Understanding disability in older heart disease patients in Ireland

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List of Abbreviations

ADL	Activities of daily living
BMI	Body mass index
CESD	Center for Epidemiologic Studies Depression Scale
CHD	Coronary heart disease
CI	Confidence interval
CSO	Central Statistics Office
DFLE	Disability-Free Life Expectancy
GHQ12	General Health Questionnaire 12-item version
HLE	Healthy Life Expectancy
IADL	Instrumental activities of daily living
IPAQ	International Physical Activity Questionnaire
LE	Life Expectancy
LLTI	Long-term limiting illness
NI	Northern Ireland
NIHS	Northern Ireland Health Survey
NISRA	Northern Ireland Statistics and Research Agency
NS-SEC	National Statistics Socio-economic Classification
OFMDFM	Office of the First Minister and Deputy First Minister (Northern Ireland)
ONS	Office for National Statistics
PAF	Population attributable fraction
ROI	Republic of Ireland
RR	Relative risk
SEP	Socioeconomic position
TILDA	The Irish Longitudinal Study on Ageing
WHO	World Health Organization

Where ‘Ireland’ is used it means the island of Ireland (i.e., both the Republic of Ireland and Northern Ireland)

1.0 Chapter 1 – Literature Review

1.1 Background

Evidence shows that life expectancy in the developed world is increasing (Christensen, Doblhammer, Rau, & Vaupel, 2009), populations are rapidly ageing, and the island of Ireland is no exception (NISRA Registrar General's Annual Report, 2012; Central Statistics Office, 2012). A recent report by the Northern Ireland Statistics and Research Agency (NISRA) and the Office of the First Minister and Deputy First Minister (OFMDFM), (NISRA, 2014) found that the population of those aged 65 and over in Northern Ireland increased 2.3% between 2012 and 2013, and that over a 10-year period (2003-2013) the population in this age group had increased by 21.7%. Similarly, in the ROI there was a 14.4% increase in the population aged 65 and over (compared to an 8.2% increase for ROI as a whole) between the census periods of 2006 and 2011 (Central Statistics Office, 2012). Moreover, population projections by EUROSTAT (2011)[1] indicate that as a result of its current young population profile, the Republic of Ireland is anticipated to have the largest percentage increase in population by 2060 of all the EU states. Although the proportion of population increase by 2060 for the UK is not as high as for Ireland (+27% vs +46%), it is still one of the countries showing the strongest projected population growth over that period, and as Northern Ireland has the youngest population profile in the UK, this growth is likely to have a greater impact on this region.

We all want to age well, so to formulate good policies for older people, we need a better understanding of the characteristics of the ageing population (Christensen, Doblhammer, Rau, & Vaupel, 2009). For example, there is some evidence to suggest that healthy life expectancy has increased, with poorer health and disability being compressed into the last years of life. This has been theorised as a 'compression of morbidity' (Fries, 1980; Simons, McCallum, Friedlander, & Simons, 2000). However, other studies have suggested that some people are living longer in poorer health, what has been termed an 'expansion of morbidity' (Crimmins & Beltrán-Sánchez, 2011; Kramer, 1980). Furthermore, Balanda, Fahy, Abdalla, and Barron (2013) have identified variation in compression versus expansion of morbidity within Northern Ireland depending on whether morbidity is defined on the basis of disability

[1] http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/3-08062011-BP/EN/3-08062011-BP-EN.PDF

or poor self-rated health. Aside from such contradictory findings, there are growing concerns about the increasing numbers of the population who are obese and/or physically inactive, two lifestyle factors for chronic conditions such as diabetes and heart disease but which independently can lead to functional limitations. Therefore, the true trajectory of future generations in terms of expansion or compression of morbidity cannot be easily predicted.

In most countries, women have a longer life expectancy than men (Barford, Dorling, Davey Smith, & Shaw, 2006), though vital statistics in both the Republic of Ireland (Central Statistics Office [CSO], 2009) and the United Kingdom (Office for National Statistics [ONS], 2014) suggest that the gap between male and female life expectancy has narrowed somewhat in recent years. Nonetheless, as a result of their longer life expectancy, women are more likely to experience morbidity/disability in the later years (Leveille, Penninx, Melzer, Izmirlian, & Guralnik, 2000; Oman, Reed, & Ferrara, 1999). This is usually dependent on context, the woman's individual/social factors, and her past experience and trajectory of illness. Certain types of illness, or constellations of conditions, may result in an expansion of morbidity (Van Oyen et al., 2010, 2013; Kingston et al., 2014).

Although in recent times Ireland has seen a decline in mortality from coronary heart disease (CHD) (Bennett et al., 2006; Bennett, Hughes, Jennings, Kee, & Shelley, 2013; Department of Health and Children, 1999, 2003; Hughes et al., 2013; O'Hara, Bennett, O'Flaherty, & Jennings, 2008), Irish CHD mortality rates are still among the highest in Europe (Bennett et al., 2006; World Health Organization[2]). Moreover, a study by the Institute of Public Health in Ireland (Balanda, Barron, Fahy, & McLaughlin, 2010) forecasted increases between the years 2007 and 2020 of 50% and 30% for ROI and NI respectively in the numbers of adults who will ever have CHD. These increases are expected to be attributed primarily to increasing life expectancy, alongside concomitant increases in age-associated risk factor levels (Balanda et al., 2010). These findings mirror those of a study by Lampe, Morris, Walker, Shaper, and Whincup (2005) among British men.

Additionally, CHD has been shown to be one of the leading causes of disability in later years (Adamson, Lawlor, & Ebrahim, 2004; Ebrahim, Wannamethee, Whincup, Walker, & Shaper,

[2] http://www.euro.who.int/en/data-and-evidence/databases/european-health-for-all-database-hfa-db

2000; Guccione et al., 1994; Guralnik et al., 1993; LaCroix, Guralnik, Berkman, Wallace, & Satterfield, 1993; Oldridge & Stump, 2004; Verbrugge, Lepkowski, & Imanaka, 1989). This represents an emerging issue for public health and for health and social care services. However, the literature that focuses specifically on risk factors for coronary heart disease-related *disability* is sparse. One of the few studies that has considered the role of specific functional limitations after CHD onset, the Whitehall II study, found that of five lifestyle-related factors examined (i.e., obesity, smoking, alcohol, diet, physical inactivity), obesity and physical inactivity were most strongly associated with disability both pre- and post-onset of CHD (Britton, Brunner, Kivimaki, & Shipley, 2012).

If we consider CHD as a mediator between various risk factors and subsequent disability, it is appropriate to examine the effects of various risk factors on CHD as being risk factors for CHD related disability. The risk factors being considered in the present study are smoking (both current and previous), high body mass index (BMI) (overweight and obesity), physical inactivity, diabetes, and depression. Whilst the findings for the effects of conventional risk factors such as smoking, high BMI, physical inactivity, and diabetes on CHD are well established (e.g., World Health Organization, 2009; Yusuf, Reddy, Ôunpuu, & Anand, 2001a, 2001b), the effects of depression on CHD are somewhat more complex and the literature is inconsistent. However, there are a number of studies that have found depressive symptoms to be associated with the onset of symptoms of coronary heart disease (Hemingway & Marmot, 1999; Wulsin & Singal, 2003), and depression has been flagged as representing one of the risk factors to be considered by the Global Burden of Disease Study (Charlson, Stapelberg, Baxter, & Whiteford, 2011).

Health inequalities exist between the most and least deprived people in society, and a gradient across all socioeconomic groups is evident in most developed countries (Battel-Kirk & Purdy, 2007; Farrell, McAvoy, & Wilde, 2008; Irish Medical Organisation, 2012; Wilkinson & Marmot, 2003). It is therefore important to study the interplay between socioeconomic status (SES) and CHD related disability. It has also been suggested that some (though not all) of the socioeconomic inequality in cardiovascular mortality and disability can be explained by a social gradient in conventional risk factors (Bajekal et al., 2013; Balanda et al., 2010; Beauchamp et al., 2010b; Hotchkiss et al., 2014; Sacker, Head, & Barley, 2008). As well as examining absolute differences in health outcomes between different

socioeconomic groups, it is useful to consider the relative differences between socioeconomic groups (Kawachi, Kennedy, & Wilkinson, 1999; Low & Low, 2006; Masseria & Allin, 2008; Wagstaff & van Doorslaer, 2000).

Aims and objectives

The primary focus of the present study, therefore, was to assess disability associated with CHD in adults aged 50 years and over in the Republic of Ireland (ROI) and Northern Ireland (NI), and to examine associated inequalities. Specifically, the main objectives of the study were:

- To assess the extent to which disability associated with CHD varies by age, gender and socioeconomic position (SEP) in ROI and NI.

- To report on disability-free life expectancy (DFLE), the average number of years an individual is expected to live free of CHD related disability if country specific patterns of mortality and disability continue.

- To assess inequalities in DFLE.

- To compare the contribution of risk factors including smoking, diabetes, obesity, physical inactivity, and depression to CHD related disability.

- To evaluate how differences in healthcare and welfare systems in each jurisdiction impact on disability following CHD.

2.0 Chapter 2 – Methodology

2.1 Data

Samples

The sources of information on CHD related disability and risk factor prevalence, and for estimation of relative risks were The Irish Longitudinal Study on Ageing (TILDA) in ROI and the Northern Ireland Health Survey (NIHS) in NI. Below is a brief overview of each study.

The Irish Longitudinal Study on Ageing (TILDA)

TILDA is a cohort study of ageing that is being carried out in the Republic of Ireland among a sample of more than 8,000 adults aged 50 years and over. A detailed description of the TILDA cohort, and of the study design and methodology is reported by Kearney et al. (2011) and Whelan and Savva (2013). Further information is available at the TILDA website (www.tilda.ie) and the Irish Social Science Data Archive (ISSDA) website (www.issda.ie) where the data are available on application. TILDA data used in the present study is from Wave 1 which was collected during the period October 2009 to February 2011.

Northern Ireland Health Survey (NIHS)

The NIHS is a cross-sectional population-based health survey that has been carried out annually in NI from 2010/11. It includes respondents aged 16 years and over, and although it encompasses various aspects of health, it is not specifically designed to study ageing in the same manner as the TILDA[3]. More information about the NIHS is available on the NISRA website (www.nisra.co.uk) and on the UK Data Archive website (www.ukda.co.uk) where the data are available on application. NIHS data used in the present study were collected during 2010/2011.

Pooled data

In the process of carrying out preliminary analyses with the TILDA and the NIHS it became evident that merging the two datasets would provide more robust estimation of relative risks.

[3] There is a designated Northern Ireland ageing study currently underway that complements the TILDA. It is anticipated that data from this study (NICOLA) will be available for analysis from late 2015 onwards.

Therefore, the datasets were harmonised with respect to all pertinent variables and merged to provide a pooled, all-Ireland dataset.

Weighting

The TILDA and NIHS each have a population weighting variable that was applied to analyses involving the individual datasets in order to ensure that estimates were representative of the populations from which the samples had been drawn. It was not possible to apply the country-specific population weights to RR analyses involving the pooled dataset; however, all RR analyses were adjusted for gender, age, and SEP (i.e., the characteristics that are typically used to establish population weights).

Variables

Below are descriptions of how we derived CHD, disability, and CHD related disability in each of the two datasets. This is followed by a description of how we derived the risk factor variables, and the socio-demographic variables for each dataset.

Coronary heart disease (CHD)

In order to define CHD related disability it was first necessary to establish prevalence of CHD. The TILDA and NIHS surveys show respondents a list of health conditions, and ask them to select which ones apply to them. Both lists include 'angina' and 'heart attack'. In the present study, a respondent was deemed to have CHD if they indicated having had either angina or a heart attack.

Table 2.1 Questions concerning experience of, and limitations of activities resulting from LLTI in TILDA and NIHS

TILDA	NIHS
Some people suffer from chronic or long-term health problems. By long-term we mean it has troubled you over a period of time or is likely to affect you over a period of time.	
1. Do you have any long-term health problems, illness, disability or infirmity? NOTE: INCLUDING MENTAL HEALTH PROBLEMS (yes/no)	1. Do you have any long-standing illness, disability or infirmity? By "long-standing" I mean anything that has troubled you over a period of time or that is likely to affect you over a period of time? (yes/no)
2. Does this illness or disability limit your activities in any way? (yes/no)	2. Does this illness or disability limit your activities in any way? (yes/no)

Long-term limiting illness (LLTI)

The second step in defining CHD related disability was to establish prevalence of long-term limiting illness (LLTI). The LLTI questions in the TILDA and NIHS were broadly similar (see Table 2.1). In the present study, a respondent was deemed to have limitations as a result of LLTI if they responded 'yes' to questions 1 and 2.

