Does pain mediate or moderate the relationship between physical activity and depressive symptoms in older people?

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A project funded by the
Centre for Ageing Research and Development in Ireland
(CARDI)[1]

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Abbreviations

CARDI	Centre for Ageing Research and Development in Ireland
CES-D	Centre for Epidemiological Studies Depression Scale
CSO	Central Statistics Office
ESRI	Economic and Social Research Institute
GHQ-12	General Health Questionnaire – 12 Item
HADS	Hospital Anxiety and Depression Scale
HARP	Healthy Ageing Research Project
HeSSOP	Health and Social Services for Older People
IPAQ	International Physical Activity Questionnaire
NI	Northern Ireland
PA	Physical activity
PAF	Postal Address File (Royal Mail)
RoI	Republic of Ireland
TILDA	The Irish Longitudinal Study on Ageing

Executive Summary

The world's population is ageing rapidly with a projected doubling of the proportion of people over the age of 60 years by 2050. Depression is an increasing problem in older adults, which is exacerbated by under diagnosis and ineffective treatment options. Broadly speaking, as people age their levels of regular physical activity (PA) decrease, while their experience of routine or chronic pain increases. PA has been shown to be an effective, yet under-utilised, treatment for depression in this cohort although the influence of pain on this relationship has not been considered.

The aim of this study is to investigate whether pain mediates or moderates the association between PA and depression/psychological distress in Irish adults aged 50 years or more. The study used national data from three surveys with older adults living in the Republic of Ireland (RoI) and Northern Ireland (NI) – the Health Ageing Research Project (HARP, 2005) (N=2053, RoI and NI participants aged 65 years and older), The Irish Longitudinal Study on Ageing (TILDA, 2011) (n=8163, RoI participants aged 50 years and older only) and the Northern Ireland Health Survey 2010/11 (NIHS 2010/11) (n=2020, NI participants aged 50 years and older only).

The primary outcome was depression/distress measured by the Hospital Anxiety and Depression Scale (HADS, Zigmond & Snaith, 1983) in HARP, the Centre for Epidemiological Studies Depression Scale (CES-D, Radloff, 1977) in TILDA, and the General Health Questionnaire – 12 items (GHQ-12, Goldberg & Williams, 1988) in NIHS 2010/11. In TILDA and NIHS 2010/11 PA was measured by the International Physical Activity Questionnaire (IPAQ) Short Form (Craig et al., 2003). Comparative categories were created from similar PA items in HARP. All participants were asked about their recent experience of pain. The impact of these on health care utilisation was also examined. Demographic factors (gender, marital status, age, social class, and education), smoking status and self-rated health were also controlled for in analyses.

Approximately 11% (11.2%) of HARP older adults were depressed/distressed compared with 8.5% of TILDA and 18.4% of NIHS 2010/11 participants. Overall, across the three studies, older adults living in RoI participated in higher levels of regular PA and also reported lower levels of recent pain compared to their NI counterparts. No mediating or moderating effects of pain were found in the association between PA and depression. Higher levels of PA were found to be independently associated with lower depression while higher levels of pain significantly increased the likelihood of depression. Both of these variables were independently predictive of depression and support previous findings. Longitudinally, depression at baseline and pain at baseline (not follow-up) was predictive of depression at follow-up. PA at baseline also had a protective effect on depression at follow-up although only when baseline and follow-up pain were not controlled for. Therefore, PA at baseline may be less important than current PA and/or pain. Being depressed and higher levels of pain were also found to significantly increase healthcare utilisation.

Consistent with previous findings in this field, both PA and pain were found to be independent predictors of depressive/distress symptoms in Irish older adults. Furthermore, pain does not play a mediating or moderating role in the relationship between PA and depression/distress. Continued support for ongoing initiatives in this area aimed at increasing PA in older adults as a means to improve both physical and mental well-being is advised. The absence of any synergistic effect between PA and pain suggests that clinicians and health service providers should continue to promote PA as a treatment for depression, irrespective of the pain levels of their patients. Therefore, treatment plans or interventions need to consider both of these factors independently.

Chapter 1. Introduction

1.1 Background to the study

A recent study involving participants 50 years and older from Northern Ireland (NI) and the Republic of Ireland (RoI) (N=6159) found core depressive symptoms (i.e. depressed mood and anhedonia) in 7.2% of their nationally representative sample (Morgan, O'Farrell, Doyle and McGee, 2011). This study also showed that those who were engaged in moderate to high levels of physical activity (PA) had a 50-56% reduction in the odds of having elevated depressive symptoms compared to those with low levels of PA (Morgan et al., 2011). Unfortunately, the analyses omitted a potentially significant explanatory variable – pain. Pain has been shown to be associated with increased risk for depression in older persons (Bair, Robinson, Katon and Kroenke, 2003; Onder, Landi, Gambassi, et al., 2005), and is also a potential reason for non-engagement in PA (Mossey, Gallagher and Tirumalasetti, 2000). It could therefore interact with (mediate or moderate the association between) depression and PA. This report details a set of analyses that investigates this in three nationally representative datasets of older adults from both the RoI and NI.

1.2 Depression and health service use in older adults

By 2020, depression is projected to be the second leading cause of disease burden worldwide. While estimates of depression rates largely focus on younger adults (i.e. < 65 years), depression is also expected to disproportionately affect older adults (Heo, Murphy, Fontaine, Bruce and Alexopoulos, 2008). This can be potentially accounted for by two trends. Firstly, rates of depression in the general population are increasing (Compton, Conway, Stinson and Grant, 2006). Secondly, the world's population is ageing with a predicted doubling in the proportion of people over the age of 60 years by the year 2050 (United Nations, 2002). In sum, future cohorts of older adults will display higher levels of depressive disorders than their predecessors (Chapman and Perry, 2008), suggesting that the need for effective and evidence-based interventions has never been more pressing. Furthermore, other established associations exist between depression and a number of other sociodemographic factors. Higher levels of depression have been demonstrated in women, non-married/co-habiting people, those of lower educational and socioeconomic groups, smokers, and those with lower self-rated health (Morgan et al., 2011; Zunzunegui et al., 2007; Djernes, 2006; Cole and Dendukuri, 2003; Everson et al., 2002). Therefore, any investigation of depressive symptoms in older people also needs to control for such factors.

Research suggests that depression in older adults is often undiagnosed and when it is may be poorly treated (Leibowitz, Pearson, Schneider, et al., 1997). Depression in older adults can often, but erroneously, be accepted by individuals and health professionals as a natural part of ageing (Birrer and Vemuri, 2004). High levels of medical comorbidity associated with depressive disorders also means that depressive symptoms can be disguised by physical complaints

(Juurlink, Herrmann, Szalai et al., 2004; Kales, Maixner and Mellow, 2005; Oslin, Datto, Kallan et al., 2002). This can make diagnosis difficult and complicate the duration and effectiveness of treatment strategies (Chapman and Perry, 2008; Unützer, 2002). Furthermore, the provision of medical services is still higher for those with depressive symptoms and no formal diagnosis compared to those with a formal diagnosis (Johnson, Weissman and Klerman, 1992). One large, multi-centre cross-national observational study (N=18,849) examined the treatment of depression in primary health care across six countries. Across all centres, participants with depressive symptoms were twice as likely as those without such symptoms, to report three or more health care visits in the previous three months (Hermann, Patrick, Diehr, et al., 2002).

1.3 Depression and physical activity in older people

PA has been identified as an effective but under–utilised treatment for depression (Fox, 1999; Dunn, Trivedi, Kampert, Clark and Chambliss, 2005; Morgan et al., 2011). Furthermore, the positive effects of PA on physical health and well-being in older people are robustly supported in research (Allender, Hutchinson and Foster, 2008; White, Wójciciki and McAuley, 2009). For example, Giuli and colleagues (2012) surveyed a group of community-dwelling older adults (N=306) about their levels of weekly exercise over the past year. They found that those who engaged in regular PA (≥1 hour of weekly exercise) were significantly more likely to have a lower body mass index (BMI), better self-rated health status and no depression. National surveys (e.g. English Longitudinal Study of Ageing) have also demonstrated this link between increased levels of PA and lower levels of depressive symptoms (Banks, Nazroo and Steptoe, 2012; Morgan, McGee, Watson et al., 2008; Morgan et al., 2011).

Several countries (e.g. Ireland, UK, US, Australia) have developed national policies that recommend minimum levels of PA for older adults. Broadly speaking, including in RoI and NI, older adults are recommended to engage in 30 minutes of moderate intensity activity at least five days a week (Department of Health and Children, Health Service Executive, 2009; Health Promotion Agency, 1996). However, evidence suggests that the proportions of older adults meeting these minimum levels of PA are negligible. For example, the most recent information from the United States found that only approximately one in five older adults are meeting the overall PA recommendations (Centers for Disease Control and Prevention, 2013). In Ireland, Morgan et al. (2011) reported 45% of the older people to be achieving overall moderate PA levels, with just 18% engaged in high levels of regular PA. The most recent figures from NI suggest that approximately 38% of all adults were meeting the recommended levels of PA; in adults over 50 years of age this figure drops to 30.4% (DHSS & PS, 2011). Furthermore, levels of recommended PA across the UK decrease for both men and women as they get older (Townsend, Bhatnagar, Wickramasinghe, et al., 2012). Understanding the interactions among PA and potential barriers like pain and depressive symptoms will provide important insights into how the physical and mental health of respondents may be improved.

1.4 Depression, physical activity and pain in older people

Relatively few studies have examined the role of pain in the association between PA and depression. Sabiston and colleagues (2012) study examined pain, PA and depression levels in female survivors of breast cancer (Mean age = 54.9 years). They found a positive association between pain and depression and a negative association between pain and PA. When this relationship was tested further, PA was found to partially mediate the relationship between pain and depression (Sabiston, Brunet and Burke, 2012). In another study, Mossey et al. (2000) found that the effect of pain on physical functioning, in a group of elderly community-dwelling residents (N=228), was a function of their level of depressive symptoms (i.e. an interaction effect was found). In sum, at all levels of pain, an increase in depressive symptoms was significantly associated with a higher probability of being in the lowest physical functioning quartile (Mossey, Gallagher and Tirumalasetti, 2000). No similar data exists in Ireland presently, and it is unclear to what extent pain may account for, or contribute to, the negative association between PA and depressive symptoms. Therefore, determining the interplay between these variables has potentially crucial clinical and policy implications for older people.

1.5 The current study

The aim of this study is to investigate whether pain mediates or moderates the association between PA and depression/psychological distress in Irish adults aged 50 years or more. Mediators and moderators are usually third variables that facilitate a more in-depth understanding of the relationship between the variable of interest and the outcome measure (Wu and Zumbo, 2008). Mediation analysis explains the mechanism of how a variable operates via another (Frazier, Tix and Barono, 2004). For example, it might be possible that the positive association between pain and depression is explained by PA – higher pain leads to lower PA, which leads to higher depression. In this case, PA would mediate the effect of pain on depression. A moderation effect is also commonly known as an interaction effect where the strength of the effect of one variable (e.g. pain) on the outcome (depression) varies with levels of another variable (PA) (Wu and Zumbo, 2008). Moderation analysis therefore accounts for the 'when' and 'for whom', e.g. are the effects of the variable seen in outcomes for women but not for men (Frazier, Tix and Barono, 2004). For example, pain may not have an impact on depression in those with high levels of PA, but it might for those with low or moderate levels of PA, above and beyond the effects seen for each variable alone.

The current study will analyse the latest national data available from three surveys – the Health Ageing Research Project (HARP, 2005), The Irish Longitudinal Study on Ageing (TILDA, 2011) and the Northern Ireland Health Survey 2010/11 (NIHS 2010/11). Using datasets that encompass older adults from both Northern and the Republic of Ireland, the study objectives are:

- To profile the prevalence levels of depression/distress, physical activity, and pain reported by older Irish adults.
- To describe the associations between levels of depression/distress, physical activity, and pain

- To ascertain any mediating and/or moderating effects in the relationships between these variables
- To ascertain any relevant age-group differences
- To examine the impact of these variables on healthcare utilisation
- To replicate the all-island findings in the most up-to-date and comprehensive ageing data from TILDA and from the NIHS 2010/11

Chapter 2. Methodology

2.1 Design
This was a quantitative study involving secondary analysis of three existing national datasets encompassing data from the Republic of Ireland (RoI) and Northern Ireland (NI).

2.2 Materials
The datasets used in this study were from the Healthy Ageing Research Project (HARP) (McGee, O'Hanlon, Barker, et al., 2005), The Irish Longitudinal Study on Ageing (TILDA) (Barrett, Burke, Cronin et al., 2011) and the Northern Ireland Health Survey 2010-2011 (NIHS 2010/11; DHSSPSNI, 2011). HARP data was obtained from the investigators, the TILDA (2011) dataset from the Irish Social Science Data Archive on 26th March 2013 (http://www.ucd.ie/issda/) and the NIHS 2010/11 dataset from the UK Data Service on the 30th May 2013 (http://ukdataservice.ac.uk/). These surveys are the latest available sources of nationally representative data on community-dwelling older people's health and well-being in Ireland.

