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# Health inequalities on the island of Ireland: Area-level deprivation, health and lifestyle factors in Northern Ireland and Ireland

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Initiative

AN INSTITIÚID UM THAIGHDE EACNAMAÍOCHTA AGUS SÓISIALTA
ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

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## Abbreviations

| | |
|---|---|
| aOR | Adjusted odds ratio |
| BMI | Body mass index |
| CATI | Computer-assisted telephone interviewing |
| CSO | Central Statistics Office |
| DEIS | Delivering Equality of Opportunity in Schools |
| ESRI | Economic and Social Research Institute |
| GHQ | General Health Questionnaire |
| GP | General practitioner |
| HP | Pobal Haase–Pratschke (HP) Index |
| HSCIMS | Health and Social Care Inequalities Monitoring System |
| HSNI | Health Survey Northern Ireland |
| IHS | Irish Health Survey |
| MVPA | Moderate-to-vigorous physical activity |
| NI | Northern Ireland |
| NICOLA | Northern Ireland Cohort for the Longitudinal Study of Ageing |
| NIMDM | Northern Ireland Multiple Deprivation Measure |
| NISRA | Northern Ireland Statistics and Research Agency |
| NUTS | Nomenclature of territorial units for statistics |
| OR | Odds ratio |
| PA | Physical activity |
| PHKH | Public Health Knowledge Hub |
| PHQ | Patient Health Questionnaire |
| pp | percentage points |
| Q | Quintile |
| SA | Small area |
| SOA | Super output area |
| SRH | Self-rated health |
| UK | United Kingdom |
| WHO | World Health Organization |

# Executive summary

## Introduction

This report provides a cross-jurisdictional analysis of health inequalities across the island of Ireland, focusing on how area-level deprivation is associated with health status, health-related behaviours and risk factors in Northern Ireland (NI) and Ireland. While traditional health narratives often emphasise individual responsibility, this research explores the 'place association' – how local environmental, social and economic conditions may shape individual health and wellbeing.

This study applies a dual analytical framework to explore different dimensions of health inequality within each jurisdiction:

- Quintile-by-quintile analysis assesses incremental shifts in health outcomes, behaviours and risk factors across all five deprivation–affluence groups.
- Pairwise analysis examines the gap between the most (Q1) and least (Q5) deprived quintiles to estimate the magnitude of disparity between the two extremes.

Together, these complementary methods illustrate how health outcomes vary along the socio-spatial spectrum, providing an empirical foundation for policymakers addressing the broader social determinants of health.

## Overview

Health inequality across the island is reflected in the substantial life expectancy gaps between the most and least deprived communities, a divide that evidence suggests has widened over the last five years. The most recently available statistics show that in Northern Ireland, males in the most deprived areas live 7.2 years less than those in the least deprived areas, while for females the gap stands at 5.5 years. In Ireland, these gaps reach 5.0 years for males and 4.5 years for females.

In light of these within-jurisdiction disparities, this study examines health outcomes and health-related risk factors across area-level deprivation quintiles. Examining patterns across the deprivation–affluence scale helps clarify whether health indicators change linearly

with increasing affluence or if specific thresholds exist, assisting policymakers in evaluating universal versus targeted public health interventions.

### Methods

The study utilises microdata from two of the most recent jurisdiction-specific health surveys available to researchers:

- The Health Survey Northern Ireland (HSNI) 2022/23: A continuous study (n = 3,216 for the analysed sample) managed by the Northern Ireland Statistics and Research Agency (NISRA).
- The Irish Health Survey (IHS) 2024: A nationwide study (n = 4,875 for the analysed sample) managed by the Central Statistics Office (CSO).

Relative area-level deprivation is measured by the Pobal Haase–Pratschke (HP) Deprivation Index for Ireland, and the Northern Ireland Multiple Deprivation Measure (NIMDM). While derived from distinct national administrative data sources, both measures capture core structural dimensions of socio-economic disadvantage (including demographics, employment and education). For each jurisdiction the deprivation index scores are standardised into quintiles.

Because the HSNI and the IHS rely on distinct survey methodologies, sampling frameworks, variable definitions and item non-response rates, direct cross-jurisdictional comparisons of raw prevalence rates or absolute values cannot be made. Consequently, this report focuses strictly on within-jurisdiction socio-economic dynamics, comparing how relative health gradients and inequalities manifest within Northern Ireland and within Ireland independently.

To examine health patterns across communities, the study uses statistical methods adjusted for population weights. This ensures the sample is representative, allowing the findings to be generalised to the wider populations of Northern Ireland and Ireland. Overall health outcomes and lifestyle behaviours are mapped across different deprivation–affluence levels. Statistical models are then applied to isolate the specific link between neighbourhood deprivation level and health outcomes, while accounting for key individual factors such as age and sex. Interaction modelling is conducted to determine whether

these associations vary across specific subgroups of the population (such as by age, sex, or urban versus rural locations). Finally, statistical decomposition techniques (counterfactual and Oaxaca–Blinder methods) are applied within each dataset to estimate the proportion of the health gap between the most and least deprived areas which statistical models can attribute to measured health risk factors (such as smoking, diet, physical activity, alcohol use and obesity) versus unexplained residual structural factors.

### Findings

- Strong area-level health disparities in self-rated health existed in both jurisdictions, with the prevalence of good health lowest in the most deprived areas. Within Northern Ireland, the absolute disparity between Q1 and Q5 appeared wider than the corresponding relative gap observed within Ireland, though survey differences limit direct comparative benchmarking.

- In Northern Ireland, long-standing illness showed a substantial overall disparity between extreme quintiles, dropping from 52 per cent in the most deprived communities (Q1) to 38 per cent in the least deprived (Q5). In Ireland a similar within-jurisdiction gradient was observed, moving from 46 per cent in Q1 to 37 per cent in Q5.

- The mental health measures collected across the different surveys differed considerably. Descriptive statistics and regression analyses within both datasets clearly indicated that the risk of poor mental health increased with area deprivation in both jurisdictions.

- A strong deprivation–affluence pattern in smoking rates was evident for both Northern Ireland and Ireland. In Northern Ireland, the adjusted odds of smoking in the least deprived areas (Q5) were 0.23 of those in the most deprived communities (Q1). Decomposition modelling indicated that tobacco use was a primary contributor to observed health inequalities in Northern Ireland.

- Frequent alcohol consumption displayed an upward socio-economic pattern in Ireland (more frequent in affluent areas). This pattern likely reflects the ‘alcohol harm paradox’, where higher-frequency drinking in affluent groups contrasts with higher rates of acute harm in deprived groups due to heavy episodic drinking.

- Exercise levels were consistently lower in more deprived areas across both Northern Ireland and Ireland. However, measurement criteria differed fundamentally (Ireland measured broad leisure activities such as walking, cycling and sports participation for at least 10 minutes per week (58 per cent in Q1 to 76 per cent in Q5); Northern Ireland measured moderate-to-vigorous physical activity (MVPA) of at least 30 minutes per week (6 per cent in Q1 to 13 per cent in Q5), precluding direct comparisons of overall activity levels.

- Within both datasets, evidence of a continuous socio-economic gradient in meeting the five-a-day fruit and vegetable recommendation was weak, with response rate variations further constraining cross-border interpretation.

- Obesity rates were highest in deprived areas and declined with greater area-level affluence in the two jurisdictions. In Ireland, obesity prevalence ranged from 33 per cent in Q1 to 20 per cent in Q5. Decomposition modelling identified obesity as a major contributor to area-level health disparities in Ireland. In Northern Ireland prevalence ranged from 26 per cent (Q1) to 20 per cent (Q5), though higher missing data rates in Northern Ireland require cautious interpretation.

### Policy implications

The findings demonstrate that while area-level deprivation is strongly linked to poorer health across the island, the relative contribution of individual risk factors versus broader environment varies by jurisdiction. In Ireland, decomposition modelling indicated that health behaviours and risk factors account for a substantial proportion of the variance in good self-rated health and poor mental health. Consequently, universal and community targeted public health interventions such as active transit infrastructure, nutritional programmes and physical activity initiatives could yield valuable public health returns across all deprivation groups.

In contrast, the analytical decomposition for Northern Ireland reveals a large ‘residual’ gap, meaning that even under theoretical models where health risk factors are equalised across groups, substantial health disparities in self-rated health (71 per cent) and long-standing illness (76 per cent) persist. While targeted behavioural supports (such as localised smoking cessation) remain vital, behavioural interventions

alone are insufficient. Addressing health gaps in Northern Ireland requires structural policies targeting upstream determinants, including economic activity, education, infrastructure, and healthcare accessibility.

Given that survey design and administrative variations currently prevent direct cross-border comparisons, future research and cross-jurisdictional policy evaluation would benefit significantly from harmonised survey methodologies and standardised health metrics across the island of Ireland.

# Chapter 1
# Introduction

## 1.1 Overview

Utilising the most recent available microdata, this report examines area-level health patterns in a range of health and related lifestyle factors, across areas with differing levels of deprivation in Northern Ireland (NI) and Ireland. Analysing health status and lifestyle through the lens of area-level deprivation represents an important shift away from traditional narratives of personal responsibility, which can overlook the constraints of neighbourhood environments and poverty (Bambra, 2016; Berg et al., 2019; Kawachi and Berkman, 2003). Instead, this approach acknowledges that broader social and environmental factors influence individual choices and, in turn, shape health outcomes (World Health Organization, 2006). By mapping health outcomes (including self-rated health and mental wellbeing) alongside behaviours such as tobacco use, alcohol consumption, dietary habits and physical activity across levels of area deprivation, this research points to how environmental conditions may manifest as physical and psychological health disparities. Framing these behaviours as being affected by one's surroundings, rather than solely by individual preference, helps provide an evidence base for policy interventions that address the 'causes of the causes' of ill health (Braveman and Gottlieb, 2014; Marmot and Bell, 2019).

Area-level deprivation serves as a broad indicator of spatial inequality, reflecting the combined, lived reality of structural, economic and environmental disadvantage experienced by residents. Rather than implying a direct or singular causal 'place effect', geographical variations in health in this report are understood as the product of overlapping individual and spatial factors. Evaluating area-level health disparities thus offers a vital lens for identifying where health burdens concentrate, irrespective of the precise balance between neighbourhood context and population composition.

## 1.2 The all-island context

Despite shared geographical and public health challenges on the island of Ireland, a parallel analysis of key health and behavioural indicators, stratified by the area-level deprivation profiles of both jurisdictions within a single report, has not been undertaken to date. The urgency of this research is underscored by stark inequalities recorded across the two jurisdictions. In Northern Ireland, the latest *Health Inequalities Annual Report* (Department of Health, 2026) highlights a 7.2-year life expectancy gap for males and a 5.5-year gap for females between the most and least deprived areas for the 2022–24 period. Crucially, the data reveal a stagnating or worsening trend over the previous five years across several dimensions, including self-rated health, long-term illness, mental health, suicide, alcohol-related deaths, smoking and e-cigarette use. Across the border in Ireland, a similar disparity pattern exists; the Central Statistics Office (2019) reported that male life expectancy in Ireland's most deprived areas was 5.0 years lower than in affluent areas, with a corresponding slightly smaller gap for females of 4.5 years. Furthermore, Devlin et al. (2025) highlighted a widening health divide between the 2016 and 2022 Censuses: those reporting 'bad or very bad' health grew by 17 per cent in the most deprived areas, compared to 12 per cent in the least deprived.

By examining health indicators and behavioural data across deprivation quintiles, this research seeks to align with, and support, the primary public health frameworks in both jurisdictions. In Ireland, the study supports the *Healthy Ireland* framework (Department of Health, 2013, 2021), and complements the strategic priorities outlined in the Health Service Executive's Public Health Strategy (2026), both of which advocate for a reduction of health inequalities in disadvantaged and hard-to-reach communities. In 2019, Ireland introduced a modest grant for general practices in deprived urban areas. While a mixed-methods evaluation by O'Shea et al. (2024) established that awardees utilised these funds for additional staffing and services, recent qualitative insights offer a deeper look at the broader context. Specifically, Phillip et al. (2026) highlighted that community-level health inequalities in underserved Dublin localities were inextricably linked to spatial stigma, social isolation and challenging environmental conditions.

In Northern Ireland, this work complements the Health and Social Care Inequalities Monitoring System (HSCIMS) by providing a cross-jurisdictional dimension to existing area-level analysis, thereby supporting the evidence-based targeting championed by Northern Ireland's Public Health Agency (2025a). Notably, a qualitative study of 'deep end' general practitioners (GPs) working in Northern Ireland's most deprived communities found that when asked about future investment, participants prioritised upstream societal issues (Butler et al., 2024), illustrating a clear desire for strategic intent to match grassroots clinical realities.

By presenting microdata on health outcomes, lifestyle behaviours and health risks across Northern Ireland and Ireland, this report bridges segmented research to establish baseline evidence within each jurisdiction to track health inequalities. Given that survey design and administrative differences preclude direct cross-jurisdictional point comparisons, the empirical insights offer policymakers an evidence base to design context-sensitive public health strategies tailored to local areas within their respective geographical contexts.

## 1.3 Research questions

The study is guided by a central, overarching question: How do health inequalities and lifestyle behaviours vary across areas of differing deprivation and affluence in Northern Ireland and Ireland? To address this, the research explores several domain-specific questions:

1. How do self-reported general health and mental health outcomes differ between deprivation quintiles in both jurisdictions?

2. How do protective health behaviours, such as physical activity levels and diet quality, differ between deprived and affluent areas for the two jurisdictions?

3. What is the association between area-level deprivation and health risk factors including smoking, alcohol consumption and obesity in each context?

4. Moderating factors: Do demographic variables (e.g. age, gender and urban/rural location) moderate the link between area-level deprivation, health outcomes, behaviours and risk factors?

When examining spatial health inequalities, a fundamental distinction exists between compositional factors (the concentration of socio-economically disadvantaged individuals residing within a specific location) and contextual factors (the independent influence of local physical, social or economic environments on health outcomes). The empirical models incorporate key individual-level socio-demographic controls, including age and sex, to account for basic population structure. All descriptive estimations, percentages and analytical models incorporate survey sampling and population calibration weights to ensure national representativeness. However, given the cross-sectional nature of the survey microdata, it is not possible to fully disentangle whether the observed geographical disparities stem purely from contextual neighbourhood dynamics or from broader compositional clustering. Consequently, findings regarding area-level deprivation may be understood as capturing the overall, compounded association of spatial and individual disadvantage as experienced by residents, rather than an isolated causal 'place effect'.

The remainder of this report is organised as follows: Chapter 2 reviews the existing international and domestic literature concerning the links between area-level deprivation, health, and lifestyle behaviours. Chapter 3 outlines the datasets and statistical methodologies employed to conduct the analysis. In Chapter 4, the core findings are presented. Finally, Chapter 5 discusses the broader implications of these results, offering evidence-based insights for public health policy across the island of Ireland.

# Chapter 2
## Literature review

This literature review synthesises international and domestic evidence on area-level socio-economic patterning of health, establishing the context for this study's core contribution: a cross-jurisdictional empirical analysis of area-level health and lifestyle inequalities across the island of Ireland. By evaluating how environmental, behavioural and structural factors interact across deprivation quintiles in both Ireland and Northern Ireland, this report bridges fragmented research to establish baseline evidence for each jurisdiction to inform public health policy.

### 2.1 Overview of literature on health and area-level deprivation

The link between residential deprivation and health outcomes is firmly established in international literature, which consistently identifies a social gradient where health deteriorates in tandem with increasing area-level disadvantage (Marmot and Bell, 2019; World Health Organization, 2025). This phenomenon indicates that health inequalities are not merely a function of individual socio-economic status but could be significantly modulated by the specific physical and social characteristics of the neighbourhood environment (Kawachi and Berkman, 2003; Marmot et al., 2020). A significant challenge in this field involves the operationalisation of deprivation, as the term lacks a singular definition or standardised measurement (Algren et al., 2015). Traditionally defined by Townsend (1987) as a ‘state of observable and demonstrable disadvantage relative to the local community’, area-level deprivation is understood as a multidimensional construct rather than a simple measure of poverty. While low household income and financial strain remain core drivers, area-level deprivation encompasses a broader deficit of resources across social, educational, material and housing dimensions, which collectively shape the living conditions of a population (Doebler and Glasgow, 2017).

Central to this discourse is the concept of the social gradient, famously highlighted in the *Marmot Review* (Marmot, 2010). This ‘ladder effect’ demonstrates that health inequality is not a binary divide between the affluent and the impoverished but exists as a

continuous slope: as deprivation increases, health outcomes worsen at every incremental step. This implies that even individuals situated in the middle of the socio-economic spectrum experience significantly poorer health than those at the apex, suggesting that area-level disadvantage exerts a pervasive influence across the entirety of society. International epidemiological research has long identified this gradient as one of the most robust findings in the field (Adler et al., 1994).

Furthermore, research indicates that area-level deprivation serves as a significant predictor of health, independent of individual circumstances (Bécares et al., 2012; Ribeiro et al., 2022). Residing in a deprived area is negatively associated with wellbeing, as structural inadequacies and deficient infrastructure compound individual material hardship (Barlow et al., 2021; Zhang et al., 2023). In the Irish context, these findings are particularly pertinent given the distinct administrative and policy landscapes of Northern Ireland and Ireland. In both jurisdictions, deprivation is frequently measured through multidimensional indices that capture material disadvantage, employment and educational attainment. These factors have been shown to exert a pervasive and longitudinal influence on the wellbeing of residents across the life course (Ferry et al., 2025; O'Reilly et al., 2006).

A central theme within the spatial health literature is the complex interplay between place-based attributes and individual socio-economic position (Cummins et al., 2007; Macintyre et al., 2002). While early ecological studies tended to emphasise neighbourhood environments when explaining geographical health disparities (Diez Roux, 2001), contemporary literature increasingly recognises that area deprivation captures a compounded, lived experience (Bernard et al., 2007). Rather than viewing local areas as isolated causal drivers of health outcomes, area-level deprivation is best conceptualised as reflecting the spatial concentration of broader socio-economic disadvantage (Galster, 2011). In line with this literature, the present study views area-level metrics not as definitive evidence of an independent 'place effect', but as a useful summary measure of the cumulative disadvantage shared by individuals residing in specific locations (Riva et al., 2007; Stafford and Marmot, 2003).

### 2.1.1 Self-rated health

Self-rated health (SRH) is established in contemporary epidemiological research as a robust and reliable indicator of health status, serving as a significant predictor of both morbidity and mortality across diverse global populations (Desalvo et al., 2006; Dore and Idler, 2024). International literature consistently demonstrates that residents of highly deprived areas are significantly more likely to report 'fair' or 'poor' health compared to those in affluent areas, an association that persists even after rigorous adjustment for individual-level socio-economic factors (Jivraj et al., 2020; Pickett and Pearl, 2001; Poortinga et al., 2008; Xiao et al., 2017).

Evidence from across the island of Ireland corroborates international trends, demonstrating a persistent social gradient in health status within both Northern Ireland and Ireland (O'Reilly et al., 2006). The latest health inequalities report from the Northern Ireland Department of Health (2026) reveals that across all areas of Northern Ireland the proportion of people reporting 'good or very good' general health decreased over the five-year period from 2018–2020 to 2022–2024, with the gap between the wealthiest and poorest areas widening.

However, academic evidence regarding the impact of area-level deprivation on SRH for Northern Ireland reflects a complex interplay between residential context and individual circumstances. A cross-sectional analysis indicated that while adults in high- and middle-deprivation areas were more likely to report suboptimal health, these inequalities largely attenuated or disappeared once socio-demographic factors and modifiable health behaviours were accounted for (Nevill et al., 2014). On the other hand, longitudinal data from the Northern Ireland Cohort for the Longitudinal Study of Ageing (NICOLA) offers a more persistent view of these disparities among older populations. Research indicates that individuals experiencing multidimensional deprivation – characterised by non-home ownership, limited educational attainment and a lack of vehicle access – faced significant health disadvantages over a 10-year horizon (Doebler and Glasgow, 2017). The study revealed a 'double disadvantage' effect: area-level income deprivation intensified individual health risks, affecting men's subjective health more severely than women's.

Further evidence from the older population in Northern Ireland corroborates these findings, revealing a clear socio-economic gradient

across all SRH measures. Specifically, the disparity in poor health between the most and least affluent areas reached approximately 50 per cent (Neville et al., 2023). Moreover, an evaluation of a place-based health initiative in Northern Ireland observed a trend toward a reduced gap in good SRH between intervention and control areas (Mohan et al., 2017). Consistent with earlier findings, however, the statistical significance of this improvement was reduced when broader socio-economic factors were included in the model, suggesting that deeply entrenched structural inequalities remain a primary driver of health status.

Across the border, early county-level research for Ireland identified housing tenure as a critical indicator of health disparity, noting that higher proportions of non-home ownership correlated significantly with lower health satisfaction and poorer SRH (Kelleher et al., 2002). In a subsequent analysis, Kelleher et al. (2003) observed that while residence in affluent areas was associated with more positive mean SRH at a bivariate level, multilevel modelling suggested that these differences were largely attributable to individual-level variation. The authors posited that this finding may reflect a confounding effect, given that the variables within the composite deprivation scores often overlap with individual socio-economic markers. Furthermore, they noted that outside of major metropolitan centres, Irish communities may be less socially and economically segregated than those in more densely populated, industrialised nations, potentially attenuating the independent 'area effect'. Research focusing on deprived suburban areas in Dublin indicates that health disadvantages remain acutely concentrated and compounded for specific groups, particularly those who are unemployed, retired, or unable to work due to long-standing illness (Darker et al., 2016).

