# The Impact of Disability on Earnings and Labour Force Participation in Canada:  Evidence from the 2001 PALS

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May 28, 2008

*Abstract*

Using Statistics Canada's 2001 Participation and Activity Limitation Survey (PALS) we examine the impact of disability on the annual earnings and labour force participation of Canadian men and women.  Our estimates show large earnings penalties associated with disability ranging from 21 percent for mild disabilities to over 50 percent for very severe disabilities.  We also find that disability is associated with a 30 percentage point reduction in labour force participation  Our estimates of the impact of disability are comparable to other studies for more severe disability but our estimates of the impact of milder disabilities are substantially and significantly larger.  This difference likely reflects improvements in the PALS design over previous Canadian surveys in accurately identifying mild disability versus non-disability. It is also a possibility that over the economic expansion of the 1990s, disabled individuals in the Canadian labour market fell behind their able bodied counterparts.

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***Abstract***

Using Statistics Canada's 2001 Participation and Activity Limitation Survey (PALS) we examine the impact of disability on the annual earnings and labour force participation of Canadian men and women.  Our estimates show large earnings penalties associated with disability ranging from 21 percent for mild disabilities to over 50 percent for very severe disabilities.  We also find that disability is associated with a 30 percentage point reduction in labour force participation  Our estimates of the impact of disability are comparable to other studies for more severe disability but our estimates of the impact of milder disabilities are substantially and significantly larger.  This difference likely reflects improvements in the PALS design over previous Canadian surveys in accurately identifying mild disability versus non-disability. It is also a possibility that over the economic expansion of the 1990s, disabled individuals in the Canadian labour market fell behind their able bodied counterparts.

**Introduction**

In 2001, 14.6 percent of Canadians aged 15 years and older reported some level of disability.[1] Of the 3.4 million disabled adults, over 2.5 million individuals reported a disability involving mobility. With such large numbers, understanding the relationship between disability and labour market outcomes is of interest to policy makers who design, manage and investigate reforms for income support programs for the disabled. In addition, proposals for policies to integrate disabled Canadians into the workforce are being proposed to help offset the expected contraction in labour supply associated with an ageing Canadian population need basic information on the determinants of labour supply of the disabled.

In this paper, we examine the impact that a disability on the employment income and labour force participation of Canadian men and women using data from [1], the *Participation and Activity Limitation Survey: A Profile of Disability in Canada* (2001). Our estimates show large earnings penalties associated with disability ranging from 21 percent for mild disabilities to over 50 percent for very severe disabilities. We also find that disability is associated with a 30 percentage point reduction in labour force participation. Relative to previous studies of the impact of disability in the Canadian labour market, our estimates for more severe disability are comparable but our estimates of the impact of milder disabilities are substantially and significantly larger. This difference likely reflects improvements in the PALS design over previous Statistics Canada surveys like the Health and Activity Limitation Survey (HALS) and the Labour Market Activity Survey (LMAS) in accurately identifying mild disability versus non-disability. Finally, as discussed earlier, some of the higher measured impact of disability

on earnings in the 2001 PALS compared to the 1989 LMAS and the 1991 HALS could reflect that disabled Canadians have fallen behind the non-disabled as the economy expanded in the 1990s. Labour force participation rates of the disabled have changed little between the HALS 1991 and the PALS 2001 suggesting that either employment opportunities for the disabled did not improve during the economic expansion, or that labour supply decisions of the disabled are inelastic.

**Literature Review**

While the literature addressing the impact of disability on labour market outcomes is small, it has generated considerable agreement concerning the directions of effects of disability on outcomes. Disability decreases the probability of labour force participation, the number of hours worked and consequently, annual employment earnings. [2] Disabled workers are more likely to be working in low skill occupations due to having lower qualifications than the non-disabled. The lower earnings of persons with disabilities persists after controlling for differences in age, sex, education and occupation. There is less agreement, however, as to the magnitudes of the negative effects of disability.

Harkness [6] uses data from the 1986 Statistics Canada Health and Activity Limitation Survey (HALS) to study the effect of disability on labour force participation. 45 percent of Harkness' sample of males participated in the labour force and for those males that participated in the labour force, their average annual income was $11,152. The labour force participation rate and average earnings for this sample are half of that for Canadian males in 1986. Harkness also reports that the 50 percent lower earnings of disabled males reflects that a disabled Canadian worked half as many hours per year as an able-bodied counterpart. Harkness' estimations reveal that having a disability is

associated with a significantly lower probability of participating in the labour force. Disability pension income, earnings of other family members and home ownership were all found to reduce the participation of disabled males in the labour force.

Hum and Simpson investigate the effect of disability on labour market activities in Canada using the Master File for the Canadian 1989 Labour Market Activity Survey (LMAS). [2]  In their sample, disabled individuals had mean earnings of $10,282 in 1989 which was 37 percent less than the $16,348 average earnings of the non-disabled (both sexes).  Conditional on having worked positive hours, the income gap between the non-disabled and the disabled is only 7 percent of the average earnings of $21,797 for individuals without disbilities (both sexes).  Hum and Simpson find that the severity of disability affects the number of hours disabled people work. [3] Men were found to reduce their hours by 11.5 percent if mildly disabled, 21 percent if moderately disabled, and 58.1 percent if severely disabled.  The comparable figures for women were 8.1 percent, 17.4 percent, and 11.6 percent.   Using only the observations for individuals who worked positive hours in 1989, Ordinary Least Squares regression estimation of the determinants of annual earnings shows that mild disability was associated with a statistically insignificant 2 percent reduction for males.  Males with a moderate level of disability had annual earnings 16.6 percent lower than non-disabled males and males with a severe disability earned 42.2 percent less.  For disabled females relative to non-disabled females, mild disability reduced earnings by 3.5 percent, moderate disability by 14.3 percent and severe disability by 48.9 percent.  Hum and Simpson conclude that disability has more impact on employment than it does on wages as Baldwin and Johnson find for the U.S. [15]