2.3 Healthy Ageing Research Programme (HARP)
2.3.1 Sampling and weighting
The Health Ageing Research Programme (HARP) was designed to address the challenges of ageing in an all-Ireland context (McGee, O'Hanlon, Barker, et al., 2005). A representative group of community-dwelling older people aged 64 years and older were recruited from the Republic of Ireland (RoI) (n=1053) and Northern Ireland (NI) (n=1000). In the RoI, participants were selected from the Register of Electors using a computer-based random sampling system in two former health board regions (McGee, O' Hanlon, Barker, et al., 2005). Respondent selection within a household was by the 'next birthday' rule and proxy responding was also facilitated achieving a final response rate of 58%.

In NI, the sampling frame used was the Royal Mail's Postal Address File (PAF) and participants were recruited from the four Northern Ireland health board regions. Names and addresses were randomly selected from the PAF and households with a resident aged 65 years or older were invited to take part. In total 1000 (13 by proxy) participants completed the extended questionnaire representing a response rate of 89%. Data for both samples were weighted to ensure representativeness, using information from the 2001 (NI sample) and 2002 (RoI sample) censuses (McGee, et al., 2005). These response rates and weighting ensured that the data were nationally representative in terms of gender, age cohort and health board region.

2.4 HARP: Longitudinal sub-sample
2.4.1 Sampling and weighting

As well as recruiting a new cohort of community-dwelling older adults, the HARP study included a sub-sample of participants who were followed up after previously taking part in an earlier version of this study - Health and Social Services for Older People (HeSSOP, Garavan, Winder and McGee, 2001). As part of HARP, as many of the original participants as possible were followed up to allow comparisons across time. Complete follow-up data were obtained for 314 participants from the original HeSSOP cohort. This represents a 55% response rate. More detailed sampling and weighting information for HARP is available elsewhere (McGee et al., 2005; O'Hanlon, McGee, Barker et al., 2005).

2.5 The Irish Longitudinal Study on Ageing (TILDA) (2011)
2.5.1 Sampling and weighting
The Irish Longitudinal Study on Ageing (TILDA) (2011) is a large-scale, nationally representative study of people aged 50 and over living in the Republic of Ireland (N=8504) (Barrett, Savva, Timonen & Kenny, 2011). The RANSAM system based on the Geodirectory developed by the Economic and Social Research Institute (ESRI) in Ireland (Whelan, 1979) was used to recruit participants. The sample design incorporated stratification, clustering and multi-stage selection (Kenny, Whelan, Cronin, et al., 2010). The response rate was 62% and the final sample was weighted using estimates for age, sex and educational attainment from the Quarterly National Household Survey (QNHS 2010). Further details on the survey methodology and sampling techniques used is available elsewhere (Barrett, Savva, Timonen & Kenny 2011; Kenny, Whelan, Cronin, et al., 2010).

2.6 Northern Ireland Health Survey 2010-2011 (NIHS 2010/11)
2.6.1 Sampling and weighting
The Northern Ireland Health Survey 2010/11 was commissioned by the Department of Health, Social Services and Public Safety in NI (DHSSPSNI) and this was the first year of the survey. The target sample was individuals aged 16+ years living in private households in NI. The sampling frame used was a random sample of more than 5000 addresses selected from the Land and Property Services Agency's (LPS) list of domestic addresses. Approximately, 3000 households took part achieving a sample size of 4085 individuals and a 62% response rate. Only adults aged 50 years and older were retained for the analysis in this report (n=2020). Data were weighted by gender and age using information from the Northern Ireland 2010 mid-year population estimates thereby reflecting the composition of the general population in NI.

2.7 Primary outcome variable: Depression/psychological distress
The primary outcome measure was the absence or presence of elevated depressive symptoms, or psychological distress in the case of NIHS 2010/11. While scales cannot diagnose depression, these were the methods adopted in the surveys analysed. Also, as all surveys used different measures of depression/psychological distress the binary outcome variable (except for the longitudinal analysis which used the continuous measure) classified participants from all three surveys as either 'depressed' or 'not depressed'. Therefore the terms 'depressed' and 'distressed' are used interchangeably throughout the report. Prevalence of depression was calculated using

the threshold scores for each measure. All of the survey items described in this section are presented in Appendix A.

2.7.1 *HARP depression measure*
The seven-item depression scale from the Hospital Anxiety and Depression Scale-item (HADS) (Zigmond and Snaith, 1983) was used to measure depression in the HARP study. The HADS is a widely-applied self-report instrument designed to assess how respondents have been feeling over the last week. Respondents indicate on a Likert scale the extent to which each statement applies to them. Performing well in both primary care and general population settings an individual's score can range from 0 (no symptoms) to 21 (maximum distress). A score of >7 seems to be the best threshold for optimal sensitivity/specificity (Brennan, Worrall-Davies, McMillan, et al., 2010).

2.7.2 *TILDA depression measure*
TILDA used the Centre for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977) to assess depression. This is a 20-item measure designed to measure symptoms of depression in the general population (i.e. non-psychiatric persons aged older than 18 years). Respondents rate the frequency of a range of depressive symptoms over the past week (e.g. depressive mood, loss of appetite, feelings of guilt and worthlessness). Radloff (1977) recommends a threshold of 16 to indicate a likelihood of clinically significant depression.

2.7.3 *NIHS 2010/11 psychological distress measure*
The NIHS 2010/11 used the 12-item General Health Questionnaire (GHQ-12) to measure recent psychological distress (Goldberg & Williams, 1988). As a specific measure for depression was not included in this survey, the GHQ-12 was used as a proxy measure of depression. This brief measure has been widely used in clinical and general populations with higher scores (≥ 4) indicating poorer mental health which may benefit from formal intervention.

2.7.4 *Standardising of measures for inter-survey comparison*
In order to allow comparison of depression scores across surveys standardised *Z*-scores were calculated for each of these measures, and then these were converted to a binary variable. All participants who scored one standard deviation or more above the mean were classified as 'depressed/distressed'. All remaining participants were classified as 'not depressed/distressed'. Further detail is provided in the statistical analyses section below.

2.8 Secondary outcome variable: Healthcare utilisation
Healthcare utilisation was measured by older adult's frequency of accessing GP services in the last year in both HARP and TILDA. In both surveys participants were asked to indicate how many times they had seen *any* GP (HARP) or *their* GP (TILDA) in the last 12 months. In NIHS 2010/11 this item was a somewhat different variable in that the interval was much shorter. NIHS 2010/11 participants were asked if they had consulted their GP or another health professional in the past two weeks (Yes/No). For HARP and TILDA a four-level categorical variable was

created representing: No GP visits; 1-2 GP visits; 3-4 GP visits; and 5 or more GP visits in the last year. In the NIHS 2010/11 the binary 'no' or 'yes, GP or other health professional visit in the last two weeks' was used.

2.9 Predictor variables

2.9.1 Physical activity measures

TILDA and NIHS 2010/11 used the validated short form of the International Physical Activity Questionnaire (IPAQ) (Craig, Marshall, Sjostrom, et al., 2003) to assess levels of PA. The IPAQ includes a series of items that measure the length of time spent being physically active at different levels of intensity (e.g. from walking to vigorous exercise). The results were categorized into *low* (little or no PA, less than 5,000 steps a day), *moderate* (approximately 5,000-10,000 steps a day) or *high* (over 10,000 steps a day) rates of PA.

HARP participants were asked to report how many times in the last 7 days (a week) they had engaged in: mild exercise (e.g. easy walking, golf); moderate exercise (e.g. fast walking, tennis); and strenuous exercise (e.g. running, vigorous swimming). We attempted to derive similar categories, as measured by the IPAQ, from the data collected to facilitate comparisons. Those who endorsed none of the above categories were classified as having engaged in '*No PA*' – comparable to the *low* category in TILDA/NIHS 2010/11. *'Mild to Low Moderate PA'* (comparable to the *moderate* category in TILDA/NIHS 2010/11) was created by including participants who positively endorsed any amount of mild exercise and at least one instance of moderate activity in the last week. The *'High-moderate to Vigorous PA'* category (comparable to the *high* category in TILDA/NIHS 2010/11) was created by combining those who reported two times or more moderate PA and any amount of strenuous PA in the last week.

2.9.2 Experience of pain

Participants were asked about the level of pain they experience and a three level categorical variable was created across the datasets. In HARP, responses were categorised as none or mild pain, moderate pain, and severe pain. In TILDA respondents were first asked if they were often troubled with pain and for those that said 'Yes' they were asked to rate how bad the pain was most of the time – mild, moderate, or severe. In NIHS 2010/11 participants indicated if they had no, moderate or severe pain or discomfort.

2.10 Demographic and health behaviour covariates

2.10.1 Demographics

Respondents in both surveys were categorised by age. For HARP the following categories were created: 65-69 years; 70-74 years; 75-79 years; and 80 years plus. For the TILDA and the NIHS 2010/11 dataset the following age categories were created: 50-54 years; 55-64 years; 65-74 years; and 75 years plus. Other demographic covariates controlled for in analyses were: gender, marital status, social class, and education (except in NIHS 2010/11).

2.10.2 Self-rated health

In HARP participants were asked to rate their current general health on a 5-point Likert scale from excellent, good, fair, poor and very poor. TILDA answered a similar question rating their health as excellent, very good, good, fair or poor. NIHS 2010/11 respondents indicated if their health in general was very good, good, fair, bad or very bad. To facilitate comparisons these responses were recoded into a 3-level categorical variable of self-rated health: Very poor/Poor; Fair; Good/Excellent.

2.10.3 Smoking

In HARP and TILDA survey respondents were categorized as being non-smokers, current smokers or former smokers/ex-smokers. In HARP participants were asked if they currently, or had ever smoked. In TILDA respondents were asked if they had ever smoked cigarettes, cigars or cigarillos or a pipe daily for a period of at least one year. Those that answered 'Yes' to this question were then asked if they smoked at the present time (i.e. within 3 months of participation was classified as Yes). In NIHS 2010/11 participants simply indicated if they were a current smoker or not (binary).

2.11 Statistical analyses

Data was analysed using descriptive and inferential statistics for each individual dataset. All tables presented in the results section include the overall numbers for clarity. Analyses were carried out using the statistical package Stata Version 12 and Stata survey commands were used throughout as data was weighted and clustered. The overall level of missing data was low (less than 2% for all variables). In HARP and TILDA all analyses controlled for the effects of gender, age, marital status, social class, education, self-rated health, smoker status and number of GP visits in the last 12 months. In the analysis of NIHS 2010/11 gender, age group, marital status, social class, smoker status and GP or health professional visit in the last 2 weeks were controlled for. Education was omitted due to differing categories used in this study and self-rated health was omitted because of a high correlation with the psychological distress measure (i.e. GHQ-12). For comparisons between younger and older participants (TILDA and NIHS 2010/11 only) the mediation and moderation analyses as described were repeated across the age groups. All analyses were weighted as per the original datasets.

2.11.1 Mediation analysis

Depression/distress (binary) was the primary outcome variable. In all three surveys, logistic regression was used to test for any mediating or moderating effect of pain on the association between PA and depression, with odds-ratios (ORs) used as the measure of effect size. First, in adjusted models, the independent relationship between PA and depression was tested followed by another model that assessed the relationship between and pain and depression. Then, mediation effects were tested for by including both pain and PA in the same model. A substantial reduction in the OR between PA and depression when pain is included in the model would suggest that pain mediates the relationship between these two variables.

2.11.2 Moderation analysis

In order to test for moderation an interaction term (PA by Pain) was included in the same model with PA, pain and relevant covariates. Evidence of a moderating effect of pain on the relationship between PA and depression would be represented by a significant p value for the interaction term(s).

2.11.4 Longitudinal analysis: HARP data only

For the longitudinal analysis, we were restricted by much lower numbers at follow-up, and the fact that PA at time two was not recorded. Therefore, to maximize power, depression at time two was predicted as a continuous variable (instead of a binary one) using linear regression, with baseline depression (continuous), pain at baseline and follow-up, PA at baseline, and age and sex as the predictors. We also report the percentage of variance explained (R-squared) for the model, with beta-values reported as the measure of effect for each variable in the model.

2.11.3 Healthcare utilisation analysis

The secondary outcome variable was healthcare utilisation. For HARP and TILDA, a multinomial regression assessed the impact of PA, pain and depression on the frequency of healthcare utilisation over the last 12 months with 'No GP visits' as the reference category. For NIHS 2010/11 the healthcare utilisation variable was binary; therefore a logistic regression was used to assess the relationship between the variables and recent GP or other health professional visits (i.e. in the last two weeks). Relative risk ratios (RRRs) were used as the measure of effect size.

Chapter 3. Results I: Sample description of HARP, TILDA and NIHS 2010/11

3.1 Introduction

The results of this study are presented in a number of chapters. In this chapter, the results of the descriptive analyses for the three datasets are presented. For brevity and comparison purposes descriptive statistics for the TILDA and NIHS 2010/11 are presented together. This is followed by the results of the mediation analyses across the three datasets in chapter four and then the moderation analyses in chapter five. Moderation and mediation analyses were used to assess the effects of pain on the relationship between PA and depression. Comparisons between younger participants present in the TILDA and NIHS 2010/11 datasets were also made and results from these analyses are included in Appendix B. The HARP longitudinal analysis is presented in chapter six and findings from the healthcare utilisation analyses concludes the results section in chapter seven.

