

# **A Formal Investigation of Inequalities in Health Behaviours After Age 50 on the Island of Ireland\***

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*Abstract:* To examine income-related inequality in smoking, low physical activity and frequent alcohol consumption we calculate concentration indices using data on older adults from the Republic of Ireland and Northern Ireland. Smoking and low physical activity are more concentrated among those with lower incomes in both regions, while frequent alcohol consumption is more concentrated among those with higher incomes. Although results for the two jurisdictions are quite similar, low levels of physical exercise appears to be more highly concentrated amongst lower income groups in the North. In conclusion, inequalities in health behaviours exist among older people on the Island of Ireland.

## I INTRODUCTION

**T**he strong, detrimental effects of smoking, heavy alcohol consumption and physical inactivity on longevity and healthy ageing are well documented. Current smoking and former smoking are strongly related to mortality and

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ill-health and have been identified as risk factors for functional status decline (Østbye *et al.*, 2002; LaCroix *et al.*, 1993; Gellert *et al.*, 2012). Low physical activity is also associated with a plethora of adverse outcomes such as decreased quality of life (Dolan *et al.*, 2008; Rejeski and Mihalko, 2001), increased risk of disease (Haskell *et al.*, 2007; Telford, 2007) and increased risk of premature mortality (Warburton *et al.*, 2006). Similar to what has been found in studies on the effect of alcohol on mortality, a U-shaped relationship between alcohol consumption and the development of disability has also been reported among middle-aged and older adults (Østbye *et al.*, 2002).

While socio-economic gradients in health behaviours in the general population have been well studied (Cutler and Lleras-Muney, 2010; Pampel *et al.*, 2010), the extent to which hazardous lifestyles are also more prevalent among socio-economically disadvantaged groups of older adults is not as well known. An exception is a recent study by Shaw *et al.* (2013). Using data on older American adults, the authors found that while smoking and inactivity are higher at lower levels of wealth, heavy drinking decreases at lower levels of wealth.

In this paper, we add to this limited literature by examining health inequalities among individuals aged 50 and above in Northern Ireland and the Republic of Ireland in relation to three key health behaviours: smoking, alcohol consumption, and physical activity. We use the first waves of the *Northern Ireland Health Survey* (HSNI) and *The Irish Longitudinal Study of Ageing* (TILDA) for Northern Ireland and the Republic, respectively. We first examine descriptive statistics and then construct a concentration index for each of the three health behaviours of interest. The concentration index is a single measure which summarises the degree to which the distribution of the health behaviour differs according to income. This measure has also the attractive property that it can be decomposed to analyse the factors lying behind such inequality as well as the contribution of such factors to inequality. To our knowledge, this is the first study that uses these techniques to measure and compare inequalities in health behaviours among older adults in Northern Ireland and the Republic of Ireland. While the primary focus of the paper will be on the health inequalities as measured in each jurisdiction in their own right, we think it is also of interest to note comparisons between the two sets of results and we will make observations of that nature along the way.

The remainder of the paper is structured as follows. Section II provides an overview of the concentration index. Section III presents the data and describes the variables used in the empirical analysis. Results are reported in Section IV and Section V concludes.

## II THE CONCENTRATION INDEX

A concentration index is a single measure of inequality which can be decomposed to analyse the factors lying behind such inequality as well as the contribution of such factors to inequality (Kakwani *et al.*, 1997; Wagstaff *et al.*, 1989; O'Donnell and Wagstaff, 2008). The index summarises the degree to which the distribution of a health outcome or behaviour differs according to income (or some other measure of household resources). It is closely related to the well-known Gini-coefficient in income inequality analysis. Indeed, the concentration index for income is, in fact, the Gini coefficient.

Suppose we have a variable of ill-health,  $h$ , where  $h_i$  is the value of that variable for individual  $i$ . Then if  $r_i$  is the fractional rank of individual  $i$  in the income distribution (or whatever measure of household resources is being used), then the concentration index is

$$C = \frac{2 * cov(h_i, r_i)}{\mu_h} \quad (1)$$

where  $\mu_h$  is the mean value of the health variable (Kakwani *et al.*, 1997).  $C$  can take on a value from  $-1$  to  $+1$ , where a negative (positive) value indicates that variable of ill-health is concentrated among the relatively poor (rich). One attractive property of the concentration index is that it is possible to decompose  $C$  into inequalities and elasticities of health determinants. If the vector  $X$  refers to those variables influencing  $h$ , then if we assume that the health variable can be described by a linear regression of the form

$$h_i = \alpha + \beta_k X_{ki} + \varepsilon \quad (2)$$

then  $C$  can be written as

$$C = \sum_k \left( \frac{\beta_k \bar{x}_k}{\mu_h} \right) C_k + \frac{GC_\varepsilon}{\mu_h} \quad (3)$$

where the index  $k$  refers to the regressors in the equation,  $C_k$  is the concentration index for each of the individual regressors,  $\beta_k$  is the coefficient for each health determinant in the regression and  $\bar{x}_k$  is the mean value of each individual regressor.  $GC_\varepsilon$  is the generalised  $C$  for the residual from the regression (Wagstaff *et al.*, 2003). There are two factors which determine whether a variable makes a contribution to the concentration index. First of all, it must be the case that it influences the health variable – this is captured by  $\frac{\beta_k \bar{x}_k}{\mu_h}$  which is the elasticity of the health variable with respect to the

regressor. The second term,  $C_k$ , indicates the degree to which the regressor itself varies with respect to income. It is possible for a regressor to have a major influence upon health (a high  $\frac{\beta_k \bar{x}_k}{\mu_h}$ ), but its impact upon the concentration index will be limited if it does not vary greatly with income (a low  $C_k$ ).

The situation above assumes the health variable is continuous. In the case of a binary health variable  $h_i$ , where  $h$  takes on values of 0 or 1, a normalisation must be applied to the concentration index (since the bounds would not be  $-1$  and  $+1$ ). Wagstaff (2005) suggested a normalisation of  $C_n = C/(1 - \mu_h)$ . In a recent contribution, Erreygers (2009) suggested that the appropriate normalisation be  $CE = 4\mu_h C = 4\mu_h(1 - \mu_h)C_n$ . This is the approach we adopt.

### III DATA AND VARIABLE DESCRIPTION

#### 3.1 Data

This study uses the first waves of the *Northern Ireland Health Survey* (HSNI) and *The Irish Longitudinal Study of Ageing* (TILDA), for Northern Ireland and the Republic, respectively.

The *Northern Ireland Health Survey* is a study of adults aged 16 and above residing in private households in Northern Ireland. It is commissioned by the Department of Health, Social Services and Public Safety in Northern Ireland and carried out by the Central Survey Unit of the Northern Ireland Statistics and Research Agency. A total of 4,971 individuals aged 16 and above were interviewed between April 2010 and March 2011. The sample was randomly selected from the Land and Property Services list of private addresses and a response rate of 62 per cent was achieved. As our analysis focuses on older adults, we only use data for respondents aged 50 and above, who represent 41 per cent of the sample.

The HSNI is based on two data collection techniques: the computer-assisted personal interview (CAPI) and the computer-assisted self interviewing (CASI). The latter is used for potentially sensitive questions, which are answered directly by respondents using the interviewers' computer. Respondents are also given the option to use a self-completion booklet instead.

*The Irish Longitudinal Study on Ageing* is a nationally representative study of community dwelling individuals aged 50 and above (and their spouses or partners of any age) residing in the Republic of Ireland. It is funded by the Department of Health and Children, Atlantic Philanthropies and Irish Life. A total of 8,504 respondents were recruited between 18 October 2009 and

22 February 2011. The sample was generated using the Irish Geodirectory, a comprehensive and up-to-date listing and mapping of all residential addresses in the Republic of Ireland. The response rate was 62 per cent.

