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ABSTRACT

A strong association between lower socioeconomic status (SES) and worse health-- the SES-health gradient-- has been documented in many countries, but little work has compared the size of the gradient across countries. We compare the size of the income gradient in self-reported health in the US and Canada. We find that being below median income raises the likelihood that a middle aged person is in poor or fair health by about 15 percentage points in the U.S., compared to less than 8 percentage points in Canada. We also find that the 7 percentage point gradient difference between the two countries is reduced by about 4 percentage points after age 65, the age at which the virtually all U.S. citizens receive basic health insurance through Medicare. Income disparities in the probability that an individual lacks a usual source of care are also significantly larger in the US than in Canada before the age of 65, but about the same after 65. Our results are therefore consistent with the availability of universal health insurance in the U.S, or at least some other difference that occurs around the age of 65 in one country but not the other, narrowing SES differences in health between the US and Canada.

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I. Introduction

Individuals with higher income enjoy significantly better health on average than those with lower income. The association between higher socio-economic status (SES) and better health, known as the health-SES gradient or socioeconomic disparities in health, has been documented with many different measures of health status and many indicators of SES (Marmot et al 1978; Marmot et al 1991; Backlund, Sorlie and Johnson, 1996; Feinstein, 1993; Kaplan et al., 1996; Kennedy et al., 1998; Mustard et al., 1997). Concerns about inequities in general, inequities in health in particular, and the low absolute level of health among the poor have led to a great deal of attention to these results.

There are many causal theories for the association between SES and health, including a posited relationship between low SES and stress, and low SES and poor health behaviors such as smoking, excess drinking, and poor dietary habits. However, no consensus has emerged to explain the relationship, although any policy attempt to reduce socioeconomic disparities in health must certainly be predicated on an understanding of the true mechanisms by which SES affects health (Deaton, 2002; Marmot, 2002).

Since health and income support systems differ significantly across countries, there may be a mostly untapped opportunity to try to disentangle causal influences on SES disparities in health by comparing the strength of these disparities in different countries. While extensive work has documented the size of the SES-health gradient within individual countries, only modest work has compared the magnitude across countries. (Exceptions are Kunst, Geurts and van den Berg, 1995 and van Doorslaer et

al., 1997.) Even less work has concretely tried to use this information to disentangle the causes of any differences in gradient magnitudes across countries.

In comparing the US and Canada, the role of health insurance availability on disparities in health is of particular policy interest. Canada's Medicare program provides health insurance for all ages, while the US Medicare program provides health insurance only for those 65 years of age and older.[1] We use this natural experiment to perform a differences-in-differences analysis to attempt to disentangle the effect of universal health insurance from other drivers of the health-SES gradient. We compare how the size of the gradient changes just after age 65 compared to just before in the United States with how the size changes for the same age range in Canada, attributing the difference to the start of universal health insurance in the US.

Because there is an extensive literature documenting a decreasing gradient as individuals age (Mustard et al 1997; Beckett 2000), it is important to use Canada as a control to identify the pure aging effect on the gradient. As a further sensitivity analysis, we examine how the US-Canadian gradient differs at various points around ages in the range of 35-75. To our knowledge, we are the first to examine how age differences in the gradient vary by country, results which can be used to shed light on the causal factors behind the gradient.

We use population-based datasets from the US and Canada with similar questions. We first examine how the correlation of self-reported health status and income differs between the two countries for the near-elderly (ages 55 to 64), among whom the gradient

[1] Technically, the US Medicare program is not universal, even for those aged 65 and over, and some forms of care, most notably prescription drugs, have not been covered during most of the history of the program. However, particularly for hospital care coverage, the program is effectively universal. The US Medicare program also covers some disabled individuals, but since disability is required for eligibility, the non-elderly portion of Medicare is not universal.

has been shown to be the greatest. We then compare the gradient narrowing in the US at age 65 with that in Canada to attempt isolate the impact of universal health insurance. In order to further assess the causal role of universal health insurance, we examine the mechanism of greater access to health care by performing the same analyses using usual source of care as the dependent variable, rather than self-reported health status.

Because our interest is in what role universal health insurance can play in reducing the socioeconomic disparities in health and because lack of financial means is the most direct barrier to health care and health insurance, we chose income, rather than education or occupation, as our measure of SES. We find that income gradients in health are significant in both countries, but larger in the US. Being below median income raises the likelihood that a middle aged person is in poor or fair health by about 15 percentage points in the US, compared to less than 8 percentage points in Canada. We also find that the ages up to middle age, during which the gradient in all countries grows, are also ages during which the gap between the US and Canadian gradients grows, while the later ages during which the gradient in all countries shrinks are ages during which the US-Canadian gradient gap shrinks. It is possible that whatever factors cause the gradient to differ by age may also affect the difference in the gradient *by country.*

We find that the 7 percentage point difference in the gradient for those in middle age is reduced by about 4 percentage points after age 65. We also find that income disparities in the probability that an individual lacks a usual source of care are significantly larger in the US than in Canada before the age of 65, but about the same after 65. We conclude that the availability of universal health insurance, or at least another difference that occurs around age 65 in one country but not the other, may be

working to narrow differences in health in the US relative to Canada. However, it is also possible that whatever forces drive gradient narrowing are stronger in the US and than in Canada and are also responsible for the differential narrowing.