### 2.1.2 Mental health

International evidence consistently indicates that residing in neighbourhoods characterised by high unemployment, poor housing quality and limited infrastructure is a significant predictor of depressive symptoms (Blair et al., 2014; Fone et al., 2007; Kim, 2010; Miles et al., 2012; Strachan et al., 2017). Longitudinal research indicates that while area deprivation leads to poorer long-term mental health for older adults in the United Kingdom (UK), strong neighbourhood cohesion significantly buffers this disadvantage (Salvatore and Grundy, 2021). Moreover, the impact of such

environments may be moderated by gender and specific regional factors; for instance, a study from England identified a strong link between depression and living in the most deprived areas for men, but not for women (Remes et al., 2019). Recent population research highlighted the association between neighbourhood deprivation and depression in Sweden (Johansson et al., 2026); while in England specific domains of neighbourhoods – e.g. physical living quality, community safety, and localised small-area socio-economic stressors – were found to interact through place-specific pathways to drive depressive symptoms (Tsimpida et al., 2026).

Conversely, some evidence suggests that a direct link between area-level deprivation and mental health is not always established (Propper et al., 2005; Weich et al., 2005). Fone et al. (2013) posit that mental health may be more closely associated with income inequality relative to the wider society than with neighbourhood-level inequality itself. This perspective is supported by findings from the Healthy Ireland survey, which indicated that objective area-level deprivation did not have a discernible association with mental health status or the likelihood of suffering from depression (Mohan and Barlow, 2023). Instead, subjective factors such as perceptions of area safety, cleanliness and the quality of local services emerged as the primary determinants of mental wellbeing.

In Ireland, regional deprivation has been found to have a significant impact on common mental disorders, specifically for women (Morrissey, 2016), and has been strongly associated with suicide rates (O'Farrell et al., 2016). Qualitative research in deprived urban areas further highlights substantial barriers to accessing mental health services, particularly for young people (Leahy et al., 2013). Research in Northern Ireland similarly indicates that rates of self-harm are more than four times higher in the most deprived areas (Griffin et al., 2019), and area effects on suicide are substantial, especially in urban locations with high deprivation (Bunting et al., 2017). Additionally, Tseliou et al. (2016) document that moving from a less to a more deprived area during childhood may be associated with poor mental health, independent of individual and household variables including child gender, family structure and housing tenure. Official statistics from Northern Ireland reveal a widening suicide inequality gap between 2018–20 and 2022–24, with rates in the most deprived areas treble those of the least deprived (Department of Health, 2026). These

communities also have double the rates of poor mental health scores and mood or anxiety prescriptions.

## 2.2 Health behaviours and risk factors

Lifestyle behaviours, including tobacco use and alcohol consumption, are key factors through which area-level deprivation can translate to health inequalities. These behaviours are often symptoms of the social gradient, where physical and social environments constrain healthy choices.

### 2.2.1 Smoking

Tobacco use remains a fundamental driver of health inequalities, with smoking prevalence acting as a primary contributor to the substantial life expectancy gap between the most and least affluent populations (Marmot, 2010). While tobacco use is declining in Ireland, e-cigarette use and dual use are increasing (Brennan et al., 2025). Daily smoking rates are over four times higher in the most deprived areas than the least, with the greatest disparities seen among those with low education and in high-deprivation neighbourhoods (Valentelyte et al., 2025). Encouragingly, Stallings-Smith et al. (2014) found that the smoking ban in Ireland led to equal mortality declines across all areas. Crucially, because the most deprived areas had higher initial mortality rates, this uniform reduction successfully narrowed the absolute inequality gap.

Northern Ireland's smoking deprivation gap widened between 2020–21 and 2024–25, with rates in the most deprived areas 3.8 times higher than the least (Department of Health, 2026). A Northern Ireland Audit Office (2024) report highlighted that smoking-related deaths were 98 per cent higher in the most deprived communities, while smoking during pregnancy was also 4.5 times higher, perpetuating long-term generational health risks. This reflects a broader ‘neighbourhood effect’ documented internationally, where area-level deprivation influences smoking behaviour independently of an individual’s personal socio-economic circumstances (Algren et al., 2015; Kleinschmidt et al., 1995; Lakshman et al., 2011). Such environments often foster ‘pro-smoking’ social norms, compounded by a high density of tobacco retailers, creating significant barriers to successful cessation (Bambra, 2016; Brose and McEwen, 2016; Shortt et al., 2015).

More broadly, literature shows that the physiological and economic consequences of this social patterning of smoking are profound. In England, smoking-related cancer incidence was more than twice as high in the most deprived areas (Payne et al., 2022). While evidence from Scotland suggests that an individual's smoking status is a stronger predictor of disease than area-level deprivation itself, both factors remain critical determinants of risk (Eberth et al., 2013). For England, Davies et al. (2026) showed that without targeted intervention, the socio-economic gradient is projected to persist; current modelling suggests the most deprived populations may not reach 'smokefree' status (prevalence <5 per cent) until 2059, over a decade after their affluent counterparts. This lag carries wider economic implications, as one in nine smokers are economically inactive due to smoking-related long-term illness, reinforcing the cycle of deprivation and ill-health (Jackson et al., 2025).

While evidence on e-cigarette use and vaping is emerging, Scottish and Canadian studies have demonstrated that tobacco smoking and e-cigarette use are significantly higher among adults in deprived areas (Adebayo et al., 2024; Fraser Wood et al., 2025). Between 2020–21 and 2024–25, e-cigarette use surged across Northern Ireland, with the sharpest increase occurring in the most deprived communities, where usage jumped from 7 per cent to 15 per cent, compared to a rise from 3 per cent to 8 per cent in the least deprived areas (Department of Health, 2026). Evidence on paediatric vaping and deprivation is mixed: Hughes et al. (2015) found no socio-economic correlation in North West England, whereas Hanewinkel and Hansen (2025) reported significantly higher usage among children in the most deprived areas of Germany.

### 2.2.2 Alcohol

The relationship between area-level socio-economic deprivation and alcohol consumption is characterised by a complex disparity often termed the 'alcohol harm paradox'. While a systematic review by Algren et al. (2015) suggested that the association between living in deprived versus affluent areas and total alcohol consumption was ambiguous, the resulting health outcomes are starkly different. Deprived areas experience disproportionately more alcohol-related morbidity and mortality (Angus et al., 2020; Erskine et al., 2010), driven by clustered risk factors (e.g. smoking, poor diet) that multiply harm (Bellis et al., 2016). Bellis et al. (2016) found that deprived high-risk

drinkers were over 10 times more likely to exhibit multiple risk factors than affluent drinkers. Alcohol-specific causes have been estimated to increase the life expectancy gap between the most and least deprived areas by 0.5 years (Angus et al., 2020).

Between 2016–20 and 2020–24, Northern Ireland's alcohol-specific death gap widened; rates in the most deprived areas rose sharply to 4.5 times those in the least deprived areas, which saw no change (Department of Health, 2026). Other academic evidence shows that the excess risk of alcohol-related death in deprived areas in Northern Ireland disappears when accounting for individual characteristics, suggesting that mortality rates are driven by resident profiles rather than area deprivation itself (Connolly et al., 2010). Nevertheless, the burden of alcohol abuse remains high in these regions, where Frazer and Frazer (2020) documented a strong correlation between deprivation rankings and GP prescriptions for the treatment of alcohol abuse in Northern Ireland. On the other hand, early research for Ireland by Kelleher et al. (2002) found that indicators such as area-level unemployment and lower educational attainment were inversely correlated with excess alcohol consumption among men.

Alcohol outlet density significantly impacts area-based health disparities. In Ireland, disadvantaged areas exhibit double the liquor licence density of affluent ones, with off-licences concentrated in poorer areas and restaurant licences in wealthier ones (Doyle and Foley, 2026), mirroring trends in New Zealand (Hay et al., 2009). This disparity begins early, as disadvantaged Irish primary schools are surrounded by a significantly higher number of licensed premises (Doyle et al., 2024).

### 2.2.3 Physical activity

There is compelling evidence that physical activity (PA) serves as a critical primary and secondary preventative measure against numerous chronic diseases (Warburton et al., 2006), yet participation is heavily influenced by neighbourhood environment. Evidence from systematic reviews has confirmed a general positive association between residence in deprived neighbourhoods and physical inactivity (Algren et al., 2015), often attributed to 'obesogenic' environments that discourage movement while promoting excessive caloric intake (Macintyre, 2007). Proximity to accessible green space correlates with higher activity levels, provided that subjective perceptions of

neighbourhood safety and social engagement are also addressed (Watts et al., 2013). However, some UK evidence using objective accelerometer data suggests that after adjusting for socio-demographic factors, inactivity may be driven more by age, high body mass index (BMI) and limited mobility – traits frequently concentrated in deprived areas – rather than location itself (Fox et al., 2011).

Within the broader UK context, research into regeneration areas and policy modelling indicates that the most disadvantaged individuals have a significantly higher probability of failing to meet activity guidelines. Furthermore, those residing in deprived areas exhibit a marked lack of awareness regarding recommended physical activity levels (Ellis et al., 2007; Hunter et al., 2014, 2015).

In Ireland, the relationship between deprivation and physical activity is further nuanced by the distinction between urban and rural settings. Barrett et al. (2016) investigated PA levels among GP patients and found significant variations across primary care areas; specifically, participants in rural areas with mixed deprivation were the least active, with almost 60 per cent classified as inactive, whereas those in urban deprived areas were found to be the most active. Furthermore, a cross-jurisdictional study of adolescents observed that students attending disadvantaged schools (as defined by Delivering Equality of Opportunity in Schools (DEIS) status in Ireland and free school meals in Northern Ireland) represented the highest proportion of the 'inactive' and 'somewhat active' categories (Woods et al., 2021).

For Northern Ireland, McCallion (2021) notes that physical inactivity accounts for approximately 2,500 deaths annually, highlighting a stark social gradient, with adults in the most deprived areas being significantly less likely to participate in sport or hold sports club memberships compared to their counterparts in the least deprived areas. This disparity is mirrored in older populations (Appleton et al., 2013); for example, the NICOLA study revealed that 51 per cent of those in the most deprived quintiles were inactive, compared to 35 per cent in the most affluent areas (Cruise and Kee, 2017). Area-based public health intervention studies to promote physical activity in Northern Ireland have yielded varied results. For instance, pedometer-based interventions in deprived Belfast general practices successfully increased patient step counts (Heron et al., 2014). Conversely, larger infrastructural projects such as urban greenways and regeneration

programmes demonstrated either a general decline in activity levels consistent with national trends (Hunter et al., 2021), or minor increases that lacked statistical significance after adjustment for individual and household factors such as gender, age and socio-economic status (Mohan et al., 2017).

### 2.2.4 Nutrition

The relationship between nutrition and residential environment is underpinned by the structural constraints of 'obesogenic' environments, where dietary habits may be shaped by the spatial distribution of resources. In several contexts deprived areas have been characterised as 'food deserts', with limited access to affordable, healthy produce and a high density of fast-food outlets (Cummins et al., 2005; Lake and Townshend, 2006). This concentration effect is evidenced in Scotland and England, where research indicates a statistically significant increase in the density of major fast-food chains as neighbourhood deprivation intensifies (Macdonald et al., 2007). Furthermore, as the modern food landscape shifts online, the most deprived districts have been found to have the highest access to online food outlets (Keeble et al., 2021).

However, the 'deprivation amplification hypothesis', which suggests that disadvantaged areas consistently suffer from poorer service provision, is challenged by conflicting empirical evidence. In Scotland, the most deprived urban neighbourhoods have been found to have better access to grocery stores and fresh produce, suggesting that spatial inequalities are highly context-specific and vary between urban, rural and island settings (Smith et al., 2010). Similarly in Northern Ireland, while fast-food outlets are more numerous in deprived deciles, these areas also frequently host a higher number of grocery retailers (Davis et al., 2025). Contemporary assessments of supermarket shelf space in Ireland found no significant difference in the prominence of unhealthy versus healthy foods based on area-level deprivation, indicating that retail environments may be more uniform than previously assumed (O'Mahony et al., 2024).

The impact of these environments on actual consumption patterns remains complex and often contradictory. While some studies indicate that residing in a deprived area predicts significantly lower fruit and vegetable intake (Schwaller et al., 2021), particularly among those in manual occupations with fewer educational qualifications (Shohaimi

et al., 2004), systematic reviews have described this association as ambiguous (Algren et al., 2015). International comparisons across seven high-income countries further demonstrate this variability; while Canada, New Zealand and Scotland showed a clear link between higher neighbourhood socio-economic status and increased fruit intake, other nations showed no such evidence, suggesting that the effect of neighbourhood disadvantage on resource access is filtered through national and regional characteristics (Ball et al., 2015). Northern Ireland-based research established that older adults in wealthier areas reported a significantly higher intake of fruit and vegetables than those in disadvantaged localities (Appleton et al., 2009). Reflecting this long-standing disparity, the five-a-day adherence gap has widened in the last five years, with consumption in the most deprived communities rising only slightly compared to sharp increases in the least deprived areas (Department of Health, 2026).

In Ireland, area-level socio-economic markers such as unemployment and education levels have historically correlated inversely with healthy dietary intake (Kelleher et al., 2002). Educational attainment appears to be a more robust predictor of dietary behaviour than geography alone; for example, pregnant women in Dublin with third-level education were found to be more receptive to dietary interventions regardless of their residential neighbourhood (O'Brien et al., 2017). Other studies of pregnant women in the same region found no significant dietary differences across area-deprivation tertiles (Lynch et al., 2024). Beyond macronutrients, area deprivation was associated with a higher risk of vitamin D deficiency (Johnston et al., 2022). Food poverty is also increasingly documented across both Ireland and Northern Ireland (Beacom et al., 2021; Kerins et al., 2025).

### 2.2.5 Obesity

The global obesity epidemic is largely underpinned by contemporary food systems that prioritise the production and marketing of highly processed, affordable and energy-dense products (Swinburn et al., 2011). Empirical research across middle- and high-income countries consistently identifies a positive association between neighbourhood-level deprivation and BMI (Coutinho et al., 2023; Harrington and Elliott, 2009; King et al., 2006; Maier et al., 2014; Van Lenthe and Mackenbach, 2002). This relationship, however, is significantly moderated by geographic context. Systematic reviews indicate that the link between area-level socio-economic status and obesity is most

pronounced in inner-city and suburban environments of large metropolitan areas, while remaining weaker or non-existent in small towns and rural settings (Ford and Dzewaltowski, 2011; Selvakumaran et al., 2023). For example, research from France suggested that while a strong correlation existed in suburban Paris, no such association was found in rural areas, indicating that the impact of deprivation may be filtered through the local built environment (Feuillet et al., 2020).

Longitudinal evidence further illustrates a gendered nature of these spatial inequalities. In England, women remaining in the most deprived neighbourhoods exhibited higher initial BMI and greater weight gain over time, whereas no significant association was found for men (Stafford et al., 2010). Similar patterns of disadvantage were observed in Australia, where increasing geographic-level disadvantage correlated with a higher prevalence of obesity in both sexes, particularly for women (Bonney et al., 2015).

Area-level deprivation in the UK was generally positively associated with obesity risk (El-Sayed et al., 2012), where adolescents in the most disadvantaged groups displayed higher fat mass indices (Staatz et al., 2021), and school-level deprivation was a significant predictor of adiposity outcomes (Cronin et al., 2022). In Northern Ireland, this was reflected in higher rates of maternal obesity among pregnant women in deprived areas (Kent et al., 2021), and a higher volume of GP prescriptions for obesity-related medications in these localities (Frazer and Frazer, 2020).

Cross-jurisdictional studies on the island of Ireland reveal that while BMI and physical activity explain only a small fraction of childhood wellbeing (O'Brien et al., 2024), public perceptions regarding the consequences of obesity are deeply intertwined with an individual's SRH and their perceived ease of adopting lifestyle improvements (Spyreli et al., 2022). This suggests that addressing the 'obesogenic' nature of deprived areas requires a nuanced understanding of how global food systems, local geography and individual socio-economic constraints intersect to shape health outcomes.

## 2.3 Summary of literature on health, health behaviours and area-level deprivation

In summary, the literature indicates a social gradient in health internationally and across the island of Ireland, where residential deprivation acts as a fundamental determinant of health outcomes and lifestyle behaviours. While the 'place effect' consistently links increasing area-level disadvantage with poorer SRH, higher rates of mental ill-health and greater prevalence of tobacco use, these associations were frequently found to be moderated by geography and individual socio-demographic factors. Specifically, the impact of 'obesogenic' environments on physical activity, nutrition and BMI appears most acute in urban settings, yet remains nuanced and sometimes contradictory in rural or regional contexts. Furthermore, while emerging evidence on e-cigarettes/vaping and the 'alcohol harm paradox' highlights the complexity of health risk behaviours, the substantial health and lifestyle disparities illustrated across these domains demonstrate the need for a contemporary, context-specific, cross-jurisdictional analysis.

# Chapter 3
# Methods

## 3.1 Data

This study relies on microdata from two key sources: the Irish Health Survey (IHS) and the Health Survey Northern Ireland (HSNI). The advantage of both surveys is that they are linked to information on the level of deprivation in the respondent's residential area. While both surveys provide rich data on health and lifestyle, there are significant methodological differences between them regarding collection modes, timing relative to post-pandemic recovery, sampling frame mechanisms, and variable-specific missingness patterns (e.g. higher item non-response for diet and BMI). These constraints must be explicitly borne in mind throughout the analysis and when interpreting observed differences.

This study received research ethics approval from the ethics committee of the ESRI in December 2025, and approval from the Health Research Consent Declaration Committee in February 2026.

### 3.1.1 Irish Health Survey

The IHS is a voluntary, nationwide study conducted by the Central Statistics Office (CSO, 2025). It is designed to align with the European Health Interview Survey, which provides harmonised data on health status, healthcare and health determinants across European nations. The 2024 iteration of the IHS was conducted in November and December, primarily through online questionnaires supplemented by a small number of telephone interviews.

Using a simple random sampling method, the CSO selected approximately 24,000 individuals aged 18 years and over from the Census 2022 frame. Participants were invited via post to complete the survey online using a provided QR code or web link, with a reminder letter sent after two weeks. The survey achieved 5,100 responses, representing a 21 per cent response rate. After excluding missing data across key variables (see Appendix Table A.1), a final sample of 4,875 individuals were available for the main analysis. However, for the decomposition modelling a smaller sample size of 1,669 was employed due to item non-response on the 'meets five-a-day' variable.

To ensure findings reflect the national population, results were weighted using design weights devised by the CSO,[1] to account for selection probabilities, alongside non-response adjustments to correct for systematic differences between participants and non-participants. Appendix Table A.2 documents the unweighted and weighted descriptive statistics for the variables of interest across both jurisdictions.

### 3.1.2 Health Survey NI

The HSNI is an annual continuous study commissioned by the Department of Health NI since 2010/11, with fieldwork managed by the Central Survey Unit of the Northern Ireland Statistics and Research Agency (NISRA). Although results have been published for the 2024/25 period (Department of Health, 2025), the preferred timeframe for this project, the most recent dataset available to researchers is the 2022/23 wave, which is held in the UK Data Service repository. Consequently, this report examines the 2022/23 HSNI data.

The fieldwork for this iteration took place between April 2022 and March 2023, utilising computer-assisted telephone interviewing (CATI). Using a systematic random sample from the NISRA address register, an eligible sample of 5,537 addresses were identified and 3,117 households participated, resulting in a 56 per cent response rate. Within these households all individuals aged 16 years and over were invited to take part, yielding a total of 3,582 interviews. The main complete-case analytical sample consisted of 3,216 individuals with complete data (see Appendix Table A.1 for information on missingness across variables). The decomposition modelling for Northern Ireland relies on a smaller sample size of 1,532 due to item non-response on the 'meets five-a-day' variable.

[1] The weighting procedure is fully documented in CSO (2025). Briefly, the weighting process involved two main steps: non-response adjustment and calibration. Because a simple random sampling method was used, design weights (the inverse of selection probability) were equal for all initial sample units. These weights were adjusted for non-response and then calibrated against Q4 2024 population estimates, broken down by sex, five-year age groups and NUTS 3 regions. NUTS 3 refers to the third level of the nomenclature of territorial units for statistics (NUTS), a hierarchical geographical classification system used across the European Union to divide economic territory for regional statistics. In Ireland, NUTS 3 regions correspond to groupings of counties used for regional analysis and administrative planning (such as the Border, Dublin, South-West and Mid-East regions).

Item non-response for the measures of diet quality (meets five-a-day) and BMI was higher in the Northern Ireland telephone sample than in Ireland's online survey, potentially reflecting social desirability bias over the phone. As such, complete-case analysis for Northern Ireland filters out individuals who declined to disclose diet- or BMI-related data, whereas Ireland's online format retained similar respondents. This potential mode-driven differential missingness presents challenges for cross-jurisdictional comparisons and model interpretation.