3.2 HARP Demographics

The total number of participants included in the analysis was 2,053. This comprised 1000 participants from Northern Ireland (NI) and 1053 participants from the Republic of Ireland (RoI). Across both regions, the majority of HARP participants were women (57.1%). Similar proportions reported being currently married or living as married (43.9%) or currently widowed (40%). Participants in HARP ranged from 65-102 years. Almost a quarter of participants (23.8%) were aged 80 years or older while a further fifth were aged between 75-79 years (19.6%). The remainder were divided almost equally between the two lower age categories (64-69 years – 30.6%; 70-74 years – 26%). The largest number of respondents was drawn from social classes 5 and 6 (44.6%) which includes semi-skilled workers and unskilled manual workers and most had primary level education only (59.7%). Key demographic information for the entire sample, as well as by region is presented in Table 3.1.

3.3 HARP depression, health behaviours, and health service use

3.3.1 Depression[2]
The vast majority of participants (88.8%) were not depressed, as measured by a threshold score of greater than seven on the HADS. Overall, 11.2% of the sample were depressed (i.e. scored >7 on HADS) and this proportion was higher in NI participants (13.5%) compared with those in the RoI (9%).

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[2] Despite the prevalence's reported here, all subsequent depression/distress analysis uses standardized scores (unless stated otherwise)

Table 3.1: Description of HARP sample, including by region.

HARP Variable Name	NI (n=1000) n	RoI (n=1053) n	Total (N=2053) N
Demographics			
Gender			
Female	611 (61.1%)	560 (53.2%)	1171 (57.1%)
Marital Status*			
Single (never married)	147 (14.7%)	78 (8%)	225 (11.6%)
Married or co-habiting	328 (32.8%)	525 (53.7%)	853 (43.9%)
Separated or divorced	77 (7.7%)	9 (0.9%)	86 (4.5%)
Widowed	448 (44.8%)	366 (37.4%)	814 (40%)
Age*			
65-69 years	239 (24.2%)	279 (26.5%)	518 (30.6%)
70-74 years	228 (23.1%)	326 (31%)	554 (26%)
75-79 years	209 (21.1%)	218 (20.7%)	427 (19.6%)
80 years plus	313 (31.6%)	230 (21.8%)	543 (23.8%)
Social Class*			
SC 1-2	134 (13.9%)	331 (31.6%)	465 (23.3%)
SC 3-4	335 (34.8%)	296 (28.2%)	631 (32.1%)
SC 5-6	493 (51.3%)	421 (40.2%)	914 (44.6%)
Education*			
Primary education only	673 (68.1%)	574 (54.9%)	1247 (59.7%)
Second level incl. Junior Cert/O level	257 (26%)	230 (22%)	487 (25.3%)
Leaving Cert./A level or higher	58 (5.9%)	241 (23.1%)	299 (15%)
Health and health behaviours			
Depression*			
Depressed (HADS>7)	133 (13.5%)	95 (9.0%)	228 (11.2%)
Level of physical activity*			
None	320 (30.0%)	111 (10.9%)	431 (20.2%)
Mild to Low Moderate	509 (52.5%)	645 (61.3%)	1154 (56.9%)
High Moderate to Vigorous	152 (17.5%)	280 (27.7%)	432 (22.8%)
Experience of pain*			
None or mild pain	688 (69.7%)	838 (79.7%)	1526 (75.5%)
Moderate pain	177 (17.9%)	136 (12.9%)	313 (15.2%)
Severe pain	122 (12.4%)	77 (7.3%)	199 (9.3%)
Visited GP in last 12 months (binary)			
Yes	849 (87.1%)	984 (95.7%)	1833 (91.2%)
Self-rated health*			
Very poor/Poor	171 (17.3%)	66 (6.3%)	237 (11.6%)
Fair	325 (32.9%)	242 (23%)	567 (27.2%)
Good/Excellent	491 (49.8%)	743 (70.7%)	1234 (61.2%)
Smoking status			
Never smoked	516 (51.6%)	442 (42%)	958 (45.4%)
Ex-smoker	302 (30.2%)	435 (41.3%)	737 (36.4%)
Current smoker	182 (18.2%)	176 (16.7%)	358 (18.2%)

Note. NI = Northern Ireland; RoI = Republic of Ireland; SC = Social class; HADS = Hospital Anxiety and Depression Scale.
*Variables have some missing data.

3.3.2 Level of physical activity

More than half of older adults in the HARP sample were physically active to a mild to low moderate level on a weekly basis (56.9%). The remainder of the sample were almost equally divided between those who reported not engaging in any regular PA (20.2%) and those who engaged in high moderate to vigorous PA (22.8%) on a regular basis. The proportions of older adults engaging in the more strenuous forms of regular PA were larger in the RoI sample (27.7%) compared with their NI counterparts (17.5%).

3.3.3 Experience of pain

Three out of every four older adults reported none or only mild pain in the past week (75.5%). Participants with moderate (15.2%) or severe pain (9.3%) comprised approximately one quarter of the sample. More older adults in NI reported moderate or severe pain compared with participants from RoI.

3.3.4 Healthcare utilisation

Overall, nine in ten participants (91.2%) had visited a GP in the previous 12 months with a slightly higher number of visits per person in the NI sample. The median number of GP visits per older adult was 4 (62.5%) with a range of 0-92 visits in the last 12 months.

3.3.5 Self rated health

Overall, approximately six in ten HARP participants rated their health as good or excellent (61.2%) compared with 11.6% who rated it as poor or very poor. As presented in Table 3.1, the proportion of participants rating their health as poor or very poor was higher in NI (17.3%) compared to their RoI counterparts (6.3%).

3.3.6 Smoking behaviour

Overall, almost one in five respondents were current smokers (18.2%) while just over a third were former smokers (36.4%). The overall rate of smoking was only slightly higher in NI (18.2%) compared with the RoI (16.7%). Also, the number of participants reporting that they had never smoked was higher in NI (51.6%) than in the RoI (42%).

3.4 TILDA and NIHS 2010/11 Demographics

The total number of participants included in the analysis of TILDA was 8,163. Participants in TILDA ranged in age from 50-80+ years with more than half the sample being aged between 50-64 years (58.4%). More than half of the participants were women (52%) while more than two thirds were currently married or living as married (67.9%). A small proportion were widowed (15.9%). In terms of social class, as determined by occupation, 31% of older adults in TILDA were currently unemployed, out of work through long-term illness or looking after a home or family. The next largest proportion of respondents was drawn from social classes 3 and 4 (20.8%) which includes lower professional and non-manual positions. Approximately one third

of participants were educated to Leaving Certificate level or higher while almost four in every ten had either none or only primary school education (38.2%).

Table 3.2: Description of TILDA and NIHS 2010/11 samples.

Variable Name	TILDA Total (N=8163) n	NIHS 2010/11 Total (N=2020) n
Demographics		
Gender		
Female	4423 (52%)	1099 (61.7%)
Marital Status		
Never married	790 (9.7%)	203 (9.9%)
Married or co-habiting	5631 (67.9%)	1243 (60%)
Separated or divorced	551 (6.6%)	211 (10.9%)
Widowed	1191 (15.9%)	363 (19.2%)
Age		
50-55 years	1622 (19.7%)	355 (19.9%)
55-64 years	3042 (38.7%)	649 (33.5%)
65-74 years	2159 (23.4%)	600 (25.3%)
75+ years	1340 (18.2%)	416 (21.4%)
*Social Class**		
SC 1-2	1799 (17%)	297 (13.7%)
SC 3-4	1679 (20.8%)	1145 (56.3%)
SC 5-6	1043 (14.1%)	501 (25.8%)
Unemployed/Not applicable	2323 (31%)	na
Unknown/Refused	795 (9.7%)	77 (4.2%)
Farmers	523 (7.4%)	na
*Education**		
No education or primary only	2501 (38.2%)	nu
Some second level	1900 (25.2%)	nu
Leaving Cert. or higher	3758 (36.6%)	nu
Health and health behaviours		
*Depression/Psychological distress**		
Depressed/Distressed (CESD>16/GHQ-12 ≥4)	684 (8.5%)	346 (18.4%)
*Level of physical activity**		
Low	2591 (33.1%)	1112 (55.1%)
Moderate	2780 (33.5%)	511 (25.4%)
High	2713 (33.4%)	397 (19.5%)
*Experience of pain**		
None or mild pain	6101 (74%)	853 (44.8%)
Moderate pain	1345 (16.7%)	823 (44.3%)
Severe pain	712 (9.4%)	201 (11%)
Visited GP in last 12 months/2 weeks		
Yes	7142 (87.5%)	579 (31.4%)
*Self-rated health**		
Very poor to Poor	417 (5.5%)	299 (14.9%)
Fair	1482 (19.4%)	563 (27.4%)
Good to Excellent	6263 (75.1%)	1158 (57.6%)
*Smoking status**		
Never smoked	3561 (42.9%)	na
Ex-smoker	3113 (37.7%)	na
Current smoker	1488 (19.3%)	368 (18%)

Note. SC = Social class; na = Not available; nu=Not used due to non-comparable categories. *Variables have some missing data

In NIHS 2010/11 the total number of participants included in the analysis was 2020. More than half of the sample was aged between 50-64 years (53.4%), while approximately 40% were male. The vast majority were currently married (60%) while almost one in five (19.5%) were widowed. The largest proportion of respondents was drawn from social classes 3 and 4 (56.3%) which includes lower professional and non-manual positions. Key demographic information for both samples is presented in Table 3.2

3.5 TILDA and NIHS 2010/11 depression, health behaviours, and healthcare utilisation

3.5.1 Depression[3]
The vast majority of TILDA (91.4%) and NIHS 2010/11 (81.6%) participants were not depressed/psychologically distressed (i.e. they had not scored above the threshold cut-off points). Current depression was recorded in 8.5% of the TILDA sample while levels of high psychological distress were recorded in 18.4% of the NIHS 2010/11 sample.

3.5.2 Level of physical activity
In TILDA, in terms of PA, the sample was divided almost equally across the three levels – low levels of PA (33.1%), moderate levels of PA (33.5%), and high levels of PA (33.4%). More than half (55.1%) of participants in the NIHS 2010/11 reported low levels of PA while approximately a quarter (25.4%) engaged in moderate levels and just 19.5% reported high levels of PA.

3.5.3 Experience of pain
In TILDA approximately three quarters of older adults reported none or only mild pain in the past week (74%) compared to more than four in ten (44.8%) older adults in NIHS 2010/11. Proportions of older adults experiencing moderate pain were also different between TILDA (16.7%) and NIHS 2010/11 (44.3%) while RoI and NI participants reporting severe pain/discomfort (9.4% and 11% respectively) were more similar.

3.5.4 Healthcare utilisation
Almost nine in ten TILDA participants (87.5%) reporting having visited a GP in the 12 months prior to the study. The median number of GP visits per older adult was 3 (59.2%) with a range for the sample of 0-25 visits in the last 12 months. Almost one third of NIHS 2010/11 participants (31.4%) had visited a GP or other health professional in the last two weeks.

3.5.5 Self rated health
Three quarters of TILDA participants (75.1%) rated their overall health as good, very good or excellent. As presented in Table 3.2, the proportion of TILDA participants rating their health as

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[3] Despite the prevalence's reported here, all subsequent depression/distress analysis uses standardized scores (unless stated otherwise)

poor was just 5.5% compared to 14.9% in NIHS 2010/11. Almost one in five (19.4%) older adults in TILDA compared with 27.4% of NIHS 2010/11 participants felt their health was fair.

3.5.6 Smoking behaviour
The overall rate of current smoking was 19.3% in TILDA. Approximately forty-three per cent (42.9%) had never smoked while similar proportions were former smokers (37.7%). The overall rate of current smoking was 18% in NIHS 2010/11.

Chapter 4. Results II: Mediation Analyses

The results from the mediation analyses conducted on HARP, TILDA and NIHS 2010/11 are presented sequentially below. As described previously different depression/distress scales were used across the datasets, to ensure compatibility, we made (z-score) binary variables, considering those who scored as 1-SD or more above the mean value as 'depressed', and those who did not as 'not depressed'.

4.1 HARP mediation analyses

Results of the mediation analyses for HARP are presented in Table 4.1 below.

Table 4.1. Logistic regression testing prediction of depression (scoring 1 SD or above) by level of physical activity and level of physical activity and pain for HARP cohort.

Survey: HARP Variable Name	Adjusted OR (95% CI)	p value
Model 1 (n=1881)		
Level of physical activity		
None	1	
Mild to Low-Moderate	.47 (.34-.65)	<.001
High-Moderate to Vigorous	.24 (.13-.43)	<.001
Model 2 (n=1894)		
Experience of pain		
None or mild pain	1	
Moderate pain	1.4 (.94-2.1)	.102
Severe pain	2.4 (1.6-3.6)	<.001
Model 3 (n=1879)		
Level of physical activity		
None	1	
Mild to Low-Moderate	.49 (.36-.68)	<.001
High-Moderate to Vigorous	.25 (.14-.46)	<.001
Experience of pain		
None or mild pain	1	
Moderate pain	1.3 (.90-2.0)	.152
Severe pain	2.2 (1.4-3.4)	<.001

Note. All models adjusted for gender, marital status, age, social class, education, self-rated health, smoking status, and number of GP visits in last 12 months.