Activities of daily living (ADL)

ADL was used in place of LLTI in sensitivity analyses in order to provide an alternative measure of disability. The domains of ADL assessed in the TILDA and NIHS differed slightly in terms of the focus of the domains themselves and the actual number of domains (see Table 2.2). However, it was felt that there was sufficient comparability between the two surveys in relation to the six items shown in bold in Table 2.2. In the present study, a respondent was deemed to have ADL limitations if they responded 'yes' to having difficulties carrying out any one of the selected items.

Table 2.2 Questions concerning limitations in ADL in TILDA and NIHS (items in bold used to establish ADL limitation)

TILDA	NIHS
Please look at card FL2. Because of a health or memory problem, do you have difficulty doing any of the activities on this card? Again exclude any difficulties you expect to last less than three months.	And do any of the things on this card apply to you?
Dressing, including putting on shoes and socks	**Cannot dress and undress without difficulty**
Walking across a room	**Cannot get in and out of a chair without difficulty**
Bathing or showering	**Cannot wash hands and face without difficulty**
Eating, such as cutting up your food	**Cannot feed, include cutting up food without difficulty**
Getting in or out of bed	**Cannot get in and out of bed on own without difficulty**
Using the toilet, including getting up or down	**Cannot get to and use toilet on own without difficulty**
	Cannot bend down and pick up a shoe from the floor when standing
	Have problem communicating with other people - that is have a problem understanding them or being understood by them

CHD related disability

The final step in defining CHD related disability was to combine CHD and LLTI prevalence data. In the present study, a respondent was deemed to have CHD related disability if they responded 'yes' to having CHD and 'yes' to having a LLTI. As mentioned in the previous section, an alternative version of CHD related disability was derived by combining CHD and ADL prevalence (rather than LLTI) in order to carry out sensitivity analyses. Therefore, in the present study, a respondent was deemed to have CHD related ADL disability if they responded 'yes' to having CHD and 'yes' to having difficulties in ADL.

Risk factor variables

Five established risk factors were included in the study and coding for these variables was standardised across the two datasets in order to facilitate merging of datasets. How each risk factor was defined is described below.

Smoking

Respondents were classified as having never smoked, having smoked previously, or being current smokers. In calculating RRs for 'current smoking' and 'previous smoking', 'never smoked' was the reference category.

Body mass index (BMI)

Respondents' BMI groupings were based on the WHO classifications of underweight (<18.5), normal weight (18.5-24.99 kg/m^2), overweight (25-29.99 kg/m^2), and obese (>30 kg/m^2). These classifications were further disaggregated into the following three groupings: underweight/normal, overweight, and obese. In calculating RRs for high BMI, 'underweight/normal' was the reference category.

Physical inactivity

This variable was based on the International Physical Activity Questionnaire Short Form (IPAQ; Craig et al., 2003) in both studies. Note that although the IPAQ categories were available as a derived variable in the TILDA dataset, the meta-data did not make clear how it had been derived; therefore, we derived our own IPAQ categories using raw data in TILDA which matched how we handled the data in NIHS (using the authorised IPAQ scoring protocol – see http://www.ipaq.ki.se./ipaq.htm), thus ensuring comparability of results.

Respondents were categorised as engaging in low, moderate, or high levels of physical activity. Preliminary analyses included both low and moderate levels of physical activity as independent variables. However, when included in the population attributable fraction (PAF; see Text Box 1 for definition) analysis it became evident that there were few effects for moderate physical activity and this variable was subsequently dropped from further analysis. Therefore, in calculating RRs for low physical activity, 'moderate/high' was the reference category. Hereafter, low physical activity will be referred to as 'physical inactivity'.

TEXT BOX 1

Population attributable fractions

Population attributable fractions (PAFs) are defined by the WHO as:

> *"... the proportional reduction in population disease or mortality that would occur if exposure to a risk factor were reduced to an alternative ideal exposure scenario"*[1]

Therefore, PAFs provide an estimate (proportion) of how much a negative health outcome (in this case, CHD related disability) could be avoided/reduced if the risk factor associated with the negative outcome (e.g., obesity) were to be removed/reduced (assuming a causal relationship between the risk factor and the health outcome and no significant interaction of confounding).

Diabetes

Whether or not the respondent had diabetes was already available as a derived variable in TILDA. In the NIHS, we derived this variable from health information provided by the respondent. In calculating RRs for diabetes, 'no diabetes' was the reference category.

Depression

In TILDA, depression was assessed using the 20-item version of the Center for Epidemiologic Studies Depression Scale (CESD; Radloff, 1977). The CESD was designed to screen for depressive symptomatology among a population during the seven days preceding assessment. In NIHS, depression was assessed using the General Health Questionnaire (GHQ12; Goldberg & Williams, 1988), a measure of psychological well-being for use in population studies. Further information on the two measures of depression, and their

psychometric properties, is provided in Appendix A. In calculating RRs for both 'moderately depressed' and 'severely depressed', 'not depressed' was the reference category.

Socio-demographic variables

Age

For the purposes of estimating relative risks (RRs), age was categorised as a dichotomous variable (50-64 and 65+). This was to maximise sample size/cell counts, and thus preserve power for RR regression analyses. For the purpose of estimating population attributable fractions (PAFs), 10-year age bands were used (50-59; 60-69; 70-79; 80+). For the purposes of estimating disability-free life expectancies (DFLEs), 5-year age bands were used (50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85+). This provided a more detailed picture of the effects of age on the burden of CHD related disability, and is the method recommended when using the Sullivan method (Sullivan, 1971; Jagger et al., 2006) to calculate DFLE. Note that in the TILDA dataset, single year of age was available for all ages up to and including 79, but that all respondents aged 80 and over were aggregated (at source) to an 80+ category in order to avoid disclosure of individuals owing to small numbers. Therefore, for the purposes of the calculation of DFLEs, the CHD related prevalence for those aged 80+ was applied to the 85+ population and mortality data in order to keep the interval of the last age group at around 10 years (as recommended), and to be comparable with the analysis using the NIHS and NI population and mortality data.

Socioeconomic position (SEP)

The present study used occupational group as an indicator of socioeconomic position (SEP). However, this variable differed somewhat in terms of how it was assessed in TILDA and NIHS, and also in terms of how population and mortality statistics were available in each of the two jurisdictions. The aim was to achieve a 3-category indicator of SEP – low, medium, and high – that was broadly comparable across the two countries. This involved ensuring both intra- and inter-country comparability: first we had to ensure comparability of SEP between health survey data and population/mortality statistics within each country, and then to ensure that SEP was sufficiently comparable across jurisdictions. The NIHS and NISRA used the National Statistics Socio-Economic Classification (NS-SEC) to assess SEP; therefore it was relatively easy to achieve harmonisation between the NIHS SEP indicator and the stratification of the population and mortality data (for examining inequalities in

DFLE). Similarly, the occupational coding used in TILDA is akin to that used by CSO for the census. Further information on derivation of SEP in the present study is available in Appendix B.

2.2 Study design

This study involved conducting secondary analysis of health survey data for the Republic of Ireland and Northern Ireland in order to establish CHD related disability prevalence, risk factor prevalence, and their associated relative risks for CHD related disability.

Wave 1 of The Irish Longitudinal Study on Ageing (TILDA) (collected in 2010) and the 2010/2011 Northern Ireland Health Survey (NIHS) datasets were used to establish CHD related disability prevalence, risk factor prevalence, and relative risk estimates in each jurisdiction. These datasets were acquired, and data cleaning and harmonisation were carried out prior to analysis. In the present context, data harmonisation relates to ensuring that all variables that were pertinent to the analyses were defined as closely and comparably as possible between the two datasets, not only to ensure that prevalence and relative risk were being estimated in a comparable manner, but also to facilitate data pooling and for subsequent analyses.

Population and mortality statistics for the same period as that of the health survey data (i.e., 2010) were sourced from official statistics agencies in each jurisdiction (Central Statistics Office [CSO; ROI] and Northern Ireland Statistics and Research Agency [NISRA]). These rates were then used to establish DFLE (based on CHD related disability prevalence) for those aged 50 years and over in both jurisdictions using the Sullivan method.

Where possible, given small sample size/cell counts, analyses were stratified by gender, 5-year age group, and by socioeconomic position (SEP; high, medium and low).

Ethical approval and data protection

The project was approved by the School Research Ethics Committee in the School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast. This study involved secondary data analysis, therefore there was no direct contact between the study

team and respondents in either health survey; the study team had no access to raw data in the form of completed questionnaires and all health survey data had been anonymised at source. Data were stored securely in accordance with the stipulations of the data owners, and the standard ethical guidelines of the School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast. Data access was restricted to those directly involved in the management or analysis of the data, and who were granted permission by the data owners.

Data limitations

Early in the project it was decided to derive the relative risks (RRs) required for the PAF calculations from the TILDA and NIHS datasets rather than from the published literature. The reason for this was that RRs were needed for each of the risk factors (e.g., smoking, obesity, physical inactivity) as they related to disability associated with CHD, and stratified by gender, age, and SEP. Even though attempts were made to contact individual authors, such specific RRs proved difficult to locate in the published literature. Additional information on the derivation of RRs is available in Appendix C.

Whilst it was originally our intention to consider the impact of CHD on instrumental activities of daily living (IADLs) as well as ADLs, there were no suitable variables in the NIHS (e.g., questions on respondents being able to do their own shopping, manage their finances, etc.), therefore we were precluded from examining IADLs.

Finally, in order to examine absolute and relative inequalities in DFLE it was necessary to stratify the analysis, and therefore the population and mortality data, by SEP. However, although mortality data were available by SEP for 2010 in both ROI and NI, population data by SEP is only available for census years. The last year that a census was carried out in both jurisdictions was 2011; therefore, the 2011 population and mortality data, stratified by SEP, were used to establish proportions that could be applied to the 2010 population and mortality data in each jurisdiction. Furthermore, population data by SEP is only available in NI up to the age of 74; therefore, the DFLE analysis for NI examining absolute and relative inequalities was limited to those aged 50-74. In order to maintain comparability between the two countries, the ROI analysis was also limited to those aged 50-74.

2.3 Analytic strategy

Prevalence analyses for risk factors (smoking, high BMI, physical inactivity, diabetes, depression) were stratified by gender, age, and SEP. Binomial regression models were used to derive RRs for risk factors on CHD related disability using the pooled, all-Ireland dataset. Each regression model was fully adjusted for all other risk factors, and for socio-demographic variables depending on degree of stratification. For example, when running regression models to establish the RR for smoking on CHD related disability in males and females, the models were adjusted for BMI, physical activity, diabetes, depression, age, and SEP.

Risk factor prevalence and relative risk (RR) estimates for NI and ROI were combined in order to calculate PAFs for each risk factor using the formula below:

PAF = (P x (RR-1)) / (1+P x (RR-1))
P= prevalence of exposure, RR= relative risk for disability

The information necessary in order to carry out PAF calculations is: prevalence of the negative health outcome and an estimate of risk for each risk factor. A series of spreadsheets was constructed and included fully adjusted RRs for each risk factor based on the pooled dataset which were then applied to the weighted, country-specific prevalence of CHD related disability.

Disability-free life expectancy (DFLE)

DFLE is a type of health life expectancy analysis that uses population data and morbidity prevalence data in order to assess the impact of morbidity on the number of years a person can expect to live free of disability. DFLEs are also a useful way of comparing the health/disability status of different countries provided the measure of disability is comparable. Using the Sullivan method[4] (Sullivan, 1971; Jagger et al., 2006), country-specific population and mortality statistics for the same period as that of the health survey data (i.e., 2010) and country-specific prevalence of the health outcome in question (in this case, CHD related disability) were used to establish DFLE (based on CHD related disability

[4] Further information about the Sullivan method is available at: http://www.eurohex.eu/pdf/Sullivan_guide_final_jun2007.pdf

prevalence) for those aged 50 years and over in both jurisdictions. Therefore, separate analyses were carried out for ROI and NI. The present study used 5-year age bands in order to examine how DFLEs vary with increasing age, and was stratified by gender in order to identify and examine differing patterns of disability across age for men and women.

In order to estimate absolute and relative inequalities in DFLE, CHD related disability (both LLTI and ADL based) for the NIHS and TILDA (separately) was stratified by 5-year age bands for those aged 50-74 (see also 'Data limitations', Section 2.2) and SEP (high, medium, low), and then applied to country-specific population and mortality data (also stratified by 5-year age bands and SEP).

Prevalence and RR analyses were conducted in Stata12 (StataCorp, 2011); calculation of PAFs and DFLEs were conducted in Microsoft Excel.

3.0 Chapter 3 – Results

3.1 Socio-demographic characteristics of the two samples

The TILDA sample comprised 8162 respondents aged 50 and over; the NIHS sample comprised 2020 respondents aged 50 and over. Overall, the distribution of men and women was more balanced in TILDA (48% and 52% respectively) than in NIHS (38.3% and 61.7%) which had a higher proportion of women (population weighted percentages) (see Fig 3.1 and Table D1, Appendix D).