Data were weighted using weights[2] devised by NISRA to ensure population representativeness (Department of Health, 2022). For a full breakdown of the weighted and unweighted descriptive statistics across both jurisdictions, see Appendix Table A.2.

## 3.2 Measures of area-level deprivation

Economic, social and political conditions, as well as geographic units and the statistical agencies responsible for data collection, differ between the two jurisdictions. As such, separate indices are employed to measure deprivation within each jurisdiction. Both jurisdictions use an area-level index informed by multiple domains including demographic, economic and educational indicators. It is worth noting that earlier methodological efforts were made to construct a unified spatial metric across both jurisdictions (Haase et al., 2015). Although not sustained across subsequent census rounds due to alignment and institutional constraints, this work underscored the potential feasibility and value of harmonised cross-border metrics.

### 3.2.1 Pobal Haase–Pratschke Deprivation Index

In Ireland, the Pobal Haase–Pratschke (HP) Deprivation Index was constructed using 2022 Census data and integrated into the IHS. The Index ranks 18,191 small area (SA) geographies, the most granular census units, typically comprising 80–120 households with an average population of approximately 300–400 residents. These SAs are

[2] Full details of the weighting procedure are documented in the survey technical report (Department of Health, 2022). Briefly, the weighting procedure for the Health Survey Northern Ireland 2022/23 combined design weights based on selection probabilities with non-response adjustments. These weights were then calibrated against mid-year population totals across sex, age and deprivation (NIMDM) quintiles to ensure overall representativeness.

evaluated across three primary domains using 10 specific census indicators:

1. Demographic profile: five-year population change, age dependency ratio, lone parent ratio.
2. Social class composition: primary education only (early school leaving), third-level education, higher social classes (managerial/professional), lower social classes (unskilled/semi-skilled).
3. Labour market situation: male and female unemployment rates.

The domain weightings are established within the statistical model using a factor-analytical approach. The Pobal HP Index is linked to the IHS by the CSO through the SA identifiers of the respondents. To facilitate analysis while protecting anonymity, these scores are presented as quintiles, dividing households into five equal-sized groups based on their level of relative advantage:

- Quintile 1: Very disadvantaged (most deprived)
- Quintile 2: Disadvantaged
- Quintile 3: Average
- Quintile 4: Affluent
- Quintile 5: Very affluent (least deprived)

### 3.2.2 NI multiple deprivation measure

The NI multiple deprivation measure 2017 (NIMDM) is the official metric for assessing area-level deprivation in Northern Ireland. It is a multidimensional tool comprising 38 indicators derived from extensive administrative data sources across seven distinct domains: income; employment; health and disability; education, skills and training; access to services; living environment; and crime. To reflect their relative contribution to overall deprivation, NISRA assigned fixed percentage weights to these domains based on their relative impact, prioritising income and employment (25 per cent each), while weighting living environment and crime lowest (5 per cent each), before combining them into the final spatial rank (NISRA, 2017).

Each of the 890 super output areas (SOAs) in Northern Ireland, which represent the smallest geographical unit with an average population of

2,100, is ranked from most deprived (rank 1) to least deprived (rank 890). Using their home addresses, HSNI respondents were assigned to the corresponding SOA and subsequently categorised into deprivation quintiles for analysis as:

- Quintile 1: Very disadvantaged (most deprived)
- Quintile 2: Disadvantaged
- Quintile 3: Average
- Quintile 4: Affluent
- Quintile 5: Very affluent (least deprived)

The jurisdiction-specific metrics reflect fundamental conceptual differences in how area-level deprivation is operationalised. The NIMDM relies heavily on direct material deprivation and service-based domains – such as income, access to services, living environment and crime – which are entirely absent from the Pobal HP Index. Moreover, because the NIMDM incorporates a specific health and disability domain (weighted at 15 per cent), examining health outcomes against Northern Ireland deprivation quintiles introduces a degree of tautology, as baseline health metrics are partly embedded within the explanatory variable itself. In contrast, the Pobal HP Index excludes health indicators entirely, relying instead on structural socio-demographic proxy measures.

Furthermore, factor weights were derived differently – statistically via factor analysis in Ireland versus pre-determined expert judgement in Northern Ireland – meaning similar domains like employment carry different relative weightings across jurisdictions. Additionally, temporal misalignment further complicates comparisons: the Pobal HP Index (2022) captures the post-Brexit and post-pandemic landscape, whereas the NIMDM (2017) relies on administrative data collected immediately following the Brexit referendum. Spatial units also differ substantially in scale: Northern Ireland's SOAs (average population ~2,100) are considerably larger than Ireland's SAs (~300–400), aggregating greater localised heterogeneity and potentially diluting pockets of extreme deprivation or affluence in the North.

Importantly, we stress that both indices measure relative deprivation within their respective jurisdictions, and equivalent labelled quintiles cannot be directly contrasted across borders (e.g. Quintile 1 for Northern Ireland with Quintile 1 for Ireland). While jurisdiction-level quintiles enable the evaluation of internal social gradients, they do not reflect identical baseline conditions or absolute levels of material deprivation. Although earlier frameworks (e.g. Haase et al., 2015) established a harmonised spatial metric, this has not been updated since, reflecting persistent challenges in aligning cross-border deprivation measures. For the interpretation of our findings, these differences mean that a steeper health gradient observed across quintiles in one jurisdiction relative to another cannot be interpreted as proof of greater absolute inequality. Rather, observed associations reflect how health status and lifestyle behaviours scale against relative local advantage within each distinct administrative, economic and policy environment.

## 3.3 Measures of health status, behaviours and risk factors

To align with established epidemiological literature and facilitate interpretable modelling, several continuous and ordinal measures – including self-rated health, mental health screening scores, alcohol consumption frequency, body mass index and physical activity – were operationalised as binary variables. While dichotomising continuous or ordinal metrics entails a loss of granular detail and does not resolve underlying survey non-comparability, this approach established consistent, standardised thresholds within each dataset aligned with international public health guidelines and clinical risk definitions.

### 3.3.1 Health status

***Good self-rated health***

Both the IHS and the HSNI require respondents to rate their general health using a consistent five-point scale: Very good, Good, Fair, Bad, or Very bad. For analytical consistency and ease of model interpretation, responses were dichotomised into a binary ‘Good self-rated health’ variable, where ‘Very good’ and ‘Good’ were coded as 1, and 'Fair', 'Bad' and 'Very bad' were coded as 0.

***Long-standing illness***

Both surveys included a binary question asking whether the individual had a long-standing health problem, with respondents selecting either 'Yes' or 'No'. As such, a binary variable 'Long-standing illness' was subsequently derived, coded as 1 if the respondent answered 'Yes' and 0 if they answered 'No'.

### 3.3.2 Poor mental health

The HSNI and IHS measure mental health using different survey instruments, as detailed in Appendix Table A.3. To identify instances of poor mental health, this research utilised the General Health Questionnaire-12 (GHQ-12) (Goldberg, 1972) from the HSNI, and the Patient Health Questionnaire-8 (PHQ-8) (Kroenke et al., 2009) from the IHS.

The General Health Questionnaire (GHQ-12), which features in the HSNI, is a screening tool designed to detect the possibility of psychiatric morbidity in the general population. The questionnaire contains 12 questions about recent general levels of happiness, depression, anxiety and sleep disturbance in the 'past few weeks':

*Have you recently:*

- *been able to concentrate on whatever you are doing?*
- *felt that you are playing a useful part in things?*
- *felt capable of making decisions about things?*
- *been able to enjoy your normal day-to-day activities?*
- *been able to face up to your problems?*
- *been feeling reasonably happy, all things considered?*

to which respondents can report four responses: 'More so than usual'; 'Same as usual'; 'Less so than usual'; 'Much less than usual'.

*Have you recently:*

- *lost much sleep over worry?*
- *felt under constant strain?*
- *felt you couldn't overcome your difficulties?*
- *been feeling unhappy and depressed?*
- *been losing confidence in yourself?*
- *been thinking of yourself as a worthless person?*

to which respondents can report four responses: 'Not at all'; 'No more than usual'; 'Rather more than usual'; 'Much more than usual'.

The responses to the 12 items are scored, and a score is then constructed from combined responses to create an overall score of between 0 and 12. A score of 4 or more is classified as a respondent with a possible psychiatric disorder and referred to as a 'high GHQ-12 score' (Department of Health, 2022). For this study, a variable 'Poor mental health' (for the Northern Ireland sample) was created where GHQ-12 scores of 4 or more were coded as 1, while scores of 3 or below were coded as 0.

On the other hand, the IHS adopts the Patient Health Questionnaire-8 (PHQ-8) depression screening instrument, which asks:

*Over the last 2 weeks, how often have you been bothered by any of the following problems?*

- *Little interest or pleasure in doing things?*
- *Feeling down, depressed or hopeless?*
- *Trouble falling or staying asleep, or sleeping too much?*
- *Feeling tired or having little energy?*
- *Poor appetite or overeating?*
- *Feeling negative about yourself or that you are a failure or have let yourself or your family down?*
- *Trouble concentrating on things, such as reading the newspaper or watching television?*
- *Moving or speaking so slowly that other people could have noticed; or being so fidgety or restless that you have been moving around a lot more than usual?*

Respondents select from one of four options for each item: 'Not at all'; 'Several days'; 'More than half the days'; 'Nearly every day', yielding a total score from 0 to 24. For Ireland, the variable 'Poor mental health' was coded as 1 for PHQ scores of 8 or above,[3] and 0 for scores of 7 or below.

[3] GHQ-12 is measured on a scale from 0–12, whereas PHQ-8 is measured from 0–24. A threshold of 8 is employed for PHQ-8 to approximate both measures of mental health across jurisdictions with the same factorial.

Although summary cutoff scores (GHQ ≥4; PHQ ≥8) classify binary psychological distress using validated clinical thresholds within each survey, differences in recall periods, scoring mechanics and scaling prevent direct cross-jurisdictional comparisons between these two measures. Rather than assuming cross-border equivalence, each screening tool is evaluated strictly within its respective dataset to assess relative within-jurisdiction mental health gradients across deprivation quintiles.

### 3.3.3 Health behaviours and risk factors

The following section describes health behaviours or risk factors reported in the HSNI and IHS surveys. These are categorised into protective health behaviours, which promote good health (comprising nutrition quality (measured by meeting the five-a-day fruit and vegetable guideline) and participating in physical activity), and health risk factors, which may increase the likelihood of adverse health outcomes (including smoking, alcohol consumption and obesity).

#### *Protective health behaviours*

##### Meets five-a-day

The IHS and HSNI monitor nutritional intake by recording the number of portions of fruit and vegetables consumed on a typical day as outlined in Table 3.1. From these, a binary 'meets five-a-day' variable was derived: this was assigned a value of 1 if the respondent consumes five or more portions daily, and 0 if otherwise.

**Table 3.1 Nutrition variables**

| IHS | HSNI |
|---|---|
| How many portions of fruit do you eat each day? | On average how many portions of fruit do you eat each day? |
| How many portions of vegetables or salad do you eat each day? | On average how many portions of salad or vegetables do you eat each day? |

*Source:* The IHS 2024 and the HSNI 2022/23.

### Physical activity

As detailed in Table 3.2, physical activity (PA) variables across the IHS and the HSNI are fundamentally irreconcilable due to substantial differences in measurement thresholds and activity classification. Additionally, both measures are subject to the inherent limitations of self-reported survey data.

For the IHS, respondents were asked to recall specific, individual activities (such as walking, cycling or sports) performed for a minimum threshold of 10 minutes in a typical week. For sports, fitness or recreational activities specifically, the survey captures the number of active days (ranging from 1 to 7 days, or 'I never carry out such physical activities'). To maintain a consistent binary variable analysis approach across both jurisdictions, the physical activity indicator for the IHS was coded as 1 if the respondent reported engaging in any listed physical activity for at least 10 minutes at least once a week, and 0 otherwise.

In contrast, the HSNI relies on a single, aggregate question measuring moderate-to-vigorous physical activity (MVPA) with a stricter minimum requirement of 30 minutes. Respondents were asked on how many days in an average week they perform physical activity intense enough to leave them out of breath. This was similarly coded as a binary indicator, equal to 1 for activity at least once a week, and 0 otherwise. Because the HSNI imposes a longer duration threshold of 30 minutes compared to 10 minutes in the IHS, and focuses strictly on breathlessness rather than individual recreational disciplines, direct cross-jurisdictional standardisation was unfeasible. Consequently, these binary physical activity variables were analysed and illustrated descriptively side by side to present activity patterns across deprivation quintiles within each respective jurisdiction.

**Table 3.2 Physical activity variables**

| IHS | HSNI |
|---|---|
| In a typical week, how many days do you WALK for at least 10 minutes? Response options: 1–7 days, or 'I never carry out such physical activities' | In an average week, on how many days would you do at least 30 minutes of physical activity (enough to make you out of breath)? |
| Respondents who walk are asked to specify their typical daily duration using the following brackets: 10–29 mins; 30–50 mins; 1–2 hrs; 2–3 hrs; or 3+ hrs | |
| In a typical week, how many days do you BICYCLE for at least 10 minutes? Response options: 1–7 days, or 'I never carry out such physical activities' | |
| Respondents who bike are asked to specify their typical daily duration using the following brackets: 10–29 mins; 30–50 mins; 1–2 hrs; 2–3 hrs; or 3+ hrs | |
| In a typical week, how many days do you carry out sports, fitness or recreational activities for at least 10 minutes? Response options: 1–7 days, or 'I never carry out such physical activities' | |
| Respondents reporting sports or fitness activities specify their typical weekly duration in hours and minutes. | |

*Source:* The IHS 2024 and the HSNI 2022/23.

### *Health risk factors*

#### Smoking

Current smoking behaviours across the IHS and HSNI datasets were standardised into binary 'Yes/No' responses. Although the specific question phrasing varies between the surveys, the underlying metrics were sufficiently comparable for a joint exploration (Table 3.3). However, a cross-jurisdictional analysis of vaping by deprivation quintiles was precluded due to an insufficient sample size within the Irish dataset. Furthermore, the IHS records cannabis use while the HSNI does not, preventing any cross-border exploration for this behaviour.

**Table 3.3 Smoking-related variables**

| IHS | HSNI |
|---|---|
| **Cigarette smoking** | |
| Do you smoke any tobacco products?<br>Yes: 'Daily'; 'Occasionally'<br>No: 'Used them in past'; 'Never' | Do you smoke cigarettes at all nowadays?<br>'Y/N' |
| On average, how many cigarettes do you smoke each day? | About how many cigarettes a DAY do you usually smoke:<br>• on weekdays?<br>• at weekends? |
| **E-cigarettes/vaping** | |
| Do you currently use electronic cigarettes or similar electronic devices (e.g. e-shisha, e-pipe)?<br>Yes: 'Daily'; 'Occasionally'<br>No: 'Former user'; 'Never' | Do you use electronic cigarettes or a vaping device at all nowadays?<br>'Y/N' |
| **Cannabis use** | |
| Have you used cannabis in the last 12 months?<br>'Y/N' | |

*Source:* The IHS 2024 and the HSNI 2022/23.

### Alcohol use

As shown in Table 3.4, categories for the frequency of alcohol use in the previous 12 months can be aligned between both surveys. For exact question formulations and response options, see Appendix Table A.4. The primary measure of alcohol consumption in this study is a binary variable for 'frequent drinking,' coded as 1 for those reporting daily or near-daily consumption, and 0 otherwise.

**Table 3.4 Frequency of alcohol consumption**

| Categorisation | IHS | HSNI |
|---|---|---|
| Frequent | • Every day or almost<br>• 5–6 days a week | • Almost every day<br>• 5 or 6 days a week |
| Regular | • 3–4 days a week<br>• 1–2 days a week | • 3 or 4 days a week<br>• Once or twice a week |
| Occasional | • 2–3 days a month<br>• Once a month | • Once or twice a month<br>• Once every couple of months |
| Infrequent | Less than once a month | Once or twice a year |
| Non-drinker | Not in past 12 months; Never | Not at all in last 12 months |

*Source:* The IHS 2024 and the HSNI 2022/23.

#### Obesity

Both the IHS and the HSNI collect self-reported anthropometric measurements, including height (recorded in feet/inches or metres/centimetres) and weight (recorded in stones/pounds or kilograms). These data allow for the calculation of BMI as a continuous variable (kg/m$^2$). For comparative analysis, a categorical variable was derived using the following classifications:

- Normal weight (including underweight): BMI <25
- Overweight: BMI 25 to <30
- Obese: BMI ≥30

From the above categories, a variable 'Obese' was defined as 1 for participants falling in the obese BMI category, and 0 otherwise.

### 3.3.4 Control variables

The multivariable regression analyses in this study control for core demographic variables common to both surveys: age and sex (the exact question wording in the IHS and the HSNI is documented in Appendix Table A.5). These attributes account for fundamental biological and demographic variations in health status across individuals in both jurisdictions.

## 3.4 Statistical analysis and estimation

The empirical framework in this study employs a combination of descriptive prevalence statistics, adjusted logistic regression estimation, interaction models and two decomposition approaches. For each health outcome and health-related behaviour/risk factor, analyses were conducted separately for each jurisdiction. The results for both are presented side by side to illustrate the trends across deprivation quintiles for each jurisdiction (acknowledging the distinct sampling and measurement approaches across each survey). To account for complex survey designs and non-response bias, all models incorporated their respective survey weights, allowing estimated parameters to be generalised to the populations across Northern Ireland and Ireland.

### 3.4.1 Adjusted logistic regression

Each outcome for analysis has a binary structure. For respondent *i* with deprivation quintile dummies *Q* (where the most deprived quintile, Q1, serves as the reference group), and a vector of harmonised controls *X* (comprising sex and age[4]), the log-odds of the outcome are specified as:

$$logit(p_i) = \alpha + \sum_{q=2}^{5} \beta_q Q_{qi} + \gamma' X_i$$

The quintile terms trace the full area-level socio-economic distribution, and results are reported as odds ratios exp($\beta_q$). A value greater than 1 denotes higher odds relative to the most deprived quintile reference group (Q1), while a value less than 1 indicates lower odds. Standard errors and 95 per cent confidence intervals accompany estimates.

### 3.4.2 Interaction models

To test whether the area-level pattern varies across subgroups, the model adds deprivation × subgroup interactions for sex, age category and urban/rural location, with *G* as the subgroup indicator:

$$logit(p_i) = \alpha + \sum_{q=2}^{5} \beta_q Q_{qi} + \delta G_i + \sum_{q=2}^{5} \theta_q Q_{qi} G_i + \gamma' X_i$$

Each interaction odds ratio exp($\theta_q$) measures whether the disparity relative to Q1 is more pronounced (above 1) or less pronounced (below 1) in the subgroup relative to the reference category – men, age 16–34 years and urban location respectively. These reference categories were selected to serve as baselines due to relatively lower illness rates and larger population shares.

### 3.4.3 Counterfactual decomposition

To evaluate the contribution of health-related behaviours and risk factors to socio-economic health disparities, a counterfactual decomposition approach was undertaken. This method provides insight on the question: if the most deprived quintile (Q1) were assigned the average behavioural profile of the least deprived quintile (Q5) for smoking, alcohol consumption, obesity, physical activity and diet, by how much would the observed Q1–Q5 health gap close?

[4] Sex (male, female); age categories (up to and including 34 years, 35–59 years, 60 years and above).

The potential reduction in the health gap under this counterfactual scenario is defined as the *closable share*. Conversely, the portion of the gap that persists following this equalisation, holding all other covariates constant at Q1 levels, is defined as the *residual share*. This unexplained component captures unobserved structural factors operating independently of individual health choices, such as disparities in public infrastructure, healthcare access, chronic environmental stress, pollution and the built environment (Crammond and Carey, 2016; Heller et al., 2024; Speybroeck et al., 2010).

Using the fitted model, the most deprived quintile's (Q1) predicted prevalence of a health outcome was computed under its own behaviour profile $B_1$, and under the least deprived quintile's profile $B_5$, holding other characteristics at their Q1 values. The behaviourally closable share represents the change in mean predicted prevalence when this profile is updated,

$$\Delta_{closeable} = E[\hat{y}_i(B_5)] - E[\hat{y}_i(B_1)]$$

while the residual share accounts for the remainder of the total Q1–Q5 gap not attributable to measured risk factor differences. Because both measures represent differences in predicted probabilities, these are reported in percentage points and sum to the total health gap.

This counterfactual decomposition is a static exploratory exercise rather than a realistic causal simulation of behavioural manipulation or policy interventions. Health-related behaviours and risk factors are not exogenous choices made in isolation; they are heavily conditioned and structured by the material, social and physical environments captured by area-level deprivation. Therefore, estimating the closable share does not imply a direct causal effect or establish a fixed upper bound on potential health improvements. In reality, structural interventions that alter environmental conditions may enable more effective, synergistic behaviour change, which may alter the behaviour–outcome relationship itself. Consequently, this model can be understood as capturing the observational share under existing baseline conditions, acknowledging that health risk factors and structural environments are deeply interdependent.

### 3.4.4 Oaxaca–Blinder decomposition

To attribute differences in health behaviours and risk factors to the overall health gap, a twofold Oaxaca–Blinder decomposition is employed. This statistical technique answers the question: when comparing the average health outcomes of two groups (here, the most deprived quintile Q1 and the least deprived quintile Q5), how much of that difference can be explained by observable differences in group characteristics (such as health behaviours and risk factors), and how much remains unexplained by these differences?