In the first stage of the analysis individual logistic regressions were carried out to assess if the level of PA (Table 4.1, Model 1) and the experience of pain (Table 4.1, Model 2) would independently predict the presence or absence of depression.

As presented in Table 4.1 Model 1, the level of recent mild to low moderate PA was a significant independent predictor of depression. This suggests that older adults who engaged in mild to low moderate PA over the last week were half as likely to be depressed compared to those who engaged in no PA. This effect was stronger in older adults who engaged in higher levels of PA on a regular basis in that those who engaged in high moderate to vigorous PA were approximately 76% less likely to be depressed than older adults who did not engage in any regular PA.

In Model 2, the experience of pain was also a significant independent predictor of depression. This suggests that older adults who reported experiencing severe pain over the last week were more than twice as likely to be depressed compared to those with none or only mild pain. While the odds of being depressed increased for those reporting moderate pain, this was not statistically significant.

The third model (Table 4.1) explored the potential mediating effects by including pain in the same model with PA. There is virtually no effect on the OR for PA when including pain in the model. This suggests that pain does not mediate the relationship between PA and depression.

4.2 TILDA mediation analyses

Similar analyses were then conducted on the TILDA dataset, the results of which are presented in Table 4.2 These results followed the pattern demonstrated in the HARP dataset. Both level of PA and experience of pain independently predicted the likelihood of current depression. These effects were seen at all levels of these variables. For example, participants engaged in moderate and high levels of PA were significantly less likely to be currently depressed compared to those engaged in low levels of PA. Both moderate and severe levels of recent pain were also associated with an increased likelihood of current depression. Similar to HARP, when both level of PA and experience of pain were entered into the same model, there is very little effect on the OR for PA. This echoes the previous finding that pain does not appear to mediate the relationship between PA and depression.

4.3 NIHS 2010/11 mediation analyses

Finally, these analyses were repeated on the NIHS 2010/11 dataset, the results of which are presented in Table 4.3. As evidenced in the two previous datasets, both PA and pain independently predicted the likelihood of current depression/distress. NIHS 2010/11 participants who reported moderate levels of PA were 70% less likely to have current distress symptoms than those engaging in only low levels of PA. This effect was not as strong for participants who reported high levels of PA (i.e. 58% reduction), although the effects were significant.

Table 4.2. Logistic regression testing prediction of depression (scoring 1 SD or above) by level of physical activity and level of physical activity and pain for TILDA cohort.

Survey: TILDA		
Variable Name	Adjusted OR (95% CI)	p value
Model 1 (n=7953)		
Level of physical activity		
Low	1	
Medium	.80 (.67-.96)	.017
High	.71 (.57-.89)	.002
Model 2 (n=8022)		
Experience of pain		
None or mild pain	1	
Moderate pain	1.9 (1.6-2.3)	<.001
Severe pain	2.3 (1.8-2.9)	<.001
Model 3 (n=7948)		
Level of physical activity		
Low	1	
Medium	.84 (.70-1.0)	.063
High	.73 (.58-.91)	.005
Experience of pain		
None or mild pain	1	
Moderate pain	1.9 (1.6-2.3)	<.001
Severe pain	2.2 (1.7-2.9)	<.001

Note. All models adjusted for gender, marital status, age, social class, education, self-rated health, smoking status, and number of GP visits in last 12 months.

Similar to both HARP and TILDA also, moderate and severe pain significantly increased the likelihood of current distress compared to those with no or only mild pain. There was very little change in the odds ratio for PA when both predictors were entered into the model together, repeating the finding that pain does not appear to mediate the relationship between PA and psychological distress. Although not reported here, this analysis was also run on the NIHS 2010/11 dataset using the PA variable they report i.e. *Meets the Chief Medical Officers recommended PA level or does not* (please see reports at http://www.dhsspsni.gov.uk/health_survey_northern_ireland_-_first_results_from_the_2010-11_survey.pdf). The findings also suggested no mediating role for pain.

Table 4.3. Logistic regression testing prediction of distress (scoring 1 SD or above) by level of physical activity and level of physical activity and pain for NIHS 2010/11 cohort.

Survey: NIHS 2010/11		
Variable Name	**Adjusted OR (95% CI)**	**p value**
Model 1 (n=1877)		
Level of physical activity		
Low	1	
Medium	.30 (.20-.45)	<.001
High	.42 (.28-.63)	<.001
Model 2 (n=1874)		
Experience of pain/discomfort		
None or mild pain	1	
Moderate pain	3.9 (2.7-5.6)	<.001
Severe pain	9.0 (5.8-14.1)	<.001
Model 3 (n=1874)		
Level of physical activity		
Low	1	
Medium	.41 (.27-.62)	<.001
High	.61 (.40-.94)	.025
Experience of pain/discomfort		
None or mild pain	1	
Moderate pain	3.6 (2.5-5.1)	<.001
Severe pain	6.9 (4.3-10.9)	<.001

Note. All models adjusted for gender, marital status, age group, social class, current smoking status, and GP/other health professional visit in the last two weeks.

In conclusion, across three national datasets of older people from both NI and RoI, pain does not appear to mediate the relationship between PA and depression/distress. Although following the same trends, in HARP the effect sizes for vigorous PA were larger than those obtained in TILDA and NIHS 2010/11 (in model 3 for HARP, TILDA and NIHS 2010/11 respectively: 75% vs. 27% vs. 39% reductions in depression/distress are seen for the highest levels of PA). While this could be interpreted to suggest that the protective effect of PA against depression was stronger for participants in HARP, it is more likely to be due to a measurement effect – the use of different scales and measures is probably leading to different effect size estimates. Similarly, while following the same direction, the association between pain and distress was stronger for NIHS 2010/11 participants compared to their counterparts in the HARP and TILDA cohorts. However, the results overall are better interpreted in terms of the direction of these effects, rather than a direct comparison of effect sizes.

4.4 Mediation analyses across age groups: TILDA and NIHS 2010/11

In order to discern possible age-group differences, comparisons were also made between the younger and older age groups in TILDA and NIHS 2010/11 datasets. Data was split into four age categories (<55 years, 55-64 years, 65-74 years and 75+ years) and the mediation analysis as described above was carried out. Higher levels of PA and pain were predictive of current depression/distress status but not across all age groups, despite the fact that the effect sizes were broadly similar across groups. For example, in TILDA, participants aged 65-74 years old who engaged in high levels of PA were 50% less likely to be depressed. In comparison, none of the PA levels (across all age groups) in NIHS 2010/11 were found to be significant. Also in TILDA, while all levels of pain across age groups were significantly associated with increased risk of levels of depression, these patterns were somewhat less consistent for NIHS 2010/11. No evidence of any mediation effect of pain between PA and depression/distress was found in TILDA or NIHS 2010/11. While the association between PA and depression was non-significant, there were still no real changes in effect sizes when adding pain to the models. Thus, while pain may be a more important predictor of depression/distress than is PA in the TILDA and NIHS 2010/11 cohorts, pain itself does not mediate the protective effects of PA on depression status. These results are reported in more detail in Tables A1-A3 in Appendix B.

Chapter 5. Results III: Results of Moderation Analyses

With the absence of any mediating role of pain in the relationship between PA and depression/distress, further models were run to determine if pain had any moderating role in this relationship. First an analysis of mean depression/distress scores across all levels of PA by levels of pain for HARP, TILDA and NIHS 2010/11 are presented in Table 5.1.

Table 5.1. Mean depression/distress scores across three levels of physical activity and pain for HARP, TILDA and NIHS 2010/11.

HARP	Level of physical activity					
	None		Mild-Low Moderate		High Moderate-Vigorous	
Experience of pain	*n*	*Mean (SD)*	*n*	*Mean (SD)*	*n*	*Mean (SD)*
None or mild	238	12.4 (3.1)	897	10.8 (2.0)	376	10.1 (1.6)
Moderate	100	13.6 (2.9)	171	11.9 (2.5)	38	11.0 (2.0)
Severe	92	14.8 (3.4)	83	12.2 (2.9)	18	11.2 (2.3)
TILDA	**Level of physical activity**					
	Low		Moderate		High	
Experience of pain	*n*	*Mean (SD)*	*n*	*Mean (SD)*	*n*	*Mean (SD)*
None or mild	1685	5.8 (6.6)	2149	4.6 (5.8)	2128	4.1 (5.6)
Moderate	495	8.8 (8.6)	427	8.0 (8.2)	387	6.7 (7.4)
Severe	353	12.3 (10.8)	170	11.7 (10.3)	159	8.9 (9.8)
NIHS 2010/11	**Level of physical activity**					
	Low		Moderate		High	
Experience of pain	*n*	*Mean (SD)*	*n*	*Mean (SD)*	*n*	*Mean (SD)*
None or mild	340	1.02 (2.1)	280	.79 (1.8)	233	.83 (1.8)
Moderate	481	2.5 (3.3)	197	1.5 (2.5)	145	1.9 (2.8)
Severe	180	3.9 (3.9)	17	3.2 (4.0)	4	5 (4.1)

With exception of NIHS 2010/11, depression scores followed an expected pattern with depression decreasing across levels of PA and increasing across levels of pain. The differences in the NIHS 2010/11 data may be due to the use of the psychological distress rather than depression measure. In general, while the mean scores indicate a trend as expected, they do not indicate any exponential changes, and thereby signify that moderating effects may be absent.

5.1 HARP moderation analyses

Table 5.2 presents the results of the moderation analysis in HARP. The two predictors, pain and PA and the interaction term (PA by pain) were entered into a logistic regression model, controlling for covariates. As before, the absence or presence of depression was the outcome measure. As in the mediation, the results indicated that increasing levels of PA were independently significantly associated with reduced odds of depression while only severe pain, not moderate pain, was associated with an increased likelihood of depression.

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Table 5.2. Moderation analysis for HARP testing prediction of depression (Scoring 1 SD or above) by level of physical activity and level of physical activity and pain and interaction terms for the HARP cohort.

HARP (n=1875) Variable Name	Adjusted OR (95% CI)	p value
Level of physical activity		
None	1	
Mild to Low-Moderate	.46 (.30-.70)	<.001
High-Moderate to Vigorous	.18 (.08-.39)	<.001
Experience of pain		
None or mild pain	1	
Moderate pain	.89 (.49-1.6)	.730
Severe pain	2.5 (1.4-4.7)	.003
Interaction terms		
No physical activity*None or mild pain	1	
Mild to Low Moderate physical activity*Moderate Pain	1.8 (.82-3.8)	.150
Mild to Low Moderate physical activity*Severe Pain	.64 (.27-1.5)	.311
High-Moderate to Vigorous physical activity*Moderate pain	3.8 (.94-15.6)	.061
High-Moderate to Vigorous physical activity*Severe pain	1.9 (.39-9.5)	.417

Note. Model adjusted for gender, marital status, age, social class, education, self-rated health, smoking status, and number of GP visits in last 12 months.

None of the interaction terms were significant, although the High-Moderate to Vigorous PA and Moderate pain interaction term was approaching significance with a p value of .059. Given the wide confidence interval this is possibly explained by small numbers (n=38) in this category. Therefore, overall, pain does not have a moderating role in the relationship between PA and depression in the HARP dataset.

Table 5.3. Moderation analysis for TILDA and NIHS 2010/11 testing prediction of depression/distress (Scoring 1 SD or above) by level of physical activity and level of physical activity and pain and interaction terms.

Variable Name	TILDA (n=7948)		NIHS 2010/11 (n=1874)	
	Adjusted OR (95% CI)	p value	Unadjusted OR (95% CI)	p value
Level of physical activity				
Low	1		1	
Moderate	.74 (.59-.93)	.011	.83 (.39-1.7)	.620
High	.71 (.55-.92)	.009	.82 (.38-1.7)	.598
Experience of pain				
None or mild pain	1		1	
Moderate pain	1.7 (1.3-2.3)	<.001	2.6 (1.5-4.5)	.001
Severe pain	2.1 (1.5-2.9)	<.001	2.6 (1.4-4.8)	.003
Interaction terms				
Low physical activity*None or mild pain	1		1	
Moderate physical activity*Moderate Pain	1.4 (.91-2.0)	.130	.48 (.19-1.2)	.117
Moderate physical activity*Severe Pain	1.0 (.67-1.6)	.877	.90 (.36-2.2)	.824
High physical activity*Moderate pain	1.4 (.81-2.3)	.240	.55 (.12-2.4)	.428
High physical activity*Severe pain	1.0 (.56-1.8)	.987	8.3 (.75-93.0)	.085

Note. TILDA model adjusted for gender, marital status, age, social class, education, self-rated health, smoking status, and number of GP visits in last 12 months.
NIHS 2010/11 adjusted for gender, marital status, age group, social class, current smoking status, and GP/other health professional visit in the last two weeks.

5.2 TILDA and NIHS 2010/11 moderation analyses

This moderation analysis was repeated on the TILDA and NIHS 2010/11, the results of which are presented alongside each other in Table 5.3. All levels of PA and pain in TILDA were independently predictive of the presence or absence of depression/distress whereas in NIHS 2010/11 just pain was significantly associated with recent psychological distress.