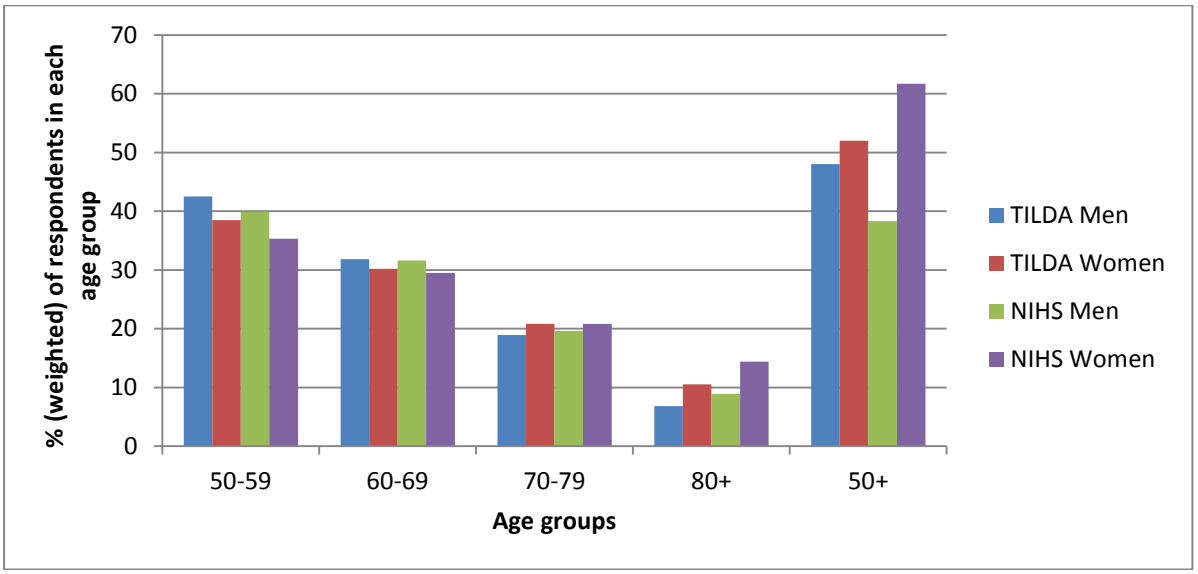

Figure 3.1 Percentage (weighted) of men and women in each age group in TILDA and NIHS

Results indicate a broadly similar distribution of respondents by age group in the two surveys; however, there was a slightly higher proportion of respondents aged 80 and over in NIHS than in TILDA (12.3% vs 8.7% respectively) which was to be expected given ROI's younger population profile. A similar pattern was evident when stratified by gender, with higher proportions of NI men and women in the 80 and over age group (8.9% and 14.4%) compared with ROI men and women (6.8% and 10.5%). As anticipated, there was a gradient of decreasing proportions of older respondents, and the ratio of women to men increased with increasing age. This was evident in both datasets (see Fig 3.1 and Table D1, Appendix D).

In Chapter 2 (see Section 2.1 and Appendix B) we described how TILDA had two additional SEP groups (i.e., 'not applicable', and 'missing/refused') that were difficult to integrate within the high, medium, or low SEP groups that were clearly defined in both samples. Consequently, the distributions were not directly comparable. However, the column distributions in Table D1 (Appendix D) show the proportions of respondents who were in each age group for each SEP group, and these were broadly comparable across the two datasets.

When age group was stratified by both gender and SEP (see Table D2, Appendix D), it was evident that the proportions in the high, medium, and low SEP groups across the two datasets were broadly comparable.

3.2 Prevalence of CHD, LLTI, and ADL

In the TILDA sample, 668 (8.6%) reported having CHD, 1887 (24.2%) reported having a limiting long-term illness (LLTI), and 697 (9.0%) reported having limitations in any one of the six activities of daily living (ADLs) selected for inclusion in this study (see Chapter 2, section 2.1). In the NIHS sample, 273 (12.4%) reported having CHD, 873 (43.4%) reporting having a LLTI, and 397 (20.7%) reported having limitations in any one ADL. Therefore, rates of CHD, LLTI, and ADL limitations were higher in NI than in ROI.

3.3 CHD related disability

Of the 668 and 273 respondents in TILDA and NIHS (respectively) who reported having CHD, 308 and 191 (TILDA and NIHS respectively) reported having concurrent limitations in LLTI This represents a CHD related disability prevalence of 4.1% and 8.8% (weighted) for the ROI and NI samples (respectively), with rates in NI being significantly higher ($p<0.001$). The prevalence for CHD related disability based on ADL limitations was somewhat lower in both ROI and NI (1.5% and 4.4% respectively).

As shown in Table 3.1, the prevalence of CHD related disability was also significantly higher in NIHS for men and women, across all age groups, and for the high, medium, and low SEP groups. Men had a slightly higher prevalence of CHD related disability in both countries, and there was a gradient of increasing prevalence of disability with increasing age in both

countries. The highest prevalence of disability among the SEPs was for the low SEP group, followed by the high group, with the medium group having the lowest levels of disability. This pattern was consistent in both countries.

Table 3.1 Distribution of CHD related disability in TILDA and NIHS by gender, age group, and SEP (weighted %)

		TILDA		NIHS		
		N	n (%)	N	n (%)	*p*
All		8162	308 (4.1)	2020	191 (8.8)	***
Gender	Men	3739	166 (4.4)	921	100 (10.0)	***
	Women	4423	142 (3.7)	1099	91 (8.1)	***
Age	50-59	3270	45 (1.6)	661	25 (4.0)	***
	60-69	2589	101 (4.2)	687	65 (8.9)	***
	70-79	1677	114 (6.9)	466	69 (13.6)	***
	80+	626	48 (8.3)	206	32 (15.2)	***
SEP	High	1799	50 (2.9)	297	24 (7.6)	***
	Medium	953	21 (2.2)	651	41 (5.9)	***
	Low	2291	112 (5.0)	1072	126 (11.1)	***
	Not applicable[§]	2323	110 (5.1)	-	-	-
	Missing/refused[§]	796	15 (2.2)	-	-	-

p: significance level; *** $p \leq 0.001$; [§] These categories apply to TILDA only

3.4 Prevalence and population attributable fractions for risk factors

Population attributable fractions (PAFs) were based on country-specific (weighted) prevalence and the all-Ireland, fully adjusted RRs derived from the pooled TILDA and NIHS data (see also Chapter 2, Section 2.3). Below we have presented the prevalence and PAFs for current smoking, obesity, physical inactivity, diabetes, and severe depression for CHD related disability based on LLTI in ROI and NI. However, for comparative purposes Tables D3, D6, D7, D8, and D9 (Appendix D) show the prevalence, RRs [95% CIs], and PAFs for both LLTI and ADL based CHD related disability in both countries[5].

Current smoking

[5] The interested reader can refer to Tables D4, D5, and D10 (Appendix D) which show the prevalence, RRs [95% CIs], and PAFs for previous smoking, overweight, and moderate depression using both LLTI and ADL based CHD related disability in both countries

The prevalence of current smoking for the overall samples in each country was comparable, though somewhat higher in ROI (19.8%) than in NI (18.0%). The PAFs for the total samples in each country were similar and indicated that in both countries approximately 6% of CHD related disability could be avoided if the respondents were not current smokers (see Table 3.2).

Table 3.2 Prevalence (weighted %) and PAFs for current smoking by gender, age group, and SEP in TILDA and NIHS

		Current smoking			
		TILDA		NIHS	
		P	PAF	P	PAF
All		19.8	6.6	18.0	6.1
Gender	Men	19.7	3.6	19.6	3.6
	Women	19.8	9.6	17.1	8.4
Age	50-64	23.2	8.3	23.9	8.6
	65+	14.9	3.7	11.3	2.8
SEP	High	13.0	7.3	11.1	6.3
	Medium	14.5	4.8	13.3	4.5
	Low	20.5	1.7	22.9	1.9

When stratified by gender it was evident that rates of current smoking were virtually identical in the male samples (19.7% vs 19.6% for ROI and NI respectively), but somewhat higher for ROI women (19.8%) than for NI women (17.1%). Equal proportions of CHD related disability (3.6%) could be attributed to current smoking for men in ROI and NI. The PAFs for ROI women (9.6%) was somewhat higher than for NI women (8.4%), and more than double that of men in both jurisdictions (see Table 3.2).

The prevalence of current smoking for those aged 50-64 for the total samples in each country was similar (23.2% vs 23.9% for ROI and NI respectively), as were the PAFs, with 8.3% and 8.6% (for ROI and NI respectively) of CHD related disability being attributed to current smoking. However, for those aged 65 years and over there was a slightly higher prevalence for current smoking among the ROI sample (14.9%) compared with the NI sample (11.3%) which was reflected in the slightly higher proportion of CHD related disability (3.7%) attributable to current smoking in ROI respondents compared to NI (2.8%).

The prevalence of current smoking for those in each of the SEP groups for the total samples in each country was broadly similar, with prevalence in the low SEP group (20.5% and 22.9% for ROI and NI respectively) notably higher than prevalence in both the medium (14.5% and 13.3% for ROI and NI respectively) and high SEP groups (13.0% and 11.1% for ROI and NI respectively). The proportions of CHD related disability that could be attributed to current smoking in the high, medium, and low SEP groups showed a counterintuitive pattern, with the lowest proportions for the low SEP group, in spite of this group having the highest prevalence of smoking. The most plausible explanation for this finding was that low cell counts for CHD resulted in less precise RRs for the high and medium SEP groups in both countries (see RRs [95% CIs] and PAFs in Table D3, Appendix D). These results should therefore be interpreted with caution.

Obesity

The prevalence of obesity for the total samples was higher in ROI than in NI. This pattern was consistent across gender, age group, and SEP group, and was also reflected in larger proportions of CHD related disability being attributed to obesity for those in ROI (see Table 3.3). Men had a higher prevalence of obesity than women in both countries (38.0% vs 32.6% in ROI; 32.4% vs 25.3% in NI), and this pattern was also evident in the PAFs.

Table 3.3 Prevalence (weighted %) and PAFs for obesity by gender, age group, and SEP

		Obesity			
		TILDA		NIHS	
		P	PAF	P	PAF
All		35.2	13.8	28.2	11.3
Gender	Men	38.0	16.4	32.4	14.4
	Women	32.6	10.6	25.3	8.4
Age	50-64	34.5	27.7	28.6	24.1
	65+	36.3	9.5	27.7	7.4
SEP	High	31.7	13.4	25.0	10.8
	Medium	29.8	*-12.0*	24.8	*-9.7*
	Low	36.0	27.5	31.4	24.9

Negative PAFs (in italic) are result of no risk (RR<1.0)

There were only small age differences in obesity, with those aged 65 and over having slightly higher prevalence than those aged 50-64 in ROI (36.3% vs 34.5%), and rates in both age

groups in NI being broadly the same (28%). However, PAFs for the 50-64 year age group were considerably higher than for those aged 65 and over, and are indicative of wider confidence intervals in the RRs for that age group (see Table D5, Appendix D). There was no evidence of a gradient in obesity by SEP group in either countries; however, the highest obesity prevalence was in the low SEP group in both countries (36.0% and 31.4% in ROI and NI respectively) (see Table 3.3). The proportion of CHD related disability that could be attributed to obesity among the low SEP group was double that of those in the high SEP group in both countries (27.5% vs 13.4% in ROI; 24.9% vs 10.8% in NI).

Physical inactivity

The prevalence of physical inactivity for the total samples was considerably higher in NI (54.8%) than in ROI (31.3%), and PAFs indicated that 27.5% and 39.9% of CHD related disability can be attributed to physical inactivity in ROI and NI (respectively). This pattern of country differences in prevalence and attributable disability was consistent across gender,[6] age group, and SEP group.

Women had higher prevalence of physical inactivity than men in both countries (37.2% vs 24.9% in ROI; 57.4% vs 50.7% in NI), and PAFs indicated that 35.6% and 46.0% (ROI and NI respectively) of CHD related disability can be attributed to physical inactivity. As expected, those aged 65 and over had considerably higher rates of physical inactivity than those aged 50-64, and this pattern was evident in both countries (39.1% vs 25.8% in ROI; 64.0% vs 46.8% in NI) and is reflected in higher PAFs for those aged 65+ (see Table 3.4).

There was no obvious gradient in physical inactivity in ROI when stratified by SEP group, and very little difference in prevalence across the three SEP groups (all around 28-29%). There was also no gradient in physical inactivity in NI; however, the low SEP group had higher rates of physical inactivity (58.8%) than the high or medium SEP groups, with around 50% of respondents in these groups being inactive. The PAFs for both ROI and NI show a counterintuitive gradient (i.e., highest PAFs for the low SEP group); however, this is likely to be a result of slightly less precise RRs and confidence intervals for the high and medium SEP groups compared to the low SEP group (see Table D7, Appendix D). Therefore these should be interpreted with caution.