Brown reports estimates based on data from the *HALS* 1991 of the impact of disability on labour market outcomes for individuals whose disabilities were the result of injuries incurred in motor vehicle accidents.[9]   The probability of participating in the workforce decreases as the severity of disability increases.  For mild, moderate and severe disabilities, the reduction in labour force participation is 5, 8 and 13 percentage points for males, and 7, 10 and 17 percentage points for females.  Receipt of a disability pension reduced participation by 13 percentage points for men, and 15 percentage points for women.  Brown reports that employment income was 10 percent, 18 percent and 25 percent lower for men with a mild, moderate or severe disability.[4]  The income differences between disabled and non-disabled females were found to be statistically insignificant.  In contrast to Hum and Simpson's findings that show little difference in impact of disability on the earnings of men and women, Brown's results are consistent with Luft's [11] and Baldwin, Zeager and Flacco's [18] findings for the U.S. that show that disabled men experience a greater decline in earnings than disabled women.

**Data, Variables and Summary Statistics**

The *2001 Participation and Activity Limitation Survey (PALS)* is a post-census national survey and the successor to the 1986 and 1991 *HALS*.[5] PALS was designed to collect information on adults and children with a disability, with disability defined on the basis of the outcome that everyday activities are limited because of a condition or health problem.[6] The target population of *PALS* consisted of all individuals living in a private household who answered "yes" to either question 7 or 8 on Form 2B of the 2001 Census which identify persons with disabilities. With a response rate of 82.5 percent, the original *PALS* sample consisted of 43,276 individuals, including 35,424 adults and 7,853 children. To ensure the non-disclosure of confidential information, the level of the public use microdata file (PUMF) for the *PALS* data-set was reduced to 20,710 disabled individuals and combined with data for 55,550 non-disabled individuals randomly drawn from the 2001 Census resulting in a data set representing 76,260 individuals.

For our study, we include observations for individuals aged 20 to 64. We exclude any observations with missing information in any of the variables of interest for our study as well as part-time and full-time students. Our sample sizes are 24,392 females and 24,085 males. 23 percent of the female sample (5,687) and 22 percent of the male sample (5,183) reported having a disability. In the PALS, disability is defined by affirmative responses to either question 7 or 8 in the 2001 Census (form 2B). *PALS* also has a derived variable, "DEGREE", that indicates four categories for the severity of disability. ("mild," "moderate," "severe," and "very severe") We represent these categories with a set of disability dummy variables.[7]

Our measure of employment income from the PALS is reported as income categories with a top category defined as over $80,000 in annual earnings. [8] We use the mid-point of each income category to value individual incomes and we treat that income variable as a continuous measure. We also drop the small number of individuals in the PALS samples who earned over $80,000 since we cannot define a mid-point for an open ended category.[9] Our measure for the labour force participation comes from the PALS variable "LFSTAT", which was created from section E "Employment Status" of the *PALS* questionnaire.[10] We define respondents categorized as employed or unemployed as in the labour force and all other cases as not in the labour force. We also include sets of dummy variables to represent the categories for age groups, education levels, and marital statuses.

Table 1 presents summary statistics for several labour market outcomes for the able bodied and disabled individuals in our samples. The average income for non-disabled and disabled women was $20,238 and $10,237 respectively. The average income for non-disabled and disabled men was $31,353 and $15,797 respectively. For both males and females, these income gaps are large at 50 percent. The impact of disability on earnings does not appear to impact on males more than females as previous studies have found. Table 1 also shows that for those individuals who participated in the labour force, the disabled work on average 90 percent of the weekly hours of the non-disabled. The proportion of disabled in the sample who reported being unemployed is double that of the non-disabled sample but the proportions of males and females who report being unemployed is comparable. With respect to labour force participation, the percentages for disabled males and females are 54.5 and 47 which are significantly lower

than for non-disabled males (90 percent participating) and females (77 percent participating).

Table 2 presents the means of the variables for the male and female, disabled and non-disabled samples as well as for the Canadian population of males and females from the 2001 Census. Disabled individuals in our samples are on average older, less likely to be married, and have lower educational attainment than the non-disabled individuals in our samples and relative to the averages for the Canadian population. In terms of occupational attainment, the only noticeable difference between the disabled and the non-disabled is that disabled individuals are less likely to have "Management" occupations.

The earnings gaps in Table 1 are comparable to Harkness' finding for disabled males in the HALS 1986 [6], but these earnings gaps are higher than the 37 percent found in the 1989 LMAS by Hum and Simpson [2], and Brown's 34 percent gap for males disabled by a motor vehicle accident from the 1991 HALS[9].[11] If we compare the average annual earnings of individuals who report participating in the labour force, then the earnings gap between the non-disabled and disabled falls to 75 percent for both males and females in the PALS 2001. Hum and Simpson find in the LMAS 1989 that for individuals reporting positive hours of work, the earnings gaps are 94 percent for males and 85 percent for females [2]. The larger earnings gaps in the PALS 2001 samples reflect, in part, that there are larger proportions of disabled individuals reporting moderate and severe disability in our PALS samples than in the LMAS and HALS 1991 samples used by [2] and [9] respectively.[12]

It is also a possibility that over the economic expansion of the 1990s, disabled individuals in the Canadian labour market fell behind their able bodied counterparts.