Data collected in TILDA is made of three components: the CAPI questionnaire; a self-completion questionnaire (SCQ), designed to explore certain areas that are considered particularly sensitive for respondents to answer directly to an interviewer; and the health assessment component of the study, conducted both in dedicated TILDA health assessment centres and, alternatively, in respondents' homes. As questions on alcohol consumption are asked in the SCQ, our analysis is based on respondents who completed both the CAPI and the SCQ.

The HSNI and TILDA datasets are comparable in that they both collect information on different aspects of the respondents' lives, ranging from physical and behavioural health to standards of living. Also, crucial for our analysis is the timing of data collection, as the surveys were conducted at approximately the same time period. The two studies, however, differ in one important respect: while TILDA is a study on ageing, the HSNI is targeted to the general adult population. As a result of this, the Northern Irish sample reduces considerably if only older individuals are selected. To illustrate, the three health behaviours of interest are measured for 2,007 respondents aged 50 and over in the HSNI, as compared to 6,722 respondents in TILDA.

### 3.2 *Missing Observations*

In calculating the concentration indices and in providing the decomposition, it must be borne in mind that some observations are missing and in particular it is possible that such observations may not be missing at random. Unsurprisingly, the variable with the greatest number of missing observations is income. Income is missing for 496 observations (7.4 per cent) in TILDA, as compared to 398 observations (19.8 per cent) in the HSNI. In contrast, observations for variables other than income are only missing in 40 cases in TILDA and in 32 cases in HSNI.

To ensure the robustness of our results, we examined insofar as possible the influence of missing income on our findings. We estimated an income function, by regressing (equivalised) income on age group, marital status and principal economic status. We then substituted the fitted values from this regression for those observations where income is missing. This is known as the regression prediction or conditional mean imputation approach (where it is applied to income only). For comparison, we also calculated the concentration indexes based only on observations where income is not missing and based on observations where income is missing but including different regressors in the income function. While there are some differences from the indices calculated

using the different approaches, they are of a similar order of magnitude suggesting that the missing observations do not unduly bias the results.

The final sample sizes, including observations for which we imputed income, are 6,682 for the Republic and 1,975 for Northern Ireland.

### 3.3 *Health Behaviours*

The three health behaviours we focus on are smoking, physical activity and frequent alcohol consumption. We now briefly review the importance of these three behaviours for health.

Smoking has long been recognised as a major risk factor in a range of health conditions and there is evidence that the disease burden falls disproportionately upon the elderly (Burns, 2000). This is owing to the cumulative adverse effects of smoking, effects which can primarily manifest themselves in later life. Lung cancer tends to be the primary cause of mortality amongst smokers over 60, with a prominent role also for chronic obstructive lung disease. It has been estimated that in the US approximately 70 per cent of smoking related deaths occur amongst those aged over 60 years.

Physical inactivity was listed in 2010 by the World Health Organisation as the fourth leading risk factor for global mortality, after high blood pressure, tobacco use and high blood glucose (WHO, 2010). The report states that "... there is strong scientific evidence that regular physical activity produces major and extensive health benefits in both adults aged 18-64 and older adults aged 65 and above. In some cases the evidence of health benefits is strongest in older adults because the outcomes related to inactivity are more common in older adults" (WHO, 2010, p. 30). The report further states that the overall evidence for adults aged 65 and over demonstrates that, compared to less active individuals, men and women who are more active have lower rates of all-cause mortality, coronary heart disease, high blood pressure, stroke, type-2 diabetes, colon cancer, breast cancer, a higher level of cardiorespiratory and muscular fitness, healthier body mass and composition and a biomarker that is more favourable for the prevention of cardiovascular disease, type 2 diabetes and the enhancement of bone health (Physical Activity Guidelines Advisory Committee, 2008; Baumann *et al.*, 2005; Paterson *et al.*, 2007).

The final health behaviour examined is alcohol consumption. While moderate alcohol consumption is associated with a number of positive outcomes, including lower levels of cardiovascular risk as highlighted by Di Castelnuovo *et al.* (2010), it is important to remember that problematic and excessive alcohol consumption has clear adverse health consequences (Ostermann and Sloan, 2001; Perreira and Sloan, 2002). In addition to the increased risk factors for conditions such as coronary heart disease, hypertension, stroke, insomnia, osteoporosis and various cancers, alcohol can

also be a contributory factor to falls which are a major source of mortality and ill-health amongst older people (Wright and Whyley, 1994). A further complication is that older people may be mixing alcohol with a variety of prescription drugs.

In order to understand whether inequalities exist for these key health behaviours, we calculate concentration indices and use decomposition analysis to determine which factors contribute most to inequality. Before turning to this formal analysis, we present descriptive statistics for the variables employed in our analysis.<sup>1</sup>

### 3.3.1 Smoking

The first health behaviour examined in this study is smoking. We construct a binary variable denoting whether the respondent is a smoker or not. Table 1 shows that smoking rates appear to be similar in the two regions with 17 per cent of older people in TILDA reporting that they currently smoke and 18 per cent of people in the HSNI study.

Table 1: *Smoking, Physical Activity and Drinking by Region*

	<i>Republic of Ireland Proportion</i>	<i>Northern Ireland Proportion</i>
Smoking		
Never smoked	0.45	0.41
Used to smoke	0.38	0.41
Smokes	0.17	0.18
Physical Activity		
Low	0.30	0.54
Moderate	0.36	0.28
High	0.34	0.18
Drinking		
Drinks 5-7 days per week	0.10	0.06

### 3.3.2 Low Physical Activity

The second health behaviour examined in this study is low physical activity. Physical activity is measured using the International Physical Activity Questionnaire (IPAQ). Both datasets contain questions from the short form of this questionnaire which is comprised of questions related to the time respondents spent being physically active during the last 7 days. Respondents are asked how many days they spent walking, doing moderate-intensity or

<sup>1</sup> Our analysis is based on unweighted data. We also carried out separate analyses in which sample weights were employed and found qualitatively similar results. Hence, results do not appear to be sensitive to use (or non-use) of sampling weights.

vigorous-intensity activities in the past 7 days and how much time they spent on these activities on those days.

Using information on days and time spent on different activities we can calculate the number of MET-minutes (metabolic equivalent task) per activity per week. MET-minutes is a way of measuring activity intensity (Kronenberg *et al.*, 2000). We calculate the respondents MET-minutes by multiplying each activity's MET value by the time spent on that activity. The MET for walking is 3.3, 4 for moderate activities and 8 for vigorous activities (Ainsworth *et al.*, 2011). Respondents' level of activity can be categorised into three categories depending on both the type and amount of activity undertaken. Following Ainsworth *et al.* (2011), the criteria for these categories are as follows:

- *High*: vigorous-intensity activity on at least 3 days achieving a minimum total physical activity of at least 1,500 MET-minutes/week OR 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 3,000 MET-minutes/week.
- *Moderate*: 3 or more days of vigorous-intensity activity of at least 20 minutes per day OR 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day OR 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum total physical activity of at least 600 MET-minutes/week.
- *Low*: this is the lowest level of physical activity. Those individuals who do not meet criteria for the high and moderate categories are considered to have a low physical activity level.

Our key indicator of physical activity is based on the criteria above, as it takes into account the time spent on activities and the type of activity undertaken. That is we focus on those who fall into the low category.