[6] Women only as RR regression model for women failed to converge therefore PAFs could not be calculated.

Table 3.4 Prevalence (weighted %) and PAFs for physical inactivity by gender, age group, and SEP

		Physical inactivity			
		TILDA		NIHS	
		P	PAF	P	PAF
All		31.3	27.5	54.8	39.9
Gender	Men	24.9	*	50.7	*
	Women	37.2	35.6	57.4	46.0
Age	50-64	25.8	24.5	46.8	37.0
	65+	39.1	32.0	64.0	43.5
SEP	High	28.9	31.4	49.8	44.0
	Medium	28.8	29.8	50.7	42.8
	Low	27.9	24.2	58.8	40.2

* PAF not estimated as regression model to derive RR failed to converge

Diabetes

The prevalence of diabetes was somewhat higher in NI (9.6%) than in ROI (8.1%). Men had slightly higher diabetes prevalence than women in both jurisdictions (9.7% and 11.4% for men in ROI and NI respectively; 6.6% and 8.4% for women in ROI and NI respectively). The proportion of CHD related disability in the total sample, and for men[7] that could be attributed to diabetes was similar across both gender and country, being in the region of 4-7% (see Table 3.5).

The prevalence for diabetes for those aged 65 and over was almost twice that of those aged 50-64 in both jurisdictions (6.1% and 7.0% for 50-64-year-olds in ROI and NI respectively; 11.0% and 12.5% for 65+ in ROI and NI respectively). The proportion of CHD related disability that could be attributed to diabetes was similar across both age group and country, being in the region of 5-6% for those aged 50-64 and 8-9% for those aged 65 and over (see Table 3.5).

The prevalence for diabetes in the SEP groups was highest for those in the low SEP group in both countries (9.6% and 10.7% for ROI and NI respectively). Prevalence was broadly similar in the high and medium SEP groups, and this pattern was the same in both countries (6.7% and 5.8% for ROI high and medium SEP groups respectively; 8.3% and 8.4% for NI

[7] Women only as RR regression model for women failed to converge therefore PAFs could not be calculated.

high and medium SEP groups respectively). The proportion of CHD related disability attributable to diabetes in all the SEP groups is similar (6-8%) with the exception of the medium SEP group in NI which is a little higher at 9.2%. However, this may be a result of wider confidence intervals for the RRs for this group (see Table D8, Appendix 8).

Table 3.5 Prevalence (weighted %) and PAFs for diabetes by gender, age group, and SEP

		Diabetes			
		TILDA		NIHS	
		P	PAF	P	PAF
All		8.1	6.2	9.6	7.2
Gender	Men	9.7	*	11.4	*
	Women	6.6	3.7	8.4	4.7
Age	50-64	6.1	5.2	7.0	6.0
	65+	11.0	7.8	12.5	8.8
SEP	High	6.7	6.2	8.3	7.6
	Medium	5.8	6.5	8.4	9.2
	Low	9.6	6.6	10.7	7.3

* PAFs not estimated as regression models to derive RRs failed to converge

Severe depression

As with physical inactivity, there were large country differences in severe depression, with NI (17.6%) having notably higher prevalence than ROI (10.2%). Consequently, the amount of CHD related disability attributed to severe depression was higher in NI (16.3% vs 25.2% for ROI and NI respectively). When stratified by gender it was evident that women had a higher prevalence in severe depression than men (as expected), and this pattern was present in both countries, though it was more obvious in ROI (7.4% vs 16.2% for men in ROI and NI respectively; 12.7% vs 18.4% for women in ROI and NI respectively). The amount of CHD related disability that could be attributed to severe depression was similar for men and women in both countries (14.0% and 17.3% respectively for ROI; 26.2% and 23.3% respectively for NI) (see Table 3.6).

As anticipated, the prevalence of severe depression was lower in those aged 65 and over than in those aged 50-64, and this was evident in both countries (11.0% vs 9.0% for ROI adults aged 50-64 and 65 and over respectively; 22.7% vs 11.7% for NI adults aged 50-64 and 65 and over respectively). The disparity between younger and older age groups in NI was

especially stark: the prevalence in those aged 65 and over was half that of those aged 50-64. PAFs for those aged 50-64 are shown in Table 3.6, but should be interpreted with caution as small cell sizes resulted in less precise estimates of relative risk (see also Table D9, Appendix D). The amount of CHD related disability attributable to severe depression for those aged 65 and over was similar between ROI (12.6%) and NI (15.7%) (see Table 3.6).

There was evidence of a slight gradient in prevalence of severe depression for SEP groups in both countries, with lower rates for the high SEP group (5.6% and 15.1% for ROI and NI respectively), rising slightly for the medium SEP group (6.6% and 17.1% for ROI and NI respectively), and highest for the low SEP group (8.5% and 18.6% for ROI and NI respectively). These gradients were also evident in the PAFs, especially in NI, but with especially high PAFs for the low SEP group in each country compared with the medium and high groups. The amount of CHD related disability attributable to severe depression varied greatly between the two countries for all three SEP group, with PAFs in NI considerably higher than in ROI (See Table 3.6).

Table 3.6 Prevalence (weighted %) and PAFs for severe depression by gender, age group, and SEP

		Severe depression			
		TILDA		NIHS	
		P	PAF	P	PAF
All		10.2	16.3	17.6	25.2
Gender	Men	7.4	14.0	16.2	26.2
	Women	12.7	17.3	18.4	23.3
Age	50-64	11.0	25.2	22.7	41.1
	65+	9.0	12.6	11.7	15.7
SEP	High	5.6	4.3	15.1	10.8
	Medium	6.6	5.9	17.1	13.8
	Low	8.5	18.4	18.6	32.9

3.5 Disability-free life expectancies

Table 3.7 shows a summary of results from DFLE analysis using prevalence of LLTI based CHD related disability for ROI and NI (see also Table D11, Appendix D, for sensitivity DFLE analyses using prevalence of ADL based CHD related disability).

Table 3.7 Life expectancy and DFLEs based on CHD and LLTI for ROI and NI age groups 50 and over (5-year-bands)

		ROI				NI			
	Age group	Total LE	DFLE	Disabled years	% of life spent disability-free	Total LE	DFLE	Disabled years	% of life spent disability-free
All	**50-54**	32.4	30.9	1.6	95.2	32.0	28.9	3.1	90.3
	55-59	27.9	26.4	1.5	94.6	27.6	24.6	3.0	89.0
	60-64	23.5	22.1	1.5	93.8	23.4	20.5	2.9	87.8
	65-69	19.3	18.0	1.3	93.2	19.3	16.7	2.6	86.6
	70-74	15.5	14.4	1.2	92.5	15.5	13.3	2.2	85.6
	75-79	12.0	11.0	1.0	92.0	12.1	10.3	1.8	84.8
	80-84	8.9	8.2	0.7	91.7	9.2	7.8	1.4	84.7
	85+	6.5	6.0	0.5	91.7	6.8	5.7	1.1	83.7
Men	**50-54**	30.6	29.0	1.6	94.8	30.2	26.8	3.4	88.8
	55-59	26.1	24.6	1.6	94.1	25.8	22.5	3.3	87.2
	60-64	21.8	20.3	1.5	93.2	21.7	18.6	3.1	85.8
	65-69	17.8	16.4	1.3	92.6	17.7	15.0	2.8	84.5
	70-74	14.1	12.9	1.2	91.7	14.1	11.6	2.4	82.7
	75-79	10.7	9.8	0.9	91.3	11.0	8.9	2.1	81.2
	80-84	7.8	7.2	0.6	91.9	8.2	6.7	1.5	81.7
	85+	5.8	5.3	0.5	91.9	6.2	5.0	1.2	80.7
Women	**50-54**	34.1	32.6	1.5	95.5	33.7	30.7	3.0	91.1
	55-59	29.6	28.1	1.5	95.0	29.2	26.3	2.9	90.0
	60-64	25.1	23.7	1.4	94.4	24.8	22.1	2.8	88.9
	65-69	20.8	19.4	1.3	93.6	20.6	18.1	2.6	87.6
	70-74	16.7	15.6	1.1	93.2	16.7	14.5	2.2	87.0
	75-79	13.0	12.0	1.0	92.5	13.0	11.2	1.8	86.4
	80-84	9.6	8.8	0.8	91.6	9.7	8.3	1.4	85.8
	85+	7.0	6.4	0.6	91.6	7.1	6.0	1.1	84.8

LE: life expectancy

Life expectancies were broadly similar between ROI and NI (e.g., 32.4 and 32.0 respectively for the 50-54-year age group; 19.3 in both countries for the 65-69-year age group), but DFLEs were slightly lower in NI owing to the higher prevalence of CHD related disability in this population. For example, the 50-54-year age group in ROI could expect to spend 95.2% of their remaining life disability-free compared to 90.3% for the same age group in NI. This pattern was also evident in the sensitivity analyses using ADL based disability (see Table D11, Appendix D). As expected, results from both countries showed decreasing total life expectancies and DFLEs with increasing age, and an increasing proportion of life expectancy that is being spent with CHD related disability.

Figures 3.2 and D1 (latter in Appendix D) show the percentage of remaining life spent disability-free for men and women in ROI and NI across all age groups using CHD related disability based on LLTI and ADL (respectively). Up to the age of 75 the patterns of DFLE are similar for ROI and NI; there is a steady decline with age in the percentage of life remaining without disability, and the group showing the lowest percentage of life remaining without disability are the NI men, followed by the NI women, the ROI men and the ROI women (see Table 3.7 and Figure 3.2). This pattern is also consistent when examining CHD related disability based on ADL rather than LLTI, though the decline over time is less steep (see Table D11 and Figure D1, Appendix D). However, after the age of 75 there are some gender and country-specific variations. For example, there is a levelling in the decrease in DFLE for ROI women and a slight increase (from age 75-80) and subsequent levelling (from 80 onwards) for ROI men, meaning that in the last decade of life ROI men and women are similar in terms of the percentage of remaining life they can expect to be disability-free. This pattern is consistent for both LLTI and ADL based disability (see Tables 3.7 and Figure 3.2; and Table D11 and Figure D1, Appendix D) and may indicate a 'survival of the fittest' effect (Crimmins, Kim, & Seeman, 2009). By contrast, the NI sample show a different pattern to ROI after the age of 80, and also a different pattern dependent on whether CHD related disability is based on LLTI or ADL. For example, NI men show a similar increase in DFLE (when based on LLTI) between the ages of 75 and 80 as was seen for ROI men, but NI men then experience a subsequent decline (see Figure 3.2). This pattern is also evident for NI men when using ADL rather than LLTI to derive CHD related disability (see Figure D1), though the slight increase in DFLE is experienced a little earlier, and the subsequent decline is much steeper. For the NI women, there is a continuing steady decline in DFLE (based on LLTI) after 75 (see Figure 3.2); however, when examining DFLE based on ADL rather than LLTI, NI women show a slight increase (which levels off) from 70 through to 80, and from 80 onwards they show an increase in disability-free life that ultimately converges with the rates for the ROI men and women. This presents a notable contrast with the decline in DFLE for NI men after the age of 75 (see Figure D1, Appendix D).

