Topics

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Income Inequality and Health: Panel Data Evidence from Canada

Abstract: Using longitudinal data from the Canadian National Population Survey (1994–2006), this study examines the impact of income inequality on current health outcomes. The result suggests that once unobserved individual specific heterogeneity is controlled for, income inequality as measured by Gini Coefficient has no significant impact on current health status. This result holds true for contemporaneous income inequality as well as for lagged income inequalities. There are mixed results from the robustness check using various measures of income inequality. Decile Ratio (90P/10P) and Coefficient of Variation have no impacts on current health status. On the other hand, contemporaneous income inequality measured by Log Mean Deviation and Theil Index have significant negative effects on current health. All of the models suggest that absolute income has a significant positive effect on health status

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1 Introduction

Growing worldwide income inequality has recently become an issue of serious concern (Fortin et al. 2012). The 2011 World Economic Forum has singled out income inequality and corruption as the two most serious challenges facing the world (World Economic Forum 2011). Income inequality has also been on the rise in Canada. Between 1981 and 2010, the market Gini coefficient, which is a measure of income inequality, increased by 19.4% in Canada (Sharpe and Capeluck 2012). An interesting issue is the possible impact of income inequality on health status. This issue has important policy implications: if inequality hurts health, then policy measures to reduce income inequality should improve health.

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The proponents of the "Income Inequality Hypothesis" argued that it was the income distribution rather than the absolute income that determined health outcomes (Runciman 1966; Wilkinson 1996). Quite a number of early studies documented a relationship between income inequality and aggregate measures of health outcomes (Rodgers 1979; Flegg 1982; Le Grand 1987; Wilkinson 1992, 1996). However, recently a number of researchers cast doubts on the robustness of this ecological relationship. They cited the reason that if individual health is a non-linear function of income, then income inequality may be spuriously correlated with the aggregate measures of health (Judge, Mulligan, and Benzeval 1998; Gravelle, Wildman, and Sutton 2002).[1] It was argued that to identify the causal effect of income inequality on health, it is necessary to use individual level data and to include individual income as a regressor (Mellor and Milyo 2002).

This study uses individual-level Canadian longitudinal data to examine the impact of province-specific income inequality on individual health. The remainder of this document has the following structure: Section 2 reviews literature; Section 3 discusses data and methodology; Section 4 presents the results of the study; and Section 5 presents some conclusions.

2 Literature review

A number of recent studies used individual-level data to examine the relationship between income equality and health status. Using data from the Canadian National Population Health Survey, McLeod et al. (2003) investigated whether metropolitan level income inequality was associated with health status. They found that household income, but not income inequality, appeared to explain some of the differences in health status among Canadians. Mellor and Milyo (2003) used the U. S. Current Population Survey (1995 to March 1999) to examine the effect of income inequality on individual health status for the general population and those in poverty. They did not find any consistent association between income inequality and health status. Lorgelly and Lindley (2008) used longitudinal data from the British Household Panel Survey (1991–2004) to examine the impact of income inequality on individual health. Their study found that absolute income had a significant positive income on health, but they did not find any evidence of the effect of income inequality on health.

1 Ecological studies focus on the comparison of groups rather than individuals. Variables in an ecological study may be aggregate measures, group-level measures or global measures (Morgenstern 1995). Generally, ecological studies are conducted when data on the individual level is not available.

Using longitudinal data from the European Community Household Panel (ECHP) survey, Hildebrand and Van Kerm (2009) examined the effect of income inequality on individual self-reported health status. They found consistent evidence that income inequality was negatively related to health status in the European Union for both men and women.

However, all these studies did not include lagged income inequality as regressors. The pathways through which income inequality was assumed to impact health, such as social spending, social erosion and psychological effects, may take a longer period to operate. So it is important to include lagged income inequalities in the modeling. A few recent studies have considered this issue by including lagged income inequalities in the estimation process. Using data from the U. S. Current Population Survey (1995 and 1997), Blakely et al. (2000) found that state-level income inequality (up to 15 years previous) was more strongly associated with self-rated health status than income inequality measured contemporaneously. Mellor and Milyo (2003) used U.S. Current Population Survey data (1995 to March 1999) to examine the effects of state-level income inequality (lagged from 5 years to 29 years) on individual health. The results from the probit models showed that income inequality was not significantly associated with individual health status after controlling for regional fixed effects. In a more recent study, using U.S. Current Population Survey data (1995 and 1997), Subramanian and Kawachi (2006) found that contemporaneous income inequality had a significant negative effect on the probability of reporting poor health. This relationship was found to be consistent even after inclusion of lagged income inequality variables. However, they did not find any significant impact of lagged income inequalities on health outcome.

This study aimed to make the following contributions to the literature on the relationship between inequality and health:

(1) In its analysis, this study uses longitudinal data and thus is able to control unobserved individual-specific fixed effects that are potentially correlated with both income inequality and health. To date, few studies have employed longitudinal data in this type of study and no Canadian study has used longitudinal data to examine the impact of income inequality on health.

(2) While a majority of the studies on the relationship between income inequality and health used only the “Gini Coefficient” as measure of income inequality, this study uses it as well other measures such as “Decile Ratio (90P/10P)”, “Coefficient of Variation”, “Log Mean Deviation” and “Theil Index.”

(3) This study includes lagged income inequalities as regressors in the model. The inclusion of lagged income inequality variables is important to take

into account that the pathways through which income inequality impacts health, such as reduction in social spending, social erosion and psychological effects, generally operate over a period of time rather than instantaneously. So far, only a few studies included lagged income inequality variables in their analyses on the relationship between income inequality and health.

(4) While a majority of the studies on the relationship between income inequality and health did not control for province/state or time-fixed effects, consequently the results of these studies may be biased because of the omission of important factors, this study includes province-specific fixed effects and year dummies and thus is expected to avoid possible biased results.

(5) Canada experienced rising income inequality, particularly after the mid-1990s. With the exception of McLeod et al. (2003), no other Canadian study covered that period. However, using data until 1998–1999, that study only focused on metropolitan areas. No Canadian study controlled for province-fixed effects or time-fixed effects. This study is expected to get different results from other Canadian studies as it covers a period from 1994 to 2006 and also control for province as well as time-fixed effects.

3 Methodology

3.1. Data

This study uses longitudinal Canadian data from the National Population Health Survey (NPHS) covering a period from 1994 to 2006. The NPHS collects data related to the health and socio-demographic correlated of health of the Canadian population. This survey has three components: Households, Institutions, and North components.[2] This study uses data from the Household component. This component of the survey started in 1994/1995 and is conducted every two years. The target population of the longitudinal NPHS Household component includes household residents in the ten Canadian provinces in 1994/1995, excluding persons living on Indian Reserves and Crown Lands, residents of health

2 The NPHS North component started in 1994–1995. This component involves data collected from the North part of Canada. The surveys were carried out by the Statistical Bureaus in Yukun and Northwest Territories with funding provided by Statistics Canada.

institutions, full-time members of the Canadian Forces bases and some remote areas in Ontario and Quebec. The present study restricts the sample to individuals aged 16 and 64, yielding 28,952 person-wave observations.

The dependent variable of this study is health outcomes, which are represented by "Self-Reported Health Status" indicator. This indicator has the following ordinal categories: 1-poor health, 2-fair health, 3-good health, 4-very good health, and 5-excellent health.

The independent variable Income Inequality is measured by the following variables: Gini Coefficient, 90/10 Income Inequality Ratio, Coefficient of Variation, Mean Log Deviation of Income, and Theil's Entropy Measure.

Other independent variables included in the model are gender, age, marital status, education, homeownership, location of residence, household income, physical activity, and provinces.