Following the standard twofold form, the overall mean outcome gap, $\Delta Y = \bar{Y}_{Q5} - \bar{Y}_{Q1}$, is decomposed into two distinct components:

$$\Delta Y = \underbrace{\sum_{k=1}^{K} \left(\bar{B}_{Q5,k} - \bar{B}_{Q1,k}\right) \beta_k^*}_{\text{Endowment component}} + \underbrace{\sum_{k=1}^{K} \bar{B}_{Q5,k} \left(\beta_{Q5,k} - \beta_k^*\right) + \sum_{k=1}^{K} \bar{B}_{Q1,k} \left(\beta_k^* - \beta_{Q1,k}\right)}_{\text{Coefficients/unexplained component}}$$

where $\bar{B}_{g,k}$ denotes the mean prevalence of behaviour or risk factor $k$ in group $g$ ($g \in \{Q1, Q5\}$), $\beta_{g,k}$ is its group-specific estimated coefficient, and $\beta_k^*$ represents the pooled reference coefficient (a neutral, average benchmark calculated across all survey respondents so that both groups are judged against the same standard).

1. The *endowment* component measures the portion of the health gap arising from differences in the actual prevalence of behaviours/risk factors between Q1 and Q5, valued at the pooled reference coefficient, $\beta_k^*$. This constitutes the main quantity reported in the results, expressed in percentage points:
    - Positive endownment term (+): Indicates that differences in the behaviour/risk factor widened or reinforced the socio-economic health disparity between Q1 and Q5.
    - Negative endownment term (−): Indicates that differences in the behaviour/risk factor offset or narrowed the socio-economic gap.

2. The *coefficients* component represents the unexplained structural portion, measuring disparities arising because the same health behaviour or risk factor may have a different health association or 'return' ($\beta_{Q5}$ vs $\beta_{Q1}$) across deprived and affluent areas.

A primary limitation of applying counterfactual and Oaxaca–Blinder decomposition techniques to observational data is the assumption of conditional independence among explanatory variables. In reality, area-level structural deprivation can influence the adoption, clustering and persistence of health risk behaviours (e.g. through fast-food retailer density, lack of safe green space or chronic stress arising from economic hardship). While this assumption violation limits drawing direct causal inferences or treating individual choices as independent of context, the decomposition remains a valuable exploratory framework. Rather than estimating isolated causal pathways, the estimates from this exercise show how neighbourhood disadvantage can shape behaviours and risk factors, which in turn can lead to differences in population health.

# Chapter 4
# Results

This chapter presents the empirical findings of the analysis; all descriptive statistics and model estimates incorporate sampling weights. Section 4.1 reports the weighted prevalence, unadjusted for demographic controls, of the three health outcomes (good self-rated health, long-standing illness and poor mental health) across deprivation quintiles in each jurisdiction, and the health behaviours and risk factors (meets five-a-day, participates in physical activity, smoking, frequent drinking, obesity). Section 4.2 reports adjusted odds ratios (aORs) of the health outcomes from logistic regressions controlling for deprivation quintile, age and sex. Section 4.3 explores whether the deprivation-based health disparities differ by sex, age category and urban/rural location. Section 4.4 reports a counterfactual decomposition partitioning the Q1–Q5 gap into a behaviourally closable share and a residual share. Section 4.5 presents an Oaxaca–Blinder decomposition attributing the health gap to individual health-related behaviours and risk factors.

While comparisons of prevalence rates, point estimates and regression coefficients between Ireland and Northern Ireland must be interpreted cautiously, the side-by-side analysis presented here allows us to investigate whether area-based health patterning holds across both jurisdictions. Cross-jurisdictional variations may reflect true population differences, variations in survey design and administration modes, conceptual differences between area-level deprivation indicators, or a combination of these factors.

## 4.1 Prevalence of health outcomes and behaviours by deprivation quintile

### 4.1.1 Health outcomes

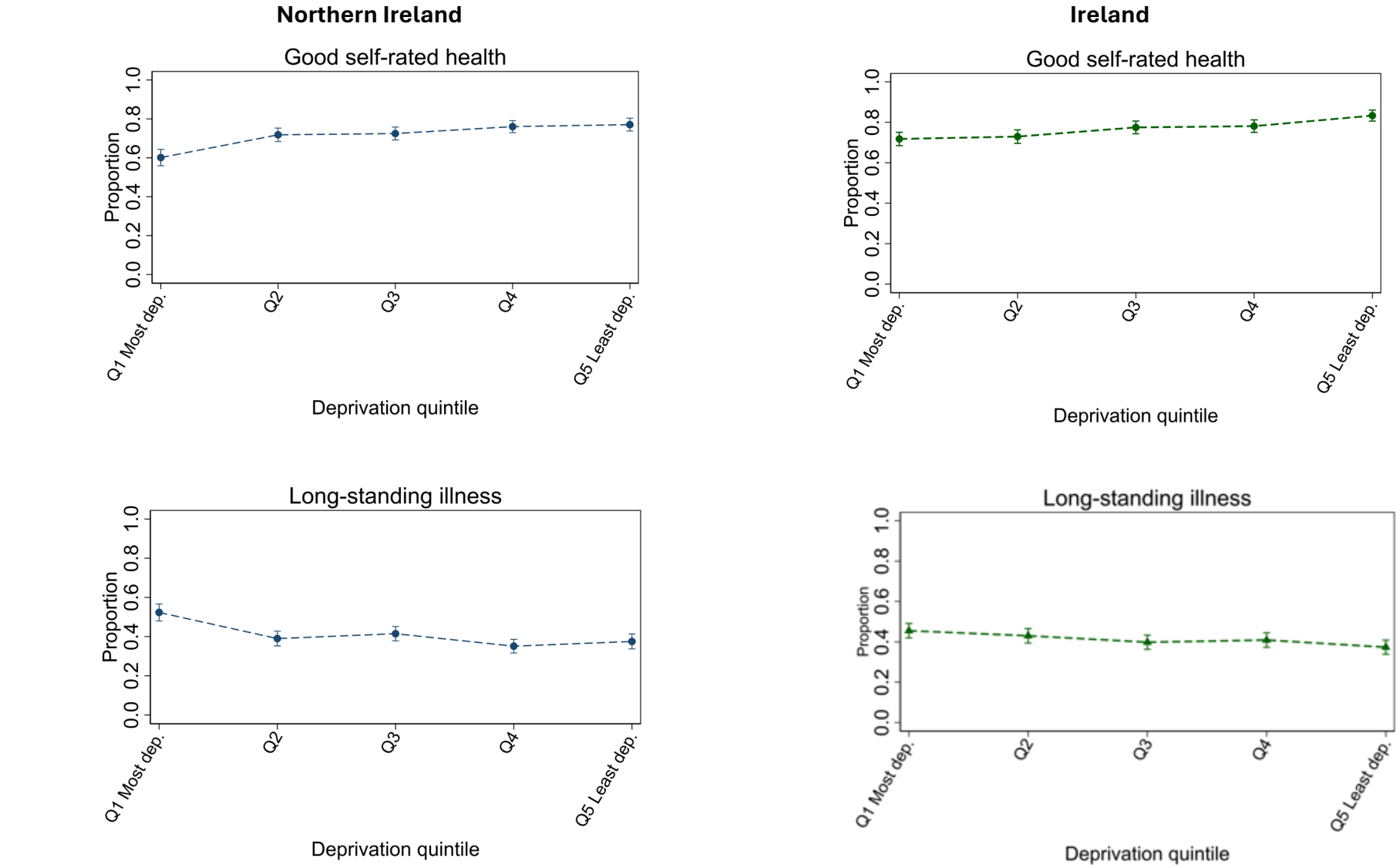
Figure 4.1 illustrates the prevalence of reporting good self-rated health, a long-standing illness and poor mental health, by quintile of area deprivation for each jurisdiction. Appendix Table A.6 reports the exact prevalence figures along with chi-square tests of difference.

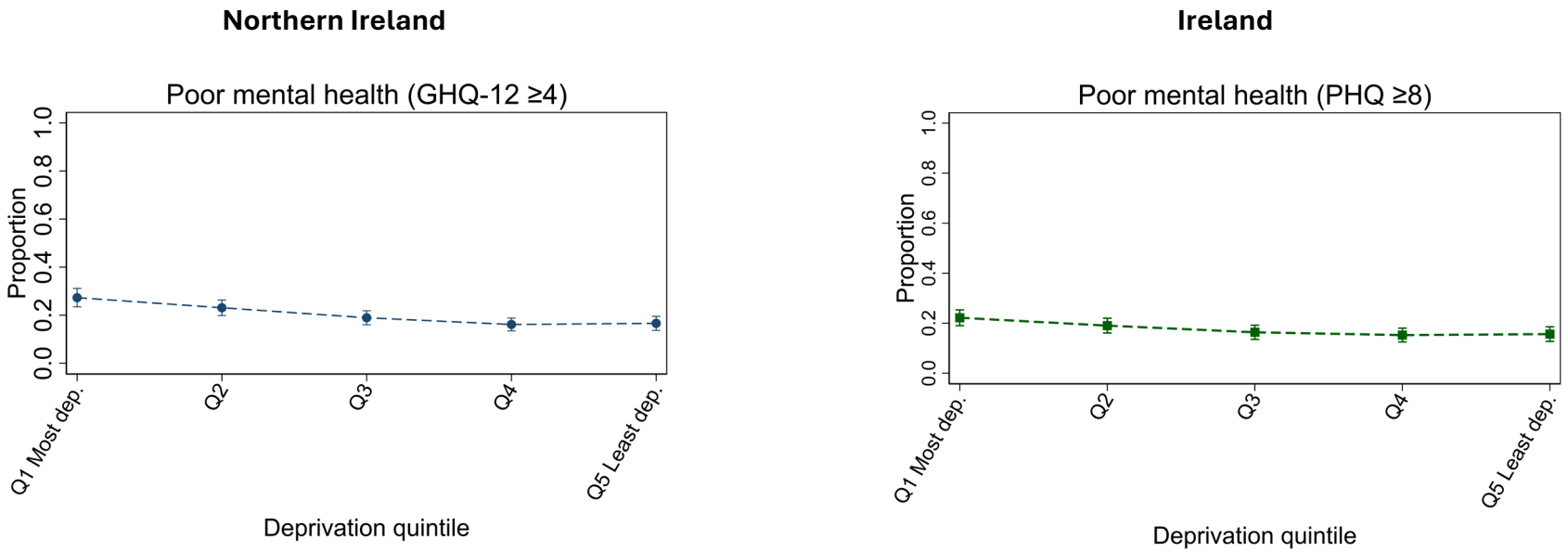
Figure 4.1 shows that for Northern Ireland, all three outcomes display health inequalities by area deprivation level: the proportion reporting

good self-rated health rose from approximately 60 per cent in Q1 (most deprived) to 77 per cent in Q5 (least deprived); the presence of a long-standing illness fell from 52 per cent to 38 per cent from Q1–Q5; and poor mental health (as derived from the GHQ-12 instrument) decreased from 27 per cent to 17 per cent. Nevertheless, overlapping confidence intervals across intermediate quintiles indicate that these inequalities may reflect a threshold gap between Q1 and higher quintiles rather than a continuous, linear gradient across all five groups.

In Ireland, the overall spread between extreme deprivation quintiles was shallower, though intermediate quintiles exhibited overlapping confidence intervals. Good self-rated health prevalence increased from 71 per cent to 83 per cent between Q1 and Q5; long-standing illness fell from approximately 46 per cent to 37 per cent; and poor mental health (as derived from the PHQ-8 instrument) declined from 22 per cent to 15 per cent. As observed in Northern Ireland, overlapping confidence intervals across intermediate quintiles indicate that health outcomes do not follow a statistically continuous gradient; rather, significance is primarily associated with differences between the highest and lowest socio-economic groups.

**Figure 4.1 Health outcomes by area-level deprivation quintile**






*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Prevalence of good self-rated health, long-standing illness and poor mental health (derived from the 12-item General Health Questionnaire (GHQ-12) in Northern Ireland and the 8-item Patient Health Questionnaire (PHQ-8) in Ireland), by area-level deprivation quintile.
n = 3,216 NI; n = 4,875 Ireland.
Bars around point estimates represent 95% confidence intervals.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

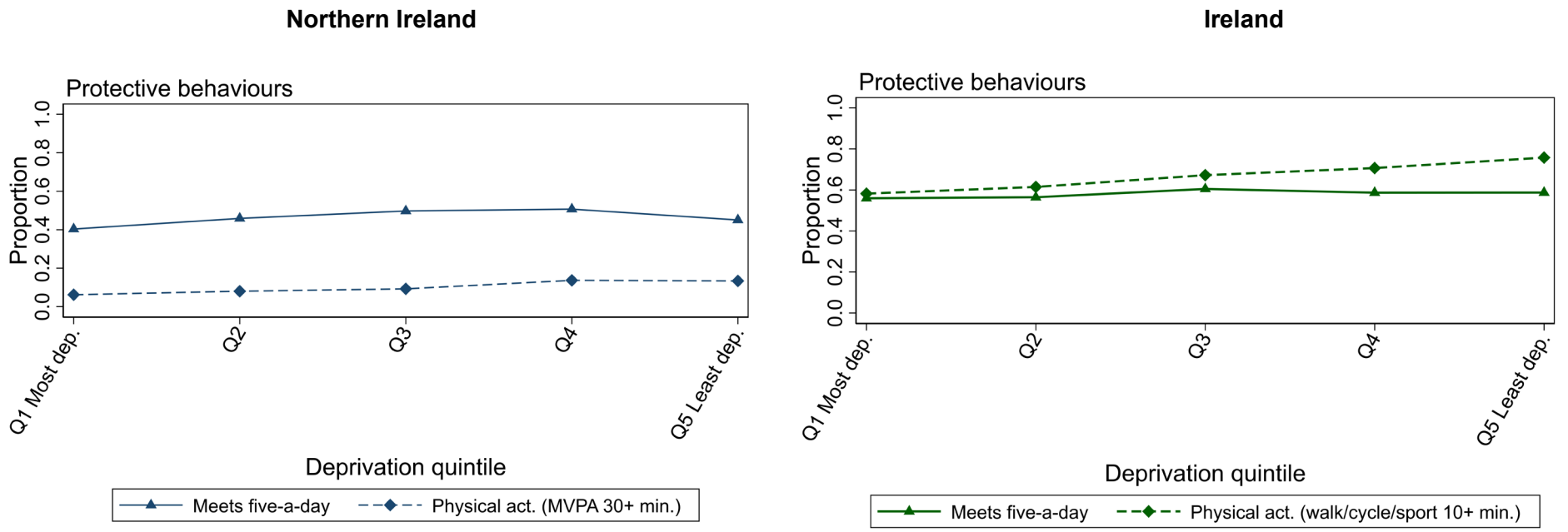
### 4.1.2 Health behaviours/risk factors

Figure 4.2 reports the prevalence of protective health-related behaviours, which encompass positive lifestyle factors that promote long-term health (meeting fruit and vegetable guidelines and participating in physical activity), by deprivation quintile in each jurisdiction. Figure 4.3 reports the prevalence of risky health-related behaviours (smoking, frequent alcohol consumption), and obesity as a health risk factor.

In Northern Ireland, meeting the five-a-day guideline displays a mild statistically significant positive association across deprivation–affluence quintiles (see Appendix Table A.6), peaking around Q4 at roughly 51 per cent. The indicator for participating in physical activity (based on reports of moderate-to-vigorous physical activity of at least 30 minutes per week) rose from a low base of 6 per cent in Q1 to 13 per cent in Q5. Among the risk factors, smoking prevalence declined steeply with area-level affluence, from approximately 25 per cent in Q1 to 7 per cent in Q5, while frequent alcohol consumption increased from 36 per cent to 45 per cent across the Q1–Q5 range. The prevalence of obesity declined modestly with decreasing levels of deprivation, from around 26 per cent in Q1 to 20 per cent in Q5.

In Ireland, deprivation-based gradients in health behaviours followed patterns broadly consistent with those observed in Northern Ireland, even though baseline prevalence estimates reflect differing survey measures and administration contexts. Meeting the five-a-day guideline hovered between 56 and 61 per cent across all quintiles. The physical activity measure for Ireland (based on reports of participation in walking, cycling or sports for ≥10 minutes a week) displayed a strong positive trend with increasing area-level affluence, rising from 58 per cent in Q1 to 76 per cent in Q5. Regarding health risks, smoking prevalence decreased with affluence (20 per cent in Q1 to 15 per cent in Q5), whereas frequent alcohol consumption increased markedly across quintiles (35 per cent in Q1 to approximately 50 per cent in Q5). Obesity levels declined with area-level affluence, decreasing from 33 per cent in Q1 to 20 per cent in Q5.

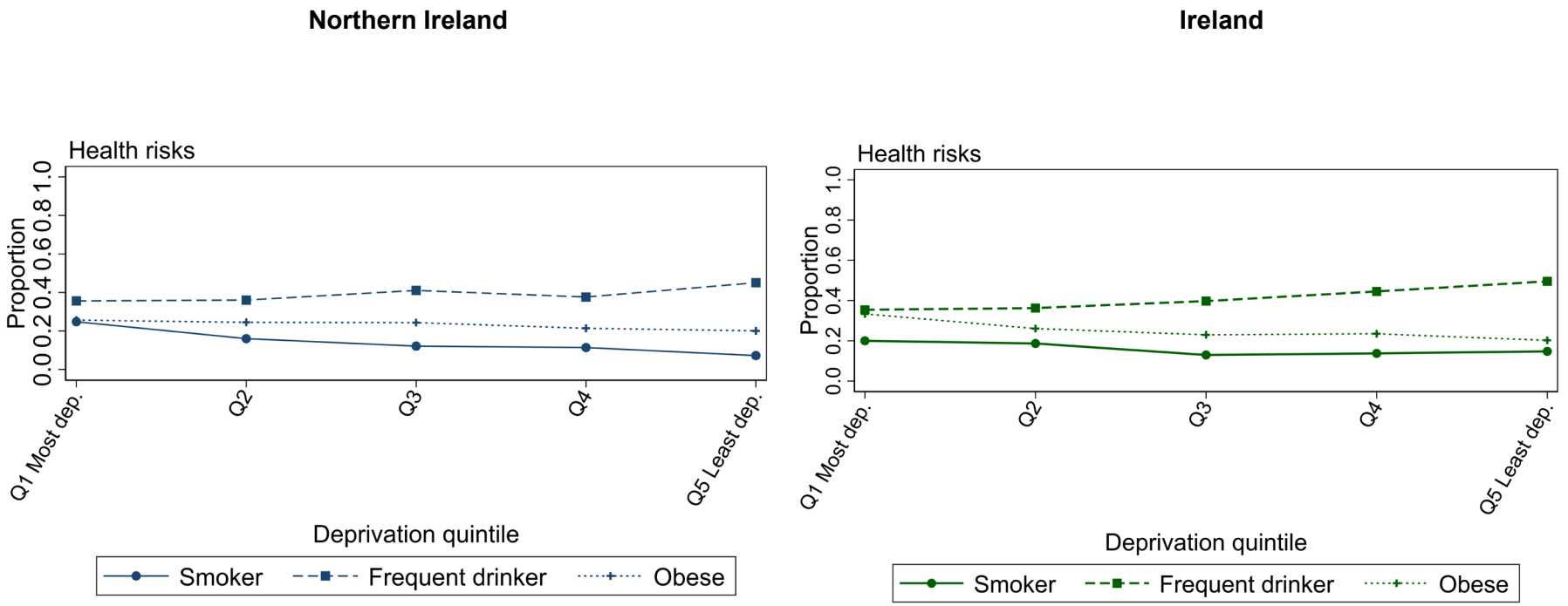
**Figure 4.2 Protective health behaviours by area-level deprivation quintile**




*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Prevalence of protective health behaviours by area-level deprivation quintile.
Sample sizes for 'meets five-a-day' are smaller than the main analysis sample in both Northern Ireland (n = 1,532) and Ireland (n = 1,669) due to item non-response (see Appendix Table A.2).
Physical activity definitions differ across surveys: Northern Ireland measures moderate-to-vigorous activity of ≥30 minutes/week (n = 3,216), whereas Ireland measures participation in walking, cycling or sports for ≥10 minutes/week (n = 4,875).
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

**Figure 4.3 Health risk behaviours/factors by area-level deprivation quintile**




*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Prevalence of health risk behaviours (current smoking; frequent drinking) and health risk factors (obesity) by area-level deprivation quintile.
n = 3,216 NI; n = 4,875 Ireland.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## 4.2 Adjusted odds ratios

Table 4.1 reports logistic regression results for the three health outcomes and the five health-related behaviours/risk factors, controlling for age and sex. The reference category in each case is Q1 (the most deprived quintile). Figures 4.4 and 4.5 present the results in forest-plot form.

### 4.2.1 Health outcomes

Table 4.1 and Figure 4.4 show that in Northern Ireland, adjusted area deprivation–affluence associations were statistically significant for all three health outcomes. The adjusted odds of reporting good self-rated health in the most affluent quintile (Q5) were approximately 2.7 times those in the most deprived quintile, with odds significantly higher across Q2–Q5 relative to Q1. The odds of long-standing illness in Q5 were approximately 0.5 times those in Q1, with reduced odds across Q2–Q5. Reduced odds of poor mental health were concentrated across Q3–Q5, where the odds in Q5 were approximately 0.5 times those in Q1.