When we convert the 2001 PALS average earnings and the 1989 LMAS average earnings into 1992 purchasing power, we find that between the two samples average earnings in constant purchasing power for males in the labour force increased by only 2 percent between 1989 and 2001, while for disabled males real earnings fell by 19 percent. Non-disabled female workers had average real earnings gains of 22 percent between 1989 and 2001 while disabled females real earnings increased by only 6 percent. While it is possible that these changes reflect that more disabled workers with marginal, or partial, attachment to the labour force were drawn into the labour force by improving employment opportunities, there has been no increase in the labour force participation rate of the disabled between [9]'s HALS 1991 sample and our PALS 2001 sample. Brown reports that for non-disabled and disabled males, the labour force participation rates in 1991 are 84 percent and 56 percent, and 72 percent and 50 percent for females [9]. Where the labour force participation rates of non-disabled men and women increased over the 1990s, labour force participation of disabled men and women fell slightly between 1991 and 2001.

**Estimation and Results**

Our samples contain observations for 24,329 female and 24,085 male respondents from the 2001 *PALS* survey. Of the 24,329 women in the sample, 17,267 earned income during the year 2000. Of the 24,085 men in the sample, 18,415 earned income during 2000. We estimate three models to study the impact of disability on labour market outcomes. First, we estimate a Probit model using an indicator variable for labour force participation as the dependent variable. Second, using ordinary least square (OLS) estimation, we estimate a model with the logarithm of annual earnings as the dependent

variable using only the observations for individuals in our sample who reported participating in the labour force. Third, we perform a Heckman two-stage estimation to correct for possible sample selection bias. We re-estimate the log-earnings equation including an Inverse Mill's Ratio constructed from our Probit estimation to account for potential sample selection bias in our OLS regression.[13] For all estimations, we include dummy variables to represent disability, severity of disability, education level, marital status, and age group as the explanatory variables. Since the estimated marginal effects for the controls for age, marital status and education are consistent with what is generally found for male and female labour supply and earnings, we focus our discussion on the estimated coefficients for the variables measuring disability.

Table 3 reports the marginal effects and t-ratios for the Probit estimations of the probability of participating in the labour force for the male and female samples.[14] Relative to a non-disabled counterpart, a disabled man has a 31 percentage point reduction in the probability that he will participate in the labour force. Disabled females have a similar magnitude of reduction. Accounting for the severity of disability, the impact of disability on labour force participation is greater for males than females and increasing in the level of severity. The reduction in the probability of participating in the labour force ranges from 14.2 percentage points for females with a mild disability to 58.4 percentage points for females with a "very severe" disability. For disabled males, the reduction ranges from 18.8 percentage points for mild disabilities to 70.8 percentage points for a severe disability.

Table 4 presents the Ordinary Least Squares estimated coefficients for the log-earnings equations using only the observations for individuals in the sample who

participated in the labour force.  The disability indicator variable is associated with a 30 percent reduction in annual earnings for both males and females.  When we account for the severity of disability, males with mild, moderate, severe and very severe disability have earnings that are 21 percent, 30 percent, 40 percent and 55 percent lower than a non-disabled male.  For females, the estimated impacts range from a 19 percent earnings reduction for mild disability to a 49 percent reduction for a very severe disability.

Table 5 presents the estimated effects of disability after correcting for the possible presence of sample selection bias.  In no case is the Inverse Mill's Ratio statistically significant but the estimated marginal effects of disability on earnings for males have changed. For males, having a disability is associated with only a 22 percent earnings penalty compared to 30 percent in the OLS estimation.  For females the earnings penalty is unchanged between models.  In the estimations that account for the severity of disability, the earnings losses associated with disability are lower for males and larger for females after accounting for sample selection bias.  Males with a mild disability have an estimated loss of earnings of 15.5 percent and males with a very severe disability have annual earnings that are 49 percent lower than an able-bodied counterpart.  For females, a mild disability reduces earnings by 21 percent relative to having no disability and a very severe disability reduces earnings by 57 percent.

The estimates in Tables 4 and 5 indicate that disability has a large negative effect on annual earnings.  Table 6 compares our estimated marginal effects of disability with those reported in [2] and [9].  It should be noted that the categories representing the severity of disability are not directly comparable between the PALS 2001 and the LMAS 1989 and HALS 1991.[15]  Our estimates suggest much larger effects of disability than the

other two studies.  The PALS estimates for disability in general are three times larger than the LMAS 1989 estimates and double the estimates for HALS 1991 sample of motor vehicle accident victims.  What is most interesting is that the larger estimated effect of disability is driven by much lower earnings of the mild and moderate disability categories in the PALS 2001.  Where the LMAS 1989 shows no significant reduction in earnings for males with mild disabilities, the PALS 2001 estimates indicate an earnings reduction of 20 percent.  For moderate disabilities, the PALS estimates are almost double those of the LMAS.  For the severely disabled, the estimated earnings reductions are comparable in size between PALS 2001 and LMAS 1989.

