to expand occupational opportunities for persons with disabilities. By providing the impetus and the opportunity for persons with disabilities to increase their human capital through increased participation in education and vocational training programs, the ADA could facilitate opportunities for more diverse and prestigious occupations.

#### Study Hypotheses

The specific aim of this policy-level study is to investigate the long term impact of the ADA on employment outcomes of persons with disabilities. The study also attempts to examine differential effects of the policy implementation on different disability groups and different genders. There are three main hypotheses for this component of the study.

*Hypothesis 1a: Overall employment of persons with disabilities will increase after implementation of the ADA, controlling for all relevant variables, during the period between 1988 and 2001.*

There is existing research that measures an initial negative impact of the ADA on labor force participation of persons with disabilities; however, changes brought about by the ADA have taken years to implement. For example, structural building changes such as accessible elevators and supports for persons with mental illness may not have been fully implemented when the previous studies were conducted. Also, there have been vast

technological improvements over the years that have benefitted persons with disabilities. Some examples of technological improvements that have had a positive impact on individuals with hearing impairments include enhanced digital hearing aids, the increased use of handheld texting devices, and Video Relay Services (a low cost mechanism for accessing sign language interpreters via teleconferencing). It is theorized that the initial negative impact of the law will be ameliorated over time through improvements in accommodations such as technological advances, advances in medical care, and increased knowledge on the part of employers and persons with disabilities.

*Hypothesis 1b: Overall employment of men with disabilities will increase at a greater rate than overall employment of women with disabilities after implementation of the ADA controlling for all relevant variables, during the period between 1988 and 2001.*

Numerous studies regarding employment outcomes of the general population have shown reduced employment for women and gender-based employment inequities. There are various theories to explain these differences including marriage roles (Marini, 1980), motherhood (Buding & England, 2001), occupational segregation (Beller, 1982; Sorenson, 1989) and discrimination (Oaxaca, 1973). While there is no existing research that examines the gender-specific effects of the ADA, there is research conducted on data collected prior to the ADA that shows that women with disabilities are subject to a double burden of discrimination with regard to wage offers (Baldwin & Johnson, 1995). Due to well-documented existing gender inequities, it is hypothesized that employers may provide job accommodations in a different manner to women. For example, an employer may be less likely to invest in an accommodation for a woman with a disability that is of child-bearing age or has small children as they may assume there would be a lower return on their investment in the employee. Likewise, a similar woman may be less able or willing to invest in additional education that would deem her more employable due to time or role constraints;



therefore, it is hypothesized that the ADA will have a lesser impact on the labor force participation of disabled women as compared to disabled men.

*Hypothesis 1c: The ADA will have a greater negative effect on labor force participation of specific disability groups with disability groups with more costly accommodations having a more negative outcomes than disability groups requiring less costly accommodation.*

Persons with disabilities are an extremely heterogeneous group with individuals covered by the ADA ranging from persons with cognitive disabilities such as severe mental retardation or psychosis to persons with physical disabilities such as paralysis or amputation to persons with a combination of both cognitive and physical disabilities such as stroke. Each of these individuals requires different accommodations with differing costs to the employer. Therefore, it is hypothesized an employer may be less likely to hire an individual who is perceived to need an investment of a costly job accommodation than someone who would need a less costly accommodation.

## **Research Methods**

### Research Design

This policy study is a longitudinal quasi-experimental design utilizing a pooled-cross sectional data set. The question of the impact of the ADA on labor force participation can be conceptualized as a “natural experiment” that lends itself well to a difference in differences estimation model. Data can be analyzed using the quasi-experimental design of pre-test post-test with treatment and control groups. Quasi-experimental design refers to the non-random group assignment of the subjects in the study (Cook & Campbell, 1979). In this case, the treatment group is persons with disabilities and the control group is persons without a reported disability, or those who would presumably not be affected by

implementation of the law. Also, as is the case with natural experiments, the variation in treatment assignment can be considered exogenous. For example, if employment status of individuals with disabilities were analyzed independent of the policy change, it would be difficult to tease out the effects of family income, past employment history, and global economic factors impacting employment such as a recession (Wooldridge, 2009).

The benefit of using a difference in differences design is there are potentially fewer threats to internal validity. This model also allows for baseline employment differences among the disabled and non-disabled groups.

The general estimation equation in the proposed analysis is as follows:

$$1) Y_{igt} = \beta_0 + \beta_1 Dis_g + \beta_2 Post_t + \beta_3 Dis_g * Post_t + \beta_4 Z_{igt} + \beta_5 Time_t * Dis_g + \varepsilon_{igt}, \text{ where } \varepsilon_{igt} = v_{igt}$$

The variable  $Y$  is a dummy variable for employment status. The variable equals one if the individual reports being employed and zero otherwise. Construction of this variable along with other explanatory variables is described more explicitly in the section entitled “Measures”. The variable  $Dis$  is a dummy variable indicating if the observation is considered to be in the treatment group or the control group. In this case,  $Dis$  equals one if the individual is disabled and zero if not disabled.  $Post$  is a vector of T-1 dummy variables for each time period. The vector  $Z$  controls for observable individual characteristics including age, race, sex, and educational status.  $Time$  is a vector interacted with  $Dis$  to allow for a different time trend coefficient for each group. This is included in the model as it is suspected that there are differing time trend variations between disabled and non-disabled.

In order to test the three main hypotheses in this portion of the study, three main empirical models are used. The first hypothesis is related to the impact of the ADA on labor force participation of persons with disabilities over time. In this analysis, the specific disability type or medical condition is not specified. Males and females are analyzed

together and separately for this model. This model will also include control variables for race, sex (in the combined model only), marital and educational status. The estimation equation in this model follows the estimating equation outlined in equation 1 above.

The second hypothesis addresses the differential impact of the ADA on labor force participation of men with disabilities as compared to women with disabilities. This is a difference in difference in difference equation with gender interacted with disability status and year to determine the differential impact on employment status of disabled men and women over time. In this model, the vector  $Z$  includes control variables for the individual factors race, marital and educational status. The estimating equation for this model is found below in equation 2.

$$2) \quad Y_{igt} = \beta_0 + \beta_1 Dis_g + \beta_2 Post_t + \beta_3 Gender_i + \beta_4 Dis_g * Post_t + \beta_5 Post_t * Gender_i + \beta_6 Dis_g * Gender_i + \beta_7 Dis_g * Post_t * Gender_i + \beta_8 Z_{igt} + \beta_9 Time_t * Dis_g + \varepsilon_{igt}, \text{ where } \varepsilon_{igt} = v_{igt}$$

The third hypothesis focuses on the differential impact of the ADA on labor force participation different disability groups. In this model the general estimating equation is modified so that  $Dis$  is a vector of dummy variables for disability type. In this model the disability type is interacted with year to determine the differential impact on employment status of persons with differing types of disabilities over time. Males and females are analyzed together and separately for this model. This model also includes the variables race, sex (in the combined model), marital and educational status as controls. The estimation equation for this model also follows the estimating equation outlined in equation 1 above.

### Data Sources

All data for this study are derived from the National Health Interview Survey (NHIS). The NHIS is a cross-sectional household interview survey which has been continuously conducted since 1957 and has been exclusively conducted by the National Center for

Health Statistics since 1969 (National Center for Health Statistics, 1989, 1999). The NHIS obtains information about the amount and distribution of illness, its effects in terms of disability and chronic impairments, and the kinds of health services people receive. This survey series provides a continuous sampling and interviewing of the civilian, noninstitutionalized population of the United States through annually released core surveys and supplemental datasets. This survey contains multiple survey questions which address individual health status, specific pathologies, impairment, functional limitations and disabilities. These multiple survey questions allow for the use of the ICF concepts of disability (WHO, 2001).

Individual persons are the primary unit of analysis for this study covering the time period of 1988 through 2001. This start period of 1988 was selected to account for baseline employment prior to the 1992 implementation date of the ADA. Data past 2001 are not utilized since the Ticket to Work and Work Incentives Improvement Act began Phase 1 implementation in February 2002. (Thornton et al., 2004). The sample includes disabled and non-disabled individuals ages 18 to 64. This age group is used as it is theorized that those younger than 18 are typically attending school and very few are engaged in full time employment. The majority of individuals 65 and older are typically not in the labor force due to retirement. Data show that labor force participation rates for men ages 65 to 69 was 34 percent in 2005 (Current Population Survey, Bureau of Labor Statistics). The rate of employment for women in this age group was 24 percent. Fourteen percent of men 70 and over were in the labor force in 2005 while 7 percent of women over the age of 70 were in the labor force.

Data from the NHIS are available annually for the time period of this study. For combined data for the years 1988 through 2001, the total number of individuals ages 18 to 64 is 899, 254. Table 1 below provides information on the number of individual respondents aged 18 to 64 who responded for select years before and after implementation of the ADA.

**Table 1. Number of Respondents to the National Health Interview Survey (NHIS) Ages 18 through 64 for Years 1988 through 2001**

<b>Year</b>	<b>Number of respondents ages 18-64</b>	<b>Percent</b>
1988	73,240	8.14
1989	70,327	7.82
1990	71,810	7.99
1991	71,648	7.97
1992	76,501	8.51
1993	65,728	7.31
1994	69,148	7.69
1995	60,801	6.76
1996	38,140	4.24
1997	61,794	6.87
1998	59,243	6.59
1999	58,788	6.54
2000	60,917	6.77
2001	61,171	6.80
Total	899, 254	100.00

It should be noted that there was a redesign of some of the NHIS questions beginning in the year 1997. In order to utilize resources for the redesign, a smaller number of households were sampled for the survey in 1996 accounting for the comparatively smaller number of respondents' ages 18 to 64 during this year (Adams et al., 1999).

Additionally, as a part of the redesign of the NHIS questions, there were some minor wording changes in some questions regarding disability which are described more fully in the measures section. Analyses of data indicate an initial 1 percent decrease in persons reporting disabilities from the years 1996 to 1997 for the two primary disability definitions used in this study. It is perceived that the survey wording change poses no significant

impact. The nature of the changes in survey questions is described more fully in the Measures section.

### Use of Sampling Weights

The NHIS is a complex, multistage probability sample that incorporates stratification, clustering, and oversampling of racial and ethnic minorities such as individuals who are black and/or Hispanic. Therefore, sampling weights are used to produce representative estimates, correct standard errors and statistical tests (National Center for Health Statistics, 1989, 1999). It should also be noted that due to confidentiality issues, many of the original sample design variables are suppressed in the NHIS public use files. However, NCHS has released public use design variables representing pseudo-strata and pseudo-PSU variables for the years 1987 to the present. These variables have been incorporated into the study in order to produce appropriate analyses. Additionally, since only a specific subpopulation of the database (individuals ages 18 to 64) is of interest for the analysis, there is a danger of computing incorrect standard errors if the individuals that fall outside of the age range are excluded. Therefore, STATA statistical software was used incorporating survey weights with the full database. This software package can produce correct estimates for the subpopulation of interest (Stata, 2007).

The sample weights provided in the NHIS data represent annual inflation factors. That is, for each individual, the person weight reflects the number of people that individual survey respondent represents in the total United States non-institutionalized population for a given year. Therefore, pooling data requires that the sample weights need to be adjusted. For this analysis, the annual final sample weight for each record was averaged or divided by 14 due to the 14 years of data that were pooled. While other methods of adjustment could have been employed, such as benchmarking the entire combined 14 years of data to independent estimates of the population at the midpoint of the 14 year period, it is not clear that they perform substantially better (Botman & Jack, 1995).

There are several issues regarding variance estimation to be considered when using multiple years of complex survey data. One issue is that annual samples are not statistically independent as they are drawn from the same geographic areas each year. Treating them as independent may result in standard errors that are too small. To ameliorate this, years within design periods that are identical in design are grouped together and standard errors are clustered (National Center for Health Statistics, 1989, 1999).

Also, sample design periods are conceptually and statistically independent. Approximately, every ten years, NHIS constructs a new sample design which may include some different geographic areas than were included in previous design periods. Therefore, different design periods should be treated as independent. The NHIS underwent two changes in sampling structure between the years of 1988 and 2001. Information on the structure including numbers of strata and primary sampling units (psu) per strata are provided in Table 2 below. In order to guarantee distinct pseudo-strata values for different sample design periods for pooled analyses of NHIS data, an algorithm designed by Moriarity and Parsons (2008) was employed.

**Table 2. Data Structure of NHIS Data for Years 1988 through 2001 and Remedy Used for Data Analysis**

Data Years	Structure	Remedy
1988-1994	62 strata, 4 PSUs per strata	Add 1000 to the pseudo- strata values
1995-1996	99 strata, 2-4 PSUs per stratum in 1995, 2-3 PSUs per stratum in 1996	Add 2000 to the pseudo- strata values
1997-2001	339 strata, 2 PSUs per strata	Add 3000 to the pseudo- strata values

A final issue related to variance estimation is that pooling across sample design periods requires accounting for each distinct design period. The remedy provided by Moriarity and Parsons is sufficient to address this issue. Pooled analysis for the years 1988-

2001 consists of 1,499,732 records with 800 degrees of freedom (number of PSUs-number of strata) when pseudo-strata values are altered.

### Measures

Whenever possible, constructs were measured using multiple measures to depict different aspects of the construct and minimize mono-measure bias. Measures are briefly summarized in Appendix 1. Additional information regarding measures is provided in Appendices 2 and 3. Appendix 2 provides a crosswalk for the different definitions of disability used in the analyses along with information regarding which year(s) the variable is available, how the survey questions are worded and specific programming used. Appendix 3 provides a crosswalk of the specific conditions used in the disability type analysis. This appendix includes the disability group category, the specific condition or disease, the corresponding ICD number and the NHIS codes.

### Dependent Variable

There is one major dependent variable: “**employment status**”. Employment status was determined by responses for the question asked regarding work status one to two weeks prior to the interview. Prior to 1997, the question is worded “During those two weeks did (respondent) work at any time at a job or business not counting work around the house?” Employment status will be coded as a binary dependent variable. The potential responses in which the respondent indicates that they do have a job whether they worked on the job or not will be coded as employed. These responses include the following: 1) worked in the past two weeks, 2) did not work, has job; not on lay off and not looking for work, and 3) did not work, has job; looking for work. All other responses will be coded as unemployed.

After 1997, the question is worded “Which of the following was (respondent) doing last week?” For these data, the potential responses in which the respondent indicates that they do have a job whether they worked on the job or not will also be coded as employed. These responses include the following: 1) working at a job or business and 2) with a job or



business but not at work. All other responses will be coded as unemployed. These definitions of employment have been used frequently in published studies regarding the employment status of persons with and without disabilities (Kennedy & Olney, 2001; Randolph & Andresen, 2004). It should be noted that the survey data obtained after 1997 does not provide the differentiation among respondents who have jobs but are not working in the week(s) prior that is available in the pre-1997 data. Since the differentiation only focuses on whether or not the respondent is actively seeking another job and this is not a focus of this study, this did not impact this study negatively.

Consideration was given to the inclusion of wages as an additional dependent variable; however, since the publicly available data for the NHIS only includes family income and does not include individual respondent income prior to 1997 wages was not included as a dependent variable.

#### *Independent Variables of Interest*

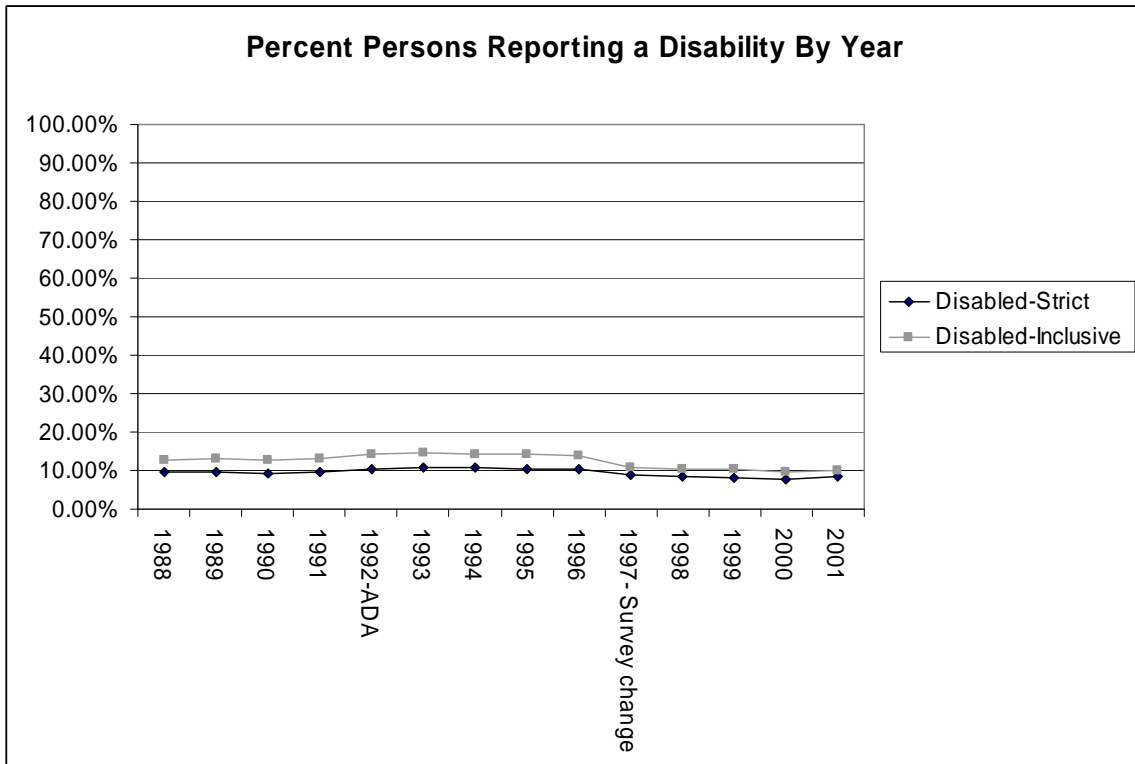
For this study, the main independent variable of interest is **disability status**. As previously mentioned the NHIS contains several questions that address disability status including self-reported work limitations and self-reported general activity limitations. The NHIS also contains questions about self-reported limitations in activities of daily living for surveys conducted after 1997 and questions about various health diagnoses for specific survey years. For these analyses, two definitions of disability were used – a strict definition including only individuals who self-identified as having a work-limitation and an inclusive definition that included individuals who reported any type of limitation. The inclusive definition of disability encompasses the more generalized, activity limitation aspects of the ICF definition of disability. For the inclusive definition, a respondent with a disability was identified as an individual who responds affirmatively to a general activity limitation and/or a work limitation. This definition is based on two questions: 1) a single question that asks if a person has a work limitation and 2) a single general question regarding activity limitations

that asks if the respondent is limited in any way in any activity. While the inclusive definition of disability is not based on questions specifically about activities of daily living, a respondent who has had difficulty with activities of daily living such as bathing, dressing, eating and transferring could respond affirmatively to the question and could be included in this disability category.

As previously mentioned, there were minor wording changes in questions about work and activity limitations in the NHIS administered after 1997. Prior to 1997, the survey question regarding work limitation was worded "Is [person] limited in the kind or amount of work [person] can do because of an impairment or health problem?". After 1997, the question was worded, "Is [person] limited in the kind or amount of work [he/she] can do because of a physical, mental or emotional problem?" The same type of change was contained in the question regarding any activity limitation. Prior to 1997, the question was worded, "Is [person] limited in any way in any activities because of an impairment or health problem?" After 1997, the question was as follows: "Is [person] limited in any way in any activities because of physical, mental or emotional problems?" Analyses of data indicated that these wording changes posed no significant impact on the percentage of persons defined as disabled in the sample.

Figure 3 below provides information on the number of individual respondents aged 18 to 64 who responded to disability-related questions for select years before and after implementation of the ADA. It should be noted that there is a small 2 percent decrease in the number of persons identified as disabled using the two primary disability definitions used in this study. Therefore, it is perceived that the definitions of disability used for this study are time-invariant and there was no significant change in how individuals responded to questions about disability before and after implementation of the ADA. Additional information on survey question wording and the coding of the strict and inclusive disability variables are found in Appendix 2.

**Figure 3.** Persons Between the Ages of 18 and 64 Reporting a Disability in the NHIS for Years 1988 through 2001



**Type of disability condition.** For analyses that require identification of specific disability types, the disability category will be identified by matching the NHIS person file with the NHIS condition file. NHIS condition files contain several recodes for several different medical conditions that can be disabling. These conditions are constructed when a condition is reported to be the main or secondary cause of an activity limitation or work limitation. Specific disability groups are constructed through NHIS impairment and chronic condition codes. NHIS defines an impairment as a “chronic or permanent defect, usually static in nature that results from a disease, injury or congenital malformation.” These include: blindness, deafness, hearing impairment, mental retardation, mental illness, and mobility impairment. These impairments constitute a very strict interpretation of the ICF disability model. For the purposes of this analysis, the condition codes for blindness,

deafness and hearing impairment are collapsed into a single category which is called “sensory impairment”.

NHIS defines “chronic condition” as a medical condition that has a date of on-set three months prior to the date of the respondent interview or it is a condition that ordinarily has a duration in excess of three months. In this analysis, these conditions include: arthritis, cancer, diabetes, and heart disease, diseases of the nervous system and respiratory disease. While still within the confines of the ICF disability model, inclusion of these conditions broadens the definition of disability. These impairments and chronic conditions are included as disability groups as they were targeted initially by policymakers as those who would be covered by the ADA. Policy clarifications regarding inclusion of individuals diagnosed with cancer were not developed until after 1994; therefore, the post period will be started after 1994 for individuals with cancer. Due to changes in the NHIS enacted in 1997, disability group variables are only used in analyses through 1996. The specific diseases and conditions that comprise each disability group are found in a table in Appendix 3. The table includes the disability group category, the specific condition or disease, the corresponding ICD number and the NHIS codes.

#### *Other independent variables*

Other independent variables that are potential predictors of workforce participation are also included in both studies. These variables have been used in numerous studies of labor force participation of persons with disabilities (Baldwin et al., 1994; Barnartt & Altman, 1997; Baldwin & Johnson, 1994; Findley & Sambamoorthi, 2005; Zwerling et al., 2002).

**Age.** Age is included as an independent variable as it can be a proxy for job experience under human capital theory. The NHIS provides the age as the age at last birthday (Adams et al., 1999). Age will be measured and tested as both a continuous variable and a categorical variable. A Wald test was conducted to determine if age should be included in the models as a continuous variable or as age splines.

**Race.** While not the focus of the proposed study, race, such as age, disability and gender can be the focus of discrimination in the marketplace and can be associated with underemployment and unemployment. In this study, race is a self-reported variable that will be measured as a categorical variable. The categories will include: White, Black, and Other. The NHIS category “other” includes Aleut, Eskimo, American Indian, Asian, Pacific Islander or any other race not listed separately. Race characterization is based on the respondents description of his or her racial background as well as the racial background of each family member (Adams et al., 1999).

**Sex.** Discrepancies in employment status based on gender are well researched among the non-disabled population (Blau et al., 1998; Buding & England, 2001). Additionally, there is some research conducted pre-ADA that indicates gender disparities among employment status of persons with disabilities. In this study, sex is a self-reported measure and will be measured as a categorical variable.

**Marital Status.** Marital status is considered to have an impact on employment in that it can have an impact on household wages. Research has shown that women who are married and have small children have a lower probability of working full-time in the labor force. For this purposes of this study, marital status is a self-reported measure will be measured as a categorical variable. The categories as provided in the NHIS include: married, widowed, divorced, separated, never married, and other.

**Education.** Education is considered to be a key variable in human capital theory. Due to the constraints of the NHIS data set, education is included in the model as a categorical variable.

**Family Size.** Family size is considered to have an impact on employment in that it can have an impact on household expenditures. Since it was theorized that family size could have an inversely proportionate effect on an individuals decision to enter the labor force, family size was tested to determine the appropriate functional form. Both the

likelihood ratio (LR) and Wald test were conducted to determine if family size should also be included as a squared variable.

**Family Income.** Family income is theorized to have an impact on decisions for individuals to enter the workforce. The NHIS provides limited information on family household income. The income recorded is the total of all income received by members of the family (as well as unrelated members living in the household) for the twelve month period preceding the week of the interview. Income from all sources including wages, salaries, rents from property, pensions, government payments and help from relatives are included in the total amount (Adams et al., 1999). For this study family income is included as a categorical variable and is defined as annual family income greater than \$20,000, less than \$20,000 and unknown. Annual family income of less than \$20,000 is considered to be a rough measure of poverty.

**Region of the Country.** As there can be regional variations in employment status, region of the country is included as a variable. Region is measured as a categorical variable indicating the region of the country in which the respondent resides including Northeast, Midwest, South and West. These regions correspond to those used by the United States Bureau of the Census (Adams et al., 1999).

**Rural/Urban Status.** Since there can be variations in employment status based on rurality, rural/urban status is included as a variable. Rural/urban status is measured as a categorical variable with the variable “rural” representing a non-metropolitan statistical area (MSA). The NHIS follows the definition of MSA as defined by the United States Census Bureau (Adams et al., 1999).

**Time.** Time is measured as a categorical variable in two ways. For one analysis, a variable for each year of the study, 1988-2001 was created. Additionally, an analysis was performed in which years were collapsed with 1988 through 1991 collapsed to create a variable representing time before the implementation of the ADA and 1993 through 2001

collapsed to create a variable representing time after implementation of the ADA. Data during the year of ADA implementation was excluded from this pre/post analysis in order to allow for the effect of implementation to take place.

## **Analysis and Model Specification**

### Descriptive Analysis.

Before conducting multivariate analysis, data were analyzed to gain a better understanding of how data might shape overall analyses. To guide proper variable selection, descriptive characteristics including mean, median, standard deviation, skewness and kurtosis were analyzed to better understand the characteristics of the data.

Table 3 provides descriptive data for analyses in which disability is defined as a self-reported work limitation or any limitation. Descriptive data is provided for combined genders as well as the male-only population and the female-only population. Means were calculated with adjustments for survey weights, stratification and clustering. With the exception of age, family size and their squared values, all variables are binary measures. For the majority of measures, the male and female population are similar with less than two percent differences in areas such as disability status, race, and geographic distribution. As would be expected, there are some economic disparities between men and women with a 16 percent higher employment rate among men and a higher percentage of men (four percent) residing in households with annual incomes greater than \$20,000. Also, schooling is distributed differently among men and women with men having a small but higher percentage completing college and post graduate studies.