"Gender" is a dummy variable with male as the base category. "Age" is a continuous variable and "Squared Age" is included in the models to capture the non-linear impact of age. "Marital Status" is a dummy variable with three categories: single, married, and widow/separated/divorced, with single as the base category. "Education Status" is also a dummy variable with four categories: less than secondary, secondary graduate, some post-secondary education, and college/university education, with less than secondary as the base category. "Having Own Home" is another dummy variable showing whether or not an individual owned a home. "Living in Urban Area" is also a dummy variable suggesting whether or not an individual lived in an urban area. "Household Income" is a continuous variable indicating the total income earned by the members in a household. "Physical Activity" is a dummy variable with three categories: not physically active, moderately physically active, and physically active.

3.2. Conceptual framework

Income inequality is expected to impact individual health in a number of ways.[3] First, there is a correlation between the degree of income inequality and the investment on social capital such as education, health and law enforcement (Kaplan et al. 1996). In an area of rising income inequalities, the interests of the rich and elite group diverge from those of typical families and consequently, social spending that benefits the middle-class and poor people gets less

3 For a detailed discussion of the pathways through which income inequality impacts health, see Kawachi and Keneddy (1999).

attention (Kawachi and Kennedy 1999). Reduced spending on the social sector may produce a negative impact on individual health outcomes. Second, income inequality may impact health via its disruptive effects on social capital such as interpersonal trust between citizens, norms of reciprocity, and association with voluntary activities (Putnam 1993; Kawachi and Kennedy 1997). Widening the gap between "haves" and "have-nots" can lead to latent social conflict and an increasing level of mistrust among members of the society (Kawachi et al. 1997). That study suggested that a society with a low level of interpersonal trust experiences a lower level of popular participation in the political process. Additionally in such a society, political institutions are less likely to invest in projects that benefit poor and vulnerable sections (Kawachi and Kennedy 1997). Third, stress or frustration brought about by invidious social comparisons is another pathway through which income inequality impacts health (Wilkinson 1999). Another study also suggested that health has an adverse effect if an individual fails to achieve the cultural model of lifestyle (Dressler 1996).

Most of the cited works used evidence from the United States. However in recent years, Canada has been experiencing a situation almost similar to that of the United States. Between 1980 and 2009, Canadian after-tax income inequality grew by 13%, which is slightly lower than the United States where the after-tax income inequality grew by 17.5% during the same period (U.S. Census Bureau 2011). In the 1980s, to offset the rising market income inequality, provinces in Canada increased both social assistance transfers and surtaxes on high earners. However in the mid-1990s, provinces reversed these inequality mitigating policies and consequently, in recent years, Canada has experienced an increase in after-tax income inequality (Frenette, Green, and Milligan 2009). OECD data on social expenditures showed that social spending as a percentage of Canadian GDP started to fall in the mid-1990s and in 2007, it stood at 16.9% of GDP (OECD 2011). The OECD data further noted a marked decline of spending on unemployment benefits as well as expenditures on higher education since the mid-1990s.

3.3. Empirical framework

The basic econometric specification is as follows:

$$H_{ijt} = a + X_{it}\beta_x + \beta E_{jt} + \sum_{k=1}^{6} \beta_k E_{jt-k} + \delta_j + \lambda t + \delta jT + \mu_i + \varepsilon_{ij} \quad (1)$$

where H_{ijt} is the health outcome for individual i living in province j in year t. X is a vector of observable individual-specific explanatory variables such as age, marital status, education, wealth, residential location, physical activity, and

income. E_{jt} represents income inequality in province j in year t and E_{jt-1} ..... E_{jt-6} represents lagged income inequality. μ represents unobservable individual-specific fixed effects; δ_j and λ_t represent unobserved determinants of health associated with the province and survey year; $\delta_j T$ denotes province specific time trend; and ε_{ijt} is the error term. The province-specific fixed effects hold constant determinants of health that differ across locations but are time invariant, such as differences in life styles, diet, and environment. The year effects take into account the factors that vary uniformly over time across provinces, such as changes in medical technology. The province-specific time trend is included to account for the unobserved factors that vary within provinces over time, such as the norm related to physical exercise.

This study utilizes a number of measures of income inequality: Gini Coefficient, Decile Ratio (90P/10P), Coefficient of Variation, Log Mean Deviation, and Theil Index. The Gini Coefficient is derived from the Lorenz curve that shows the percentage of total income earned by the cumulative percentage of the population. The Gini Coefficient is defined as the ratio of the area between the Lorenz curve and the 45° line of equality and the total area under that line. A limitation of the Gini Coefficient is that it is most sensitive to the inequalities in the middle part of the income spectrum. The Decile Ratio, a simple and effective way to measure inequality, is by taking the income earned by the top 10% of households and dividing that figure by the income earned by the poorest 10% of households. However, this measure ignores information about income in the middle of the income distribution. The Coefficient of Variation is calculated by dividing the standard deviation of income distribution by its mean. The result will be smaller in more equal societies. However, this measure has no upper bound and the two components of this measure (standard deviation and mean) may be exceedingly influenced by anomalous low-and high-income values. Both the Log Mean Deviation and the Theil Index are sensitive to transfers at the lower end of income distribution.

This study uses two measures for the health-dependent variable: "Poor Health" and "Self-Reported Health". The dummy variable Poor Health is derived from the variable Self-Reported Reported Health. The dependent variable Poor Health takes the value of 1 if respondents rated their health status as fair or poor, and 0 otherwise.[4] The variable Self-Reported Health has the following five ordinal categories: 1-poor health, 2-fair health, 3-good health, 4-very good health, and 5-excellent health.

A simple way to estimate the impact of income inequality on the probability of being in poor health is to use a logit model. However, the logit model can't

4 This measurement follows the method used by Mellor and Milyo (2003).

take into account the unobserved individual specific heterogeneity that may be correlated with both health outcomes and income inequality. For example, individuals with a personal low discount rate may take less care about developing human capital and also their own health. With poor human capital, these individuals may not be able to move out of the area of high income inequality. At the same time, less orientation to the future may be a reason for unhealthy behavior and consequently poor health outcomes. Any regression that does not control for the unobserved individual specific heterogeneity may lead to a biased outcome of the effect of income inequality on health. To control the unobserved individual-specific fixed effects, the study utilized the conditional fixed effects logit method.

Since the variable Self-Reported Health that has five ordinal categories, this study utilizes a simple ordered probit method. However, this method does not take into account the unobserved specific heterogeneity. To deal with this issue, this study also utilizes a fixed effects method.[5]

The empirical model includes lagged income inequality variables to take into account the possibility that the pathways through which income inequality impacts health, such as reduction in social spending, social erosion and psychological effects, generally operate over a period of time rather than instantaneously.

4 Results

Table 1 provides the descriptive statistics. The results of the regression with Gini Coefficient as a measure of inequality are shown in Table 2. The second column shows the results of the logit model that does not control for the unobserved individual-specific heterogeneity. In this model, the marginal effect of the contemporaneous inequality suggests that an increase in the Gini Coefficient by one unit increases the probability of reporting poor health by 0.001 units. However, this coefficient is not statistically significant. On the other hand, the results show that some of the lagged Gini Coefficient values have significant positive effects on the probability of having poor health. Other results of the logit estimation were as follows: Compared to males, females are more likely to be

5 "Self-Reported Health" has ordinal categories and thus a method such as order probit or logit is more suitable for statistical analysis. However, Ferrer-i-Carbonell and Frijters (2004) suggested that it makes no difference if one assumes cardinality or ordinality of the health variable. Thus the fixed effects model assumed that the cardinality assumption of the health variable can be applied to the analysis.