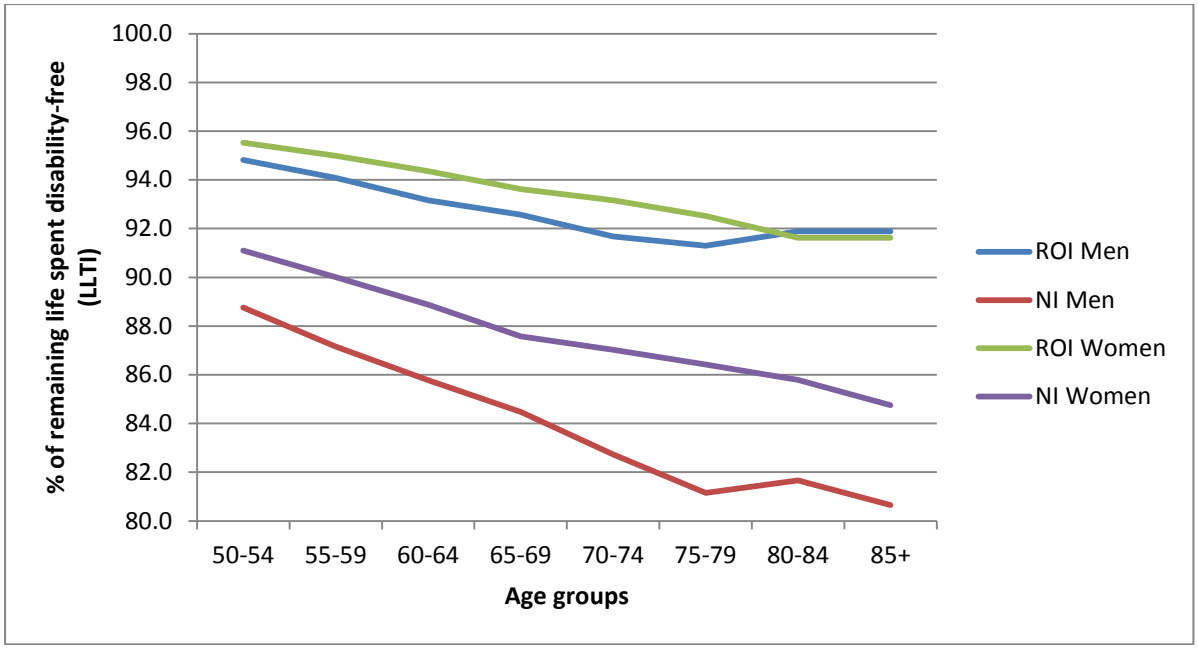

Figure 3.2 Graph comparing percentage of life spent disability-free (CHD and LLTI limitations) across all age groups, for men and women in the ROI and NI

Absolute and relative inequalities in DFLEs

Initially it was our intention to estimate absolute and relative inequalities in DFLE separately for men and women. However, stratifying CHD related disability (both LLTI and ADL based) by both gender and SEP resulted in some zero cell counts, especially for younger women in the high and medium SEP groups. This was especially problematic when examining CHD related disability based on ADL as a result of the lower prevalence compared to LLTI based CHD disability. Therefore, we restricted this analysis to the overall ROI and NI samples (i.e., not stratified by gender) using CHD related disability based on LLTI.

Results indicated that those in the low SEP group had consistently lower life expectancies (LEs), lower DFLEs, and higher proportions of remaining life lived with disability. These absolute differences were apparent for each age group, and for both countries, though the differences were greater for ROI than for NI. However, there was little evidence of gradients for SEP in LE, DFLE, or percentage of life lived with disability. Inequalities were greater for DFLE than for LE (with the exception of the oldest age group in NI), but the gap between absolute differences in DFLE and LE narrowed with increasing age (see Table 3.8).

Similarly, relative differences were evident in LE and DFLE for all age groups and in both countries, with the exception of the 70-74 year age group in NI. Relative differences were more apparent in ROI than in NI (see Table 3.8).

Table 3.8 DFLEs by SEP and age group (maximum age 74), and absolute and relative differences between high and low SEP groups for ROI and NI

		50-54			55-59			60-64			65-69			70-74		
		LE	DFLE	% of life with dis	LE	DFLE	% of life with dis	LE	DFLE	% of life with dis	LE	DFLE	% of life with dis	LE	DFLE	% of life with dis
ROI	High SEP	24.0	23.4	2.2	19.2	18.6	2.8	14.4	13.9	3.4	9.6	9.2	4.3	4.9	4.6	5.6
	Medium SEP	22.8	22.4	2.0	18.2	17.7	2.6	13.6	13.2	3.3	9.2	8.8	3.8	4.7	4.5	4.0
	Low SEP	23.0	22.2	3.8	18.3	17.5	4.6	13.7	12.9	6.0	9.2	8.6	6.8	4.7	4.3	8.2
	AD	1.00	1.20		0.90	1.10		0.70	1.00		0.40	0.60		0.20	0.30	
	RD	1.04	1.05		1.05	1.06		1.05	1.08		1.04	1.07		1.04	1.07	
NI	High SEP	23.7	21.8	7.8	18.9	17.2	8.9	14.2	12.6	11.2	9.5	8.4	11.9	4.8	4.1	14.8
	Medium SEP	23.1	22.2	4.1	18.5	17.5	5.3	13.9	13.0	6.3	9.3	8.5	8.7	4.7	4.3	9.4
	Low SEP	23.2	20.9	9.8	18.5	16.4	11.3	13.9	12.2	12.2	9.3	8.1	13.2	4.8	4.1	13.5
	AD	0.48	0.90		0.43	0.80		0.33	0.40		0.22	0.30		0.07	0.00	
	RD	1.02	1.04		1.02	1.05		1.02	1.03		1.02	1.04		1.01	1.00	

LE: life expectancy; DFLE: disability-free life expectancy; SEP: socioeconomic position; ROI: Republic of Ireland; NI: Northern Ireland
AD: absolute difference=high SEP - low SEP
RD: relative difference=high SEP/low SEP

4.0 Chapter 4 – Discussion

The overarching aims of the present study were to assess disability associated with CHD in adults aged 50 years and over in ROI and NI, and to examine associated socioeconomic inequalities. In this chapter we will summarize and discuss the findings in relation to the main objectives of the study.

The first objective was to assess the extent to which disability associated with CHD varies by age, gender, and SEP in ROI and NI. The findings showed that CHD related disability was significantly higher in NI than in ROI, whether using CHD related disability that was based on LLTIs or limitations in ADL, and that this difference across the jurisdictions was consistent across gender, all age groups, and all SEP groups. As the rates of CHD and LLTIs (as well as ADLs) were higher in the NIHS sample than in TILDA, it is not surprising that CHD related disability would also be higher in NI. At a population level, Balanda et al. (2010) have suggested that the higher rates of CHD in NI compared to ROI can be explained by the higher proportion of older people in NI and differences in socioeconomic patterning in the two countries. Our results showed a higher proportion of respondents aged 80 and over and a lower ratio of men:women in NIHS than in TILDA, reflecting the NI population profile. Therefore the prevalence of CHD and CHD related disability may have been even higher in NI had there been a larger number of men in the NI sample.

The present study did not adjust for area-based variation when deriving CHD rates from TILDA and NIHS on the basis that both surveys have representative samples and allow for weighting. However, area-based variation has been observed in other studies, with Balanda et al. (2010) reporting that the lowest rates of CHD in ROI are in the Dublin area. This may be as a result of a younger age profile in the Dublin area (CSO, 2012), or the consequence of selective migration to or from Dublin (e.g., O'Reilly, Browne, Johnson, & Kelly, 2001). However, as the TILDA prevalence rates have been weighted to be representative of the ROI population, and as a large proportion of the population of ROI live in the Dublin area, there is a possibility that this has resulted in lower CHD prevalence figures (and thus CHD related disability figures) in the ROI sample.

The prevalence rates found for ADL based CHD related disability in ROI and NI in the present study were broadly similar to the 2.2% overall prevalence found in a UK study using the Whitehall II sample (Britton et al., 2012). It should be noted, however, that the Whitehall II study had a disproportionate number of male respondents, and the sample was not representative of the population (i.e., mostly white-collar workers). A study by Kattainen et al. (2004) using two large, nationally representative cross-sectional surveys among older adults in Finland found broadly similar prevalence in domains of disability (similar to that used in the present study) that were associated with CHD. However, the prevalence of CHD related disability in the present study, the Whitehall II study, and the Kattainen et al. study are based on cohort and cross-sectional studies and thus may underestimate actual population figures as a result of 'healthy cohort' effects: there is evidence to suggest that those who take part in health surveys may be generally healthier than those who chose not to participate (Bisgard, Folsom, Hong, & Sellers, 1994; Kauppi, Sokka, & Hannonen, 2005; Vercambre & Gilbert, 2012). Furthermore, both the NIHS and TILDA samples were drawn from community-dwelling older adults which may have led to some underestimation of disability.

As anticipated, prevalence of CHD related disability increased with increasing age, and this pattern was more apparent in NI. There was no evidence of a social gradient in the prevalence of CHD related disability in either ROI or NI; however, in both countries the prevalence of disability was highest in the low SEP group, followed by the high SEP group, with the medium SEP group having the lowest prevalence of disability. This finding supports numerous studies that demonstrate the impact of inequalities on health outcomes, and emphasizes the need to adopt a social determinants of health approach to understanding social patterning in health and health behaviours (Balanda et al., 2010; Battel-Kirk & Purdy, 2007; Beauchamp et al., 2010a; Farrell et al., 2008; Irish Medical Organisation, 2012; Sacker, Head, & Barley, 2008; Wilkinson & Marmot, 2003).

The second objective was to report on disability-free life expectancy (DFLE), the average number of years an individual is expected to live free of CHD related disability if country specific patterns of mortality and disability continue, and also to assess inequalities in DFLE by examining absolute and relative differences in DFLE. Findings indicated that although the impact of CHD related disability on healthy life expectancy in older age was not as great as is traditionally seen with more global definitions of disability, there was evidence of a

proportionate reduction in disability-free life years as a percentage of life expectancy with increasing age (except in the very oldest age groups). Furthermore, there was evidence of variation between gender, country, and in some instances both gender and country. In particular, NI men had the lowest life expectancies and DFLEs when examining both LLTI and ADL based CHD related disability, and showed steeper declines in the percentage of life spent without disability after the age of 75 when using the ADL based CHD related disability measure. In contrast to NI men, NI women had less of a decline generally in percentage of life spent without ADL related disability; moreover, they had an (proportionate) increase in DLFE from age 80 onwards. ROI men had a similar increase in DFLE between 75 and 80, which then levelled off. Furthermore, when DFLE analyses were stratified by SEP, there was evidence of both absolute and relative differences between the low and high SEP in LEs and DFLEs, with the greater levels of inequality being shown in ROI.

The third objective was to compare the contribution of risk factors including smoking, overweight and obesity, diabetes, physical inactivity, and depression to CHD related disability. Findings indicated few, if any, country differences in smoking, overweight, and diabetes – both countries had similar prevalence of these risk factors overall and also broadly when cross tabulated by gender, age group, and SEP group. However, the use of the 50-64 and 65 and over age bands obscured country-specific differences in current smoking that became evident among those aged 75 and over and the 80+ age groups when disaggregated. Although each of these age groups, in both countries, had the lowest prevalence rates for current smoking compared to the younger age groups, in each case the prevalence rates for ROI were double those of NI. Furthermore, the PAFs for current and previous smoking suggest that whilst these were risk factors for CHD related disability for both men and women for those aged 50 and over, the contribution for women was greater. These findings are contrary to those of Matthews et al. (1989) and Bonithon-Kopp, Scarabin, Darne, Malmejak, and Guize (1990), but congruent with a more recent study that found that smoking was associated with earlier onset of myocardial infarction (heart attack) in women (Bähler, Gutzwiller, Erne, & Radovanovic, 2012).

There were higher levels of obesity in ROI which were reflected in the proportion of disability attributed to obesity in this country compared with NI. There were also large between country differences for physical inactivity and depression, with NI having

considerably higher rates compared to ROI, differences that were still apparent when stratified by gender, age group, and SEP group. For the most part, the risk factors demonstrated the expected patterns of distribution – for example, women had higher levels of physical inactivity and depression in both jurisdictions, and those aged 65 and over had lower prevalence of overweight, smoking, and severe depression. Men had slightly higher rates of diabetes than women in ROI and NI, which is congruent with other studies (Rosner Preis et al., 2009). There was evidence of health inequalities in both countries for most of the risk factors, with those in the low SEP group having the highest prevalence of current smoking (and conversely the lowest prevalence of previous smoking which indicates smoking cessation), overweight, obesity, physical inactivity (NI only), diabetes, and severe depression. Therefore, risk factors for disability also showed clear evidence of inequalities, and mirror the findings of other studies in developed countries (Balanda et al., 2010; Beauchamp et al., 2010b; Farrell et al., 2008; Sacker, Head, & Barley, 2008).

The final objective was to evaluate how differences in healthcare and welfare systems in each jurisdiction impact on disability following CHD. This is discussed in Chapter 5, with a particular focus on implications for policy.

Strengths of the present study

This study benefited from the use of two large representative national samples which allowed us to conduct analyses that would not otherwise have been possible given the low prevalence of CHD related disability. Both sets of health survey data were collected in 2010/2011, which also happened to be a census year in both countries, thus facilitating harmonisation of survey data with population and mortality data for the DFLE calculations. Both samples were population-based and therefore could be weighted, which renders the findings more generalisable. For the most part the pertinent variables were comparable across the two datasets, or could be re-coded so as to make them sufficiently comparable. The only exception to this was the SEP variable (see Chapter 2 and Appendix B). Finally, we were able to derive our own RRs which allowed us to weight, adjust, and stratify to suit the requirements of the study, as well as to evaluate the robustness of estimates, and eliminate possible biases that the use of published RRs might have introduced.

Limitations of the present study

Some of the limitations of the study have been outlined in Chapter 2 (Method) and concern difficulties in estimating RRs from the health survey data at more fine grained levels of stratification. Furthermore, RRs for each risk factor were derived from cross-sectional data; therefore caution is advised when making inferences regarding causality of the risk factors on future CHD related disability as there may be lag effects arising from the fact that the exposure (risk factor) is being measured at the same time as the health outcome in question.

