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

Cara L. Brown and J.C. Herbert Emery*

Abstract *Using Statistics Canada's 2001 "Participation and Activity Limitation Survey" (PALS) this paper examines the impact of disability on the annual earnings and labour force participation of Canadian men and women. The study's findings include estimates showing large earnings penalties associated with disability ranging from 21 percent for mild disabilities to over 50 percent for very severe disabilities. This study also finds that disability is associated with a 30-percentage point reduction in labour force participation. These estimates of the impact of disability are comparable to other studies for more severe disability but this study's 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 "Health and Activity Limitation Survey" (HALS) and "Labour Market Activity Survey" (LMAS) in accurately identifying mild disability versus non-disability. The article concludes with excerpts from several Canadian cases where written judgments from the trial judges provide insights into how the trier of fact uses the HALS and PALS data to link an assessment of loss of income damages to an individual plaintiff.*

I. Introduction

From the 2001 *Participation and Activity Limitation Survey* ("PALS"),[1] 12.4% of the total Canadian population reported being disabled (11.5% males, 13.3% females). In the 2006 PALS, these rates changed to 14.3% overall (13.4% males, 15.2% females).[2] Of the 3.4 million disabled adults in Canada, 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

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to policy makers who design, manage, and investigate reforms for income support programs for the disabled. In addition, the wage gap and differing labour force experiences of persons with disabilities vis-à-vis non-disabled persons can have some practical application in economic assessment for civil litigation. After presenting the results from the 2001 PALS, this paper discusses their introduction into Canada's court system and how various judges in reported cases have viewed them.

This paper examines the impact that a disability has on the employment income and labour force participation of Canadian men and women using data from the 2001 PALS public use micro-data file ("PUMF"). These estimates show large earnings penalties associated with disability ranging from 21 percent for mild disabilities to over 50 percent for very severe disabilities. Additional findings indicate 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, this study's estimates for more severe disability are comparable, but its 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 Canadian HALS surveys (the 1986 and 1991 *Health and Activity Limitation Surveys* (HALS) which were the precursors to the 2001 PALS), and the Canadian *Labour Market Activity Survey* ("LMAS")[3] in accurately identifying mild disability versus non-disability. 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. Interestingly, in the US, recent studies have concluded that a "downward trend in employment for people with disabilities began in the 1990s and has continued on to the present" Barnow (2008).[4]

The close of the article provides excerpts from actual Canadian reported cases where judges have commented on how they view the HALS and PALS data and how they have been used to establish awards for loss of income in Canada.

II. Literature Review

While the literature addressing the impact of disability on labour market outcomes in Canada 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.[5] Moller (2005) notes that, "A number of studies indicate that there is a

positive relationship between health and earnings…In both the short and the long run significant earnings losses are found. *Most of the changes in earnings seem to derive from changes in annual hours of work, rather than changes in wages*" (p. 956, emphasis added). Similarly, Charles (2003) finds, using panel data instead of cross-sectional data, that "disabled men experience sharp drops in expected annual earnings, *caused mainly by hours reductions rather than changes in wages,* around the measured date of onset." (p. 619, emphasis added)

Disabled workers are more likely to be working in low skill occupations due to having lower qualifications than the non-disabled. Schur (2003) finds that workers with disabilities are about twice as likely as nondisabled workers to be in contingent and part-time jobs. The lower earnings of persons with disabilities persist 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 (1993) uses data from the 1986 Statistics Canada HALS to study the effect of disability on labour force participation. 45 percent of Harkness's sample of males participated in the labour force. For those males participating 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 can be explained by the fact that a disabled Canadian male worked half as many hours per year as his able-bodied counterpart worked. Harkness's 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 males with a disability in the labour force.

Hum and Simpson (1996) investigate the effect of disability on labour market activities in Canada using the Master File for the Canadian 1989 LMAS. In their sample, individuals with a disability 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 people with disabilities is only 7 percent of the average earnings of $21,797 for individuals without disabilities (both sexes). Hum and Simpson find that the severity of disability affects the number of hours people with disabilities work.[6] 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; males with a severe disability earned 42.2 percent less. For females with a disability 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 (1994) find for the U.S.

Gannon (2005) finds that disabled men with a 'current severe limitation' are 9 percentage points less likely to participate in the work force compared to men with disabilities. Women with the same constraint have a lower probability of participation by 26 percentage points compared to women with no disability.

Brown (2009) reports estimates based on data from the 1991 HALS of the impact of disability on labour market outcomes for individuals whose disabilities were the result of injuries incurred in motor vehicle accidents. 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 was 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 (2009) reports that employment income was 10 percent, 18 percent and 25 percent lower for men with a mild, moderate or severe disability.[7] 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 (1975) and Baldwin, Zeager and Flacco's (1994) findings for the U.S. that show that men with disabilities experience a greater decline in earnings than women with disabilities.

Preliminary results from the 2006 PALS show that participation rates are lower, unemployment rates are higher, and incomes are lower for persons with disabilities in Canada versus non-disabled persons. Whereas participation rates reach 80% for persons *without* a disability, this rate decreases to 70% for those with a mild disability; to 60% for those with a moderate disability; and to just above 40% for those with a severe disability. Unemployment rates are barely 6% for persons *without* a disability but rise to almost 8% for those with a moderate disability and more than 12% for those with a severe disability. An analysis of median employment incomes showed that females with a disability experienced

27% lower wages whereas males with a disability earned 37% lower wages in Canada in 2005.[8]