**Table 3. Descriptive Statistics for Analyses Using Strict and Inclusive Disability Definitions and Data from Years 1988 through 2001**

Variable	Mean	SE	Male Only		Female Only	
			Mean	SE	Mean	SE
Male	48.90%	-				
Female	51.10%	-				
Employed	76.14%	-	84.16%	-	68.46%	-
Disabled-strict definition	9.47%	-	9.35%	-	9.58%	-
Disabled-inclusive definition	12.37%	-	12.03%	-	12.70%	-
White	82.63%	-	83.59%	-	81.72%	-
Black	11.90%	-	10.99%	-	12.77%	-
Other	5.47%	-	5.42%	-	5.51%	-
Age	38.58	0.04	38.44	0.04	38.72	0.04
Age Squared	1646.09	0.31	1634.06	0.34	1657.60	3.26
Family size	2.95	0.01	2.94	0.01	2.96	0.01
Family Size Squared	12.06	0.16	12.17	0.21	11.96	0.20
Age-39	-0.42	0.04	-0.56	0.04	-0.28	0.04
Age-39 Squared	157.56	0.37	156.42	0.43	158.64	0.40
Family Size-3	-0.05	0.01	-0.06	0.01	-0.04	0.01
Family Size-3 Squared	3.35	0.15	3.52	0.20	3.18	0.18
Family income >20,000	72.48%	-	74.54%	-	70.51%	-
Family income <20,000	22.58%	-	20.50%	-	24.57%	-
Family income unknown	4.34%	-	4.36%	-	4.32%	-
Northeast	19.83%	-	19.71%	-	19.94%	-
Midwest	24.28%	-	24.42%	-	24.14%	-
East	21.20%	-	21.47%	-	20.94%	-
South	34.69%	-	34.40%	-	34.98%	-
High school graduate	34.96%	-	33.85%	-	36.03%	-
Associates degree/Some college	24.94%	-	23.28%	-	26.02%	-
College graduate	13.86%	-	14.26%	-	13.48%	-
Post graduate work	8.54%	-	9.68%	-	7.45%	-
No high school diploma	15.87%	-	16.48%	-	15.29%	-
Schooling unknown	1.82%	-	1.93%	-	1.72%	-
Married Spouse in household	62.32%	-	63.04%	-	61.63%	-
Married Spouse not in household	0.99%	-	0.99%	-	0.99%	-
Widowed	1.86%	-	0.63%	-	3.02%	-
Divorced	7.84%	-	6.29%	-	9.33%	-
Separated	2.28%	-	1.65%	-	2.88%	-
Unmarried	0.71%	-	0.69%	-	0.73%	-
Urban	77.97%	-	77.73%	-	78.20%	-
Rural	22.03%	-	22.27%	-	21.80%	-
Post ADA implementation	65.99%	-	66.13%	-	65.87%	-
Post ADA X Disabled (strict)						
Post ADA X Disabled (inclusive)						



**Table 3.** Descriptive Statistics for Analyses Using Strict and Inclusive Disability Definitions and Data from Years 1988 through 2001

Variable	Mean	SE				
1988	6.67%	-	6.63%	-	6.71%	-
1989	6.75%	-	6.71%	-	6.78%	-
1990	6.81%	-	6.78%	-	6.83%	-
1991	6.86%	-	6.84%	-	6.88%	-
1992	6.92%	-	6.91%	-	6.93%	-
1993	6.98%	-	6.98%	-	6.98%	-
1994	7.12%	-	7.13%	-	7.10%	-
1995	7.17%	-	7.18%	-	7.16%	-
1996	7.23%	-	7.24%	-	7.22%	-
1997	7.33%	-	7.36%	-	7.29%	-
1998	7.41%	-	7.44%	-	7.38%	-
1999	7.50%	-	7.51%	-	7.49%	-
2000	7.58%	-	7.59%	-	7.58%	-
2001	7.67%	-	7.68%	-	7.66%	-

N = 1,499,732, T = 14

Table 4 provides descriptive data for the disability-specific analyses. It is important to note that due to changes in the NHIS survey questions only data from 1988 to 1996 can be used for this analysis. Data are provided for the male-only population, the female-only population and both genders combined. Means were calculated with adjustments for survey weights, stratification and clustering. The means were very similar to those for the data used for the combined disability analyses. The percentages for disability categories ranged from 13 percent to less than 1 percent. Arthritis was the largest category with 13 percent of the population reporting the diagnosis. With ten percent, respiratory conditions constituted the second largest category. The smallest category was mental retardation with approximately one-third of a percent reporting the condition. It should be noted that in this data the percentages in many of these disability categories appear to be low. For example, the 12 month prevalence of depression for the United States population has been estimated at 17 percent (Kessler, 1994) and the prevalence of mental retardation in the noninstitutionalized population has been estimated to be .78 percent (Lee et al.). Therefore,

it should be noted that some disability conditions may be underestimated in these analyses and reported results may be considered to be conservative.

Disability categories were generally expressed similarly among genders with a slightly larger percentage of women reporting arthritis, nervous disorders and respiratory diseases and a slightly larger percentage of men reporting sensory impairments.

**Table 4.** Descriptive Statistics of Pooled Data for Analyses Using Specific Disability Conditions and Data from Years 1988 through 1996

Variable	Mean	SE	Male Only		Female Only	
			Mean	SE	Mean	SE
Male	48.82%	-				
Female	51.18%	-				
Employed	75.78%	-	84.23%	-	67.72%	-
Arthritis	13.31%	-	12.78%	-	13.82%	-
Cancer	0.77%	-	0.63%	-	0.92%	-
Circulatory disease	6.61%	-	6.29%	-	6.93%	-
Diabetes	1.44%	-	1.36%	-	1.52%	-
Neurological disorders	3.08%	-	2.17%	-	3.96%	-
Mental Illness	2.06%	-	1.91%	-	2.21%	-
Mental retardation	0.38%	-	0.44%	-	0.31%	-
Mobility Impairment	8.39%	-	8.65%	-	8.14%	-
Sensory Impairment	3.28%	-	4.17%	-	2.42%	-
Respiratory Disease	9.79%	-	8.45%	-	11.07%	-
White	83.88%	-	84.84%	-	82.96%	-
Black	11.82%	-	10.95%	-	12.66%	-
Other	4.30%	-	4.21%	-	4.37%	-
Age	38.27	0.05	38.13	0.06	38.40	0.06
Age Squared	1622.07	4.16	1609.73	4.52	1633.84	4.34
Family size	3.10	0.01	3.09	0.01	3.11	0.01
Family Size Squared	11.93	0.08	11.90	0.08	11.95	0.07
Age-39	-0.73	0.05	-0.87	0.06	-0.60	0.06
Age-39 Squared	158.37	0.52	156.91	0.59	159.76	0.55
Family Size-3	0.10	0.01	0.09	0.01	0.11	0.01
Family Size-3 Squared	2.34	0.02	2.38	0.02	2.30	0.02
Family income <20,000	26.20%	-	23.85%	-	28.44%	-
Family income >20,000	70.48%	-	72.83%	-	68.25%	-
Family income unknown	3.32%	-	3.33%	-	3.30%	-
Northeast	20.17%	-	20.07%	-	20.26%	-
Midwest	24.17%	-	24.37%	-	23.97%	-
East	21.69%	-	21.90%	-	21.49%	-
South	33.98%	-	33.66%	-	34.28%	-
High school graduate	38.15%	-	36.41%	-	39.81%	-
Associates degree/Some college	22.52%	-	21.64%	-	23.35%	-
College graduate	12.68%	-	13.29%	-	12.09%	-
Post graduate work	9.04%	-	10.43%	-	7.71%	-
No high school diploma	16.45%	-	16.98%	-	15.95%	-
Schooling unknown	1.16%	-	1.25%	-	1.08%	-
Married Spouse in household	64.59%	-	65.51%	-	63.71%	-
Married Spouse not in household	0.91%	-	0.88%	-	0.94%	-
Widowed	1.96%	-	0.64%	-	3.22%	-
Divorced	7.79%	-	6.19%	-	9.33%	-
Separated	2.32%	-	1.63%	-	2.97%	-
Unmarried	0.65%	-	0.63%	-	0.66%	-

**Table 4. (cont.)** Descriptive Statistics of Pooled Data for Analyses Using Specific Disability Conditions and Data from Years 1988 through 1996

Variable	Mean	SE			
Urban	76.72%	-	76.49%		76.94%
Rural	20.74%	-	20.96%	-	20.53%

N = 999,033, T=9

In order to determine if there were issues with multicollinearity in the data, the variance inflation factor (VIF) was calculated for each variable. As a high degree of correlation would be expected among quadratic terms and interaction terms, these terms were not included in the analysis. For the analyses in which disability status was defined as either a self-reported work limitation or an activity limitation, the VIF scores ranged from 1.02 to 1.46; therefore, no issues with serious multicollinearity were detected with these data. Also, for the variables included in the analyses with specific disability conditions, the VIF scores ranged from 1.00 to 1.13; therefore, there were no issues with serious multicollinearity were detected with these data either.

#### Data Completeness

All data for this study are from the NHIS which is previously described. The NHIS sampling plan selects households and noninstitutional group quarters for interview each week. These households are from a probability sample representative of the target population. The NHIS uses four sample panels and no sample cuts; therefore, the annual expected number of completed interviews is approximately 35,000 to 40,000 households containing about 75,000 to 100,000 persons. Respondents are informed that participation in the survey is voluntary and the confidentiality of respondent responses is assured under Section 308(d) of the Public Health Service Act. The annual response rate of NHIS is close to 90 percent of the eligible households in the sample. (Centers for Disease Control and Prevention, 2009).

Issues with data completeness have been addressed through the NHIS survey documentation process. Depending upon the variable type and the survey year, the NHIS either codes the missing data as unknown or imputes the value. For the years 1988 to 1996, the survey data includes some variables such as age, month of birth and Hispanic origin that have a small proportion of imputed values. The number of imputed values is extremely small. For example, for the year 1966, age was imputed for 2 of the 63,402 respondents and Hispanic origin was imputed for one percent of respondents. Since the percentage of imputed values is so small for these variables, it is expected that the impact on analyses is negligible. For the years 1997 through 2001, variables (excluding income) with missing values are coded as non-response or unknown.

For variables where there is a high frequency of non-response, such as personal and family income, the NHIS provides imputation files for all survey years. These files provide flags that indicate if the income variables have been imputed. The family income variable used for this analysis, "family income \$20, 000 or more", had approximately three percent missing values in the sample and were coded unknown by NHIS. Since this constituted such a small percentage of the sample, the NHIS coding was maintained and the imputation files were not used.

### Trend Analysis

In order to determine the consistency of study variables throughout the study period and determine the impact of planned changes to the survey, bivariate trend analysis was conducted. Trend analysis was employed to help discern variations in particular measures, the extent of which variation occurred as well as potential sources of the variation. All variables included in the analysis were determined to be consistent over the time period studied with no obvious breaks despite planned changes in NHIS sampling and wording of questions. As noted previously, there was a small 2 percent decrease in the number of persons identified as disabled for both of the major disability definitions after the planned

change in survey question wording in 1997. As this change is small, it is perceived that the definitions of disability used for this study are time-invariant and there was no significant change in how individuals responded to questions about disability before and after implementation of the ADA.

### Variable Specifications

In order to determine the best function for specific variables, analyses were conducted including variables in their quadratic forms. For ease in the interpretation of the effect on employment status, for continuous variables the variable mean was subtracted from all observations and quadratic terms were created from the de-meanned form (Wooldridge, 2009). The coefficients could then be interpreted as a change in employment status due to a change in the independent variable for values of that variable close to the mean as opposed to values of the variable near zero, which provides for a more logical interpretation. For example, the coefficient for age was defined as age-39 (mean age). Therefore, a base case interpretation could be provided for a 39 year old as opposed to a person with an age of 0. Quadratic terms were only included if the terms were statistically significant.

Interaction terms were guided by theory. It was suspected that there was some interaction between the variables age and other socio-demographic variables - particularly in the in the case of age and marital status. Therefore, models using age as a quadratic term were compared to models using interaction terms with specific martial status variables. The model including age and family status as quadratic terms was utilized, excluding interaction terms as the inclusion of these interaction terms rendered some of the principal variables insignificant.

Time was analyzed in two ways. In one analysis, dummy variables representing each individual year were used. In the second analysis, grouped year dummies representing pre and post ADA implementation were used. Due to clustering, a Wald test

was conducted to determine the correct form. A likelihood ratio test would not have been appropriate as it would have not used the correct variance covariance matrix. Results of the Wald test were significant ( $F(12,808)=57.80$ ;  $\text{Prob} > F=0.00$ ); therefore, the null hypothesis that all years are equivalent to each other can be rejected and it is appropriate to use individual year dummies.

Age was analyzed by using age splines as well as age as a quadratic term. Splines were created using the following age groupings: 18-29, 30-39, 40-49, 50-59 and 60-64. A Wald test was conducted after performing the regression with age splines. ( $F(5,815)=3849.70$ ,  $\text{Prob} > F=0.00$ ). Therefore, the null hypothesis that all age splines are equivalent to each other was rejected. An additional form of the Wald test in which one of the age splines was dropped and the variable age was included was conducted ( $F(4,816)=3124.69$ ,  $\text{Prob} > F=0.00$ ). The results of this test also indicate that the null hypothesis that all age splines are equivalent to each other can be rejected. Additionally, in order to obtain the log likelihood values and calculate Akaike's information criterion (AIC) values, the models were run using the non-survey commands accounting for weights and clustering effects. The AIC value for the model with splines was 995243, while the AIC value for the model with age included in a quadratic form was 1021301. Despite the smaller AIC value of the model with age splines, the model with age included as a quadratic was selected. This was chosen because the difference in the AIC values at two percent was very small and the model with age included as a quadratic allowed marginal effects that varied by age, rather than the piecewise linear marginal effects imposed on splined variables.

#### Multivariable Model Specification

As the dependent variable "employment" is binary, the options of using a linear probability, logit and probit model were explored. The linear probability model was determined to be less desirable due to the possibility of this model to provide out of range predictions. While logit and probit models both provide in-range predictions and provide

virtually the same results, a logit model was employed for all analyses due to the popularity of the model in the literature. Additionally, since the NHIS utilizes a complex, multistage probability sample that incorporates stratification, clustering, and oversampling of certain subpopulations, survey commands, including commands that account for sample weights, stratification and clustering were used.

Tests were conducted to determine the best model fit for the different disability definitions used. In order to obtain the log likelihood values and calculate Akaike's information criterion (AIC) values, the models were run using the non-survey commands accounting for weights and clustering effects. For the models without year fixed effects, the AIC value for the strict definition of disability was 795762.3. The AIC value for the inclusive definition of disability in the model without year fixed effects was 801608.2. For the models with year fixed effects, the AIC value for the strict definition of disability was 793801.1. The AIC value for the inclusive definition of disability was 799466.2. In comparing the AIC values, the model with the strict definition of disability and year fixed effects has the lowest AIC and appears to have the best fit; however, as there is only a .97% difference between the largest and smallest AIC value, all models appear to have similar fit to the data. The results of all models are included and discussed below.

For the analysis of the impact of the ADA on the employment status of persons with specific disability types, logit models were also employed. Additionally, the AIC was calculated to determine the best model fit. Again, the models were run using non-survey commands, accounting for weights and clustering effects. The models were run three ways for each specific disability type. The first model used the strict definition of disability in that the disability type variable was defined as reporting a medical condition as well as having a self-reported work limitation. In the second model the inclusive definition of disability was employed. Disability type was defined as reporting a medical condition as well as reporting any limitation. The third model relaxed the definition of specific disability type even further.



In this model a disability type was defined as reporting the medical condition even if a work limitation or any other limitation were not reported. This model most closely approximates the ADA definition of disability in which one is “being regarded as having such impairment”. Each of the disability specific models was run for the total population combined and for males and females separately. A total of 90 disability-specific models were run, including three models for each of the 10 specific conditions for the total population combined and separately for each sex.

In comparing the AIC for the three models for each specific disability type, the most restrictive model in which the variable was defined as reporting a medical condition as well as having a self-reported work limitation consistently had the smallest AIC value and therefore had the best fit. The most relaxed model in which the variable was defined as reporting a medical condition even if a work limitation or any other limitation were not reported consistently provided the largest AIC value when compared to models with the strict definition and the inclusive definition. However, there was an average of a half a percent difference between the smallest and largest AIC value of the three models for each disability type; therefore, all three models are reported.

## **Results**

Results of the analyses related to the ADA portion of this study are found in Tables 5 through 6. Table 5 relates to Hypothesis 1a.

**Table 5.** Analysis Results: Effects of ADA Implementation on Employment Status of Persons with Disabilities

	Model 1: Strict Definition		Model 2: Inclusive Definition		Model 3: Strict Definition/Fixed Years Effect		Model 4: Inclusive Definition/Fixed Years Effect	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Disabled	-1.547***	0.02	-1.279***	0.01	-1.656***	0.04	-1.354***	0.03
Post ADA	-0.045***	0.01	-0.049***	0.01	-	-	-	-
Disabled X Post ADA	-0.373***	0.02	-0.337***	0.02	-	-	-	-
1988	-	-	-	-	0.107***	0.02	0.109***	0.02
1989	-	-	-	-	0.105***	0.02	0.107***	0.02
1990	-	-	-	-	0.075***	0.02	0.080***	0.02
1991	-	-	-	-	-0.011	0.02	-0.012	0.02
1993	-	-	-	-	0.001	0.02	0.000	0.02
1994	-	-	-	-	0.033**	0.02	0.039**	0.02
1995	-	-	-	-	0.052**	0.02	0.055**	0.02
1996	-	-	-	-	0.063**	0.03	0.071***	0.03
1997	-	-	-	-	0.156***	0.02	0.147***	0.02
1998	-	-	-	-	0.105***	0.02	0.096***	0.02
1999	-	-	-	-	-0.324***	0.02	-0.337***	0.02
2000	-	-	-	-	-0.044**	0.02	-0.054**	0.02
2001	-	-	-	-	-0.031	0.02	-0.038*	0.02
Disabled X 1988	-	-	-	-	0.126***	0.05	0.081*	0.04
Disabled X 1989	-	-	-	-	0.162***	0.05	0.101**	0.04
Disabled X 1990	-	-	-	-	0.130***	0.05	0.081**	0.04
Disabled X 1991	-	-	-	-	0.120**	0.05	0.103***	0.04
Disabled X 1993	-	-	-	-	0.048	0.05	0.026	0.04
Disabled X 1994	-	-	-	-	-0.018	0.05	-0.055	0.04
Disabled X 1995	-	-	-	-	-0.056	0.06	-0.070	0.05
Disabled X 1996	-	-	-	-	-0.149**	0.06	-0.172***	0.05
Disabled X 1997	-	-	-	-	-0.515***	0.05	-0.498	0.05
Disabled X 1998	-	-	-	-	-0.474***	0.06	-0.498***	0.05
Disabled X 1999	-	-	-	-	-0.434***	0.06	-0.409***	0.05
Disabled X 2000	-	-	-	-	-0.539***	0.06	-0.504***	0.05
Disabled X 2001	-	-	-	-	-0.547***	0.06	-0.542***	0.05
Male	1.078***	0.01	1.056***	0.01	1.079***	0.01	1.058***	0.01
Black	-0.091***	0.01	-0.099***	0.01	-0.081***	0.01	-0.089***	0.01
Other race	-0.265***	0.03	-0.276***	0.03	-0.240***	0.03	-0.248***	0.03
Family income <20,000	-0.954***	0.01	-0.967***	0.01	-0.983***	0.01	-0.998***	0.01
Family income unknown	-0.552***	0.02	-0.563***	0.02	-0.585***	0.02	-0.595***	0.02
Northeast	-0.117***	0.02	-0.116***	0.02	-0.119***	0.02	-0.117***	0.02
Midwest	0.101***	0.02	0.100***	0.02	0.100***	0.02	0.100***	0.02
East	-0.078***	0.02	-0.072***	0.02	-0.077***	0.02	-0.071***	0.02
Rural	0.038**	0.02	0.034*	0.02	0.041**	0.02	0.038**	0.02
Age-39	-0.006***	0.00	-0.006***	0.00	-0.007***	0.00	-0.007***	0.00
Family Size-3	-0.153***	0.00	-0.153***	0.00	-0.176***	0.00	-0.177***	0.00
Age-39 Squared	-0.003***	0.00	-0.003***	0.00	-0.003***	0.00	-0.003***	0.00
Family Size-3 Squared	0.002***	0.00	0.002***	0.00	0.002***	0.00	0.002***	0.00
High school graduate	0.484***	0.01	0.493***	0.01	0.470***	0.01	0.478***	0.01

**Table 5.** Analysis Results: Effects of ADA Implementation on the Employment Status of Persons with Disabilities

	Model 1: Strict Definition		Model 2: Inclusive Definition		Model 3: Strict Definition/Fixed Years Effect		Model 4: Inclusive Definition/Fixed Years Effect	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Associates degree/Some college	0.526***	0.01	0.540***	0.01	0.516***	0.01	0.529***	0.01
College graduate	0.670***	0.02	0.698***	0.02	0.652***	0.02	0.678***	0.02
Post graduate work	0.878***	0.02	0.922***	0.02	0.852***	0.02	0.892***	0.02
Unknown	-0.361***	0.03	-0.359***	0.03	-0.340***	0.03	-0.337***	0.03
Married Spouse not in household	0.063***	0.03	0.067***	0.03	0.066**	0.03	0.071**	0.03
Widowed	0.316***	0.02	0.319***	0.02	0.303***	0.02	0.305***	0.02
Divorced	0.569***	0.01	0.555***	0.01	0.560***	0.01	0.547***	0.01
Separated	0.231***	0.02	0.227***	0.02	0.230***	0.02	0.226***	0.02
Unmarried	-0.064	0.05	-0.060	0.05	-0.085*	0.05	-0.084*	0.05
Intercept	1.360***	0.02	1.372***	0.02	1.336***	0.02	1.348***	0.02

N=1,499,732

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

**Hypothesis 1a.** Hypothesis 1a states that the overall employment of persons with disabilities will increase after implementation of the ADA, controlling for all relevant variables, during the period between 1988 and 2001. Overall results for all analyses conducted reveal that this hypothesis is not supported.

While results varied according to the definition of disability used and how time was measured, analysis of the interaction terms in all analyses showed that in the years after implementation of the ADA, similar to previous studies, there was a decrease in the probability of employment of a person with a disability. In Model 1, grouped year analysis using the strict definition of disability revealed that there was a 35 percent probability of employment of a person with a disability in the years after implementation of the ADA. As there was a 45 percent probability of employment in the years prior to implementation, this represented a 10 percent decrease in the probability of employment of a person who defined their disability as a self-reported work limitation. In Model 2, use of the inclusive definition of disability provided a slightly more positive result. This analysis indicated an

overall 43 percent probability of employment of disabled individuals after the ADA was implemented. For the more inclusive definition of disability the implementation of the ADA resulted in a 9.5 percent decrease in probability of employment. Results for the interaction term for both Model 1 and Model 2 were significant at the .01 level.

As the results of these analyses did not support the initial hypotheses, several interpretations of estimated parameters and marginal effect were performed to better understand the data. Table 8 provides information on the probability of employment of men and women after implementation of the ADA. The table provides predicted probabilities for the base case for men and women with disabilities and without reported disabilities. The base case is a married, 39 year old, white, individual living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with no high school degree after implementation of the ADA. For Model 1, a non-disabled woman had a predicted probability of employment of 79 percent. In comparison, a disabled female with similar characteristics had a 35 percent probability of employment after implementation of the ADA. Conversely, a non-disabled male had a 92 percent probability of employment and a disabled male had a 62 percent probability of employment, holding all other characteristics constant. The results of Model 2 provided a similar pattern of the probability of employment for disabled and non-disabled men and women. This showed that despite implementation of the ADA, there was a continued disparity in the employment of persons with disabilities.

**Table 6.** Predicted Probability of Employment for the Base Case for Disabled and Non-disabled Men and Women

Model 1		Model 2	
Non-disabled Male	Disabled Male	Non-disabled Male	Disabled Male
92%	62%	92%	68%
Non-disabled Female	Disabled Female	Non-disabled Female	Disabled Female
79%	35%	80%	43%

Results for analyses which included fixed year effects show a slightly different pattern of the probability of employment of persons with disabilities in the years immediately after implementation of the ADA. For Model 3, in 1988, four years prior to the implementation of the law, the probability of employment for an individual with a self-reported work limitation was 42 percent. For the years immediately after the implementation of the ADA, 1993 through 1995, the results were not significant; therefore, I could not rule out no immediate effect of the law. Starting with the year 1996 and continuing to the year 2001, the interactions terms were significant at the 0.01 level with interpretations supporting a continued decreased probability of employment for persons with disabilities. In 1996, the probability of employment of an individual with a self-reported work impairment was 40 percent- two percent less than prior to implementation of the law. For 1997 and 1998, the probability continued to decrease, reaching the lowest probability in year 1999, when there was 25 probability of employment for a person with a disability. Results for year 2000 and 2001 indicated a slight increase over that of 1999 showing that the probability of employment for a person with a disability was 28 percent and 29 percent respectively. This represents a decrease in probability of employment for a person with a disability of approximately 13 percent for the period of 1992, when the ADA was implemented, to 2001.

Results for Model 4, a fixed years effect model including the more inclusive definition of disability, followed a similar pattern with the results remaining non-significant until four years after implementation of the ADA. The probability of employment using Model 4 results were similar to those of Model 3. An individual with any type of limitation had a 56 percent probability of being employed immediately prior to implementation of the ADA and 50 percent probability of not being employed immediately after implementation in 1993. The decline continues until 1999 when the probability of employment for a person with a disability was 32 percent. Results for year 2000 and 2001 indicated a slight increase showing a 36 percent probability of employment for persons with a disability. This represents a decrease in probability of employment for a person with a disability of approximately 14 percent from the time of ADA implementation to 2001.

Figures 4 and 5 provide information on the predicted probability of employment of men and women with and without disabilities presented separately. In these analyses, the probabilities are estimated for the base case of men and women with and without strict and inclusive disabilities for each year from 1988 through 2001. More specifically for a disabled man, the probability is predicted for a white, married, 39 year old, living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with no high school degree. In reviewing these figures, it is apparent that persons with disabilities whether they are male or female have a much lower probability of employment than persons without disabilities.