The study did not specifically consider co-morbidities in relation to CHD related disability. The only exception to this was the adjustment for diabetes in all the regression models that were conducted to estimate RRs for each risk factor (for the PAF calculations). On that basis it is important to view the PAFs for each risk factor as being representative of only a portion of possible overall disability that a person may experience. Furthermore, we did not consider the severity of CHD or disability (i.e., degree of limitation as a result of long-term illness); however, we conducted sensitivity analyses with an alternative definition of CHD related disability using ADL rather than LLTI.

Related to the issue of co-morbidity, there is also an assumption underlying the way that CHD related disability was coded in the present study. We have assumed that a respondent has CHD related disability if they reported having CHD (i.e., either experienced angina or a heart attack) and a LLTI. In truth, especially at older ages, LLTI may be as a result of a co-morbid condition (e.g., as a result of arthritis – the Global Burden of Disease Study [Murray et al., 2013] has shown musculoskeletal conditions to contribute the greatest burden of disease in old age in the UK), and thus we may be over-estimating prevalence of disability that can be specifically attributed to CHD.

A further limitation was that depression was the only variable available in both datasets that could be used to address psychosocial issues in the experience of CHD related disability. Although the findings provided compelling evidence for the impact of moderate and severe depression on CHD related disability, it would have been helpful to have had access to additional psychosocial variables such as measures of social support, loneliness, and self-efficacy. These are of particular import to older age groups, and as they are associated with

depression they would have complemented the findings of the present study regarding the role of depression in CHD related disability.

There are other risk factors such as high total cholesterol level and hypertension that arguably could have been included in the analysis, but as this information was not available in both datasets the decision was made to exclude them. However, for many individuals these factors are associated with physical inactivity/high BMI, and on that basis it could be argued that we have addressed them, albeit indirectly, through their relationship with physical inactivity and high BMI.

Directions for future research

In light of the dearth of research that is specifically focused on CHD related disability and the imperative to increase understanding of the health and social care needs of this group, there are a number of possible directions for future research. For example, studies could focus on projections of CHD related disability within the context of an increasingly ageing population, as well as the financial impact of projected care for this group. Additionally, the methodology used in the present study could be applied to other chronic conditions that are associated with disability. Finally, it would be useful to examine the role of depression prior to and after a CHD event, as well as how it impacts on the development and perception of disability, in order to support those with co-morbid depression.

5.0 Chapter 5 – Implications for Health and Social Care Policy

In this final chapter we outline how the findings of the present study may impact on, and have implications for health and social care policy in ROI and NI.

Changing demographics, increasing needs?

As highlighted in Chapter 1, the populations of ROI and NI have the lowest proportions of older people compared to other EU states. However, given population projections that suggest increases in the numbers and proportions of older people over the coming years, there is a strong likelihood that we will have increasing numbers of people living with CHD and CHD related disability, and this will place concomitant pressure on health and social care agencies in the future.

At present, both jurisdictions have strategies that seek to improve cardiovascular health (including CHD) in the population. The "*Changing Cardiovascular Health: National Cardiovascular Health Strategy 2010-2019*" in ROI (Department of Health and Children, 2010) outlines a range of preventive measures at the individual and population level, as well as recommendations for management of CHD. The "*Service Framework for Cardiovascular Health and Wellbeing*" in NI (Department of Health, Social Services and Public Safety Northern Ireland [DHSSPSNI], 2009) has similar recommendations, and also includes a focus on inequalities and issues relating to health service access. Therefore, the relevant agencies in the two jurisdictions are acting similarly in relation to tackling the issues of chronic conditions and their risk factors. However, Balanda et al. (2010) have highlighted that only a very small proportion of total healthcare expenditure is allocated towards preventive programmes at the population level (3%; source: OECD). This, coupled with the projected costs incurred as a result of increased health and social care needs for those experiencing CHD and CHD related disability, suggests that governments should be acting now to ensure provision can be met, and to ensure that any proposed welfare reforms will not disadvantage those with CHD and CHD related disability. For example, cardiovascular disease (CVD) is one of the most common conditions for which disability benefit is claimed in NI.[8] People whose daily living or mobility activities are restricted due to CVD-related disability have a real need for welfare support, and future demand for welfare assistance for

[8] http://www.dsdni.gov.uk/index/stats_and_research/benefit_publications/benefit-publications-archive/dla.htm

CVD-related disability is likely to increase due to an increasing and ageing population. It is expected that the Personal Independence Payment (PIP) will replace Disability Living Allowance in Northern Ireland in the near future for eligible people of working age. It is therefore imperative to gain greater understanding of the implications of this anticipated key policy reform to ensure that appropriate financial support is reaching those who need it most.

Focus for prevention: Population or individual level approaches?

Results of the present study, and a considerable body of other literature, suggest that increasing levels of physical activity and reducing BMI should be the focus of public health initiatives to reduce CHD related disability, both for those already experiencing disability, and for those aged less than 50 in order that they can avoid such disability in their later years. Furthermore, depression has been shown in the present analysis to have strong associations with CHD related disability, though the mechanisms of its effects are not clearly understood. There are, therefore, clear imperatives to focus future research on understanding the role of depression as it affects CHD and CHD related disability, and to continue efforts to support population-wide and patient focussed psychological well-being. This is especially relevant for the appropriate agencies in NI, where current physical inactivity levels and depression rates are substantially higher than in ROI.

Whether strategies to address such problems should be targeted at everyone in the population irrespective of whether or not a person has such health problems or demonstrates poor health behaviours (i.e., at the population level), or whether they should be targeted only at those who are already exhibiting symptoms, negative health outcomes, or risky health behaviours (i.e., at the individual level) has been a matter for debate in the literature (Manuel et al., 2006; Rose, 1985). For example, Jørgensen et al. (2013) have stressed the importance of population level prevention strategies to improve cardiovascular health by focusing on population measures to change lifestyle and health behaviours and cite examples such as alcohol and tobacco control, and changes to the built environment to encourage and promote increased physical activity. Similarly, Vinther, Jørgensen, and Borglykke (2013) found that in a Danish sample of over 6000 participants, the majority of CHD events (whether fatal or non-fatal) were among groups who would not be considered to be high risk for a CHD event. Therefore, population-based prevention strategies have the greatest potential for moving the entire distribution of risk "leftwards", addressing those at both moderate and high risk, the

former making by far the greatest contribution to disease burden. However, the latest European guidelines on CVD prevention (including CHD) advocate a combination of population and individual level prevention strategies (Perk et al., 2012).

Population level approaches tackling health and lifestyle behaviours also have the advantage of improving the health of future generations: it is acknowledged that the aetiology of chronic conditions such as CHD have their roots in early life (e.g., Eriksson, Forsén, Tuomilehto, J., Osmond, & Barker, 2001; Forsén, Eriksson, Tuomilehto, Osmond, & Barker, 1999; Kaijser et al., 2008; Leon et al., 1998; Park, Falconer, Viner, & Kinra, 2012; Reilly & Kelly, 2011; Vos et al., 2003), therefore, women of childbearing age with healthy lifestyles are more likely to have healthy children and encourage healthy lifestyle behaviours in their children. At the opposite end of the age spectrum, evidence suggests that prevention strategies that are put in place to tackle poor health behaviours or risky lifestyles after health problems have become apparent (i.e., secondary prevention strategies) can be effective in improving health outcomes even at older ages (e.g., Bejan-Angoulvant et al., 2010; Doolan & Froelicher, 2008).

Adopting a social determinants of health approach to prevention

There is a general recognition that factors associated with chronic illness and subsequent disability are socioeconomically patterned, and as such any approaches (whether at the population or individual level) need to be underpinned with an understanding of the social determinants of health and disability (Murray et al., 2013). Indeed, results of the present study have demonstrated absolute and relative inequalities in life expectancies and DFLEs across all age groups, especially in ROI, and highlight the need to narrow the inequality gap. However, this can present challenges when translating research findings into practice, especially as it relates to addressing inequalities in health (Capewell & Graham, 2010; DiCesare et al., 2013; Koh et al., 2010). For example, Capewell and Graham (2010) suggest that population level approaches are more effective in reaching all socioeconomic groups, whereas individual level interventions (i.e., those targeting high-risk groups) may actually widen the inequalities gap, with those in high socioeconomic groups benefiting more. Similarly, a recent review highlights the negative impact of socioeconomic disadvantage on the uptake and effectiveness of interventions for the prevention and management of cardiovascular disease, and argues that interventions that may work with one socioeconomic group may be ineffective with others (Beauchamp et al., 2010b, also Emberson, Whincup,

Morris, & Walker, 2004 and Marmot, 2004). In light of this, Balanda et al. (2010) have advocated that policy needs to adopt a social determinants of health approach in order to address the social, socioeconomic, and social environmental issues that underpin unhealthy lifestyles and behaviours (also Farrell et al., 2008; Irish Medical Organisation, 2012; Marmot, 2010).

Allied to the problem of socioeconomic barriers in tackling CHD and related risk factors, there is the issue of regional differences within both ROI and NI. Whilst our study showed that rates of CHD and CHD related disability were higher in NI than in ROI, we know that the higher overall rates in NI are in part driven by regional differences within NI: the largest NI conurbations of Belfast, Derry, and Strabane have considerably higher rates of CHD for the 65-74 and 75+ years compared with the rest of NI and ROI, whilst Dublin (the largest ROI conurbation) has lower rates of CHD than the rest of ROI and NI. This must have repercussions for any strategies/policies that are in place, or that are planned, in terms of tackling CHD (and presumably related disability) among older people in high prevalence areas. Healthcare and service planning tends to centre around the major conurbations, but many older people live in semi-urban or rural areas and thus are more isolated from the high-end technological healthcare usually available in city hospitals that would benefit those with established CHD. Additionally, the lack of public transport in rural areas may limit access to specialised care. A major priority therefore when evaluating and planning health and social care services for this group should be the issue of the availability of, and accessibility to facilities and specialist care for isolated populations.

Multi-sectoral approaches to management and prevention

The most recent European guidelines on CVD prevention, as well as the WHO's Commission on Social Determinants of Health (CSDH) emphasise the fact that health systems alone are unlikely to be effective in instigating and maintaining the level of change necessary to reduce CHD and advocate the importance of multi-sector involvement – a number of different agencies need to be involved (Perk et al., 2012; WHO, 2008).

Monitoring progress

We have already seen changes in CHD prevalence as a result of management of the condition of the past 25 years, and coupled with projections of CHD prevalence this provides a basis

for future service planning and utilisation. However, it is important that there is ongoing monitoring of trends in CHD prevalence and survival rates in order to ensure that services currently in place are meeting requirements, and to inform future planning, a view that is advocated by the latest European guidelines on CVD prevention (Perk et al., 2012).

In terms of any changes to provision of health and social care that may emerge in the coming years, it is important that such changes are fit for purpose – therefore, it would be useful to engage users in service evaluation, planning, and management in order to ensure that current and future provision is meeting their requirements.

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Appendices

Appendix A

Additional information on depression measures

Center for Epidemiologic Studies Depression Scale (CESD; Radloff, 1977)

The CESD was designed to screen for depressive symptomatology among a population during the seven days preceding assessment. The 20-item version has satisfactory internal reliability (α=0.87 for the 20-item version); in the present study the measure demonstrated comparable, if not better internal reliability (total sample α=0.93; men α=0.84; women α=0.95).

Respondents use a four-point Likert-type response option that incorporates the presence of the symptom in question (e.g., 'I had crying spells'), and the duration of time that the respondent has been experiencing the symptom. Possible responses range from 'Rarely or none of the time' (0) to 'Most or all of the time' (3). Scores on the CESD 20-item scale can range from 0 to 60, with higher scores indicative of a higher incidence of both the presence and duration of symptoms. Radloff (1977) recommends a 'caseness' cut-off score of ≥16 on the total scale score in order to classify respondents as having a degree of depression that is in the clinical range. However, there is also evidence to suggest that scores below that threshold (i.e., in the range 7-15) can produce sub-clinical levels of depression that can also be debilitating. Therefore, in the present study scores of ≥16 were defined as severe depression, scores between 7 and 15 were defined as moderate depression, and scores <7 were defined as not depressed.

General Health Questionnaire (GHQ12; Goldberg & Williams, 1988)

The GHQ12 is a measure of psychological well-being for use in population studies. The GHQ12 has satisfactory internal reliability (α=0.87); in the present study the measure demonstrated comparable internal reliability (total sample α=0.90; men α=0.90; women α=0.89).