III. Data, Variables, and Summary Statistics

The 2001 PALS is a post-census national survey and the successor to the 1986 and 1991 HALS.[9] 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.[10] 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 identifies persons with disabilities. These filter questions were substantially improved from the 1991 HALS survey as per Statistics Canada (2002b). The Census filter question 7 was: does this person have any **difficulty** hearing, seeing, communicating, walking, climbing stairs, bending, learning or doing any similar activities? The Census filter question 8 was: does a physical condition **or** mental condition **or** health problem **reduce the amount or the kind of activity** the person can do? Ten types of disabilities were considered: hearing, seeing, communication, mobility, agility, pain and discomfort, learning difficulties, memory problems, developmental disability and psychological conditions. After identifying persons in the 2001 Census form, the 2001 PALS questionnaire asked people detailed questions about not only the *frequency* of activity limitation, but also the *intensity and type of impairment* was questioned. Indeed, the 2001 PALS questionnaire consists of 131 questions asking about impairment (section B); 52 questions about help needed with everyday activities (section C); then sections on how the impairment affects education (section D), employment (section E) and social participation (section F); and then a final section on the costs associated with disability and the individual's income level (section G).[11] The PALS scoring of the questionnaire interacts the questions about frequency and intensity of the impairment to make a determination of type and severity of the injury. In some cases, such as with a hearing disability, three questions are asked (not just one).[12]

The PALS method of first, identifying persons with disabilities, and second, asking specific and numerous questions about the type of disability and how it affects work and home life, differs from one of the surveys in the US, namely the *Current Population Survey* ("CPS").[13] As described by Hale (2008), the main purpose of the CPS questions about labor force activity has *not* been to identify the disabled population, but rather to exclude those who are not participating in the labor force, with little concern for the reason why the person was not participating. Hale acknowledges, "We do not know the characteristics of those who endorse

the questions [about disability]. This point has been made in numerous venues." (p. 103) This author extends his criticism about the CPS when he says, "From BLS' perspective, the questions were designed to act as a set to identify the disability population, and not to identify people with specific disabilities." (p. 107) Jones (2005) remarks "The CPS has long been criticized as a source of information about the disabled and its impact on their earnings." (p. 156) Jones points to Hale's (2001) revelation that the CPS does not identify any disabled wage-earners because once the respondent meets the criteria for employed or unemployed, the response of 'disabled' is erased from the published file because the CPS deems it inconsistent with labor force activity. Skoog and Toppino (1998) recognize that the CPS data fail to link an individual's disability status with employment or employability. Moreover, there is no specification in the CPS between types of disabilities: there is no reference to disabled hands; none to traumatic brain injury; none to vision or wheelchairs. Jones (2005) contends that because of this and other failures, the CPS "was designed…to be valid at the population level, not the individual level." (p. 159). This is not the case with the PALS data – indeed, the identification of people with and without disabilities, and by severity and type of disability (amongst 10 different categories) in and out of the labour force[14] is what permits the current authors to quantify the wage gaps between those individuals.

Hale (2008) has similar qualms about the propensity of the *American Community Survey* ("ACS") to identify the disabled population in the US. Concerns about the ACS questions included the inability of the respondent to accurately answer the questions, and the fact that the ACS identified far fewer individuals with disabilities that did the *Survey of Income and Program Participation* ("SIPP"). The SIPP, however, has its own problems. Hale (2008) discusses the inability of the SIPP-style questions to accurately identify the disabled population.[15] Jones (2005) remarks that "'Disability' as statutorily defined for the purposes of identifying those in need of civil rights protection does not necessarily identify the same people as do household surveys." (p. 159). Jones (2005) also remarks that the SIPP does not focus on employment status or employability.

As long ago as 1981, Phillip Rones identified the key questions that must be answered to assess the effects of disability on job market performance: "(1) how many people have physical handicaps (generally limited to chronic conditions); and (2) how do these handicaps limit the kind or amount of work or the pay of those so identified?" (p. 37). The 2001 PALS survey was designed precisely with these questions in mind.[16] Gannon (2005) notes how important the identification questions are to the results: "…if the reporting of disability in the survey is prone to

measurement error, we cannot estimate the true effect of disability on participation." (p. 936)

Despite the improvements to the PALS questionnaire compared to some of the US databases, the respondent's answers are ultimately based on a self-report. Charles (2003) describes some of the problems related to self-reporting about disability. The first two problems, however, are not germane to the PALS survey, because the detailed questions about activity limitation in section B of the questionnaire allow a determination of "type" of disability; and in the 1991 HALS questionnaire, there was a question that asked about the origin of the limitation – whether, for instance, it occurred at birth or because of a motor vehicle accident.[17] The third problem that Charles (2003) mentions is the propensity of persons with poor labour force attachment to use disability as an excuse for their low earnings, even though the low earnings may be unrelated to health. Fortunately, because there are so many questions in section B of the PALS questionnaire that ask the respondent to describe his or her limitation (by frequency, intensity, and how it affects different aspects of life), it appears unlikely that using disability as an excuse would have occurred with many respondents due to the unwieldy effort it would have taken.

With a response rate of 82.5 percent, the original 2001 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 PUMF for the 2001 PALS data-set was reduced to 20,710 individuals with disabilities 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 this study, the current authors include observations for individuals aged 20 to 64. This study excluded any observations with missing information in any of the variables of interest for the study, as well as part-time and full-time students. Thus, the 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. *PALS* also has a derived variable, "DEGREE", that indicates four categories for the severity of disability ("mild," "moderate," "severe," and "very severe"). These categories are represented with a set of disability dummy variables.[18]

For this article, the measure of employment income from the 2001 PALS is reported as income categories with a top category defined as over $80,000 in annual earnings.[19] This study uses the mid-point of each income category to value individual incomes and treats that income variable as a continuous measure. Additionally, the small number of individuals in the *PALS* samples who earned over $80,000 were dropped because it was impossible to define a mid-point for an open ended

category.[20] This study's measure for labour force participation comes from the PALS variable "LFSTAT", which was created from section E "Employment Status" of the PALS questionnaire.[21] We define respondents categorized as employed or unemployed as in the labour force and all other cases as not in the labour force. Also included in this study are 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 individuals with disabilities in our samples. The average income for non-disabled and women with disabilities was $20,238 and $10,237 respectively. The average income for non-disabled and men with disabilities was $31,353 and $15,797 respectively. For both males and females, these income gaps are large at 50 percent. (Table 2 illustrates that the sample means for persons with disabilities, as a group, are less well educated than the non-disabled. This may be the reason for some of the wage gap – which is why the current authors proceed to regression analysis rather than relying on the simple averages in Table 1). The impact of disability on earnings does not appear to impact males more than females as previous studies have found. Table 1 also shows that for those individuals who participated in the labour force, the individuals with disabilities work on average 90 percent of the weekly hours of the non-disabled. The proportion of individuals with disabilities 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 males with disabilities and females with disabilities are 54.5 and 47.0, which are significantly lower than for non-disabled males (90 percent participating) and females (77 percent participating).