Table 1: Descriptive statistics

Variable	Overall sample	Male sample	Female sample
Excellent health	0.22	0.23	0.22
	(0.003)	(0.005)	(0.005)
Very good health	0.42	0.42	0.41
	(0.004)	(0.006)	(0.005)
Good health	0.28	0.28	0.27
	(0.003)	(0.005)	(0.004)
Fair health	0.07	0.06	0.08
	(0.002)	(0.002)	(0.002)
Poor health	0.01	0.01	0.02
	(0.0008)	(0.001)	(0.001)
Age (average figure)	45.24	44.01	46.70
	(0.101)	(0.145)	(0.136)
Single	0.16	0.19	0.13
	(0.003)	(0.005)	(0.003)
Married	0.71	0.73	0.69
	(0.003)	(0.005)	(0.005)
Divorced/Widow	0.13	0.08	0.18
	(0.002)	(0.003)	(0.004)
Less than secondary education	0.15	0.15	0.16
	(0.003)	(0.004)	(0.003)
Secondary graduate education	0.16	0.15	0.17
	(0.003)	(0.004)	(0.004)
College- university education	0.43	0.44	0.41
	(0.004)	(0.006)	(0.005)
Some post -secondary education	0.26	0.26	0.26
	(0.003)	(0.005)	(0.004)
Home ownership	0.77	0.77	0.76
	(0.004)	(0.005)	(0.004)
Residing in urban area	0.80	0.79	0.80
	(0.003)	(0.004)	(0.004)
Household income	$62,384	$66,813	$57,149
	(356.99)	(562.12)	(395.25)

Source: National Population Health Survey (1994–2006).

in poor health; Probability of being in poor health increases with age, but at a decreasing rate; Married people are significantly less likely to be in poor health; Education has a significant negative impact on the probability of being in poor health; Household income has a significant negative impact on the probability of having poor health; Physical actively negatively impacts the probability of having poor health.

Table 2: Regression results: determinants of health

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Gini coefficient	0.022	−0.381	−0.092**	−0.039
	(0.080)	(0.893)	(0.045)	(0.026)
Lag 1 Gini coefficient	−0.102	−0.543	0.004	0.042
	(0.151)	(0.479)	(0.022)	(0.030)
Lag 2 Gini coefficient	0.271*	0.032	−0.063	−0.053
	(0.075)	(0.701)	(0.077)	(0.075)
Lag 3 Gini coefficient	0.237*	−0.051	−0.010	−0.013
	(0.091)	(0.520)	(0.091)	(0.084)
Lag 4 Gini coefficient	−0.116	−0.796	−0.039	−0.030
	(0.200)	(0.831)	(0.026)	(0.031)
Lag 5 Gini coefficient	0.008	−0.321	0.029	0.025
	(0.078)	(0.460)	(0.067)	(0.060)
Lag 6 Gini coefficient	0.287*	0.655	0.022	0.034
	(0.079)	(0.608)	(0.096)	(0.077)
Female	0.103*		−0.032*	
	(0.035)		(0.010)	
Age	0.091*	0.041	−0.019*	−0.021
	(0.009)	(0.078)	(0.002)	(0.018)
Squared Age	−0.0006*	0.0002	0.0001*	0.0005*
	(0.00009)	(0.0002)	(0.00002)	(0.00004)
Marital status -base: single				
Being married	−0.117*	−0.084	0.024	0.026
	(0.054)	(0.148)	(0.015)	(0.025)
Being widow/divorced	0.044	0.012	0.030	0.108*
	(0.060)	(0.175)	(0.020)	(0.036)
Education status base: less than secondary				
Secondary grad.	−0.496*	−0.414	0.147*	0.083
	(0.056)	(0.289)	(0.018)	(0.053)
Some post-secondary education	−0.423*	−0.243	0.116*	0.045
	(0.047)	(0.217)	(0.016)	(0.042)
College university education	−0.685*	−0.543**	0.171*	0.059
	(0.047)	(0.228)	(0.016)	(0.045)
Having own home	−0.330*	0.154	0.051*	−0.003
	(0.040)	(0.094)	(0.013)	(0.019)
Living in urban area	0.033	−0.032	−0.011	0.008
	(0.040)	(0.087)	(0.011)	(0.019)
Household income	−0.139*	−0.139*	0.009*	0.007*
	(0.009)	(0.009)	(0.001)	(0.001)

(*continued*)

Table 2: (*Continued*)

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Physical activity base: inactive				
Physical activity	−0.778*	−0.586*	0.126*	0.002
	(0.052)	(0.080)	(0.013)	(0.015)
Moderate physical activity	−0.555*	−0.307*	0.073*	−0.0004
	(0.043)	(0.060)	(0.011)	(0.0121)
Constant	−3.90*			3.72*
	(0.254)			(0.700)
Province control	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Province specific trend	Yes	Yes	Yes	Yes

Notes: Significance: *1%, **5%.
For logit and conditional fixed effects logit models (columns 2 and 3), the dependent variable is poor health.
For ordered probit and fixed effects model (columns 4 and 5), the dependent variable is self-reported health status.

The third column in Table 1 shows the results of the conditional fixed effects logit model. In this model where unobserved individual specific heterogeneities are taken into account, contemporaneous income and lagged income inequality variables are not statistically significant. On the other hand, household income and physical activity variables are found to have a significant negative impact on the probability of being in poor health.

The fourth and fifth columns in Table 1 show the results of the models in which dependent variables are represented by Self-Reported Health Status. The results of the ordered probit model are shown in the fourth column. In this model, the contemporaneous income inequality has a significant negative effect on health status. However, the lagged income inequalities do not have any significant impact on health status. On the other hand, education, household income and physical activity are found to have a significant positive impact on health. The results of the fixed effects model, which controlled for the unobserved individual specific heterogeneity, are shown in the fifth column. In this model, the marginal effect analysis suggests that a one unit increase in the Gini Coefficient will lead to a 0.039 units decrease in health. However in this model, none of the inequality variables is found to have a statistically significant effect on health. On the other hand, the results show that household income has a significant positive impact on health.

As a robustness check, this study estimates models using different measures of income inequality such as Decile Ratio (P90/P10), Coefficient of Variation, Log Mean Deviation and Theil Index.

The results of the four models with Percentile Ratio (P90/P10) as the independent variable are shown in Table 3. In none of these models does income inequality variables have significant effects on health status. However, in all of these models, household income has a significant positive impact on health.

Table 3: Regression results: determinants of health

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
90th percentile/10th percentile	0.031	−0.004	−0.007	−0.001
	(0.033)	(0.068)	(0.011)	(0.011)
Lag 1 90th percentile/ 10th percentile	0.025	0.036	−0.009	−0.005
	(0.035)	(0.064)	(0.010)	(0.010)
Lag 2 90th percentile/ 10th percentile	0.028	0.055	−0.0005	0.001
	(0.036)	(0.065)	(0.009)	(0.010)
Lag 3 90th percentile/ 10th percentile	0.008	0.021	0.013	0.013
	(0.036)	(0.062)	(0.009)	(0.010)
Lag 4 90th percentile/ 10th percentile	0.014	0.010	−0.016	−0.009
	(0.036)	(0.060)	(0.009)	(0.012)
Lag 5 90th percentile/ 10th percentile	0.027	0.036	−0.003	−0.0005
	(0.031)	(0.063)	(0.009)	(0.011)
Lag 6 90th percentile/ 10th percentile	0.036	0.044	0.007	0.009
	(0.036)	(0.064)	(0.010)	(0.012)
Female	0.104*		−0.032*	
	(0.035)		(0.010)	
Age	0.092*	0.041	−0.019*	−0.021
	(0.009)	0(.078)	(0.002)	(0.018)
Squared age	−0.0006*	0.0002	0.0001*	0.0005*
	(0.00009)	(0.0002)	(0.00002)	(0.00004)
Marital status -base: single				
Being married	−0.117**	−0.078	0.024	0.026
	(0.054)	(0.148)	(0.015)	(0.025)
Being widow/divorced	0.041	0.012	0.030	0.108*
	(0.060)	(0.175)	(0.020)	(0.036)
Education status base: less than secondary				
Secondary grad.	−0.499*	−0.413	0.147*	0.082
	(0.056)	(0.289)	(0.018)	(0.053)
Some post-secondary education	−0.425*	−0.243	0.116*	0.045
	(0.047)	(0.217)	(0.016)	(0.043)