The rest of the paper is organized as follows: Section II discusses the many possible theories of the SES-health gradient, and how the gradient evolves at different ages. Section III discusses the empirical methods. Section IV presents our data. Section V provides the results and Section VI concludes.

I. Background

Evidence of significant SES-health gradients in the US is strong. Despite an overall decline in death rates in the United States since 1960, Pappas et al. (1993) find that poor or poorly educated people still die at higher rates than those with higher incomes or better educations. Moreover, this disparity actually increased in the 25 years following Kitagawa and Hauser's classic study of 1960 (1973). The magnitude of these socioeconomic differences in health has been found to vary by age, and much work documents a narrowing of socioeconomic differences in health at older ages in the United States (Deaton and Paxson, 1998; Backlund et al., 1996), a narrowing that is stronger for measures of morbidity (such as the prevalence of chronic conditions or limitations to functional status) than mortality (House et al., 1990; Preston and Taubman, 1994).

Canadian research has also found significant SES-health gradients (e.g. Ulysse, 1997) that vary with age. Mustard, Derksen, Berthelet et al. 1997 find a negative relationship between SES and mortality and the prevalence of specific chronic health conditions in the province of Manitoba, a relationship that that they estimate is strongest in early and late

midlife. In Canada as whole, Prus (2001) finds a significant relationship between education and health (including self-rated health and activity limitations) that increases from ages 25 to 64, and then decreases in later life.

One theory seeking to explain why disparities in health decrease with age follows the notion of the "survival of the fittest," where higher mortality for more disadvantaged groups at younger ages may leave a particularly robust group alive at older ages. A recent study, however, finds that the decline at older ages in the association between socioeconomic status and health is similar if one focuses on a consistent set of individuals over time rather than a cross section of individuals at different ages (Beckett, 2000). Other hypotheses that explain or contribute to the declining gradient with age need to be put forward, and may relate to theories underlying the existence of SES disparities in health in general.

The literature linking SES and health covers several different measures of SES (primarily income, wealth, education and occupation) and many different measures of health status. While most assume that lower SES causes poorer health, the causality, at least running from income or wealth as a measure of SES, could run in the reverse direction, with poor health lowering income and wealth due to lower earning power (Ettner 1996a; Smith 1999). While this effect is important for some individuals, it now appears that its quantitative contribution to the overall gradient is probably modest (Smith 1999; Deaton 2002; Meer et al. 2003).

Income may affect health because a certain set of material conditions, such as safe water, good sanitation, and adequate nutrition and housing are necessary for health. This suggests that income may affect health up to a threshold level where these material

conditions are satisfied, after which additional income is not related to health. Cross country evidence suggests that this threshold is met at a national income of about $5,000 per capita (Marmot, 2002), which does not suggest a significant role for material conditions in explaining the existence of an SES-health gradient in either the US or Canada.

Higher income may also be positively correlated with various psychosocial conditions that affect health such as self-esteem, personal sense of satisfaction, incidence of stressful life events, sense of control, and social support (House, Lepkowski, Kinney et al, 1994). It is even possible that those of lesser relative rank have greater stress in their lives simply by virtue of being of lower rank. Such a mechanism is supported by animal studies that experimentally manipulate an animal's status within a group and observe changes in both stress hormones and actual health outcomes (Cohen 1997; Cohen 1999). There is also some human experimental evidence of causal relationships.[2] These pathways suggest that income could be positively related to health throughout the range of income (Marmot, 2002), and a continuous rather than threshold relationship between income and health has indeed been documented both in the US (Deaton, 2002; Backlund, Sorlie and Johnson, 1999; McDonough et al., 1997) and Canada (Wolfson et al., 1993).[3]

Lower SES is also generally found to be associated with a higher prevalence of negative health behaviors such as smoking, excessive drinking, drug use, obesity, and

[2] It should be noted that the effect of relative rank depends on the comparison group, which is not necessarily one's country (Frank 1985). If Canadians include the United States when psychologically evaluating their relative status, then income redistribution within Canada may not have a straightforward effect.

[3] There is also a related, although distinct, literature on whether income inequality, as distinct from income level, is associated with health across areas. Laporte (2002) explains how the two issues are connected and why the relationship is more complicated than is often assumed. Ross et al (2000) compare the association of income inequality and health across areas within Canada and across areas within the United States, finding no association within Canada. Reviewing the extensive literature, however, Lynch et al (2004) conclude that income inequality does not seem to have an independent effect on health.

promiscuity (Deaton, 2002; Prus, 2001; Millar, 1996; Millar and Stephens, 1993; Roberge, Berthelot & Wolfson, 1995), and this is sometimes thought to be a special problem in the US. Eisner (2002), for example, finds a higher prevalence of drug use and problem drinking in the US than in Canada and most other countries studied. But some researchers argue that risky behavior itself is a function of low income, education, and lack of social control (Williams, 1990; Link and Phelan, 1995; Link et al., 1998). And in the end, poor health behaviors have been found in several studies to explain only a small portion of socioeconomic inequalities in health (Lantz et al., 1998; Marmot, 1994).