Similar to HARP, almost all interactions terms were also insignificant suggesting that pain does not have a moderating role in the association between PA and depression in both the RoI (TILDA) and NI (NIHS 2010/11) cohorts. Only the high PA and high pain category in the NIHS 2010/11 suggests a trend towards significance although given the extremely wide confidence interval this is probably a factor of small numbers in this category similar to the findings mentioned in the mediation analysis presented for HARP earlier.

Chapter 6. Results IV: Longitudinal analysis – HARP data only

As previously mentioned, the HARP dataset contained follow-up data for 314 participants from the original cohort. A linear regression explored whether baseline depression (raw scores), baseline PA, and pain at baseline and follow-up, predicted depression at follow-up, controlling for age and sex. Table 6.1 shows the results of this longitudinal analysis.

Table 6.1. Linear regression presenting predicted influence of baseline depression, baseline physical activity, and pain at baseline and follow-up, on follow-up depression in HARP longitudinal cohort.

HARP (n=282) Variable Name	β	95% CI	p value
Baseline depression	.22	.10-.34	.001
Baseline level of physical activity None*			
Mild to Low-Moderate	-.28	-1.3-.70	.575
High-Moderate to Vigorous	-.37	-1.4-.70	.497
Baseline experience of pain No pain*			
Mild pain	-.38	-.97-.20	.199
Moderate pain	-.90	-1.8- -.03	.044
Severe pain	.23	-.82-1.3	.664
Follow-up experience of pain No pain*			
Mild pain	1.3	.60-1.9	<.001
Moderate pain	.69	-.11-1.5	.092
Severe pain	2.9	1.6-4.2	<.001

Note. Model controlled for age and sex. * Reference category.

Overall, a large proportion of variance in depressive symptoms (31.4%) at follow-up was explained by this model. In other words, almost one third of depression at follow-up was predicted by all the variables in the analysis. Unsurprisingly, depressive symptoms at time two (according the HADS depression subscale) were predicted by depression at baseline, adjusting for baseline PA, baseline and follow-up pain levels, along with age and sex. Each unit increase on the baseline depression score corresponded with a 0.22 increase in depression at follow-up. Pain at baseline did not predict subsequent depression (with the exception of moderate pain, which was *protective* of subsequent depression when controlling for all other factors). However pain at follow-up did predict depression at follow-up, with as expected each category of pain

associated with increasing depressive symptoms (although the effect size for the moderate category was smaller and not statistically significant, possibly due to low numbers). Thus, those who were in the higher pain category on average had depression scores 2.9 units higher than those without pain. When analysing the data by omitting current pain levels, baseline pain still did not predict follow-up depressive symptoms (when controlling for age, sex and PA at baseline - data not shown).

Although baseline PA levels were not associated with subsequent depressive symptoms in the fully-adjusted model above, mild-to-low-moderate PA levels were protective of depressive symptoms when omitting current and baseline pain levels but when adjusting for baseline depression (β=-.69, 95% CI -1.36 to -.02, p=0.044). Thus, while PA at baseline is protective of depression at follow-up, it may be less important than current PA levels (which were not recorded), or current pain.

Chapter 7. Results V: Results of Healthcare Utilisation Analysis

Analyses were conducted to examine the impact of depression/distress, PA and pain on healthcare utilisation. The results of these analyses are presented in Table 7.1 (HARP), 7.2 (TILDA) and 7.3 (NIHS 2010/11). In HARP and TILDA the outcome variable was frequency of GP visits in last 12 months with no GP visits as the reference category.

7.1 HARP healthcare utilisation analysis

Table 7.1 presents the results of the healthcare utilisation analysis from the HARP dataset. For participants in HARP who were currently depressed there was no significant difference between groups in terms of number of GP visits in the last 12 months.

Table 7.1: Impact of depression, physical activity and pain on GP visits in last 12 months for HARP.

HARP Variable name	1-2 GP Visits*		3-4 GP Visits		5+ GP Visits	
	RRR (95% CI)	p value	RRR (95% CI)	p value	RRR (95% CI)	p value
Depression						
Yes	.99 (.55-1.8)	.967	.72 (.40-1.3)	.284	1.1 (.61-1.9)	.844
Level of physical activity						
None	1		1		1	
Mild to Low-moderate	2.2 (1.3-3.6)	.002	2.6 (1.6-4.4)	.000	3.0 (1.8-4.9)	.000
High-moderate to Vigorous	1.5 (.80-2.6)	.220	1.6 (.84-2.9)	.158	1.7 (.89-3.0)	.106
Experience of pain						
None or mild pain	1		1		1	
Moderate pain	1.3 (.64-2.6)	.490	1.5 (.75-2.9)	.262	2.1 (1.1-4.1)	.031
Severe pain	5.7 (1.3-26.2)	.024	10.8 (2.4-47.9)	.002	18.4 (4.3-79.5)	.000

Note. Model adjusted for gender, marital status, age, social class, education, self-rated health, and smoking status.
* Reference category: No GP visits. RRR= Relative risk ratio

Significant differences were found between groups at the mild to low-moderate level of PA. For example, those engaged in mild to low-moderate levels of regular PA were three times more likely to have five or more GP visits in the last year compared to those who reported no physical activity. No significant differences were identified between groups at the higher level of PA

perhaps because of small numbers in these categories. That those who have higher levels of PA have increased GP visits is perhaps surprising. However, it may reflect those who are more likely to seek care, or those who have had PA recommended to them as a result of a chronic condition. Also, increased likelihood of GP visits found with level of PA may be a factor of the measure used. More meaningful interpretation may be possible with the validated measure used in TILDA and NIHS 2010/11.

Finally, as pain levels increase HARP participants are significantly more likely to report an increased number of GP visits when compared to those without pain. For example, those with moderate levels of pain were twice as likely to report 5 or more GP visits in the last year when compared to those who had no pain. For those with severe pain there was a significant increase in the frequency of GP visits across groups compared to those with no pain; however, given the small numbers and the extremely large confidence intervals caution is advised in interpreting these figures.

7.2 TILDA healthcare utilisation analysis

As seen in Table 7.2, TILDA participants with depression were found to be at an increasing risk of more frequent GP visits in the last 12 months compared to those with no depression. For example, depressed respondents had a 75% higher risk of having five or more GP visits compared to those with no depression.

Results clearly indicate that as levels of PA increase the odds of an increasing number of GP visits significantly reduces, but only for those engaged in high levels of regular PA. Therefore, moderate levels of PA appeared to have no significant impact on the odds of reporting a reduced number of GP visits (in comparison to those with low PA). However, those engaged in high levels of PA were less likely to have attended their GP when compared to those who had low PA levels, with estimates ranging from 18-45% reduction in odds of attending.

As expected, increasing levels of pain were associated with an increased risk of a higher number of GP visits. This was especially true for those reporting at least three (or more) GP visits in the last 12 months. For example, those with moderate levels of pain were at almost three times significantly higher risk of five or more GP visits compared to those with no pain. This risk increased to almost three and a half times for those with severe pain, in comparison to those with no pain.

Table 7.2. Impact of depression, physical activity and pain on GP visits in last 12 months for TILDA.

TILDA: Variable name	1-2 GP Visits*		3-4 GP Visits		5+ GP Visits	
	RRR (95% CI)	p value	RRR (95% CI)	p value	RRR (95% CI)	p value
Depression						
Yes	.925 (.689-1.24)	.603	1.38 (1.02-1.88)	.039	1.75 (1.27-2.40)	.001
Level of physical activity						
Low	1		1		1	
Moderate	.947 (.774-1.16)	.596	.929 (.752-1.15)	.495	.920 (.737-1.15)	.461
High	.815 (.669-.991)	.041	.698 (.566-.860)	.001	.545 (.438-.678)	<.001
Experience of pain						
None or mild pain	1		1		1	
Moderate pain	1.23 (.958-1.57)	.106	1.70 (1.31-2.21)	<.001	2.91 (2.24-3.78)	<.001
Severe pain	1.13 (.737-1.73)	.575	2.05 (1.34-3.15)	.001	3.42 (2.26-5.18)	<.001

Note. Model adjusted for gender, marital status, age, social class, education, self-rated health, and smoking status.
* Reference category: No GP visits. RRR = Relative risk ratio

7.3 NIHS 2010/11 healthcare utilisation analysis

In NIHS 2010/11 the outcome variable was GP or health professional visit in the last two weeks therefore the time interval was much shorter than that used in HARP or TILDA, which may account for differences in the findings.

A significant difference was found between those with and without recent psychological distress in terms of an increased likelihood of a GP/health professional visit in the last two weeks (see Table 7.3). That is, those who reported recent psychological distress were 50% more likely to have visited a GP or other health professional in the last two weeks than those without these symptoms. A significant protective effect of PA was also demonstrated in that those who engaged in moderate levels of PA were 32% less likely to have visited a health professional in the last two weeks compared to those who had engaged in low levels of PA recently.

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Table 7.3. Impact of recent psychological distress, physical activity and pain on GP/other health professional visits in last two weeks for NIHS 2010/11.

NIHS 2010/11 (n=1874)		
Variable Name	**Adjusted OR (95% CI)**	**p value**
Distressed		
No	1	
Yes	1.5 (1.1-2.0)	.007
Level of physical activity		
Low	1	
Medium	.68 (.52-.89)	.005
High	.80 (.59-1.1)	.129
Experience of pain/discomfort		
None or mild pain	1	
Moderate pain	1.9 (1.5-2.5)	<.001
Severe pain	3.4 (2.4-4.9)	<.001
Note. NIHS 2010/11 adjusted for gender, marital status, age group, social class, and current smoking status.		

Finally, in the NIHS 2010/11 cohort, the impact of pain on healthcare utilisation was also apparent. Participants with moderate levels of pain increased their likelihood of a GP or healthcare professional visit in the last two weeks by 90% compared to those with no pain while respondents with severe levels of pain were more than three times as likely, than those with no pain, to have attended a GP or health professional in the last two weeks.

Chapter 8. Limitations

The authors acknowledge that this study has a number of limitations. Firstly, as described in the methods section there are differences across the three surveys in terms of the survey measures used and the manner in which some of the questionnaire items were asked. Perhaps most importantly, the way depression was measured is worth commenting on. Two of studies used validated measures of depression, while the third used a measure of psychological distress. While these cannot be assumed to be diagnostic of major depressive disorder, scoring above established thresholds are proven to be indicative of psychological distress worthy of formal mental health intervention. Cognisant of these inter-survey differences, a degree of reliability was assured by standardising the measures across the surveys. Nonetheless, comparisons made between surveys should still be mindful of these differences.

The secondary outcome variable was healthcare utilisation as measured by GP visits. While participants in HARP and TILDA were asked about their frequency of GP visits over the last 12 months in NIHS 2010/11 this interval was much shorter at just two weeks. They also included 'health professional' in this question meaning that participants who responded positively may not have been referring to a visit to their GP per se within this time period. Thus, the reported data is perhaps not directly comparable for this outcome.

Another limitation was the measurement of PA across surveys although the difficulties in reliably assessing levels of PA in surveys have been noted previously (Morgan et al., 2011). Importantly, the IPAQ measure used in TILDA and NIHS 2010/11 was the most similar, although a modified version was used in the NI study. This may, in part, explain the lack of some significant findings in NIHS 2010/11 in comparison to TILDA. In HARP, the PA variable was derived by re-categorising participants based on their responses to the PA items in an attempt to make them comparable with TILDA/NIHS 2010/11. However, this method has not been robustly tested and therefore may account for the stronger effect sizes of PA on depression that was found in HARP. Therefore, the consistent direction of the effects, and not necessarily the size of the effects per se, may be a better indicator of the overall association between PA and depressive symptoms.

The pain survey item was probably the most similar across surveys. Respondents choose from a Likert scale ranging from poor or bad to good or excellent. This makes proportions in each of these categories more comparable. The largest difference in this item between surveys was in the NIHS 2010/11 where participants were asked about their recent level and pain and discomfort. Therefore, older adults in NIHS 2010/11 who responded positively to this item may have been referring to a much wider range of physical complaints than their counterparts in HARP and TILDA.

Similar to other population studies, this study is also limited by the fact that the surveys used were all cross-sectional and utilised self-report. Cross-sectional data presents the likelihood of associations between variables but does not allow the inference of causation. Self-report data has inherent biases associated with it such as social desirability and recall bias (Rubenstein, Schairer, Wieland and Kane, 1984). For example, one study found that older participants were more likely to over-report their levels of PA (although under-reporting errors were noted too) (Heesch et al., 2010). Irrespective of causality, the evidence-based bi-directional relationship between PA and depression (Teychenne, Ball, and Salmon, 2008; Roshanaei-Moghaddam, Katon, and Russo, 2009) and pain and depression (Mossey et al., 2000; Chou, 2007) suggests that interventions should incorporate strategies relevant to both of these factors. While longitudinal studies can provide better evidences of the directions of associations, the longitudinal data presented here was limited by a small sample size, and by measurement issues previously outlined.

Chapter 9. Discussion

The aim of this study was to investigate whether pain mediates or moderates the relationship between PA and depressive symptoms in Irish adults aged 50 years or more. The study used data from HARP, TILDA and NIHS 2010/11 surveys which were carried out in both the RoI and NI. Measures of depression and psychological distress were used to categorise older adults as depressed or not depressed across surveys.