In Ireland, the odds of good self-rated health were higher and statistically significant as the level of deprivation declined from Q3 to Q5, where the odds of good self-rated health in Q5 were 1.9 times those in Q1. The deprivation-based pattern for long-standing illness was weaker; no statistically significant differences were estimated between Q1 and quintiles Q2 and Q4, though individuals in Q5 had approximately 0.8 times the odds of long-standing illness compared to Q1. Poor mental health displayed a significant area-level disparity, with a reduced odds observed when contrasting Q1 with higher affluence levels (Q2–Q5).

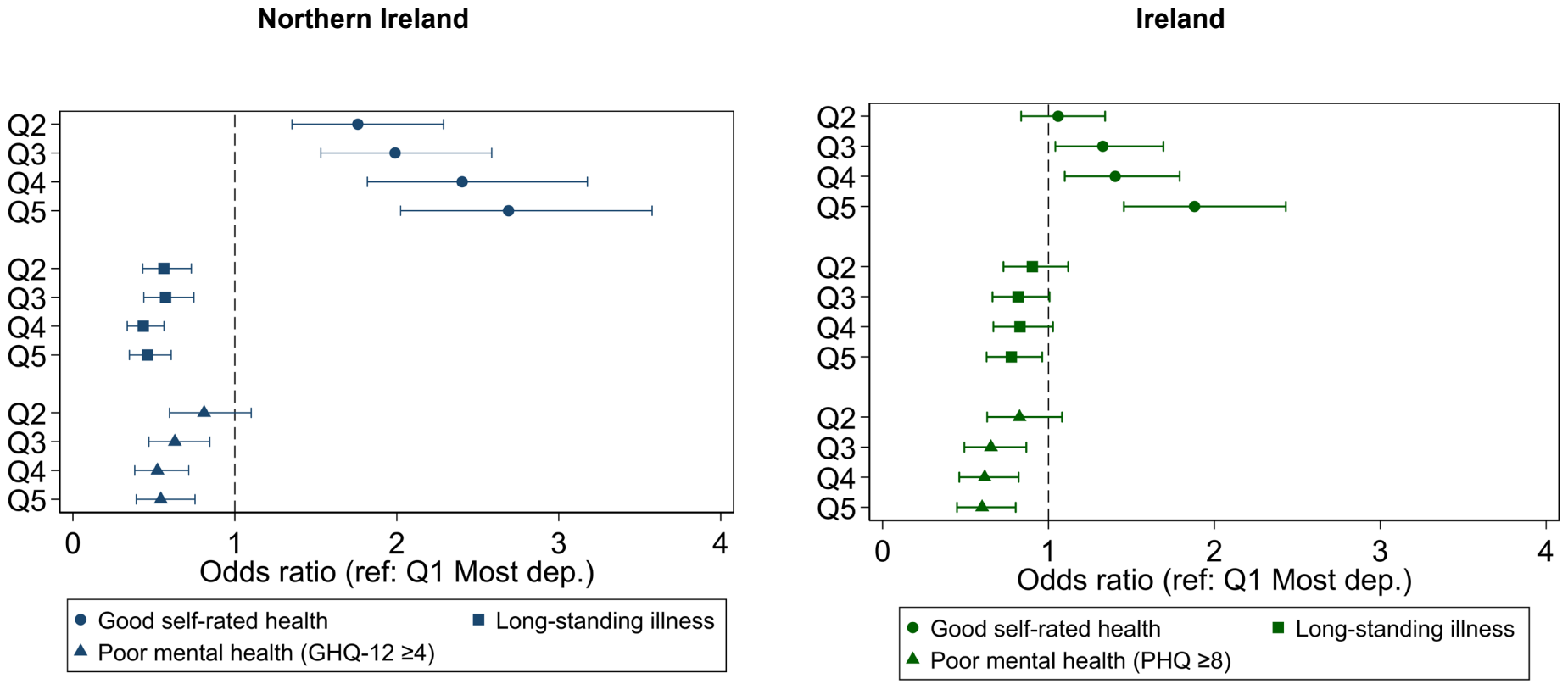
**Table 4.1 Adjusted odds ratios by area-level deprivation quintile**

| | Good self-rated health | | Long-standing illness | | Poor mental health§ | | Meets five-a-day | | Physical activity± | | Smoker | | Frequent drinker | | Obese | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quintile | NI | Ire | NI | Ire | NI§ | Ire§ | NI | Ire | NI± | Ire± | NI | Ire | NI | Ire | NI | Ire |
| Q2 vs Q1 | 1.76** | 1.06 | 0.56*** | 0.90 | 0.81 | 0.81* | 1.26 | 1.02 | 1.29 | 1.14 | 0.56*** | 0.91 | 0.98 | 1.02 | 0.94 | 0.70*** |
| | (0.24) | (0.13) | (0.08) | (0.10) | (0.13) | (0.09) | (0.25) | (0.20) | (0.33) | (0.12) | (0.10) | (0.13) | (0.14) | (0.11) | (0.13) | (0.08) |
| Q3 vs Q1 | 1.99*** | 1.33* | 0.57*** | 0.82* | 0.63*** | 0.76** | 1.48 | 1.20 | 1.55 | 1.45** | 0.42*** | 0.56*** | 1.21 | 1.23 | 0.90 | 0.60*** |
| | (0.27) | (0.16) | (0.08) | (0.09) | (0.09) | (0.09) | (0.29) | (0.23) | (0.36) | (0.16) | (0.07) | (0.09) | (0.17) | (0.13) | (0.13) | (0.07) |
| Q4 vs Q1 | 2.40*** | 1.40* | 0.43*** | 0.83 | 0.52*** | 0.78* | 1.56 | 1.11 | 2.34* | 1.73*** | 0.38*** | 0.62*** | 1.02 | 1.49** | 0.76* | 0.61*** |
| | (0.34) | (0.18) | (0.06) | (0.09) | (0.08) | (0.09) | (0.31) | (0.21) | (0.56) | (0.20) | (0.07) | (0.10) | (0.14) | (0.16) | (0.11) | (0.07) |
| Q5 vs Q1 | 2.69*** | 1.88*** | 0.46*** | 0.78** | 0.54*** | 0.72*** | 1.27 | 1.10 | 2.32* | 2.16*** | 0.23*** | 0.64*** | 1.37 | 1.93*** | 0.69** | 0.52*** |
| | (0.39) | (0.25) | (0.06) | (0.08) | (0.09) | (0.08) | (0.25) | (0.21) | (0.55) | (0.25) | (0.06) | (0.10) | (0.19) | (0.21) | (0.10) | (0.06) |
| N | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 1,532 | 1,669 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Survey-weighted logistic regression; reference Q1 (most deprived).
OR >1 = higher odds than Q1. Standard errors in parentheses. Regression models adjusted for age and sex.
Statistical significance indicated by p-value: * p<0.05, ** p<0.01, *** p<0.001.
⁺Measures used to derive indicators for poor mental health and physical activity differ considerably for Northern Ireland and Ireland.
§Poor mental health was derived from the 12-item General Health Questionnaire (GHQ-12) in Northern Ireland and the 8-item Patient Health Questionnaire (PHQ-8) in Ireland.
±Physical activity was derived from a measure of moderate-to-vigorous activity of ≥30 minutes/week in Northern Ireland, and a measure of participation in walking, cycling or sports for ≥10 minutes/week in Ireland.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

**Figure 4.4 Forest plot of adjusted odds ratios for health outcomes by area-level deprivation quintile**




*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Health outcome odds ratios by area-level deprivation quintile.
n = 3,216 NI; n = 4,875 Ireland.
Bars around point estimates represent 95% confidence intervals.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

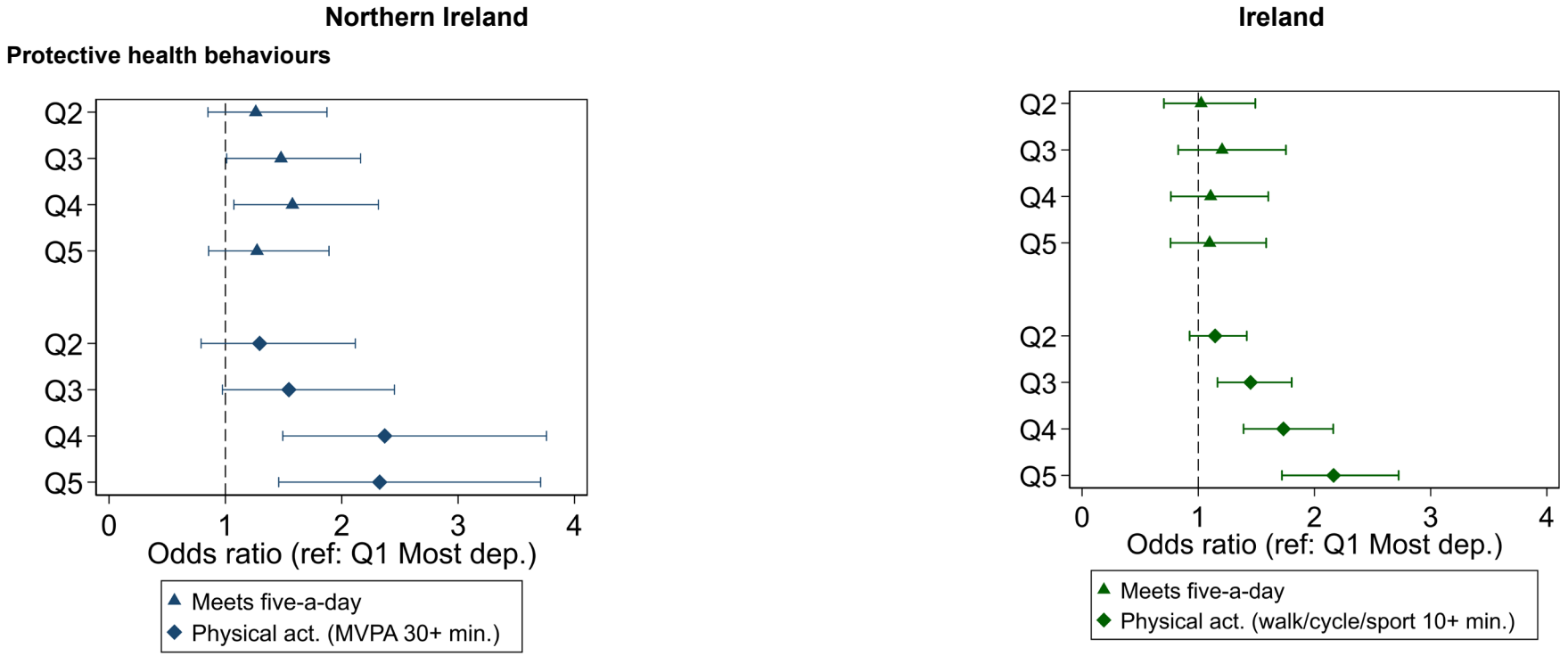
### 4.2.2 Health behaviours and risk factors

Examining protective health behaviours for Northern Ireland, Table 4.1 shows that individuals in more affluent quintiles (Q2–Q5) were not statistically significantly more likely to meet the five-a-day fruit and vegetable recommendation than those in the most deprived quintile (Q1). Conversely, physical activity displayed a clear positive association with affluence: individuals in Q4 were 2.3 times more likely to engage in physical activity than those in Q1, with a similar effect observed at Q5. For Ireland, adjusted regression models showed no statistically significant gradient across quintiles for meeting the five-a-day target. However, physical activity participation in Ireland increased substantially with affluence, where individuals in Q3 (aOR = 1.45), Q4 (aOR = 1.73) and Q5 (aOR = 2.16) exhibited progressively higher odds of physical activity relative to Q1.

Turning to health risk factors, Table 4.1 illustrates a steady decline in the adjusted odds of smoking as area-level affluence increased across quintiles 2 to 5 in Northern Ireland. The odds of smoking in Q5 were estimated as 0.23 times those of Q1, representing a substantial inverse pattern as illustrated in Figure 4.5. An affluence-based pattern was not statistically significant for alcohol consumption in Northern Ireland. However, individuals in Q4 and Q5 were associated with a lower odds of obesity (aOR = 0.76 and aOR = 0.69 respectively), relative to Q1.

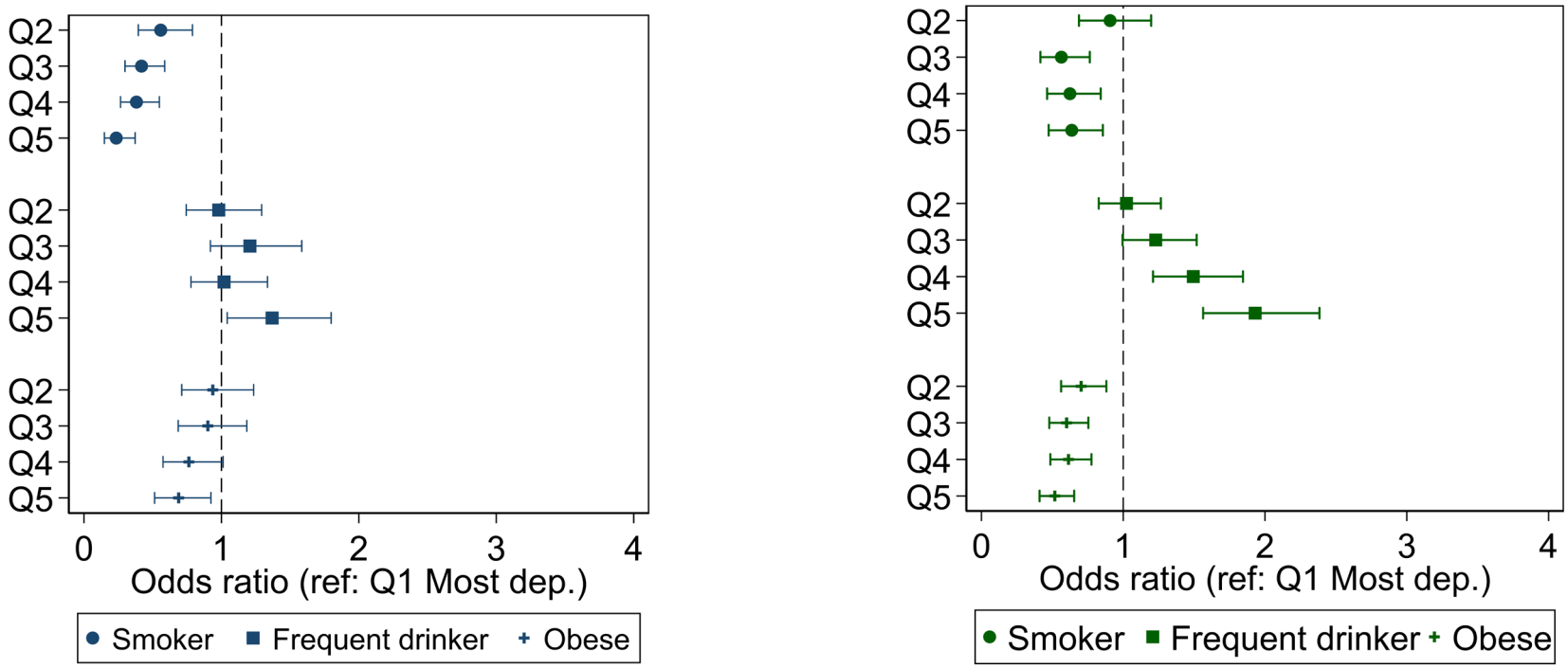
In Ireland, higher affluence was associated with significantly lower odds of smoking across quintiles. Frequent drinking displayed an upward association with area-level affluence: compared to Q1, individuals in Q4 had 1.5 times higher odds of frequent alcohol consumption, and those in Q5 nearly doubled the odds (aOR = 1.93) (Figure 4.5). A significant inverse obesity pattern was evident in Ireland, where relative to Q1, the odds of obesity were significantly lower in Q2 (aOR = 0.70), Q3 (aOR = 0.60), Q4 (aOR = 0.61) and Q5 (aOR = 0.52).

**Figure 4.5 Forest plots of adjusted odds ratios for health behaviours (protective and risk) by area-level deprivation quintile**



**Northern Ireland** **Ireland**

**Health risks**




*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Health behaviour/risk factor odds ratios by area-level deprivation quintile.
n = 3,216 NI; n = 4,875 Ireland. Sample sizes for 'meets five-a-day' are smaller than the main analysis sample in both Northern Ireland (n = 1,532) and Ireland (n = 1,669) due to item non-response (see Appendix Table A.2).
Bars around point estimates represent 95% confidence intervals.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## 4.3 Heterogeneity by sex, age and urban/rural location

For each health outcome and jurisdiction, the interaction between deprivation quintiles and sex, age category and urban/rural location was estimated. Overall, interaction effects by age and sex were weak, indicating that socio-economic disparities in health outcomes and behaviours were broadly stable across age groups and between men and women in both jurisdictions. Because only scattered single-quintile interaction effects reached statistical significance, this research found no evidence of systematic age- or sex-modification of the underlying deprivation-based patterns. Full estimation results for these models are consequently provided in Appendix Tables A.7 and A.8 respectively.

On the other hand, some indication of urban–rural interactions with area deprivation were estimated in the analyses for Northern Ireland, and these associations concentrated within the less deprived rural quintiles. For example, when examining the interaction between rural location and less deprived areas (Q2–Q5) in Northern Ireland, rural residents in Q4 and Q5 were estimated to have a lower odds of reporting good self-rated health and a higher odds of smoking, relative to their urban counterparts (see Appendix Table A.9).

## 4.4 Counterfactual decomposition

### 4.4.1 Behaviour–outcome associations for decomposition analyses

Before turning to the decompositions, the underlying behaviour–outcome associations on which they draw are reported, noting that these models draw on complete cases with available data for all included variables. Table 4.2 reports, for each outcome and each jurisdiction, a single survey-weighted logistic regression of the outcome on all five health-related behaviours and risk factors together with sex, age category and deprivation quintile. Each regressor is expressed as an odds ratio with its standard error displayed in parentheses. Because the three health outcomes are modelled as a function of all five health behaviours and risk factors, alongside deprivation quintiles and age–sex controls, these models are based on a smaller analytical sample size than the previous regression analyses. Specifically, including the five-a-day diet quality variable reduces the available sample size for Northern Ireland from 3,216 to 1,532, and for Ireland from 4,875 to 1,669.

The associations between the health outcomes and behaviours matter for what follows, because the contribution of any behaviour or risk factor to the deprivation gap in Sections 4.4.2 and 4.5 combines two quantities: how strongly the behaviour predicts the outcome (the odds ratios in Table 4.2), and how much the prevalence of that behaviour differs between the most and least deprived quintiles (the disparities reported in Section 4.1). A behaviour can only contribute materially to the gap if it both predicts the outcome and is unequally distributed across deprivation quintiles.

Dietary and physical activity associations diverge markedly across the two jurisdictions, differences that may partly reflect underlying variations in survey measurement rather than true differences in behavioural relationships. Participating in physical activity (defined as weekly moderate-to-vigorous physical activity of 30 minutes or more in Northern Ireland, and walking, cycling or sports participation for at least 10 minutes in Ireland) displayed differing statistical profiles. In Ireland, the physical activity measure was significantly associated with greater odds of reporting good self-rated health (aOR = 2.09, $p<0.001$),

lower odds of experiencing long-standing illness (aOR = 0.63, p<0.01), and reduced odds of poor mental health (aOR = 0.52, p<0.01). In Northern Ireland, however, the physical activity indicator displayed no statistically significant association with health outcomes, with odds ratios remaining close to 1 across all three health measures. Conversely, meeting the five-a-day fruit and vegetable guideline significantly lowered the odds of poor mental health in Northern Ireland (aOR = 0.57, p<0.01).

Table 4.2 shows that smoking was associated with substantially reduced odds of good self-rated health in Northern Ireland, as well as an elevated odds of long-standing illness and poor mental health. In Ireland, smoking correlated with lower odds of good self-rated health and higher odds of poor mental health, though any association with long-standing illness did not reach statistical significance. The modelling showed that obesity carries strong adverse health associations in both jurisdictions, correlating with lower odds of good self-rated health and increased odds of long-standing illness and poor mental health in both Northern Ireland and Ireland.

While the model estimates in Table 4.2 indicate an inverse association between frequent alcohol consumption and adverse health outcomes in Northern Ireland – such as a higher estimated odds of good self-rated health and lower odds of long-standing illness and poor mental health – this finding requires careful contextualisation. Rather than signalling frequent drinking as a protective factor, this pattern may reflect residual socio-economic confounding and interrelated lifestyle clustering (Conry et al., 2011; Naimi et al., 2005). In population surveys, frequent moderate alcohol consumption often tracks with higher socio-economic position and greater affluence (Katikireddi et al., 2017). These more affluent cohorts tend to benefit from a broader cluster of health-protective factors, including superior material living conditions, healthier dietary patterns and higher physical activity levels, which mitigate overall health risks (Probst et al., 2020).

Where the estimated health behaviour and risk factor associations with health outcomes reported here are combined with area-level prevalence distributions, these underpin the decomposition analyses in Sections 4.4.2 and 4.5.