An explanation for the differences in the estimated effects of disability concerns the identification of who is disabled.  For example, it could be the case that the classification of the severity of disability in the PALS has individuals who compare to severely disabled in the LMAS being classified as not only moderately disabled but also mildly disabled in the PALS.  The more likely reason that the PALS 2001 data reveals much larger earnings losses associated with mild and moderate disability levels reflects that the PALS design has been to more accurately identify who is disabled. In all likelihood, the LMAS 1989 data may suffer from poor identification of disabled individuals such that the measurement error is worse for less severe disabilities.[16] Statistics Canada describes how the PALS data is based on revamped Census filter questions for identifying disability [24].  The new Census filter questions identify higher prevalence of disability at all severity levels relative to the previous Census filter questions with the gap in proportions of population identified between questions falling with the severity of disability.  It is also the case that a number of individuals identified as

having a mild disability in the 1991 HALS subsequently turn out in post-censal survey to not have a true disability. As such, the HALS and potentially the LMAS have lower estimated effects of mild disability since these data sets fail to accurately identify who is mildly disabled. The LMAS in particular, would not have the benefit of a follow up to the original survey so as to eliminate the "false positive" identification of persons with mild disabilities.

Finally, as discussed earlier, some of the increase in the measured impact of disability on earnings between the LMAS 1989 and HALS 1991 could reflect that disabled Canadians have fallen behind the non-disabled as the economy expanded in the 1990s.[17] There is some evidence that this deterioration in the labour market outcomes for the disabled has taken place in the U.S. Bound and Waidmann find that in the U.S., employment rates for the disabled fell through the 1990s while employment rates for the non-disabled were non-decreasing [25]. They argue that this trend may be explained by an increasing proportion of disabled individuals collecting Social Security Disability Insurance benefits in the 1990s. As noted earlier, labour force participation rates of the disabled in Canada have changed little between the HALS 1991 and the PALS 2001, but there has been some deterioration in employment outcomes relative to the non-disabled over the decade. Where unemployment rates for non-disabled males and females fell from 9.8 percent and 8.2 in 1991 to 6.4 percent and 5.6 percent in 2001, the unemployment rates of disabled males and females increased from 10.1 percent and 9.5 percent in 1991 to 12.1 percent and 11.1 percent in 2001.[18] It must be the case that employment opportunities for the disabled in Canada did not improve during the economic expansion, and may have even deteriorated.

**Conclusions**

Using the 2001 Statistics Canada Participation and Activity Limitation Survey (PALS) we examine the impact of disability on the income and on labour force participation of Canadian men and women. Our estimates show large earnings penalties associated with disability ranging from 21 percent for mild disabilities to over 50 percent for very severe disabilities. We also find that disability is associated with a 30 percentage point reduction in labour force participation. We find no difference in the impact of disability between males and females relative to their comparator non-disabled group. Our estimates of the impact of disability are comparable to other studies for more severe disability but our estimates of the impact of milder disabilities are substantially and significantly larger. This difference likely reflects improvements in the PALS design over previous surveys like the HALS and LMAS in accurately identifying mild disability versus non-disability. It is also a possibility that over the economic expansion of the 1990s, disabled individuals in the Canadian labour market fell behind their able bodied counterparts.

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Table 1: Employment Statistics for Males and Females with a Disability, Canada (2001 Participation and Activity Limitation Survey)

|  | Canadian Non-Disabled Population Sampled in PALS | | Canadian Disabled Population Sampled in PALS | | Canadian Population Sampled in the 2001 Census | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Males | Females | Males | Females | Males | Females |
| Unemployment Rate | 6.4% | 5.6% | 12.7% | 11.1% | 6.8% | 6.1% |
| Participation Rate | 90.0% | 76.6% | 54.5% | 47.0% | 86.1% | 75.4% |
| Hours Worked per Week* | 43.5 | 36.0 | 39.0 | 32.9 | - | - |
| Proportion Receiving Disability Pension | N/A | N/A | 15.32% | 12.8% | N/A | N/A |
| Average Employment Income | $31,354 | $20,238 | $15,797 | $10,237 | $36,865 | $22,885 |

NOTES:  * indicates that this average is for only those individuals coded as in the labour force.

TABLE 2: Sample Frequencies for Age, Marital Status, Education and Occupational Attainment (Percentages)