(*continued*)

Table 3: (*Continued*)

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
College university education	−0.688*	−0.546**	0.171*	0.058
	(0.047)	(0.228)	(0.015)	(0.045)
Having own home	−0.332*	0.143	0.051*	−0.002
	(0.042)	(0.093)	(0.013)	(0.019)
Living in urban area	0.031	−0.034	−0.011	−0.009
	(0.040)	(0.087)	(0.011)	(0.018)
Household income	−0.139*	−0.038*	0.009*	0.007*
	(0.009)	(0.011)	(0.001)	(0.001)
Physical activity base: inactive				
Physical activity	−0.776*	−0.581*	0.126*	0.002
	(0.052)	(0.080)	(0.013)	(0.015)
Moderate physical activity	−0.553*	−0.305*	0.073*	−0.0004
	(0.041)	(0.063)	(0.011)	(0.012)
Constant	−4.54*			3.69*
	(0.555)			(0.738)
Province control	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Province specific trend	Yes	Yes	Yes	Yes

Notes: Significance: *1%, **5%.
For logit and conditional fixed effects logit models (columns 2 and 3), the dependent variable is poor health.
For ordered probit and fixed effects model (columns 4 and 5), the dependent variable is self-reported health status.

Table 4 shows the results of the models that include Coefficient of Variation as a measure of income inequality. In all of the models, the contemporaneous Coefficient of Variation has an insignificant impact on health. However in the simple logit model, which does not control for the unobserved individual-specific heterogeneities, some of the lagged income inequality variables have significant positive effects on the probability of having poor health.

Table 5 provides the results of the models in which income inequality is represented by the Log Mean Deviation of income. The results show that contemporaneous income inequality has a significant negative impact on health in both the ordered probit and fixed effects models. The marginal effect analysis for the ordered probit model suggests that an increase in the Log Mean Deviation of income by one unit will reduce the probability of reporting "Excellent Health" by 0.039 units. The marginal effect results for the fixed effects model show that a one unit increase in the Log Mean Deviation of income reduced health by 0.044

Table 4: Regression results: determinants of health

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Coefficient of variation	0.023	−0.704	−0.071	−0.019
	(0.080)	(0.630)	(0.045)	(0.033)
Lag 1 coefficient of variation	−0.085	−0.765	0.008	0.051
	(0.137)	(0.615)	(0.020)	(0.039)
Lag 2 coefficient of variation	0.263*	−0.285	−0.075	−0.063
	(0.074)	(0.441)	(0.074)	(0.070)
Lag 3 coefficient of variation	0.237*	−0.276	−0.009	−0.016
	(0.089)	(0.331)	(0.095)	(0.079)
Lag 4 coefficient of variation	−0.105	−0.853	−0.020	−0.021
	(0.187)	(0.660)	(0.029)	(0.023)
Lag 5 coefficient of variation	0.029	−0.548	0.014	−0.007
	(0.077)	(0.557)	(0.066)	(0.058)
Lag 6 coefficient of variation	0.277*	−0.308	0.027	0.029
	(0.076)	(0.755)	(0.093)	(0.073)
Female	0.103*		−0.032*	
	(0.035)		(0.010)	
Age	0.091*	0.042	−0.019*	−0.021
	(0.009)	(0.078)	(0.002)	(0.018)
Squared age	−0.0006*	0.0002	0.0001*	0.0005*
	(0.00009)	(0.0002)	(0.00002)	(0.00004)
Marital status-base: single				
Being married	−0.117**	−0.084	0.025	0.026
	(0.054)	(0.148)	0.015)	(0.025)
Being widow/divorced	0.044	0.009	0.030	0.108*
	(0.060)	(0.175)	(0.020)	(0.036)
Education status base: less than secondary				
Secondary grad.	−0.496*	−0.409	0.147*	0.082
	(0.056)	(0.289)	(0.018)	(0.053)
Some post-secondary education	−0.423*	−0.238	0.116*	0.045
	(0.043)	(0.217)	(0.016)	(0.043)
College university education	−0.686*	−0.541*	0.171*	0.059
	(0.047)	(0.228)	(0.015)	(0.045)
Having own home	−0.331*	0.155	0.051*	−0.003
	(0.041)	(0.093)	(0.013)	(0.018)
Living in urban area	0.032	−0.036	−0.011	−0.009
	(0.040)	(0.087)	(0.011)	(0.018)
Household income	−0.138*	−0.038*	0.009*	0.007*
	(0.008)	(0.011)	(0.001)	(0.001)

(*continued*)

Table 4: (*Continued*)

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Physical activity base: inactive				
Physical activity	−0.778*	−0.585*	0.126*	0.002
	(0.052)	(0.080)	(0.013)	(0.015)
Moderate physical activity	−0.555*	−0.305*	0.073*	−0.0005
	(0.043)	(0.063)	(0.011)	(0.0121)
Constant	−3.85*			3.72*
	(0.245)			(0.700)
Province control	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Province specific trend	Yes	Yes	Yes	Yes

Notes: Significance: *1%, **5%.
For logit and conditional fixed effects logit models (columns 2 and 3), the dependent variable is poor health.
For ordered probit and fixed effects model (columns 4 and 5), the dependent variable is self-reported health status.

Table 5: Regression results: determinants of health

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Log mean deviation	−0.009	−0.355	−0.096**	−0.044**
	(0.080)	(0.890)	(0.045)	(0.023)
Lag 1 log mean deviation	−0.209	0.342	0.001	0.037
	(0.344)	(0.702)	(0.021)	(0.020)
Lag 2 log mean deviation	0.269*	0.088	−0.058	−0.050
	(0.074)	(0.135)	(0.079)	(0.078)
Lag 3 log mean deviation	0.241*	−0.059	−0.020	−0.023
	(0.089)	(0.687)	(0.079)	(0.084)
Lag 4 log mean deviation	−0.724	−0.335	−.0041	−0.034
	(0.536)	(0.746)	(0.025)	(0.028)
Lag 5 log mean deviation	−0.038	−0.367	0.032	0.026
	(0.082)	(0.614)	(0.069)	(0.065)
Lag 6 log mean deviation	0.283*	0.290	0.025	0.034
	(0.077)	(0.644)	(0.097)	(0.077)
Female	0.103*		−0.032*	
	(0.035)		(0.010)	

(*continued*)

Table 5: (*Continued*)

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Age	0.091*	0.041	−0.019*	−0.021
	(0.009)	(0.078)	(0.002)	(0.018)
Squared age	−0.0006*	0.0002	0.0001*	0.0005*
	(0.00009)	(0.0002)	(0.00002)	(0.00004)
Marital status -base: single				
Being married	−0.117**	−0.084	0.024	0.026
	(0.054)	(0.148)	(0.015)	(0.025)
Being widow/divorced	0.044	0.009	0.030	0.108*
	(0.060)	(0.175)	(0.020)	(0.036)
Education status base: less than secondary				
Secondary grad.	−0.495*	−0.412	0.147*	0.082
	(0.056)	(0.289)	(0.018)	(0.053)
Some post-secondary education	−0.423*	−0.243	0.116*	0.045
	(0.047)	(0.217)	(0.016)	(0.043)
College university education	−0.685*	−0.540**	0.171*	0.059
	(0.047)	(0.228)	(0.015)	(0.045)
Having own home	−0.331*	0.154	0.051*	−0.002
	(0.042)	(0.093)	(0.013)	(0.019)
Living in urban area	0.033	−0.034	−0.011	−0.009
	(0.040)	(0.087)	(0.011)	(0.018)
Household income	−0.138*	−0.038*	0.009*	0.007*
	(0.009)	(0.011)	(0.001)	(0.001)
Physical activity base: inactive				
Physical activity	−0.778*	−0.586*	0.126*	0.002
	(0.052)	(0.080)	(0.013)	(0.015)
Moderate physical activity	−0.555*	−0.307*	0.073*	−0.0004
	(0.041)	(0.063)	(0.011)	(0.012)
Constant	−3.69*			3.72*
	(0.310)			(0.699)
Province control	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Province-specific trend	Yes	Yes	Yes	Yes

Notes: Significance: * 1%, ** 5%.
For logit and conditional fixed effects logit models (columns 2 and 3), the dependent variable is poor health.
For ordered probit and fixed effects model (columns 4 and 5), the dependent variable is self-reported health status.

units. Some of the lagged Log Mean Deviation of income variables have significant positive effects on the probability of being in poor health in the simple logit model shown in the second column. On the other hand, the household income variable is found to have a significant positive impact on health in all of the models.