Table 1 shows that more than half of respondents fall into the low physical activity category in Northern Ireland, compared to less than one in three in the Republic. Conversely, the proportion of those who fall into the moderate and high physical activity categories is considerably higher in the Republic than in Northern Ireland. In Table 2 we examine low activity levels by age group among the over 50s for Northern Ireland and the Republic of Ireland respectively. Unsurprisingly, in both regions the levels of low physical activity increase with age. At all age groups, levels of low activity are higher in Northern Ireland.

Such large differences in physical activity among older adults across the two regions deserve more attention. Focusing on how physical activity is



Table 2: *Low Physical Activity Level by Age-group by Region*

	<i>Republic of Ireland Proportion</i>	<i>Northern Ireland Proportion</i>
Age		
50-54	0.25	0.45
55-59	0.26	0.44
60-64	0.26	0.48
65-69	0.26	0.54
70-74	0.33	0.55
75-79	0.42	0.70
80+	0.50	0.75
Total	0.30	0.54

measured in the two surveys, it is worth noting that while respondents in Northern Ireland are asked about frequency of walking “at a brisk or fast pace” in the previous 7 days, respondents in the Republic are asked about frequency of “any walking” in the previous 7 days. Hence, we might expect frequency of walking and time spent doing this activity to be higher in the Republic than in Northern Ireland. However, as Table 3 shows, the mean total minutes per activity per week are considerably higher in the Republic also for moderate and vigorous activity. As measures of moderate and vigorous activity are very similar in the two surveys, it does not seem to be the case that cross-country differences are solely due to measurement differences.

Table 3: *Mean Total Minutes Per Activity Per Week by Region*

	<i>Republic of Ireland</i>	<i>Northern Ireland</i>
Walking	367.62	93.65
Moderate	333.20	142.46
Vigorous	141.84	86.94

Furthermore, differences in physical activity among older adults across the two regions have also been found in other studies. For example, using data on community dwelling individuals aged 65 and above in the Republic of Ireland and Northern Ireland, McGee *et al.* (2005) found that 77 per cent of respondents believed that they were exercising enough in the Republic, compared to 56 per cent in Northern Ireland.

Further evidence is provided by the British Heart Foundation who compile details on physical activity levels for the UK (including figures specifically for Northern Ireland) and also comparable figures for other European countries

(including the Republic of Ireland). They show that activity levels for Northern Ireland are slightly below those for the other regions of the UK. For example, for men aged 55-64, 35 per cent in England and 37 per cent in Scotland meet the recommended levels of physical activity, while the corresponding figure for Northern Ireland is 28 per cent (see Townsend *et al.*, 2012). Evidence for females and older age groups is somewhat contradictory. Townsend *et al.* (2012) suggest that the gap is narrower for females and is reversed for older age groups, so that overall activity levels in Northern Ireland are just below the UK average. However, a fact sheet for physical activity levels released by the British Heart Foundation in 2014 (British Heart Foundation, 2014) indicates that physical activity levels for Northern Ireland for those aged 75 and over are lower than comparable figures for England and Scotland.

The figures for the rest of Europe, however, show that the Republic of Ireland had the highest level of regular exercise/sport in the EU, with the UK about one-third down the rankings (unfortunately these figures are not broken down by age). Thus, the evidence suggests that the gap between the Republic of Ireland and Northern Ireland appears to be jointly explained by higher levels of activity in the Republic and also by lower levels in the North.

### 3.3.3 Alcohol Consumption

In both TILDA and the HSNI, respondents are asked how often have they have had an alcoholic drink. The response categories are: almost every day, 5 or 6 days a week, 3 or 4 days a week, once or twice a week, once or twice a month, less than once a month and the last response option is “Not at all in the last 6 months” for TILDA and “Not at all in the last 12 months” for HSNI. We categorise respondents into two groups: those who drink very frequently and those who do not. We consider those who drink almost everyday and those who drink 5 to 6 days per week to be frequent drinkers.<sup>2</sup>

As comparable data on the quantity of alcohol consumed is not available in the two datasets, we cannot compare the amount of alcohol consumed by these frequent drinkers. Therefore, the actual amount consumed may or may not be moderate. However, while we are unable to determine whether consumption levels are moderate or not, we are able to ascertain whether frequent alcohol consumption is equally distributed in terms of income.

From Table 1 we can see that rates of high frequency alcohol consumption are higher in the Republic of Ireland than in Northern Ireland with approximately 10 per cent of people drinking on at least 5 to 7 days per week compared to only 6 per cent in Northern Ireland.

<sup>2</sup> We also investigated different cut-off points, for example distinguishing those who drink every day from all other respondents and the results were qualitatively similar.

### 3.4 *Living Standards Variable*

In order to construct concentration indices, we require a measure of living standards over which we can rank households. The measures we use are gross household income for HSNI respondents and net household income for TILDA respondents. We also equalise these measures by dividing them by the square root of household size (Avendano and Glymour, 2008; Avendano *et al.*, 2009; Buhmann *et al.*, 1988; Huisman *et al.*, 2003). Also, as explained in the data section above, income is imputed for those observations where income is missing.

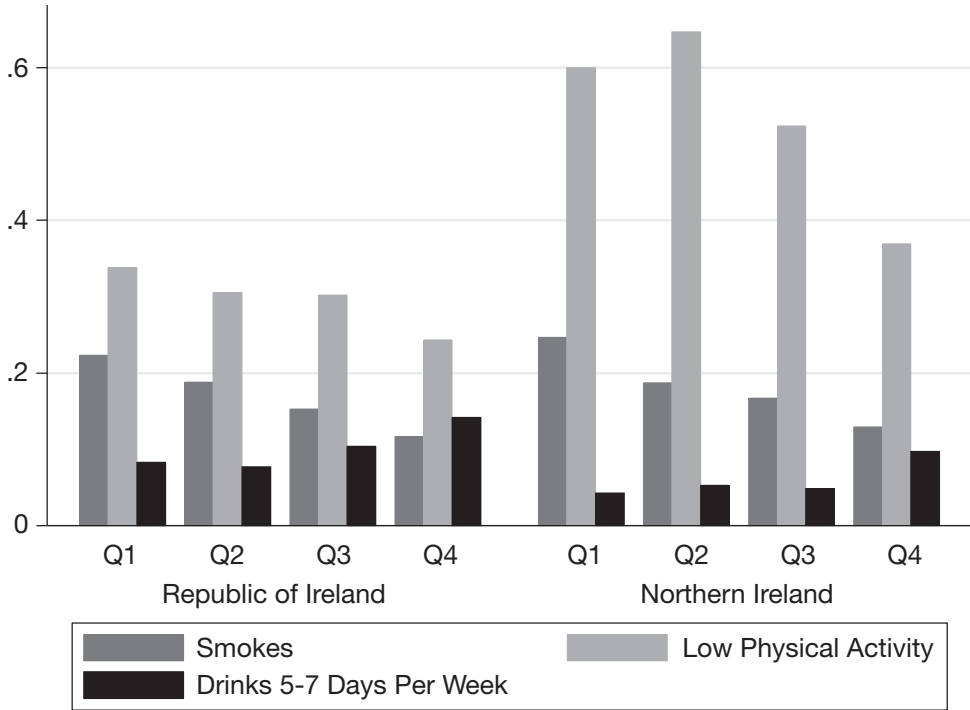
Respondents in the HSNI sample are asked to select their total gross household income from 38 income bands. Respondents in the TILDA sample are asked to state their approximate total net household income. If they refuse or cannot provide a point estimate, they are given the option to select their approximate total household income from 5 income bands. We use the midpoint of each of these income bands for those who only select an income band.