Table 2 presents the sample means of the variables for males and females, with and without disabilities, as well as for the Canadian population of males and females from the 2001 Census. Individuals with disabilities in this study's samples are on average older, less likely to be married, and have lower educational attainment than the non-disabled individuals in the samples, and relative to the averages for the Canadian population. In terms of occupational attainment, the only noticeable difference between the individuals with disabilities and the non-disabled is that individuals with disabilities are less likely to be in "Management" occupations.

The earnings gaps in Table 1 are comparable to Harkness's (1993) finding for males with a disability in the 1986 HALS, but these earnings gaps are higher than the 37 percent found in the 1989 LMAS by Hum and Simpson (1996), and Brown's (2009) 34 percent gap for males with a

disability by a motor vehicle accident from the 1991 HALS.[22] If one compares the average annual earnings of individuals who report participating in the labour force, then the earnings ratio between the non-disabled and individuals with disabilities falls to 75 percent for both males and females in the 2001 PALS (i.e. a 25 percent gap). Hum and Simpson (1996) find in the 1989 LMAS that for individuals reporting positive hours of work, the earnings ratios are 94 percent for males and 85 percent for females. The larger earnings gaps in the 2001 PALS samples reflect, in part, that there are larger proportions of individuals with disabilities reporting moderate and severe disability in our 2001 PALS samples than in the 1989 LMAS and HALS 1991 samples used by Hum and Simpson (1996) and Brown (2009) respectively.[23]

It is also a possibility that over the economic expansion of the 1990s, individuals with disabilities in the Canadian labour market fell behind their able bodied counterparts. When converting the 2001 PALS average earnings and the 1989 LMAS average earnings into 1992 purchasing power, the study finds 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 males with a disability real earnings fell by 19 percent. Non-disabled female workers had average real earnings gains of 22 percent between 1989 and 2001 while females with disability real earnings increased by only 6 percent. While it is possible that these changes reflect that workers with more disabilities 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 workers with disabilities between Brown's (2009) 1991 HALS sample and this study's 2001 PALS sample. Brown (2009) reports that for non-disabled and males with disabilities, the labour force participation rates in 1991 are 84 percent and 56 percent, and 72 percent and 50 percent for females. Where the labour force participation rates of non-disabled men and women increased over the 1990s, labour force participation of men and women with disabilities fell slightly between 1991 and 2001.

IV. Estimation and Results

The samples in this study 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. Three models were estimated to study the impact of disability on labour market outcomes. First, a Probit model was estimated using an indicator variable for labour force participation as the dependent variable. Second, using

ordinary least squares (OLS) estimation, a model was estimated 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. (This regression is done twice: once using the overall dummy variable for disability, then using specific dummy variables for different severity levels of disability). Third, a Heckman two-stage estimation was performed to correct for possible sample selection bias. This method re-estimates the log-earnings equation including an Inverse Mill's Ratio constructed from the Probit estimation to account for potential sample selection bias in the OLS regression.[24] All estimations 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, this paper's discussion focuses 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.[25] 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 OLS 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. In a second set of regressions that 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 the current authors' estimated marginal effects of disability with those reported in Hum and Simpson (1996) and Brown (2009). It should be noted that the categories representing the severity of disability are not directly comparable between the 2001 PALS and the 1989 LMAS and 1991 HALS.[26] This study's estimates suggest much larger effects of disability than the other two studies. The 2001 PALS estimates for disability in general are three times larger than the 1989 LMAS estimates and double the estimates for 1991 HALS 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 2001 PALS. Where the 1989 LMAS shows no significant reduction in earnings for males with mild disabilities, the 2001 PALS 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 2001 PALS and 1989 LMAS.

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.

However, the more likely reason that the 2001 PALS 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 1989 LMAS data suffers from poor identification of disabled individuals such that the measurement error is worse for less severe disabilities.[27] Statistics Canada (2002) describes how the PALS data is based on revamped Census filter questions for identifying disability. The new Census filter questions identify a 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 turned 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, does 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 1989 LMAS and 1991 HALS could reflect that disabled Canadians have fallen behind the non-disabled as the economy expanded in the 1990s.[28] As noted earlier, labour force participation rates of individuals with disabilities in Canada have changed little between the 1991 HALS and the 2001 PALS, 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.[29] 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.

V. Use of PALS Data in Court Cases

It is sometimes difficult to quantify how disabling conditions may translate into loss of earnings. The impairment suffered by the plaintiff may not have translated into a loss of earnings because of a 'boom' in the plaintiff's industry (generating increase in earnings beyond the pre-incident income levels regardless of the plaintiff's reduced capacity); or the plaintiff may be able to offset a foregone promotion, reduced productivity or loss of billable hours by working additional hours or overtime hours which were not worked before the incident. If this is the case, it can be difficult to know what the true impact will be when the plaintiff can no longer compensate with such strategies in the future, or when the 'boom' period ends.

The wage gaps in Table A (by type) and Table 6 (by degree of severity) offer statistical support in cases where the impairment of injury will occur sometime in the future in terms of the impact on earnings, but is not explicitly manifesting itself at the date of incident or a few years thereafter. The impact of the person's impairment may be obscured by an

increase in economic activity in the person's industry or an expansion of the person's business that would have occurred anyway, and the loss is amongst the cost of replacement workers. These wage gaps are also ideal for cases in which "loss of opportunity" or "loss of chance" has to be assessed, but the loss may occur in the future either because the minor child or adult has not yet entered the labour force or the true impact of the injury may only come with age.