Respondents use a three-point Likert-type response option. Possible responses range from 0-12 with higher scores indicative of a higher incidence of symptoms of psychological distress. Although Goldberg and Williams (1988) do not provide any recommended threshold in order to establish 'caseness', a score of ≥4 on the total scale score has been suggested as

appropriate (Mari &Williams, 1985). Therefore, this is the threshold that was applied in order to classify respondents as having a degree of depression that is in the clinical range. As was the case for the CESD (see above), it is possible to examine the effects of sub-clinical levels of depression: respondents with scores between 1 and 3 were deemed to fall within this category (Mari &Williams, 1985). Respondents were therefore classified as not depressed, moderately depressed, or severely depressed.

Appendix B

Derivation of socioeconomic position (SEP)

When deriving a SEP variable for our analyses, we had to ensure that the indicators of SEP between the two countries were comparable. The three SEP groups (professional/managerial [high]; lower non-manual [medium]; manual [low]) were broadly similar; however, in the NIHS there was a group of individuals coded as 'no socioeconomic group (SEG), armed forces, etc.' who were difficult to place. In TILDA there was a separate group for 'farmers' that was equally difficult to place. Excluding these two groups altogether or keeping them as separate SEP groups was not an option because of the effect this would have on sample/cell sizes (especially in the NIHS). Therefore, we made the decision to compare the distributions of these respective groups against the distributions of the manual SEP group using alternative indicators of SES (e.g., educational level, housing tenure, household income). For both the 'farmers' group in TILDA and the 'no SEG' group in NIHS the distributions using alternative measures of SES were broadly similar to the distributions of the respective TILDA and NIHS manual SEP groups. Therefore, the decision was taken to include each of these two categories with the respective country-specific manual groups.

There was another difficulty within the TILDA dataset insofar as there was a sizeable 'not applicable' category (n=2323), 78% of whom were women. We suspected that these were women who had never worked outside of the home and who therefore could not be allocated to a specific occupational group. There was no comparable group in the NIHS. The decision was taken to treat this 'not applicable' group as a separate and independent group with no counterpart in the NIHS rather than try to absorb them within one of the three SEP categories.

There was also a 'missing/refused' group in TILDA with quite large numbers (n=796) which was difficult to integrate into the 3-category SEP variable which we kept as a separate SEP group.

Therefore, within both health surveys we had a 3-category SEP indicator (high, medium, low) that was broadly similar and that allowed us to make meaningful comparisons and ultimately pool data, but within TILDA there were two additional groups (a 'not applicable' group and a 'missing/refused' group) that were retained in order to maximise sample size.

Appendix C

Advantages/disadvantages of deriving our own relative risks (RRs)

The following advantages of this approach were that: (i) we could adjust and weight the RR analyses as required by the study design, (ii) we could provide the appropriate level of stratification, (iii) we could determine the robustness of the risk estimates (information that is sometimes absent in published RRs) and (iv) there was less likelihood that the relative risks were biased. When deriving the RRs from the published literature it is not possible to ensure that they come from a sample that has similar characteristics as the one from which the prevalence is being derived.

However, there are also some disadvantages that are acknowledged: (i) both data sources are cross-sectional and therefore caution is required in terms of attributing causality to any particular risk factor (though this could equally apply when using published RRs), (ii) there were some limitations with sample size and small cell counts, especially in the NIHS, when using CHD related disability as an outcome variable (given its low rates of prevalence) and applying stratification. The latter disadvantage was addressed by merging the TILDA and NIHS datasets on pertinent variables and using only the pooled data to establish RR estimates; by aggregating age to two groups; and by minimising the level of stratification. In most instances this was sufficient to provide robust estimates. However, some of the RRs for BMI (overweight and obesity) and physical inactivity have wide confidence intervals, therefore these estimates, and resulting PAFs for these two risk factors, should be treated with caution.

Appendix D

Table D1. Results of age group x gender and age group x SEP crosstabulations showing distributions (weighted %) of TILDA and NIHS respondents

			Gender		SEP				
		Total	Men	Women	High	Medium	Low	Not applicable	Missing/ refused
TILDA	**50-59**	3270 (40.4)	1461 (42.5)	1809 (38.5)	657 (37.9)	403 (41.4)	702 (30.9)	1056 (45.9)	452 (57.3)
	60-69	2589 (31.0)	1206 (31.8)	1383 (30.2)	612 (34.3)	294 (30.7)	736 (30.8)	719 (30.0)	228 (28.7)
	70-79	1677 (19.9)	804 (18.9)	873 (20.8)	412 (21.0)	184 (19.6)	613 (26.5)	377 (15.6)	91 (10.4)
	80+	626 (8.7)	268 (6.8)	358 (10.5)	118 (6.8)	72 (8.3)	240 (11.8)	171 (8.5)	25 (3.7)
	Total	8162 (100.0)	3739 (48.0)	4423 (52.0)	1799 (100.0)	953 (100.0)	2291 (100.0)	2323 (100.0)	796 (100.0)
NIHS	**50-59**	661 (37.0)	289 (39.9)	372 (35.3)	104 (41.8)	228 (38.1)	329 (35.2)	-	-
	60-69	687 (30.3)	327 (31.6)	360 (29.5)	95 (28.6)	230 (31.5)	362 (29.9)	-	-
	70-79	466 (20.3)	221 (19.6)	245 (20.8)	69 (19.2)	129 (17.9)	268 (22.2)	-	-
	80+	206 (12.3)	84 (8.9)	122 (14.4)	29 (10.4)	64 (12.5)	113 (12.7)	-	-
	Total	2020 (100.0)	921 (38.3)	1099 (61.7)	297 (100.0)	651 (100.0)	1072 (100.0)	-	-

SEP: socioeconomic position

Table D2. Results of gender x age group x SEP crosstabulations showing demographic and socioeconomic distribution (weighted %) of TILDA and NIHS respondents

		TILDA					NIHS		
		SEP					SEP		
		High	Medium	Low	Not applicable	Missing/ refused	High	Medium	Low
Male	**50-59**	293 (38.3)	84 (34.1)	430 (30.8)	341 (66.2)	313 (59.6)	61 (39.3)	67 (43.2)	161 (38.9)
	60-69	310 (34.4)	86 (31.5)	474 (31.1)	164 (31.4)	172 (30.9)	62 (27.2)	76 (36.5)	189 (31.5)
	70-79	229 (21.2)	73 (24.9)	433 (27.2)	15 (2.4)	56 (7.7)	56 (22.8)	31 (12.9)	134 (20.8)
	80+	65 (6.1)	25 (9.5)	163 (10.9)	0	13 (1.8)	22 (10.6)	14 (7.5)	48 (8.8)
Female	**50-59**	364 (37.5)	319 (44.4)	272 (31.0)	715 (38.9)	139 (51.0)	43 (45.7)	161 (36.5)	168 (32.4)
	60-69	302 (34.2)	208 (30.4)	262 (30.1)	555 (29.6)	56 (23.0)	33 (30.6)	154 (30.0)	173 (28.8)
	70-79	183 (20.8)	111 (17.4)	180 (25.3)	364 (20.3)	35 (17.3)	20 (23.7)	98 (19.5)	134 (23.3)
	80+	53 (7.6)	47 (7.8)	77 (13.6)	169 (11.3)	12 (8.7)	0	50 (14.1)	65 (15.5)
Total	**50-59**	657 (37.9)	403 (41.4)	702 (30.9)	1056 (45.9)	452 (57.3)	104 (41.8)	228 (38.1)	329 (35.2)
	60-69	612 (34.3)	294 (30.7)	736 (30.8)	719 (30.0)	228 (28.7)	95 (28.6)	230 (31.5)	362 (29.9)
	70-79	412 (21.0)	184 (19.6)	613 (26.5)	377 (15.6)	91 (10.4)	69 (19.2)	129 (17.9)	268 (22.2)
	80+	118 (6.8)	72 (8.3)	240 (11.8)	171 (8.5)	25 (3.7)	29 (10.4)	64 (12.5)	113 (12.7)
	Total	1799 (100.0)	953 (100.0)	2291 (100.0)	2323 (100.0)	796 (100.0)	297 (100.0)	651 (100.0)	1072 (100.0)

SEP: socioeconomic position
Zero cell counts are a result of aggregation to avoid disclosure due to small numbers

Table D3. Prevalence (weighted %), RRs (95% CIs), and PAFs for current smoking on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RR	95% CIs		ROI	NI		RR	95% CIs		ROI	NI
All	8026	19.8	2020	18.0	1.36	1.05	1.75	6.6	6.1	All	1.51	1.01	2.27	9.2	8.5
Men	3685	19.7	921	19.6	1.19	0.82	1.71	3.6	3.6	Men	1.25	0.70	2.23	4.7	4.7
Women	4341	19.8	1099	17.1	1.54	1.08	2.19	9.6	8.4	Women	1.69	0.96	2.97	12.0	10.5
Age 50-64	4602	23.2	1004	23.9	1.39	0.92	2.10	8.3	8.6	50-64	1.33	0.68	2.62	7.2	7.4
Age 65+	3424	14.9	1016	11.3	1.26	0.90	1.75	3.7	2.8	65+	1.46	0.88	2.45	6.5	5.0
High SEP	1781	13.0	297	11.1	1.60	0.74	3.47	7.3	6.3	High SEP	2.78	0.81	9.50	18.8	16.5
Medium SEP	938	14.5	651	13.3	1.35	0.61	3.00	4.8	4.5	Medium SEP	2.74	0.87	8.57	20.1	18.8
Low SEP	2254	20.5	1072	22.9	1.09	0.75	1.58	1.7	1.9	Low SEP	1.15	0.68	1.97	3.1	3.4

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position

Table D4. Prevalence (weighted %), RRs (95% CIs), and PAFs for previous smoking on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RR	95% CIs		ROI	NI		RR	95% CIs		ROI	NI
All	8026	37.8	2020	38.8	1.54	1.26	1.89	16.9	17.3	All	1.64	1.17	2.29	19.4	19.8
Men	3685	45.2	921	49.1	1.34	1.01	1.79	13.4	14.4	Men	1.27	0.80	2.01	10.7	11.6
Women	4341	30.9	1099	32.4	1.77	1.33	2.35	19.2	19.9	Women	2.08	1.30	3.32	25.0	25.9
Age 50-64	4602	35.2	1004	37.0	1.22	0.81	1.82	7.1	7.5	50-64	0.77	0.36	1.65	*-8.9*	*-9.5*
Age 65+	3424	41.4	1016	40.8	1.68	1.33	2.14	22.1	21.8	65+	2.01	1.36	2.96	29.5	29.2
High SEP	1781	42.8	297	43.3	1.88	1.09	3.24	27.5	27.7	High SEP	3.04	1.15	8.05	46.6	46.8
Medium SEP	938	37.1	651	40.1	1.61	0.93	2.78	18.4	19.6	Medium SEP	1.39	0.48	4.05	12.7	13.6
Low SEP	2254	41.3	1072	36.8	1.42	1.05	1.91	14.7	13.3	Low SEP	1.26	0.80	1.97	9.6	8.6

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position
Negative PAFs (in italic) are result of no risk (RR<1.0)

Table D5. Prevalence (weighted %), RRs (95% CIs), and PAFs for overweight on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RRs	95% CIs		ROI	NI		RRs	95% CIs		ROI	NI
All	8026	42.8	2020	41.6	1.06	0.77	1.44	2.4	2.3	All	2.08	1.08	4.02	31.7	31.1
Men	3685	46.0	921	46.1	1.10	0.70	1.74	4.6	4.6	Men	1.90	0.80	4.51	29.1	29.2
Women	4341	39.9	1099	38.6	0.99	0.64	1.54	*-0.2*	*-0.2*	Women	1.96	0.71	5.45	27.8	27.1
Age 50-64	4602	43.4	1004	40.8	1.11	0.56	2.18	4.5	4.2	50-64	2.62	0.31	22.40	41.4	39.8
Age 65+	3424	41.9	1016	42.6	1.05	0.74	1.50	2.2	2.2	65+	2.03	1.02	4.05	30.2	30.5
High SEP	1781	43.9	297	48.4	1.06	0.50	2.25	2.7	3.0	High SEP	7.09	0.93	54.21	72.8	74.7
Medium SEP	938	43.5	651	40.9	0.68	0.34	1.39	*-15.9*	*-14.8*	Medium SEP	1.35	0.25	7.32	13.3	12.6
Low SEP	2254	45.3	1072	40.1	1.35	0.81	2.23	13.5	12.2	Low SEP	2.02	0.78	5.26	31.6	29.1

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position
Negative PAFs (in italic) are result of no risk (RR<1.0)