For men, the probability of employment for men with disabling conditions is much lower than that of men without reported disabilities. For example, in the first year studied, 1988, the probability of employment for a man without a disability is 97 percent compared to a 82 percent probability of employment for a man with a self-reported work limitation and an 86 percent probability of employment for a man with any reported limitation. It is of note that during the period studied (1988 to 2001) the predicted probability of employment of men

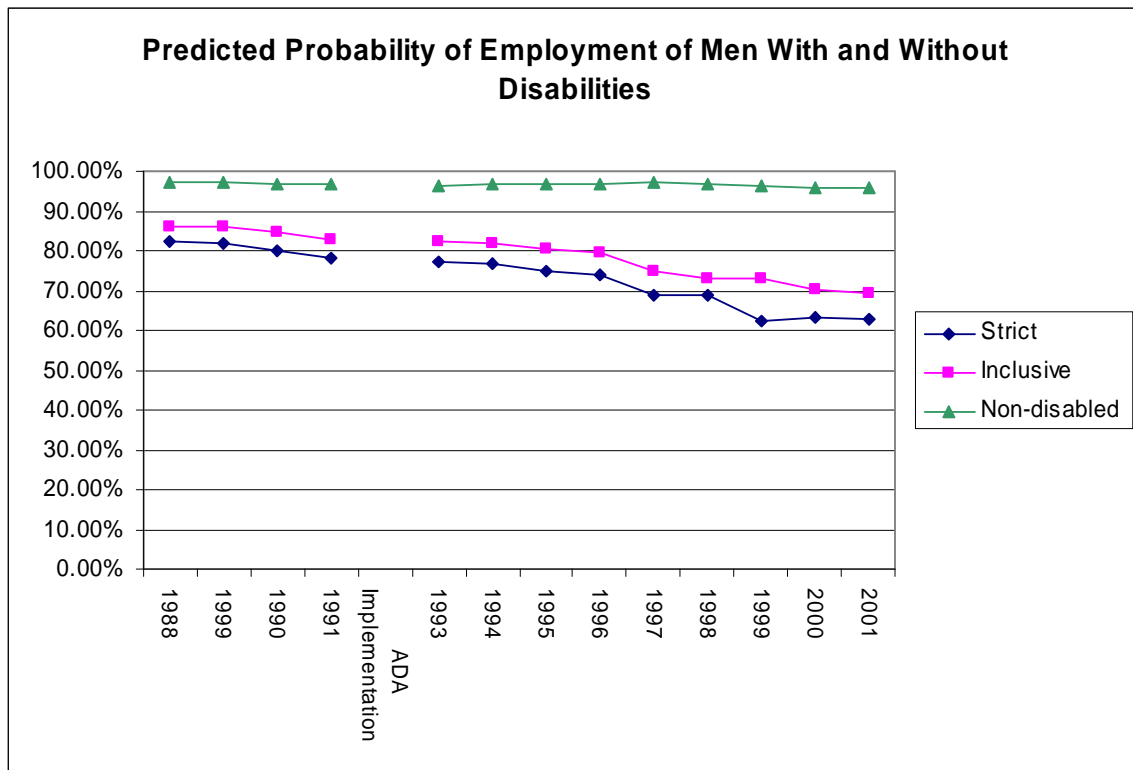
without disabilities is stable, ranging from 97 to 96 percent. However, during the same time period the probability of employment among disabled men with similar characteristics, regardless of how disability is defined, declines in an accelerating fashion after implementation of the ADA. The implementation corresponds to a significant and widening employment gap between men with and without disabilities.

Like men, the probability of employment for women with disabling conditions is lower than that of men without reported disabilities. In 1988, the probability of employment for a woman who does not report a disability is 73 percent compared to a 44 percent probability of employment for a woman with similar demographic characteristics and a self-reported work limitation and an 49 percent probability of employment for a woman reporting any type of limitation. Unlike the employment pattern for non-disabled men, the employment pattern for non-disabled women did not remain static during the time period studied. The predicted probability of employment ranged from 73 percent in 1988 to a high of 75 percent in 1997. The probability of employment dropped to 61 percent in 1999 and leveled off to 72 percent in 2000 and 2001. During the same time period, women with disabilities showed increasing volatility in employment patterns. Prior to implementation of the ADA, employment for women defined as disabled under both the strict and inclusive definitions of disability remained fairly stable with women classified under the strict definition exhibiting employment probabilities ranging from 44 to 46 percent and women classified under the inclusive definition of disability exhibiting employment probabilities ranging from 49 to 50 percent. Immediately after implementation of the ADA for women defined as disabled under the strict definition, the probability of employment exhibited a slightly decreased probability of employment of 42 percent. The probability of employment for this group continued to decline until 1999 to 23 percent and then leveled off to 29 percent in 2000 and 2001. Similarly, immediately after implementation of the ADA, women defined as disabled under the inclusive definition, exhibited a slightly decreased probability of employment of 46

percent. The probability of employment for this group continued to decline until 1999 to 29 percent and then leveled off to 35 percent in 2000 and 2001.

Additionally, even though there are disparities in probability of employment among disabled men and women, the overarching patterns of employment status are similar both before and after implementation of the ADA. Both groups, whether categorized under the strict or inclusive definition of disability, face either stable or slightly declining probability of employment from 1988 until implementation of the ADA in 1992. After implementation of the law, both the male and female disabled population face an overall decline in the probability of gainful employment.

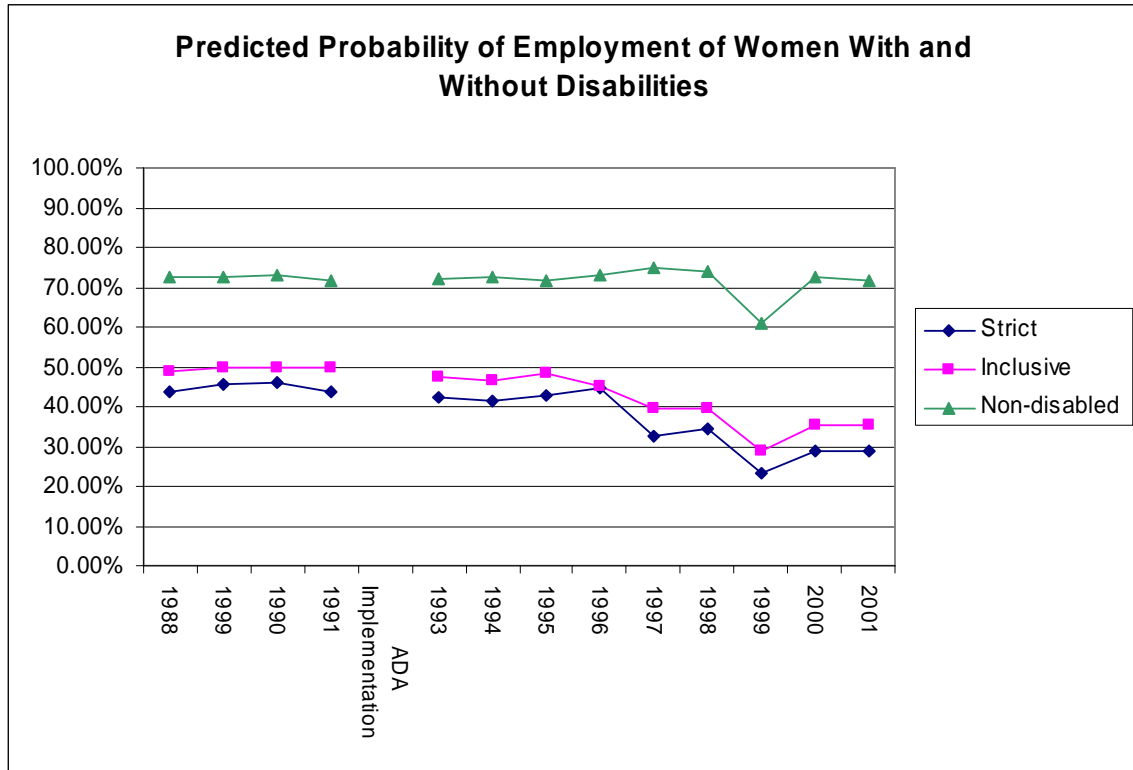
**Figure 4.** Predicted Probability of Employment of Men With and Without Disabilities for the Years 1988 through 2001



Note: Predicted probabilities are estimated for the base case – a white, married, 39 year old, living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with no high school degree.



**Figure 5.** Predicted Probability of Employment of Women With and Without Disabilities for the Years 1988 through 2001



Note: Predicted probabilities are estimated for the base case – a white, married, 39 year old, living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with no high school degree.

Table 7 provides information on analyses related to Hypothesis 1b.

**Table 7.** Analysis Results: Effects of ADA Implementation on the Employment Status of Men and Women with Disabilities

	Model 5: Strict Definition		Model 6: Inclusive Definition		Model 7: Strict Definition/Fixed Years Effect		Model 8: Inclusive Definition/ Fixed Years Effect	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Male X Disabled X Post ADA	-0.017	0.04	-0.06709*	0.03	-	-	-	-
Male X Post ADA	-0.147***	0.02	-0.13511***	0.02	-	-	-	-
Male X Disabled X 1988	-	-	-	-	0.103	0.08	0.031	0.08
Male X Disabled X 1989	-	-	-	-	-0.019	0.08	-0.033	0.08
Male X Disabled X 1990	-	-	-	-	0.015	0.08	0.001	0.08
Male X Disabled X 1991	-	-	-	-	0.055	0.09	-0.041	0.09
Male X Disabled X 1993	-	-	-	-	0.079	0.09	0.035	0.08
Male X Disabled X 1994	-	-	-	-	0.049	0.08	0.013	0.08
Male X Disabled X 1995	-	-	-	-	-0.075	0.09	-0.124	0.08
Male X Disabled X 1996	-	-	-	-	-0.044	0.10	-0.096	0.09
Male X Disabled X 1997	-	-	-	-	-0.071	0.09	-0.230***	0.08
Male X Disabled X 1998	-	-	-	-	-0.169*	0.10	-0.224**	0.09
Male X Disabled X 1999	-	-	-	-	-0.064	0.09	-0.181**	0.09
Male X Disabled X 2000	-	-	-	-	0.142	0.10	0.015	0.08
Male X Disabled X 2001	-	-	-	-	0.084	0.10	-0.055	0.09
Male X 1988	-	-	-	-	0.248***	0.04	0.260***	0.04
Male X 1989	-	-	-	-	0.239***	0.03	0.252***	0.03
Male X 1990	-	-	-	-	0.125***	0.03	0.136***	0.04
Male X 1991	-	-	-	-	0.069**	0.03	0.092***	0.03
Male X 1993	-	-	-	-	0.027	0.03	0.033	0.03
Male X 1994	-	-	-	-	0.038	0.04	0.048	0.04
Male X 1995	-	-	-	-	0.018	0.05	0.039	0.05
Male X 1996	-	-	-	-	0.053	0.04	0.068	0.05
Male X 1997	-	-	-	-	0.092**	0.04	0.122	0.04
Male X 1998	-	-	-	-	0.015	0.04	0.043	0.04
Male X 1999	-	-	-	-	-0.012	0.04	0.016	0.04
Male X 2000	-	-	-	-	-0.162***	0.04	-0.132***	0.04
Male X 2001	-	-	-	-	-0.164***	0.04	-0.127***	0.04
Disabled	-1.181***	0.02	-0.991***	0.02	-1.246***	0.04	-1.048***	0.04
Male X Disabled	-0.790***	0.03	-0.668***	0.03	-0.819***	0.06	-0.659***	0.05
Post ADA	0.004	0.01	-0.004***	0.01	-	-	-	-
Disabled X Post ADA	-0.340***	0.03	-0.281***	0.02	-	-	-	-
1988	-	-	-	-	0.027	0.02	0.025	0.02
1989	-	-	-	-	0.028	0.02	0.026	0.02
1990	-	-	-	-	0.034	0.02	0.035*	0.02
1991	-	-	-	-	-0.035	0.02	-0.044**	0.02
1993	-	-	-	-	-0.009	0.02	-0.011	0.02
1994	-	-	-	-	0.021	0.02	0.023	0.02
1995	-	-	-	-	0.047*	0.02	0.042*	0.02
1996	-	-	-	-	0.046	0.03	0.049	0.03

**Table 7: Analysis Results: Effects of ADA Implementation on the Employment Status of Men and Women with Disabilities**

	Model 5: Strict Definition		Model 6: Inclusive Definition		Model 7: Strict Definition/Fixed Years Effect		Model 8: Inclusive Definition/ Fixed Years Effect	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
1997	-	-	-	-	0.126***	0.03	0.107***	0.03
1998	-	-	-	-	0.101***	0.02	0.082***	0.03
1999	-	-	-	-	-0.321***	0.03	-0.343***	0.03
2000	-	-	-	-	0.014	0.02	-0.007	0.03
2001	-	-	-	-	0.028	0.02	0.007	0.03
Disabled X 1988	-	-	-	-	0.024	0.06	0.024	0.05
Disabled X 1989	-	-	-	-	0.115*	0.06	0.073	0.05
Disabled X 1990	-	-	-	-	0.092	0.06	0.056	0.05
Disabled X 1991	-	-	-	-	0.079	0.06	0.110	0.05
Disabled X 1993	-	-	-	-	-0.002	0.06	0.003	0.05
Disabled X 1994	-	-	-	-	-0.059	0.07	-0.073	0.06
Disabled X 1995	-	-	-	-	-0.030	0.06	-0.019	0.06
Disabled X 1996	-	-	-	-	-0.139*	0.08	-0.137**	0.06
Disabled X 1997	-	-	-	-	-0.506***	0.07	-0.408***	0.06
Disabled X 1998	-	-	-	-	-0.407***	0.07	-0.391***	0.06
Disabled X 1999	-	-	-	-	-0.401***	0.07	-0.316***	0.06
Disabled X 2000	-	-	-	-	-0.587***	0.07	-0.482***	0.06
Disabled X 2001	-	-	-	-	-0.571***	0.07	-0.487***	0.06
Male	1.289***	0.02	1.280***	0.02	1.160***	0.03	1.139***	0.03
Black	-0.089***	0.01	-0.098***	0.01	-0.080***	0.01	-0.087***	0.01
Other race	-0.266***	0.03	-0.276***	0.03	-0.240***	0.03	-0.247***	0.03
Family income <20,000	-0.951***	0.01	-0.964***	0.01	-0.980***	0.01	-0.995***	0.01
Family income unknown	-0.554***	0.02	-0.565***	0.02	-0.586***	0.02	-0.596***	0.02
Northeast	-0.118***	0.02	-0.117***	0.02	-0.119***	0.02	-0.118***	0.02
Midwest	0.099***	0.02	0.099***	0.02	0.098***	0.02	0.099***	0.02
East	-0.081***	0.02	-0.074***	0.02	-0.080***	0.02	-0.073***	0.02
Rural	0.039**	0.02	0.036**	0.02	0.043**	0.02	0.040**	0.02
Age-39	-0.006***	0.00	-0.006***	0.00	-0.007***	0.00	-0.006***	0.00
Family Size-3	-0.154***	0.00	-0.154***	0.00	-0.177***	0.00	-0.177***	0.00
Age-39 Squared	-0.003***	0.00	-0.003***	0.00	-0.003***	0.00	-0.003***	0.00
Family Size-3 Squared	0.002***	0.00	0.002***	0.00	0.002***	0.00	0.002***	0.00
High school graduate	0.486***	0.01	0.496***	0.01	0.473***	0.01	0.482***	0.01
Associates degree/Some college	0.528***	0.01	0.543***	0.01	0.517***	0.01	0.532***	0.01
College graduate	0.672***	0.02	0.701***	0.02	0.653***	0.02	0.681***	0.02
Post graduate work	0.874***	0.02	0.920***	0.02	0.847***	0.02	0.889***	0.02
Unknown	-0.363***	0.03	-0.361***	0.03	-0.341***	0.03	-0.338***	0.03
Married Spouse not in household	0.058*	0.03	0.061**	0.03	0.062**	0.03	0.066**	0.03
Widowed	0.291***	0.02	0.291***	0.02	0.279***	0.02	0.278***	0.02
Divorced	0.558***	0.01	0.543***	0.01	0.550***	0.01	0.536***	0.01
Separated	0.221***	0.02	0.217***	0.02	0.221***	0.02	0.218***	0.02
Unmarried	-0.066	0.05	-0.061	0.05	-0.089*	0.05	-0.087*	0.05
Intercept	1.290***	0.02	1.297***	0.02	1.310***	0.02	1.321***	0.02

N=1,499,732

**Hypothesis 1b.** Hypothesis 1b states that the overall probability of employment of men with disabilities will increase at a greater rate than the overall probability of employment of women with disabilities after implementation of the ADA controlling for all relevant variables, during the period between 1988 and 2001. Results for this analysis provide no support for this hypothesis.

When analyzed using a difference-in-difference-in-difference model with the strict definition of disability and combining years, the term interacting gender, disability status and the period after implementation of the ADA is not significant; thereby, not rejecting the null hypothesis that the employment of men with disabilities does not vary from that of women with disabilities.

In the analysis using the strict definition of disability with a separate variable for each year, the interaction term is only significant for one year. For the year interacting gender, disability status and the year 1998, the term is significant only at the 0.10 level providing some support that the employment of men with disabilities varies after implementation of the ADA at a different rate than that of women.

However, when using the inclusive definition of disability in which those who have any limitation are included in the analysis, the results for the analysis combining years after implementation of the ADA are significant at the .10 level. For this model, conditional on being disabled, men had a four percent greater drop in employment than women after implementation of the ADA. As men have typically proportionately higher representation in the workforce, the proportion of men and women employed pre and post ADA implementation conditional on being disabled was reviewed as well. The proportion of disabled men employed before ADA as compared to disabled men employed after implementation of the ADA was 85 percent while the proportion of women employed before the ADA compared to disabled women employed after the ADA was 88 percent. This three percentage point difference in proportion employed further supports the interpretation that

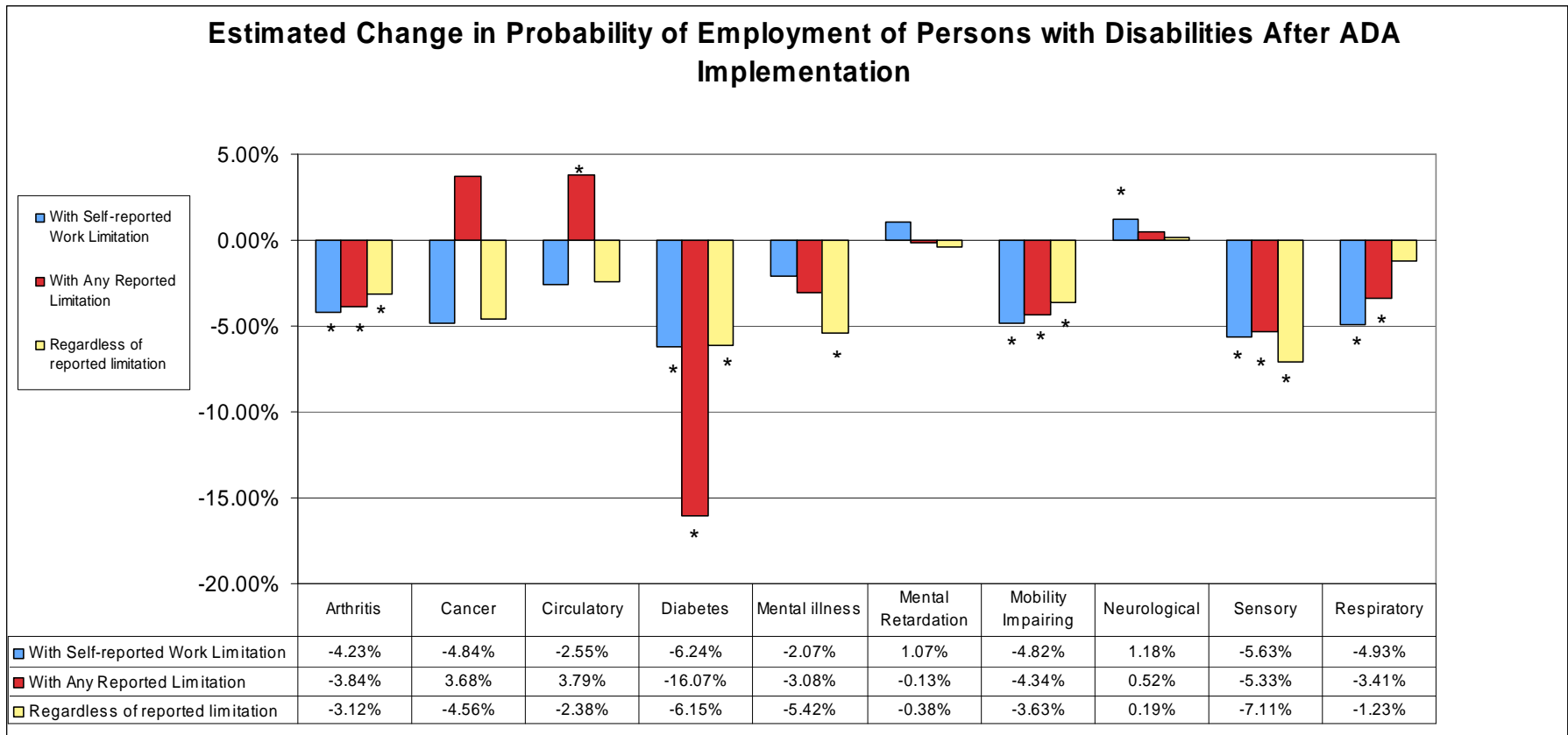
overall disabled men had a greater drop in employment after implementation of the ADA compared to disabled women.

Likewise, there are significant results for the analysis which includes a separate variable for each year post-ADA. The terms interacting gender, disability status and the years 1997, 1998 and 1999 are significant at the .01, .05 and .05 levels, respectively. In analyzing the marginal effect of employment status for disabled men and women, in 1997, disabled men had a two percent greater drop in employment status than disabled women did; however, proportionately, the drops in employment were virtually identical. The proportion of disabled men employed before ADA as compared to disabled men employed on 1997 was 86 percent while the proportion of women employed before the ADA compared to disabled women employed in 1997 was 86.8 percent. Also, in 1998 and 1999, disabled men had a greater decrease in employment compared to disabled women of four and three percent respectively. In 1998, the proportion of disabled men employed before ADA as compared to disabled men employed after implementation of the ADA was 83 percent while the proportion of women employed before the ADA compared to disabled women employed after the ADA was 86 percent. This three percent difference in proportion employed further supports the interpretation that overall disabled men had a greater drop in employment after implementation of the ADA compared to disabled women in this particular year. However, in 1999, the proportions of disabled men and women employed before and after implementation of the law were both 71 percent providing virtually no support for a difference between the employment gains between the genders for the year of 1999.

**Hypothesis 1c.** Hypothesis 1c states the ADA will have a greater negative effect on labor force participation of specific disability groups with disability groups with more costly accommodations having a more negative outcomes than disability groups requiring less costly accommodation. Analysis results for this hypothesis are mixed.

Tables 8 through 10 and Figures 6 through 8 provide information on analyses related to Hypothesis 1c. These tables provide the predicted change in the probability of employment of persons with specific disabling conditions after implementation of the ADA. As stated previously, models were run for ten different disability groups for men and women separately and combined. The models were run for each disability group in three ways: those with the disabling condition and a self-reported work limitation, those with the condition and any reported limitation and those with a disability regardless of whether they reported a limitation. There were a total of 90 models run for this analysis. In the interest of space, the full results of these models have not been included.

**Figure 6.** Estimated Change in Probability of Employment of Persons with Disabilities After ADA Implementation



Note: \*p<0.10, p values refer to interacted coefficients.

**Table 8.** Estimated Change in Probability of Employment of Persons with Disabilities by Disability Group After ADA Implementation

Disability Group	With Self-reported Work Limitation	With Any Reported Limitation	Regardless of reported limitation
Arthritis	-4.23% ***	-3.84% ***	-3.12%***
Cancer	-4.84%	3.68%	-4.56%
Circulatory	-2.55%	3.79%**	-2.38%
Diabetes	-6.24%***	-16.07%***	-6.15%***
Mental illness	-2.07%	-3.08%	-5.42%***
Mental retardation	1.07%	-0.13%	-0.38%
Mobility Impairing	-4.82***	-4.34%***	-3.63%***
Neurological	1.18%*	0.52%	0.19%*
Sensory	-5.63***	-5.33%**	-7.11***
Respiratory	-4.93%***	-3.41%*	-1.23%

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

Note: *p* values refer to interacted coefficients.

When viewing the combined results in Figure 6 and Table 8, there is little evidence that the ADA resulted in an increase in employment for persons with disabilities with the exception of neurological conditions. There is, however, some evidence that the law resulted in a decrease in employment for other conditions.

Four disability categories, arthritis, diabetes, mobility impairments, and sensory impairments, yielded consistently negative and significant results across the three limitation categories. After implementation of the ADA, persons with arthritis reported decreased probability of employment ranging from three to four percent. Persons with mobility impairments reported a four to five percent decreased probability of employment and persons with sensory impairments, such as deafness or blindness, reported a five to seven percent decrease in probability of employment. Persons with diabetes reported the greatest decreases in employment probability, ranging from six percent to 16 percent decreased probability of employment after implementation of the ADA.

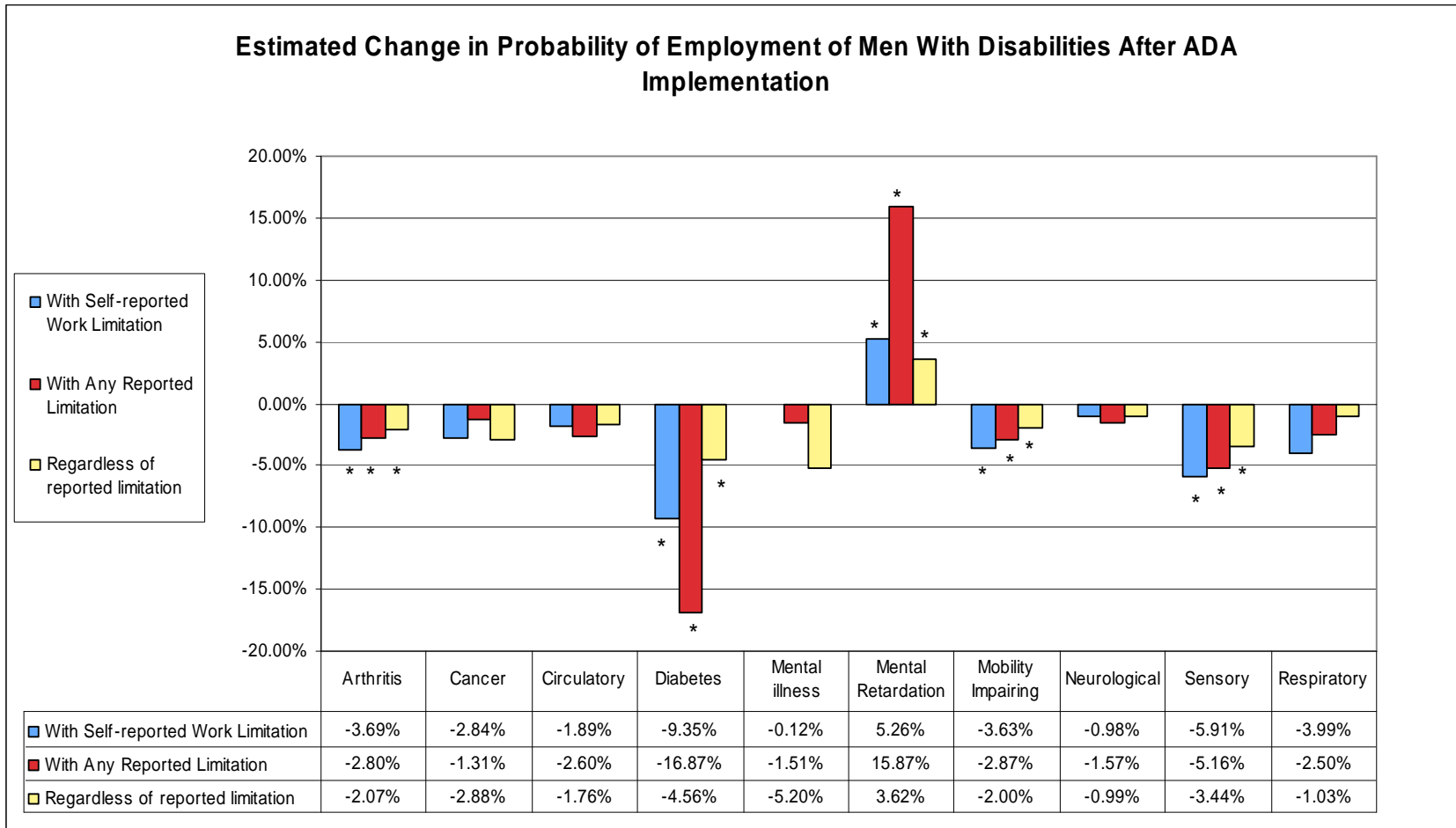


Of the remaining four disability categories including cancer, circulatory diseases, mental illness and respiratory diseases, I can find no evidence of an effect of the ADA on the employment of persons with disabilities.