To compare the impact on labour force participation ("LFP") rates from the 2001 PALS to the figures in Table 3, women who reported only a mild case of disability had a statistically significant effect of a 14% reduction in predicted participation rates, and those who reported a moderate level of disability experienced a statistically significant 23% reduction in their chance of entering the labour force. Those in the severe range have a 40% reduction in their probability of entering the labour force, which proves to be significant, and women who indicated the level of severity to be very severe a 58% reduction in their chance of entering the labour force. With respect to the impact on male labour force participation rates, the reduction in the probability of participating in the labour ranged from 19% for those in the mild category to over 70% in the very severe category when compared against non-disabled men. As was the case for women, the male LFP rates all proved to be statistically significant.

In the 2001 PALS, the seven types of disability[30] are agility, hearing, mobility, pain,[31] seeing, speech and "other"[32] disability categories. Each category of disability is then separated into two classes that indicate if the particular disability is less or more severe. Those two levels of disability are then compared to non-disabled men and women to see how employment income and participation rates vary between the two groups.[33]

The findings, reproduced in Table A below, indicate that for both men and women, disability has a negative and statistically significant effect on employment income and labour force participation when compared to non-disabled men and women. Women who indicated that they suffer from a mobility disability make between 29.5% and 41% less than non-disabled women and are 26% to 53% less likely to enter the labour force. Men who indicated a disability in the mobility category experience 24% to 27% less employment income than non-disabled men, and are 35% to 63% less likely to enter the workforce depending on the limitation of their mobility.

The other categories tell a similar story with agility and speech affecting a disabled woman's employment income the most with a 35% to 53% and a 35% to 48% reduction respectively. For the men, speech and

the "other" category impact earnings the most with losses that range from 41% to 45% and 36% to 42% respectively.

Table A: **Earnings Gaps due to <u>TYPE</u> of disability, 2001 PALS**

	MALES		FEMALES	
	Marginal Effect	*t*-Statistic	Marginal Effect	*t*-Statistic
Agility				
Less Severe	-22.18%	-3.47	-34.88%	-4.47
More Severe	-46.45%	-3.11	-52.63%	-3.22
Hearing				
Less Severe	-14.82%	-2.86	-32.95%	-5.36
More Severe	-16.68%	-2.12	-27.24%	-2.45
Mobility				
Less Severe	-23.58%	-3.77	-29.52%	-4.27
More Severe	-27.12%	-2.15	-41.36%	-2.67
Pain				
Less Severe	-17.09%	-4.43	-21.63%	-4.41
More Severe	-24.66%	-3.03	-33.46%	-3.42
Seeing				
Less Severe	-26.48%	-3.29	-38.26%	-4.01
More Severe	-36.42%	-2.25	-20.85%	-1.11
Speech				
Less Severe	-41.10%	-3.91	-35.33%	-2.48
More Severe	-45.52%	-4.86	-48.23%	-3.52
Other				
Less Severe	-36.25%	-5.84	-35.07%	-4.27
More Severe	-42.04%	-3.74	-44.86%	-3.28

**Statistical Significance Occurs when t-stat>1.645 or 5% Interval*

With respect to labour force participation, men with severe mobility limitations have the smallest probability of joining the labour force with a rate of 64% less than men without severe mobility restrictions. For the women, those whom indicated a severe disability in agility had the lowest probability of joining the labour force when compared to non-disabled women with a marginal effect of -55.1%. (The table with these results is not replicated in this article, but the data is available from the author upon request.)

VI. Regression Results by Occupational Category From the 2001 PALS

When correcting for sample selection bias a negative and statistically significant marginal effect on income for men occurs in 7 of the 10 occupational categories. (The results are not shown here, but are available from the author upon request.) A male who is disabled and is in "management" is estimated to make 16% less annual income in 2000 than his non-disabled counterpart. In health related jobs a disabled man makes 35% less employment earnings than a non-disabled male in the same occupation category. The estimated marginal effects for all other employment categories are negative and follow the same trend, male disabled workers make less then their counterparts in each occupational category. For the women the same effect is true. Those disabled women in the business or administration occupation class make 29% less than non-disabled management women, and disabled women who have jobs in the sales or services occupations make 37% less than non-disabled women in the same field.

VII. Canadian Case Law on the HALS/PALS Approach

This section considers reported cases in which the results of regression analysis has been conducted from the 2001 PALS and the 1991 HALS and been presented to judges in Canadian courts. In most cases, the judges quite rightly discern the need to make the link between the respondents of these surveys and the individual plaintiff in question.

In *Mahe v. Boulianne* (2008),[34] Marshall J. considered the 1991 HALS and 2001 PALS data presented by one of the authors (Brown) on the plaintiff's behalf:

> [93] I accept the Health and Activity Limitation Survey and Participation and Activity Limitation Survey ["HALS-PALS"] approach to ascertaining the effect of disability on earnings. The Plaintiff has less than 11 years of working life before likely retirement. One to two of those years will probably be spent in retraining. When this is considered along with this disability, I conclude that he should be compensated on the basis of a very severe disability with a 49% PALS reduction in earnings as set out in scenario A2 B3 on page 5 of Exhibit 18.

In *Dabrowski v. Robertson* (2007),[35] Veit, J. considered the 1991 HALS and 2001 PALS data presented on the plaintiff's behalf. Even though Veit,

J. did not award damages in this case because she found no liability on the part of the defendant, she stated the following regarding the use of those surveys with respect to making an award for loss of income:

> [155] Had the court concluded that Ms. Robertson was to some degree negligent with respect to the accident, it would have concluded that, as of the date of trial, Mr. Dabrowski had, essentially, recovered from the accident: as of the date of trial, Mr. Dabrowski held a truck driving job that is similar to the job he had before the accident, he is making more money than he made at the time of the accident, his depression and anxiety are manageable, as is his highway driving at speed phobia…
>
> [157] Nonetheless, the court would have gone on to conclude that Mr. Dabrowski had established, through Cara Brown's HALS/PALS analysis, that it was possible that he would suffer some loss of income in the future, although that loss would be based on a minor or moderate level of disability rather than the severe level of disability used by Ms. Brown.