| | PALS Non-Disabled Males | PALS Non-Disabled Females | PALS Disabled Males | PALS Disabled Females | 2001 Census Males | 2001 Census Females |
|---|---|---|---|---|---|---|
| 20-24 | 8.1 | 6.9 | 13.7 | 10.0 | 10.8 | 10.5 |
| 25-29 | 9.8 | 10.1 | 5.8 | 5.9 | 10.3 | 10.4 |
| 30-34 | 12.1 | 12.2 | 8.2 | 8.6 | 11.4 | 11.5 |
| 35-39 | 14.9 | 15.0 | 12.4 | 14.0 | 13.7 | 13.8 |
| 40-44 | 15.5 | 15.3 | 17.2 | 17.2 | 14.0 | 14.1 |
| 45-49 | 13.0 | 13.4 | 9.2 | 10.3 | 12.7 | 12.7 |
| 50-54 | 11.7 | 11.7 | 11.0 | 12.0 | 11.4 | 11.3 |
| 55-59 | 8.6 | 8.7 | 11.1 | 12.1 | 8.7 | 8.7 |
| 60-64 | 6.4 | 6.8 | 11.3 | 10.2 | 6.9 | 7.0 |
| Divorced | 4.7 | 6.4 | 6.5 | 10.4 | 7.6* | |
| Married/Common Law | 70.6 | 72.2 | 57.8 | 59.6 | 49.5* | |
| Separated | 2.3 | 3.2 | 2.7 | 4.4 | 3.0* | |
| Never Married/Single | 21.9 | 15.9 | 32.1 | 21.7 | 33.5* | |
| Widowed | 0.5 | 2.3 | 0.9 | 3.9 | 6.4* | |
| Less High School | 23.8 | 21.9 | 36.5 | 32.7 | 32.2* | |
| High School | 24.6 | 27.5 | 23.6 | 25.3 | 16.1* | |
| Trade Certificate or Diploma | 16.2 | 9.4 | 18.2 | 10.6 | 13.6* | |
| College | 14.2 | 20.1 | 12.8 | 19.0 | 18.7* | |
| University | 21.2 | 21.0 | 8.9 | 12.3 | 19.5* | |
| Management | 13.5 | 8.5 | 6.6 | 5.1 | 12.6 | 7.9 |
| Business/Finance/Admin | 9.0 | 28.8 | 9.8 | 28.8 | 9.1 | 27.8 |
| Natural Sciences | 9.9 | 2.9 | 7.8 | 2.5 | 9.5 | 3.0 |
| Health | 2.0 | 9.4 | 1.3 | 10.0 | 2.0 | 8.9 |
| Social Science/Education | 4.9 | 11.3 | 4.6 | 11.6 | 4.9 | 11.0 |
| Art/Culture/Rec/Sports | 2.2 | 2.9 | 2.6 | 3.7 | 2.4 | 3.2 |
| Sales/Services | 15.4 | 25.8 | 22.0 | 29.7 | 18.9 | 29.0 |
| Trade/Transport/Equipment | 27.1 | 2.5 | 30.6 | 2.5 | 25.7 | 2.2 |
| Occupations Unique to Primary Industry | 6.5 | 2.4 | 6.3 | 2.0 | 6.2 | 2.1 |
| Occupations Unique to Process and Manufacturing | 9.5 | 5.7 | 8.5 | 4.3 | 8.8 | 5.0 |

*Both Sexes

TABLE 3: Marginal Effects for Probit Estimation for Probability of Participating in the Labour Force

| | Females | t-ratio | Females | t-ratio | Males | t-ratio | Males | t-ratio |
|---|---|---|---|---|---|---|---|---|
| **No Disability** | | | | | | | | |
| **Disability** | -0.283 | -37.42 | | | -0.31 | -48.13 | | |
| **Mild** | | | -0.142 | -11.72 | | | -0.188 | -19.54 |
| **Moderate** | | | -0.227 | -16.97 | | | -0.275 | -23.08 |
| **Severe** | | | -0.403 | -30.1 | | | -0.477 | -36.47 |
| **Very Severe** | | | -0.584 | -28.2 | | | -0.708 | -35.01 |
| **Age 20-24** | | | | | | | | |
| **Age 25-29** | -0.042 | -2.65 | -0.032 | -2 | -0.009 | -0.79 | -0.002 | -0.16 |
| **Age 30-34** | -0.06 | -3.89 | -0.043 | -2.75 | -0.014 | -1.3 | -0.005 | -0.41 |
| **Age 35-39** | -0.028 | -1.93 | -0.012 | -0.79 | -0.026 | -2.45 | -0.012 | -1.14 |
| **Age 40-44** | -0.011 | -0.75 | 0.011 | 0.79 | -0.049 | -4.56 | -0.033 | -3.11 |
| **Age 45-49** | -0.007 | -0.49 | 0.015 | 0.96 | -0.05 | -4.25 | -0.036 | -3.05 |
| **Age 50-54** | -0.078 | -4.96 | -0.055 | -3.49 | -0.11 | -8.64 | -0.091 | -7.21 |
| **Age 55-59** | -0.277 | -16.13 | -0.262 | -15.18 | -0.279 | -18.47 | -0.261 | -17.31 |
| **Age 60-64** | -0.455 | -24.74 | -0.443 | -23.87 | -0.505 | -29.4 | -0.495 | -28.62 |
| **Divorced** | | | | | | | | |
| **Married/Common Law** | -0.075 | -6.32 | -0.092 | -7.57 | 0.05 | 4.93 | 0.046 | 4.44 |
| **Separated** | -0.027 | -1.3 | -0.034 | -1.61 | -0.009 | -0.52 | -0.006 | -0.37 |
| **Never Married/Single** | -0.043 | -2.87 | -0.047 | -3.08 | -0.065 | -5.57 | -0.065 | -5.46 |
| **Widowed** | -0.129 | -5.46 | -0.146 | -6.06 | -0.058 | -1.94 | -0.061 | -1.97 |
| **Less High School** | | | | | | | | |
| **High School** | 0.137 | 17.92 | 0.133 | 17.19 | 0.051 | 9.21 | 0.045 | 7.87 |
| **Trade Certificate or Diploma** | 0.162 | 16.69 | 0.161 | 16.26 | 0.072 | 12.13 | 0.068 | 11.15 |
| **College** | 0.212 | 26.76 | 0.209 | 25.85 | 0.073 | 11.45 | 0.068 | 10.31 |
| **University** | 0.219 | 27.13 | 0.213 | 25.99 | 0.082 | 13.73 | 0.076 | 12.36 |
| *Sample Size* | 24,392 | | 24,392 | | 24,085 | | 24,085 | |
| *Pseudo R-Squared* | 0.16 | | 0.18 | | 0.27 | | 0.27 | |