Using the appropriate threshold scores for each measure approximately 11% (11.2%) of HARP older adults were depressed/distressed. Excluding the NI HARP participants reduces this figure to 9% (RoI older adults only) making it broadly similar with the prevalence rate of 8.5% found in TILDA. In contrast, the level of high psychological distress found in the NIHS 2010/11 sample (18.4%) is somewhat higher than that found in HARP NI older adults (13.5%). Therefore, caution is advised in drawing conclusions based on the differences between surveys as much of this difference may be best explained by the use of different measures rather than an indication of widely different prevalence rates. Nonetheless, it does provide a sound rationale for the approach used in this study; to standardise the measures before conducting any analyses. Furthermore, utilising common measures of depression/distress across surveys would enable better comparisons in the future.

Older adults were also asked about their level of recent PA. In TILDA and NIHS 2010/11 this was categorised as low, medium or high while categories in HARP were broadly similar. In HARP, participants in NI reported a higher percentage of older adults not engaged in regular PA compared with the RoI sample participants. As a consequence, across the other categories of PA, RoI participants consistently engaged in more PA than their counterparts in NI. Overall approximately 23% of HARP participants reported high moderate or vigorous PA on a regular basis. Comparisons between TILDA and NIHS 2010/11 participants repeated this cross-region pattern with more than a third (33.5%) of RoI older adults reporting moderate PA compared to just a quarter (25.4%) of NI older adults. Comparisons with Morgan et al (2011) who also examined PA levels in a sample of RoI and NI older adults suggest a shift in the amount of PA older adults are currently engaging in. For example, in Morgan et al (2011), 35.6% of RoI older adults and 38.8% of NI participants were engaged in low levels of PA as measured by the IPAQ. While this is slightly lower in the more recent RoI sample (TILDA) at 33.1%, there appears to be a much larger proportion of NI older adults (NIHS 2010/11, 55.1%) in the low PA category. This suggests that more older adults in NI are engaging in low levels of PA than 4-5 years ago. Importantly, the levels of PA in NI adults over 50 years reported in our study are also consistent with findings from the rest of the UK (Townsend et al., 2012). In relation to older adults in RoI there has also been a shift in the amount of PA from medium to high levels. In sum, older adults in RoI appear to have increased their levels of high PA. This could be as a result of initiatives in

this region in the time between studies or a reflection of a more health-conscious cohort of ageing adults.

Experience of recent pain was another key variable investigated across these studies. In the earlier study, HARP, 24.5% of older adults reported either severe or moderate pain in the last week. Similar to PA, the proportion of older adults with any pain was higher for NI older adults (30.3%) compared with RoI participants (20.3%). In the later surveys from these regions the pattern is similar, with lower levels of pain in RoI (TILDA) participants (26%) compared to older adults from NI (NIHS 2010/11) (45.2%). While the duration of pain (i.e. three months or longer would indicate chronic pain) is not considered here, comparable levels of chronic pain in the Irish population have been reported at 35.5% (Raferty, Sarma, Murphy et al., 2011) and at 45% in a community survey conducted in England (N=4172) (Carnes, 2011).

In terms of the main aims of the study, no mediating or moderating effects of pain on the association between PA and depression were seen. Adding pain to the models for each dataset did not attenuate the association between PA and depressive/distress symptoms. Thus, higher levels of PA are protective against depression/distress, irrespective of the levels of pain an older adult reports. Similarly, there was no synergistic interaction between pain and PA when predicting depression/distress. In other words, while incremental associations were seen between PA and pain and depression, as expected, the combination of PA and pain did not provide any multiplicative effects over and beyond each variable alone. Thus, pain levels did not moderate the association between PA and depression/distress. This is in contrast to previous findings that reported a partial mediating effect of PA on the relationship between pain and depression (Sabiston et al., 2012) and the moderating effect of depression on PA demonstrated at all levels of pain reported by Mossey et al (2000). Given that all of our analyses were conducted on population-based data and not small community-based samples, and the findings were replicated across all datasets, it is likely a robust conclusion that pain does not mediate or moderate the relationship between PA and depression. Overall, these findings suggest that clinicians can continue to recommend PA for mental well-being, irrespective of an individual's pain levels (assuming that pain is not directly preventing PA).

We also conducted some tentative analyses on the prospective association between the explanatory variables and depressive symptoms at follow-up in the HARP study. Depression at baseline was a significant predictor of subsequent depression, as would be expected from other literature (Byers et al., 2012; Doyle et al. 2011). Interestingly, low-to-moderate levels of PA were protective of subsequent depression (when controlling for baseline depression). However, this did not survive adjustment for current pain, and current PA levels were unavailable. It is therefore unknown to what extent current PA would account for the association between baseline PA and depressive symptoms at follow-up. There was no significant association seen for the higher category of PA. However, the less reliable measure of PA in this cohort may be

concealing its protective effects. Although pain at baseline was not relevant, the level of pain at follow-up was, suggesting that perhaps there is no long-term impact of pain on mental health, but that current pain is far more relevant. Further longitudinal studies using robust measures need to be conducted in order to clarify the long-term benefits of PA on mental and health and well-being and the comparative contribution of pain to depressive symptoms over time in this age cohort.

Finally, only participants- in HARP did not show increased in healthcare utilisation for those who were depressed/distressed. For both TILDA and NIHS 2010/11 participants, being depressed/distressed led to significantly increased likelihood of higher numbers of GP visits within the last 12 months, or a significantly increased likelihood of visiting a healthcare professional within the past 2 weeks. The pattern was inconsistent across levels of PA in that significant reductions in healthcare utilisation were only found at the high level of PA in TILDA. In NIHS 2010/11, reductions in healthcare utilisation were also seen for those at moderate levels of PA, but although the association was in the same direction for those at higher levels of PA, it was somewhat smaller and non-significant. It is unclear why this conflicting pattern emerged but difficulties in measuring PA in a consistent manner may explain this, and the fact that widely different time intervals for healthcare utilisation (last 2 weeks/last 12 months) were recorded. The most consistent finding across the surveys was that increasing pain levels were associated with increased GP or health professional visits. While prevalence estimates vary, pain gradually increases as we age (Gibson and Lussier, 2012). The associated burden on health services, as demonstrated here and elsewhere (Blyth, March, Brnabic and Cousins, 2004), necessitates effective pain management techniques that eases this demand and adequately relieves unnecessary suffering in older cohorts.

This study makes an important, clinically-relevant contribution to active ageing research in the island of Ireland. To our knowledge no other population-based approach has investigated the mediating or moderating effect of pain on PA or depression in Irish people. Overall, our findings suggest that pain does not play a mediating or moderating role in the relationship between PA and depression. Instead our analyses found that both PA and pain were independent predictors of depressive/psychological distress symptoms in Irish older adults. Therefore, our findings would support ongoing initiatives in this area. The *Go for Life* initiative in the RoI (http://ageandopportunity.ie/node/40) and the *Ageing Well* programme (http://www.ageingwellnetwork.com/) in NI have both been designed and implemented with a view to encouraging and supporting older people to engage in more PA thereby improving their mental and physical health. Our results show that clinicians and health service providers should therefore continue to consider and promote PA as a treatment for depression, irrespective of the pain levels of their patients. Although PA and pain are clearly inter-related, there is no evidence of synergistic effects. Therefore, treatment plans or interventions need to consider both of these factors independently.

These findings will be relevant for a range of healthcare professionals, health promotion, policy makers and service providers and provide important insights into how the physical and mental health of respondents may be improved. The importance of the treatment of depression in older people has been highlighted repeatedly (Chapman and Perry, 2008) and the protective effects of PA are evidenced in older people in Ireland. These findings also inform public health and policy approaches for active and healthy ageing (e.g. public transport to increase PA, the need for effective pain management, etc.). Given the ageing population both here and abroad, increasing investment in initiatives and strategies aimed at improving mental and physical health in older people is an intuitive step and in the long-term potentially cost-effective.

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Appendices

Appendix A:

Survey items from HARP, TILDA and NIHS 2010/11 used in the current study

Notes:

1. The number/letter before each question indicates where the item can be found in the original surveys.

2. HARP was completed by interviewers using paper and pen. TILDA and NIHS 2010/11 were completed using computer-assisted personal interviewing (CAPI) therefore; the format of the items below is different by survey.

HARP

SECTION A – BACKGROUND INFORMATION

A1 *[Int. tick as appropriate]*   **Respondent is:**   Male .... ❏$_1$ Female ....❏$_2$

A2 What is your date of birth? ⬜⬜ ⬜⬜ ⬜⬜⬜⬜
                                        Day   Month   Year

A3 What is your marital status? Married ❏$_1$ Separated ❏$_2$ Divorced ❏$_3$ Widowed ❏$_4$

 Never married / Single ❏$_5$

SECTION B – HEALTH PROMOTION

B3   LEISURE ACTIVITIES: Thinking back over the last 7-day's (a week), about how many times did you do the following kinds of exercise for more than 20 minutes during your free time?

(Please write the appropriate number on each line)   **Times**
(a) **MILD EXERCISE** (e.g. easy walking, golf, bowling, light gardening)   _____
(b) **MODERATE EXERCISE** (e.g. fast walking, tennis, easy cycling heavy gardening)   _____
(c) **STRENUOUS EXERCISE** (e.g. running, vigorous swimming, long distance cycling)   _____

B4 Do you or did you ever smoke?

Yes, regularly now ❏$_1$ Yes, occasionally now ❏$_2$ Yes, regularly in the past ❏$_3$

Yes, occasionally in past ❏$_4$ No, never ❏$_5$

SECTION C – GENERAL HEALTH AND OUTLOOK

C9 In general, how would you rate your general health?

Current health: Excellent ❑$_1$ Good ❑$_2$ Fair ❑$_3$ Poor ❑$_4$ Very Poor ❑$_5$

C17 How much pain have you had in the past week?

None ❑$_1$→ **Go to D.1**   Mild pain ❑$_2$ Moderate pain ❑$_3$ Severe pain ❑$_4$

SECTION E – YOUR FEELINGS (GHQ-12)

E1 Next I want to ask about the way you have been feeling recently. These questions are being asked of people generally, so some questions may not apply to you, but for each statement, can you say what best describes the way you have been feeling in the past week.

E1.1   I still enjoy the things I used to enjoy:

Definitely as much	Not quite so much	Only a little	Hardly at all
☐$_1$	☐$_2$	☐$_3$	☐$_4$

E1.2   I can laugh and see the funny side of things:

As much as I always could	Not quite so much now	Definitely not so much now	Not at all
☐$_1$	☐$_2$	☐$_3$	☐$_4$

E1.3   I feel cheerful:

Not at all	Not often	Sometimes	Most of the time
☐$_1$	☐$_2$	☐$_3$	☐$_4$

E1.4   I feel as if I am slowed down:

Nearly all the time	Very often	Sometimes	Not at all
☐$_1$	☐$_2$	☐$_3$	☐$_4$

E1.5 I have lost interest in my appearance:

Definitely	I don't take so much care as I should	I may not take quite as much care	I take as much care as ever
☐$_1$	☐$_2$	☐$_3$	☐$_4$

E1.6   I look forward with enjoyment to things:

As much as ever I did	Rather less than I used to	Definitely less than I used to	Hardly at all
$\square_1$	$\square_2$	$\square_3$	$\square_4$

E1.7   I can enjoy a good book or radio or TV programme:

Often $\square_1$ **Sometimes $\square_2$**   Not often $\square_3$ Very seldom $\square_4$

SECTION F1 – YOUR VIEWS ABOUT QUALITY OF CARE AND ACCESS TO GP SERVICES

F1.4 In the last 12 months how many times have you seen any GP? _____ times

SECTION H- FINAL SECTION

H10   Which of the following best describes the highest level of education you have completed yourself?

Primary Education or Less .... $\square_1$
Some 2nd level, no exams .... $\square_2$
Passed Group, Inter or Junior Cert .... $\square_3$
Passed Leaving/Matric .... $\square_4$
Diploma or equivalent from university/RTC/IT .... $\square_5$
Primary/Bachelors Degree or equivalent .... $\square_6$
Higher Degree .... $\square_7$

H12   What was your main pre-retirement occupation? *[If farmer, please record number of acres farmed. If relevant, record grade or rank e.g. army, garda/police, civil service]*

_____

[Int. -   If respondent had an occupation ask:]

H13 Were you employed or self-employed?

Employed…………………$\square_1$
Self-employed………....…....$\square_2$

H14 Did you manage or supervise others?

No………………………………… $\square_1$ **H14b** How many people do/did you manage
                                                                          or supervise?

Yes - Manager……………..………$\square_2$ Less than 25................................$\square_1$
Yes - Foreman or supervisor...…… $\square_3$ 25 or more……………………   ...$\square_2$

[Int .- If respondent is female ask:]

H15 What was the occupation of your spouse in his most recent job or business? Please describe as fully as possible the type of work done. [Int. If farmer, record the acreage, if manager or supervisor record the numbers supervised and if relevant, record the rank or grade – e.g. rank in army or Gardaí, grade in civil Service.]