(i) The HALS/PALS analysis

[158] Had the court concluded that Mr. Dabrowski was entitled to recovery, *it would have agreed with Mr. Dabrowski's economist, Cara Brown, on her endorsement of the HALS/PALS approach to using statistical data to predict the probable effect of disability of a member of the labour force.* (Emphasis added) This approach is particularly important in a situation such as the one here where Mr. Dabrowski eventually returned to the labour force, and was earning more money at the time of trial than he had been earning at the time of the accident. As Ms. Brown puts it:

> The impairment suffered by the plaintiff may not have translated into a loss of earnings because of a 'boom' in the plaintiff's industry (generating increase in earnings beyond the pre-incident income levels regardless of the plaintiff's reduced capacity).

[159] Where a victim of negligence is a member of the labour force, or is expected to become a member of the labour force, it is appropriate to recognize the potential loss of income from employment separately from the award that is made for the disability itself in the pain and suffering award for non-pecuniary damages. In this way, the additional potential loss to earning power which is borne by a victim of negligence who is, or who

> expects to be, employed can be fairly compensated. A person who has no attachment to the labour force and a person who is attached to the labour force who both lose a leg are not entitled to the same award of damages.
>
> [160] In this case, Dr. Jomha has provided evidence to the effect that Mr. Dabrowski should expect to feel the results of his ankle injury permanently.
>
> [161] On this issue, the court notes, as well, that Ms. Robertson's economist…does not disagree with either the validity of the HALS/PALS input or the regressive analysis undertaken by Ms. Brown. His only concern is limited to the observation that, where much is known about an individual litigant, that specific information rather than generalized information of the type found in the surveys, should be preferred.
>
> [162] I do not disagree with [the opposing expert's] concern. However, even accepting Ms. Brown's approach, I would not, as she has, classified Mr. Dabrowski's impairment as 'severe" or "very severe". In modifying her approach, I would have relied on Ms. Brown's own standards:
>
> > The validity with which the HALS or PALS data represents the plaintiff's reduced earning capacity in the future depends on medical or vocational prognostications about the plaintiff and the degree of severity the plaintiff will suffer, such severity being defined by the HALS and PALS surveys.
>
> [163] Here, I would place Mr. Dabrowski's impairment in the moderate category.
>
> [164] In the result, the court has estimated Mr. Dabrowski['s] future loss of income at $50,000.00.

Veit, J. emphasizes the way in which she links the results of the HALS and PALS studies with the assessment of Mr. Dabrowski's injury by Dr. Jomha (para. [160]), and in her revision of Mr. Dabrowski's severity of disability from "severe" or "very severe" to "moderate" (para. [163]). This is an excellent example of the trial judge's concern about translating the general findings from the HALS and PALS studies to an individual plaintiff. Without such evidence, the Canadian courts will likely find it difficult to apply the HALS and PALS results to an individual plaintiff. This means that the completion of the questionnaires, as well as evidence

from medical or vocational experts, will be necessary to establish these links.

Justice Rooke commented at length on the HALS/PALS approach used by one of the authors (Brown) in *Russell v. Turcott,*[36] and accepted not only the regression analysis that had been undertaken, but also realized that Ms. Russell's impairments were described as "moderate" and that this dovetailed with the plaintiff expert's vocational assessment of Ms. Russell. Nonetheless, Justice Rooke was alive to some of the concerns about the data, in that the two surveys are not directly comparable (the definition of disability changed between the HALS survey in 1991 and the PALS survey in 2001), that the estimates of loss differ between surveys (the percentage wage loss estimates are larger from the PALS survey than from the HALS survey), and that the description of the approach was described with words such as 'possibility' and 'could'. (paras. [298], [300], [303], [304], [305], [306]).

Justice Rooke also grappled with the application of HALS/PALS to Ms. Russell because even though he concurred with Ms. Brown's statement that '[it] is *sometimes* difficult to quantify how disabling conditions may translate into loss of earnings' [emphasis added] (para [304] - indeed, Justice Rooke said that being *sometimes* difficult is an understatement in Ms. Russell's case), in Ms. Russell's case her injury had been manifesting itself at the date of incident and a few years thereafter, but it was not certain that it would "occur sometime in the future". (paras. [307], [308], [310], [311], and [312]) Justice Rooke appeared to want to accurately assess any award given that Ms. Russell's impairments could either resolve after attendance at a chronic pain clinic, or that she could still experience a future loss of income in the long term (para [312]). Justice Rooke summarizes the dilemma that he saw in this case in para. [313]:

> "Where there would be a clear determination of a future loss of income, and a reasonable assessment of its playing out over time, the type of analysis done by Ms. Brown should be applied at the appropriate level of severity of impact, on a most reasonable assumption of occupation. However, that is not clear here. Nevertheless, I am prepared to accept that there is some *existent* contingency for potential future loss of income. But again, the *extent* of that contingent loss is not clear. Where the *existence* of loss is uncertain, even where accepted, and the *extent* of loss is not clear, I believe it appropriate to contemplate a form of "quick start" (my term) with a lump sum payment for the contingency. " (para [313])

Justice Rooke's final decision with regard to Ms. Russell's potential loss of income in the future resulted in a lump sum award of $100,000 (para. [316]).

The 1991 HALS approach was presented in *Jones v. Cheesebrough*[37] by one of the authors (Brown), and commented on by the trial judge as being consistent with the losses awarded by the court.[38] In *Robinson v. Williams* (2005),[39] Veit, J. commented on one of the author's testimony (Brown) on behalf of the defendants, and awarded an income loss based on a HALS type approach:

> …there is a wage gap between a person who has the kind of mild/moderate functional disability for employment purposes suffered by Mr. Robinson (the inability to cut his toe nails does not have an impact on his employability) and a fully able-bodied worker. That wage gap is in the range of 3-6%. In the circumstances here, this results in a probable yearly deficit for Mr. Robinson in the range of $3,000 - $3,500.