A final driver of SES-health gradients is differential access to medical care. Historical evidence has attributed declines in mortality more to improved nutrition and housing and less to medical care (McKeown, 1979; Fogel, 1997). This has led some to be skeptical of the role of differential access to medical care as a reason for significant SES-health gradients. Recent literature, however, posits a stronger role for medical care in improving health, especially in certain areas such as heart disease (Deaton, 2002). Although access to care differences may not be the sole drivers of SES-health gradients, they certainly could be significant. Income-driven differences in the quality and quantity of medical care would predict greater SES-health gradient steepness in the US compared to Canada, due to Canada's universal health insurance.

In addition to income, it should be noted that higher education levels are associated with better health. In fact, since education increases earnings, education may affect health both through a direct effect, and an indirect effect through income (Elo and Preston, 1996). Part of an observed correlation between education and health may also

be due to education proxying for a third variable, such as patience or risk aversion. However, education has been hypothesized to have a causal effect on health. Grossman (1972) hypothesizes that education enhances a person's efficiency as a producer of health, and there has been evidence that minimum schooling laws in the US in the early twentieth century improved health for affected cohorts (Lleras-Muney, 2001).

III. Empirical Methods

A. Gradient Difference Estimates

We compare the size of the SES-health gradient in the US and Canada, using a measure of relative income in each country. We first focus on the near elderly (ages 55 to 64) in each country, among whom the gradient has been shown to be largest. We use the following linear probability model to estimate the gradient difference[4]:

$$(1)\ PH_i = \beta_0 + \beta_{US} USA_i + \beta_{LI} LOW\_INC_i + \boldsymbol{\beta}_X' \mathbf{X_i} + \beta_{GD} USA*LOW\_INC_i + \varepsilon_i$$

where PH_i is an indicator denoting whether individual i is in poor health, LOW_INC_i is an indicator denoting whether i is below median income, and USA_i is an indicator denoting if i is in the US. X_i is a vector of covariates, specifically indicators for female, non-white, high school degree at most, and employment. Since income and education are known to be positively correlated, we control for education here, allowing us then to focus specifically on the availability of financial resources and its effect on access to care and health status.

β_{US} indicates any level difference in reported health status between the US and Canada, and will be positive if health status is worse on average in the US than in

[4] We have performed some past specifications with probits. The non-linear specification did not meaningfully affect our results.

Canada. β_{LI} indicates the size of the health-income gradient in Canada, and should be positive since individuals with low income are generally in worse health. The coefficient of the USA-low income interaction term, β_{GD}, indicates how much higher or lower the gradient is in the US relative to Canada. As discussed in the background section, theories that predict that at least part of an SES-health gradient is due to differences in access to health care would predict that this difference should be positive (steeper gradient in the US).[5]

B. Identification of Universal Health Insurance Effect

Next, we consider the size of the gradient in the two countries among both the near and young elderly (those aged 65 to 74). To isolate the effect of universal health insurance on health status, we exploit a natural experiment that changes the insurance status of most Americans at age 65. We examine the change at age 65 in socioeconomic disparities in health in the US relative to the change in Canada. This analytic method, a differences-in-differences on a variable that is already itself a difference, the health-income gradient, is much like the differences-in-differences-in-differences approach used increasingly by empirical economists (Gruber 1994; Kaestner 2000; Joyce and Kaestner 1996a and 1996b).

Specifically, we estimate the following triple-interaction linear probability model:

$$(2)\ PH_i = \beta_0 + \beta_{US} USA_i + \beta_{LI} LOW\_INC_i + \boldsymbol{\beta}_X' \mathbf{X}_i + \beta_{65+} AGE\_65\_PLUS_i + \beta_{GD} USA*LOW\_INC_i + + \beta_{GA} LOW\_INC*AGE\_65\_PLUS_i + \beta_{UA} USA*AGE\_65\_PLUS_i + \beta_{UHI} USA*LOW\_SES*AGE\_65\_PLUS_i + \varepsilon_i$$

[5] It should be noted, however, that such a finding would be consistent with other causal pathways. For example, a reverse causal mechanism in which health drives income could also be consistent with a steeper gradient in the US, due to greater social support in Canada.

As before, β_{GD} will indicate how much the gradient differs between the US and Canada. β_{65+} will indicate the overall effect of age on poor health status, and is expected to be positive. β_{GA} will indicate how much the gradient changes at age 65 in Canada, and is expected to be negative, as prior literature shows that the gradient tends to become more narrow with age. β_{UA} measures the effect of aging on health status in the US relative to Canada. We have no reason to expect β_{UA} to have a particular sign or to be statistically significant. However, if empirically there were such a relationship and we did not include this interaction term, our triple interaction term could spuriously pick up such an effect.