While comparing results between the two jurisdictions is not an explicit goal of this analysis, it might be asked if the use of gross household income for Northern Ireland and net household income for the Republic of Ireland undermines such a comparison. We do not think so, as what is critical in the calculation of a concentration index is the *rank* of households by income, not the actual value of income itself. So this would only be an issue if re-ranking occurred when moving from gross to net income or vice versa.<sup>3</sup>

Figure 1 shows the distribution of the three health behaviours by income quartile in the Republic and Northern Ireland. In both countries, individuals who are in the top two quartiles of the income distribution are less likely to smoke and less likely to carry out low levels of physical activity as compared to individuals in the bottom two quartiles. In contrast, frequent drinkers are more likely to be concentrated in the top two quartiles in both the Republic and Northern Ireland.

<sup>3</sup> In analyses not reported here, we investigated this further using data for Ireland from the 2010 wave of the EU *Survey of Income and Living Conditions* (EU-SILC). An advantage of this dataset is that two measures of income are included for the same respondents: total gross household income and total net disposable household income. We calculated the Spearman rank correlation for two definitions of income and found that for individuals aged 50 and above ( $N = 3,669$ ), the rank correlation is 0.9899. For the complete sample of all ages ( $N = 11,005$ ), the rank correlation is 0.9862. Given the high degree of correlation between the two definitions of income, we conclude that using net rather than gross income for the Republic of Ireland should not undermine our results.

Figure 1: *Smoking, Low Physical Activity and Drinking 5-7 Days per Week by Equivalised Income Quartile by Region*



### 3.5 Decomposition Variables

Following its construction, as outlined in Equation (3), the concentration index is decomposed into inequalities and elasticities of the factors influencing health. In Tables 5 to 8 we include as factors variables which are common to both jurisdictions, while in Tables 9 and 10 we include additional variables which are available in the TILDA dataset only.

The variables used in the “common” decompositions are: gender; age; marital status (married/cohabiting, never married, separated/divorced and widowed); religion (Catholic, other Christian, other religion and no religion); self-rated health (very good, good, fair and less than fair); and principal economic status (employed/self-employed, retired and other economic status). Our choice of variables is motivated (a) by their plausibility as factors which might be associated with the health behaviours we are analysing and (b) by data availability.

Gender is included as men and women have different life expectancies and this in turn may be related to health behaviours (Martelin *et al.*, 2004). Age is also included as it seems plausible that health behaviours will be influenced

by age and the age spread within both samples is non-trivial (as will be shown in Table 4).

Marital status is also included as there is evidence that it can affect smoking and drinking amongst men (Rosengren *et al.*, 1989) and also health outcomes such as heart disease amongst women (see Floud *et al.*, 2014). Religion is included as it seems plausible that it could act as a mediating factor for various social behaviours, including drinking. Self-assessed health is included as ability to engage in health behaviours may be directly impacted by health status. For example, those in poor health may not be as active as those in good health. It is also important to include principal economic status as this not only impacts time availability but also economic resources. For example, consumption of cigarettes may be more difficult if one is not in receipt of a wage.

Aside from the issue of comparability of income across these two regions, we do not include income in the decomposition as recent research by Erreygers and Kessels (2013) has cautioned against its inclusion in decomposition analyses.

In Tables 9 and 10, for the Republic of Ireland only, we include extra variables which are available in TILDA. These are highest education level achieved (up to lower secondary; higher secondary; and tertiary education following the *International Standard Classification of Education* (OECD, 1999)), urban/rural location, health care entitlement status and information on various health conditions. The link between education and health behaviors is well documented (Cutler and Lleras-Muney, 2010) while it seems likely that physical activity will be influenced by urban/rural location.

For health care entitlement status, we employ a variable that denotes whether a respondent living in the Republic of Ireland is entitled to public health care only (the respondent has a medical card/GP visit card but does not have private health insurance), private health care only (the respondent has private health insurance only), both private and public health care entitlement status (the respondent has a medical card/GP visit card and private health insurance), or no entitlement (the respondent does not have private health insurance or a medical/GP visit card). It is important to include health care entitlement status as contact with the health care professionals may influence health behaviours. For example, a GP may advise a respondent to cut down on their alcohol consumption.

In terms of the variables which we include in the decomposition, it is important to note that we are not necessarily claiming causal links between these factors and the health behaviors we are analysing. In the case of some variables, such as age and gender, these variables are fixed and outside the control of the individual. For variables such as marital status it seems

plausible that causality could work in both directions e.g., marital status could influence health behaviors, but health behaviors, such as frequent drinking, could also influence marital status. It is also possible that some other, unobserved, factor could influence both. So, in general, it seems best to regard these as factors which may be associated with health behaviours, though in some cases a causal link may also be warranted.

Table 4 lists the variables used in the decomposition analysis. In both regions, slightly less than half of the respondents are males. Age is coded in five-year age-bands as more detailed information on age is not available for public-use in the HSNI dataset. The proportion of individuals in each age category is similar for both samples, although there are slightly higher proportions of younger individuals in the Republic and slightly higher proportions of older individuals in Northern Ireland. In the Republic, 71 per cent of respondents are married (or living with a partner) compared to 63 per cent of respondents in the North. Separation and divorce are higher in the North (10 per cent versus 6 per cent). Approximately 18 per cent of respondents in the North are widowed compared to 14 per cent in the Republic (perhaps reflecting the slightly older age profile in the North).

Also, a higher proportion of respondents in the TILDA sample (37 per cent) are employed or self-employed than in the HSNI sample (29 per cent), whereas a higher proportion of the HSNI sample are retired (50 per cent compared to 37 per cent). The category labelled “Other economic status” groups a number of other categories whose sample sizes are too small to model separately. These other categories include those who are unemployed, in education or training, looking after their home or family, permanently sick as well as other situations. Approximately 26 per cent of respondents in TILDA and 21 per cent in HSNI are grouped into this “other” category.

Focusing on the extra variables that are available in TILDA, Table 4 shows that around 52 (48) per cent of respondents live in an urban (rural) area. Also, around 29 per cent of respondents in the TILDA dataset are entitled to public health care only. This compares to 43 per cent being entitled to private health care only and 18 per cent being entitled to both. The remaining 10 per cent have no entitlement. The most common diagnosed illnesses are hypertension (36 per cent) and arthritis (28 per cent).

## IV RESULTS

### 4.1 *Concentration Indices*

The concentration index (CI) indicates the extent to which any particular health activity or status is concentrated more amongst the poor or the rich.

Table 4: *Sample Characteristics of Respondents Aged 50 and Over by Region*

	<i>Republic of Ireland Proportion</i>	<i>Northern Ireland Proportion</i>
Male	0.45	0.46
Age		
50-54	0.20	0.18
55-59	0.20	0.15
60-64	0.18	0.17
65-69	0.15	0.17
70-74	0.12	0.13
75-79	0.08	0.10
80 and over	0.07	0.10
Marital status		
Married/partner	0.71	0.63
Never married	0.09	0.09
Separated/Divorced	0.06	0.10
Widowed	0.14	0.18
Religion		
Catholic	0.89	0.36
Other Christian	0.05	0.51
Other religion	0.01	0.09
No religion	0.05	0.04
Self-rated health		
Very good	0.45	0.21
Good	0.32	0.36
Fair	0.18	0.28
Less than fair	0.05	0.15
Principal economic status		
Employed/self-employed	0.37	0.29
Retired	0.37	0.50
Other economic status	0.26	0.21
Education level		
Up to lower secondary	0.52	–
Higher secondary	0.17	–
Tertiary	0.31	–
Urban	0.52	
Health care entitlement status		
Public only	0.29	–
Private only	0.43	–
Both private and public	0.18	–
No entitlement	0.10	–
Diagnosed illness		
Hypertension	0.36	–
Diabetes	0.07	–
Lung disease	0.04	–
Asthma	0.09	–
Arthritis	0.28	–
Cancer	0.06	–

It can take on a value from  $-1$  to  $+1$ . Since the health variables we analyse can be regarded as higher-risk behaviours, a negative CI indicates a situation where the health behaviours are concentrated amongst the less well-off, and thus could be regarded as pro-rich (or anti-poor) inequality. A positive value of CI indicates a situation where the health behaviours are concentrated amongst the better-off and so could be regarded as pro-poor inequality.