_____

TILDA

SECTION 1. Cover Screen-H (Household – only asked once)

CS002: In which month and year were you born?
MONTH: ____YEAR: _____
DK_____MONTH
DK ____YEAR
RF_____MONTH
RF_____YEAR

BL:IF CS002=DK or RF then GO TO CM003, OTHERWISE GO TO CS004

CS004: IWER: (Code without asking.) Is Respondent male or female?
1. MALE
2. FEMALE
(HRS/ELSA/SHARE)

SECTION 3. DEMOGRAPHICS (DM)

SHOW CARD CS1
CS006: [For the first interview read out] Can I just check again, are you …
[Otherwise] Are you…
1. Married
2. Living with a partner as if married
3. Single (never married) **GO TO DM001**
4. Separated
5. Divorced
6. Widowed
(HRS)

Note: Married includes those living temporarily apart due to illness, work, etc..
Living with a partner is a situation where there is no formal marriage but R is living in a marriage-like relationship.
Separated is a situation where R is not living with partner and there is no marriage-like relationship anymore.

DM001: Now I would like to ask some questions about your background. What is the highest level of education you have completed?
1. Some primary (not complete)
2. Primary or equivalent
3. Intermediate/junior/group certificate or equivalent
4. Leaving certificate or equivalent
5. Diploma/certificate
6. Primary degree
7. Postgraduate/higher degree
96. None
98. DK
99. RF
(TILDA)

SECTION 5. PHYSICAL & COGNITIVE HEALTH (PH)

IWER: CODE THE ONE THAT APPLIES
PH001: Now I would like to ask you some questions about your health.

Would you say your health is..
IWER: READ OUT
1. excellent,
2. very good,
3. good,
4. fair,
5. or, poor?
98. DK
99. RF
(ELSA/ HRS/ SHARE)

Pain section

PH501: Are you often troubled with pain?
1. Yes   **GO TO PH502**
5. No   **GO TO PH507**
98. DK   **GO TO PH507**
99. RF   **GO TO PH507**
(ELSA/HRS)

IWER: CODE THE ONE THAT APPLIES
PH502: How bad is the pain most of the time? Is it...
IWER: READ OUT
1 mild,
2 moderate,
3 or, severe
98. DK
99. RF

SECTION 7. HEALTHCARE UTILISATION (HU)

HU005: In the last 12 months, about how often did you visit your GP?
IWER: IF RESPONDENT HAS NOT VISITED GP IN THE LAST 12 MONTHS CODE 0
0…200
98. DK   **GO TO HU007**
99. RF   **GO TO HU007**
BL:
IF HU005=0 GO TO HU007
IF HU005>0 AND HU001=1, 2 GO TO HU007
IF HU005>0 AND HU001~=1, 2 GO TO HU006
(SHARE)

SECTION 8. MENTAL HEALTH (MH)

Depression

IWER: SHOW CARD MH1

INTRO: The next section of the interview is about people's mood, feelings and well-being. I am going to read a list of statements that describe some of the ways you may have felt or behaved in the last week. Please look at this card and indicate how often you have felt this way during the past week.

MH001: I was bothered by things that usually don't bother me
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
  1. Rarely or none of the time (less than 1 day)
  2. Some or a little of the time (1-2 days)
  3. Occasionally or a moderate amount of time (3-4 days)
  4. All of the time (5-7 days)
98. DK
99. RF

MH002: I did not feel like eating; my appetite was poor.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
  1. Rarely or none of the time (less than 1 day)
  2. Some or a little of the time (1-2 days)
  3. Occasionally or a moderate amount of time (3-4 days)
  4. All of the time (5-7 days)
98. DK
99. RF

MH003: I felt that I could not shake off the blues even with help from my family or friends.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
  1. Rarely or none of the time (less than 1 day)

    2.   Some or a little of the time (1-2 days)
    3.   Occasionally or a moderate amount of time (3-4 days)
    4.   All of the time (5-7 days)

98. DK
99. RF

MH004: I felt that I was just as good as other people.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
    1.   Rarely or none of the time (less than 1 day)
    2.   Some or a little of the time (1-2 days)
    3.   Occasionally or a moderate amount of time (3-4 days)
    4.   All of the time (5-7 days)

98. DK
99. RF

MH005: I had trouble keeping my mind on what I was doing.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
    1.   Rarely or none of the time (less than 1 day)
    2.   Some or a little of the time (1-2 days)
    3.   Occasionally or a moderate amount of time (3-4 days)
    4.   All of the time (5-7 days)

98. DK
99. RF

MH006: I felt depressed.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
    1.   Rarely or none of the time (less than 1 day)
    2.   Some or a little of the time (1-2 days)
    3.   Occasionally or a moderate amount of time (3-4 days)
    4.   All of the time (5-7 days)

98. DK
99. RF

MH007: I felt that everything I did was an effort.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
    1.   Rarely or none of the time (less than 1 day)
    2.   Some or a little of the time (1-2 days)
    3.   Occasionally or a moderate amount of time (3-4 days)
    4.   All of the time (5-7 days)

98. DK
99. RF

MH008: I felt hopeful about the future.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
    1.   Rarely or none of the time (less than 1 day)
    2.   Some or a little of the time (1-2 days)
    3.   Occasionally or a moderate amount of time (3-4 days)

       4.   All of the time (5-7 days)

98. DK

99. RF

MH009: I thought my life had been a failure.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
       1.   Rarely or none of the time (less than 1 day)
       2.   Some or a little of the time (1-2 days)
       3.   Occasionally or a moderate amount of time (3-4 days)
       4.   All of the time (5-7 days)

98. DK

99. RF

MH010: I felt fearful.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
       1.   Rarely or none of the time (less than 1 day)
       2.   Some or a little of the time (1-2 days)
       3.   Occasionally or a moderate amount of time (3-4 days)
       4.   All of the time (5-7 days)

98. DK

99. RF

MH011: My sleep was restless.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
       1.   Rarely or none of the time (less than 1 day)
       2.   Some or a little of the time (1-2 days)
       3.   Occasionally or a moderate amount of time (3-4 days)
       4.   All of the time (5-7 days)

98. DK

99. RF

MH012: I was happy.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
       1.   Rarely or none of the time (less than 1 day)
       2.   Some or a little of the time (1-2 days)
       3.   Occasionally or a moderate amount of time (3-4 days)
       4.   All of the time (5-7 days)

98. DK

99. RF

MH013: I talked less than usual.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
       1.   Rarely or none of the time (less than 1 day)
       2.   Some or a little of the time (1-2 days)

3. Occasionally or a moderate amount of time (3-4 days)
        4. All of the time (5-7 days)
98. DK
99. RF

MH014: I felt lonely.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
        1. Rarely or none of the time (less than 1 day)
        2. Some or a little of the time (1-2 days)
        3. Occasionally or a moderate amount of time (3-4 days)
        4. All of the time (5-7 days)
98. DK
99. RF

MH015: People were unfriendly.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
        1. Rarely or none of the time (less than 1 day)
        2. Some or a little of the time (1-2 days)
        3. Occasionally or a moderate amount of time (3-4 days)
        4. All of the time (5-7 days)
98. DK
99. RF

MH016: I enjoyed life.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
        1. Rarely or none of the time (less than 1 day)
        2. Some or a little of the time (1-2 days)
        3. Occasionally or a moderate amount of time (3-4 days)
        4. All of the time (5-7 days)
98. DK
99. RF

MH017: I had crying spells.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
        1. Rarely or none of the time (less than 1 day)
        2. Some or a little of the time (1-2 days)
        3. Occasionally or a moderate amount of time (3-4 days)
        4. All of the time (5-7 days)
98. DK
99. RF

MH018: I felt sad.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
        1. Rarely or none of the time (less than 1 day)

2. Some or a little of the time (1-2 days)
3. Occasionally or a moderate amount of time (3-4 days)
4. All of the time (5-7 days)
98. DK
99. RF

MH019: I felt that people disliked me.
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
1. Rarely or none of the time (less than 1 day)
2. Some or a little of the time (1-2 days)
3. Occasionally or a moderate amount of time (3-4 days)
4. All of the time (5-7 days)
98. DK
99. RF

MH020: I could not get "going."
IWER: PROMPT IF NECESSARY - 'WOULD YOU SAY THIS STATEMENT DESCRIBES THE WAY YOU FELT DURING THE PAST WEEK RARELY…….. SOME OF THE TIME…..?'
1. Rarely or none of the time (less than 1 day)
2. Some or a little of the time (1-2 days)
3. Occasionally or a moderate amount of time (3-4 days)
4. All of the time (5-7 days)
98. DK
99. RF

SECTION 9. EMPLOYMENT SITUATION (WE)

Current activity status
IWER: SHOW CARD WE1

WE001. Now I'm going to ask you some questions about work, retirement and pensions. Please look at card WE1. Which one of these would you say best describes your current situation?

IWER: CODE THE ONE THAT APPLIES

1 Retired   **GO TO WE003**
2 Employed **GO TO WE101**
(including unpaid work in family business, temporarily away from work, or participating in apprenticeship or employment programme - such as Community Employment)
3 Self-employed (including farming) **GO TO WE201**
4 Unemployed **GO TO WE003**
5 Permanently sick or disabled **GO TO WE003**
6 Looking after home or family **GO TO WE003**
7 In education or training **GO TO WE003**
95 Other (specify) **GO TO WE002**
98. DK **GO TO WE003**
99. RF **GO TO WE003**

(ELSA)

SECTION 13. BEHAVIOURAL HEALTH (BH)

INTRO: Now I would like to ask some questions about your lifestyle.

Smoking
BH001: Have you ever smoked cigarettes, cigars, cigarillos or a pipe daily for a period of at least one year?
1. Yes   **GO TO BH002**
5. No   **GO TO BH101**
98. DK **GO TO BH101**
99. RF **GO TO BH101**
(SHARE/ Similar question ELSA/HRS)

BH002: Do you smoke at the present time?
IWER: IF RESPONDENT SMOKED IN THE PAST 3 MONTHS CODE 1
1. Yes   **GO TO BH004**
5. No, I have stopped   **GO TO BH003**
98. DK   **GO TO BH003**
99. RF   **GO TO BH003**
(SHARE/ Similar question ELSA/HRS)

Exercise section
INTRO: We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The next set of questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and garden work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the **last 7 days**.
Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

BH101: During the **last 7 days**, on how many days did you do **vigorous** physical
activities like heavy lifting, digging, aerobics, or fast bicycling?
1. _____Number of days per week
5. No I have not done any vigorous physical activities   **GO TO BH103**
98. DK/ NOT SURE
99. RF

BH102: How much time did you usually spend doing **vigorous** physical activities on one of those days?
_____ hours per day (0 …10)
_____ minutes per day   **[bh102a]**
98. DK/NOT SURE
99. RF

BH103: Think about all the **moderate** activities that you did in the **last 7 days**. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

1. _____ days per week
5. No I have not done any moderate physical activities   **GO TO BH105**
98. DK
99. RF

BH104: How much time did you usually spend doing **moderate** physical activities on one of those days?
_____ hours per day (0 …10)
_____ minutes per day   **[bh104a]**
98. DK/NOT SURE
99. RF

BH105: Now think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.
During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
1. _____ days per week
5. No I have not done any walking   **GO TO BH107**
98. DK
99. RF

BH106: How much time did you usually spend **walking** on one of those days?
_____ hours per day (0 …5)
_____ minutes per day   **[bh106a]**
98. DK/NOT SURE
99. RF

BH107: The last question is about the time you spent **sitting** on weekdays during the **last 7 days.** Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television. During the **last 7 days**, how much time (per day) did you spend **sitting** on a week day?
(This question is looking for the usual number of hours spent <u>sitting</u> on a typical week day. If respondent has difficulty calculating, interviewer may suggest they approximate by subtracting time spent sleeping, walking, standing, exercising etc. from the 24 hours)

_____ hours per day (0 …20)
_____ minutes per day   **[bh107a]**
98. DK/NOT SURE
99. RF

NIHS 2010/11

BASIC HOUSEHOLD INFORMATION
(Collected from HOH/spouse/partner or, as a last resort, from some other responsible adult).

I am first going to ask a few questions about the people who live here and some details about your accommodation.

1. How many adults are there in your household, that is, people aged 16 or over whose main residence this is and who are catered for by the same person as yourself or share living accommodation with you?
FIRST NAME OF EACH ADULT ENTERED IN BOX THEN:
2. Sex
3. Age
4. Marital status:
      Married (spouse in household)
      Married (spouse not in household)
      Cohabiting
      Single (never married)
      Separated
      Divorced

GENERAL HEALTH SECTION

1. ALL
"How is your health in general, would you say it was":
      Very Good
      Good
      Fair
      Bad
      Very Bad

PHYSICAL ACTIVITY SECTION

Now I am going to ask you about the time you spent being physically active during the last 7 days. Please answer each question even if you do not consider yourself to be an active person. I will be asking you about activities you did at work, to get from place to place, for exercise or sport, or as part of your house or garden chores.
(CONTINUE);
ALL

Q1 During the last 7 days, on how many days did you do activities which took vigorous or hard effort, for at least 10 minutes at a time, like running, aerobics, heavy gardening or anything else that caused large increases in breathing or heart rate?