TABLE 4: Ordinary Least Squares Estimated Coefficients for Log-Earnings Equations for Males and Females in the Labour Force

| Dependent Variable: log(employment income) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Males** | | **Males** | | **Females** | | **Females** | |
| **Independent Variables** | Marginal Effect | *t-* Statistic | Marginal Effect | *t-* Statistic | Marginal Effect | *t-* Statistic | Marginal Effect | *t-* Statistic |
| **No Disability** | | | | | | | | |
| **Disability** | -0.3 | -21.61 | | | -0.28 | -18.32 | | |
| **Mild** | | | -0.213 | -10.49 | | | -0.19 | -7.91 |
| **Moderate** | | | -0.295 | -11.88 | | | -0.29 | -10.9 |
| **Severe** | | | -0.398 | -14.65 | | | -0.37 | -13.19 |
| **Very Severe** | | | -0.551 | -13.39 | | | -0.49 | -9.9 |
| **Age 20-24** | | | | | | | | |
| **Age 25-29** | 0.45 | 13.48 | 0.461 | 13.72 | 0.34 | 9.16 | 0.35 | 9.32 |
| **Age 30-34** | 0.69 | 19.06 | 0.696 | 19.34 | 0.52 | 13.26 | 0.53 | 13.52 |
| **Age 35-39** | 0.69 | 19.44 | 0.699 | 19.8 | 0.57 | 14.8 | 0.58 | 14.99 |
| **Age 40-44** | 0.78 | 21.47 | 0.796 | 21.77 | 0.69 | 17.24 | 0.71 | 17.65 |
| **Age 45-49** | 0.78 | 20.25 | 0.791 | 20.52 | 0.85 | 19.44 | 0.87 | 19.74 |
| **Age 50-54** | 0.75 | 19.19 | 0.76 | 19.48 | 0.86 | 18.83 | 0.88 | 19.18 |
| **Age 55-59** | 0.51 | 12.9 | 0.522 | 13.18 | 0.54 | 11.92 | 0.55 | 12.14 |
| **Age 60-64** | 0.22 | 5.55 | 0.226 | 5.63 | 0.22 | 4.47 | 0.23 | 4.65 |
| **Divorced** | | | | | | | | |
| **Married/Common Law** | 0.14 | 4.42 | 0.136 | 4.39 | -0.11 | -4.54 | -0.12 | -4.8 |
| **Separated** | 0.02 | 0.35 | 0.02 | 0.42 | -0.18 | -4.52 | -0.18 | -4.56 |
| **Never Married/Single** | -0.18 | -5.95 | -0.175 | -5.94 | -0.03 | -0.99 | -0.04 | -1.13 |
| **Widowed** | 0.4 | 3.44 | 0.406 | 3.51 | -0.2 | -3.83 | -0.21 | -3.98 |
| **Less High School** | | | | | | | | |
| **High School** | 0.19 | 9.86 | 0.179 | 9.53 | 0.23 | 10.02 | 0.23 | 9.91 |
| **Trade Certificate or Diploma** | 0.29 | 13.51 | 0.288 | 13.34 | 0.23 | 7.85 | 0.23 | 7.83 |
| **College** | 0.41 | 16.94 | 0.397 | 16.65 | 0.61 | 22.02 | 0.6 | 21.91 |
| **University** | 0.46 | 19.64 | 0.452 | 19.35 | 0.98 | 31.08 | 0.97 | 30.93 |
| **Inverse Mills Ratio** | | | | | | | | |
| **constant** | 9.5 | 248.69 | 9.503 | 249.33 | 9.16 | 228.33 | 9.17 | 228.75 |
| *Sample Size* | 18,451 | | 18,451 | | 17267 | | 17267 | |
| *R-Squared* | 0.15 | | 0.15 | | 0.12 | | 0.12 | |

NOTES: *Coefficients expressed as the log transformation: $e^{B}-1$*

TABLE 5:  Estimated Coefficients for Log-Earnings Equations for Males and Females in the Labour Force, With  Correction for Sample Selection