β_{UHI} is now our main coefficient of interest, revealing how much more the gradient narrows at age 65 in the US relative to Canada. We hypothesize that the coefficient will be negative, indicating that the disparity narrows more in the US than in Canada. We attribute this difference to the Medicare eligibility at age 65 in the US, although it should be noted that any other change that occurs at age 65 in one country but not in the other could also affect the triple interaction. One variable which may change at age 65 in both countries and be related to the use of health services and health is, of course, retirement. Retirement may, for example, decrease the time cost of seeking medical care. Age 65 is, however, the normal age of retirement in both the US and in Canada (Baker, Gruber and Milligan 2004). However, many individuals do retire before age 65, and little work has explicitly compared the size of the retirement spike at age 65 in Canada and the US. For this reason, we include a dummy variable for paid employment status in each country. Although we have been concerned that employment

status is itself a function of health (e.g. Dwyer and Mitchell, 1999; Bound, 1991), we find that none of the coefficients in our model is significantly affected by the inclusion of work status, except the age 65 dummy, which is discussed in the results section.

Extensive literature documents that the health-income gradient widens until middle age and then narrows. If the gradient is higher in the US than in Canada, it might narrow more in the US than in Canada at age 65 simply as part of the normal narrowing with age, and independent of the advent of universal health insurance. To examine this hypothesis, we will perform the same analysis above changing the age range of the sample and the age cut point used for examining the narrowing. This will allow us to identify any exceptional narrowing of the gradient at age 65 compared to a general narrowing that may also occur at other ages.

In order to further access whether or not the effect is truly one of universal health insurance or some other difference that occurs at age 65 in one country but not the other, we perform all of the same analyses using whether or not the individual has a usual source of care as the dependent variable. If we observe the same effect on access as on health status, it strengthens the conclusion of a causal effect for universal health insurance.

IV. Data

Data for Canada come from the National Population Health Survey (NPHS), a population-based health survey of non-institutionalized individuals conducted by phone by Statistics Canada (see Tambay and Catlin, 1995 for a basic description of the NPHS survey). The NPHS uses a multi-stage stratified probability sample. While limited data

in the NPHS is collected from all household members, one person over 12 years of age in each household is randomly selected for a more in-depth interview. We use information from this subset of the data (known as the Health File) on adults from the NPHS 1996/97 public use file.

For the U.S., we pool information on adults aged 55 to 74 from two years of data from the National Health Interview Survey (NHIS), 1997 and 1998. The NHIS is an in-person health survey conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention. We use NHIS data from the Sample Adult File (in which only one adult per household was sampled), and some corresponding information for these individuals from the Person File.

Total family income is available in $5-10 thousand dollar intervals up to $80,000 in the NPHS and $75,000 in the NHIS. Income is assumed to be the mid-point of each interval, with those with income of $75 or 80 thousand or more assumed to have income of US$100,000. Average annual exchange rates were applied to the Canadian income data to convert to US dollars. Income is then expressed in 1995 US dollars using the American Consumer Price Index. Income data are missing for approximately 5 percent of the US sample and 15 percent of the Canadian sample. For observations missing income, we therefore predicted linear income in each country as a function of three education groups, dummy variables for marital status, gender, work force status, age groups, province (for Canada), and region and race (for the U.S.). Finally, we roughly divide individuals into those in the bottom and top half of the income distribution by country. (Due to the original categorical nature of the data, median breaks cannot be exact.)

In addition to income, other covariates were chosen to be as comparable as possible across countries. Dummy variables for gender and race (coded as non-white – versus white) are straight-forward and comparable in both surveys. An individual is considered working in the NPHS if they are currently working for pay (full or part time). An individual is considered working in the NHIS if their major activity in the last week was working at a job or business. The NPHS public use file does not record educational attainment in single years, and the fraction with "less than secondary school graduation" was much higher than "less than high school degree" in the NHIS (nearly 42 percent for the near elderly in the NPHS versus about 25 percent for the near elderly in the NHIS). We therefore use the most similar break among the categories available: High (secondary) school degree at most (about 53 percent in NPHS and 57 percent in US), versus at least some college, to get a similar place in the education distribution in each country.

Our measure of health status consists of general, self-reported health status, which is recorded in five categories (excellent, very good, good, fair and poor) in each country. Many studies have established a strong link between self-assessed health and mortality (Borawski, Kinney, and Kahana, 1996; Chipperfield, 1993; Idler and Angel, 1990; Idler and Kasl, 1991) following the original finding of Mossey and Shapiro (1982) that self-assessed health predicted mortality even better than a patient's medical record. Self-assessed health has also been found to predict changes in functional ability (Idler and Kasl, 1991) and life satisfaction (Larson, 1978). While we therefore believe that it is a meaningful measure of health status in the US and Canada, it should be recognized that while self rated health does proxy well for other more objective measures of health status,

it is likely to be subject to some more subjective influences as well. For example, self-rated health is known to vary with attitudes and perceptions that can vary across cultures (Angel and Cleary, 1984; Angel and Thoits, 1987), and culture may play a role in determining when an individual considers a health condition as something out of the ordinary (Natividad, 1998). In comparing three Asian countries, Zimmer et al. (2000) find that there is a significant residual influence by country in self-rated health, even after controlling for objective measures of health and other covariates. However, Zimmer et al. also found that differences in self-rated health across the three countries did correspond as expected with differences in medical care availability and socioeconomic development. So although it may not be appropriate to interpret the coefficient on the country dummy in our US/Canada models as a measure of the overall level of health in one country compared to the other, self reported health is expected to respond to different levels of access to care, such as any differences in access before and after age 65 within each country.