VIII. Using the PALS Wage Gaps When Plaintiffs are Self-Employed

Even though courts may be reluctant to apply the HALS/PALS wage deficits to someone who is self-employed, it should be noted that the 2001 PALS questionnaire *did* include self-employed persons. This can be seen in the selections offered to PALS respondents in questions E13, E54 and E80. In all three questions in the "Participation and Activity Limitation Survey - 2001 (Adults - 15 and over)", the respondent was asked, "In this job, are you (is…) mainly…

...

(3) self-employed alone or in a partnership…".[40]

In question E13, respondents who answered affirmatively to (3) constituted 11% of the total respondents who answered either (1), (2) or (3).[41] This is close to the population on the whole, of whom 16% are self-employed in Canada.[42]

The reluctance to directly apply the HALS/PALS wage deficits to the self-employed appears to stem mainly from the accurate recognition by the courts that some portion of the entrepreneur's income is earned by the investment of the organization's capital and labour (of other employees). The importance of this realization is that this portion of earnings is not derived directly from the physical efforts of the entrepreneur, so to the extent that the worker's ongoing impairment (as represented by the

HALS/PALS deficits) would not affect this portion of earnings, then the application of the HALS/PALS deficits overstates the loss that the entrepreneur might experience.

Since it is known that the 2001 PALS survey *did* include self-employed respondents, and it is also known that impairments can still affect a worker's capabilities even if s/he is self-employed (assuming the plaintiff is physically working in the business and is not simply a silent investor), then the HALS/PALS wage deficits can be used as a proxy for the potential future impact of an injury. The adjustment that needs to be made, however, is to exclude the portion of the entrepreneur's income that is earned from the investment of capital and/or labour of other employees. These authors attempt to measure this portion by using Statistics Canada's *Financial Performance Indicators 2003-05.* These statistics report return to equity ratios[43] for organizations by province (in this example, Alberta), gross revenue (in this example, under $5 million), industry sector (in this example, NAICS 23 – construction), and year (averaged ratios for 2003, 2004 and 2005 were used - the most recent data available from this source). This ratio may not be the exact measure of the portion of the entrepreneur's income arising from investing in capital and labour but it is the closest measure to be found by province, industry sector and establishment revenue that allows these authors to estimate the "return" to an entrepreneur that may be separate and apart from his/her own physical efforts. Thus, in applying the HALS/PALS ratios, first the entrepreneur's income was adjusted downward by excluding this portion of his/her income related to the return on equity. For instance, in this example, Table B below shows that the average "return on equity" from 2003 to 2005 was 28.53% for construction businesses. Based on the plaintiff's ownership (i.e., 100% or less, depending on whether there are other owners) the plaintiff's self-employed income was reduced by this "return on equity"; in this example, the plaintiff is a 100% owner of his business, so it is assumed that his deficits would not affect the return on equity (100% x 28.53% = 28.53%). Thus the estimate of the plaintiff's self-employed income was reduced by 28.53% before the HALS/PALS reductions were applied for the purpose of estimating his potential loss of income. This adjustment is an attempt to adjust for the realization that any deficits or impairments that the entrepreneur might have are not likely to affect his/her return to equity derived from the investment of capital or labour.

Table B: Financial Performance Indicators – Construction Sector

Year	Firm Revenue: Under $5 million (Alberta)	
	Average Return on Equity	Average Operating Profit Margin
2003	35.50%	5.70%
2004	26.80%	3.70%
2005	23.30%	2.90%
Average	**28.53%**	**4.10%**

Source: Statistics Canada's *Financial Performance Indicators, 2003-2005,* NAICS 23, construction, Alberta.

Use of financial performance indicators for the construction sector as a whole may overstate the return on equity realized by the plaintiff. For example, although the average return on equity for residential building construction (NAICS 236110) in Alberta from 2003 to 2005 as per Statistics Canada's *Financial Performance Indicators* is similar to that of the whole construction sector (30.0%), the average return on equity for commercial/institutional building construction (NAICS 236220) and industrial building construction (NAICS 236210) are 23.93% and 16.57%, respectively. This indicates that the reduction of the HALS/PALS earnings gaps for the plaintiff may be overly conservative and may result in his losses being understated.

IX. Conclusions

Using the 2001 Statistics Canada *Participation and Activity Limitation Survey*, this study examined the impact of disability on the income and on labour force participation of Canadian men and women. The estimates showed large earnings penalties associated with disability ranging from 21 percent for mild disabilities to over 50 percent for very severe disabilities. This study also found that disability is associated with a 30 percentage point reduction in labour force participation. This study's estimates of the impact of disability are comparable to other studies for more severe disability, but the 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.

The HALS and PALS wage gaps can be useful in Canadian court cases when the injury or impairment suffered by the plaintiff is difficult to translate into loss earnings, is obscured by other factors, or will manifest sometime in the future. Wage gaps can be applied based on degree of severity or type of disability, but the court excerpts show that a link to the person in question must be established in court testimony, usually through the completion of a survey questionnaire and/or through corroborating testimony from a medical or vocational expert. These authors have created such a questionnaire for the 2001 PALS, which can be found in Appendix 5-2 of Brown's *Damages: Estimating Pecuniary Loss*.[44]

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	PALS Non-Disabled	PALS Disabled	PALS Disabled	2001 Census	2001 Census
	Males	Females	Males	Females	Males	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

NOTES: * Both Sexes

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

	Females		Females		Males		Males	
		t-ratio		*t*-ratio		*t*-ratio		*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		17,267		17,267	
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	-4.10			-0.29	-4.76
Severe			-0.33	-5.65			-0.40	-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	8.90
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	-0.10	-3.13	-0.11	-3.29
Separated	0.08	1.50	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	0.30	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	0.30	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		17,267		17,267	
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	n/a	n/a	n/a	n/a

NOTES: PALS estimates are from Tables 4 and 5. LMAS 1989 are calculated from the estimated coefficients from Table 4 of Hum and Simpson 1996. HALS 1991 estimates are from Brown (2009). "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.