For the results for men, found in Figure 7 and Table 9, for all disabling conditions except mental retardation, the probability of employment decreased after implementation of the ADA for every disabling condition. Interestingly, the analysis results for mental retardation were positive and significant. In the years immediately after implementation of the ADA, the probability of employment for a male with mental retardation increased between four and 16 percent, depending on how limitations were defined. For individuals with mental retardation with a self-reported work limitation, the probability of employment increased by five percent. For individuals with mental retardation who reported any type of limitation, the probability of employment increased by 16 percent. For the category of individuals with mental retardation who may or may not have reported a limitation, the probability of employment increased by four percent.

For men, four disability categories, arthritis, diabetes, mobility impairments and sensory impairments, provided consistently negative and significant results across the three limitation categories. After implementation of the ADA, men with arthritis reported a decreased probability of employment ranging from two to four percent. Men with diabetes reported the greatest decreases in employment probability, ranging from five percent to 17 percent decreased probability of employment after implementation of the ADA. Men with sensory conditions exhibited a three to six percent decrease in the probability of employment and men with mobility impairments exhibited a two to four percent decrease in the probability of employment in the years immediately following the passage of the Americans with Disabilities Act.

**Figure 7.** Estimated Change in Probability of Employment of Men With Disabilities After ADA Implementation



Note: \* $p < 0.10$ ,  $p$  values refer to interacted coefficients.

**Table 9.** Estimated Change in Probability of Employment of Men with Disabilities by Disability Group After ADA Implementation

Disability Group	With Self-reported Work Limitation	With Any Reported Limitation	Regardless of reported limitation
Arthritis	-3.69%**	-2.80%**	-2.07%***
Cancer	-2.84%	-1.31%	-2.88%
Circulatory	-1.89%	-2.60%	-1.76%
Diabetes	-9.35%**	-16.87%***	-4.56%***
Mental illness	-0.12%	-1.51%	-5.20%
Mental retardation	5.26%**	15.87%**	3.62%**
Mobility Impairing	-3.63%*	-2.87%*	-2.00%*
Neurological	-0.98%	-1.57%	-0.99%
Sensory	-5.91%*	-5.16%**	-3.44%***
Respiratory	-3.99%	-2.50%	-1.03%

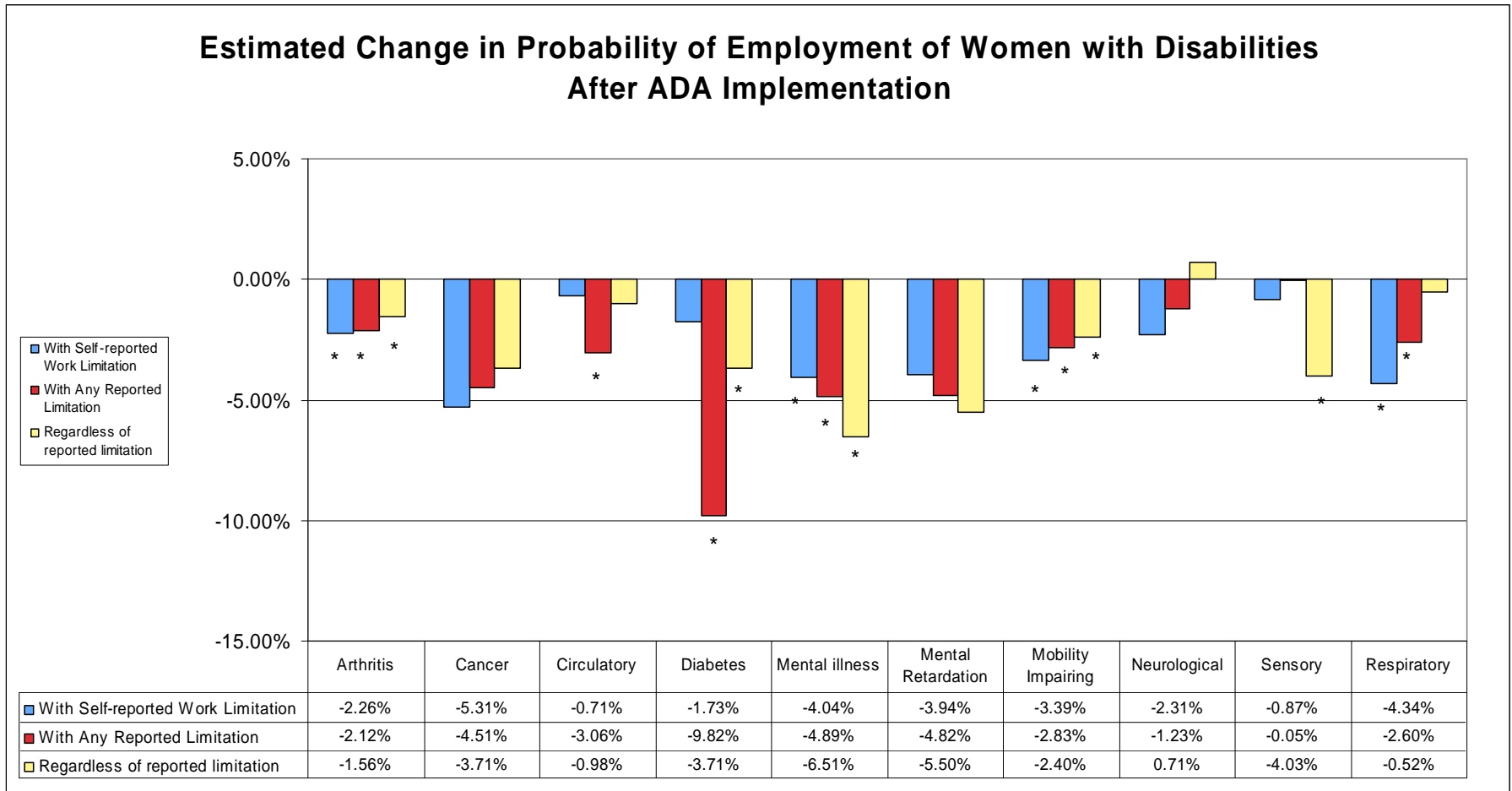
\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

Note: *p* values refer to interacted coefficients.

Of the remaining five disability categories for men, including cancer, circulatory diseases, mental illness, neurological disorders and respiratory diseases, the results were not significant. Therefore, I can not rule out that there was no effect on the employment of men with these particular disabilities upon implementation of the ADA.

The results for women are found in Figure 8 and Table 10. For women, the probability of employment decreased after implementation of the ADA for every disabling condition regardless of the respondent's reported perception of severity except for the category that included individuals with neurological conditions regardless of limitation status. The results for this category were not significant; however.

**Figure 8.** Estimated Change in Probability of Employment of Women with Disabilities After ADA Implementation



Note: \* $p < 0.10$ ,  $p$  values refer to interacted coefficients.

**Table 10.** Estimated Change in Probability of Employment of Women with Disabilities by Disability Group After ADA Implementation

Disability Group	With Self-reported Work Limitation	With Any Reported Limitation	Regardless of reported limitation
Arthritis	-2.26%**	-2.12%**	-1.56%**
Cancer	-5.31%	-4.51%	-3.71%
Circulatory	-0.71%	-3.06%**	-0.98%
Diabetes	-1.73%	-9.82%***	-3.71%*
Mental illness	-4.04%**	-4.89%***	-6.51%***
Mental retardation	-3.94%	-4.82%	-5.50%
Mobility Impairing	-3.39%***	-2.83%***	-2.40%***
Neurological	-2.31%	-1.23%	0.71%
Sensory	-0.87%	-0.05%	-4.03%**
Respiratory	-4.34%***	-2.60%*	-0.52%

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

Note: *p* values refer to interacted coefficients.

Three disability categories, arthritis, mental illness, and mobility impairments yielded consistently negative and significant results across the three limitation categories. After implementation of the ADA, women with arthritis reported a decreased probability of employment of around three percent. Women with mental health diagnoses reported the largest decreases in probability of employment among women reporting a four to seven percent decrease in probability of employment.

Four disability categories, including circulatory conditions, diabetes, sensory impairments and respiratory conditions yielded consistently negative results across the three limitation categories; however, results were only significant for one or two of the limitations categories for these disabilities. For circulatory conditions, diabetes and respiratory conditions results were significant for the category of any reported limitation. In this category, women with circulatory diseases there was a three percent decrease in the probability of employment after implementation of the ADA. Women with diabetes

experienced a 10 percent decrease and women with respiratory conditions had a three percent decrease in the probability of employment after implementation of the law.

The results of the remaining three disability categories which included cancer, mental retardation and neurological diseases were not significant; therefore, I can not rule out that there was no effect from the ADA on the employment of women with these specific medical conditions.

## **Conclusions**

### Discussion

When viewed as a whole, the results of this analysis of the impact of the Americans with Disabilities Act on the labor force participation of persons with disabilities indicate that the policy did not perform as intended. With the exception of men with mental retardation, results showed that initially there was virtually no impact on the employment of persons with disabilities. However, starting in 1996 there was a decrease in the probability of employment of persons with disabilities that persisted through the year 2001.

### Disability Definition

Despite employing several different methods of defining disability, the analysis showed the law had little immediate effect on labor force participation across the board among persons with disabilities. As previous research on the topic only used self-reported work limitations as a definition for disability, it was hypothesized that a more inclusive definition of disability that more closely followed the intent of the law and included individuals who were “regarded as” disabled would prove to show some positive effect of the ADA. While the use of the more inclusive definition appeared to have a less negative effect in degree, it still revealed a significant long-term drop in the probability of employment of those who were determined to have disabilities. More specifically, for the models employing grouped year analysis, the model utilizing a self-reported work limitation indicated a 10 percent decrease in the probability of employment of a person with a disability nine years

after ADA implementation, while the model utilizing the more inclusive definition of any activities limitation indicated a 9.5 percent decrease in the probability of employment of the disabled nine years after implementation of the law.

Also, the disability-specific models in which respondents were identified through reported medical conditions indicated the ADA did not improve the employment status of persons with disabilities. The disability-specific models were run three ways: 1) with a medical condition and a self-reported work limitation; 2) with a medical condition and a self-reported limitation ; and 3) with a medical condition regardless of any limitation. Of the specific disabling conditions that were comprised of individuals regardless of limitation, only two disability groups experienced an increase in employment- men with a diagnosis of mental retardation and women with neurological disorders. Only men with mental retardation had a statistically significant gain in employment.

These results indicate that with the exception of men with mental retardation and women with neurological disorders, the Americans with Disabilities Act did not remove barriers for persons with disabilities in the workplace.

#### Long term impact

An additional perspective offered by this study was the analysis of the long-term impact of the policy. Previous studies had used data which analyzed the impact of the law until 1995 or 1997. This study incorporated data from the years 1988 through 2001. This includes the late 1990's, a period in America characterized by economic prosperity. Unfortunately, results of this analysis show that individuals with disabilities did not share in this economic prosperity.

Similar to previous studies there was no positive effect in employment among disabled persons immediately after the implementation of the law in 1992. For both the strict and inclusive models, the results were not significant for the years 1993 through 1995. Starting with the year 1996, there was a decrease in employment status among disabled

individuals that was statistically significant. This decrease continued until 1999 and began to rise in 2000 and 2001. This gain in employment, albeit small, supports the idea that some aspects of the ADA may have been misunderstood, difficult to put into place or even ignored by employers initially. However, compliance with the ADA may have begun at a later date as aspects of the policy were better understood and appreciated by employers and employees.

There are many types of accommodations that employers may have not been quick to provide. One such example is structural changes such as elevators and ramps for persons with mobility impairments. Structural changes such as these can require significant resources and significant time to build; therefore, the positive results of these accommodations could have taken years to be put into place.

Another issue may have been that it took time for the development and refinement of technological advances that could assist the disabled in the workplace. Many work accommodations for persons with disabilities require assistive technologies that were not widely in use in the early years after ADA implementation. For example; voice recognition technology which could be used by persons with mobility impairments was in its infancy when the ADA was implemented. This technology can now be used to assist persons use computers more effectively. Also, video relay services, a videotelecommunication service that allows hearing impaired persons to communicate over video telephones with hearing persons via a sign language interpreter, was not widely available until 2000, when employment of the disabled began to increase.

An additional barrier could have been slow diffusion of knowledge regarding assistive technology. While some government assistance was provided to increase access to technology for the disabled, it wasn't until 1998 that the Assistive Technology Act was passed. This act which provided funding for states to provide funding for assistive technology, equipment loaner programs, training and technical assistance may have



contributed to the impetus for increased knowledge and utilization of assistive technology in the work place.

Also, the ADA was signed into law prior to the internet boom which occurred in the late 90's and early 00's. With the advent of the internet, access to information increased and this increase of information could have provided the disabled community and their employers with increased knowledge regarding assistive technology and the responsibility of employers to provide this technology to employees who required it. This may have provided some impetus for the small increase in employment experienced in 2000 and 2001.

Also, lags in accommodations may have existed due to a lack of human resources. It may have taken some time to increase the pool of individuals trained to provide job-related accommodation services for persons with disabilities. For some jobs, individuals may require personnel-dependent accommodations such as sign language interpreters for persons who are deaf or personal aides for persons who have conditions that severely restrict their mobility. It may have taken time to identify and train sufficient numbers of people to meet the needs of the workplace.

However, it should be noted that despite the small gains in employment experienced by persons with during 2000 and 2001, employment levels for both men and women with disabilities did not equal the levels of employment experienced prior to implementation of the ADA; therefore, the law did not have a positive impact on its intended audience during the first decade after it was implemented.

Additionally, the decrease in employment of persons with disabilities persists during a time of economic expansion in the overall population is puzzling. Previous studies regarding the effect of labor market activities on persons with disabilities and specific disabilities are ambiguous. One research brief provides information regarding how men and women with disabilities fare with labor market changes (Stapleton, 2005). This study found weak evidence to support the hypothesis that male workers with disabilities were more likely

than those without disabilities to lose their jobs in a declining labor market. There was also no evidence to suggest that women with disabilities lost jobs during times when the labor market conditions declined. Additionally, there are peer-reviewed studies of the effect of the labor market conditions that focus on persons with mental illness. Among individuals with severe mental illness, Catalano and colleagues (1999) did not find that their employment status was dependent upon labor demand. Conversely, Salkever and colleagues (2007) found a weak relationship between employment outcomes and local unemployment rates in a multi-site study of persons with schizophrenia. The results of a study by Waghorn and colleagues (2009) indicated that responsiveness to labor market forces is dependent upon the severity of the mental health diagnosis. This study, based on Australian data, found that labor force participation for persons with anxiety and depression increased with improved labor market conditions from 1998 to 2003, however labor force participation did not change significantly among persons with schizophrenia during this same time period.

One potential reason that the ADA did not increase the employment of persons with disabilities was an increasing reliance of the disabled on social security benefits coupled with governmental policies that discourage engagement in competitive employment. Stapleton and colleagues (2006) describe a “poverty trap” for SSDI beneficiaries in which they can lose all their benefits if their earnings exceed a predetermined monthly amount. This monthly amount is minimal. In 2006, the amount was \$860 for non-blind beneficiaries and \$1,450 for blind beneficiaries. Stapleton and colleagues also describe policies for SSI recipients that discourage engaging in work. SSI recipients who earn more than \$65 per month have their benefits reduced by \$1 for every \$2 they earn, an effective tax rate of 50 percent on their earnings. This loss of income is a great disincentive for SSI beneficiaries to engage in paid work. However, the SSI and SSDI policies have been in existence many years prior to the implementation of the ADA and therefore do not adequately explain why

decreases in employment of persons with disabilities took place around implementation of the ADA.

Additionally, a study by Duggan and Imberman (2006) showed that the number of individuals receiving SSDI increased greatly around the implementation of the ADA. Their study estimated that the fraction of the working-age population receiving SSDI rose by 76 percent from 1984 to 2003. The authors attributed some of this growth to the aging of baby boomers and the increase in women in the labor force; however, the authors credited the majority of the program growth to program policies and their interaction with the economy. While Duggan and Imberman reported an increase in SSDI recipients around the time period that the ADA was implemented, the NHIS data used for this study did not show an increase in persons who reported a disability during this time period. This implies that while the overall number of disabled persons who self-identified as disabled did not increase, the percentage that relied on public assistance during this time did increase substantially.

Another reason that the ADA did not promote the employment of persons with disabilities may be the impact of the law on the perceptions of affected employers. One theory is that employers perceived the ADA as increasing the costs of hiring persons with disabilities (DeLiere, 2000; Acemoglu & Angrist, 2001). Employers perceived that the law required more expensive accommodations than previously provided to workers with disabilities. Also, employers perceived that the ADA potentially increased the cost of firing employees with disabilities through potential lawsuits and litigation costs. Finally, employers perceived that there would be higher associated health care costs with hiring workers with disabilities.

There are some reports and studies conducted around the time of implementation of the ADA that describe employer opinions about the ADA and attitudes towards persons with disabilities. Articles in the business literature report that many employers, particularly those in small businesses, were apprehensive about potential litigation and accommodation costs

of the ADA (Dibattista, 1997; Litvan, 1994; Maurer & Zugelder, 1998). Some reports indicate that small businesses were unaware of the implications of the ADA. One survey conducted in 1992 found that 40 percent of small business owners were unaware of the ADA and 30 percent knew about the law but were unable to afford the required structural accommodations (McKee, 1993).

Most of the research focusing on employers, the ADA and persons with disabilities focuses on employer attitudes. Hernandez and colleagues (2000) conducted a literature review regarding employer attitudes towards workers with disabilities and their ADA employment rights. Their review of 37 studies conducted between 1987 and 1999 found that employers expressed positive global attitudes towards persons with disabilities and general support for the ADA. However, when the studies analyzed components of the ADA specific to employment rights, employers expressed concern and less support for employment rights as compared to public services and accommodation rights. The review conducted by Hernandez and colleagues provides valuable information regarding employer attitudes; however, it is important to note that they found no studies that directly observed employers' actual hiring practices. Finally, the Hernandez review found that workers with physical disabilities were viewed more positively by employers than workers with intellectual or psychiatric disabilities.

Later studies indicate that similar opinions of employers regarding hiring persons with disabilities persist. In 2008, the Office of Disability Employment Policy of the United States Department of Labor funded a survey of employers that focused on employer practices related to hiring, promoting and retaining persons with disabilities (U.S. Department of Labor, 2009). This study showed that employers who actively recruited persons with disabilities differed from those who did not were in company size, sector of the economy and industry type. Employers that were more likely to report that they actively recruited employees with disabilities included larger employers and those in the public

sector. Smaller and medium-sized companies were more likely to report that fear of increased costs such as health care costs, workers compensation costs and litigation costs contributed to challenges in hiring workers with disabilities. Private sector companies in areas such as construction, manufacturing, and retail were more likely than others to report that the nature of the work was a challenge in hiring those with disabilities.

The results of this study indicate there was no positive long-term impact of the ADA on the employment of persons with disabilities. There are several potential reasons for these perplexing results including slow diffusion of knowledge regarding the ADA, disincentives for employment inherent in social security benefit policies and employer fear of potential ADA costs. Additional research is needed to better understand the interaction of these phenomena.

#### Impact on Women

Another contribution of this study was the inclusion of the impact of the law on women. While previous studies had only focused on the impact of the ADA on the employment status of disabled men, this one analyzed the impact of the policy on women combined with, and separately from, men.

This study specifically hypothesizes that the employment of men with disabilities would increase at a greater rate than that of women after implementation of the ADA. This hypothesis was based on gender-based employment inequities that have been demonstrated in the literature for the non-disabled population due to issues that women face such as marriage roles (Marini, 1980), motherhood (Buding & England, 2001), occupational segregation (Beller, 1982; Sorenson, 1989) and discrimination (Oaxaca, 1973). This hypothesis was also influenced by previous studies in which it was noted that women with disabilities were subjected to a “double burden” of discrimination with respect to wage offers (Baldwin & Johnson, 1995).

The findings of this study did not support the hypothesis that the employment of men with disabilities would increase at a greater rate than that of women after implementation of the ADA. For the years that yield statistically significant results, overall men with disabilities appear to have a two to four percent greater decrease in employment compared to women with disabilities.

In order to gain a better understanding of the impact of the law on the genders, it is helpful to review the probability of employment of men and women between the years 1988 and 2001 (Figures 4 and 5). For men with disabilities the decline in employment begins prior to the implementation of the ADA and continues to decline until 2000, leveling off in 2000 and 2001. For women with disabilities, employment levels decline after implementation of the ADA and continue to decline until 1999. Employment rises in 2000 and again in 2001 for women with disabilities. While overall employment rates for women who are disabled are much lower than that of men with disabilities, there seems to be a rebound in employment for women after 1999 that is merely expressed as stabilization in employment for men.

These counterintuitive findings may indicate that decisions impacting labor force participation of disabled women are very complex and that implementation of the ADA would not mitigate decisions that disabled women would make regarding marriage and motherhood. Conversely, employers may not view disabled women similarly to non-disabled women. Employers may perceive that women with disabilities, in general, may not make the same choices as non-disabled women in regards to marriage, child-bearing and child-rearing and as a consequence would perceive that women with disabilities would stay on the job longer. As a result, employers could be more willing to make investments in job accommodations for women with disabilities.

Another reason for this finding may be that during this time period, more men than women with disabilities were leaving the workforce and either participating in vocational

rehabilitation programs or applying for disability benefits. Further research is needed to determine why more men than women with disabilities were leaving the workforce during this time period.

One finding from the disability-specific component of this research does seem to support potential gender discrimination among those affected by the ADA. Among the specific disability groups there was only one group, men with mental retardation that experienced a significant increase in employment upon implementation of the ADA. Women with mental retardation experienced a decrease in employment regardless of perception of limitations; however, these results were not significant. While these results has not been replicated in other ADA studies, one small study based on an analysis of the National Survey of Community Rehabilitation Providers, Individual Outcomes Survey conducted between 2004 and 2005 did find gender differences in the employment outcomes of persons with developmental disabilities (Boeltzig et al., 2009). This study showed that while both men and women with developmental disabilities are earning meaningful wages, women are working fewer hours in lower wage jobs and earn less money. It should be noted that while the term developmental disability is not synonymous with mental retardation, individuals with mental retardation do comprise a large proportion of the developmentally disabled population. The findings of this ADA study and the Boeltzig study provide some support of gender discrimination that women with disabilities face in the workplace.

#### Impact on Disability Groups

This study also provided additional information regarding the variation of the impact of the ADA among different disability groups. Overall, the ADA appears to have not promoted the employment of men and women with a variety of medical conditions regardless of how limiting the person perceives their condition to be. However, with some specific disabling conditions, gender appears to interact with disabling condition in very specific and sometimes conflicting ways.

In comparing the impact of the ADA on men and women within specific disability groups, there appear to be some similarities. Both men and women with the conditions arthritis, diabetes and mobility impairments appeared to have the most significant negative employment impact from the ADA. This seems to support the hypothesis that ADA will have a greater negative effect on labor force participation of specific disability groups with disability groups with more costly accommodations having a more negative outcomes than disability groups requiring less costly accommodation. The conditions arthritis and diabetes are perceived to be chronic and can have a varying, increasingly debilitating impact on the individual over time. Depending upon the employee abilities and job tasks, employers could possibly perceive accommodations as being on-going, variable and, as a result, expensive.

Of note, is that the condition diabetes had the greatest decrease in employment after implementation of the ADA. Certain types of diabetes are highly correlated with obesity (Weyer et al., 2001) and studies have documented that persons who are obese can face employment discrimination (Carr & Friedman, 2005) and lower wages, particularly women (Cawley, 2004). Additional research is warranted to determine if persons with diabetes face additional social discrimination due to weight and if gender discrimination coexists along with the disability discrimination.

Employment outcomes for individuals with the diagnoses of mental retardation appeared to be very different for men and women. As stated previously, among individuals with the diagnosis of mental retardation, men experienced an increase in employment following the ADA while women experienced a decrease in employment. This could be interpreted that among men, disabling conditions that required work accommodations that accounted for cognitive functioning benefitted from the ADA, while disabling conditions that might require accommodations for declining physical strength did not benefit in the years immediately after implementation of the law. Another way to interpret this difference in response to the law is that conditions that were static such as mental retardation could have



been easier and less costly to provide accommodations for as opposed to the diseases of arthritis and diabetes which are chronic and variable and can require varying types of accommodations over time. Among men with mental retardation, an initial appropriate job placement with appropriate accommodations could remain unchanged and prove less costly for employers over time.

An additional explanation for the increase of employment in men with mental retardation could be additional government funding and specialized programs provided for the employment of persons with developmental disabilities and mental retardation. What remains unanswered is why these programs would benefit men and not women.

Employment outcomes for individuals with the diagnoses of mental illness appeared to be very different for men and women. Women experienced a statistically significant decrease while for men the results were not significant. An explanation for this finding may be found in how mental illness is expressed among men and women. While similar rates for severe mental conditions such as schizophrenia are found among men and women, women have higher rates of depression and anxiety compared to men and men have higher rates of drug and alcohol dependence. In this study, all mental health diagnoses are subsumed under the category mental illness, further research is needed to determine if the ADA had a differential impact upon men and women with differing mental health diagnoses.