IF Q1 = RESPONSE OF 1,2,3 …7 DAYS THEN ASK Q2

Q2 On each day you did vigorous activity for at least 10 minutes, how much time on average (in minutes) did you spend doing it?
INTERVIEWER - PLEASE RECORD TIME IN MINUTES
ALL

Q3 During the last 7 days, on how many days did you do activities which took moderate effort, for at least 10 minutes at a time, like cycling, vacuuming, gardening or anything else that caused some increase in breathing or heart rate? Please do not include walking in your answer.

IF Q3 = RESPONSE OF 1,2,3 …7 DAYS THEN ASK Q4

Q4 On each day you did moderate activity for at least 10 minutes, how much time on average (in minutes) did you spend doing it?
INTERVIEWER - PLEASE RECORD TIME IN MINUTES
ALL

Q5 During the last 7 days, on how many days did you walk at a brisk or fast pace, for at least 10 minutes at a time, to get from place to place, for recreation, pleasure or exercise?

IF Q5 = RESPONSE OF 1,2,3 …7 DAYS THEN ASK Q6

Q6 On each day when you walked briskly for at least 10 minutes, how much time on average (in minutes) did you spend walking?
INTERVIEWER - PLEASE RECORD TIME IN MINUTES
ALL

Q7 I would like you now to think about all of the walking you have done in last 4 weeks, either locally or away from home. Please include any country walks and any walking in the course of your work or to and from work.":
(CONTINUE);
ALL

SELF COMPLETION FOR GHQ12, WARWICK-EDINBURGH, CERVICAL SMEAR, BREAST SCREENING AND EQ5D.

GHQ12
ALL

Q11. Have you recently been able to concentrate on whatever you are doing?":
better	"Better than usual",
same	"Same as usual",
less	"Less than usual",
muchless	"Much less than usual"

ALL

Q12. Have you recently lost much sleep over worry?":
notatall	"Not at all",
nomore	"No more than usual",
more	"Rather more than usual",
muchmore	"Much more than usual"

Q13. "Have you recently felt that you are playing a useful part in things?":
  moreso   "More so than usual",
  sameas   "Same as usual",
  lessuse   "Less so than usual",
  mluseful   "Much less useful"

Q14. "Have you recently felt capable of making decisions about things?":
  morethan   "More so than usual",
  sameuse   "Same as usual",
  lessthan   "Less so than usual",
  mlcapab   "Much less capable"

Q15. "Have you recently felt under constant strain?":
  notatall   "Not at all",
  nomore   "No more than usual",
  more   "Rather more than usual",
  muchmore   "Much more than usual"

Q16. "Have you recently felt you couldn't overcome you difficulties?":
  notatall   "Not at all"
  nomore   "No more than usual",
  more   "Rather more than usual",
  muchmore   "Much more than usual"

Q17. "Have you recently been able to enjoy your normal day-to-day activities?":
  mothan   "More so than usual",
  samusual   "Same as usual",
  lessso   "Less so than usual",
  muusual   "Much less able"

Q18. "Have you recently been able to face up to your problems?"
  mothan   "More so than usual",
  samusual   "Same as usual",
  lessso   "Less so than usual",
  muusual   "Much less able"

Q19. "Have you recently been feeling unhappy and depressed?"
- notatall   "Not at all",
- nomore   "No more than usual",
- more   "Rather more than usual",
- muchmore   "Much more than usual"

ALL

Q20. "Have you recently been losing confidence in yourself?"
- notatall   "Not at all",
- nomore   "No more than usual",
- more   "Rather more than usual",
- muchmore   "Much more than usual"

ALL

Q21. "Have you recently been thinking of yourself as a worthless person?":
- notatall   "Not at all",
- nomore   "No more than usual",
- more   "Rather more than usual",
- muchmore   "Much more than usual"

Q22. "Have you recently been feeling reasonably happy, all things considered?":
- morehapp   "More so than usual",
- samehapp   "Same as usual",
- lesshapp   "Less so than usual",
- mlhappy   "Much less happy");

ALL

EQ5D SELF COMPLETION
ASK ALL QUESTIONS OF EVERYONE

Q4. "Pain/ Discomfort":
A "I have no pain or discomfort",
B "I have moderate pain or discomfort",
C "I have extreme pain or discomfort")

Q7. "Please indicate the description that best applies to you":
A "I am a current smoker",
B "I am an ex-smoker",
C "I have never smoked")

Q8. "Have you consulted your GP or other health professional in the past two weeks":
     Yes   No

EMPLOYMENT:
[**INTROWK**] I am going to ask you some questions about employment now...

NOTE: THE PERSON ABOUT WHOM THE QUESTIONS ARE BEING ASKED HRP,a Male aged 45

1. CONTINUE
[**PAIDWORK**] Did you do any paid work in the 7 days ending Sunday.. *PREVIOUS DATE SUN* .., either as an employee or as self-employed?
1. Yes -> IF ((MALE AGE<65) OR (FEMALE AGE<63)) -> [SCHEMES] ELSE [MJOBINT]
2. No -> [ANYWORK]

[**OCCUP**] What is/was you occupation?
DESCRIBE FULLY

[**TITLE**] What is/was your job title? ENTER JOB TITLE
[**FULLY**] Please describe fully what you do/did

 [**SOC**] Standard Occupational Classification
[**SEG**] Socio-Economic Group

1 Employer govt., industry	10 Semi-skilled manual
2 Manager govt., industry	11 Unskilled manual
3 Professional, self employed	12 Own account workers
4 Professional employee	13 Farmer - employer, manager
5 Intermediate non-manual	14 Farmer - own account
6 Junior non-manual	15 Agricultural worker
7 Personal service	16 Armed forces
8 Foremen – manual	17 Inadequate definition
9 Skilled manual	18 No gainful occupation

Appendix B. Tables showing the results of the mediation and moderation analyses across age categories for TILDA and NIHS 2010/11.

Table A1. Results of mediation and moderation analyses across the four age categories for TILDA.

Variable Name	<55 years (n=1622)		55-64 years (n=3042)		65-74 years (n=2159)		75+ years (1340)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Model 1								
Level of PA								
Low	1		1		1		1	
Medium	.70 (.47-1.0)	.074	.93 (.69-1.3)	.637	.72 (.51-1.0)	.067	.77 (.47-1.3)	.289
High	.68 (.46-1.0)	.063	.86 (.62-1.2)	.364	.50 (.33-.77)	.002	.83 (.44-.1.6)	.564
Model 2								
Experience of pain								
None/mild	1		1		1		1	
Moderate	1.9 (1.2-2.9)	.008	1.9 (1.5-2.5)	.000	2.2 (1.5-3.2)	.000	1.9 (1.2-3.1)	.007
Severe	1.8 (1.1-3.0)	.033	2.3 (1.6-3.3)	.000	3.1 (1.9-4.9)	.000	2.1 (1.1-3.8)	.019
Model 3								
Level of PA								
Low	1		1		1		1	
Medium	.69 (.47-1.0)	.065	.98 (.73-1.3)	.871	.75 (.52-1.1)	.116	.85 (.51-1.4)	.529
High	.69 (.46-1.0)	.069	.88 (.62-1.2)	.442	.52 (.34-.81)	.004	.83 (.44-1.6)	.571
Experience of pain								
None/mild	1		1		1		1	
Moderate	1.9 (1.2-3.0)	.006	1.9 (1.5-2.6)	.000	2.2 (1.5-3.2)	.000	1.9 (1.2-3.0)	.010
Severe	1.8 (1.1-3.1)	.030	2.3 (1.6-3.3)	.000	2.9 (1.8-4.8)	.000	1.9 (1.1-3.7)	.027

Model 4

Level of PA	1		1		1		1	
Low	.87 (.63-1.2)	.406	.43 (.23-.79)	.008	.72 (.36-1.5)	.358	.48 (.22-1.1)	.066
Moderate	.92 (.67-1.3)	.597	.39 (.21-.76)	.006	.39 (.17-.93)	.033	.54 (.19-1.5)	.227
High								
Experience of pain	1		1		1		1	
None/mild pain	1.9 (1.2-2.8)	.004	2.2 (1.1-4.4)	.022	.99 (.38-2.6)	1.00	1.6 (.79-3.2)	.197
Moderate pain	2.2 (1.4-3.7)	.002	1.9 (.92-4.2)	.080	2.5 (1.2-5.6)	.019	1.0 (.36-2.8)	.996
Severe pain								
Interaction terms	1		1		1		1	
Low PA*None/mild pain								
Moderate PA*Moderate Pain	1.1 (.61-1.9)	.811	1.5 (.57-3.9)	.405	3.0 (.83-11.2)	.093	1.9 (.47-7.6)	.377
	.90 (.50-1.6)	.734	.73 (.22-2.4)	.608	4.3 (.84-21.9)	.079	1.2 (.27-5.5)	.789
Moderate PA*Severe Pain	1.1 (.56-2.3)	.729	3.4 (1.0-11.3)	.043	.73 (.17-3.2)	.677	3.0 (.36-25.8)	.310
High PA*Moderate pain	.76 (.36-1.6)	.480	1.3 (.31-5.1)	.752	2.05 (.378-11.1)	.405	2.1 (.23-19.6)	.506
High PA*Severe pain								

Note. PA = Physical activity; OR = Odds ratio; CI = Confidence interval. Adjusted for gender, marital status, age, social class, education, self-rated health, smoking status, and number of GP visits in last 12 months.

Table A2. Results of mediation analyses across the four age categories for NIHS 2010/11.

Variable Name	50-55 years (n=339)		55-64 years (n=622)		65-74 years (n=553)		75+ years (n=363)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Model 1								
Level of PA								
Low	1		1		1		1	
Medium	.49 (.23-1.1)	.071	.57 (.26-1.3)	.168	.68 (.25-1.8)	.441	.46 (.10-2.0)	.305
High	.46 (.20-1.1)	.078	1.6 (.86-3.1)	.135	.47 (.12-1.9)	.992	.82 (.14-4.8)	.822
Model 2								
Experience of pain								
None/mild	1		1		1		1	
Moderate	2.9 (1.3-6.6)	.011	2.1 (1.1-4.2)	.031	2.6 (1.0-6.7)	.050	5.3 (1.5-18.1)	.008
Severe	5.8 (1.7-19.3)	.004	2.1 (.86-5.0)	.104	1.7 (.57-5.4)	.329	5.4 (1.2-25.0)	.030
Model 3								
Level of PA								
Low	1		1		1		1	
Medium	.61 (.28-1.5)	.221	.58 (.26-1.3)	.180	.64 (.23-1.7)	.375	.58 (.13-2.6)	.472
High	.53 (.21-1.2)	.161	1.7 (.89-3.4)	.103	.50 (.12-2.0)	.335	.98 (.14-6.6)	.980
Experience of pain								
None/mild	1		1		1		1	
Moderate	2.8 (1.2-6.5)	.015	2.2 (1.1-4.4)	.024	2.5 (.97-6.6)	.057	4.9 (1.4-17.1)	.012
Severe	4.7 (1.5-15.5)	.010	2.2 (.90-5.6)	.081	1.6 (.52-5.2)	.399	5.1 (1.1-24.1)	.042

Note. PA = Physical activity; OR = Odds ratio; CI = Confidence interval. Adjusted for gender, marital status, age group, social class, smoking status, and number of GP visits in last 2 weeks.

Table A3. Results of moderation analyses across the four age categories for NIHS 2010/11.

Variable Name	50-55 years (n=338)		55-64 years (n=618)		65-74 years (n=550)		75+ years (n=347)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Model 4								
Level of PA								
Low	1		1		1		1	
Moderate	1.3 (.34-5.1)	.692	.62 (.18-2.2)	.461	.12 (.01-1.1)	.057	.93 (.10-9.1)	.952
High	.88 (.18-4.4)	.878	1.1 (.39-2.9)	.881	6.6 (2.8-1.5)	<.001	1.1 (2.3-5.4)	<.001
Experience of pain								
None/mild pain	1		1		1		1	
Moderate pain	9.3 (2.8-30.8)	<.001	4.5 (1.9-10.4)	<.001	2.3 (.91-5.7)	.079	7.2 (1.6-31.2)	.009
Severe pain	21.8 (5.9-79.1)	<.001	6.1 (2.4-15.4)	<.001	3.4 (1.2-9.4)	.020	11.6 (2.2-60.8)	.004
Interaction terms								
Low PA*None/mild pain	1		1		1		1	
Moderate PA*Moderate Pain	.24 (.04-1.2)	.088	.31 (.06-1.6)	.159	3.7 (.34-40.7)	.283	.34 (.02-7.5)	.494
Moderate PA*Severe Pain	Omitted	-	1.5 (.22-11.1)	.664	Omitted	-	Omitted	-
High PA*Moderate pain	.33 (.05-2.3)	.260	.72 (.19-2.6)	.613	Omitted	-	Omitted	-
High PA*Severe pain	Omitted	-	Omitted	-	Omitted	-	Omitted	-

Note. Adjusted for gender, marital status, age group, social class, smoking status, and GP or other health professional visit in last 2 weeks.
Several interaction terms were omitted from moderation analyses due to very small numbers.
PA = Physical activity; OR = Odds ratio; CI = Confidence interval.