Table 5 provides concentration indices for smoking, low physical activity and frequent drinking. For both the Republic of Ireland and Northern Ireland a statistically significant negative CI is found for smoking and low physical activity, indicating that these behaviours are concentrated amongst the poor. While the CI for smoking is slightly higher in absolute value for Northern Ireland, the overall order of magnitude is very similar to that of the Republic ( $-0.11$  and  $-0.09$ , respectively). The CI for low physical activity is considerably greater for Northern Ireland, however ( $-0.20$  as compared to  $-0.08$  in the Republic). This suggests that this particular dimension of ill-health is more concentrated amongst the poor and indicates a higher degree of pro-rich inequality in this behaviour in the North.

Table 5: *Concentration Index by Region*

	<i>Republic of Ireland</i>			<i>Northern Ireland</i>		
	<i>CI</i>	<i>se</i>	<i>t</i>	<i>CI</i>	<i>se</i>	<i>t</i>
Smokes	-0.093	0.010	-8.90	-0.108	0.020	-5.43
Low physical activity	-0.077	0.013	-6.00	-0.204	0.026	-8.02
Drinks 5-7 days per week	0.052	0.009	5.90	0.045	0.014	3.24

Conversely, a positive CI is estimated for frequent alcohol consumption for both Northern Ireland and the Republic and the order of magnitude is very similar (around 0.05). This indicates that frequent alcohol consumption is concentrated among those with higher incomes and thus contributes to pro-poor inequality.

Before analysing the decomposition of this index, it is useful to try to get an intuitive sense of what these figures actually mean. The sign of the concentration index indicates the direction of any relationship between the health variable and rank in the distribution of whatever measure of household resources is being used. The index combines elements of a correlation (in that it reflects the strength of the relationship) and a covariance (in that it also reflects the degree of variability in the health variable). In addition, Koolman and van Doorslaer (2004) have shown that multiplying the value of the index by 75 gives the percentage of the ill-health variable which, in the case of a negative index, would need to be redistributed from the poorer half to the



richer half of the population to arrive at a distribution with a concentration index of zero.

Applying this adjustment to smoking, it suggests that about 7.0 per cent of smoking in the Republic of Ireland and 8.1 per cent in Northern Ireland would need to be transferred from the poorer half of the (over 50) population to the richer half of the population in order to eliminate income related inequality in smoking. The corresponding figures for low physical activity are 5.8 per cent for the Republic and 15.3 per cent for Northern Ireland. Since the concentration indices for alcohol consumption are positive, the adjustment indicates that about 3.9 (3.4) per cent of alcohol consumption would need to be switched from the richer to the poorer half of the population in the Republic (Northern Ireland) in order to eliminate income related inequality in alcohol consumption.

How do these concentration indices compare with concentration indices calculated elsewhere for other health measures in different populations? Koolman and Van Doorslaer (2004) show that such indices calculated for dental visits in the EU range from below 0.1 (broadly for North European countries) to above 0.1 and in some cases above 0.2 (broadly for Southern European countries and the Republic of Ireland). Thus it seems fair to say that the concentration indices calculated here are mostly on the low to moderate side, with the exception of physical activity in Northern Ireland.

#### 4.2 *Decomposition Analysis*

One attractive property of the CI is that it is possible to decompose the index according to the contributions of individual factors. If we regard, say smoking, as depending upon a number of factors, then the CI for smoking will be the sum of the contribution of each of these factors. In turn the contribution of each factor is the product of the sensitivity of smoking with respect to that factor (i.e., elasticity of smoking with respect to that factor) and the degree of income-related inequality in that factor itself (i.e., CI for that factor). The interpretation of the CI for each factor is similar to that of the overall CI. There is typically a residual factor also, reflecting the role of factors which we do not or cannot observe.

The results of the decomposition for smoking, low physical activity and frequent drinking are provided in Tables 6 to 8 respectively.

##### 4.2.1 Smoking

The entries in each column of Table 6 give the elasticity of smoking with respect to each factor, the CI for each factor, the total contribution of each factor to the smoking CI and the percentage contribution of each factor to the smoking CI for the Republic of Ireland and Northern Ireland, respectively.

Focusing first on the elasticity column, it can be seen that in both countries the probability of being a smoker is higher for individuals who are males, younger, in poor health and currently not married and not in employment. Turning then to the column displaying the percentage contribution of each factor, it is worth noting that a positive value of the percentage contribution for each factor indicates that this factor operates to bring about the concentration of smoking amongst the less well-off. A negative value indicates that the factor operates in the opposite direction, i.e., on its own this factor would lead to smoking being more concentrated amongst the better-off. It is also worth noting that the residual in the decomposition is about 59 per cent in the Republic and 69 per cent in Northern Ireland, suggesting a greater role for unobserved factors in explaining smoking in the North.

The entries of Table 6 show that in both regions poor health (defined as answering less than “good” health to a question on self-assessed health) makes a substantial contribution to the negative CI. This arises because poor health is positively associated with smoking and is also heavily concentrated among the less well-off. To illustrate, poor health contributes 17 per cent and 29 per cent of the income-related smoking inequality in the Republic of Ireland and Northern Ireland, respectively.

In both regions, being older reduces the probability of smoking and since older people generally have lower incomes, the contribution of this factor is to reduce the degree to which smoking is concentrated amongst the poor. The lower probability of smoking amongst the older may reflect a survival bias, in the sense that non-smokers typically live longer.

Being widowed, separated/divorced or never married is associated with higher probabilities of smoking and since they are concentrated amongst lower incomes, they contribute to increase the degree to which smoking is concentrated amongst lower income groups. Their contribution to the smoking CI is of the order of around 18 per cent in the Republic and 24 per cent in Northern Ireland.

Finally, the contributions of the factors capturing principal economic status are also worth commenting on. “Other economic status”, which includes mainly individuals who are in unemployment or sick and disabled, is positively associated with smoking in both regions, and the elasticity is much higher in the Republic (0.12 in the Republic of Ireland versus 0.06 in Northern Ireland). Also, the contribution of “other economic status” to the smoking CI is almost double in the Republic (23 per cent in the Republic of Ireland versus 13 per cent in Northern Ireland).