### Study Limitations

For this study, several limitations merit discussion. First, despite using different definitions of disability, measurement error may still persist. While the NHIS is constructed in such a manner that it is fairly straightforward to capture respondents who perceive themselves as disabled or limited and report work limitations and other activity limitations, it is more difficult to identify those who may not report limitations but are, under the ADA, “regarded as such”. There were attempts to capture this group in the disability specific component of the study in which individuals who were identified as having a medical

condition were included regardless of whether they reported a limitation. The danger with this method is that the medical conditions could not be adjusted for severity level. Individuals who had a medical condition which were well-managed and were not perceived to have limitations by themselves or others may have been included in this category. However, it is important to note that measurement error in an explanatory variable only causes bias if the error is correlated with the observed value of the variable, not if the measurement error is correlated with the true value of the variable. Therefore, it is perceived that the observed presence of a medical condition is more closely correlated with the true categorization of being regarded as disabled. In this case it likely causes little issue with bias.

A second, related limitation is that the NHIS relies on self report for medical conditions and only includes diagnostic screening for some disabling conditions as special supplements. As a result, there may be a lack of sensitivity to potentially diagnosable but not reported conditions; therefore, the results may be conservative for potentially stigmatizing medical conditions such as mental illness.

A third limitation of this study is omitted variable bias. These results could be biased if other policies affecting employment of disabled individuals were implemented simultaneously with the ADA. As previously stated, only data through 2001 was used to assess the impact the law. Data past 2001 was not used since the Ticket to Work and Work Incentives Improvement Act began Phase 1 implementation in February 2002. (U.S. Department of Labor, 2003). This study was not able to control for state-level policies that were implemented during the time period studied since state indicators were not available in the data.

A fourth and final limitation of this study is the inability to control for age of onset of disability. This could be significant as the age of onset of a disability, particularly if it occurred early in life could impact educational attainment. This could cause disability status

to be correlated with education and cause issues with multicollinearity. While multicollinearity does not bias coefficient estimates, it could potentially cause increased standard errors. This limitation was partially mitigated through the analyses with specific disability groupings. Some disabilities, such as mental retardation or sensory impairments, more clearly manifest themselves at an early age, while some, such as cancer or arthritis more likely occur later in life after the primary years for schooling have passed. However, since there was no ability to control completely for age of onset, this remains a limitation.

### Policy Implications and Future Research

Employment of persons with disabilities continues to be a policy puzzle. Despite the implementation of the Americans with Disabilities Act, significant federal and state funding, increases in employer and employee awareness, and advances in technology, this research shows that the majority of individuals with disabilities have lower levels of employment almost a decade after the ADA was passed. As discussed previously, there are several potential reasons for this including disincentives in the social security program, continued employer misperceptions regarding the work abilities of the disabled, employer misperceptions regarding the cost of accommodating disabled workers and the concerns of employers regarding rising health care costs associated with disabled workers.

This research shows that there are significant variations in the impact of the law upon gender and disability groups. This research along with the other ADA research conducted shows that the conundrum of employing the disabled can not be resolved by a one size fits all policy. Disability is a complex condition which can serve to magnify other groups that experience social discrimination. Therefore, several strategies should be employed by policy makers to support the employment of persons with disabilities. Strategies should be multi-faceted and target potential employers, persons with disabilities and the population at large.

While there is little research that examines employer practices in hiring and retaining persons who have or acquire disabilities, one available study highlights employers' perceptions about the costs of hiring workers with disabilities including the costs of accommodations and potential health care costs (U.S. Department of Labor, 2009). Previous research has shown that the direct costs of accommodations are typically less than \$500 per employee (Job Accommodation Network, 1999). Also, more recent research has reviewed direct and indirect costs to companies in accommodating workers with disabilities and has found that the overall cost of accommodation is much less than previously thought (Schartz et al., 2006). Data from this research has shown that almost 50 percent of all accommodations have zero direct cost to the company and the median cost of accommodations is \$25. Indirect costs as reported by companies providing accommodations are also negligible. Additionally, there are tax incentives that businesses can use to make the workplace accessible for persons with disabilities. These include tax credits for small businesses for removing architectural barriers or buying specialized equipment for persons with disabilities and tax deductions for businesses to remove barriers in existing facilities or transportation vehicles.

Strategies to target potential employers could include increased education regarding the actual costs of accommodations and increased education regarding tax incentives. Consideration should be given to expand the tax credits to medium and large size businesses and converting the architectural/transportation tax deduction to a tax credit, thereby further reducing the cost of accommodation to employers.

Employers have voiced concerns regarding the cost of providing health care to disabled workers. Disabled persons do consume a disproportionate amount of health care compared to non-disabled persons. An analysis of Medical Expenditure Panel Survey (MEPS) data for 2005 shows that while 12 percent of those age 18 to 64 not residing in institutions reported a disability, they accounted for 37 percent of all health care

expenditures for that age group (Stapleton & Liu, 2009). In addition, the recently passed Affordable Care Act may have an impact on how employers perceive health care costs of the disabled. In an effort to offer protection to health care consumers, the Act requires that, starting in 2014, persons with pre-existing conditions, including disabilities, will not be denied coverage or charged higher premiums due to their condition or disability. While these protections are lauded by those in the disability community, there is concern that this will increase the overall cost of providing health care insurance through employers since there were few cost-containing measures included in the health care reform bill. This could potentially increase employers' concerns about the costs of hiring persons with disabilities.

Some elements of the Affordable Care Act hold some promise for decreasing health care costs for employers. For small businesses, there are tax credits to offset the costs of insurance and private health insurance markets that offer affordable health insurance plans. These strategies may keep the costs of health care insurance in check and encourage small businesses to hire and retain persons with disabilities.

Strategies that target individuals with disabilities should include making substantial revisions to the social security policies that discourage individuals with disabilities from working. One such strategy could involve emulating the Veterans Affairs Disability Compensation Program (VADC). In this program, eligible veterans receive benefits regardless of their earnings. Additionally, there is a "partial disability" designation in which a veteran can receive a percentage of benefits based on the extent of their disability. This partial disability mechanism, if utilized by the social security program, could serve to control program costs yet still provide needed financial support to a person with disability.

Finally, social marketing strategies should be employed to target employers and the population at large to challenge current perceptions held about persons with disabilities. The "Think Beyond the Label" campaign is a recent web-based endeavor that appears to be very promising. This is a national multi-media marketing campaign which targets employers

by making a business case for hiring workers with disabilities. It has a website that features resources for businesses as well as a presence on several social networking sites such as Facebook and Twitter. This effort should be expanded as funding permits. Additionally, evaluations of the impact of this program should be conducted so that the program can be refined and messages can be targeted to appropriate members of the business community and the general population.

Along with these policy recommendations, further research is required to explore how specific disability groups and genders interact with the workforce. These studies could provide policy makers with information to create additional targeted programs for specific disability groups, gender groups and age groups.

Additionally, further research is needed to ascertain how persons with disabilities make decisions about entering and staying in the job market- specifically how personal and family finances impact these decisions. While outside the range of this study, decisions regarding obtaining and maintaining disability payments have influenced individuals with disabilities about entering the workforce. Some researchers propose that current policy only serves to impoverish those who are disabled and prevents them from engaging in competitive employment (Burkhauser, 2005; Stapleton, 2006).

Further research on how labor market increases and declines impact specific disability groups is needed. While previous research has offered mixed results regarding the impact of the economy on labor force participation of the disabled, this study indicated that persons who disabled experienced decreased employment during a strong economic period. These confusing results should be analyzed further.

Finally, additional research needs to be conducted among the disabled to determine how they obtain employment. There are a plethora of studies regarding how the non-disabled utilize social networks to obtain employment (Granovetter, 1973; Lin & Dumin,

1986; Phillips & Massey, 1999; Gabbay & Zuckerman, 1998). These studies need to be replicated among the disabled community to see how social networks impact them.

## **CHAPTER 3: SOCIAL NETWORKS AND LABOR FORCE PARTICIPATION OF PERSONS WITH DISABILITIES**

### **Introduction and Background**

#### Social Networks and Employment of Persons with Disabilities

In the general population, the positive association between the presence of social networks and favorable employment outcomes is well documented (Granovetter, 1973; Lin & Dumin, 1986; Phillips & Massey, 1999; Gabbay & Zuckerman, 1998). However, despite the well-documented barriers to labor force participation experienced by persons with disabilities, there is little research that analyzes the association of social networks with employment characteristics of disabled persons. While there are many definitions of social capital and social networks present in the social science literature, for the purposes of this study, social networks are defined as linkages among defined sets of persons such as family, friends, and neighbors which can be utilized in a purposeful manner (Lin, 1999).

An extensive literature review provided two existing quantitative studies and one qualitative study that addressed the association of networks with the employment status of persons with disabilities (Roy, Dimigen & Taylor, 1998; Evert et al., 2003; Jackson et al., 2006). These existing studies focused on specific disability groups, individuals with visual impairment, individuals with psychosis, and individuals with spinal cord injury, and did not focus on the larger disabled population.

The study regarding employment of persons with visual impairment examined the relationship of the employment status and the range of the social networks of 51 visually impaired college graduates in Great Britain (Roy, Dimigen & Taylor, 1998). This study investigated network size, frequency and general location of social contacts. The study



concluded that unemployed visually impaired college graduates tended to have a smaller network, socialized less frequently and socialized in more structured or formal mechanisms than did employed visually impaired college graduates. While this study did not use a non-disabled comparison group, these findings do appear to mirror the findings of studies of social networks and employment status conducted with the general population (Granovetter, 1973).

The major limitation of this study was the sophistication of the empirical methods utilized. The analysis used chi-square analysis and did not utilize a more sophisticated regression analysis that would have allowed relevant control variables such as gender, marital status, race or severity of visual impairment. Additionally, social networks and employment can be considered to be endogenous as it is feasible for employment to increase or strengthen social relationships or vice versa. Additional limitations of this study included the small sample size and the heterogeneity of the educational levels of the study participants.

The study that examined the occupational status of individuals with psychosis used data obtained from an epidemiological study of 968 individuals living in four predominantly urban areas of Australia (Evert et al., 2003). This study used a structural equations model to determine the relationship between social networks and employment status. The study analyzed the composition of networks in which compositions were described in the following manner: family dominated, friends dominated, friends and family dominated and socially isolated. Evert and colleagues found that after controlling for education, gender, marital status, living arrangement, diagnosis and course of mental illness, people with psychosis who had networks dominated by family members or both friends and family members were more likely to be employed than those in friend dominated networks or those who were socially isolated. These findings seem to differ from the findings of social network composition and employment status conducted with the general population in which friends

are more likely than family members to provide linkages to employment (Granovetter, 1973; Marsden, 1990; Moore, 1990; Aguilera, 2002). While the study conducted by Evert and colleagues, was well-designed, one limitation is the lack of a non-disabled comparison group.

In a qualitative study, Jackson and colleagues (2006) analyzed the face-to-face interview and focus group responses of 31 African American males living in the southern region of the United States with spinal cord injuries to assess the implications of social capital and social networks on seeking and maintaining employment. Analysis revealed that the individuals in the study did possess many aspects of social capital, particularly extensive social networks. However, for many, the disabling aspects of a spinal cord injury coupled with existing institutional and structural obstacles did not parlay social capital or social networks into employment.

Limitations of this study included a non-experimental design and a limited sample which includes only African American men living in the South. As non-disabled African American men living in the South may face employment discrimination, it is difficult to assess whether disability, race or other factors affected employment status. Additionally, the researchers conceded the sample seemed to be biased with “highly motivated, resourceful optimists”, which could even serve to limit generalizability of the study results to other African American men with spinal cord injury living in the South.

In general, the existing studies regarding the association of social networks and employment status of persons with disabilities have limitations in that they 1) utilize small geographically homogeneous samples which limit generalizability, 2) generally do not address the endogeneity inherent in social networks and employment and 3) do not include comparisons with other groups such as non-disabled persons or other disability groups.

### Significance of the Study

The social network component of this study provides information on a mechanism that has been associated with gainful employment that has been well researched among the non-disabled population but not well utilized or understood among the disabled population. Preliminary research conducted with individuals with visual impairments and mental health disorders has provided mixed results regarding the association of social networks with employment status of persons with disabilities. This study attempts to provide additional information on the types of social networks that increase employment among persons with disabilities as well as a comparison of specific disability groups.

Additionally, from a practical standpoint, this social network study serves to inform those whose duties involve working directly with persons with disabilities to incorporate them into the workforce, such as the occupational health nurse or the vocational rehabilitation counselor, on how the presence and composition of social networks are associated with workforce participation (Rogers, Randolph & Mastroianni, 2003; Salazar, 2001). This research could shed light on effective strategies to enhance and maintain gainful employment for persons with disabilities.

Finally, this study seeks to improve upon the limitations of the existing literature by using a large, nationally representative sample of disabled persons in an effort to promote generalizability, utilize an instrumental variables approach to address potential endogeneity and provide comparisons of social network composition among specific disability groups.

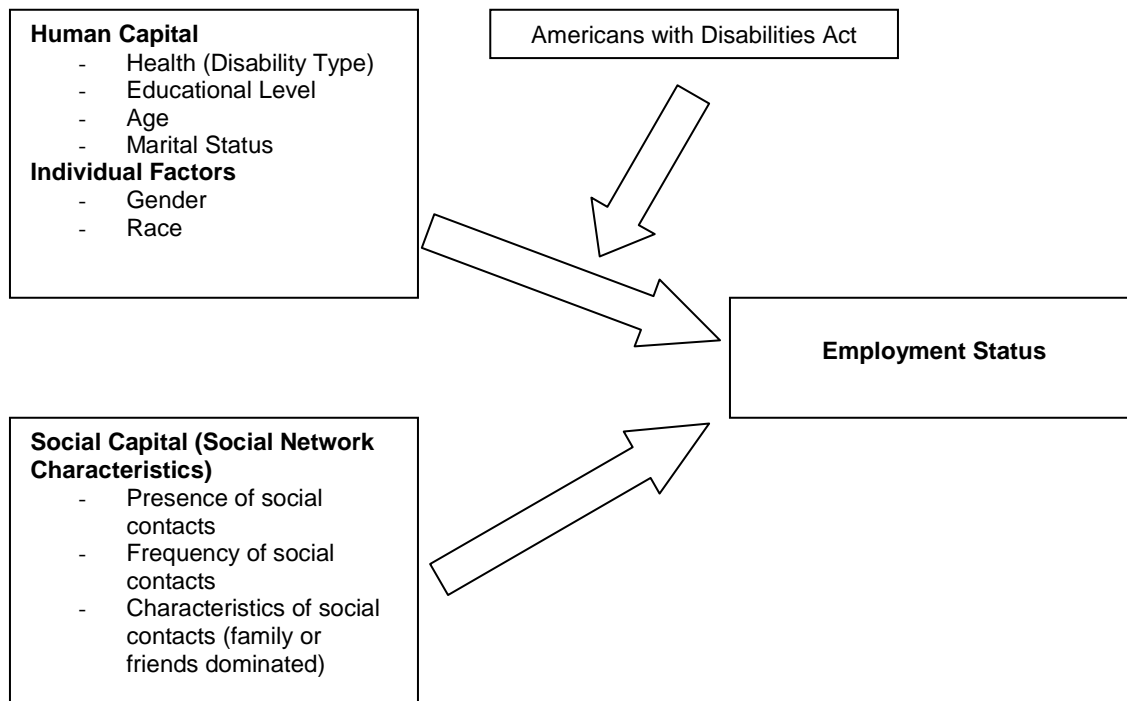
### **Theoretical Perspectives and Conceptual Framework**

#### Conceptual Framework

The conceptual framework of this study draws upon both economic and sociological theories of employment. The employment status of persons with disabilities is conceptualized to be a result of human capital, social capital and other individual factors (Becker, 1964; Bourdieu, 1986). The overall conceptual framework which encompasses both

the ADA policy study and the social network study is depicted in Figure 9 below. While the conceptual framework for the social network study is described below, the framework for the ADA study is more fully described in Chapter 2.

**Figure 9.** Conceptual Framework for the Impact of Social Networks on the Employment of Persons with Disabilities



*Social capital and social network theory*

Having a strong presence in sociological research, social networks are a concept that have been utilized to study a wide variety of social phenomena including economic development, immigration, homelessness and labor market outcomes (Woolcock, 1998; Massey et al., 1987; Dordick, 1997; Fernandez, Castilla, & Moore, 2000). Social network theory is based on the concept of social capital, first defined by Bordieu (1986) and later expanded upon by Putnam (1990) and Lin (1999). Bordieu distinguishes social capital from economic and cultural capital by defining it as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less

institutionalized relationships of mutual acquaintance and recognition." Putnam defines social capital as the collective value of all social networks and the good will that arises from these networks to do things for one another. The definitions for social capital as ascribed to by Bordieu and Putnam have applications to communities or groups.

On the other hand, Lin has provided a more specific definition to social capital which is linked to individuals as opposed to communities or societies as a whole. Lin also assigns a purposive or goal-oriented component to social capital. Lin specifically defines social capital as "investment in social relations with expected returns in the marketplace". Lin's definition of social capital will be used to provide the basis for social network theory and social networks in the proposed study.

Social networks are considered to be one component of social capital. While there are many ways to define and operationalize social networks, Lin specifically defines social networks as "resources embedded in a social structure which are accessed or mobilized in purposive actions" (1999). Research conducted with the general population has shown that social networks are an important factor in labor market outcomes. The presence of extensive social networks is positively associated with gaining and keeping employment, increased earnings and job promotions (Lin & Dumin, 1986; Phillips & Massey, 1999; Gabbay & Zuckerman, 1998). Research has also shown that social networks play a significant role in the number of job offers and the types of jobs offered (Simon & Warner, 1992; Huffman & Torres, 2002).

There are several attributes of social networks that have been hypothesized to influence employment outcomes, including size, density, strength of ties and composition. These characteristics, in general, are components of "range" which is defined to be the extent to which a network contains a diverse set of actors (Burt, 1983). Granovetter's (1973) discussion of strong and weak ties can be conceptualized as a discussion of network range. Granovetter postulates that weak interpersonal ties to others in a social network can be

more beneficial to individuals as opposed to strong ties because weak ties are more likely to connect people who do not know one another and provide non-redundant resources. The theory of the strength of weak ties has been utilized to show the differences in how family and friend based social networks are used to obtain employment. Research regarding the general population has shown that while family based social networks may provide stronger bonds with higher levels of obligation compared to friendship networks, they are more likely to provide redundant employment information (Marsden, 1990; Moore, 1990; Aguilera, 2002). Therefore, family members are less likely than friends to provide information or resources that could potentially lead to a job.

As previously mentioned, there is a paucity of research that addresses the impact of social networks on labor force participation of disabled persons; however, there are studies that document the presence of existing social networks among many types of disability groups, including individuals with chronic physical disabilities, cognitive disabilities and severe mental illness (Morgan et al., 1984; Kutner, 1987; Bates & Davis, 2004; Song et al., 2006). The proposed study will investigate the association between various aspects of social networks and the employment status of persons with disabilities. It is theorized that social networks serve a similar function in linking disabled persons to employment opportunities as networks do with nondisabled persons. Additionally, it is theorized that social capital, specifically social networks, may fulfill a function in which human capital fails to provide employment opportunities for persons with disabilities. Whereas the decreased employment outcomes historically experienced by persons with disabilities are conceptualized as a result of decreased human capital experienced by persons with disabilities, social networks, in some instances, may serve to mitigate some of the discrepancies in employment.

### Study Hypotheses

The specific aim of the social network or interpersonal-level study was to investigate the impact of social networks on the employment status of persons with disabilities. This study examined three main hypotheses regarding social networks and labor force participation of persons with disabilities.

*Hypothesis 2a: The presence of social networks and frequency of social contacts is associated with greater labor force participation for disabled persons.*

The presence of social networks in determining positive employment outcomes for the general population has been well documented (Lin & Dumin, 1986; Phillips & Massey, 1999; Gabbay & Zuckerman, 1998). While there are few studies that investigate the association of social networks and employment outcomes of persons with disabilities, existing studies have indicated that the presence of a social network and frequency of contact is positively associated with labor force participation among persons who with visual impairments and persons with psychosis. It is hypothesized that this positive association between social networks and employment status could be extended to the disabled population in general.

*Hypothesis 2b: Friendship networks and familial networks have a differential effect on labor force participation for persons with disabilities. The presence of a friendship network is hypothesized to have a stronger association with labor force participation as compared to a familial network for persons with disabilities.*

Research regarding the general population has shown that “weak” ties with members of a social network are more likely to garner non-redundant resources and information (Granovetter, 1974). Therefore friendship networks are more likely than family networks to provide information or resources that could potentially lead to a job. It is hypothesized that familial and friendship networks function similarly overall in the disabled population as well.

It should be noted a complication from this line of inquiry is that friendship networks may be formed as a result of employment; the empirical methods used in this paper will attempt to tease out this difference.

*Hypothesis 2c: Social networks have a differential association with labor force participation of different disability groups. There will be a stronger positive correlation between employment and social networks among persons with disabilities that are viewed more positively by society than persons with disabilities viewed more negatively by society.*

Persons with disabilities represent a very diverse population. Previous research has shown differing employment outcomes such as wages and employment status based on disability type (Barnartt & Altman, 1997; Stoddard, Jans, Ripple & Kraus, 1998). Some research has also poorer employment outcomes for individuals with disabilities associated with more prejudicial attitudes such as mental illness or mental retardation (Baldwin & Johnson, 1994; Johnson & Lambrinos, 1987). Therefore, it is hypothesized that social networks would provide different effects for employment status among different disability groups.

Additionally, building and maintaining social relationships requires interaction with people. Characteristics of some disabilities may adversely affect ones ability to interact socially. Specifically, individuals with cognitive disabilities or severe communication disabilities, in addition to being negatively viewed by society, may have difficulty engaging in social interactions with the population at large, thereby limiting their ability to develop a network of social contacts. Also, some types of mental illness such as psychosis or severe anxiety disorders may impede ones ability to interact socially and expand their social network, particularly a friends dominated one. Therefore, it is hypothesized that persons with disabilities that impede their ability to interact with others, either due to prejudicial



attitudes or communication difficulties, would have a less positive association between social networks and employment status than would individuals with disabilities that would not impede social interaction.

## **Research Methods**

### Research Design

The study design for this component regarding social networks was conceptualized as a cross-sectional observational design<sup>2</sup>. Since the dependent variable is dichotomous (employed/not employed), logistic regression analysis was used to test the model.

Also, since endogeneity is suspected between employment and the social contact variables an instrumental variables model was employed.

For all analyses, a two stage residual inclusion (2SRI) model was employed. As described by Terza and colleagues (2008), 2SRI is an alternative implementation of the two-stage instrumental variables approach used in non-linear models and has been shown to be consistent and non-biased.

The general system of equations for the 2SRI model is represented by two equations. The main equation of the 2SRI estimator is:

$$1) \quad y = M(x_e\beta_e + x_o\beta_o + x_u\beta_u) + e$$

where  $x_e$  is a vector of endogenous regressors (in this case, social contact variables),  $x_o$  is a vector of observable exogenous regressors (human capital and sociodemographic variables) and  $x_u$  is a vector of unobservable confounder latent variables that influence the binary outcome of  $y$  (employed/not employed) and are correlated with the endogenous variables. Also,  $e$  is the random error.

The first stage equation of the 2SRI estimator is:

$$2) \quad x_{es} = r_s(w\alpha_s) + x_{us}$$

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<sup>2</sup> It should be noted that the design for this component of the study differs from that of the ADA policy study in that it will use data from the 1995 NHIS-D and only observations that meet the ICF definition of disability will be included. As such, the proposed social network study does not have a longitudinal design and does not include non-disabled individuals as a control group.

where  $w$  is a vector of identifying instrumental variables and  $\alpha$  is a vector of parameters. The elements of  $w$  must satisfy the following three conditions: (1) they can not be correlated with  $x_u$ ; (2) they should be correlated with  $x_e$ ; and they can not be correlated with the error term in equation 1.

The second stage of the estimator is:

$$3) \quad y = M(x_e\beta_e + x_o\beta_o + e^{hat}_u\beta_u) + e^{2SRI}$$

where  $e^{2SRI}$  is the regression error term and where  $e^{hat}_u$  are residuals of the first stage equation (equation 2). In 2SRI, the actual observed value of the endogenous regressors are maintained in the second stage regression model while the residuals from the auxiliary regressions are substituted for the unobserved confounders; thereby, providing consistent estimates of the true unobserved confounder variables. The 2SRI method has been used increasingly in the health economics literature, including studies conducted by DeSimone (2002), Baser and colleagues (2004), and Norton and VanHoutven (2006).

The general system of equations for the 2SRI model was used to test the three hypotheses in this portion of the study; however, the results for all disabled men and women were modeled separately to test hypotheses 2a and 2b and the results for each specific disability group and gender were modeled separately for hypothesis 2c. It should be noted that the sample size for some disability groups caused problems with convergence. After conducting diagnostics, it was determined that these subsets had a very small sample size across the social contact variables; therefore, these models were eliminated. The eliminated disability groups are cancer and mental retardation for both men and women and sensory impairment for women. There were a total of 15 disability-gender models run for this analyses.

A number of variables were considered as potential instruments. Instruments related to family networks include the number of living relatives. The data in the NHIS-D allows

construction of variables regarding the number of first-order relatives including number of sisters, brothers, daughters, and sons. The data also provides information on whether the respondent's parents are living. Also, the data provides information on the amount of time it takes for family members to travel to the respondent's home. Number of living relatives and the amount of time required to travel to meet them would feasibly be correlated to frequency of social contacts, yet not correlated to employment status. Instruments related to a friends dominated network include amount of times the respondent attends community activities such as church, movies, sporting events and going out to eat.

In order to better understand the analyses, results are often presented as predicted probabilities. In these analyses, the probabilities were estimated for the base case for men and women. More specifically for either a disabled man or woman, the probability was predicted for a white, married, 42 year old, living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with a high school degree.

### Model Specification

For the first stage equation of the 2SRI model, the endogenous social contact variables were constructed into five categories which were exclusive and unable to be ranked; therefore, the model was run as a multinomial logit model. For the second stage equation, or the main outcome equation, the dependent was binary; therefore, the options of using a linear probability, logit and probit model were explored. Since the linear probability model can potentially provide out of range predictions, this model was rejected. Both logit and probit models provide in-range predictions and virtually the same results; however, the logit model was used for all main outcome analyses due to its frequent use in the literature.

Also, since the NHIS utilizes a complex, multistage probability sample that incorporates stratification, clustering, and oversampling of certain subpopulations, commands that account for sample weights, stratification and clustering were used.

Additionally, in order to provide correct standard errors, the standard errors were bootstrapped.

Because an instrumental variables (IV) approach was employed in order to address the suspected endogeneity in the model, several tests were employed to determine if appropriate instruments were selected. Tests were used to identify instruments that are substantially correlated to the endogenous explanatory variable and uncorrelated with the error of the structural equation of interest (Wooldridge, 1999). There is not a lot of guidance in the literature in terms of specification tests for instruments in two-stage residual inclusion models. Here, I generalized some standard tests for instrumental variables into the non-linear models used in this analysis, but these tests have generally not been validated for this use.