The results of the four models with income inequality measured by Theil Index are shown in Table 6. Once again, the contemporaneous income inequality variable has a significant negative impact on self-reported health in both the ordered probit and fixed effects models. For the ordered probit model, the marginal effect analysis suggests that a one unit increase in the Theil Index leads to a decrease in the probability of reporting "Excellent Health" by 0.038 units. For the fixed effects model, the marginal effect analysis shows that a one unit increase in the Theil Index would reduce reported health by 0.066 units. Some of the lagged income inequality variables are significant in the simple logit model. However in all other models, lagged Theil Index has no significant effect on reported health. In all of the models, the household income variable positively affects health status.

Table 6: Regression results: determinants of health

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Theil index	−0.009	−0.483	−0.087**	−0.066*
	(0.078)	(0.637)	(0.044)	(0.021)
Lag 1 Theil index	−0.139	−0.816	0.010	0.015
	(0.171)	(0.663)	(0.015)	(0.013)
Lag 2 Theil index	0.268*	−0.605	−0.066	−0.062
	(0.074)	(0.570)	(0.077)	(0.068)
Lag 3 Theil index	0.242*	−0.636	−0.017	−0.021
	(0.089)	(0.555)	(0.095)	(0.079)
Lag 4 Theil index	−0.191	−0.250	−0.030	−0.025
	(0.327)	(0.660)	(0.025)	(0.024)
Lag 5 Theil index	−0.010	−0.923	0.022	0.015
	(0.074)	(0.557)	(0.066)	(0.054)
Lag 6 Theil index	0.278*	−0.505	0.025	0.026
	(0.075)	(0.755)	(0.097)	(0.085)
Female	0.103*		−0.032*	
	(0.035)		(0.010)	
Age	0.091*	0.042	−0.019*	−0.016*
	(0.009)	(0.078)	(0.002)	(0.002)
Squared age	−0.0006*	0.0002	0.0001*	0.0001*
	(0.00009)	(0.0002)	(0.00002)	(0.00002)

(*continued*)

Table 6: (*Continued*)

Variable	Logit model	Conditional fixed effects logit model	Ordered probit model	Fixed effects model
Marital status -base: single				
Being married	−0.117*	−0.084	0.025	0.023
	(.054)	(0.148)	(0.015)	(0.013)
Being widow/divorced	0.044	0.010	0.030	0.025
	(0.060)	(0.175)	(0.020)	(0.018)
Education status base: less than secondary				
Secondary grad.	−0.496*	−0.414	0.147*	0.128*
	(0.056)	(0.289)	(0.018)	(0.016)
Some post-secondary education	−0.423*	−0.242	0.116*	0.101*
	(0.043)	(0.217)	(0.016)	(0.014)
College university education	−0.686*	−0.543*	0.171*	0.148
	(0.047)	(0.228)	(0.015)	(0.014)
Having own home	−0.330*	0.154	0.051*	0.045
	(0.040)	(0.094)	(0.013)	(0.011)
Living in urban area	0.033	−0.036	−0.011	−0.009
	(.040)	(.087)	(.011)	(.010)
Household income	−0.139*	−0.038*	0.009*	0.008*
	(0.009)	(0.011)	(0.001)	(0.001)
Physical activity base: inactive				
Physical activity	−0.778*	−0.586*	0.126*	0.101*
	(0.052)	(0.080)	(0.013)	(0.011)
Moderate physical activity	−0.555*	−0.307*	0.073*	0.061*
	(0.043)	(0.060)	(0.011)	(0.010)
Constant	−3.80*			4.17*
	(0.247)			(0.054)
Province control	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Province-specific trend	Yes	Yes	Yes	Yes

Notes: Significance: *1%, **5%.
For logit and conditional fixed effects logit models (columns 2 and 3), the dependent variable is poor health.
For ordered probit and fixed effects model (columns 4 and 5), the dependent variable is self-reported health status.

In summary, there were no consistent results for the effects of contemporaneous income inequality on health status. The effects are negative for some measures of income inequality while for most of the measures, there are no significant effects. Similarly for most of the measures, the lagged income inequality has no significant effect on health status.

To check the robustness of the results involving Gini Coefficient, this study conducts a few more statistical tests.[6] The health indicator Self-Reported Health Status may suffer from differential self-reporting bias by income (Bago d'Uva et al. 2008). Given this problem, this study utilizes a more objective health indicator "Health Utility Index" as a dependent variable and estimates OLS and fixed effects models. The results, as shown in the Appendix Table 7, suggests that contemporaneous Gini Coefficient has no significant impact on health status measured by the Health Utility Index. However, a few lagged Gini Coefficients are found to have a significant negative impact on health.

This study further checks whether dropping province-specific trends, province-fixed effects and year dummies would impact the results. The results, as shown in Appendix Tables 8 and 9, show that contemporaneous Gini Coefficient has no significant impact on health even after dropping province-fixed effects, year dummies and province-specific trends. Only in the cases of the simple logit and ordered probit models, the contemporaneous Gini Coefficient has a significant negative effect on health. Given the case that the "proportional odds" assumption in the ordered probit/logit model is often violated, this study also uses a "Multinomial Logit Model" besides the ordered probit model. The results of this model's estimations are shown in Appendix Tables 10 and 15. In the estimations, two specifications are used: model without province-specific trends and model with province-specific trends. The results confirm the findings that contemporaneous Gini Coefficient has no significant impact on health status. Finally, given the possibility that the measures of income inequality are highly correlated with one another, the study estimates models adding lagged Gini variables in a sequential way. The results of these models, as shown in Appendix Tables 16–25, are not qualitatively different from the single model shown in the Table 2.

5 Conclusions

Using longitudinal data from the Canadian National Population Survey (1994–2006), this study examines the impact of income inequality on current health outcomes. The result suggests that once unobserved individual specific heterogeneity is controlled for, income inequality as measured by Gini Coefficient has no significant impact on current health status. This result holds true for contemporaneous income inequality as well as for lagged income inequalities.

6 The author is grateful to the anonymous referee for these suggestions.

There are mixed results from the robustness check using various measures of income inequality. Decile Ratio (90P/10P) and Coefficient of Variation have no impacts on current health status. On the other hand, contemporaneous income inequality measured by Log Mean Deviation and Theil Index have significant negative effects on current health. All of the models suggest that absolute income has a significant positive effect on health status.

The result of the study that contemporaneous income inequality as measured by Gini Coefficient has no impact on health is consistent with the findings of a number of studies using individual level data (McLeod et al. 2003; Mellor and Milyo 2002; Lorgelly and Lindley 2008). Further, the results of this study are also similar to the findings of Mellor and Milyo (2003) that used contemporaneous as well as lagged Gini Coefficients. The result of this study is also consistent with the results of other studies that absolute income has a significant positive impact on health.