## Table 4.2 Full multivariable models on health outcomes

| | Good self-rated health | | Long-standing illness | | Poor mental health[§] | |
|---|---|---|---|---|---|---|
| | **NI** | **Ireland** | **NI** | **Ireland** | **NI[§]** | **Ireland[§]** |
| **Health behaviours/risk factors** | | | | | | |
| Meets five-a-day | 1.28 | 0.91 | 0.91 | 1.19 | 0.57*** | 1.01 |
| | (0.17) | (0.15) | (0.11) | (0.15) | (0.10) | (0.19) |
| Physical activity[±] | 1.13 | 2.90*** | 0.94 | 0.63** | 0.99 | 0.52** |
| | (0.24) | (0.47) | (0.18) | (0.09) | (0.24) | (0.11) |
| Smoker | 0.39*** | 0.47*** | 2.09*** | 1.11 | 2.58*** | 2.42*** |
| | (0.08) | (0.11) | (0.41) | (0.23) | (0.50) | (0.59) |
| Frequent drinker | 1.62* | 1.27 | 0.70** | 0.83 | 0.66** | 0.75 |
| | (0.22) | (0.20) | (0.09) | (0.10) | (0.10) | (0.14) |
| Obese | 0.37*** | 0.27*** | 2.02*** | 2.57*** | 1.82*** | 1.86** |
| | (0.05) | (0.05) | (0.28) | (0.38) | (0.28) | (0.41) |
| **Demographic controls** | | | | | | |
| Female (ref: male) | 0.87 | 0.96 | 1.33* | 0.93 | 1.23 | 1.21 |
| | (0.11) | (0.15) | (0.17) | (0.11) | (0.20) | (0.25) |
| Age 35–59 (ref: <35 years) | 0.55* | 0.82 | 1.71** | 1.22 | 1.11 | 0.43*** |
| | (0.13) | (0.21) | (0.35) | (0.23) | (0.27) | (0.10) |
| Age 60+ (ref: <35 years) | 0.21*** | 0.50** | 4.83*** | 2.86*** | 1.16 | 0.25*** |
| | (0.05) | (0.13) | (0.97) | (0.57) | (0.27) | (0.07) |
| **Area-level deprivation quintile (ref: Q1)** | | | | | | |
| Q2 | 2.29*** | 0.97 | 0.51*** | 0.96 | 0.88 | 0.86 |
| | (0.46) | (0.23) | (0.10) | (0.19) | (0.20) | (0.24) |
| Q3 | 2.05*** | 1.33 | 0.52** | 0.89 | 0.63* | 0.73 |
| | (0.43) | (0.32) | (0.11) | (0.17) | (0.13) | (0.21) |
| Q4 | 2.42** | 0.97 | 0.45*** | 1.04 | 0.55* | 0.53* |
| | (0.52) | (0.23) | (0.09) | (0.20) | (0.13) | (0.16) |
| Q5 | 2.74*** | 1.64* | 0.47** | 0.86 | 0.68* | 0.54* |
| | (0.58) | (0.41) | (0.10) | (0.17) | (0.15) | (0.16) |
| **Observations[µ]** | 1,532 | 1,669 | 1,532 | 1,669 | 1,532 | 1,669 |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Odds ratios from survey-weighted logistic regression; standard errors in parentheses.
Reference categories: male; age 16–34; not employed; deprivation Q1 (most deprived).
[µ]The sample sizes for the decomposition analyses are smaller than those in Sections 4.1–4.3 since the analysis includes 'meets five-a-day' as a control variable, which reduces the number of available observations for both Northern Ireland (n = 1,532) and Ireland (n = 1,669).
Statistical significance indicated by p-value: * p<0.05, ** p<0.01, *** p<0.001.
[§]Poor mental health was derived from the 12-item General Health Questionnaire (GHQ-12) in Northern Ireland and the 8-item Patient Health Questionnaire (PHQ-8) in Ireland.
[±]Physical activity was derived from a measure of moderate-to-vigorous activity of ≥30 minutes/week in Northern Ireland, and a measure of participation in walking, cycling or sports for ≥10 minutes/week in Ireland.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

### 4.4.2 Counterfactual decomposition

This section evaluates the extent to which the Q1–Q5 health gap would narrow if the most deprived quintile (Q1) were assigned the behavioural profile of the least deprived quintile (Q5). As detailed in Section 3.4.3, this exercise calculates the *behaviourally closable share* (the portion of the gap attributable to differences in smoking, alcohol, obesity, physical activity and diet) and the *residual share* (the portion reflecting broader structural and unobserved disparities). Both components are expressed in percentage points of prevalence, and sum to the total observed gap.

Table 4.3 presents the decomposition results across outcomes. In Northern Ireland, health disparities are largely shaped by the residual share, particularly for physical health outcomes. The total Q1–Q5 gap in good self-rated health of 24.2 percentage points (pp) closes by −7.1 pp (29 per cent) under behavioural equalisation, leaving a residual share of −17.1 pp (71 per cent). Similarly, the 20.2 pp gap in long-standing illness closes by 4.8 pp (24 per cent), leaving 15.4 pp (76 per cent) residual. For poor mental health, the behavioural contribution accounts for 6.8 pp of the 14.0 pp total gap (48 per cent), while 7.3 pp (52 per cent) remains residual.

For Northern Ireland, the large residual share (i.e. structural component) may reflect deeply rooted, non-behavioural determinants of health. Such factors include long-standing legacy effects of conflict (e.g. localised trauma and mental health burdens in severely impacted communities), elevated rates of historical economic inactivity, and persistent neighbourhood-level deficits in infrastructure and services. Consequently, addressing behavioural differences alone may leave a substantial portion of the health gap unaddressed unless these underlying structural conditions are simultaneously targeted.

In Ireland, the behavioural share plays a large role across all outcomes. Behavioural equalisation accounts for 66.9 per cent of the total gap in good self-rated health (8.9 pp of 13.3 pp, leaving a 4.4 pp residual) and 50.4 per cent of the gap in poor mental health (4.0 pp of 8.0 pp, leaving a 4.0 pp residual). For long-standing illness, the 11.3 pp gap is split relatively evenly, with behaviours accounting for 45.9 per cent (5.2 pp) of the disparity, and the residual share comprising the remaining 6.1 pp.

These findings indicate that full behavioural equalisation between the most and least deprived areas would leave the majority of the Q1–Q5 gap in physical health outcomes intact in Northern Ireland. In Ireland, the equivalent exercise would close a substantial majority of the gap in good self-rated health and half of the poor mental health gap. These results suggest that universal behavioural interventions may be more effective in reducing area-level health inequalities in Ireland than in Northern Ireland, although non-trivial residual shares across both jurisdictions indicate that behavioural equalisation alone would be insufficient to eliminate area-level health disparities entirely.

**Table 4.3 Counterfactual decomposition of the Q1–Q5 health gap**

| Outcome | Jur. | Q1 actual (%) | Q1 w/Q5 behaviours (%) | Q5 actual (%) | Total gap (pp) | Behaviourally closable (pp) | Residual (pp) | % closable |
|---|---|---|---|---|---|---|---|---|
| Good self-rated health | NI | 55.0 | 62.1 | 79.1 | -24.2 | -7.1 | -17.1 | 29.3 |
| | Ireland | 75.0 | 83.9 | 88.3 | -13.3 | -8.9 | -4.4 | 66.9 |
| Long-standing illness | NI | 56.2 | 51.4 | 36.0 | 20.2 | 4.8 | 15.4 | 23.7 |
| | Ireland | 48.2 | 43.0 | 36.9 | 11.3 | 5.2 | 6.1 | 46.0 |
| Poor mental health[§] | NI | 29.8 | 23.0 | 15.8 | 14.0 | 6.8 | 7.3 | 48.3 |
| | Ireland | 16.7 | 12.7 | 8.7 | 8.0 | 4.0 | 4.0 | 50.4 |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* The sample sizes for the decomposition analyses are smaller than those in Sections 4.1–4.3 since the analysis includes 'meets five-a-day' as a control variable, which reduces the number of available observations for both Northern Ireland (n = 1,532) and Ireland (n = 1,669).
Q1 with Q5 behaviours = the predicted Q1 prevalence under the Q5 behaviour distribution, holding Q1 demographics fixed.
Total gap = Q1 actual−Q5 actual; behaviourally closable = portion attributable to behaviour differences; residual = remainder. Values in percentage points (pp).
[§]Poor mental health was derived from the 12-item General Health Questionnaire (GHQ-12) in Northern Ireland and the 8-item Patient Health Questionnaire (PHQ-8) in Ireland.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## 4.5 Oaxaca–Blinder decomposition

While the counterfactual analysis in Section 4.4.2 evaluates the behaviours as an aggregate block, this section attributes socio-economic health gaps to individual lifestyle-related factors and health risks. Table 4.4 reports the per-behaviour endowment contributions from Oaxaca–Blinder decompositions comparing the Q5 (least deprived) and Q1 (most deprived) groups. Each cell reports the contribution of prevalence differences between Q1 and Q5 in the level of that behaviour to the total Q1–Q5 gap in the relevant outcome, holding statistical returns to characteristics fixed. Results are presented in percentage points (pp) and discussed as percentage shares of the total gap.[5] A contribution that runs in the direction of the gap widens it, while a contribution of the opposite sign offsets it.

In Northern Ireland, the endowment component was led primarily by smoking. Observational differences in smoking prevalence aligned with 17.8 per cent (+4.3 pp out of 24.2 pp, $p<0.05$) of the Q1–Q5 gap in good self-rated health, and 45.0 per cent (−6.3 pp out of 14.0 pp, $p<0.001$) of the gap in poor mental health. While smoking and poor mental health are strongly co-associated in observational cross-sectional data, this statistical exercise reflects shared variance and underlying structural stressors rather than a direct, isolated causal pathway.

Using the data available for this research, this exercise did not find that any other individual behaviour or risk factor was statistically significant for good self-rated health and poor mental health in Northern Ireland. Furthermore, none of the measured behaviours available for this investigation was individually significant for long-standing illness. The overall endowment component was nonetheless statistically significant for good self-rated health (+4.9 pp, $p<0.05$) and poor mental health (−7.6 pp, $p<0.01$), indicating that health-related lifestyle

[5] To express each behaviour's contribution as a share of the gap, the percentage point figure in Table 4.4 is divided by the total Q1–Q5 gap for that outcome reported in Table 4.3. For example, the smoking endowment for poor mental health in Northern Ireland is −6.3 pp against a total gap of 14.0 pp, so smoking accounts for 6.3/14.0 = 45 per cent of the gap; for good self-rated health the smoking endowment of +4.3 pp against a 24.2 pp gap gives 17.8 per cent. The sign indicates the direction of the effect: smoking widens the poor mental health gap and narrows the good self-rated health gap, while the share is taken in absolute terms.

behaviours jointly contributed to disparities in health outcomes even where individual terms were imprecisely estimated. Consequently, the behavioural decomposition in Northern Ireland rested substantially on smoking.

In Ireland, a different set of risk factors shaped the endowment component. Obesity was the primary contributor to physical health disparities, accounting for 48.2 per cent (−5.45 pp out of 11.3 pp, $p<0.001$) of the long-standing illness gap and 32.4 per cent (+4.31 pp out of 13.3 pp, $p<0.001$) of the good self-rated health gap. Physical activity was also a key contributor, accounting for 21.5 per cent (+2.86 pp out of 13.3 pp, $p<0.05$) of the good self-rated health gap, and 24.9 per cent (−1.9 pp out of 8.0 pp, $p<0.05$) of the poor mental health gap. The total endowment component in Ireland was highly significant for both physical health outcomes (+10.5 pp for good self-rated health and −10.9 pp for long-standing illness, both $p<0.001$).

**Table 4.4 Oaxaca–Blinder decomposition: endowment contribution of behaviours to the Q1–Q5 gap**

| Health outcome | Jur. | Meets five-a-day | Physical activity‡ | Smoker | Frequent drinker | Obese | Total endowments |
|---|---|---|---|---|---|---|---|
| Good self-rated health | NI | +1.09 | −1.15 | +4.30* | +0.38 | +1.66 | +4.88* |
| | | (1.19) | (1.44) | (0.17) | (0.50) | (1.17) | (3.25) |
| | Ireland | −0.18 | +2.86* | −0.08 | +0.75 | +4.31*** | +10.52*** |
| | | (0.33) | (1.29) | (0.56) | (0.76) | (1.52) | (2.39) |
| Long-standing illness | NI | −0.82 | +0.20 | −3.07 | −0.32 | −0.88 | −3.71 |
| | | (0.93) | (1.73) | (1.65) | (0.46) | (0.72) | (3.20) |
| | Ireland | +0.09 | −0.34 | +0.04 | −0.96 | −5.45*** | −10.95*** |
| | | (0.23) | (1.16) | (0.29) | (0.95) | (1.70) | (2.61) |
| Poor mental health§ | NI | −0.82 | 0.83 | −6.30*** | -0.09 | −1.24 | −7.57** |
| | | (0.91) | (1.28) | (1.98) | (0.30) | (0.91) | (2.79) |
| | Ireland | -0.04 | −1.99* | +0.11 | -0.10 | −1.42 | −2.11 |
| | | (0.16) | (1.13) | (0.74) | (0.68) | (1.02) | (0.93) |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Twofold Oaxaca–Blinder decomposition (pooled), endowment component, expressed in percentage points of the Q1–Q5 gap. Standard errors in parentheses.

The sample sizes for the decomposition analyses are smaller than those in Sections 4.1–4.3 since the analysis includes 'meets five-a-day' as a control variable, which reduces the number of available observations for both Northern Ireland (n = 1,532) and Ireland (n = 1,669).

SE-based significance: * p<0.05, ** p<0.01, *** p<0.001.

§Poor mental health was derived from the 12-item General Health Questionnaire (GHQ-12) in Northern Ireland and the 8-item Patient Health Questionnaire (PHQ-8) in Ireland.

‡Physical activity was derived from a measure of moderate-to-vigorous activity of ≥30 minutes/week in Northern Ireland, and a measure of participation in walking, cycling or sports for ≥10 minutes/week in Ireland.

Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## 4.6 Results summary

The empirical findings may be summarised in four principal points. First, area-level health inequalities were evident across all three health outcomes in both jurisdictions. However, observed disparities and baseline health levels reflect distinct national survey methodologies, differing modes of administration and varying contextual baselines rather than direct cross-border differentials.

Second, the behavioural pathways linking area-level deprivation present notable profiles within each jurisdiction. In Northern Ireland, smoking exhibited a pronounced inverse association with respect to area-level deprivation, emerging as a major behavioural correlate associated with area-based health disparities in decomposition models. In Ireland, by contrast, the modelling reveals that health disparities operate more prominently alongside obesity and physical activity gradients along the area-level deprivation spectrum, bearing in mind that physical activity measures differ across the two surveys. Frequent drinking was associated with higher area-level affluence in Ireland. Meanwhile, protective health behaviours – including meeting five-a-day fruit and vegetable guidelines and engaging in physical activity – varied across deprivation levels within each respective jurisdiction.

Third, the area-level socio-economic health patterns across the majority of health indicators exhibited considerable structural stability across demographic subgroups for the two jurisdictions. Sex and age exerted negligible interaction associations with deprivation for health outcomes and health behaviours or risk factors. Minor variations in good self-rated health and smoking patterns in less deprived rural areas were estimated.

Finally, the share of the deprivation gap statistically associated with behavioural differences across quintiles differed across the two jurisdictions. In Ireland, a large share of the gap was accounted for by observed behaviours. In Northern Ireland the exercise revealed that the gap in health outcomes remains predominantly residual. Consequently, universal behavioural interventions (particularly those targeting obesity and physical activity) may offer distinct avenues for addressing health patterns in Ireland. In Northern Ireland, addressing

health gaps requires targeted, structural strategies alongside continued efforts in tobacco control and upstream socio-economic determinants.

# Chapter 5
# Summary and conclusions

## 5.1 Summary of findings

This report analyses health inequalities by area-level deprivation for both jurisdictions on the island of Ireland, utilising contemporary microdata from the Irish Health Survey 2024 and the Health Survey Northern Ireland 2022/23. The empirical findings provide three primary insights regarding health outcomes, lifestyle disparities and structural constraints across area-level deprivation quintiles in both jurisdictions, outlined below.

### 5.1.1 Pervasive health inequalities

First, persistent socio-economic disparities in relation to area-level deprivation, encompassing good self-rated health, long-standing illness and poor mental health, were visible across the two jurisdictions, pointing to health patterning across the socio-economic spectrum as established in wider international literature (Marmot and Bell, 2019; World Health Organization, 2025). Incremental increases in area-level affluence and reductions in area-level deprivation correspond with variations in subjective health status, though overlapping confidence intervals across intermediate quintiles indicate that these disparities often reflect pronounced gaps between the most deprived quintile and higher groups, rather than a uniform linear gradient. Furthermore, because the two jurisdictions employ distinct survey instruments, varying administration modes and differing definitions of deprivation (with Northern Ireland's Multiple Deprivation Measure incorporating health indicators directly), direct cross-border benchmarking of absolute health levels or effect sizes should be avoided.

### 5.1.2 Divergent behavioural pathways

Second, the specific behavioural correlates connecting residential disadvantage to health outcomes presented distinct profiles within each jurisdiction. In Northern Ireland, health inequalities across the deprivation spectrum correlated closely with tobacco use. Following multivariate adjustment, a prominent disparity was observed for smoking in Northern Ireland, echoing localised reports of dense retail tobacco clustering and concentrated smoking mortality in

disadvantaged communities (Northern Ireland Audit Office, 2024). Conversely, the socio-economic disparities in Ireland were characterised more prominently by obesity and physical activity differences. This finding may be consistent with international studies noting that suburban and urban environments can display significant disparities in obesogenic factors (Coutinho et al., 2023; Ford and Dzewaltowski, 2011).

Frequent drinking exhibited an upward social pattern, leaning progressively toward more affluent quintiles. The trend was especially pronounced in Ireland. This aligns with cross-jurisdictional research on older cohorts on the island, which reports more frequent alcohol consumption among higher-income groups (Hudson et al., 2015). While population-based data consistently show that more affluent individuals drink more frequently and in greater overall quantities (Doyle et al., 2026), this pattern likely reflects the well-established 'alcohol harm paradox' (Bellis et al., 2016). This paradox occurs where lower socio-economic groups suffer significantly higher alcohol-related morbidity and mortality despite lower average consumption or higher abstinence rates, driven largely by more extreme, heavy episodic drinking thresholds when they do consume alcohol (Lewer et al., 2016).

### 5.1.3 Structural determinants and health behaviours

Third, decomposition analyses indicate that the proportion of the deprivation health gap statistically associated with behavioural differences differed between the jurisdictions, reflecting the varying extent to which area-level deprivation captures modifiable factors versus structural influences. In Ireland, the closable share accounted for a substantial portion of the area-level deprivation health gap in observational models (up to 67 per cent of disparities in good self-rated health and 50 per cent in poor mental health). While individual indicators such as obesity, smoking or physical activity account for a portion of the health gap in observational models, these factors can be heavily constrained by neighbourhood environment, stress and material resources.

In Northern Ireland, the area-level health disparity was predominantly residual (explaining over 71 per cent of the gap in good self-rated health and 76 per cent in long-standing illness). This indicates that even if behavioural profiles were statistically equalised across area

deprivation quintiles, the majority of physical health disparities would remain intact in Northern Ireland, highlighting the heavy influence of deep-seated, structural disadvantage that operates independently of lifestyle pathways.

The variance between these analytical findings highlights that spatial inequalities operate within distinct jurisdictional contexts and administrative frameworks. Furthermore, because Northern Ireland's deprivation index explicitly incorporates a health and disability domain (whereas Ireland's index relies solely on socio-economic and demographic indicators), part of the observed divergence in residual health gaps may be driven by these differing measurement structures rather than contextual differences alone. In Northern Ireland, the overwhelming residual share indicates that health inequalities cannot be remedied solely through behavioural or lifestyle policy modifications. Instead, the persistent physical health gap points toward deeply entrenched systemic inequalities such as historical economic inactivity, educational deficits and structural infrastructure decay (Fitzgerald and Morgenroth, 2020; Leitch and Cownie, 2020). Furthermore, it may reflect a residual post-conflict dynamic characterised by lower institutional trust in the State (Rao et al., 2026), which can diminish receptivity and adherence to public health guidance (e.g. smoking cessation or dietary campaigns) within impacted communities (Seeman et al., 2025). Addressing these disparities requires interventions that address upstream socio-economic determinants, alongside efforts to rebuild civic trust and account for the enduring societal impacts of the Troubles (Braveman and Gottlieb, 2014; Marmot et al., 2020; Mohan et al., 2017; Mohan et al., 2020).

## 5.2 Policy considerations

The empirical evidence established in this report indicates that health inequalities on the island of Ireland are shaped by a complex interplay between individual lifestyles and area-level deprivation within neighbourhoods, commonly framed as the 'place effect' (Kawachi and Berkman, 2003). Importantly, the differing magnitude of residual shares observed across jurisdictions demonstrates that a single, standard public health model applied across Northern Ireland and Ireland would be insufficient. Policies that rely on a standard, undifferentiated approach in terms of either geographic jurisdiction or

demographic sub-populations cannot fully address the root causes of these area-level health disparities, as centralised frameworks fail to capture how social determinants interact dynamically within specific area-deprivation contexts (Marmot et al., 2020; Rutter et al., 2017).