First, a test was conducted in order to determine if the instruments selected were appropriate instruments and had sufficient strength. Studies have highlighted the problems with “weak” instruments, including the potential to bias instrumental variable estimates towards OLS (Bound, Jaeger, & Baker, 1995) and invalidating distributions used to evaluate statistics on Hausman tests and other tests (Staiger & Stock, 1997).

Testing instrument strength involved running an F test on the joint significance of the instruments. The results for the model including disabled men ( $\chi^2=176.97$ ;  $\text{prob}=0.000$ ) as well as the results of the model including disabled women ( $\chi^2=243.33$ ;  $\text{prob}=0.000$ ) indicated that I should reject the null hypothesis that the coefficients on the instruments equal 0. Therefore, these high scores indicate that these are potential instruments. Additionally, the pseudo  $R^2$  for the women’s model was 0.0938, while the pseudo  $R^2$  for the male model was 0.0957. These scores are very close to the recommended level of .1, therefore, the potential instruments are considered to be strong.

Next, a variant of a Hausman test was conducted to determine if endogeneity is indeed an issue in the model. In this test, I test the significance of the first stage residuals in

the main outcome (or second stage) equation using a joint test. By testing the residuals, I am testing the degree to which unobservable factors affect the outcomes (Pizer, 2009). The joint test results of the model including disabled men ( $\chi^2=17.74$ ;  $\text{prob}=0.001$ ) and disabled women ( $\chi^2=10.48$ ;  $\text{prob}=0.03$ ) both indicated to reject the null hypothesis of exogeneity; therefore, this is evidence of endogeneity in the model.

Finally, tests to determine if instruments are validly excluded from the equation of interest were employed. Two tests of excludability were conducted for the male and female model: a Lagrange Multiplier (LM) test and a likelihood ratio (LR) test. For the model including males the results for the LM test ( $NR^2=73.78$ ;  $\text{prob}>0.00$ ) and the results for the LR test ( $LR=24.70$ ;  $\text{prob}>0.00$ ) indicate to reject the null hypothesis of excludability. Some instruments may be inappropriately excluded from the logit model; however, these tests results do not provide diagnostics on which instrument(s) may need to be excluded.

For the model including females the results for the LM test ( $NR^2=5.54$ ;  $\text{prob}>0.85$ ) support rejecting the null hypothesis of excludability. The results of the LR test were inconclusive ( $LR=-3.35$ ;  $\text{prob}>1.00$ ). For this model the instruments are most likely appropriately excluded from the logit model.

Also, though not reported, the standard errors for the model with robust standard errors were very similar to the model with bootstrapped standard errors for both the male and female model. Because of this similarity, while the models reported bootstrapped standard errors, but the disability-specific models were run with conventional robust standard errors because of the substantial computing time required for bootstrapping.

## Data Sources

For this study, data from the 1995 National Health Interview Survey on Disability (NHIS-D) and the 1995 NHIS Core and Condition files were used. The specific NHIS-D file, the 1995 Adult Follow-back Phase II, includes questions on housing and long-term care services, transportation, social activity, work history/employment, vocational rehabilitation, assistive devices and technologies, health insurance, assistance with key activities, self direction, family structure, relationships, living arrangements, conditions and impairment, health opinions and behaviors, community services and proxy status. While this data is more than 10 years old, these variables are not available in any other year's files.

Respondents for the 1995 Adult Follow-back Phase II were identified through the 1995 Disability Phase I survey. The Phase I survey included screening questions regarding health conditions and activity limitations. The Phase I survey defined disability more broadly than self-reported work limitation and therefore includes a broad representation of persons with disabilities that more closely approximates the ADA disability definition.

The 1995 Adult Follow-back Phase II was designed to be used in conjunction with the NHIS Core and Condition files that were fielded in 1995. The Core file provides basic demographic data and the Condition file provides information regarding specific medical conditions and disability types. For the NHIS 1995 the Household response rate was 93.8%; the response rate for the Disability Phase I was 92.8% and the response rate for the 1995 Adult Follow-back Survey was 92.1% (U.S. Department of Health and Human Services, 1999).

The 1995 Adult Follow-back Phase II file contains 9,574 non-institutionalized individuals who are ascertained to have a disability. The final sample used for this study includes 6,312 disabled non-institutionalized individuals ages 18 to 64.

### Use of Sampling Weights

The NHIS is a complex, multistage probability sample that incorporates stratification, clustering, and oversampling of certain subpopulations such as individuals who are Black and/or Hispanic. Therefore, sampling weights were used to produce representative estimates, correct standard errors and statistical tests (National Center for Health Statistics, 1989, 1999). It should also be noted that due to confidentiality issues, many of the original locational variables are suppressed in the NHIS public use files. However, NCHS has released public use design variables representing pseudo-strata and pseudo-PSU variables for the years 1987 to the present. These variables were incorporated into the study in order to produce generalizable analyses. Additionally, STATA survey commands were used to create nationally representative results (Stata, 2007).

### Measures

Whenever possible, robustness analyses were conducted using alternative definitions of several key variables. Measures are briefly summarized in Appendix 4. Also, Appendix 3 provides a crosswalk of the specific conditions used in the disability type analysis. This table includes the disability group category, the specific condition or disease, the corresponding ICD number and the NHIS codes.

### Dependent Variable

The outcome variable for all models is “**employment status**”. Employment status was determined by responses for the question asked regarding work status one to two weeks prior to the interview. The survey question was worded “During those two weeks did (respondent) work at any time at a job or business not counting work around the house?” Employment status was coded as a binary dependent variable. The potential responses in which the respondent indicates that they do have a job whether they worked on the job or not were coded as employed. These responses include the following: 1) worked in the past

two weeks, 2) did not work, has job; not on lay off and not looking for work, and 3) did not work, has job; looking for work. All other responses were coded as unemployed.

### Independent Variables of Interest

For the main independent variables of interest, categorical variables were constructed from social contact variables from the NHIS-D. The NHIS-D includes questions regarding social activities the respondent engaged in during the past two weeks. The survey asks if the respondent “got together with friends or neighbors in the past two weeks” and if the respondent answered affirmatively, asks the number of times. The survey also includes questions regarding talking on the telephone with friends or neighbors and the frequency of telephone contact. These questions were repeated for face to face contact and telephone contact with relatives.

The endogenous variables, type of social network were constructed into an exhaustive and mutually exclusive categorical variable, which includes the following categories:

1) “socially isolated” – no telephone contact or visits from family members or friends for the past two weeks;

2) “family dominated network”- frequent telephone contact and visits with family members and infrequent or telephone contact or visits from friends in the past two weeks;

3) “friends dominated network”- frequent telephone contact and visits with friends and infrequent or telephone contact or visits from family members in the past two weeks;

4) “family and friends dominated network- high frequency ” - frequent telephone contact and visits with family members and friends for the past two weeks. For this category the number of contacts with both family and friends are in excess of the mean.

5) “family and friends dominated network- low frequency ” – less frequent telephone contact and visits with family members and friends in the past two weeks. For this category the number of contacts with family and friends are below the mean.



These variables were created by ordering data to determine the level of contact individuals receive in each of family or friendship domains. The portion of the sample that reported no contact in the previous two weeks from friends, neighbors or family were deemed “socially isolated”. Of those who were not in the socially isolated category, those who have contact with their friends in excess of the mean number of contacts with contacts with family members below the mean number of contacts were deemed to have a “friends dominated network”. Individuals with a “family dominated network” were determined in a similar manner. The remaining sample was categorized as “family and friends dominated”. To further refine this variable, individuals who had both friends and family contact events in excess of the mean were categorized as “family and friends dominated- high contact”. Those individuals who had both friends and family contact events below the mean were categorized as “family and friends dominated- low contact”. Similarly constructed categorical variables have been used in a study of the social network characteristics of physically disabled persons (Morgan et al.; 1984) and a study of the occupational functioning of individuals with psychosis (Evert et al., 2003).

**Type of disability condition.** For analyses that require identification of specific disability types, the disability category was identified by matching the NHIS person file with the NHIS condition file. NHIS condition files contain several recodes for several different medical conditions that can be disabling. These conditions were constructed when a condition was reported by the NHIS respondent to be the main or secondary cause of an activity limitation or work limitation. Specific disability groups were constructed through NHIS impairment and chronic condition codes. NHIS defines an impairment as a “chronic or permanent defect, usually static in nature, that results from a disease, injury or congenital malformation.” These include: blindness, deafness, hearing impairment, mental retardation, mental illness, and mobility impairment. These impairments constitute a very strict interpretation of the ICF disability model. For the purposes of this analysis, the condition

codes for blindness, deafness and hearing impairment were collapsed into a single category which was called “sensory impairments”.

NHIS defines “chronic condition” as a medical condition that has a date of on-set three months prior to the date of the respondent interview or it is a condition that ordinarily has a duration in excess of three months. In this analysis, these conditions included: arthritis, cancer, diabetes, heart disease, diseases of the nervous system and respiratory disease. While still within the confines of the ICF disability model, inclusion of these conditions broadens the definition of disability. The specific diseases and conditions that comprise each disability group are found in a table in Appendix 3. The table includes the disability group category, the specific condition or disease, the corresponding ICD number and the NHIS codes.

#### Other independent variables

Other independent variables that are potential predictors of workforce participation are also included in both studies. These variables have been used in numerous studies of labor force participation of persons with disabilities (Baldwin et al., 1994; Barnartt & Altman, 1997; Baldwin & Johnson, 1994; Findley & Sambamoorthi, 2005; Zwerling et al., 2002).

**Age.** Age was included as an independent variable as it can be a proxy for job experience under human capital theory. The NHIS provides the age as the age at last birthday (Adams et al., 1999). Because it was theorized that age could have an inversely proportionate effect on labor force participation, age was tested to determine if the variable should be included in a linear or quadratic form. A Wald test was conducted and from the results ( $\chi^2=130.92$ ;  $\text{prob}=0.000$ ), it was determined that age should also be included in the quadratic form.

**Race.** While not the focus of this study, race, such as age, disability and gender can be the focus of discrimination in the marketplace and can be associated with underemployment and unemployment. In this study, race was a self-reported variable that

was measured as a categorical variable. The categories included: White, Black, and Other. The NHIS category “other” includes Aleut, Eskimo, American Indian, Asian, Pacific Islander or any other race not listed separately. NHIS documentation states that race characterization is based on the respondents’ description of his or her racial background as well as the racial background of each family member (Adams et al., 1999). Additional information on how decisions are made to code race if the respondent’s description of their racial background does not match the racial background of family members was not provided in NHIS documentation.

**Sex.** Discrepancies in employment status based on gender are well researched among the non-disabled population (Blau et al., 1998; Buding & England, 2001). Additionally, there is some research conducted pre-ADA that indicates gender disparities among employment status of persons with disabilities. In this study, sex was a self-reported measure and was measured as a binary variable indicating male or female.

**Marital Status.** Marital status is considered to have an impact on employment in that it can have an impact on household wages. Research has shown that women who are married and have small children have a lower probability of working full-time in the labor force. For this purposes of this study, marital status was a self-reported measure that was measured as a categorical variable. The categories as provided in the NHIS include: married spouse in household, married spouse not in household, widowed, divorced, separated, never married, and other. Due to small sample size, for the purposes of this study, the category married spouse not in household was combined with married spouse in household and the category other was combined with never married.

**Education.** Education is considered to be a key variable in human capital theory. Due to the constraints of the NHIS data set, education was included in the model as a categorical variable. The categories are no high school diploma, high school graduate,

some college, college graduate, post graduate and unknown. Due to small sample size, the category unknown was combined with no high school diploma.

**Family Size.** Family size is considered to have an impact on employment in that it can have an impact on household expenditures. Since it was theorized that family size could have an inversely proportionate effect on an individual's decision to enter the labor force, family size was tested to determine if the variable should be included in a linear or quadratic form. A Wald test was conducted and from the results ( $\chi^2 = 32.05$ ;  $\text{prob} = 0.000$ ), it was determined that family size should also be included in the quadratic form.

**Family Income.** Family income is theorized to have an impact on decisions for individuals to enter the workforce. The NHIS provides limited information on family household income. The income recorded is the total of all income received by members of the family except for the disabled respondent (as well as unrelated members living in the household) for the twelve month period preceding the week of the interview. Income from all sources including wages, salaries, rents from property, pensions, government payments and help from relatives are included in the total amount (Adams et al., 1999). For this study, I used the NHIS recode for family income which is defined as annual family income greater than \$20,000, less than \$20,000 and unknown. This was included in the model as a categorical variable.

**Region of the Country.** As there can be regional variations in employment status, region of the country was included as a variable. Region was measured as a categorical variable indicating the region of the country in which the respondent resides including Northeast, Midwest, South and West. These regions correspond to those used by the United States Bureau of the Census (Adams et al., 1999).

**Rural/Urban Status.** As there can be variations in employment status based on rurality, rural/urban status was included as an explanatory variable. Rural/urban status was measured as a categorical variable with the variable "rural" representing a non-metropolitan

statistical area (MSA). The NHIS follows the definition of MSA as defined by the United States Census Bureau (Adams et al., 1999).

### Instruments

Several potential instruments were identified to address potential problems with endogeneity.

**How Quickly Family Members Can Travel to Visit Respondent.** This variable was included as a potential instrument as it is perceived to be correlated with the endogenous variable social contact. It is theorized that the distance family members would have to travel to visit the respondent is correlated with the frequency of contact with family but would not be correlated with employment. The NHIS-D provides this variable as the number of hours it takes for a family member not living in the household to travel to visit the respondent.

**How Quickly Adult Children Can Travel to Visit Respondent.** This variable is perceived to function in the model in a similar manner as the family travel instrument. The NHIS-D provides this variable as the number of hours it takes for an adult child of a respondent that is not living in the household to travel to visit the respondent.

**Number of Living Relatives.** The NHIS-D provides information on the availability of the number of living relatives in several categories: sons, daughters, sisters, and brother. Additionally, the living relative status of the respondent's parents is also provided. It is perceived that these variables are theoretically appropriate instruments as living status is correlated with the frequency of contact with family but would not be correlated with employment. The NHIS-D does not differentiate if these relatives are household members.

**Frequency of Dining Out.** This variable was included as a potential instrument as it is perceived to be correlated with the endogenous variable social contact. It is perceived that frequency of dining out is correlated with the frequency of contact with friends and

family but would not be correlated with employment. The NHIS-D provides this variable as the number of times one has dined out in the past two weeks.

**Frequency of Attending Social Events.** Similar to dining out, this variable is perceived to be correlated with the endogenous variable social contact. It is perceived that frequency of attending social events is correlated with the frequency of contact with friends and family but would not be correlated with employment. The NHIS-D provides this variable as the number of times one has attended the movies or an outdoor sporting event in the past two weeks.

**Frequency of Attending Church.** This variable was included as a potential instrument as it is perceived to be correlated with the endogenous variable social contact. It is perceived that frequency of attending church is correlated with frequency of contact with friends and family but would not be correlated with employment. The NHIS-D provides this variable as the number of times church is attended in the past two weeks.

## **Analysis and Model Specification**

### Descriptive Analysis

Before conducting multivariate analysis, data were analyzed to gain a better understanding of how data might shape overall analyses. To help with functional form specification, descriptive characteristics including mean, median, standard deviation, skewness and kurtosis were analyzed to better understand the characteristics of the data.

Table 11 provides descriptive data for pooled analysis. Descriptive data is provided for combined genders as well as the male and female samples. Means were calculated with adjustments for survey weights, stratification and clustering. With the exception of age, family size and their squared values, all demographic variables are binary measures. The instruments of frequency of attending church, going to the movies, going out to eat and days out of the house in the past two weeks are continuous variables. For the majority of

measures, the male and female sample is similar with less than two percent differences in areas such as disability status, race, and geographic distribution. As would be expected, there are some economic disparities between men and women with a 10 percent higher employment rate among men and a higher percentage of men (three percent) residing in households with annual incomes greater than \$20,000. A higher percentage of men (six percent) are employed compared to women. Also, schooling is distributed differently among men and women with men having a small but higher percentage completing college and post graduate studies.

There are also some disparities between men and women for the social network variables. Nine percent of men are categorized as socially isolated compared to six percent of women. A higher percentage of women have a friends or a relative dominated contacts while a higher percentage of men have mixed contacts. Also, women appear to attend church more frequently, while men appear to go out to eat more frequently. Rates of movie attendance are similar for both sexes.

**Table 11.** Descriptive Statistics for Social Network Analysis

Variable	Mean	SE	Male Only		Female Only	
			Mean	SE	Mean	SE
Male	45.63%	-				
Female	54.37%	-				
Employed	54.32%	-	58.84%	-	50.52%	-
Socially Isolated	7.43%	-	9.49%	-	5.70%	-
Friends dominated contacts	16.74%	-	16.34%	-	17.08%	-
Relatives dominated contacts	16.05%	-	13.01%	-	18.60%	-
Relative and friends contacts- high frequency	19.19%	-	13.72%	-	23.78%	-
Relative and friends contacts- low frequency	40.59%	-	47.44%	-	34.83%	-
Too much social activity	4.75%	-	3.75%	-	5.59%	-
Not enough social activity	34.49%	-	31.59%	-	36.93%	-
About enough social activity	46.46%	-	44.83%	-	47.83%	-
Don't know if enough social activity	14.29%	-	19.82%	-	9.65%	-
Arthritis	39.07%	-	38.26%	-	39.75%	-
Cancer	2.36%	-	1.95%	-	2.70%	-
Circulatory disease	16.72%	-	17.32%	-	16.22%	-
Diabetes	5.53%	-	4.87%	-	6.09%	-
Nervous disorders	10.92%	-	9.05%	-	12.49%	-
Mental Illness	11.47%	-	10.93%	-	11.93%	-
Mental retardation	2.52%	-	2.92%	-	2.18%	-
Mobility Impairment	25.53%	-	26.86%	-	24.42%	-
Sensory Impairment	6.09%	-	11.76%	-	6.93%	-
Respiratory Disease	16.86%	-	13.90%	-	19.35%	-
White	83.05%	-	84.14%	-	82.14%	-
Black	13.46%	-	12.67%	-	14.12%	-
Other	3.49%	-	3.19%	-	3.74%	-
Age-42	0.50	0.20	0.79	0.29	0.25	0.22
Age-42 Squared	164.91	2.54	166.49	3.89	163.59	2.93
Family Size-3	-0.16	0.02	-0.22	0.03	-0.11	0.03
Family Size-3 Squared	2.33	0.06	2.32	2.32	2.33	0.08
Family income >20,000	38.81%	-	37.44%	-	39.95%	-
Family income <20,000	59.48%	-	60.93%	-	58.28%	-
Family income unknown	1.71%	-	1.63%	-	1.77%	-



**Table 11.** Descriptive Statistics for Social Network Analysis

Variable	Mean	SE	Male Only		Female Only	
			Mean	SE	Mean	SE
Northeast	18.14%	-	19.52%	-	16.98%	-
Midwest	23.74%	-	24.56%	-	23.05%	-
East	21.52%	-	19.79%	-	22.98%	-
South	36.59%	-	36.14%	-	36.98%	-
High school graduate	37.13%	-	36.74%	-	37.45%	-
Associates degree/Some college	21.07%	-	19.73%	-	22.20%	-
College graduate	8.26%	-	8.69%	-	7.89%	-
Post graduate work	6.67%	-	6.71%	-	6.63%	-
No high school diploma	26.11%	-	27.36%	-	25.07%	-
Schooling unknown	0.76%	-	0.77%	-	0.76%	-
Married Spouse in household	55.73%	-	58.74%	-	53.21%	-
Married Spouse not in household	0.91%	-	0.92%	-	0.90%	-
Widowed	4.03%	-	1.33%	-	6.30%	-
Divorced	12.72%	-	10.30%	-	14.75%	-
Separated	4.28%	-	2.97%	-	5.37%	-
Unmarried	22.32%	-	0.18%	-	0.13%	-
Urban	77.48%	-	75.95%	-	78.75%	-
Rural	22.52%	-	24.05%	-	21.25%	-
<i>Instruments</i>						
Frequency of attending church	0.89	0.03	0.76	0.03	1.01	0.03
Frequency of attending movies	0.86	0.03	0.86	0.05	0.86	0.04
Frequency of going out to eat	2.27	0.09	2.60	0.18	2.00	0.06
Number of living children	2.13	0.03	1.99	0.04	2.26	0.04
Number of living sisters	1.72	0.03	1.69	0.04	1.76	1.76
Number of living brothers	1.66	0.02	1.66	0.04	1.66	0.03
Mother living	0.62	0.01	0.61	0.01	0.63	0.01
Father living	0.43	0.01	0.42	0.01	0.43	0.01
Time takes family to travel to you	1.70	0.11	1.81	0.14	1.60	0.15
Time takes adult children to travel to visit you	0.84	0.07	0.94	0.10	0.75	0.08
Number of observations	6312		2766		3546	

In order to determine if there were issues with multicollinearity in the data, the variance inflation factor (VIF) was calculated for each variable. As a high degree of correlation would be expected among quadratic terms and interaction terms, these terms were not included in the VIF analysis. The VIF scores ranged from 1.02 to 1.67; therefore, no serious issues with multicollinearity were detected with these data.

### Data Completeness

All data for this study are from the NHIS 1995 Condition File and the NHIS Disability Follow-Up File 1995 which is previously described. Issues with data completeness have been addressed through the NHIS survey documentation process. Missing values for data have been imputed by the NHIS program staff where possible or simply coded unknown using NHIS procedures. No observations were excluded due to missing values. Also, the response rates for the three surveys used to provide this data are as follows. For the NHIS 1995 the Household response rate was 93.8%; the response rate for the Disability Phase1 was 92.8% and the response rate for the 1995 Adult Follow-back Survey was 92.1% (U.S. Department of Health and Human Services, 1999).

### Variable Specifications

In order to determine the best function for specific variables, analyses were conducted including continuous variables in their quadratic forms. To minimize bias in the interpretation of the effect on employment status, the variable mean was subtracted from all observations and quadratic terms were created from the de-meanned form (Wooldridge, 2009). The coefficients could then be interpreted as a change in employment status due to a change in the independent variable for values of that variable close to the mean as opposed to values of the variable near zero, which provides for an easier interpretation.

### **Results**

Results of the analyses related to the social network portion of this study are found in Table 12 and Figures 10 and 11. Table 12 relates to Hypothesis 2a and 2b.

**Table 12.** Analysis Results: Effect of Social Network Types on Employment of Men and Women with Disabilities

	Male	Bootstrapped	Female	Bootstrapped
	Coefficient	S.E.	Coefficient	S.E.
Socially Isolated	-0.195	1.15	0.023	0.84
Friends dominated contacts	0.176	1.03	2.379*	1.12
Relatives dominated contacts	0.779	1.89	2.247*	1.01
Relative and friends contacts- high frequency	3.417**	1.20	0.424	0.71
Relative and friends contacts- low frequency (referent category )	-	-	-	-
Black	-0.506**	0.18	-0.130	0.14
Other	-0.794*	0.40	0.089	0.24
White (referent category)				
Family income <20,000	-1.637**	0.14	-1.145**	0.11
Family income unknown	-1.265**	0.45	-1.251**	0.36
Family income >\$20,000 (referent category)				
Northeast	-0.110	0.18	-0.201	0.13
Midwest	0.011	0.16	0.144	0.12
East	0.083	0.17	0.080	0.13
South (referent category)				
Age-42	-0.046**	0.01	-0.045**	0.01
Age-42 Squared	-0.002**	0.00	-0.002**	0.00
Family Size-3	-0.195**	0.05	-0.243**	0.05
Family Size-3 Squared	0.018	0.02	0.035**	0.01
No high school diploma	-0.556**	0.18	-0.542	0.13
Associates degree/Some college	-0.223	0.18	0.217	0.12
College graduate	0.282	0.23	0.579**	0.19
Post graduate work	0.527*	0.26	0.814**	0.23
High school diploma (referent category)				
Married Spouse not in household	0.854	0.64	0.587	0.57
Widowed	-0.542	0.57	0.238**	0.22
Divorced	-0.315	0.21	0.654	0.14
Unmarried	0.142	0.41	0.184	0.23
Married (referent category)				
Too much social activity	1.190**	0.40	0.058	0.21
Not enough social activity	-0.098	0.14	-0.342**	0.10
Don't know if enough social activity	0.074	0.25	-0.372	0.20
Social activity just right (referent category)				
Residual 1	-0.013	1.19	-0.445	0.88
Residual 2	-0.590	1.05	-2.455*	1.12
Residual 3	-1.136	1.89	-2.225*	1.01
Residual 4	-3.604**	1.22	-0.413	0.73
Intercept	0.980*	0.49	-0.171	0.41
Number of observations	2766		3546	
Log psueodlikelihood	-1483.65		-2044.35	

\*p<0.05; \*\*p<0.01

**Hypothesis 2a.** Hypothesis 2a states that the presence of social networks and frequency of social contacts is associated with greater labor force participation for disabled persons.

In order to test this hypothesis, after the 2SRI models were run, a Wald test to test the joint significance of the social contacts variables was conducted. The results of this test among men with disabilities was  $\chi^2=15.99$ ;  $\text{prob}=0.003$  and among women with disabilities was  $\chi^2=14.12$ ;  $\text{prob}=0.006$ ; therefore, for both the male and female sample the null hypothesis that the social contact variables were all equivalent to zero and there is no difference in employment among the different social contact categories was rejected. Social networks do have an impact on employment for both disabled men and women.

Additional Wald tests were conducted after the 2SRI models to better understand the presence of social networks. This included tests to determine if the coefficients on the socially-isolated network were equivalent to the coefficients on the other social network categories for both the male and female models. The results of these tests among men indicated to reject the null hypothesis of equivalence for socially isolated networks and networks comprised of friends and family members with high frequency contacts ( $\chi^2=7.88$ ;  $\text{prob}=0.005$ ) and fail to reject the null hypothesis of equivalence for socially isolated networks and networks comprised of friends dominated ( $\chi^2=0.09$ ;  $\text{prob}=0.759$ ) or family dominated contacts ( $\chi^2=0.33$ ;  $\text{prob}=0.563$ ). These results indicate that among disabled men, a network characterized as socially isolated does have a different effect on employment outcomes from a network comprised of friends and family members with high frequency contacts. A socially isolated network does not have a different effect on employment outcomes compared to friends dominated networks or family dominated networks.

The test results for women were different from that of men. Test results indicated to reject the null hypothesis of equivalence for socially isolated networks and networks comprised of friends dominated contacts ( $\chi^2=7.99$ ;  $\text{prob}=0.005$ ) or family dominated contacts ( $\chi^2=5.97$ ;  $\text{prob}=0.015$ ). Test results also indicated to fail to reject the null hypothesis of equivalence for socially isolated networks and networks comprised of friends and family members with high frequency contacts ( $\chi^2=0.02$ ;  $\text{prob}=0.892$ ). These results showed that among disabled women, a network characterized as socially isolated does have a different effect on employment outcomes from networks that are friends dominated or family dominated. A socially isolated network does not have a different effect on employment outcomes compared to mixed networks with high frequency contacts.