A few studies have used Canadian data to examine the relationship between income inequality and health outcomes. Using aggregate data, Veenstra (2000), Veenstra (2002), Ross et al. (2000) and Laporte and Ferguson (2003) did not find any evidence of the impact of income inequality on health. Using individual level Canadian data, McLeod et al. (2003) also found that income inequality had no significant impact on health. This study extends the other Canadian studies in the sense that it uses longitudinal data and thus can incorporate individual specific fixed effects in the analysis. Thus, this study further confirms the already existing Canadian evidence that income inequality has no significant effect on health. To explain the lack of a relationship between income inequality and health in Canada, Lynch et al. (2004) suggested that something implicit in Canada's social structure buffers any adverse health effects of income inequality. It was argued that Canada's universal health care system, publicly funded education, redistributive taxation and social policies blunt negative health effects of unequal distribution of income (Ross et al. 2000; Senmartin et al. 2003).

So far, only a few studies used longitudinal data and included lagged inequalities in the models. Further studies, using longitudinal data and including lagged income inequalities, are needed to confirm the findings of this study. Furthermore, not many studies have been done using data from developing countries. It will be interesting to examine the relationship between income and health outcomes for developing countries, particularly the countries where income inequality is rising. Finally, future studies on the relationship between income inequality and health outcomes might use different measures of income inequality such as Decile Ratio, Coefficient of Variation, Theil Index and Log Mean Deviation.

Appendix Table 1: Regression results: determinants of health (Health Utility Index)

Variable	OLS model	OLS model	OLS model	Fixed effects model	Fixed effects model	Fixed effects model
Gini coefficient	0.005	−0.005	−0.003	0.002	−0.0002	0.001
	(0.045)	(0.005)	(0.004)	(0.002)	(0.003)	(0.002)
Lag 1 Gini coefficient	0.029	−0.006	−0.004	0.031	−0.004	−0.001
	(0.024)	(0.005)	(0.005)	(0.021)	(0.004)	(0.005)
Lag 2 Gini coefficient	0.006	−0.0003	−0.0002	−0.002	0.001	0.0002
	(0.006)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)
Lag 3 Gini coefficient	−0.015*	−0.010	−0.011	−0.021*	−0.010**	−0.013*
	(0.008)	(0.009)	(0.009)	(0.009)	(0.004)	(0.004)
Lag 4 Gini coefficient	−0.021	0.003	0.002	−0.026	0.003	0.0009
	(0.017)	(0.002)	(0.003)	(0.021)	(0.004)	(0.007)
Lag 5 Gini coefficient	−0.021	−0.003	−0.004	−0.030	−0.003	−0.006
	(0.013)	(0.003)	(0.004)	(0.019)	(0.004)	(0.005)
Lag 6 Gini coefficient	−0.014*	−0.009	−0.009	−0.024**	−0.008**	−0.009*
	(0.007)	(0.006)	(0.006)	(0.011)	(0.003)	(0.003)
Female	−0.008*	−0.007*	−0.007*			
	(0.001)	(0.001)	(0.001)			
Age	−0.002*	−0.003*	−0.003*	0.002*	0.003	0.003
	(0.0003)	(0.0003)	(0.0003)	(0.0006)	(0.002)	(0.002)
Squared age	0.00001*	0.00002*	0.00001*	−0.00001	−0.00003	−0.00003
	(0.000001)	(0.000002)	(0.000001)	(0.000002)	(0.000006)	(0.000006)
Marital status -base: single						
Being married	0.019*	0.018*	0.018*	0.008*	0.009*	0.009*
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Being widow/divorced	−0.008**	−0.007**	−0.007**	−0.007	−0.005	−0.004
	(0.003)	(0.0003)	(0.0003)	(0.005)	(0.005)	(0.005)

(*continued*)

Appendix Table 1: (*Continued*)

Variable	OLS model	OLS model	OLS model	Fixed effects model	Fixed effects model	Fixed effects model
Education status base: less than secondary						
Secondary grad.	0.029*	0.031*	0.031*	0.022*	0.016**	0.016*
	(0.003)	(0.003)	(0.003)	(0.008)	(0.008)	(0.008)
Some post-secondary education	0.021*	0.023*	0.023*	0.008	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.009)	(0.006)	(0.006)
College university education	0.035*	0.037*	0.037*	0.010	0.006	0.006
	(0.002)	(0.002)	(0.002)	(0.006)	(0.006)	(0.006)
Having own home	0.020*	0.021*	0.021*	0.003	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Living in urban area	−0.001	−0.001	−0.001	−0.001	0.0004	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Household income	0.002*	0.002*	0.003*	0.0004**	0.0006*	0.0006*
	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Physical activity base: inactive						
Physical activity	0.032*	0.034*	0.034*	0.013*	0.012*	0.013*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Moderate physical activity	0.030*	0.031*	0.031*	0.010*	0.010*	0.009*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.932*	0.908*	0.911*	0.887*	0.811*	0.822*
	(0.012)	(0.009)	(0.009)	(0.021)	(0.095)	(0.095)
Province control	No	Yes	Yes	No	Yes	Yes
Year effect	No	Yes	Yes	No	Yes	Yes
Province specific trend	No	No	Yes	No	No	Yes

Note: Significance: *1%, **5%, ***10%.

Appendix Table 2: Regression results: determinants of health

Variable	Logit model	Logit model	Logit model	Conditional fixed effects logit model	Conditional fixed effects logit model	Conditional fixed effects logit model
Gini coefficient	0.204*	0.022	0.022	−0.294	−0.391	−0.381
	(0.080)	(0.079)	(0.080)	(0.834)	(0.893)	(0.893)
Lag 1 Gini coefficient	−0.157*	−0.022	−0.102	−0.225**	−0.349	−0.543
	(0.051)	(0.091)	(0.151)	(0.111)	(0.630)	(0.479)
Lag 2 Gini coefficient	0.268*	0.281*	0.271*	−0.132	−0.015	0.032
	(0.075)	(0.075)	(0.075)	(0.447)	(0.552)	(0.701)
Lag 3 Gini coefficient	0.368*	0.258*	0.237*	−0.207*	−0.010	−0.051
	(0.177)	(0.089)	(0.091)	(0.056)	(0.550)	(0.520)
Lag 4 Gini coefficient	0.099	−0.015	−0.116	−0.320	−0.463	−0.796
	(0.083)	(0.093)	(0.200)	(0.439)	(0.755)	(0.831)
Lag 5 Gini coefficient	0.033	0.030	0.008	−0.361	−0.305	−0.321
	(0.078)	(0.078)	(0.078)	(0.460)	(0.420)	(0.460)
Lag 6 Gini Coefficient	0.300*	0.309*	0.287*	0.696	0.911	0.655
	(0.079)	(0.079)	(0.079)	(0.498)	(0.608)	(0.608)
Female	0.102*	0.093*	0.103*			
	(0.037)	(0.037)	(0.035)			
Age	0.091*	0.096*	0.091*	0.036	0.027	0.041
	(0.009)	(0.010)	(0.009)	(0.024)	(0.078)	(0.078)
Squared age	−0.0005*	−0.0006*	−0.0006*	0.0002	0.0002	0.0002
	(0.00009)	(0.0001)	(0.00009)	(0.0002)	(0.0002)	(0.0002)
Being married	−0.128*	−0.113*	−0.117*	−0.058	−0.067	−0.084
	(0.056)	(0.056)	(0.054)	(0.148)	(0.152)	(0.148)
Being widow/divorced	0.050	0.048	0.044	0.062	0.052	0.012
	(0.063)	(0.063)	(0.060)	(0.181)	(0.182)	(0.175)
Secondary grad.	−0.448*	−0.486*	−0.496*	−0.438	−0.410	−0.414
	(0.056)	(0.056)	(0.056)	(0.298)	(0.299)	(0.289)