Table D6. Prevalence (weighted %), RRs (95% CIs), and PAFs for obesity on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RRs	95% CIs		ROI	NI		RRs	95% CIs		ROI	NI
All	8026	35.2	2020	28.2	1.45	1.08	1.96	13.8	11.3	All	3.85	2.06	7.20	50.1	44.5
Men	3685	38.0	921	32.4	1.52	0.97	2.37	16.4	14.4	Men	3.03	1.31	7.04	43.6	39.7
Women	4341	32.6	1099	25.3	1.36	0.90	2.06	10.6	8.4	Women	4.68	1.84	11.89	54.5	48.2
Age 50-64	4602	34.5	1004	28.6	2.11	1.12	3.97	27.7	24.1	50-64	9.67	1.28	72.91	75.0	71.2
Age 65+	3424	36.3	1016	27.7	1.29	0.92	1.81	9.5	7.4	65+	3.27	1.69	6.35	45.2	38.6
High SEP	1781	31.7	297	25.0	1.49	0.72	3.09	13.4	10.8	High SEP	6.03	0.77	47.39	61.4	55.7
Medium SEP	938	29.8	651	24.8	0.64	0.30	1.39	*-12.0*	*-9.7*	Medium SEP	2.05	0.40	10.62	23.9	20.7
Low SEP	2254	36.0	1072	31.4	2.05	1.27	3.33	27.5	24.9	Low SEP	4.42	1.79	10.94	55.2	51.8

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position
Negative PAFs (in italic) are result of no risk (RR<1.0)

Table D7. Prevalence (weighted %), RRs (95% CIs), and PAFs for physical inactivity on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RRs	95% CIs		ROI	NI		RRs	95% CIs		ROI	NI
All	8026	31.3	2020	54.8	2.21	1.83	2.67	27.5	39.9	All	3.50	2.51	4.88	43.9	57.8
Men	3685	24.9	921	50.7	*					Men	3.15	2.06	4.82	34.9	52.2
Women	4341	37.2	1099	57.4	2.49	1.85	3.33	35.6	46.0	Women	4.08	2.35	7.10	53.4	63.9
Age 50-64	4602	25.8	1004	46.8	2.26	1.60	3.17	24.5	37.0	50-64	5.14	2.52	10.49	51.6	65.9
Age 65+	3424	39.1	1016	64.0	2.20	1.76	2.76	32.0	43.5	65+	3.10	2.13	4.50	45.0	57.3
High SEP	1781	28.9	297	49.8	2.58	1.61	4.14	31.4	44.0	High SEP	3.30	1.53	7.10	39.9	53.4
Medium SEP	938	28.8	651	50.7	2.47	1.43	4.27	29.8	42.8	Medium SEP	2.82	0.97	8.26	34.4	48.0
Low SEP	2254	27.9	1072	58.8	2.14	1.63	2.83	24.2	40.2	Low SEP	4.45	2.69	7.33	49.0	67.0

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position

* RR not estimated as regression model failed to converge

Table D8. Prevalence (weighted %), RRs (95% CIs), and PAFs for diabetes on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RRs	95% CIs		ROI	NI		RRs	95% CIs		ROI	NI
All	8026	8.1	2020	9.6	1.81	1.47	2.23	6.2	7.2	All	1.55	1.09	2.19	4.2	5.0
Men	3685	9.7	921	11.4	*					Men	1.52	0.96	2.40	4.8	5.6
Women	4341	6.6	1099	8.4	1.58	1.12	2.24	3.7	4.7	Women	1.61	0.94	2.74	3.9	4.9
Age 50-64	4602	6.1	1004	7.0	1.91	1.23	2.99	5.2	6.0	50-64	1.70	0.80	3.65	4.1	4.7
Age 65+	3424	11.0	1016	12.5	1.77	1.39	2.25	7.8	8.8	65+	1.47	0.99	2.18	4.9	5.6
High SEP	1781	6.7	297	8.3	1.99	1.16	3.41	6.2	7.6	High SEP	2.24	1.03	4.86	7.6	9.3
Medium SEP	938	5.8	651	8.4	2.21	1.23	3.94	6.5	9.2	Medium SEP	1.87	0.66	5.29	4.8	6.8
Low SEP	2254	9.6	1072	10.7	1.74	1.30	2.33	6.6	7.3	Low SEP	1.54	0.97	2.45	4.9	5.5

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position

* RR not estimated as regression model failed to converge

Table D9. Prevalence (weighted %), RRs (95% CIs), and PAFs for severe depression on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RRs	95% CIs		ROI	NI		RRs	95% CIs		ROI	NI
All	8026	10.2	2020	17.6	2.92	2.35	3.63	16.3	25.2	All	4.48	3.19	6.28	26.1	37.9
Men	3685	7.4	921	16.2	3.19	2.36	4.32	14.0	26.2	Men	4.78	3.00	7.62	21.9	38.0
Women	4341	12.7	1099	18.4	2.64	1.93	3.61	17.3	23.3	Women	4.26	2.59	7.01	29.3	37.5
Age 50-64	4602	11.0	1004	22.7	4.07	2.68	6.18	25.2	41.1	50-64	14.29	5.34	38.29	59.3	75.1
Age 65+	3424	9.0	1016	11.7	2.60	2.00	3.37	12.6	15.7	65+	3.68	2.51	5.38	19.5	23.8
High SEP	1781	5.6	297	15.1	1.80	0.89	3.63	4.3	10.8	High SEP	3.10	1.20	8.02	10.5	24.2
Medium SEP	938	6.6	651	17.1	1.94	0.95	3.95	5.9	13.8	Medium SEP	4.38	1.43	13.40	18.3	36.6
Low SEP	2254	8.5	1072	18.6	3.64	2.69	4.93	18.4	32.9	Low SEP	4.70	2.99	7.40	24.0	40.7

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position

Table D10. Prevalence (weighted %), RRs (95% CIs), and PAFs for moderate depression on LLTI and ADL based CHD related disability for ROI and NI by gender, age group, and SEP

	LLTI based disability									ADL based disability					
	TILDA		NIHS		All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence			All-Ireland RRs			PAFs using all-Ireland RRs & country-specific prevalence	
	N	%	N	%	RRs	95% CIs		ROI	NI		RRs	95% CIs		ROI	NI
All	8026	18.0	2020	26.6	2.10	1.71	2.57	16.5	22.5	All	2.38	1.68	3.37	19.9	26.8
Men	3685	15.6	921	24.3	2.32	1.77	3.05	17.1	24.3	Men	2.56	1.62	4.04	19.6	27.5
Women	4341	20.2	1099	28.0	1.85	1.36	2.52	14.7	19.3	Women	2.20	1.29	3.74	19.5	25.1
Age 50-64	4602	17.9	1004	26.3	3.22	2.14	4.83	28.4	36.8	50-64	9.91	3.67	26.74	61.4	70.1
Age 65+	3424	18.2	1016	26.9	1.80	1.42	2.28	12.7	17.7	65+	1.78	1.20	2.64	12.4	17.3
High SEP	1781	15.1	297	27.1	2.02	1.24	3.29	13.3	21.6	High SEP	3.03	1.44	6.38	23.4	35.5
Medium SEP	938	19.7	651	27.5	1.83	1.05	3.18	14.0	18.5	Medium SEP	1.72	0.54	5.48	12.3	16.4
Low SEP	2254	16.4	1072	25.8	2.18	1.60	2.96	16.2	23.4	Low SEP	2.19	1.33	3.59	16.3	23.5

RRs: relative risks; CIs: confidence intervals; PAFs: population attributable fractions; LLTI: limiting long-term illness; ADL: activities of daily living; CHD: coronary heart disease; ROI: Republic of Ireland; NI: Northern Ireland; SEP: socioeconomic position

Table D11. Life expectancies and DFLEs based on CHD and ADL for ROI and NI age groups 50 and over (5-year age bands)

		ROI				NI			
	Age group	Total LE	DFLE	Disabled years	% of life spent disability-free	Total LE	DFLE	Disabled years	% of life spent disability-free
All	**50-54**	32.4	31.8	0.63	98.1	32.0	30.5	1.52	95.3
	55-59	27.9	27.3	0.63	97.8	27.6	26.2	1.45	94.7
	60-64	23.5	22.9	0.61	97.4	23.4	22.0	1.39	94.0
	65-69	19.3	18.7	0.59	96.9	19.3	18.1	1.24	93.6
	70-74	15.5	15.0	0.56	96.4	15.5	14.5	1.06	93.2
	75-79	12.0	11.5	0.49	95.9	12.1	11.4	0.77	93.7
	80-84	8.9	8.5	0.35	96.1	9.2	8.5	0.63	93.2
	85+	6.5	6.3	0.26	96.1	6.8	6.4	0.39	94.3
Men	**50-54**	30.6	29.9	0.67	97.8	30.3	28.6	1.63	94.6
	55-59	26.1	25.5	0.65	97.5	25.8	24.3	1.58	93.9
	60-64	21.8	21.2	0.66	97.0	21.7	20.2	1.48	93.2
	65-69	17.8	17.1	0.64	96.4	17.7	16.4	1.32	92.6
	70-74	14.1	13.5	0.60	95.7	14.1	12.9	1.20	91.5
	75-79	10.7	10.2	0.51	95.2	11.0	10.1	0.89	91.9
	80-84	7.8	7.5	0.28	96.4	8.2	7.4	0.82	90.0
	85+	5.8	5.6	0.21	96.4	6.2	5.4	0.80	87.1
Women	**50-54**	34.1	33.6	0.59	98.3	33.7	32.2	1.49	95.6
	55-59	29.6	29.0	0.60	98.0	29.2	27.8	1.41	95.2
	60-64	25.1	24.5	0.57	98.0	24.8	23.4	1.38	94.4
	65-69	20.8	20.2	0.56	97.3	20.6	19.4	1.24	94.0
	70-74	16.7	16.2	0.53	96.8	16.7	15.7	1.02	93.9
	75-79	13.0	12.5	0.48	96.3	13.0	12.2	0.74	94.3
	80-84	9.6	9.2	0.40	95.9	9.7	9.2	0.56	94.3
	85+	7.0	6.7	0.29	95.9	7.1	6.9	0.24	96.6

DFLE: disability-free life expectancy; CHD: coronary heart disease; ADL: activities of daily living; ROI: Republic of Ireland; NI: Northern Ireland; LE: life expectancy

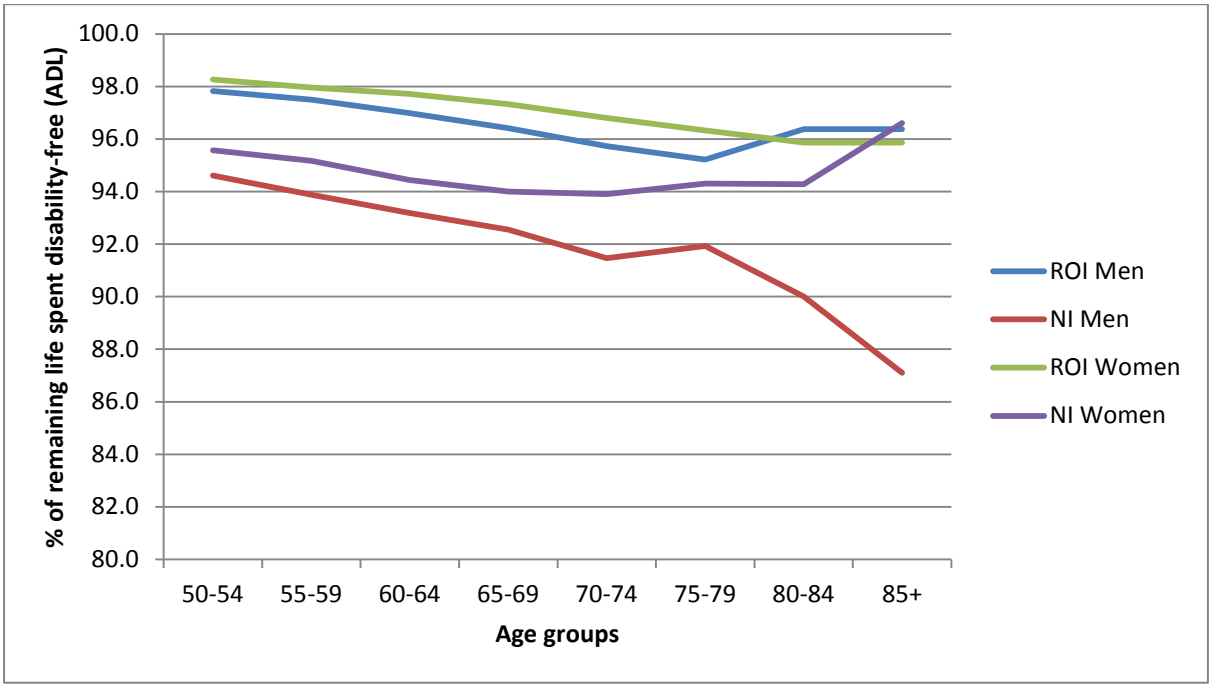

Figure D1. Graph comparing percentage of life spent disability-free (CHD and ADL limitations) across all age groups, for men and women in the ROI and NI