Overall, the relative contributions of various factors to the negative CI in smoking for Northern Ireland and the Republic show considerable

Table 6: Decomposition Analysis for Smoking by Region

	Republic of Ireland			Northern Ireland		
	Elas.	CI	% Cont.	Elas.	CI	% Cont.
Male	0.069***	0.025	0.002	0.072*	0.035	0.003
Age						
55-59	-0.041***	0.076	-0.003	-0.021	0.100	-0.002
60-64	-0.077***	0.029	-0.002	-0.034	0.056	-0.002
65-69	-0.078***	-0.039	0.003	-0.092***	-0.018	0.002
70-74	-0.078***	-0.077	0.006	-0.073***	-0.117	0.009
75-79	-0.059***	-0.109	0.006	-0.081***	-0.134	0.011
80+	-0.056***	-0.159	0.009	-0.099***	-0.175	0.017
Total Age		0.019	-20.571		0.034	-31.972
Marital status						
Never married	0.025***	-0.085	-0.002	0.019	-0.088	-0.002
Separated/divorced	0.049***	-0.093	-0.005	0.044***	-0.145	-0.006
Widowed	0.060***	-0.161	-0.010	0.086***	-0.202	-0.017
Total marital status		-0.016	-0.016		-0.025	-0.025
Catholic	0.106	-0.004	0.000	0.049	-0.033	-0.002
Self-rated health						
Good	0.068***	-0.025	-0.002	0.148***	0.054	0.008
Fair	0.090***	-0.120	-0.011	0.107**	-0.069	-0.007
Less than fair	0.034***	-0.163	-0.005	0.157***	-0.155	-0.024
Total self-rated health		-0.018	-0.018		-0.024	-0.024
Principal economic status						
Retired	0.094***	-0.024	-0.002	0.117	-0.050	-0.006
Other economic status	0.121***	-0.180	-0.022	0.061**	-0.230	-0.014
Total principal economic status		-0.024	-0.024		-0.020	-0.020
Residual		-0.055	-0.055		-0.075	-0.075
Total		-0.093	100		-0.108	100

Reference categories: Female, Age 50-54, Married, Non-Catholic, Self-rated health very good, Employed or self-employed.

Abbreviations: Elas: elasticity; CI: contribution index; Cont: contribution; % Cont: % contribution

\* p<0.10 ; \*\* p<0.05 ; \*\*\* p<0.01. Statistical significance is reported for coefficients in probit regression.

similarity, with the exception of principal economic status. This may reflect issues concerning differences in the definition of “other economic status” in the North and the Republic and is a potentially useful area for further research.

#### 4.2.2 Low Physical Activity

Turning now to low physical activity (see Table 7), we note first of all that the residuals for both the North and the Republic are much lower at about 10 per cent in both countries.

Interestingly, while the association between male gender and low physical activity is negative and statistically significant in the Republic, it is statistically insignificant in the North. Poor health makes the greatest contribution to the negative CI for low physical activity in both the North and the Republic and the order of magnitude is similar in both cases. The pathway appears reasonably straightforward. Poor health is associated with low physical activity and is heavily concentrated among the less well-off. It should be noted that the relationship between low physical activity and poor health is likely to be simultaneous, in the sense that low physical activity is likely to be both a cause and effect of poor health. As might also be expected, age also makes a substantial contribution to the negative CI. The elderly are more likely to report low physical activity and also have lower incomes.

The role of marital status is less pronounced for physical activity than for smoking. The relative contribution is considerably higher for the North than for the Republic, reflecting in particular a stronger association between widowhood and lower physical exercise and also a higher CI for widowhood itself. It is not clear what is driving this stronger association. Principal economic status also plays a role, and as in the case of smoking, the role is greater in the Republic than in the North.

Thus overall, once again we see similarity in the contributions of age and self-assessed health for both the North and the Republic. However, the relative contributions of marital and principal economic status differ, with a greater role for the former in the North and the latter in the Republic.

#### 4.2.3 Alcohol Consumption

It is worth bearing in mind that unlike the other two activities, the total CI for frequent drinking is positive, i.e. frequent drinking is more concentrated amongst the better-off. In this case, a positive (negative) value of the percentage contribution for each factor indicates that this factor operates to bring about the concentration of drinking amongst the more (less) well-off.

Table 7: Decomposition Analysis for Low Physical Activity by Region

	Republic of Ireland			Northern Ireland			
	Elas.	CI	% Cont.	Elas.	CI	% Cont.	
Male	-0.139***	0.044	-0.006	-0.033	0.104	-0.003	1.687
Age							
55-59	0.003	0.132	0.000	-0.011	0.291	-0.003	1.562
60-64	0.001	0.051	0.000	0.003	0.163	0.000	-0.222
65-69	0.000	-0.069	0.000	0.030*	-0.054	-0.002	0.778
70-74	0.027***	-0.135	-0.004	0.017	-0.343	-0.006	2.841
75-79	0.045***	-0.190	-0.009	0.032***	-0.392	-0.013	6.196
80+	0.057***	-0.278	-0.016	0.041***	-0.510	-0.021	10.144
Total Age			-0.027			-0.044	21.298
Marital status							
Never married	-0.006	-0.149	0.001	-0.002	-0.258	0.001	-0.303
Separated/divorced	-0.003	-0.163	0.000	0.017**	-0.422	-0.007	3.533
Widowed	-0.007	-0.281	0.002	0.044***	-0.591	-0.026	12.577
Total marital status			0.003			-0.032	15.806
Catholic	0.096*	-0.007	-0.001	0.020	-0.095	-0.002	0.950
Self-rated health							
Good	0.064***	-0.043	-0.003	0.091***	0.159	0.014	-7.042
Fair	0.098***	-0.210	-0.021	0.171***	-0.201	-0.034	16.778
Less than fair	0.056***	-0.285	-0.016	0.137***	-0.454	-0.062	30.263
Total self-rated health			-0.040			-0.082	39.998
Principal economic status							
Retired	0.008	-0.043	0.000	0.024	-0.145	-0.003	1.704
Other economic status	0.041***	-0.314	-0.013	0.027*	-0.671	-0.018	8.953
Total principal economic status			-0.013			-0.022	10.657
Residual			0.007			-0.019	9.603
Total			-0.077			-0.204	100

Reference categories: Female, Age 50-54, Married, Non-Catholic, Self-rated health very good, Employed or self-employed.

Abbreviations: Elas: elasticity; CI: contribution index; Cont: contribution; % Cont: % contribution

\* p&lt;0.10 ; \*\* p&lt;0.05 ; \*\*\* p&lt;0.01. Statistical significance is reported for coefficients in probit regression.

The results for the decomposition for alcohol consumption are presented in Table 8. They show a relatively high residual of around 76 per cent in the Republic and 72 per cent in the North, indicating that much of the income related inequality in drinking is unexplained. Consistent with the relatively low fraction of the CI which is “explained”, most individual factors make relatively modest contributions. There are one or two differences between the Republic of Ireland and Northern Ireland which are worthy of note. The first of these is with respect to age. The overall relationship between age and drinking is more pronounced in the North than in the Republic, though in both cases the elasticities are not statistically significant. Being older is associated with lower drinking in both countries and, allied to the fact that older people have lower incomes, this contributes to a lower concentration of frequent drinking amongst the poor and hence a higher concentration amongst the rich. Overall, age contributes about 14 per cent of the positive CI of the North but around 1 per cent for the Republic.

The role of retirement also differs between the North and the Republic. In both cases being retired is positively associated with frequent drinking and thus in both cases it makes a negative contribution to the CI (given that retirement is associated with lower incomes). This association is much stronger in the North, and so the negative contribution of retirement is about -16 per cent in the North but only about -4 per cent in the Republic. In contrast, “other economic status” contributes positively to the CI.

Self-assessed health contributes positively to the CI and the order of magnitude is similar for both the North and the Republic. The key issue here is the relationship between more frequent drinking and health. For both the North and the Republic, more frequent drinking is associated with a lower probability of poor health, although the elasticities are not statistically significant in most cases. While this may appear counter-intuitive, as indicated previously there is evidence to suggest that moderate drinking may have a protective effect on health.

It is worth noting that in the decompositions for smoking and frequent drinking there is a substantial residual component. This reflects the fact there is a relatively large component of the overall CI which we cannot explain. The results in Tables 6 and 8 are still of importance however, given that a number of observable factors, particularly in the case of smoking, do make substantial contributions to the overall CI. Thus, if inequality arising from these factors could be reduced or removed, this would have a significant effect on overall inequality. In the case of alcohol, it is also worth pointing out that even though the residual is large in percentage terms, the overall CI is small. With a low CI as the base, small absolute effects in terms of the contributions of variables (and hence in the residual) can have large percentage effects.