Endnotes

1. Statistics Canada has been involved in conducting surveys on persons with disabilities since the early 1980s. The 2001 post-censal disability survey (because it uses the Census as a sampling frame to identify its target population), renamed the *Participation and Activity Limitation Survey* (PALS), was carried out in the fall of 2001, about four months after the 2001 Census. The PALS provides detailed information about the demographic and socio-economic situation of persons with disabilities as well as the type and severity of their disabilities. The 2001 PALS uses new Census disability filter questions to identify its population; they are more inclusive than the ones used in 1991. The PALS sample used a new sampling plan. The PALS questionnaire content, including new screening questions, is significantly different from that used in the 1991 HALS questionnaire. (Source: Statistics Canada, "A New Approach to Disability Data: Changes between the 1991 Health and Activity Limitation Survey (HALS) and the 2001 Participation and Activity Limitation Survey (PALS)." Catalogue no. 89-578-XIE (Ottawa: Minister of Industry, 2002), pp. 2-4.)

2. As per Statistics Canada's *Participation and Activity Limitation Survey 2006: Tables*. Catalogue no. 89-628-XIE – No. 003. (Ottawa: Minister of Industry, 2007). Tables 3.1 and 3.1-1, pp. 31-32. These rates exclude the Yukon, Northwest Territories and Nunavut. The total size of the 2001 PALS sample was 43,276; the total size of the 2006 PALS sample was 47,793. In 2001, the Aboriginal community was excluded as it was covered in the *Aboriginal Peoples Survey* (APS); in 2006, the aboriginal communities were included. (Source: Statistics Canada's *Participation and Activity Limitation Survey 2006: Technical and Methodological Report*, catalogue no. 89-0628-XIE – No. 001 (Ottawa, Ontario: Minister of Industry), December 2007, pp. 10 and 12). At the time this paper was written and submitted for publication, the 2006 PALS PUMF had not been released, so our results are restricted to the 2001 PALS PUMF and earlier results from the 1991 HALS PUMF.

3. The *Labour Market Activity Survey* (LMAS) collects annual information on employment. The objectives of the survey were to: measure the frequency and number of job changes occurring in the Canadian labour market over one-, two- and three-year periods; provide information on the characteristics of jobs held (wage rates, usual work schedules, etc.); identify groups of people who would benefit from EIC programs; and identify participants of specific EIC programs. Detailed

information for 1991 was released on March 4, 1993. The sample was cross-sectional.

4. Barnow's 2008 publication focuses mainly on the problems of measuring employment and disability in the three main American surveys (the 2000 Census, the *Current Population Survey* ("CPS") and the *Survey of Income and Program Participation* ("SIPP")) but he does reference Stapleton and Burkhauser's 2003 edited volume entitled *The Decline in Employment of People with Disabilities: A Policy Puzzle* (Kalamazoo, MI: Upjohn Institute for Employment Research) and Stapleton, Burkhauser and Houtenville's 2004 research brief *Has the Employment Rate of People with Disabilities Declined?* (Ithaca, NY: Cornell University, Employment and Disability Institute) when citing the finding that employment prospects for the disabled have worsened in the past two decades.

5. For Canada see, Gower (1988), Nessner (1990), Statistics Canada (2008, 2007, 2002, 1991), Harkness (1993), Bergob (1995), Shain (1995), Hum and Simpson (1996) and Brown (2009). For the U.S. see Davis (1972), Luft (1975), Fenn and Vlachonikolis (1986), Haveman and Wolfe (1990), Danzon (1993), Baldwin and Johnson (1994), Stern (1996), Hale, Hayghe and McNeil (1998), Baldwin, Zeager and Flacco (1994), Beegle and Stock (2003), Charles (2003), and Schur (2003). For Australia, see Brazenor (2002) and Wilkins (2004). For Sweden, see Thoursie (2004); Denmark, Dano (2005); and Ireland, Gannon (2005).

6. 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.

7. Estimates from a two-stage Heckman procedure to control for sample selection bias.

8. Sources: Statistics Canada's *Participation and Activity Limitation Survey 2006: Tables (Part III)*, Catalogue no. 89-628-X – No. 008, July 2008, Table 2 and Statistics Canada's *Participation and Activity Limitation Survey 2006: Tables (Part V)*, Catalogue no. 89-628-X – No. 011, October 2008, Table 7.2.

9. The 2001 PALS survey improved the Census filter questions as well as the questionnaire that users answered about their impairments from the 1991 HALS survey. 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 (source: Statistics Canada, *A New Approach to Disability Data: Changes between the 1991 Health and Activity Limitation Survey (HALS) and the 2001 Participation and Activity Limitation Survey (PALS)*, catalogue 89-578-XIE, December 2002):

- The 2001 PALS included new census disability filter questions to identify its population. The new filter questions were 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, was 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". The HALS severity scale gave more weight to physical disabilities than to non-physical disabilities but the 2001 PALS severity scale assigned an equal weight to all types of disabilities.
- 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).

10. PALS *User Guide* 2004, p.3.

11. Source: Statistics Canada. 2004. *Participation and Activity Limitation Survey (PALS) 2001: User's Guide to the Public Use Microdata File*.

12. An example of the three questions about a hearing impairment are: (1) how much difficulty do you have hearing what is said in a conversation

with one person? (2) how much difficulty do you have hearing what is said in a conversation with at least three other persons? (3) how much difficulty do you have hearing what is said in a telephone conversation? (Source: Statistics Canada's *Participation and Activity Limitation Survey 2006: Technical and Methodological Report 2006*, catalogue no. 89-628-XIE, December 2007).

13. Rones (1981) noted that the CPS data from the March 1977 edition used techniques that "do not provide an adequate distinction between the disabled and non-disabled" (p. 37) because there were no specific questions on health or disability status. Rather, the CPS tried to identify a disabled population by (a) including persons who received income from any government transfer program; (b) including persons whose work activity was limited during the year by reason of ill health or disability; and (c) including persons whose wage rate was less than $1 an hour and who were in certain occupations, as it was assumed these persons were participating in sheltered workshops and thus counted as disabled.