(*continued*)

Appendix Table 2: (*Continued*)

Variable	Logit model	Logit model	Logit model	Conditional fixed effects logit model	Conditional fixed effects logit model	Conditional fixed effects logit model
Some post-secondary education	−0.381*	−0.432*	−0.423*	−0.288	−0.249	−0.243
	(0.049)	(0.049)	(0.047)	(0.233)	(0.224)	(0.217)
College university education	−0.623*	−0.667*	−0.685*	−0.564**	−0.532**	−0.543**
	(0.047)	(0.047)	(0.047)	(0.228)	(0.238)	(0.228)
Having own home	−0.355*	−0.357*	−0.330*	0.159	0.159	0.154
	(0.040)	(0.044)	(0.040)	(0.094)	(0.094)	(0.094)
Living in urban area	0.034	0.032	0.033	−0.052	−0.047	−0.032
	(0.040)	(0.042)	(0.040)	(0.087)	(0.091)	(0.087)
Household income	−0.125*	−0.143*	−0.139*	−0.040*	−0.141*	−0.139*
	(0.009)	(0.009)	(0.009)	(0.011)	(0.011)	(0.009)
Physical activity	−0.777*	−0.777*	−0.778*	−0.632*	−0.633*	−0.586*
	(0.052)	(0.055)	(0.052)	(0.080)	(0.080)	(0.080)
Moderate physical activity	−0.530*	−0.530*	−0.555*	−0.307*	−0.307*	−0.307*
	(0.043)	(0.043)	(0.043)	(0.065)	(0.066)	(0.060)
Constant	−30.90*	−40.02*	−30.90*			
	(0.254)	(0.254)	(0.254)			
Province control	No	Yes	Yes	No	Yes	Yes
Year effect	No	Yes	Yes	No	Yes	Yes
Province specific trend	No	No	Yes	No	No	Yes

Notes: Significance: *1%, **5%.

For logit and conditional fixed effects logit models, the dependent variable is poor health.

Appendix Table 3: Regression results: determinants of health

Variable	Ordered probit model	Ordered probit model	Ordered probit model	Fixed effects model	Fixed effects model	Fixed effects model
Gini coefficient	−0.055**	−0.060**	−0.092**	0.058	0.042	−0.039
	(0.027)	(0.031)	(0.045)	(0.027)	(0.025)	(0.026)
Lag 1 Gini coefficient	0.0005	−0.013	0.004	0.062	0.047	0.042
	(0.025)	(0.032)	(0.022)	(0.019)	(0.011)	(0.030)
Lag 2 Gini coefficient	−0.072	−0.086	−0.063	−0.004	−0.023	−0.053
	(0.069)	(0.067)	(0.077)	(0.019)	(0.012)	(0.075)
Lag 3 Gini coefficient	−0.044	−0.056	−0.010	−0.064**	−0.007	−0.013
	(0.086)	(0.086)	(0.091)	(0.031)	(0.016)	(0.084)
Lag 4 Gini coefficient	−0.026	−0.035	−0.039	−0.035	0.010	−0.030
	(0.025)	(0.025)	(0.026)	(0.056)	(0.048)	(0.031)
Lag 5 Gini coefficient	0.022	0.011	0.029	0.039	0.044	0.025
	(0.064)	(0.064)	(0.067)	(0.023)	(0.032)	(0.060)
Lag 6 Gini coefficient	−0.032	−0.047	0.022	0.013	0.003	0.034
	(0.068)	(0.068)	(0.096)	(0.019)	(0.019)	(0.077)
Female	−011	−011	−0.032*			
	(0.010)	(0.010)	(0.010)			
Age	−0.014*	−0.014*	−0.019*	−0.010*	0.016	−0.021
	(0.002)	(0.002)	(0.002)	(0.003)	(0.017)	(0.018)
Squared age	0.00002	0.00002	0.0001*	−0.0001*	−0.0001*	0.0005*
	(0.00002)	(0.00002)	(0.00002)	(0.00003)	(0.00003)	(0.00004)
Being married	0.052*	0.051*	0.024	−0.007	−0.004	0.026
	(0.015)	(0.015)	(0.015)	(0.020)	(0.020)	(0.025)
Being widow/divorced	−0.003	−0.004	0.030	−0.001	0.002	0.108*
	(0.020)	(0.020)	(0.020)	(0.028)	(0.028)	(0.036)
Secondary grad.	0.236*	0.249*	0.147*	0.020	0.012	0.083
	(0.018)	(0.018)	(0.018)	(0.044)	(0.044)	(0.053)

(*continued*)

Appendix Table 3: (*Continued*)

Variable	Ordered probit model	Ordered probit model	Ordered probit model	Fixed effects model	Fixed effects model	Fixed effects model
Some post-secondary education	0.196*	0.211*	0.116*	0.019	0.012	0.045
	(0.016)	(0.016)	(0.016)	(0.033)	(0.033)	(0.042)
College university education	0.325*	0.333*	0.171*	0.057	0.052	0.059
	(0.011)	(0.011)	(0.016)	(0.035)	(0.035)	(0.045)
Having own home	0.123*	0.128*	0.051*	−0.016	−0.016	−0.003
	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)	(0.019)
Living in urban area	−0.009	−0.006	−0.011	−0.005	−0.005	0.008
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.019)
Household income	0.033*	0.034*	0.009*	0.002**	0.002**	0.007*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Physical activity	0.392*	0.400*	0.126*	0.032*	0.030**	0.002
	(0.013)	(0.013)	(0.013)	(0.011)	(0.011)	(0.015)
Moderate physical activity	0.223*	0.226*	0.073*	0.0009	0.0008	−0.0004
	(0.012)	(0.012)	(0.011)	(0.009)	(0.009)	(0.012)
Constant						30.72*
						(0.700)
Province control	No	Yes	Yes	No	Yes	Yes
Year effect	No	Yes	Yes	No	Yes	Yes
Province specific trend	No	No	Yes	No	No	Yes

Notes: Significance: *1%, **5%.

For ordered probit and fixed effects model, the dependent variable is self-reported health status.

Appendix Table 4: Regression results: determinants of health (Multinomial Logit Method)

Variable	Excellent health	Good health	Fair health	Poor health
Gini coefficient	0.103	−0.007	0.065	0.018
	(0.148)	(0.113)	(0.105)	(0.167)
Lag 1 Gini coefficient	−0.956	−0.108	−0.041	−0.512
	(0.546)	(0.080)	(0.091)	(0.642)
Lag 2 Gini coefficient	0.953**	0.956**	0.209	−0.817
	(0.459)	(0.474)	(0.462)	(0.497)
Lag 3 Gini coefficient	0.149	0.361	0.336	−0.335
	(0.474)	(0.470)	(0.474)	(0.525)
Lag 4 Gini coefficient	−0.166	0.073	−0.031	−0.109
	(0.216)	(0.120)	(0.140)	(0.099)
Lag 5 Gini coefficient	0.355	0.334	0.322	0.305
	(0.285)	(0.280)	(0.267)	(0.315)
Lag 6 Gini coefficient	0.820	0.443	0.228	0.851
	(0.519)	(0.501)	(0.533)	(0.539)
Female	−0.024	−0.049**	0.105	−0.096
	(0.025)	(0.024)	(0.042)	(0.086)
Age	0.010*	0.020*	0.084*	0.207*
	(0.006)	(0.006)	(0.010)	(0.027)
Squared age	−0.0001*	−0.00002	−0.0005*	−0.001*
	(0.00006)	(0.00002)	(0.0001)	(0.0001)
Being married	0.073**	−0.147*	−0.210	0.013
	(0.038)	(0.036)	(0.063)	(0.139)
Being widow/divorced	0.069	−0.033	0.026	0.224
	(0.051)	(0.046)	(0.072)	(0.147)
Secondary grad.	0.179*	−0.286*	−0.568*	−0.564*
	(0.049)	(0.043)	(0.068)	(0.137)
Some post-secondary education	0.089**	−0.285*	−0.559*	−0.414*
	(0.044)	(0.036)	(0.056)	(0.110)
College university education	0.222*	−0.424*	−0.778*	−0.813*
	(0.042)	(0.036)	(0.016)	(0.1171)
Having own home	0.613*	−0.177*	−0.389*	−0.613*
	(0.013)	(0.031)	(0.050)	(0.013)
Living in urban area	0.010	0.023	−0.050	0.010
	(0.011)	(0.028)	(0.048)	(0.011)
Household income	0.227*	−0.027*	−0.129*	−0.227*
	(0.022)	(0.008)	(0.010)	(0.022)
Physical activity	0.482*	−0.419*	−0.789*	−0.977*
	(0.031)	(0.033)	(0.062)	(0.113)
Moderate physical activity	0.148*	−0.309*	−0.548*	−0.967*
	(0.034)	(0.028)	(0.050)	(0.134)
Constant	−10.45	−10.61	−30.84	−60.60*
	(0.306)	(0.266)	(0.349)	(0.967)
Province control	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Province specific trend	No	No	No	No