To make the data more manageable, we follow previous literature and consider the share of each country's population who report themselves as being in fair or poor health (e.g. Kunst et al. 1995) relative to excellent, very good or good. We also consider one measure of the use of health services, consisting of whether or not an individual reports having a usual source of care. Although the relevant survey question identifying a usual source of care is not identical in the US and Canadian surveys, it is the access measure for which the questions are most comparable in the two countries. In the US data, the survey question is phrased "Is there a place that you usually go to when you are sick or need advice about your health?," while in Canada the question reads "Do you

have a regular medical doctor?". Due to the difference in wording between the two countries, the mean difference between the two countries in the fraction of individuals reporting a usual source of care may not be material, though differences by income, education and age within a country are considered important determinants of access to care (e.g. Ettner 1996b).

All variables except income were missing for less than 1 percent of the sample, so we excluded these individuals from the analysis. Our final sample size for the near elderly (aged 55 to 64) consists of 8,003 in Canada and 7,398 in the US. Sample statistics are presented in Table 1. As one can see from this table, approximately 20 percent of near elderly Americans report being in fair or poor health, compared to less than 18 percent of near elderly Canadians. Also, over 9 percent of near elderly Americans report having no usual source of care, compared to less than 7 percent of Canadians.

V. Results

Table 2 presents estimates from linear probability models, as described in equation (1), that predict the gradient difference in the two countries controlling for other factors likely to influence health status, including gender, race, education, and working status. As can be seen from the second column of data in the table, we find that income-health gradients are significant in both countries, but that the gradient is about twice as large in the US than in Canada. Specifically, we find that the gradient is 7.5 percentage points in Canada and 7.6 percentage points higher, or 15.1 percentage points, in the US. For usual source of care, we show a small but statistically significant gradient of 1.3

percentage points in Canada. This gradient is nearly 5 percentage points higher for the near elderly in the US. Thus, we see both a substantial income-health gradient difference and a substantial income-access gradient between the US and Canada.

Table 3 presents our triple interaction specification results, designed to isolate the effect of universal health insurance by comparing how the gradients in health and access narrow at age 65 in the US compared to Canada. The first column of Table 3 is analogous to the first column of Table 2 having no triple interaction, but with the sample expanded to include both the near and the young (ages 65 to 74) elderly in each country. The specification also adds an indicator for being age 65 or over.

The basic results are similar to those in Table 2, with the income-health gradient estimated to be 5.6 percentage points higher in the US than in Canada. The counter-intuitive result that those above age 65 are less likely to be in poor health is explained by the working status control and the endogeneity of working status to health. Those who chose to continue working after the usual age of retirement of 65 are likely to be healthier than the average person, and therefore healthier than those who keep working until age 65. Similarly, those who chose to stop working before the usual age of retirement are likely to be less healthy than the average person and therefore less healthy than who stop working at 65. Because the age 65+ coefficient is identified by comparisons of the health of over-65 workers with that of under-65 workers and comparisons of the health of non-workers over-65 with that of non-workers, the coefficient's counter-intuitive sign is understandable. If we run the regressions without the working status control, the sign of the age 65+ coefficient is reversed and none of our other findings change in a meaningful way.

The triple interaction regression is contained in the second column of Table 3. Similar to Table 2, we find that the income-health gradient for the near elderly is about 7.3 percentage points higher in the US than in Canada. The coefficient on the triple interaction reported in the final row of the column indicates that this difference is reduced by 4 percentage points after age 65. Alternatively viewed, the gradient in Canada is 7.8 percentage points before age 65 and narrows by about 1.1 percentage points (at least, using the point estimate) after 65. The US gradient is about 15.1 percentage points before age 65 and narrows by about 5.4 percentage points after. Either way, results indicate that the gradient narrows at age 65 by about 4 percentage points more in the US than it does in Canada, suggesting that more than half of the US-Canada gradient difference of 7.3 percentage points is due to the lack of universal health insurance in the US or something else that changes around the age of 65 in one country and not the other.

The final column of Table 3 compares the income gradient in access to care in the US and Canada before and after age 65. Similar to Table 2, we find only a small gradient (about 1.3 percentage points) for the near elderly in Canada, a difference which is about 5 percentage points higher among the near elderly in the US. We find, however, that the income-access gradient difference between the near elderly in the US and Canada is reduced by about 5.4 percentage points after the age of 65 has been reached. Therefore, while the gradient difference is about 5 percentage points among the near elderly, this difference is eliminated after age 65. While the usual source of care results are modest in practical magnitude, they are only one indicator of access. Thus, our access results are consistent with a mechanism of universal health insurance facilitating access to health

care and therefore reducing income disparities in health status in both countries for those ages that have universal insurance.

Obviously, the Medicare programs in the US and Canada are not identical, and the Canadian program relies much less on deductibles and co-pays than the US program does. However, prescription drug coverage in Canada varies significantly by province, and, like the US, can be less widespread for the over 65 than for the under 65, who do rely on private coverage (Millar, 1999; Grootendorst, O'Brien and Anderson, 1997). Using our one general measure of access to care, we find that the US and Canadian Medicare programs are at least similar enough to produce similar access measures between the two countries for the over 65, which is not true for those under 65.