Future resource allocation and public health frameworks could be targeted more effectively by balancing universal, population-wide measures with tailored, context-specific interventions targeted at area-level deprivation (Abdalla and Galea, 2026; McGowan et al., 2021; Moore et al., 2021). Given that baseline health outcomes across deprived quintiles present significant public health challenges in both jurisdictions, addressing these gaps requires broad macroeconomic, social policy and health infrastructure investments to elevate overall population health outcomes. However, to prevent universal strategies from unintentionally widening inequalities, broad investment must be paired with targeted, deprivation-weighted resourcing. This dual strategy aligns directly with the 'GPs at the Deep End' practice model in Northern Ireland (Butler et al., 2024), which highlights how frontline primary care in highly deprived areas bears an overwhelming burden from intergenerational trauma, the legacy of the Troubles and complex multimorbidity.

In Ireland, the 'Deep End Ireland' network brings together general practitioners working in socio-economically disadvantaged communities. O'Shea et al. (2024) highlight that modest, targeted grants allowed these practices to enhance service capacity and tailor care pathways to local needs. This integrated framework approach aligns with the Health Service Executive's (2026) *Public Health Strategy 2025–2030*, which sets out a structural pivot toward regionalised, integrated public health delivery aimed at addressing the wider determinants of health equity across the life course. Furthermore, as Phillip et al. (2026) argue, amplifying local voices and involving residents directly in decision-making processes remain vital for addressing deeply entrenched spatial and area-deprivation inequalities highlighted throughout this study.

Given that smoking prevalence remains a major contributor to health status disparities across area deprivation quintiles, sustained policy efforts are required to deliver high-quality, continuous interventions specifically targeted at smokers living in area-level socio-economically disadvantaged neighbourhoods (Northern Ireland Audit Office, 2024;

Public Health Agency, 2025b). To dismantle these ingrained behavioural clusters, macro-level fiscal measures may be structurally paired with immediate legislative frameworks, such as the Tobacco and Vapes Act (Williams and Hopkinson, 2026), and accessible, area-targeted cessation pathways. Within this framework, fiscal policies that mandate consistent, real-terms tax increases on tobacco products can serve as a highly cost-effective, population-wide mechanism to reduce consumption rates and discourage uptake among future generations, while simultaneously generating state revenue (World Health Organization, 2021). Long-term predictive modelling confirms that such sustained annual price increments can substantially contract socio-economic disparities in smoking-related cancer incidence and all-cause premature mortality over time, as financial pressures disproportionately trigger positive cessation behaviours among lower-income cohorts and across the most area-deprived quintiles (Gillespie et al., 2026; Lim and Khang, 2021).

However, macro-level fiscal measures need to be coupled with accessible, community-level support to assist current smokers in quitting. Individuals from lower socio-economic backgrounds have been found to experience disproportionate structural barriers to cessation, including higher baseline nicotine dependence and lower localised social support networks (Brose and McEwen, 2016; Hiscock et al., 2015).

Both jurisdictions have operationalised targeted interventions to address these equity gaps. In Ireland, this is driven through the *Sláintecare Healthy Communities* programme, which concentrates dedicated cessation infrastructure in areas of high social deprivation (Department of Health, 2023). Similarly, Northern Ireland's Public Health Agency commissions targeted specialist stop smoking services embedded directly within local community settings and general practices, deliberately prioritising client reach within the most deprived quintiles (Northern Ireland Audit Office, 2024; Public Health Agency, 2025b). Combining multi-faceted interventions by integrating behavioural counselling with pharmacological treatments (such as nicotine replacement therapy) offers an equity-focused mechanism to narrow smoking-driven health inequalities in both jurisdictions (Smith et al., 2020; Soerjomataram et al., 2011).

In contrast to tobacco use, frequent alcohol consumption correlated with higher area-level affluence, leaning progressively toward more affluent area-level quintiles in both jurisdictions. Because of this widespread diffusion among higher-income groups and more affluent areas, alcohol interventions require a population-based approach rather than being restricted to the specific geographic boundaries of deprived neighbourhoods. Population-wide measures, such as minimum unit pricing and statutory restrictions on alcohol outlet density, are vital tools to address the 'alcohol harm paradox' (Bellis et al., 2016; Mohan, 2024). These structural mechanisms may help protect vulnerable populations from heavy episodic drinking and the localised clustering of commercial off-licenses in deprived areas, without ignoring the high frequency of consumption observed in area-level affluent areas (Doyle and Foley, 2026; Doyle et al., 2026).

To effectively mitigate area-level health inequalities driven by physical inactivity and obesity, public health frameworks can transition from generic health promotion toward targeted, evidence-based initiatives tailored to deprived communities. The structural delivery mechanism of such programmes is decisive; empirical literature confirms that intensive, group-based interventions are substantially more effective for adults in disadvantaged areas than individualised counselling or broad, population-wide campaigns (Cleland et al., 2012; Craike et al., 2018). Nevertheless, public health commissioners encounter a recurring structural barrier: health gains achieved through intensive interventions frequently decay over the medium to long term.

In relation to addressing obesity levels in deprived areas, the rapid emergence of glucagon-like peptide-1 (GLP-1) receptor agonists presents new opportunities and challenges for spatial health inequalities. While pharmacotherapy is formally integrated alongside lifestyle interventions within the Health Service Executive (2021) *Model of Care for Overweight and Obesity*, public reimbursement via Community Drug Schemes remains tightly regulated through managed access protocols. This limits state-funded treatments to specific high-risk patient groups, creating a tier of out-of-pocket expenditure that risks widening socio-economic health gaps (Larkin et al., 2022). Although pharmacological therapies provide clear clinical efficacy for weight reduction, structured community-level initiatives remain essential to improve cardiorespiratory fitness, foster sustained physical activity and modify the underlying environmental and social

determinants of ill health. Achieving sustained population health returns will therefore require local public health interventions to combine structured group dynamics with robust, neighbourhood-tailored maintenance frameworks over time.

To successfully coordinate these multi-layered strategies and address the substantial residual health gaps that persist beyond lifestyle choices across levels of area-level deprivation, it is imperative that cross-border health research and governance are systematically strengthened. This report highlights that comparing health trends across the island of Ireland remains challenging due to inconsistent data collection methods and differing outcome measures. A critical milestone in this integration is the recent creation of the All-Island Public Health Knowledge Hub (PHKH). The PHKH is designed to strengthen the public health evidence base across both Ireland and Northern Ireland by establishing a unified, publicly accessible data portal. It is important that survey methodologies and key metrics for health outcomes, health-related behaviours and risk factors, and area-level deprivation are coordinated between the two jurisdictions. By utilising the PHKH to bridge existing data fragmentation, researchers and policymakers can better monitor health-risk synergies, evaluate area-based interventions, and develop joint, upstream strategies to tackle area-level determinants of health across the respective jurisdictions.

## 5.3 Limitations of the work and directions for future research

Several limitations should be considered when interpreting the findings of this study. First, the analysis is based on cross-sectional survey data from the Irish Health Survey and the Health Survey Northern Ireland, which limits the ability to draw causal conclusions. While the results demonstrate consistent associations between area-level deprivation and health outcomes, they cannot determine whether area-level deprivation directly causes poorer health behaviours or whether individuals with poorer health are more likely to reside in disadvantaged areas. A related conceptual limitation lies in the inability to fully separate contextual drivers (the independent health impact of the local physical, social or built environment) from compositional factors (the concentration of socio-economically disadvantaged individuals living within a specific area). Longitudinal

studies that track individuals and neighbourhood contexts over time would provide a stronger basis for understanding the causal pathways linking deprivation, health behaviours and health outcomes.

Second, the study relies on self-reported measures of health status, lifestyle behaviours and anthropometric characteristics. Self-report data are widely used in population health research, but may be affected by recall error, social desirability bias and differential reporting across socio-economic groups. Measures such as smoking, alcohol consumption, physical activity and body weight may therefore be subject to some degree of measurement error. Moreover, the differing survey modes employed by the IHS (primarily online) and the HSNI (mainly telephone) may alter the extent to which social desirability bias affects respondents across the two datasets. Consequently, observed cross-jurisdictional variations, such as differences in decomposition components, may partly reflect these survey mechanics rather than true population differences. Furthermore, while dichotomising metrics (such as self-rated health, BMI and physical activity) was required to harmonise cross-jurisdictional survey data, this forfeits some granular detail. Future work using continuous or non-linear models could further explore potential threshold or dose-response effects within intermediate deprivation quintiles.

Third, substantial differences in how the surveys were administered and what data were captured presented significant challenges relating to data harmonisation in this work. Although considerable effort was made to align measures across the two jurisdictions, differences in questionnaire design, variable definitions and survey methodologies limited the extent to which outcomes could be directly compared. In particular, mental health indicators were measured using different validated instruments, while physical activity measures could not be fully reconciled across surveys.

Fourth, the area-level deprivation measures employed between the two areas differed substantially, and since they are area-based indicators, these should not be interpreted as direct measures of individual socio-economic circumstances. Although area-level deprivation captures important contextual influences on health, substantial heterogeneity exists within neighbourhoods. Some individuals living in deprived areas may not themselves be

disadvantaged, while some disadvantaged individuals reside in relatively affluent areas. Moreover, population mobility and boundary effects mean individuals may not fit neatly into a single quantile, and area-based quantiles rarely divide target populations into perfectly equal numbers. Consequently, the findings may be interpreted as reflecting neighbourhood-level inequalities rather than individual-level socio-economic effects.

Additionally, while jurisdiction-specific deprivation indices capture local relative disadvantage effectively, future research could benefit from the development and application of a single, fully harmonised island-wide deprivation measure (building upon earlier work by Haase et al., 2015). Subject to data access and spatial boundary alignment, testing survey models against a unified cross-border deprivation metric could serve as a valuable robustness check.

A further limitation relates to temporal comparability. The most recent IHS data available for this study relate to 2024, whereas the latest accessible HSNI microdata for researchers was collected during 2022/23. This alignment was chosen deliberately to maximise data completeness and ensure as much structural variable compatibility as possible across both micro datasets. Although this represents the best available evidence for both jurisdictions, differences in collection periods may mean that some observed contrasts reflect broader social, economic or policy changes occurring between survey waves rather than jurisdictional differences alone.

Future research would benefit from greater harmonisation of health survey instruments across the island of Ireland, enabling more direct comparisons of health behaviours, mental health outcomes and socio-economic determinants. The development of linked administrative and longitudinal datasets would also provide opportunities to examine how changes in neighbourhood conditions influence health trajectories over the life course. In addition, future work could complement quantitative frameworks with qualitative research to gain deeper contextual insights into the lived experiences underpinning the trends reported here. Moving beyond deprivation rankings alone, mixed-methods approaches could explore the specific neighbourhood mechanisms that shape health inequalities, including access to healthcare, transport, green space, food environments, housing quality, social cohesion and perceptions of safety. Such research

would help identify which dimensions of place matter most for health and would provide policymakers with more actionable evidence to design effective interventions.

Finally, the findings highlight the importance of recognising that the effects of deprivation are context-dependent. The relationship between neighbourhood disadvantage and health is shaped by local social, economic and environmental conditions, meaning that interventions that are effective in one setting may not necessarily translate to another. It is therefore vital that future research continues to investigate how place-based factors interact with individual characteristics to produce health inequalities across different communities and jurisdictions.

## References

Abdalla, S.M. and Galea, S. (2026), 'Embracing complexity and innovation to tackle the social determinants of health', *BMJ Global Health*, 8(Supp 1), pp. 1–4.

Adebayo, Y., Duaa, A., Bafail, A. and Ebenezer, O. (2024), 'Prevalence, demographic, socio-economic, and lifestyle factors associated with cigarette, e-cigarette, and dual use: evidence from the 2017 – 2021 Scottish Health Survey', *Internal and Emergency Medicine*, 19(8), pp. 2151–2165.

Adler, N.E., Boyce, T., Chesney, M.A., Cohen, S., Folkman, S., Kahn, R.L. and Syme, S.L. (1994), 'Socioeconomic status and health: the challenge of the gradient.', *American Psychologist*, 49(1), p. 15.

Algren, M.H., Bak, C.K. and Berg-beckhoff, G. (2015), 'Health-risk behaviour in deprived neighbourhoods compared with non-deprived neighbourhoods: a systematic literature review of quantitative observational studies', *PLoS ONE*, 10(10), pp. 1–17.

Angus, C., Pryce, R., Holmes, J., Meier, P., Brennan, A., Gillespie, D. and Hickman, M. (2020), 'Assessing the contribution of alcohol-specific causes to socio-economic inequalities in mortality in England and Wales 2001–16', *Addiction*, 115(12), pp. 2268–2279.

Appleton, K.M., McGill, R., Neville, C. and Woodside, J. (2013), 'Moderate-vigorous physical activity in older people in Northern Ireland: levels, demographic patterns and types of moderate-vigorous physical activity undertaken', *Ageing International*, 38(3), pp. 207–217.

Appleton, K.M., Mcgill, R. and Woodside, J.V. (2009), 'Fruit and vegetable consumption in older individuals in Northern Ireland: levels and patterns', *British Journal of Nutrition*, 102(7), pp. 949–953.

Ball, K., Lamb, K.E., Costa, C., Cutumisu, N., Ellaway, A., Kamphuis, C.B.M., Mentz, G., et al. (2015), 'Neighbourhood socioeconomic disadvantage and fruit and vegetable consumption: a seven countries comparison', *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), p. 68.

Bambra, C. (2016), *Health Divides: Where You Live Can Kill You*. Bristol: Policy Press.

Barlow, P., Mohan, G., Nolan, A. and Lyons, S. (2021), 'Area-level deprivation and geographic factors influencing utilisation of general practitioner services', *SSM – Population Health*, 15, p. 100870.

Barrett, E.M., Hussey, J. and Darker, C.D. (2016), 'Location and deprivation are important influencers of physical activity in primary care populations', *Public Health*, 136, pp. 80–86.

Beacom, E., Furey, S., Hollywood, L. and Humphreys, P. (2021), 'Conceptualising household food insecurity in Northern Ireland: risk factors, implications for society and the economy, and recommendations for business and policy response', *SN Business & Economics*, 1(5), p. 67.

Bécares, L., Nazroo, J., Albor, C., Chandola, T. and Stafford, M. (2012), 'Examining the differential association between self-rated health and area deprivation among white British and ethnic minority people in England', *Social Science and Medicine*, 74(4), pp. 616–624.

Bellis, M.A., Hughes, K., Nicholls, J., Sheron, N., Gilmore, I. and Jones, L. (2016), 'The alcohol harm paradox: using a national survey to explore how alcohol may disproportionately impact health in deprived individuals', *BMC Public Health*, 1, p. 111.

Berg, J., Harting, J. and Stronks, K. (2019), 'Individualisation in public health: reflections from life narratives in a disadvantaged neighbourhood', *Critical Public Health*, 31(1), pp. 101–112.

Bernard, P., Charafeddine, R., Frohlich, K.L., Daniel, M., Kestens, Y. and Potvin, L. (2007), 'Health inequalities and place: a theoretical conception of neighbourhood', *Social Science & Medicine*, 65, pp. 1839–1852.

Blair, A., Ross, N.A., Gariepy, G. and Schmitz, N. (2014), 'How do neighborhoods affect depression outcomes? A realist review and a call for the examination of causal pathways', *Social Psychiatry and Psychiatric Epidemiology*, 49(6), pp. 873–887.

Bonney, A., Mayne, D.J., Jones, B.D., Bott, L., Stephen, E., Andersen, J., Caputi, P., et al. (2015), 'Area-level socioeconomic gradients in overweight and obesity in a community- derived cohort of health service users – a cross-sectional study', *PLoS ONE*, 10(8), pp. 1–13.

Braveman, P. and Gottlieb, L. (2014), 'The social determinants of health: it's time to consider the causes of the causes', *Public Health Reports*, 129, pp. 19–31.

Brennan, M.M., Bowe, A.K., Sheridan, A., Doyle, F., Boland, F. and Kavanagh, P. (2025), 'Evolution of nicotine product use in Ireland 2015–2023, and associations with quit intentions and attempts: an analysis of nationally representative repeated cross-sectional surveys', *The Lancet Regional Health – Europe*, 55, pp. 1–11.

Brose, L.S. and McEwen, A. (2016), 'Neighbourhood deprivation and outcomes of stop smoking support – an observational study', *PLoS ONE*, 11(1), p. e0148194.

Bunting, B., Corry, C., O'Neill, S. and Moore, A. (2017), 'Death by suicide at the ward level in Northern Ireland', *Psychological Medicine*, 48(8), pp. 1375–1380.

Butler, D., O'Donovan, D., Johnston, J. and Hart, N. (2024), ''Challenging but ultimately rewarding' – lived experiences of Deep End Northern Ireland GPs: a qualitative study', *British Journal of General Practice*, 74(749): e797-e804.

Central Statistics Office. (2019), 'Mortality differentials in Ireland 2016–2017', available at: www.cso.ie/en/releasesandpublications/in/mdi/mortalitydifferentialsinireland2016-2017/.

Central Statistics Office. (2025), 'Irish Health Survey 2024', available at: www.cso.ie/en/releasesandpublications/ep/p-ihsmr/irishhealthsurvey2024-mainresults/backgroundnotes/.

Cleland, C.L., Tully, M.A., Kee, F. and Cupples, M.E. (2012), 'The effectiveness of physical activity interventions in socio-economically disadvantaged communities: a systematic review', *Preventive Medicine*, 54(6), pp. 371–380.

Connolly, S., Reilly, D.O., Rosato, M. and Cardwell, C. (2010), 'Area of residence and alcohol-related mortality risk: a five-year follow-up study', *Addiction*, 106(1), pp. 84–92.

Conry, M.C., Morgan, K., Curry, P., McGee, H., Harrington, J., Ward, M. and Shelley, E. (2011), 'The clustering of health behaviours in Ireland and their relationship with mental health, self-rated health and quality of life', *BMC Public Health*, 11(1), p. 692.

Coutinho, S.R., Andersen, O.K., Lien, N. and Gebremariam, M.K. (2023), 'Neighborhood deprivation, built environment, and overweight in adolescents in the city of Oslo', *BMC Public Health*, 21(3), p. 812.

Craike, M., Wiesner, G., Hilland, T.A. and Bengoechea, E.G. (2018), 'Interventions to improve physical activity among socioeconomically disadvantaged groups: an umbrella review', *International Journal of Behavioral Nutrition and Physical Activity*, 15(1), p. 43.

Cronin, F.M., Hurley, S.M., Buckley, T., Mancebo, D., Lakshmanan, N., Gorman, A.O., Layte, R., et al. (2022), 'Mediators of socioeconomic differences in overweight and obesity among youth in Ireland and the UK (2011–2021): a systematic review', *BMC Public Health*, 22(1), p. 1585.

Cruise, S. and Kee, F. (2017), *Early Key Findings from a Study of Older People in Northern Ireland: The NICOLA Study*. Belfast: Queen's University Belfast.

Cummins, S., Curtis, S., Diez-Roux, A.V. and Macintyre, S. (2007), 'Understanding and representing 'place' in health research: a relational approach', *Social Science & Medicine*, 65, pp. 1825–1838.

Cummins, S.C.J., McKay, L. and Macintyre, S. (2005), 'McDonald's restaurants and neighborhood deprivation in Scotland and England', *American Journal of Preventive Medicine*, 29(4), pp. 308–310.

Darker, C.D., Donnelly-Swift, E., Whiston, L., Moore, F. and Barry, J.M. (2016), 'Determinants of self-rated health in an Irish deprived suburban population – a cross sectional face-to-face household survey', *BMC Public Health*, 16(1), p. 767.

Davies, N.P., Murray, R.L., Morling, J.R., Bains, M., Jones, M. and Langley, T. (2026), 'Impact of the United Kingdom's smokefree generation policy on tobacco-related equity in England: a simulation study', *Tobacco Control*, tc-2025-059669. doi: 10.1136/tc-2025-059669. Epub ahead of print.

Davis, G., Pimlott, S., Nally, B. and Dunne, A. (2025), *The Availability of Fast Food Outlets and Grocery Retailers in Northern Ireland and their Distance to Secondary Schools*. *Food Standards Agency Research and Evidence*, https://doi.org/10.46756/001c.138457

Department of Health. (2013), *Healthy Ireland: A Framework for Improved Health and Wellbeing 2013–2025*. Dublin: Department of Health.

Department of Health. (2021), *Healthy Ireland Strategic Action Plan 2021–2025*. Dublin: Government of Ireland. Available at: https://assets.gov.ie/static/documents/healthy-ireland-strategic-action-plan-2021–2025.pdf.

Department of Health. (2022), *Health Survey (NI): Technical Report 2021/22*. Belfast: Department of Health.

Department of Health. (2023), *Sláintecare Healthy Communities Progress Report 2022*. Dublin: Department of Health.

Department of Health. (2025), *Health Survey (NI): First Results 2024/25*. Belfast: Department of Health.

Department of Health. (2026), *Health Inequalities Annual Report 2026*. Belfast: Department of Health.

Desalvo, K.B., Bloser, N., Reynolds, K., He, J. and Muntner, P. (2006), 'Mortality prediction with a single general self-rated health question', *Journal of General Internal Medicine,* 21(3), pp. 267–275.