Notes: Significance: *1%, **5%, ***10%.
The base outcome is 'Very Good Health'.

Appendix Table 5: Regression results: determinants of health (Multinomial Logit Method)

Variable	Excellent health	Good health	Fair health	Poor health
Gini coefficient	0.104	−0.096	0.065	0.029
	(0.153)	(0.113)	(0.109)	(0.137)
Lag 1 Gini coefficient	−0.400	−0.087	−0.093	−0.105
	(0.233)	(0.080)	(0.086)	(0.165)
Lag 2 Gini coefficient	0.750**	0.721**	0.739**	0.658
	(0.363)	(0.337)	(0.362)	(0.743)
Lag 3 Gini coefficient	0.861**	0.575	0.455	0.852
	(0.362)	(0.224)	(0.474)	(0.986)
Lag 4 Gini coefficient	−0.758	0.085	−0.097	0.079
	(0.498)	(0.133)	(0.140)	(0.135)
Lag 5 Gini coefficient	0.355	0.647	0.633	0.573
	(0.285)	(0.721)	(0.712)	(0.735)
Lag 6 Gini Coefficient	0.174	0.515	0.667**	0.249
	(0.124)	(0.765)	(0.337)	(0.216)
Female	−0.096	−0.048**	0.115**	−0.090
	(0.052)	(0.024)	(0.042)	(0.076)
Age	0.099	0.020*	0.088*	0.227*
	(0.066)	(0.006)	(0.010)	(0.037)
Squared age	−0.0001*	−0.00002	−0.0005*	−0.0001*
	(0.00006)	(0.00002)	(0.0001)	(0.00001)
Being married	0.928**	−0.863*	−0.810*	0.010
	(0.038)	(0.036)	(0.053)	(0.139)
Being widow/divorced	0.070	0.065	0.026	0.251
	(0.051)	(0.046)	(0.072)	(0.187)
Secondary grad.	0.197*	−0.751*	−0.568*	−0.565*
	(0.049)	(0.032)	(0.038)	(0.077)
Some post-secondary education	0.095**	−0.752*	−0.571*	−0.659*
	(0.048)	(0.026)	(0.056)	(0.073)
College university education	0.252*	−0.654*	−0.458*	−0.442*
	(0.052)	(0.026)	(0.026)	(0.051)
Having own home	−0.986	−0.835*	−0.675*	−0.540*
	(0.633)	(0.031)	(0.034)	(0.053)
Living in urban area	0.014	0.025	0.055	0.100
	(0.031)	(0.028)	(0.051)	(0.097)
Household income	0.036*	−0.972*	−0.877*	−0.797*
	(0.003)	(0.008)	(0.010)	(0.018)
Physical activity	0.622*	−0.658*	−0.457*	−0.374*
	(0.031)	(0.023)	(0.022)	(0.050)
Moderate physical activity	0.165*	−0.735*	−0.578*	−0.380*
	(0.034)	(0.028)	(0.029)	(0.044)
Constant	0.251	0.295	−0.020	−0.060*
	(0.048)	(0.083)	(0.007)	(0.007)
Province control	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Province specific trend	Yes	Yes	Yes	Yes

Notes: Significance: *1%, **5%, ***10%.
The base outcome is ‘Very Good Health’.

Appendix Table 6: Determinants of health (Logit Model)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gini coefficient	0.022	0.022	0.023	0.021	0.021	0.019
	(0.078)	(0.079)	(0.078)	(0.079)	(0.079)	(0.079)
Lag 1 Gini coefficient	−0.061					
	(0.108)					
Lag 2 Gini coefficient		0.282*				
		(0.077)				
Lag 3 Gini coefficient			0.260*			
			(0.089)			
Lag 4 Gini coefficient				−0.009		
				(0.087)		
Lag 5 Gini coefficient					0.043	
					(0.074)	
Lag 6 Gini coefficient						0.308*
						(0.084)

Notes: * significant at 1% level.
The models include following variables: age, marital status, education, home ownership, location, household income, physical activity, province, year, and province specific trends.

Appendix Table 7: Determinants of health (Conditional Fixed Effect Logit Model)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gini coefficient	−0.370	−0.371	−0.362	−0.404	−0.415	−0.485
	(0.540)	(0.535)	(0.332)	(0.272)	(0.478)	(0.434)
Lag 1 Gini coefficient	−0.541					
	(0.475)					
Lag 2 Gini coefficient		0.095				
		(0.377)				
Lag 3 Gini coefficient			−0.078			
			(0.303)			
Lag 4 Gini coefficient				−0.562		
				(0.815)		
Lag 5 Gini coefficient					−0.242	
					(0.227)	
Lag 6 Gini coefficient						0.694
						(0.684)

Notes: * significant at 1% level.
The models include following variables: age, marital status, education, home ownership, location, household income, physical activity, province, year, and province specific trends.

Appendix Table 8: Determinants of health (Ordered Probit Model)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gini coefficient	−0.090**	−0.086**	−0.085**	−0.089**	−0.091**	−0.085**
	(0.043)	(0.040)	(0.042)	(0.044)	(0.044)	(0.042)
Lag 1 Gini coefficient	0.001					
	(0.027)					
Lag 2 Gini coefficient		−0.080				
		(0.067)				
Lag 3 Gini coefficient			−0.029			
			(0.068)			
Lag 4 Gini coefficient				−0.046		
				(0.035)		
Lag 5 Gini coefficient					0.033	
					(0.063)	
Lag 6 Gini coefficient						0.027
						(0.068)

Notes: * significant at 1% level.
The models include following variables: age, marital status, education, home ownership, location, household income, physical activity, province, year, and province specific trends.

Appendix Table 9: Determinants of health (Fixed Effects Model)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gini coefficient	−0.039	−0.038	−0.036	−0.039	−0.043	−0.035
	(0.025)	(0.027)	(0.033)	(0.029)	(0.041)	(0.030)
Lag 1 Gini coefficient	0.057					
	(0.041)					
Lag 2 Gini coefficient		−0.045				
		(0.032)				
Lag 3 Gini coefficient			−0.015			
			(0.025)			
Lag 4 Gini coefficient				−0.037		
				(0.027)		
Lag 5 Gini coefficient					0.032	
					(0.025)	
Lag 6 Gini coefficient						0.037
						(0.030)

Notes: * significant at 1% level.
The models include following variables: age, marital status, education, home ownership, location, household income, physical activity, province, year, and province specific trends.

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