There is extensive documentation that the health-income gradient is largest in middle age and then narrows with age. Since the gradient is larger in the US than in Canada, it is possible that the increased narrowing at age 65 is part of a general aging trend, and not causally related to the advent of universal health insurance in the US. In order to examine this possibility, we repeat the basic analyses of Table 3 for different age groups and different age cuts. Results are contained in Table 4. We find that the gradient is higher just after age 35 compared to just before, higher just after age 45 compared to just before, and higher just after age 55 compared to just before. (That is, the first three triple interaction terms in the sixth column of the table are all positive and statistically significant.) So at younger ages, we find that the difference in the income-health gradient between the US and Canada widens with age, the reverse of what is seen at age 65. At age 65, the trend is reversed, with the gap then narrowing by more in the US than in Canada. After age 65, there is no significant difference between the US and

Canada in how the gradient changes with age. These results are consistent with a causal effect for universal health insurance of important magnitude.

However, the age variation in US-Canadian gradient gap is also consistent with other theories. Examining the 4th column in Table 4, we see that the gradient in Canada first widens up to age 55, then flattens and then falls after age 65, consistent with the extensive literature on how the gradient varies with age. The 4th and 5th columns move in tandem, showing that the gradient gap between the US and Canada widens, flattens and narrows for the same ages in which the gradient itself grows, flattens and narrows. This result indicates that whatever factors are driving the difference in the gradient by age could be the same factors that drive the differences between the US and Canadian gradients. In this case, it is possible that the narrowing around age 65 would have occurred anyway and is not causally driven by universal health insurance.

Another theory consistent with our results is that differential mortality drives the gradient. Specifically, if the worst off in the US are worse off than the worst off in Canada, they may die earlier (e.g. in their early 60s). This may cause the SES gradient to narrow more after the age of 65 in the US than in Canada. Using panel data on the same people over time (keeping the deceased in the sample), Becket (2000) found that differential mortality did not explain a decrease in the gradient with age in the US. She did, however, only consider those up to age 74 and had few observations at older ages. Therefore, although we doubt that differential mortality could explain all of the greater gradient narrowing around age 65 in the US compared to Canada, it is possible that it does play a role.

The fact that the Canadian public use data only contains age in five-year intervals limits the analyses we can perform for pooled US and Canadian data. In particular, we cannot use a regression discontinuity design with the pooled data. However, even if age were available in finer units and even if the sample size were sufficient, it is not clear that such an analysis could better test the effect of universal health insurance on health disparities. It may be that access to health care takes time to impact health, spreading the effect after age 65 out over time. Moreover, if the psychological stress of the financial burden of paying individual insurance premiums or continuing to work longer than would be preferred drives some of the health income gradient without universal health insurance, the stress will erode as an individual approaches aged 65, spreading the effect out before age 65.

Previous research has found a significant relationship between income and health throughout the range of incomes in both the US and Canada. In this paper, we have compared the gradient in health for those under median income in each country. We also tested the sensitivity of our results to using other income cut-offs for defining the low-income category. The results are shown in Table 5. Turning first to the access results, the fifth column of the table shows that although there is a significant access gradient for all income groups in Canada, the gradient tends to be larger for those at the lowest end of the income distribution. Canadian near elderly with income below the 20th percentile are, for example, 2.2 percentage points more likely to lack a usual source of care than those with higher income, while this difference is about 1.3 percentage points for those with income below the median compared to others. The sixth column of the table shows that the access-gradient is even more strongly linked to the level of income in the US than in

Canada. American near elderly with incomes below the 20th percentile are, for example, 8.8 (2.2 plus 6.6) percentage points more likely to lack a usual source of care than those with higher income, while this difference is about 6.3 (1.3 plus 5.0) percentage points for those with income below the median compared to others. This pattern is consistent with the fact that uninsurance rates are inversely related to income among the near elderly in the U.S. The last two columns show results of equal magnitude and opposite sign, indicating that the access gradient that exists for the near elderly is eliminated for the young elderly in the US no matter what choice of income cut-off is used. This is consistent with a role for universal health insurance in the U.S. at age 65.

The second through fourth columns of the table perform a similar analysis for health status. The second column shows that there is a significant health-income gradient for all income groups in Canada, with the magnitude growing as the definition of low-income is increasingly restricted to the very poorest. The third column reveals a similar pattern for the US. These results illustrate that whatever drives the gradient appears more marked among the lowest income in both countries. The fourth column indicates that between the 30th and 70th percentile cut-offs, the point-estimates of the universal health insurance effect are essentially the same, showing a 3 to 4 percentage point reduction in the gradient no matter what cut-off is used.

Uninsurance in the age 55-64 age group is largest at the low end of the income distribution. Therefore, if the US-Canadian difference in the age 65 narrowing of the health-income gradient were causally driven by universal health insurance, we would expect the triple interaction coefficient to be largest at the lowest part of the distribution and decrease at higher points in the distribution, as it does for access in the last column.

However, empirically we find that it is essentially constant through most of the income distribution and insignificant at either end (possibly due to lower statistical power). This result argues against attributing the effect to universal health insurance. It is also possible that while the effect of universal health insurance at the bottom of the income distribution is through actual use of health care services, the effect in the middle of the income distribution is through alleviation of the stress of the financial and psychological difficulties of obtaining insurance through other means.