| Dependent Variable: log(employment income) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Male** | | **Males** | | **Females** | | **Females** | |
| **Independent Variables** | Marginal Effect | t-Statistic | Marginal Effect | t-Statistic | Marginal Effect | t-Statistic | Marginal Effect | t-Statistic |
| **No Disability** | | | | | | | | |
| **Disability** | -0.22 | -3.98 | | | -0.29 | -3.97 | | |
| **Mild** | | | -0.155 | -2.67 | | | -0.21 | -4.97 |
| **Moderate** | | | -0.238 | -4.1 | | | -0.29 | -4.76 |
| **Severe** | | | -0.33 | -5.65 | | | -0.4 | -3.85 |
| **Very Severe** | | | -0.49 | -6.29 | | | -0.57 | -3.35 |
| **Age 20-24** | | | | | | | | |
| **Age 25-29** | 0.45 | 13.34 | 0.456 | 13.51 | 0.35 | 8.76 | 0.35 | 8.9 |
| **Age 30-34** | 0.67 | 18.62 | 0.684 | 18.85 | 0.51 | 11.54 | 0.51 | 12.07 |
| **Age 35-39** | 0.68 | 18.82 | 0.686 | 19.09 | 0.56 | 14.04 | 0.57 | 14.37 |
| **Age 40-44** | 0.78 | 20.53 | 0.792 | 20.7 | 0.67 | 16.53 | 0.69 | 16.74 |
| **Age 45-49** | 0.78 | 19.37 | 0.787 | 19.52 | 0.8 | 18.38 | 0.82 | 18.39 |
| **Age 50-54** | 0.76 | 16.89 | 0.761 | 16.99 | 0.82 | 15.74 | 0.83 | 16.79 |
| **Age 55-59** | 0.64 | 9.27 | 0.633 | 9.25 | 0.49 | 4.91 | 0.46 | 4.71 |
| **Age 60-64** | 0.42 | 3.85 | 0.403 | 3.69 | 0.11 | 0.73 | 0.06 | 0.41 |
| **Divorced** | | | | | | | | |
| **Married/Common Law** | 0.12 | 3.73 | 0.124 | 3.82 | -0.1 | -3.13 | -0.11 | -3.29 |
| **Separated** | 0.08 | 1.5 | 0.08 | 1.58 | -0.15 | -3.67 | -0.16 | -3.76 |
| **Never Married/Single** | -0.15 | -4.79 | -0.15 | -4.78 | -0.03 | -0.94 | -0.04 | -1.18 |
| **Widowed** | 0.42 | 3.4 | 0.413 | 3.34 | -0.21 | -3.34 | -0.23 | -3.52 |
| **Less High School** | | | | | | | | |
| **High School** | 0.16 | 7.12 | 0.164 | 7.1 | 0.27 | 4.52 | 0.29 | 4.8 |
| **Trade Certificate or Diploma** | 0.26 | 8.81 | 0.258 | 8.87 | 0.27 | 3.59 | 0.3 | 3.85 |
| **College** | 0.38 | 12.16 | 0.381 | 12.19 | 0.68 | 6.67 | 0.72 | 6.94 |
| **University** | 0.44 | 14.36 | 0.439 | 14.37 | 1.1 | 9.43 | 1.15 | 9.74 |
| **Inverse Mills Ratio** | -0.09 | -0.75 | -0.064 | -0.55 | 0.21 | 0.99 | 0.3 | 1.31 |
| **constant** | 9.55 | 204.99 | 9.54 | 205.04 | 9.11 | 90.66 | 9.08 | 88.36 |
| *Sample Size* | 18,451 | | 18,451 | | 17267 | | 17267 | |
| *R-Squared* | 0.15 | | 0.15 | | 0.12 | | 0.12 | |

NOTES:  *Coefficients expressed as the log transformation: $e^B$-1.*  The Inverse Mills Ratio value for each observation is generated from the estimated models in Table 3.

TABLE 6: Percentage Loss of Employment Earnings Due to Disability for Males and Females from PALS 2001, LMAS 1989 and HALS 1991

|  | PALS 2001 | PALS 2001 | PALS 2001 | PALS 2001 | PALS 2001 | LMAS 1989 | LMAS 1989 | HALS 1991 |
|---|---|---|---|---|---|---|---|---|
|  | Females | Females | Males | Males | Males | Females | Males | Males |
|  | OLS | Heckman | OLS | Heckman | OLS | OLS | OLS | Heckman |
| "Aggregate" | 28 | 29 | 30 | 22 | 30 | 9 | 9 |  |
| Mild | 19 | 21 | 21 | 15 | 21 | 4 | 2 | 10 |
| Moderate | 29 | 29 | 30 | 23 | 30 | 14 | 17 | 18 |
| Severe | 37 | 40 | 40 | 33 | 44* | 49* | 42* | 25 |
| Very Severe | 49 | 57 | 55 | 49 | na | na | na | na |

NOTES: PALS estimates are from Tables 5 and 6. LMAS 1989 are calculated from the estimated coefficients from Table 4 of Hum and Simpson 1996. HALS 1991 estimates are from Brown (2004) "Heckman" refers to controls for sample selection bias. * indicates single category for severe disability. In the PALS case, the model was re-estimated with a single category for the severe and very severe categories.

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[1] [1] This prevalence has increased slightly over the last 10 years as [2, page 285] report that 12.9% of the population aged 15-64 reported some form of disability in 1991.

[2] For Canada see, [2], [3], [4], [5], [6], [7], [8], and [9]. For the U.S. see [10],[11],[12],[13],[14],[15],[16],[17],[18],[19] and [20]. For Australia, see [21] and [22]. For Sweden, see [23].

[3] Hum and Simpson also classify disabilities by types of impairment mobility, sensory, mental or multiple impairment types. They found sensory disabilities are not associated with any labour market disadvantage compared with the non-disabled and indeed, average earnings, hours worked and wages exceed those of the non-disabled. However, the other three disability types are associated with significantly lower average hours of work and annual earnings.

[4] Estimates from a two-stage Heckman procedure to control for sample selection bias.