Table 8: Decomposition Analysis for Frequent Alcohol Consumption by Region

	Republic of Ireland			Northern Ireland		
	Elas.	CI	% Cont.	Elas.	CI	% Cont.
Male	0.262***	0.015	0.004	0.268***	0.012	0.003
Age						
55-59	0.000	0.045	0.000	0.025	0.032	0.001
60-64	0.037*	0.017	0.001	-0.028	0.018	-0.001
65-69	-0.002	-0.023	0.000	-0.058	-0.006	0.000
70-74	0.012	-0.046	-0.001	-0.044	-0.038	0.002
75-79	-0.010	-0.065	0.001	-0.041	-0.044	0.002
80+	0.003	-0.095	0.000	-0.035	-0.057	0.002
Total Age			0.001			0.006
Marital status						
Never married	-0.019*	-0.051	0.001	0.003	-0.029	0.000
Separated/divorced	0.012	-0.056	-0.001	-0.009	-0.047	0.000
Widowed	-0.001	-0.096	0.000	-0.026	-0.066	0.002
Total marital status			0.000			0.002
Catholic	-0.901***	-0.002	0.002	-0.068	-0.011	0.001
Self-rated health						
Good	-0.024	-0.015	0.000	-0.003	0.018	0.000
Fair	-0.044***	-0.072	0.003	-0.054	-0.022	0.001
Less than fair	-0.008	-0.097	0.001	-0.040	-0.051	0.002
Total self-rated health			0.004			0.003
Principal economic status						
Retired	0.133***	-0.015	-0.002	0.433***	-0.016	-0.007
Other economic status	-0.031	-0.107	0.003	-0.059	-0.075	0.004
Total principal economic status			0.001			-0.003
Residual			0.039			0.032
Total			0.052			0.045
			100.000			100.000

Reference categories: Female, Age 50-54, Married, Non-Catholic, Self-rated health very good, Employed or self-employed.

Abbreviations: Elas: elasticity; CI: contribution index; Cont: contribution; % Cont: % contribution

\* p<0.10 ; \*\* p<0.05 ; \*\*\* p<0.01. Statistical significance is reported for coefficients in probit regression.

### 4.3 *Decomposition Analysis in the Republic of Ireland Only*

We now exploit the increased availability of variables in the TILDA dataset and include a number of extra variables in the decomposition analysis for the Republic of Ireland. As specified above, we also examine whether respondents live in an urban/rural setting, their education level and Health care entitlement status and whether they report a diagnosis of key illnesses, namely hypertension, diabetes, lung disease, asthma, arthritis and cancer.

As in our cross-country analysis above, we focus upon smoking, physical activity and frequent alcohol consumption. We also carry out further analysis using an alternative alcohol consumption measure, which focuses on quantity rather than frequency of alcohol consumed. We categorise respondents as “drinking above the recommended limits” if their weekly alcohol intake exceeds the Department of Health recommended maximum intake for low risk drinking, which is 21 units per week for men and 14 units per week for women (Hope, 2000).

The results for the decomposition for smoking and low physical activity using additional variables are presented in Table 9. Focusing first on smoking, it can be seen that the probability of being a smoker is higher for individuals who live in an urban area, who have either no health care entitlement or are only entitled to public health care and for those who report a diagnosis of lung disease. The probability of being a smoker is lower for individuals who have hypertension, asthma or arthritis. Health care entitlement status contributes to 67 per cent of the income-related smoking inequality. In particular, entitlement to public health care makes a substantial contribution to the negative CI, owing to the combination of it being strongly correlated with smoking (high elasticity) and also it being highly concentrated amongst lower income groups (large negative CI). The residual in the decomposition is about 10 per cent down from 59 per cent with the addition of these extra variables which suggests that these additional variables play a role in explaining health inequalities in smoking.

It should be noted in passing that while the inclusion of health care entitlement can be justified on the basis that it can capture people’s engagement with health professionals, there is also a cost to its inclusion. As pointed out by Erregeyers and Kessel (2104), current practice in decompositions of this type is moving away from including a variable capturing socio-economic status (such as income) as a variable in the decomposition. Since health care entitlement in Ireland is highly correlated with income, the inclusion of the entitlement variable is uncomfortably close to the inclusion of an income variable. On balance, we choose to retain this variable in the decompositions but this issue should be borne in mind when interpreting the results.



Table 9: Decomposition Analysis for Smoking and Low Physical Activity in the Republic of Ireland

	Smoking			Low Physical Activity			
	Elas.	CI	% Cont.	Elas.	CI	% Cont.	
Male	0.031	0.025	0.001	-0.139***	0.044	-0.006	7.941
Age							
55-59	-0.035**	0.075	-0.003	0.000	0.132	0.000	-0.002
60-64	-0.070***	0.029	-0.002	-0.003	0.051	0.000	0.226
65-69	-0.070***	-0.040	0.003	-0.010	-0.069	0.001	-0.875
70-74	-0.075***	-0.078	0.006	0.021*	-0.136	-0.003	3.607
75-79	-0.056***	-0.108	0.006	0.040***	-0.189	-0.007	9.661
80+	-0.054***	-0.158	0.009	0.052***	-0.276	-0.014	18.530
Total Age			0.019		-0.024		31.147
Marital status							
Never married	0.011	-0.085	-0.001	-0.006	-0.149	0.001	-1.213
Separated/divorced	0.036***	-0.093	-0.003	-0.003	-0.163	0.000	-0.548
Widowed	0.040***	-0.161	-0.006	-0.008	-0.281	0.002	-3.085
Total marital status			-0.010		0.004		-4.846
Catholic	0.063	-0.004	0.000	0.089	-0.007	-0.001	0.759
Self-rated health							
Good	0.056***	-0.025	-0.001	0.049***	-0.044	-0.002	2.784
Fair	0.076***	-0.120	-0.010	0.082***	-0.209	-0.017	22.117
Less than fair	0.027***	-0.162	-0.004	0.051***	-0.283	-0.014	18.509
Total self-rated health			-0.015		-0.034		43.410
Principal Economic Status							
Retired	0.069**	-0.025	-0.002	0.009	-0.043	0.000	0.477
Other economic status	0.057***	-0.180	-0.010	0.034**	-0.315	-0.011	13.867
Total principal economic status			-0.012		-0.011		14.344
Education level							
Up to lower secondary	0.128***	-0.135	-0.017	0.026	-0.235	-0.006	7.852
Higher secondary	0.052***	0.068	0.004	0.027***	0.119	0.003	-4.212
Total educational attainment			-0.014				3.640

Table 9: Decomposition Analysis for Smoking and Low Physical Activity in the Republic of Ireland (Contd.)

	Smoking		Low Physical Activity	
	Elas.	Cont.	Elas.	Cont.
Urban	0.135***	0.049	-0.039*	0.086
Health care entitlement status				
Public only	0.219***	-0.272	0.020	-0.474
Private only	-0.008	0.215	0.011	0.375
No entitlement	0.065***	-0.027	0.006	-0.048
Total entitlement status		-0.063		-0.006
Diagnosed illness				
Hypertension	-0.066***	-0.039	0.016	-0.068
Diabetes	-0.003	-0.070	0.017***	-0.122
Lung	0.016***	-0.126	0.004	-0.220
Asthma	-0.038***	-0.017	-0.011*	-0.030
Arthritis	-0.048***	-0.048	0.045***	-0.102
Cancer	0.000	-0.028	0.009*	-0.050
Total diagnosed illness		0.004		-0.008
Residual		-0.009		0.016
Total		-0.093		-0.077
		100		100
				4.295
				12.425
				-5.167
				0.386
				7.644
				1.415
				2.711
				1.269
				-0.410
				5.964
				0.568
				10.102
				-19.851

Reference categories: Female, Age 50-54, Married, Non-Catholic, Self-rated health very good, Employed or Self-employed; Tertiary Education Level; Both Private and Public Health Care Entitlement Status

Abbreviations: Elas: elasticity; CI: contribution index; Cont: contribution; % Cont: % contribution

\* p<0.10 ; \*\* p<0.05 ; \*\*\* p<0.01. Statistical significance is reported for coefficients in probit regression.