VI. Conclusions and Discussion

There are a great many possible causal mechanisms behind the association between income and health. The actual causes and their relative magnitudes have important policy implications. International variation in health systems, public policies and cultures could be used to disentangle the different possible causes of the gradient and determine their relative quantitative magnitudes. In this paper, we took the first steps in such research, examining the US and Canada and focusing on the role of universal health insurance.

We found that among the near elderly, those below median income in the US are 7.5 percentage points more likely to report being in poor or fair health than are those below median income in Canada. This is a practically significant difference, revealing greater health inequality in the US than in Canada. We attempted to isolate the effect of universal health insurance from the effect of other factors on the US-Canadian gradient gap by using the natural experiment of eligibility for universal health insurance at age 65

in the US. We found that the gap narrows at age 65 by 4 percentage points, a reduction of more than half the magnitude of the gap.

While our results are consistent with a dramatic quantitative role for universal health insurance in the US-Canadian gradient gap, our examination of how the US-Canadian gradient gap varies with age suggests other possible theories. We found that the ages during which the gradient grows, flattens and shrinks in all countries are the same ages during which the US-Canadian gradient gap also widens, is flat and narrows, respectively. Thus, whatever factors may be driving the gradient variation with age could be the same ones driving the US-Canadian gap.

To our knowledge, our results are the first ones examining how gradient differences between countries vary with age. While we cannot definitively say that universal health insurance causes all of the 4 percentage point gap shrinkage at age 65, our results, particularly our access results, are consistent with such a causal role. More work comparing gradients and their variation with age across countries whose institutions differ can further help disentangle the causes of the gradient. Once the causes of the gradient are understood, policies can be more effectively targeted. In particular, we could learn just how much inequality reduction universal health insurance would buy us in the US. Although far from definitive, our present results suggest that it *might* buy us quite a bit.

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Table 1: Sample Statistics

Near Elderly (Ages 55 to 64)

	USA	*Canada*	*Difference US - Canada*
Fair or Poor Health Status	0.200	0.175	*0.025*
	(0.005)	(0.004)	*[0.000]*
No Usual Source of Care	0.092	0.068	*0.024*
	(0.003)	(0.003)	*[0.000]*
Income Below Median	0.504	0.547	*-0.043*
	(0.006)	(0.006)	*[0.000]*
Female	0.554	0.530	*0.024*
	(0.006)	(0.006)	*[0.003]*
Non-White	0.271	0.046	*0.225*
	(0.005)	(0.002)	*[0.000]*
High School Degree at Most	0.566	0.531	*0.035*
	(0.006)	(0.006)	*[0.000]*
Working	0.556	0.449	*0.107*
	(0.006)	(0.006)	*[0.000]*
N	7,398	8,003	

The table consists of sample means, with standard errors in parentheses. Prob values associated with a t test of the significance of the difference between the means by country are presented in square brackets. The source for the U.S. data is the U.S. National Health Interview Survey 1997 and 1998. The source for the Canadian data is the National Population Health Survey, 1996/1997.

Table 2: Gradient and Gradient Difference Regressions

Near Elderly (Ages 55 to 64)

	Fair or Poor Health Status		No Usual Source of Care	
USA	*0.023****	*-0.015**	*0.020****	*-0.004*
	(0.006)	*(0.009)*	*(0.005)*	*(0.006)*
Female	-0.046***	-0.046***	-0.034***	-0.034***
	(0.006)	(0.006)	(0.004)	(0.004)
Non-White	0.100***	0.093***	0.017***	0.012*
	(0.009)	(0.009)	(0.006)	(0.006)
High School Degree at Most	0.075***	0.074***	0.011**	0.011**
	(0.006)	(0.006)	(0.005)	(0.005)
Working	-0.163***	-0.165***	0.016***	0.015***
	(0.006)	(0.006)	(0.004)	(0.005)
Income Below Median	0.112***	0.075***	0.036***	0.013**
	(0.006)	(0.009)	(0.005)	(0.006)
*USA * Income Below Median*		*0.076****		*0.049****
		(0.012)		*(0.009)*

The table consists of coefficient estimates and standard errors (in parentheses) from linear probability models. *** indicates significant at the .01 level. ** indicates significant at the .05 level. * indicates significant at the .01 level. The sample size is 15,401. The source for the U.S. data is the U.S. National Health Interview Survey 1997 and 1998, and the source for the Canadian data is the National Population Health Survey 1996/97.