In order to further clarify the meaning of these results, predictions of the probability of employment of men and women with modal characteristics for all social contact categories were performed. More specifically, the probability was predicted for a white, married, 42 year old, living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with a high school degree. Among disabled men who were categorized to be socially isolated, there was a 68.68 percent chance of labor force participation. This can be compared to a 76.06 percent probability of employment for those with a friends dominated network and 85.31 percent probability of employment for those with a family dominated network. The probability of employment of a disabled man with a mixed network with a low frequency of contacts, the referent category, was 72.72 percent. The highest probability of employment for a disabled man proved to be among those with a mixed network with a high frequency of contacts (98.78 percent). This result was the only network coefficient among disabled men that was significantly different from the referent category low frequency contacts from a mixed friends and family member network.

The probability of employment among disabled women who are socially isolated and have mean values of other variables was calculated to be 45.74 percent. This can be

compared to the predicted probabilities of disabled women with other types of social networks. Women with disabilities with a friends dominated network had a 90.10 percent probability of employment while women with a relatives dominated network had an 88.85 percent probability of employment. Both of these results were significantly different from the referent category friends and family with low frequency contacts. Interestingly, lower levels of probable employment were found among women with mixed friends and family networks. Women with disabilities with mixed networks with frequent contacts had a 56.29 percent chance of being employed while those with less frequent contacts had a 45.74 percent chance of being employed. The coefficient for women with disabilities with mixed networks with frequent contacts was not significantly different from that of women with disabilities with mixed networks with a lower number of contacts.

In comparing the results of men and women, the lowest probability of employment for both groups was among individuals deemed socially isolated, while higher probabilities of employment for disabled men and women were found in categories in which higher levels of social contact occurs. The coefficients on both the male and female models were the lowest values of the four social contact variables; however, these results were not significantly different than the referent category friends and family with low frequency. Among disabled men, the only coefficient that was significantly different from the referent category was for men with a mixed family and friends network with high levels of contact. This coefficient also had the highest value. Among women with disabilities, the coefficients on the social network categories of friends dominated contacts and relatives dominated contacts were of the highest value and also significantly different than the category friends and family with low frequency.

**Hypothesis 2b.** Hypothesis 2b states that friendship networks and familial networks have a differential effect on labor force participation for persons with disabilities. The

presence of a friendship network would have a stronger association with labor force participation as compared to a familial network for persons with disabilities.

In order to test this hypothesis, after the 2SRI models were run, a test to determine if the coefficient on the friends dominated network was equivalent to the coefficient on the family dominated network was run for both the male and female models. The results of this test among men with disabilities was  $\chi^2=0.11$ ;  $\text{prob}=0.7353$  and among women with disabilities was  $\chi^2=0.02$ ;  $\text{prob}=0.892$ ; therefore, I failed to reject the null hypothesis that the friends and family variables were equivalent for both the male and female sample.

These results indicate that friends dominated social networks compared to family dominated social networks do not appear to have different effects on the employment status of men and women with disabilities as studies have indicated they would in the non-disabled population.

**Hypothesis 2c.** Hypothesis 2c states that social networks have a differential association with labor force participation of different disability groups. There will be a stronger positive correlation between employment and social networks among persons with disabilities that are viewed more positively by society than persons with disabilities viewed more negatively by society. Analysis results for this hypothesis vary across disability types.

Figures 10 and 11 provide information on analyses related to Hypothesis 2c. These tables provide the predicted probability of employment by social contact type. These results are provided by disability type and gender. In these analyses, the probabilities are estimated for the base case for men and women which has been described in the methods section.

As stated previously, there were a total of 15 disability-gender models run for this analyses provided below. In the interest of space, the full set of model coefficients are provided in Appendices 5 and 6; below, I describe the predictions from these models.

In viewing the overall results for men with disabilities, general patterns of employment emerge for different disability groups. As with men with any disability, many of

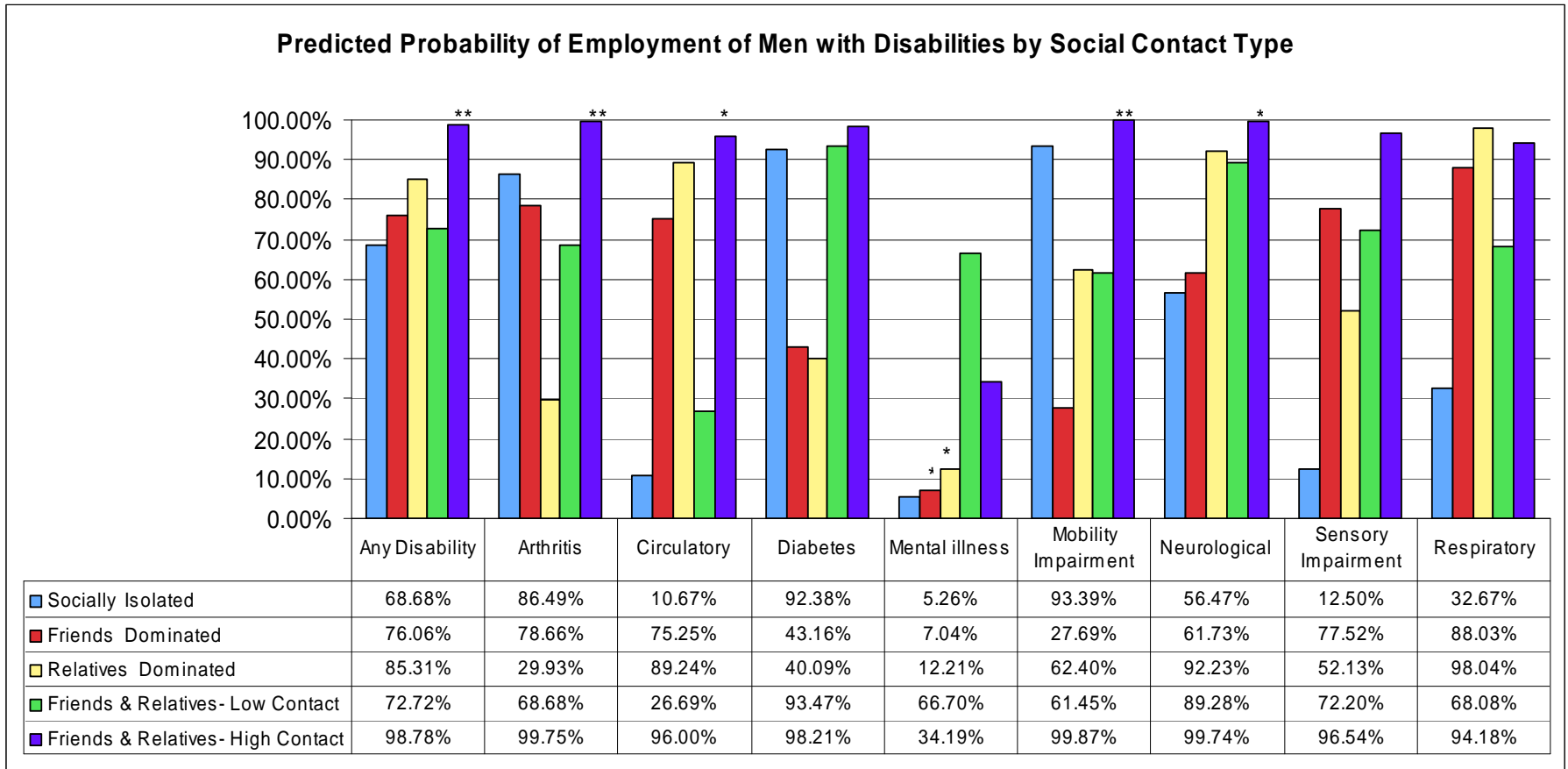
the specific disability groups have the highest probability of employment among men with mixed friends and family social contacts of high frequency. For men with arthritis, circulatory disease, mobility impairments and neurological disease, the mixed social contact category is significantly different from the referent case and has the highest probability of employment, ranging from 96.00 percent to 99.87 percent. The results for men with circulatory conditions, mobility impairments and neurological conditions were significantly different than the category mixed friends and family social contacts of low frequency at the .05 level while the results for men with arthritis were significantly different at the .01 level.

Other disability groups including diabetes, sensory impairments and respiratory disease also have a high probability of employment among this social contact category, ranging from 94.18 percent for respiratory disease to 98.21 percent for diabetes. These results are not statistically significant from the results for men with these disabilities that have mixed social networks with low frequency contacts.

Additionally, the probability of employment based on social contact type for the disability groups of circulatory disease, mental illness, neurological disorders sensory impairments and respiratory diseases most closely approximate the employment patterns evidenced by that of men with any disability. In this predominant pattern, there is a lower level of probability of employment among those who are socially isolated, while the highest probability of employment occurs among those who have a high level of contact with a mixed network of family and friends. A different pattern emerges among men with arthritis, diabetes and mobility impairments. In this pattern, those who are socially isolated have a nearly equivalent probability of employment as those who have a mixed network with frequent contacts; however, these results are not significantly different from those of the referent social network category. Among men with disabilities, there also appears to be trends in the probability of employment based on social contact and disability type. Men



**Figure 10. Predicted Probability of Employment of Men with Disabilities by Social Contact Type**



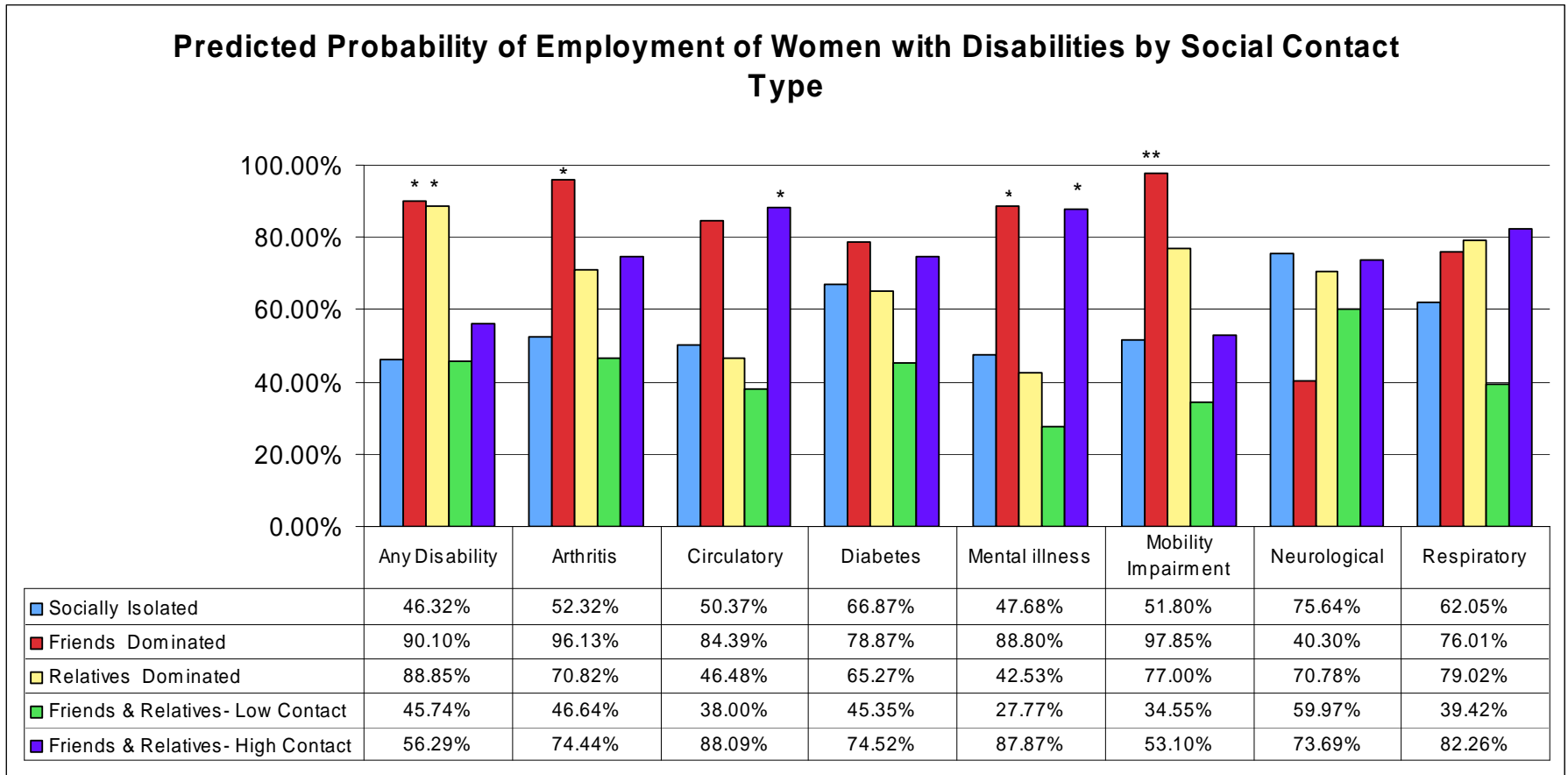
\*p<0.05; \*\*p<0.01

Note: *p* values refer to significance of the coefficients in the outcome equation. Predicted probabilities are provided for the modal case which is white, married, 42 year old, living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with a high school degree.

with mental illness, a condition frequently associated with discrimination, appeared to experience a substantially decreased probability of employment overall compared to other disability groups. To illustrate, men with a diagnosis of mental illness had a 5.26 percent probability of employment if they were considered socially isolated, a 7.04 percent probability of employment if they had a friends dominated network and a 12.21 percent probability of employment if they had a family dominated network. Of these, only the coefficients on the friends dominated and family dominated categories were significantly different from that of men with mental illness with mixed social contacts of low frequency. There was a slightly higher probability of employment among men with mixed social networks. A man with a mental health diagnosis with a mixed network with less frequent social contact had a 66.70 percent probability of employment while a man with mental illness with a mixed network with frequent contacts had a 34.19 percent probability of employment. However, the difference between these two categories was not statistically significant.

In viewing the combined results for women with disabilities, there appeared to be some overall patterns of employment for different disability groups. As with women with all disabilities combined, many of the specific disability groups have the highest probability of employment among women with friends-dominant social contacts. For women with arthritis, mental illness, and mobility impairments, the friends-dominant social contact category has the highest probability of employment, ranging from 88.80 percent to 97.85 percent. This category for women in these disability groups was significantly different than that of the referent social network category. The results for women with arthritis and mental illness were significant at the .05 level while the results for women with mobility impairments were significant at the .01 level. Other disability groups including circulatory disease, diabetes,

**Figure 11. Predicted Probability of Employment of Women with Disabilities by Social Contact Type**



\*p<0.05; \*\*p<0.01

Note: *p* values refer to significance of the coefficients in the outcome equation. Predicted probabilities are provided for the modal case which is white, married, 42 year old, living in an urban area in the south, with an annual family income greater than 20 thousand, family size of three, and with a high school degree. Results for sensory impairment are not reported due to convergence issues.

and respiratory disease also have a high probability of employment among this social contact category, ranging from 76.01 percent for respiratory disease to 84.39 percent for circulatory disease. However, the results for this category were not significantly different from that of the category mixed social contact of low frequency.

There appeared to be a great deal of variability among the disability groups for the social contact category of relatives dominated network. Two disability groups indicated a low probability of employment associated with this type of social contact category. Women with mental illness had a 42.53 percent probability of employment, while women with circulatory disease had a 46.48 percent probability of employment. All other disability categories had much higher probabilities ranging from 70.78 percent to 79.02 percent. Results for this category were not significantly different from that of the referent social category for any disability group.

For the social contact categories with mixed friends and family contact, women with disabilities appeared to have lower levels of employment associated with less frequent contacts. Results ranged from 27.77 percent probability to 59.97 percent probability. On the other hand, for the category mixed contacts with high frequency, two disability groups had among the highest probabilities of employment for the disability group. These results were also significantly different from those for women with mixed contacts of low frequency. For this category, disabled women with circulatory disease had an 88.09 percent probability of employment and women with mental illness had an 87.87 percent probability of employment.

## **Conclusions**

### Discussion

The results of this analysis of the impact of the social networks on the labor force participation of persons with disabilities indicate that specific components of social networks,

frequency and type of social contacts, are associated with employment. As evidenced among studies among non-disabled persons, there was a somewhat positive association between the presence of friends dominated and family dominated social network and employment among women with disabilities and a positive association between the presence of and friends and family dominated social networks with high frequency social contact and employment among disabled men.

#### Variation among Gender

One of the most interesting findings of this study is the apparent variation among disabled men and women. These differences were first apparent among the types of social contact that disabled men and women reported. While the social contact categories were ranked similarly among disabled men and women with the greatest percentage of each falling into the category of mixed social contact low frequency and the smallest percentage falling among those deemed socially isolated, there were differences in the distribution of disabled men and women among the categories. A higher percentage of disabled men had no social contacts and were categorized as socially isolated. Women also had slightly higher percentages among friends dominated social contacts and relatives dominated contacts while men had a higher percentage of respondents who were classified in the mixed contact/high frequency category.

Among disabled women, there was a higher probability of employment associated with having friends dominated or family dominated social contacts; however, higher probability of employment among disabled men was associated with a high frequency of contacts with a mixed network for family and friends. While this suggests that the employment status of both genders benefits from having a high frequency of contacts, on the whole, disabled women appear to have a higher probability of employment if their social contacts are predominantly from one group. While additional factors regarding the social contacts, such as the initiator of the contact, the responsibilities associated with them or the

support gleaned from them, is not clarified in the data, one could ascertain that disabled women experience social contacts differently from disabled men. It appears that disabled women with social networks that are predominantly of one type and therefore require similar responsibilities and provide similar types of support have a higher probability of employment. It appears that for women with disabilities that have social networks comprised of both friends and family with high frequency contacts, there is no employment benefit. The same does not seem to hold true for disabled men.

### Variation among Disability Groups

Another interesting finding of this study is the variation of the impact of social networks among certain disability groups, although the variation by gender appears to have a stronger effect than variation by disability group. This disability group variation is most evident among persons with mental illness, particularly men with mental illness. Men with mental illness had the lowest overall probability of employment compared with men with any disability and men with other specific disability groups. The pattern of probability of employment based on social contact type was similar to that demonstrated by men with disabilities in general, with men who are socially isolated demonstrating the lowest probability of employment and men with friends or family dominated networks demonstrating higher levels of employment and those with mixed networks demonstrating the highest probability of employment. This pattern appears to mirror that found in the study of individuals with psychosis conducted by Evert and colleagues (2003). They found higher levels of employment among individuals with mixed social networks. As they did not differentiate between high levels of contact and low levels of contact, it is not possible to compare these patterns.

This pattern of employment was not found among women with mental illness, however. Unlike men with mental illness, women with mental illness had a higher probability of employment for every type of social contact variable. These levels were similar to those

demonstrated among other groups of disabled women. Women with mental illness, like women with any disability had a significantly higher probability of employment if their social contacts were predominantly from friends.

### Study Limitations

For this study, there are a few limitations that warrant discussion. First, despite attempts to control for endogeneity, bias may still persist due to the use of invalid exclusion restrictions. Testing results revealed that some of the instruments used may have been inappropriately excluded from the second stage equation; however, test results do not pinpoint the specific instrument(s).

A second limitation is that this study did not use a non-disabled comparison group so it is difficult to draw conclusions on whether social networks serve the same function with disabled groups that they do with the general population. However, the study did use different disability groups and therefore comparisons can be made among those groups.

A third and final limitation of this study is omitted variable bias. These results could be biased due to missing information regarding social networks. Due to the limitations of the data, there was no information regarding network size and strength of network ties.

### Policy Implications and Future Research

In conclusion, these findings emphasize the importance of assisting persons with disabilities in maintaining social networks with family and friends. This study has demonstrated a strong relationship between social networks and occupational functioning among men and women with disabilities, regardless of disability type. In practical terms, these results emphasize the importance of professionals who work to improve occupational outcomes of persons with disabilities in building strategies to help those with disabilities to maintain existing relationships and forge new ones.

Several strategies should be employed by policy makers to increase the employment of persons with disabilities. One option would be flexible funding streams for vocational

rehabilitation providers to administer to facilitate increased social inclusion opportunities for persons with disabilities. Funds could be used to pay for fees or dues for clubs and events, transportation to social events and outings or accommodations an individual may need to fully participate in social events. Funding could be provided for accommodations for private social events that are not already covered by Section 504 of the Rehabilitation Act or the Americans with Disabilities Act. Accommodations could include sign language interpreters for individuals who are deaf, aides for individuals who need physical assistance or adaptive technology that could facilitate inclusion in a social setting.

Another strategy would be to provide funding for social skills training for persons with disabilities. Such training could expand the social and interviewing skills training currently provided through vocational rehabilitation providers and focus on social skills necessary to gain and maintain friendships and improve relationships with family members.

Another strategy would include additional funding for drop-in centers. A facility-based program providing advocacy, support and training, drop-in centers have targeted serving individuals who are homeless or mentally ill. The target population of drop-in centers could be expanded to serve individuals with other disabilities such as physical or developmental disabilities. Additionally, services could be expanded to include social skills training and a wider variety of recreational activities.

Finally, since persons with mental illness, particularly men, seem to have a low probability of employment, policy makers should ensure that existing programs funded through the public mental health system should emphasize strengthening social networks as a means towards gainful employment. For example, flexible funding should be provided as an adjunct to existing supported employment programs to enable men with mental illness to improve existing social contacts and build new ones.

What is not clear from this research is what particular types of social ties should be enhanced for persons with disabilities. It is not known whether there is a differential benefit



in facilitating increased social opportunities with individuals with similar disabilities, different disabilities or with members of the general population. Further research is required to determine if persons' with disabilities employment status benefits from increased social contact opportunities with others with disabilities or with non-disabled community members.

Further research is also needed to see if technology-based social networking tools can be used as an effective method to increase social contacts and social networks among persons who are disabled. The internet coupled with adaptive technology could level the playing field for persons with disabling conditions that limit mobility or impair verbal communication. Research is needed to see if access to the internet and social networking websites can increase networks for persons with disabilities and lead to increased employment opportunities.

## APPENDICES

### Appendix 1. Variables for ADA Policy Study

Dependent Variable	Measure
Employment status	Dummy variable - 1= if employed within the past two weeks in reference year, 0 otherwise
Main explanatory variables Note: Variables are constructed as dummy variables unless otherwise noted	
Human Capital	
Health - Disabled- strict definition	Self reported work disability
Disabled- inclusive definition	Any limitation
Arthritis (Disability categories)	Determined by chronic condition codes and diagnostic recodes, translated from self report of arthritis
Cancer	Determined by chronic condition codes and diagnostic recodes, translated from self report of cancer
Circulatory conditions	Determined by chronic condition codes and diagnostic recodes, translated from self report of circulatory conditions
Diabetes	Determined by chronic condition codes translated from self report of diabetes
Mental Illness	Determined through ICD-9 codes; translated from self-report of mental illness
Mental retardation	Determined by chronic condition code, translated from reported cognitive impairment
Mobility/Orthopedic Impairments	Determined by chronic condition codes and diagnostic recodes, translated from self report of mobility/orthopedic conditions
Neurological Disorders	Determined by chronic condition codes and diagnostic recodes, translated from self report of neurological disorders
Sensory Impairments	Determined by chronic condition codes and diagnostic recodes, translated from self report of sensory impairments including deafness, blindness, hearing and speech impairments
Respiratory Conditions	Determined by chronic condition codes and diagnostic recodes, translated from self report of respiratory conditions
Education	
Age-39	Age 39 is the base case
Marital Status	Married- Spouse in household is the referent case
Individual Factors	
Female	Male is referent case
Black	White is the referent case
Other race	White is the referent case
Socioeconomic Factors	
Family Size-3	
Family Size-3 Squared	
Family income	
Region	Includes Northeast, Midwest, East and South. South is the referent case.
Urban	Rural is the referent case

**Appendix 1. Variables for ADA Policy Study (continued)**

Dependent Variable	Measure
<b>Year Variables</b>	
Pre ADA (1988 – 1992)	Indicates year 1988 through 1992 or pre ADA implementation
Post ADA (1994-2001)	Indicates year 1994 through 2001 or post ADA implementation. 1993 is the referent year as it is the year the ADA was implemented.
<b>Interaction Terms</b>	
<b>Hypothesis 1.a.</b>	
Disabled- strict definition*1988-2001	Interaction term indicating employment effect on disabled <u>with a self reported work disability</u> after implementation of law
Disabled- inclusive definition*1988-2001	Interaction term indicating employment effect on disabled <u>with any limitation</u> after implementation of law
<b>Hypothesis 1.b.</b>	
Disability*Male*1988-2001	Interaction term indicating effect on employment of disabled <u>men</u> after implementation of law
Disability*Female*1988-2001	Interaction term indicating effect on employment of disabled <u>women</u> after implementation of law
<b>Hypothesis 1.c.</b>	
Arthritis *1988-1996	Interaction term indicating employment effect on <u>specific disability group</u> after implementation of law
Cancer *1988-1996	Note: Changes in the NHIS preclude analysis of disability groups past 1996
Circulatory Conditions *1988-1996	“ “
Diabetes*1988-1996	“ “
Mental Illness*1988-1996	“ “
Mental retardation*1988-1996	“ “
Mobility/Orthopedic Impairments*1988-1996	“ “
Neurological Disorders*1988-1996	“ “
Sensory Impairments*1988-1996	“ “
Respiratory Impairments *1988-1996	“ “

**Appendix 2: Disability Definition Crosswalk**

Disability Definition	Year(s) Available in NHIS data	Question	Variable name	Programming code	Definition	Variable location
Strict definition Wrkdis1a	1988-1996	<b>Activity Limitation Status Measured by “Ability to Work” – Recode</b> from question “Does any impairment or health problem keep ___ from working at a job or business? Is ___ limited in the kind or amount of work ___ could do because of any impairment or health problem?”	dis_1	wrklim<=3	1)unable to work or 2) limited in kind/amount of work or 3)limited in other activities	72
	1997-2001	Are (other than the persons mentioned) any of these family members limited in the kind or amount of work (you/they) can do because of physical, mental or emotional problems?	Dis_6	Plawrklim  <=1	0) unable to work 1)limited in work 2) not limited in work 7) refused 8) not ascertained 9) don't know	82

**Appendix 2: Disability Definition Crosswalk (cont.)**

Disability Definition	Year(s) Available in NHIS data	Question	Variable name	Programming code	Definition	Variable location
Inclusive definition Wrkdis2a	1988-1996	<b>Activity Limitation Status Measured by “Ability to Work” – Recode</b> from question “Does any impairment or health problem keep ___ from working at a job or business? Is ___ limited in the kind or amount of work ___ could do because of any impairment or health problem?” <b>AND</b> <b>Activity Limitation Status – Recode</b> from question “Is ___ limited in ANY WAY in any activities because of an impairment or health problem? In what way is ___ limited?”	dis_3  (combination of work limit and activity limit)	wrklim<=3 or limit<=3	1)unable to work or 1)limited in kind/amount of work or 3)limited in other activities <b>or</b> 1)unable to perform major activities or 2)limited in kind/amount major activity or 3)limited in other activities	71, 72
	1997-2001	Any limitations, all persons all conditions	Dis_8	anylimt 86 ==1	1) limited in any way 2) not limited in any way (includes unknown)	86