Table 10: *Decomposition Analysis for Frequent Alcohol Consumption and Drinking Above Recommended Limit in the Republic of Ireland*

	Frequent Alcohol Consumption			Drinking Above Limit		
	<i>Elas.</i>	<i>CI</i>	% <i>Cont.</i>	<i>Elas.</i>	<i>CI</i>	% <i>Cont.</i>
Male	0.278***	0.015	0.004	0.269***	0.011	0.003
Age						
55-59	0.004	0.045	0.000	-0.020	0.028	-0.001
60-64	0.041*	0.017	0.001	-0.049**	0.011	-0.001
65-69	0.010	-0.024	0.000	-0.067***	-0.015	0.001
70-74	0.037*	-0.046	-0.002	-0.058***	-0.028	0.002
75-79	0.008	-0.065	-0.001	-0.058***	-0.042	0.002
80+	0.020	-0.094	-0.002	-0.053***	-0.065	0.003
Total Age			-0.004			0.007
Marital status						
Never married	-0.012	-0.051	0.001	0.008	-0.031	0.000
Separated/divorced	0.015*	-0.056	-0.001	0.028**	-0.036	-0.001
Widowed	0.010	-0.096	-0.001	0.051**	-0.064	-0.003
Total marital status			-0.001			-0.004
Catholic	-0.756***	-0.002	0.002	-0.596***	-0.002	0.001
Self-rated health						
Good	0.009	-0.015	0.000	0.079**	-0.010	-0.001
Fair	-0.009	-0.071	0.001	0.019	-0.049	-0.001
Less than fair	0.003	-0.097	0.000	0.002	-0.067	0.000
Total self-rated health			0.000			-0.002
Principal Economic Status						
Retired	0.117***	-0.015	-0.002	0.133**	-0.009	-0.001
Other economic status	0.022	-0.108	-0.002	0.047	-0.072	-0.003
Total principal economic status			-0.004			-0.005
Education level						
Up to lower secondary	-0.211***	-0.080	0.017	-0.053	-0.055	0.003
Higher secondary	-0.034**	0.041	-0.001	0.012	0.027	0.000
Total educational attainment			0.016			0.003

Table 10: *Decomposition Analysis for Frequent Alcohol Consumption and Drinking Above Recommended Limit in the Republic of Ireland (Contd.)*

	Frequent Alcohol Consumption			Drinking Above Limit			
	Elas.	CI	% Cont.	Elas.	CI	% Cont.	
Urban	0.188***	0.029	0.006	0.206***	0.020	0.004	21.918
Health care entitlement status							
Public only	-0.064**	-0.162	0.010	-0.051	-0.109	0.006	29.305
Private only	0.117**	0.128	0.015	0.012	0.083	0.001	5.114
No entitlement	-0.031**	-0.016	0.001	-0.012	-0.011	0.000	0.714
Total entitlement status			0.026	49.083		0.007	35.133
Diagnosed illness							
Hypertension	0.061**	-0.023	-0.001	0.103***	-0.015	-0.002	-8.361
Diabetes	-0.007	-0.042	0.000	-0.009	-0.026	0.000	1.248
Lung disease	-0.008	-0.075	0.001	-0.004	-0.051	0.000	0.960
Asthma	0.004	-0.010	0.000	-0.015	-0.008	0.000	0.618
Arthritis	-0.028	-0.035	0.001	1.819	-0.024	0.001	5.188
Cancer	-0.004	-0.017	0.000	0.123	-0.011	0.000	0.231
Total diagnosed illness			0.000	0.893		0.000	-0.116
Residual			0.008	14.999		0.005	24.273
Total			0.052	100		0.019	100

Reference categories: Female, Age 50-54, Married, Non-Catholic, Self-rated health very good, Employed or Self-employed; Tertiary Education Level; Both Private and Public Health Care Entitlement Status

Abbreviations: Elas: elasticity; CI: contribution index; Cont: contribution; % Cont: % contribution

\* p<0.10 ; \*\* p<0.05 ; \*\*\* p<0.01. Statistical significance is reported for coefficients in probit regression.

With regards to physical activity, it can be seen that the probability of low physical activity is higher for individuals who live in a rural area and for those who report a diagnosis of diabetes, arthritis or cancer. In contrast to the results for smoking, health care entitlement status does not make a substantial contribution to the negative CI for low physical activity.

Finally, we turn to alcohol consumption and present the results in Table 10. These results show a much lower residual of around 15 per cent compared to 76 per cent in the main analysis. While the results are similar, there are some differences. With the addition of health-related variables it is not surprising that the contribution of self-assessed health to the CI is reduced from 8.2 per cent in the main model to 0.5 per cent. The contributions of the factors capturing health care entitlement and urban residence are worth commenting on. Entitlement to private health care and urban residence are positively associated with frequent drinking and, allied to the fact that people with private health care entitlement and living in urban areas have higher incomes, these factors contribute to increase the degree to which frequent drinking is concentrated amongst the better-off. These factors contribute to 29 per cent and 10 per cent, respectively, of the income-related alcohol inequality.

The CI for drinking above the recommended limits is positive and statistically significant, although relatively small in magnitude (CI = 0.019; standard error = 0.008). This indicates that above-limit alcohol consumption is concentrated among those with higher incomes. Also for this health behaviour, we find that living in an urban area and reporting a diagnosis of hypertension are positively associated with above-limit alcohol consumption. There appears, however, to be a reduced role for health care entitlement.

## V CONCLUSIONS

This is one of the first studies to formally examine inequalities in health behaviours among older adults. Aside from being significant in its own right, this is particularly important in the context of a rapidly ageing society. We also compare inequalities in health behaviours across the Republic of Ireland and Northern Ireland, which given the similarities (and differences) between the jurisdictions may be of interest.

By employing concentration indexes, we find that smoking and low levels of exercise are both concentrated amongst lower income groups, while frequent drinking is concentrated (though to a lesser extent) amongst higher income groups. The degree of such concentration is quite similar in both Northern Ireland and the Republic, with the exception of low levels of physical

exercise, which appears to be more highly concentrated amongst lower income groups in the North.

Are there policy implications arising from the analysis? Two of the three socio-economic gradients are “pro-rich” or “anti-poor”, suggesting that for an inequality adverse policymaker some form of policy intervention could be warranted. However, as we note in our discussion of the results, the degree of income related inequality in smoking and physical activity is modest, with the possible exception of physical activity in Northern Ireland. Indeed, the low level of physical activity amongst the older population in Northern Ireland in general may merit some form of intervention.

While not wishing to over-emphasise the comparative nature of the results, it is notable that for the contributions of many of the factors in the decompositions, the sign and order of magnitude in Northern Ireland and the Republic are quite similar. It is possible that in some cases it may be the same underlying factors which lie behind income related inequalities.

Based on these findings, our study confirms that, similar to the US, in the three areas of health behaviours under investigation, a socio-economic gradient is present for older people. This confirms that while such gradients may diminish, they do not disappear with age, and that income-related health inequality remains an important issue amongst the elderly, a proportion of the population which is projected to grow in the future.

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