Table 3: Gradient Difference and Triple Interaction Regressions

Near and Young Elderly (Ages 55 to 74)

	Fair or Poor Health Status		No Usual Source of Care	
USA	*-0.007*	*-0.018***	*-0.004*	*-0.004*
	(0.074)	*(0.009)*	*(0.005)*	*(0.006)*
Female	-0.041***	-0.041***	-0.026***	-0.026***
	(0.005)	(0.005)	(0.003)	(0.003)
Non-White	0.105***	*0.105****	*0.010***	*0.008**
	(0.007)	*(0.007)*	*(0.004)*	*(0.004)*
High School Degree at Most	0.079***	*0.079****	*0.009****	*0.009****
	(0.005)	*(0.005)*	*(0.003)*	*(0.003)*
Working	-0.153***	*-0.151****	*0.018****	*0.018****
	(0.005)	*(0.005)*	*(0.004)*	*(0.004)*
Income Below Median	0.073***	*0.078****	*0.023****	*0.013***
	(0.007)	*(0.009)*	*(0.004)*	*(0.006)*
Age 65+	-0.041***	*-0.036****	*-0.023****	*-0.017***
	(0.005)	*(0.012)*	*(0.003)*	*(0.008)*
Interactions				
*USA * Income Below Median*	*0.056****	*0.073****	*0.018****	*0.050****
	(0.009)	*(0.013)*	*(0.006)*	*(0.008)*
Age 65+ Income Below Median*		*-0.011*		*0.015**
		(0.014)		*(0.009)*
*USA * Age 65 +*		*0.029**		*-0.0002*
		(0.016)		*(0.010)*
Triple Interaction				
*USA * Age 65+ * Income Below Median*		*-0.040***		*-0.054****
		(0.019)		*(0.125)*

The table consists of coefficient estimates and standard errors (in parentheses) from linear probability models. *** indicates significant at the .01 level. ** indicates significant at the .05 level. * indicates significant at the .01 level. The sample size is 29,943. The source for the U.S. data is the U.S. National Health Interview Survey 1997 and 1998, and the source for the Canadian data is the National Population Health Survey 1996/97.

Table 4: Triple Interaction Regressions - by Age Group

Midpoint Age	Age Range	N	Fair or Poor Health Status: Income Below Median	Fair or Poor Health Status: USA * Income Below Median	Fair or Poor Health Status: USA * Income Below Median * Age Above Midpoint	Usual Source of Care: Income Below Median	Usual Source of Care: USA * Income Below Median	Usual Source of Care: USA * Income Below Median * Age Above Midpoint
35	25 to 44	55,662	0.023***	0.006	0.021***	0.030***	0.077	-0.006
			(0.004)	(0.006)	(0.008)	(0.006)	(0.009)	(0.012)
45	35 to 54	49,710	0.036***	0.032***	0.020*	0.034***	0.073***	-0.014
			(0.005)	(0.007)	(0.011)	(0.006)	(0.008)	(0.012)
55	45 to 64	36,648	0.077***	0.042***	0.046***	0.032***	0.062***	-0.014
			(0.007)	(0.010)	(0.015)	(0.006)	(0.009)	(0.013)
65	55 to 74	29,943	0.078***	0.073***	-0.040**	0.013**	0.050***	-0.054***
			(0.009)	(0.013)	(0.019)	(0.006)	(0.008)	(0.012)
75	65+	25,672	0.064***	0.032*	-0.027	0.027***	-0.003	-0.010
			(0.012)	(0.016)	(0.028)	(0.006)	(0.008)	(0.014)

The table consists of coefficient estimates and standard errors (in parentheses) from linear probability models. *** indicates significant at the .01 level. ** indicates significant at the .05 level. * indicates significant at the .01 level. Although not reported, controls for country, gender, race, education, working status, income group, and two other DD estimators are included. The sample size is 29,943. The source for the U.S. data is the U.S. National Health Interview Survey 1997 and 1998, and the source for the Canadian data is the National Population Health Survey 1996/97.

Table 5: Triple Interaction Regressions for Different Low-Income Cuts

Near and Young Elderly (Ages 55 to 74)

	Fair or Poor Health Status			Usual Source of Care		
	Low Income	USA * Low Income	USA * Low Income * Age 65+	Low Income	USA * Low Income	USA * Low Income * Age 65+
Low Income Under						
20th Percentile	0.143***	0.087**	-0.008	0.022***	0.066***	-0.064***
	(0.005)	(0.015)	(0.020)	(0.007)	(0.010)	(0.013)
30th Percentile	0.098***	0.109***	-0.030	0.017***	0.065***	-0.062***
	(0.009)	(0.013)	(0.018)	(0.006)	(0.009)	(0.012)
40th Percentile	0.091***	0.080***	-0.031*	0.020***	0.051***	-0.049***
	(0.009)	(0.000)	(0.018)	(0.006)	(0.008)	(0.012)
50th Percentile	0.078***	0.073***	-0.040***	0.013**	0.050***	-0.054***
	(0.009)	(0.013)	(0.019)	(0.006)	(0.008)	(0.012)
60th Percentile	0.071***	0.058***	-0.031	0.016***	0.037***	-0.040***
	(0.009)	(0.013)	(0.021)	(0.006)	(0.008)	(0.013)
80th Percentile	0.055***	0.047***	0.014	0.011	0.032***	-0.031
	(0.012)	(0.016)	(0.030)	(0.008)	(0.010)	(0.019)

The table consists of coefficient estimates and standard errors (in parentheses) from linear probability models. *** indicates significant at the .01 level. ** indicates significant at the .05 level. * indicates significant at the .01 level. Although not reported, controls for country, gender, race, education, working status, income group, and two other DD estimators are included. The sample size is 29,943. The source for the U.S. data is the U.S. National Health Interview Survey 1997 and 1998, and the source for the Canadian data is the National Population Health Survey 1996/97.