14. In the follow-up to the 2001 PALS, Statistics Canada found in the 2006 PALS that whereas 44% of people with disabilities were not in the labour force, only 20% of people without disabilities were not in the labour force. (Source: Statistics Canada's *Participation and Activity Limitation Survey 2006: Labour Force Experience of People with Disabilities in Canada*, catalogue no. 89-628-X – No. 007, July 2008, Chart 1).

15. Hale (2008) notes that the SIPP-style questions were designed to ask if the person had difficulty doing something in particular (if she or he did, then they were assumed to have a 'moderate' disability); or if the person was unable to do something (in which case, the person was assumed to have a 'severe disability'). Follow-up questions from the Census showed that the SIPP questions failed to reliably identify the same number of people with disabilities. In subsequent yearly interviews half those reporting being blind or deaf in the first year were without hearing or seeing limitations a year later. Nearly a third unable to walk initially could walk without restrictions a year later. As a result, "SIPP was no longer considered the gold standard." (p. 105)

16. Question A2B, one of the "filter" questions of the 2001 PALS questionnaire, asks the respondent: "Does a physical condition OR mental condition OR health problem REDUCE THE AMOUNT OR THE KIND OF ACTIVITY you (…) can do at work or at school?" Section B, called

"Activity Limitations", then asks a further 131 questions about how the limitation(s) affect the person.

17. This question permitted the authors to generate results from the 1991 HALS survey that were specifically from a motor vehicle accident – so the respondent did not have time before onset to acquire more human capital as a way of ameliorating the impact of the disability. (These results are published in Brown (2009)). The 2001 PALS dropped this question when they updated the 1991 HALS survey.

18. 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 (Hum and Simpson 1996, 298).

19. 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." (Appendix C, p. 314)

20. These 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.

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

22. Haveman and Wolfe (1990) report that in 1984, disabled males in the U.S. had annual earnings that were 0.54 of non-disabled males.

23. 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 and Simpson's (1996) 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.

24. This final model is only identified by the Probit functional form.

25. Probit estimation techniques are applied in situations where one 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.

26. Hum and Simpson's (1996) LMAS 1989 categories are directly comparable to the HALS categories however. See their data appendix.

27. Hum and Simpson (1996) suggest that the LMAS 1989 data leads to underestimates of the extent of severe disabilities. Statistics Canada (2002b) investigated this problem with HALS 1991 data that was developed from a post-censal survey. 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.

28. Haveman and Wolfe (1990) 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.

29. 1991 unemployment rates are from Brown (2009) and are based on data from the 1991 HALS.

30. The disability variables that are used to represent the seven different types of disability come from seven derived variables, "DEG_AGIL", "DEG_HEAR", "DEG_MOBP", "DEG_OTHER", "DEG_PAIN", "DEG_SEEP", and "DEG_SPCH" which were created from individual responses to disability screening questions in section B of the PALS questionnaire. (Source: *User's Guide to the Public Use Microdata File PALS 2001* Appendix C pp. 309-312)

31. Limited in the amount or kind of activities one can do because of a long-term pain that is constant or reoccurs from time to time, for example, recurrent back pain. (Source: *User's Guide to the Public Use Microdata File PALS 2001*, appendix G).

32. For confidentiality reasons related to the PUMF, 5 types of disabilities were reclassified into the "other" disabilities category. The disabilities included in this category are: "Learning", "Memory", "Developmental", "Psychological", and "Unknown". (Source: User's Guide to the Public Use Microdata File PALS 2001 Appendix G).

33. Added in the regressions was a dummy variable to capture all disabled individuals whom did not indicate that the particular disability was the one they experienced.

34. [2008] ABQB 680, filed Dec. 17, 2008. One of the authors (Brown) testified on behalf of the plaintiff in this matter.

35. [2007] ABQB 522 (CanLII). One of the authors (Brown) testified on behalf of the plaintiff in this matter.

36. [2009] ABQB 19, filed Feb. 6, 2009. One of the authors (Brown) testified on behalf of the plaintiff in this matter.

37. [2003] A.J. No. 324 2003 ABQB 196, para. 98. One of the authors (Brown) testified on behalf of the plaintiff in this matter.

38. Lomas, J. commented on this author's approach of using a 7% deficit based on the HALS research.

39. ABQB 659. One of the authors (Brown) testified on behalf of the defendant in this matter. See Brown Economic Consulting's *The Economics Editor* "Use of HALS/PALS Approach in Case Law" December 2005 Volume Two, Issue 10 and *The Economics Editor*, "Participation and Activity Limitation Survey ('PALS')" March 2007 Volume Four, Issue 3.

40. Statistics Canada, *Participation and Activity Limitation Survey (PALS) 2001: User's Guide to the Public Use Microdata File* (Minister of Industry, 2004), *Appendix B: Survey Questionnaire*, pp. 46, 54, 59.

41. Statistics Canada, *Participation and Activity Limitation Survey (PALS) 2001: User's Guide to the Public Use Microdata File* (Minister of Industry, 2004), *Appendix C: Dictionary of Data File*, p. 157.

42. Baldwin, John R. and James Chowhan, *The impact of self-employment on labour-productivity growth: A Canada and United States comparison*, Statistics Canada Research Paper catalogue no. 11F0027MIE – No. 016 August 2003, Figure 1, p. 3.

43. Return on equity is defined in *Financial Performance Indicators* 2003-05 as the ratio that "measures the level of return to the owners (investors) and it represents their measure of profitability. The earnings figure is the after-tax profits, including a deduction for interest expense

(payments to lenders). It is the net profit available to the owners (investors). The ratio indicates how many cents are returned to every dollar invested by the owners."

44. Source: Adapted from Statistics Canada, Housing, Family and Social Statistics Division, Participation and Limitation Survey (PALS) 2001: *User's Guide to the Public Use Microdata File, Appendix B: Survey Questionnaire, Participation and Activity Limitation Survey – 2001* (Adults 15 and over), FORM 02 (excerpted questions dealing with severity of disability); D. Faucher, *PALS 2001 Disability Scale for Adults*, January 29, 2002; and consultations with senior analysts at Statistics Canada.

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