**Appendix 3. National Health Interview Survey (NHIS) Condition Recodes**

<b>Condition Category</b>	<b>Specific Condition</b>	<b>ICD Number(s)</b>	<b>Recode Number</b>	<b>NHIS Recode Type</b>
<b>Arthritis</b>	Arthritis	711., 0,9 712. 8,9, 714-716 720.0, 721	101	Chronic Condition Recode C
	Rheumatism, unspecified	729.0	102	
	Gout, including gouty arthritis	274	103	
	Sciatica, including lumbago	724.2, 3	104	
	Intervertebral disc disorders	722	105	
	Bone spur/tendinitis NOS	726. ,9	106	
	Disorders of bone or cartilage	730. ,0-3,9, 731. 0,2, 732, 733	107	
	Rheumatoid arthritis, except spine	714	430	Diagnostic Recode B
	Other arthropathies	710-712, 715, 716	431	
	Other disorders of the joints	717-719	432	
	Ankylosing spondylitis	720.0	433	
	Other dorsopathies	720.1-724, X80	434	
	Rheumatism, excluding the back	725-727, 728.0,1,3,5,8,9, 729, X86	435	
	Osteomyelitis, periostitis and other infections involving bone	730	436	
	Acquired deformities of the limb	X20-X29, X33-X35, X73-X78	437	
	Residual	731-733, 739, X70, X79, X90, X93, X84, X85, X89	439	

**Appendix 3. NHIS Condition Recodes (cont.)**

<b>Condition Category</b>	<b>Specific Condition</b>	<b>ICD Number(s)</b>	<b>Recode Number</b>	<b>NHIS Recode Type</b>
<b>Cancer</b>	Malignant neoplasm of the skin	172,173	119	Chronic Condition Recode C
	Malignant neoplasm of the stomach, intestines, colon and rectum	151-154	316	
	Malignant neoplasm of the breast- female	174	421	
	Malignant neoplasm of female genital organs	179-184	422	
	Malignant neoplasm of the prostate	185	423	
	Malignant neoplasms of the lung and bronchus	162, 2-9	613	
	Malignant neoplasm of other respiratory sites	160,161,162.0, 163	615	
	Malignant neoplasm of lip, oral cavity and pharynx	140-149	80	Diagnostic Recode B
	Malignant neoplasm of esophagus	150	90	
	Malignant neoplasm of stomach	151	91	
	Malignant neoplasm of small intestine	152	92	
	Malignant neoplasm of colon	153	93	
	Malignant neoplasm of rectum	154	94	
	Malignant neoplasm of liver	155.0	95	
	Malignant neoplasm of pancreas	157	96	
	Residual	155.1, 156, 158, 159	99	

**Appendix 3. NHIS Condition Recodes**

<b>Condition Category</b>	<b>Specific Condition</b>	<b>ICD Number(s)</b>	<b>Recode Number</b>	<b>NHIS Recode Type</b>
<b>Cancer</b>	Malignant neoplasm of larynx	161	100	
	Malignant neoplasm of trachea and lung	162	101	
	Residual	160, 163-165	109	
	Malignant neoplasm of bone	170	110	
	Malignant neoplasm of skin	172	111	
	Other malignant neoplasm of skin	173	112	
	Malignant neoplasm of female breast	174	113	
	Residual	171, 175	119	
	Malignant neoplasm of cervix	180	120	
	Malignant neoplasm of placenta	181	121	
	Malignant neoplasm of uterus	179, 182	122	
	Malignant neoplasm of ovary	183	123	
	Malignant neoplasm of prostate	185	124	
	Malignant neoplasm of testes	186	125	
	Malignant neoplasm of bladder	188	126	
	Residual	184,187,189	129	
	Malignant neoplasm of brain	191	130	
	Residual	190, 192-199	139	
	Hodgkin's disease	201	140	
	Leukemia	204-208	141	
Residual	200,202,203	149		



### Appendix 3. NHIS Condition Recodes

Condition Category	Specific Condition	ICD Number(s)	Recode Number	NHIS Recode Type
<b>Circulatory Conditions</b>	Rheumatic fever with or without heart disease	390, 392-398, 399	501	Chronic Condition Recode C
	Ischemic heart disease	413, 414	502	
	Tachycardia or rapid heart		503	
	Heart murmurs	785.2	504	
	Other and unspecified heart rhythm disorders	427. 4-6, 8, 9, 785.1	505	
	Congenital heart disease	745,746	506	
	Other selected diseases of the heart (excludes hypertension)		507	
	High blood pressure (hypertension)	401-405	508	
	Cerebrovascular disease	430-435, 437	509	
	Hardening of the arteries	440	510	
	Aneurysm	441. ,0-6, 442	511	
	Phlebitis, thrombophlebitis	451	512	
	Varicose veins of lower extremities	454	513	
	Hemorrhoids	455	514	
	Poor circulation	459. , 8,9	515	
	Acute rheumatic fever	390, 392-398, 399-A	250	Diagnostic Recode B
	Chronic rheumatic heart disease	393-398	251	
	Residual	399-A	259	
	Hypertensive heart disease	402,404	260	
	Residual	401,403,405	269	
Ischemic heart disease	413, 414	271		
Pulmonary embolism	415.1	280		
Cardiac dysrhythmias	427	281		
Residual		289		
Subarachnoid haemorrhage	430	290		

### Appendix 3. NHIS Condition Recodes

Condition Category	Specific Condition	ICD Number(s)	Recode Number	NHIS Recode Type
<b>Circulatory</b>	Intracerebral and other intracranial haemorrhage	431, 432	291	
	Cerebral infarction	433, 434	292	
	Cerebral atherosclerosis	437.0	294	
	Residual		299	
<b>Diabetes</b>	Diabetes	250	403	Chronic Condition Recode C
<b>Mental Illness</b>	Senile and presenile organic psychotic conditions	290	210	Diagnostic Recode B
	Schizophrenia psychoses	295	211	
	Affective psychoses	296	212	
	Other psychoses	291-294, 297-299	213	
	Neurotic and personality disorders	300, 301	214	
	Alcohol dependence syndrome	303	215	
	Drug dependence	304	216	
	Physiological malnutrition arising from mental factors	306.1-5	217	
	Residual	302, 305, 307-314, 315.4,5,8,9 316-A, X10, X14	219	
<b>Mental Retardation</b>	Mental Retardation	X19	208	Chronic Condition Recode C
<b>Mobility/Orthopedic Impairments</b>	Absence both arms/hands	X20,X21	209	Chronic Condition Recode C
	Absence one arm/hand	X23,X24	210	
	Absence of fingers –one or both hands	X22,X25	211	
	Absence one or both legs	X26,X28	212	
	Absence of feet/toes –one or both legs	X27,X29	213	

**Appendix 3. NHIS Condition Recodes**

<b>Condition Category</b>	<b>Specific Condition</b>	<b>ICD Number(s)</b>	<b>Recode Number</b>	<b>NHIS Recode Type</b>
<b>Mobility/Orthopedic Impairments</b>	Paralysis, entire body	X40	219	Chronic Condition Recode C
	Paralysis, one side of body-hemiplegia	X41	220	
	Both legs- paraplegia	X46	221	
	Other paralysis	X42-X45, X47-X49	222	
	Partial cerebral palsy	X50	223	
	One side of body only-hemiparesis	X51	224	
	Legs- both or paraparesis	X56	225	
	Other paralysis	X52-X55, X57-X59	226	
	Paralysis- other site	X60-X64	227	
	Curvature of back or spine	X70	228	Chronic Condition Recode C
	Orthopedic impairment	X80	229	
	Spina bifida	X71	230	
	Impairment of the hands, fingers	X74	231	
	Impairment of the shoulders	X84	232	
	Other impairment of the upper extremities	X73	233	
	Clubfoot	X78	235	
	Other impairment of the lower extremities	X75, X76, X85, X86	236	
	Other deformity	X79, X89	237	
<b>Neurological Disorders</b>	Epilepsy	345	405	Chronic Condition Recode C
	Neuralgia, unspecified	729.2	408	
	Meningitis	320,322	220	Diagnostic Recode B
	Parkinson's Disease	332	221	
	Other degenerative and hereditary disorders of the central nervous system	330, 331.0-2, 8, 9, 333-336	222	

### Appendix 3. NHIS Condition Recodes

Condition Category	Specific Condition	ICD Number(s)	Recode Number	NHIS Recode Type
<b>Neurological Disorders</b>	Multiple Sclerosis	340	223	
	Infantile cerebral palsy and other paralytic syndromes	344.1, X40, X41.9, X50.9, (X42-X49, X51-X60, X63, X64)	224	
	Epilepsy	345	225	
	Residual	323-325, 337, 341, 346-352, 353-349	229	
<b>Sensory Impairments</b>	Blind, both eyes	X00	201	Chronic Condition Recode C
	Other visual impairment	X01-X03	202	
	Deaf – both ears	X05	203	
	Other hearing impairment	X06-X09	204	
<b>Respiratory Conditions</b>	Chronic bronchitis	490,491	601	Chronic Condition Recode C
	Asthma	493	602	
	Hay fever	477	603	
	Nasal polyps	471	604	
	Chronic sinusitis	473	605	
	Deviated nasal septum	470	606	
	Chronic disease of tonsils and adenoids	474	607	
	Chronic laryngitis	476	608	
	Emphysema	492	609	
	Pleurisy	511	610	
	Pneumoconiosis	500-505	611	
	Tuberculosis	011, 019	612	
	Other diseases of the lung	515, 518	614	
	Acute bronchitis and bronchiolitis	466	320	Diagnostic Recode B
Pneumonia	480-483, 485, 486	321		
Influenza	487	322		

**Appendix 3. NHIS Condition Recodes**

<b>Condition Category</b>	<b>Specific Condition</b>	<b>ICD Number(s)</b>	<b>Recode Number</b>	<b>NHIS Recode Type</b>
<b>Respiratory Conditions</b>	Bronchitis, chronic and unspecified, emphysema and asthma	490-493	323	
	Bronchiectasis	494	324	
	Other chronic obstructive pulmonary disease	495, 496	325	
	Pneumoconiosis and other lung disease due to external agents	500-508	326	
	Pleurisy	511	327	
	Residual	510, 512-516, 518, 519, X30	329	

#### Appendix 4. Variables for Social Network Study

Dependent Variable	Measure
Employment status	Dummy variable - 1= if employed within the past two weeks in reference year, 0 otherwise
Main explanatory variables Note: Variables are constructed as dummy variables unless otherwise noted	
Socially Isolated	No contact with family members or friends through visits or telephone for the past two weeks. Mixed network contacts of low frequency is the referent case.
Friends-dominated contacts	Frequent contact (above the mean) with friends and neighbors through visits or telephone for the past two weeks. Few contacts with family members (below the mean). Mixed network contacts of low frequency is the referent case.
Relatives-dominated contacts	Frequent contact (above the mean) with family members through visits or telephone for the past two weeks. Few contacts with friends and neighbors (below the mean). Mixed network contacts of low frequency is the referent case
Relative and friends contacts- high frequency	Mixed contact from friends and family members through visits or telephone for the past two weeks. The number of contact for both is above the mean. Mixed network contacts of low frequency is the referent case.
<b>Human Capital</b>	
Health- Arthritis (Disability categories)	Determined by chronic condition codes and diagnostic recodes, translated from self report of arthritis
Circulatory conditions	Determined by chronic condition codes and diagnostic recodes, translated from self report of circulatory conditions
Diabetes	Determined by chronic condition codes translated from self report of diabetes
Mental Illness	Determined through ICD-9 codes; translated from self-report of mental illness
Mobility/Orthopedic Impairments	Determined by chronic condition codes and diagnostic recodes, translated from self report of mobility/orthopedic conditions
Neurological Disorders	Determined by chronic condition codes and diagnostic recodes, translated from self report of neurological disorders
Sensory Impairments	Determined by chronic condition codes and diagnostic recodes, translated from self report of sensory impairments including deafness, blindness, hearing and speech impairments
Respiratory Conditions	Determined by chronic condition codes and diagnostic recodes, translated from self report of respiratory conditions
Education	Includes No high school diploma, associate's degree or some college, college graduate and post graduate work. High school diploma is the referent case.
Age-42	Age of 42 is the base case
Age-42 Squared	
Marital Status	Married- Spouse in household is the referent case
<b>Individual Factors</b>	
Black	White is the referent case
Other race	White is the referent case

**Appendix 4. Variables for Social Network Study (continued)**

Dependent Variable	Measure
<b>Socioeconomic Factors</b>	
Family Size-3	Family size of 3 is the referent case
Family Size-3 Squared	
Family income less than \$20,000 per year	Family income greater then \$20,000 per year is the referent case
Region	Includes Northeast, Midwest, East and South. South is the referent case.
Urban	Rural is the referent case
<b>Other social variables</b>	
Perception of amount of socialization	Includes too much socialization, too little socialization and don't know. The referent case is the right amount of socialization.
<b>Instruments</b>	
Frequency of attending church	
Frequency of attending movies	
Frequency of going out to eat	
Number of living children	
Number of living sisters	
Number of living brothers	
Mother living	
Father living	
Time takes family to travel to disabled respondent's home	Time in hours it takes family members (excluding adults children) to travel to visit disabled respondent in their home.
Time takes adult children to travel to disabled respondent's home	Time in hours it takes adult children to travel to visit disabled respondent in their home.

**Appendix 5. Analysis Results: Effect of Social Network Types on Employment of Men with Disabilities by Disability Group**

Men by Disability Group	Arthritis		Circulatory		Diabetes		Mental Illness	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Socially Isolated	1.072	1.18	-1.115	2.03	-0.165	1.57	-3.326	1.84
Friends dominated contacts	0.652	1.17	2.177	1.62	-2.936	3.08	-3.016*	1.41
Relatives dominated contacts	-1.636	1.88	3.126	1.85	-3.063	1.72	-2.407*	1.18
Relative and friends contacts- high frequency	5.200**	1.25	4.188**	1.90	1.342	1.52	-1.090	2.07
Black	-0.863**	0.31	-0.511	0.39	-1.106	0.85	0.128	0.51
Other	-1.184**	0.45	0.390	0.78	-0.568	0.99	-1.370	1.21
Family income <20,000	-1.768**	0.18	-1.710**	0.32	-2.636**	0.63	-1.264**	0.43
Northeast	-0.175	0.22	0.174	0.45	-1.676	0.89	-0.076	0.43
Midwest	-0.097	0.22	0.118	0.29	0.064	0.79	-0.145	0.45
East	0.234	0.24	-0.685	0.43	0.243	0.75	-0.522**	0.46
Age-42	-0.035**	0.01	-0.063**	0.02	-0.049	0.03	-0.049	0.02
Age-42 Squared	-0.001	0.00	0.000	0.00	-0.001	0.00	0.001	0.00
Family Size-3	-0.129	0.07	-0.328**	0.12	-0.145	0.27	-0.565**	0.14
Family Size-3 Squared	0.014	0.02	0.103	0.04	-0.090	0.09	0.089	0.05
No high school diploma	-0.813**	0.23	-0.548	0.31	-1.967*	0.77	-0.713	0.43
Associates degree/Some college	-0.549	0.31	-0.429	0.43	-1.207	0.83	-0.658	0.48
College graduate	0.378	0.33	0.832	0.59	-1.947*	0.94	-0.633	0.85
Post graduate work	0.494	0.43	0.626	0.61	-1.058	1.37	-0.161	0.80
Widowed	-0.681	0.67	1.380	1.14	0.999	1.29	-0.223	1.54
Divorced	-0.139	0.29	-0.302	0.47	-0.638	1.03	-0.084	0.57
Separated	-0.103	0.49	-2.108*	0.87	0.744	1.21	0.333	0.87
Too much social activity	1.249*	0.52	0.634	0.87	2.230	1.23	2.517	1.81
Not enough social activity	-0.193	0.18	0.252	0.31	0.786	0.66	0.619	0.38
Don't know if enough social activity	0.103	0.29	0.544	0.44	-0.695	0.95	0.812	0.47
Residual 1	-0.894	1.23	0.337	2.04	1.547	1.97	1.554	1.91
Residual 2	-0.854	1.18	-2.477	1.68	4.020	3.19	2.350	1.44
Residual 3	1.247	1.90	-3.288	1.87	2.855	1.81	1.639	1.29
Residual 4	-5.510**	1.29	-5.185**	1.94	-1.711	1.85	0.238	2.16
Intercept	0.785	0.51	-1.010	0.81	2.661	1.16	0.435	0.62

N= 1099

N=499

N=150

N=291

\*p<0.05;\*\*p<0.01



**Appendix 5. Analysis Results: Effect of Social Network Types on Employment of Men with Disabilities by Disability Group (Cont.)**

Men by Disability Group	Mobility Impaired		Neurological Disorders		Sensory Impaired		Respiratory Conditions	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Socially Isolated	2.195	1.32	-1.859	2.08	-2.900	1.69	-1.481	1.32
Friends dominated contacts	-1.413	1.59	-1.641	1.70	0.283	1.30	1.238	1.09
Relatives dominated contacts	0.053	1.96	0.355	2.03	-0.869	2.72	3.157	1.93
Relative and friends contacts- high frequency	6.088**	1.76	3.824*	1.92	2.361	1.93	2.027	1.32
Black	-0.996**	0.33	-0.153	0.70	-0.606	0.61	-1.032	0.55
Other	-0.672	0.47	-0.240	0.84	-0.450	0.90	0.022	1.05
Family income <20,000	-1.735**	0.20	-2.092**	0.43	-1.858**	0.40	-2.320**	0.43
Northeast	0.625	0.33	0.410	0.51	0.018	0.50	-0.357	0.48
Midwest	-0.095	0.27	-0.327	0.58	0.100	0.61	-0.018	0.39
East	0.486	0.29	-0.123	0.50	0.461	0.41	-1.156**	0.44
Age-42	-0.060**	0.01	-0.085**	0.02	-0.031*	0.01	-0.063**	0.01
Age-42 Squared	-0.001	0.00	-0.002	0.00	-0.003*	0.00	-0.001	0.00
Family Size-3	-0.188*	0.09	-0.421*	0.16	-0.489**	0.15	-0.313**	0.12
Family Size-3 Squared	0.008	0.03	0.079	0.05	0.085	0.07	0.051	0.04
No high school diploma	-0.862**	0.26	-1.499**	0.48	-0.792	0.41	-0.187	0.39
Associates degree/Some college	-0.265	0.33	-1.331**	0.51	-0.528	0.43	0.345	0.40
College graduate	0.191	0.49	-1.542	0.92	0.973	0.78	0.331	0.78
Post graduate work	0.995*	0.44	0.027	0.59	-0.097	0.70	0.854	0.62
Widowed	0.608	0.79	-3.177*	1.29	-0.532	1.64	0.415	1.47
Divorced	0.352	0.36	-0.252	0.51	-0.319	0.51	-0.558	0.49
Separated	0.142	0.64	-0.515	0.99	0.548	0.85	0.332	0.74
Too much social activity	1.401*	0.62	-0.909	1.33	2.675**	0.77	0.724	0.70
Not enough social activity	-0.112	0.22	-1.305**	0.48	-0.322	0.40	0.003	0.38
Don't know if enough social activity	-0.605	0.35	-0.696	0.60	0.568	0.49	0.111	0.46
Residual 1	-2.164	1.41	1.978	2.08	3.498	1.88	1.321	1.49
Residual 2	1.206	1.61	0.815	1.74	-0.933	1.40	-2.706*	1.27
Residual 3	-0.229	2.02	0.187	2.03	0.854	2.80	-4.246*	2.02
Residual 4	-6.223**	1.80	-3.702	2.01	-2.198	2.00	-3.126*	1.43
Intercept	0.453	0.61	2.119*	0.92	0.954	1.21	0.758	0.68

N=780

N=259

N=328

N=373

\*p<0.05;\*\*p<0.01

**Appendix 6. Analysis Results: Effect of Social Network Types on Employment of Women with Disabilities by Disability Group**

Women by Disability Group	Arthritis		Circulatory		Diabetes		Mental Illness	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Socially Isolated	0.228	0.96	0.504	1.32	0.889	1.41	0.863	1.29
Friends dominated contacts	3.348 <sup>+</sup>	1.59	2.177	1.73	1.504	1.58	3.026	1.44
Relatives dominated contacts	1.022	1.18	0.349	1.37	0.818	1.57	0.654 <sup>**</sup>	1.60
Relative and friends contacts- high frequency	1.204	1.04	2.488 <sup>+</sup>	0.98	1.262	1.58	2.936	1.33
Black	0.058	0.29	-0.589	0.35	-0.335	0.54	-0.814	0.54
Other	0.700	0.43	1.348 <sup>+</sup>	0.54	0.725	0.81	-0.553	1.06
Family income <20,000	-1.371 <sup>**</sup>	0.17	-0.555	0.25	-1.106 <sup>+</sup>	0.52	-1.257 <sup>**</sup>	0.33
Northeast	-0.095	0.20	-0.585	0.33	-1.339 <sup>+</sup>	0.68	-0.458	0.40
Midwest	0.211	0.19	-0.169	0.29	-0.942	0.54	0.479	0.38
East	0.383	0.21	-0.068	0.32	-0.716	0.61	-0.490	0.37
Age-42	-0.035 <sup>**</sup>	0.01	-0.048 <sup>**</sup>	0.01	0.010	0.03	-0.015	0.02
Age-42 Squared	-0.003 <sup>**</sup>	0.00	-0.001	0.00	-0.002	0.00	-0.001	0.00
Family Size-3	-0.208 <sup>**</sup>	0.07	-0.188	0.11	-0.383 <sup>+</sup>	0.16	-0.075	0.12
Family Size-3 Squared	0.037	0.02	0.055 <sup>+</sup>	0.03	0.015	0.05	0.033	0.04
No high school diploma	-0.547 <sup>**</sup>	0.19	-0.485	0.25	-1.139 <sup>+</sup>	0.57	0.099	0.35
Associate degree/Some college	-0.193	0.18	0.200	0.32	-0.036	0.57	0.304	0.40
College graduate	0.403	0.29	0.497	0.52	2.869 <sup>**</sup>	1.02	0.563	0.60
Post graduate work	0.383	0.36	0.538	0.54	1.380	0.84	0.244	0.55
Widowed	-0.486	0.29	-0.397	0.37	-0.499	0.71	-1.738	0.94
Divorced	0.446 <sup>+</sup>	0.21	0.383	0.32	1.236 <sup>+</sup>	0.51	0.667	0.38
Separated	0.275	0.32	-0.507	0.47	-	-	-0.182	0.63
Too much social activity	-0.145	0.30	0.379	0.55	-0.556	1.08	0.543	0.70
Not enough social activity	-0.408 <sup>+</sup>	0.16	-0.521 <sup>+</sup>	0.25	-0.216	0.45	-0.516	0.30
Don't know if enough social activity	-0.308	0.35	-0.416	0.48	-0.915	1.00	-0.369	0.47
Residual 1	-0.326	1.03	-0.648	1.41	-1.747	2.33	-1.717	1.43
Residual 2	-3.258 <sup>+</sup>	1.61	-1.938	1.73	-0.909	1.77	-2.721	1.49
Residual 3	-1.130	1.20	-0.337	1.41	0.045	1.69	-0.379	1.59
Residual 4	-1.271	1.04	-2.704 <sup>**</sup>	1.02	-0.751	1.73	-2.992 <sup>**</sup>	1.41
Intercept	-0.135	0.54	-0.489	0.66	-0.187	0.88	-0.956	0.71

N=1449

N=620

N=232

N=401

\*p<0.05;\*\*p<0.01

**Appendix 6. Analysis Results: Effect of Social Network Types on Employment of Women with Disabilities by Disability Group (Cont.)**

Women by Disability Group	Mobility Impaired		Neurological Disorders		Sensory Impaired		Respiratory Conditions	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Socially Isolated	0.711	1.02	0.729	1.73	-	-	0.922	1.08
Friends dominated contacts	4.454**	1.44	-0.797	1.57	-	-	1.583	1.17
Relatives dominated contacts	1.847	1.58	0.481	2.14	-	-	1.756	1.11
Relative and friends contacts- high frequency	0.763	1.24	0.626	1.28	-	-	1.964	1.12
Black	-0.194	0.27	0.340	0.40	-	-	-0.475	0.34
Other	0.396	0.51	-0.134	0.90	-	-	-0.825	0.56
Family income <20,000	-1.279**	0.23	-1.674**	0.33	-	-	-1.192**	0.24
Northeast	0.076	0.26	-0.313	0.41	-	-	-0.229	0.33
Midwest	0.394	0.24	-0.055	0.34	-	-	0.662*	0.28
East	0.537	0.30	-0.246**	0.35	-	-	0.209**	0.32
Age-42	-0.017	0.01	-0.065*	0.02	-	-	-0.071**	0.01
Age-42 Squared	-0.002**	0.00	-0.002**	0.00	-	-	-0.002**	0.00
Family Size-3	-0.204*	0.08	-0.479	0.12	-	-	-0.370**	0.09
Family Size-3 Squared	0.044	0.03	0.002	0.04	-	-	0.048	0.03
No high school diploma	-0.362	0.25	-0.446	0.38	-	-	-0.708*	0.28
Associates degree/Some college	-0.027	0.26	0.603	0.37	-	-	-0.289	0.29
College graduate	0.766**	0.35	0.486	0.59	-	-	0.710	0.43
Post graduate work	0.173	0.43	2.202**	0.69	-	-	0.673	0.50
Widowed	-1.158**	0.42	-0.008	1.00	-	-	0.198**	0.48
Divorced	0.110	0.28	0.525	0.35	-	-	0.892	0.34
Separated	0.248	0.41	0.302	0.57	-	-	-0.563	0.52
Too much social activity	0.104	0.44	0.905	0.62	-	-	0.170	0.50
Not enough social activity	-0.420	0.23	-0.448	0.35	-	-	-0.327	0.24
Don't know if enough social activity	-0.366	0.38	-0.906	0.75	-	-	-0.581	0.42
Residual 1	-1.023	1.11	-1.054	1.75	-	-	-1.930	1.20
Residual 2	-4.154**	1.44	0.560	1.59	-	-	-1.786	1.21
Residual 3	-1.915	1.58	-0.833	2.15	-	-	-2.145	1.14
Residual 4	-0.579	1.26	-0.730	1.34	-	-	-2.028	1.14
Intercept	-0.639	0.70	0.404	0.76	-	-	-0.430	0.60

N=881

N=436

N=683

\*p<0.05;\*\*p<0.01

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