[5] Data from the two surveys cannot be compared because of major differences in how the sampling methodologies were computed, how the operational definitions of the target populations were done and the content of the questionnaires. (PALS User's Guide pg. 7) Both HALS and PALS provide detailed information about the demographic and socio-economic situation of persons with disabilities as well as the type and severity of their disabilities. The following summarizes the major differences between the 1991 HALS and 2001 PALS:

- The 2001 PALS included new census disability filter questions to identify its population. The new filter questions are more inclusive than the ones used in 1991.
- The HALS sample included both respondents who answered YES to the disability filter questions on the census form and those who answered NO. The 2001 PALS survey sampled only those individuals with positive answers to the 2001 Census filter questions. Respondents who answered NO to the census disability filter questions were excluded from the PALS.
- The PALS questionnaire content, including new screening questions, is significantly different from those of the HALS 1991 questionnaire. In particular, the content related to the identification of the types and severity of activity limitations. For example, for the 2001 PALS survey new questions were designed to better identify non-physical disabilities including learning disabilities, developmental disabilities and psychological conditions. In the 1991 HALS, persons with learning disabilities, mental illness and developmental disabilities were grouped together under the category of "Other".
- Compared to the 1991 HALS, the 2001 PALS used a different approach in the identification of the severity of the activity limitations. For example, the HALS severity scale gave more weight to physical disabilities than to non-physical disabilities. In addition, the severity scale in the 1991 HALS was divided into three groups (mild, moderate and severe), while the PALS severity scale was divided into four groups (mild, moderate, severe and very severe).

[6] PALS User Guide 2004 p.3

[7] The categories of disability level came from a derived variable "DEGREE" which is derived from an index measuring the severity of disability. The index is constructed on the basis of an individual's responses to the filter questions (Section A) and screening questions (Section B) of the PALS questionnaire. It represents a score of the respondent's degree of severity over all types of disability (e.g. mobility, sensory, or mental). The four levels of severity, mild, moderate, severe and very severe, are created by examining the distribution of the global severity index scores that are constructed using all questions for each type of disability in the PALS 2001 questionnaire. For each type of disability, there were two types of questions asked: intensity and frequency. Points were assigned to each question based on severity, the maximum score being given for someone who is totally disabled in all areas. The product of intensity and frequency was used then to measure severity. The distribution was then divided into deciles. The first decile corresponds to the 10% of people with the lowest disability scores. Then the second decile corresponds to the next 10% of people with the lowest disability score, and so on... The average score was calculated for each decile and a plot of this average score as a function of the decile was produced. The severity levels were then determined by graphical means. The interpretation of these

disability levels is as follows: person in Level 1 are less disabled than persons in Level 2, who in turn are less disabled than persons in Level 3 and so on. For practical purposes, these levels were assigned names: "mild," "moderate," "severe," and "very severe." These measures of severity of not directly comparable to those produced for the HALS 1991 which were based on points awarded the number of functions that an individual reports that he/she had trouble or complete inability to perform. The scores are summed across all functions. A score of "0" indicates no disability; 1-4, mild disability; 5-10, moderate disability and greater than 10, sever disability [2, page 298].

[8] The income measure that we use is from the PALS question G10 that asks respondents to "estimate in which of the following groups your personal income fell". The categories of employment income come from a derived variable "EMPINR." [1, Appendix C, page 314]

[9] This exclusion criteria eliminated less than 2 percent of all observations. As this exclusion will have more of an effect on the non-disabled sample than the sample of disabled individuals, there will be a small downward bias in our measured income gap between the groups.

[10] For persons without disability aged 15-64 years, their labour force status is taken from the 2001 Census of Population.

[11] [13] reports that in 1984, disabled males in the U.S. had annual earnings that were 0.54 of non-disabled males.

[12] In our PALS 2001 samples for males and females, the frequencies for severity levels are 35 percent with a mild disability, 25 percent with a moderate disability and 40 percent with severe or very severe disability. Hum's and Simpson's LMAS 1989 sample has 47 percent mild disability, 35 percent moderate disability and 17 percent severe disability. The HALS 1991, according to Hum and Simpson, has 67 percent with a mild disability, 27 percent moderate and only 6 percent with a severe disability. [2]

[13] This final model is only identified by the Probit functional form.

[14] Probit estimation techniques are applied in situations where on has a binary (0 or 1) dependent variable. The estimated coefficients in the Probit model only indicate whether the probability of observing the defined outcome increases or decreases with changes in the independent variable. Since the binary dependent variable has no meaningful scale, estimated coefficients have no meaningful interpretation as marginal effects on the dependent variable like they do in OLS estimation. The coefficients are used to generate marginal effects of those variables which are interpreted as the change in the predicted probability of observing the defined outcome.

[15] See Footnote 7. The LMAS 1989 categories are directly comparable to the HALS categories. See [2]'s data appendix.

[16] [2] suggest that the LMAS 1989 data leads to underestimates of the extent of severe disabilities. Statistics Canada investigated this problem with HALS 1991 data that was developed from a post-Censal survey [24]. The HALS data set consisted of individuals who had answered "yes" to disability filter questions on the 1991 Census form. Because the Census filter questions are limited in their identification of persons with disabilities, post-Censal surveys with further screening questions to identify disability were conducted for all individuals who answered "yes" to the census screening question, and to a random sample of individuals who had responded "no" to the same questions. In the end, half of the disabled sample in the HALS 1991 had answered "no" to the Census filter question but were subsequently identified in the post-Censal survey. It turns out that 67 percent of the adults with disabilities identified in the post-censal survey after being missed by the Census filter questions had mild disabilities compared to 29 percent of the disabled individuals identified by the Census filter questions.

[17] [13] found that American males with disabilities experienced real earnings gains relative to the non-disabled from the 1960s to the mid-1970s, but from the late-1970s to the early 1980s, real earnings declined.

[18] 1991 unemployment rates are from [9] and are based on data from the 1991 HALS.