Devlin, A., McGuinness, S. and Whelan, A. (2025), *Barriers to Social Inclusion in Ireland: Change over Time and Space, 2016–2022*. ESRI Research Series 212, Dublin: ESRI.

Diez Roux, A.V. (2001), 'Investigating Neighborhood and Area Effects on Health', *American Journal of Public Health*, 91(11), pp. 1783–1789.

Doebler, S. and Glasgow, N. (2017), 'Relationships between deprivation and the self-reported health of older people in Northern Ireland', *Journal of Aging and Health*, 29(4), pp. 594–619.

Dore, E.C. and Idler, E. (2024), 'Self-rated health predicts mortality – but it depends on your age', *Social Science & Medicine*, 362, p. 117439.

Doyle, A. and Foley, R. (2026), 'An examination of alcohol outlet density, license type, and area-level deprivation in Ireland', *BMC Public Health,* https://doi.org/10.1186/s12889-026-29490-8.

Doyle, A., Stevely, A.K., Murphy, L. and Holmes, J. (2026), 'A systematic review of the association between alcohol-related deaths and area-level socioeconomic deprivation and other geographic characteristics in high-income countries', *BMC Public Health*, 26(1), p. 1892.

Doyle, A., Foley, R. and Houghton, F. (2024), 'A spatial examination of alcohol availability and the level of disadvantage of schools in Ireland', *BMC Public Health*, 24(1), p.795.

Eberth, B., Olajide, D., Craig, P. and Ludbrook, A. (2013), 'Smoking-related disease risk, area deprivation and health behaviours', *Journal of Public Health*, 36(1), pp. 72–80.

El-sayed, A.M., Scarborough, P. and Galea, S. (2012), 'Unevenly distributed: a systematic review of the health literature about socioeconomic inequalities in adult obesity in the United Kingdom', *BMC Public Health*, 12(1), p. 18.

Ellis, E., Grimsley, M., Goyder, E., Blank, L. and Peters, J. (2007), 'Physical activity and health: evidence from a study of deprived communities in England', *Journal of Public Health*, 29(1), pp. 27–34.

Erskine, S., Maheswaran, R., Pearson, T. and Gleeson, D. (2010), 'Socioeconomic deprivation, urban-rural location and alcohol-related mortality in England and Wales', *BMC Public Health*, 10(99), pp. 6–13.

Ferry, F., McDowell, R., Rosato, M., Murphy, J. and Leavey, G. (2025), 'Does change in area-level deprivation, change health outcomes? A latent class growth analysis of population data', *SSM – Population Health*, 31, p. 101826.

Feuillet, T., Valette, J.F., Charreire, H. and Julia, C. (2020), 'Influence of the urban context on the relationship between neighbourhood deprivation and obesity', *Social Science & Medicine*, 265, p. 113537.

Fitzgerald, J. and Morgenroth, E.L. (2020), 'The Northern Ireland Economy: problems and prospects', *Journal of the Statistical and Social Inquiry Society of Ireland*, 49, pp. 64–87.

Fone, D., Dunstan, F., Williams, G., Lloyd, K. and Palmer, S. (2007), 'Places, people and mental health: a multilevel analysis of economic inactivity', *Social Science and Medicine*, 64(3), pp. 633–645.

Fone, D., Greene, G., Farewell, D., White, J., Kelly, M. and Dunstan, F. (2013), 'Common mental disorders, neighbourhood income inequality and income deprivation: small-area multilevel analysis', *British Jounral of Psychiatry*, 202(11), pp. 286–293.

Ford, P.B. and Dzewaltowski, D.A. (2011), 'Neighborhood deprivation, supermarket availability, and BMI in low-income women: a multilevel analysis', *Journal of Community Health*, 36, pp. 785–796.

Fox, K.R., Hillsdon, M., Sharp, D., Cooper, A.R., Coulson, J.C., Davis, M., Harris, R., et al. (2011), 'Neighbourhood deprivation and physical activity in UK older adults', *Health and Place*, 17(2), pp. 633–640.

Fraser Wood, T., Dummer, T.J., Peters, C.E. and Murphy, R.A. (2025), 'Neighborhood level factors and use of cigarettes, cannabis and e-cigarettes: a population-based study among Canadian adults', *PLoS ONE*, 20(11), p. e0320035.

Frazer, J.S. and Frazer, G.R. (2020), 'GP prescribing in Northern Ireland by deprivation index: retrospective analysis', *Family Medicine and Community Health*, 8(3), pp. 2–10.

Galster, G. (2011), 'The mechanism(s) of neighbourhood effects: theory, evidence, and policy implications', in M. van Ham, D. Manley, N. Bailey, L. Simpson and D. Maclennan, eds. *Neighbourhood Effects Research: New Perspectives*. Dordrecht: Springer, pp. 23–56.

Gillespie, D., Morris, D., Kai, R., Chen, L., Brennan, A. and Branston, J.R. (2026), 'Reducing tobacco supplier profits and pricing power: modelling the impact of a tobacco price cap and tax increase on socioeconomic inequalities in England', *Social Science & Medicine*, 402, p. 119325.

Goldberg, P. (1972), *The Detection of Psychiatric Illness by Questionnaire*. London: Oxford University Press (Maudsley Monographs, no. 21).

Griffin, E., Bonner, B., Dillon, C.B., O'Hagan, D. and Corcoran, P. (2019), 'The association between self-harm and area-level characteristics in Northern Ireland: an ecological study', *European Journal of Public Health*, 29(5), pp. 948–953.

Haase, T., Pratschke, J. and Gleeson, J. (2015), 'All-Island HP Deprivation Index', in J. Gleeson, ed. *The Atlas of the Island of Ireland: Mapping Social and Economic Patterns*. Maynooth: All-Island Research Observatory and International Centre for Local and Regional Development, pp. 112–117.

Hanewinkel, R. and Hansen, J. (2025), 'Regional socioeconomic deprivation in Germany and nicotine use among children and adolescents', *International Journal of Environmental Health Research,* 34(2), pp. 1023–1033.

Harrington, D.W. and Elliott, S.J. (2009), 'Weighing the importance of neighbourhood: a multilevel exploration of the determinants of overweight and obesity', *Social Science and Medicine*, 68(4), pp. 593–600.

Hay, G.C., Whigham, P.A., Kypri, K. and Langley, J.D. (2009), 'Neighbourhood deprivation and access to alcohol outlets: a national study', *Health and Place*, 15(4), pp. 1086–1093.

Health Service Executive. (2021), *Model of Care for the Management of Overweight and Obesity*. Dublin: Health Service Executive.

Health Service Executive. (2026), *HSE Public Health Strategy 2025–2030: Achieving the Best Possible Health for Everyone in Ireland*. Dublin: Health Service Executive.

Heron, N., Tully, M.A., McKinley, M.C. and Cupples, M.E. (2014), 'Steps to a better Belfast: physical activity assessment and promotion in primary care', *British Journal of Sports Medicine*, 48(21), pp. 1558–1563.

Hiscock, R., Dobbie, F. and Bauld, L. (2015), 'Smoking Cessation and socioeconomic status: an update of existing evidence from a national evaluation of English stop smoking services', *BioMed Research International*, 1, p. 274056.

Hudson, E., Madden, D. and Mosca, I. (2015), 'A formal investigation of inequalities in health behaviours after age 50 on the island of Ireland', *The Economic and Social Review*, 46(2), pp. 233–265.

Hughes, K., Bellis, M.A., Hardcastle, K.A., McHale, P., Bennett, A., Ireland, R. and Pike, K. (2015), 'Associations between e-cigarette access and smoking and drinking behaviours in teenagers', *BMC Public Health*, 15(1), p. 244.

Hunter, R.F., Adlakha, D., Cardwell, C., Cupples, M.E., Donnelly, M., Ellis, G., Gough, A., et al. (2021), 'Investigating the physical activity, health, wellbeing, social and environmental effects of a new urban greenway: a natural experiment (the PARC study)', *International Journal of Behavioral Nutrition and Physical Activity*, 18(1), pp. 1–19.

Hunter, R.F., Boeri, M., Tully, M.A., Donnelly, P. and Kee, F. (2015), 'Addressing inequalities in physical activity participation: implications for public health policy and practice', *Preventive Medicine*, 72, pp. 64–69.

Hunter, R.F., Tully, M.A., Donnelly, P., Stevenson, M. and Kee, F. (2014), 'Knowledge of UK physical activity guidelines: implications for better targeted health promotion', *Preventive Medicine*, 65, pp. 33–39.

Jackson, S., Cox, S. and Brown, J. (2025), 'Trends in health-related economic inactivity by smoking status in England, 2013 – 2025: a population-based analysis', *The Lancet Regional Health – Europe*, 57, p. 101419.

Jivraj, S., Murray, E.T., Norman, P. and Nicholas, O. (2020), 'The impact of life course exposures to neighbourhood deprivation on health and well-being: a review of the long-term neighbourhood effects literature', *European Journal of Public Health*, 30(5), pp. 922–928.

Johansson, E.W., Shaaban, A.N., Ohlis, A., Mattsson, M., van der Velde, L., Wicks, S., et al. (2026), 'Depression or anxiety by region, small-area deprivation, and health care level in Sweden', *JAMA Network Open*, 9(8), pp. 1–12.

Johnston, D., Byrne, F., Scully, H., Laird, E., Bellew, P., Hendrick, L., Johnson, H., et al. (2022), 'The association between area-level demographic and socioeconomic parameters and vitamin D status in Ireland', *Proceedings of the Nutrition Society*, 81(June), p. 6285.

Katikireddi, S.V., Whitley, E., Lewsey, J., Gray, L. and Leyland, A.H. (2017), 'Socioeconomic status as an effect modifier of alcohol consumption and harm: analysis of linked cohort data', *The Lancet Public Health*, 2(6), pp. e267–e276.

Kawachi, I. and Berkman, L.F. (2003), *Neighborhoods and Health*. New York: Oxford University Press.

Keeble, M., Adams, J., Bishop, T.R.P. and Burgoine, T. (2021), 'Socioeconomic inequalities in food outlet access through an online food delivery service in England: a cross-sectional descriptive analysis', *Applied Geography*, 133(June), p. 102498.

Kelleher, C.C., Friel, S., Gabhainn, S.N. and Tay, J.B. (2003), 'Socio-demographic predictors of self-rated health in the Republic of Ireland: findings from the National Survey on Lifestyle, Attitudes and Nutrition, SLAN', *Social Science and Medicine*, 57(3), pp. 477–486.

Kelleher, C., Timoney, A., Friel, S. and McKeown, D. (2002), 'Indicators of deprivation, voting patterns, and health status at area level in the Republic of Ireland', *Journal of Epidemiology & Community Health*, 56(1), pp. 36–44.

Kent, L., Cardwell, C., Young, I. and Eastwood, A. (2021), 'Trends in maternal body mass index in Northern Ireland: a cross-sectional and longitudinal study', *Family Medicine and Community Health*, 9(4), p. e001310.

Kerins, C., Kerrigan, P., Furey, S., McCartan, A., Kelly, C., Jahir, T. and Vaughan, E. (2025), 'Newspaper framing of food poverty and insecurity on the island of Ireland', *Health Promotion International*, 40(6), pp. 1–11.

Kim, J. (2010), 'Neighborhood disadvantage and mental health: the role of neighborhood disorder and social relationships', *Social Science Research*, 39(2), pp. 260–271.

King, T., Kavanagh, A.M., Jolley, D., Turrell, G. and Crawford, D. (2006), 'Weight and place: a multilevel cross-sectional survey of area-level social disadvantage and overweight/obesity in Australia', *International Journal of Obesity*, 30(2), pp. 281–287.

Kleinschmidt, I., Hills, M. and Elliott, P. (1995), 'Smoking behaviour can be predicted by neighbourhood deprivation measures', *Journal of Epidemiology and Community Health*, 49(2), pp. 72–77.

Kroenke, K., Strine, T.W., Spitzer, R.L., Williams, J.B., Berry, J.T. and Mokdad, A.H. (2009), 'The PHQ-8 as a measure of current depression in the general population', *Journal of Affective Disorders,* 114(1–3), pp. 163-173.

Lake, A. and Townshend, T. (2006), 'Obesogenic environments: exploring the built and food environments', *The Journal of the Royal Society for the Promotion of Health*, 126(6), pp. 262–267.

Lakshman, R., McConville, A., How, S., Flowers, J., Wareham, N. and Cosford, P. (2011), 'Association between area level socioeconomic deprivation and a cluster of behavioural risk factors: cross sectional, population based study', *Journal of Public Health*, 33(2), pp. 234–245.

Larkin, J., Walsh, B., Moriarty, F., Clyne, B., Harrington, P. and Smith, S.M. (2022), 'What is the impact of multimorbidity on out-of-pocket healthcare expenditure among community-dwelling older adults in Ireland? A cross- -sectional study', *BMJ Open*, 12(9), pp. 1–12.

Leahy, D., Schaffalitzky, E., Armstrong, C., Bury, G., Cussen-murphy, P., Davis, R., Dooley, B., et al. (2013), 'Primary care and youth mental health in Ireland: qualitative study in deprived urban areas', *BMC Family Practice*, 14(1), p. 194.

Leitch, R. and Cownie, E. (2020), 'Poverty and education in Northern Ireland: the legacy of division and conflict', *Poverty in Education Across the UK*, pp. 37–64.

Lewer, D., Meier, P., Beard, E., Boniface, S. and Kaner, E. (2016), 'Unravelling the alcohol harm paradox: a population-based study of social gradients across very heavy drinking thresholds', *BMC Public Health*, 16(1), pp. 1–11.

Lim, H.K. and Khang, Y.H. (2021), 'Tobacco price increases in Korea and their impact on socioeconomic inequalities in smoking and subsequent socioeconomic inequalities in mortality: a modelling study', *Tobacco Control*, 30, pp. 160–167.

Lynch, S., Killeen, S.L., O'Brien, E., Mullane, K., Hokey, E., Mealy, G. and McAuliffe, F.M. (2024), 'Diet quality and blood pressure among pregnant women with overweight or obesity: a secondary analysis of two randomized controlled trials', *Acta Obstetricia et Gynecologica Scandinavica*, 103(6), pp. 1073–1082.

Macdonald, L., Cummins, S. and Macintyre, S. (2007), 'Neighbourhood fast food environment and area deprivation – substitution or concentration?', *Appetite*, 49, pp. 251–254.

Macintyre, S. (2007), 'Deprivation amplification revisited; or, is it always true that poorer places have poorer access to resources for healthy diets and physical activity?', *International Journal of Behavioral Nutrition and Physical Activity*, 4(1), p. 32.

Macintyre, S., Ellaway, A. and Cummins, S. (2002), 'Place effects on health: how can we conceptualise, operationalise and measure them ?', *Social Science & Medicine*, 55, pp. 125–139.

Maier, W., Scheidt-Nave, C., Holle, R., Kroll, L.E., Lampert, T., Du, Y., Heidemann, C., et al. (2014), 'Area level deprivation is an independent determinant of prevalent type 2 diabetes and obesity at the national level in Germany. Results from the National Telephone Health Interview Surveys 'German Health Update' GEDA 2009 and 2010', *PLoS ONE*, 9(2), p. e89661.

Marmot, M. (2010), *Fair Society, Healthy Lives: The Marmot Review*. London: The Marmot Review.

Marmot, M., Allen, J., Boyce, T., Goldblatt, P., Morrison, J. (2020), *Health Equity in England: The Marmot Review 10 Years On*. London: Institute of Health Equity.

Marmot, M. and Bell, R. (2019), 'Social determinants and non-communicable diseases: time for integrated action', *British Medical Journal*, 364, pp. 10–12.

McCallion, K. (2021), *Female Participation in Sport and Physical Activity in Northern Ireland*. Belfast: Northern Ireland Assembly, Research and Information Service.

McGowan, V.J., Buckner, S., Mead, R., Mcgill, E., Ronzi, S., Beyer, F. and Bambra, C. (2021), 'Examining the effectiveness of place-based interventions to improve public health and reduce health inequalities: an umbrella review', *BMC Public Health*, 21(1), p. 1888.

Miles, R., Coutts, C. and Mohamadi, A. (2012), 'Neighborhood urban form, social environment, and depression', *Journal of Urban Health*, 89(1), pp. 1–18.

Mohan, G. (2024), 'An evaluation of the impact of a national minimum unit price on alcohol policy on alcohol behaviours', *Journal of Public Health*, 47(1), pp. e94–e105.

Mohan, G. and Barlow, P. (2023), 'Area-level deprivation, neighbourhood factors and associations with mental health', *PLoS ONE*, 18(1), pp. 1–18.

Mohan, G., Longo, A. and Kee, F. (2017), 'Evaluation of the health impact of an urban regeneration policy: neighbourhood renewal in Northern Ireland', *Journal of Epidemiology and Community Health*, 71(9), pp. 919–927.

Mohan, G., Longo, A. and Kee, F. (2020), 'Post-conflict area-based regeneration policy in deprived urban neighbourhoods', *Regional Studies*, 54(6), pp. 789–801.

Moore, G., Campbell, M., Copeland, L., Craig, P., Movsisyan, A., Hoddinott, P., Littlecott, H., et al. (2021), 'Adapting interventions to new contexts – the ADAPT guidance', *BMJ*, 374, pp. 1–10.

Morrissey, K. (2016), 'Gender differences in the association between common mental disorders and regional deprivation in Ireland', *The Professional Geographer*, 68(1), pp. 129–137.

Naimi, T.S., Brown, D.W., Brewer, R.D., Giles, W.H., Mensah, G., Serdula, M.K., Mokdad, A.H., et al. (2005), 'Cardiovascular risk factors and confounders among nondrinking and moderate-drinking U.S. adults', *American Journal of Preventative Medicine*, 28(4), pp. 369–373.

Nevill, A., Donnelly, P., Shibli, S., Foster, C. and Murphy, M. (2014), 'Modifiable behaviors help to explain the inequalities in perceived health associated with deprivation and social class: evidence from a national sample', *Journal of Physical Activity and Health*, 11(2), pp. 339–347.

Neville, C., Burns, F., Cruise, S., Scott, A., Reilly, D.O., Kee, F. and Young, I. (2023), 'Cohort profile: the Northern Ireland Cohort for the Longitudinal Study of Ageing (NICOLA)', *International Journal of Epidemiology*, 52(4), pp. e211–e221.

Northern Ireland Audit Office. (2024), *Tackling the Public Health Impacts of Smoking and Vaping*. Belfast: Northern Ireland Audit Office.

Northern Ireland Statistics and Research Agency. (2017), *Northern Ireland Multiple Deprivation Measures 2017*. Belfast: Northern Ireland Statistics and Research Agency.

O'Brien, E.C., Alberdi, G., Geraghty, A.A. and McAuliffe, F.M. (2017), 'Lower education predicts poor response to dietary intervention in pregnancy, regardless of neighbourhood affluence: secondary analysis from the ROLO randomised control trial', *Public Health Nutrition*, 20(16), pp. 2959–2969.

O'Brien, W., Belton, S., Fitzpatrick, B., Shannon, S., Brennan, D., Chambers, F., Donovan, K.O., et al. (2024), 'Relationship between gender, physical activity, screen time, body mass index and wellbeing in Irish children from social-disadvantage', *Child Care in Practice*, 30(3), pp. 220–234.

O'Farrell, I.B., Corcoran, P. and Perry, I.J. (2016), 'The area level association between suicide, deprivation, social fragmentation and population density in the Republic of Ireland: a national study', *Social Psychiatry and Psychiatric Epidemiology*, 51(6), pp. 839–847.

O'Mahony, S., Collins, N., Doyle, G., McCann, A., Burke, K., Moore, A. and Gibney, E.R. (2024), 'A cross-sectional study of the relative availability and prominence of shelf space allocated to healthy and unhealthy foods in supermarkets in urban Ireland, by area-level deprivation', *BMC Public Health*, 1, p. 2689.

O'Reilly, D., Thompson, K.J., Murphy, A.W., Bury, G., Gilliland, A., Kelly, A., O'Dowd, T., et al. (2006), 'Socio-economic gradients in self-reported health in Ireland and Northern Ireland', *Irish Journal of Medical Science*, 175(3), pp. 43–51.

O' Shea, M., Kiely, B., Donnell, P.O. and Smith, S.M. (2024), 'An evaluation of the social deprivation practice grant in Irish general practice', *BJGP Open*, 8(2), pp. 1–8.

Payne, N., Brown, K.F., Delon, C., Kotrotsios, Y., Soerjomataram, I. and Shelton, J. (2022), 'Socio-economic deprivation and cancer incidence in England: quantifying the role of smoking', *PLoS ONE*, pp. 1–13.

Phillip, E., Griffin, S., Keogh, E., Bachari, A., Nyamakope, T., McDonnell, F., Kelly, J., et al. (2026), 'Community perspectives on health needs and assets in underserved Dublin areas: a participatory qualitative study', *Health Promotion International*, 41(1), pp. 1–16.

Pickett, K.E. and Pearl, M. (2001), 'Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review', *Journal of Epidemiology and Community Health*, 55(2), pp. 111–122.

Poortinga, W., Dunstan, F.D. and Fone, D.L. (2008), 'Neighbourhood deprivation and self-rated health: the role of perceptions of the neighbourhood and of housing problems', *Health and Place*, 14, pp. 562–575.

Probst, C., Kilian, C., Sanchez, S., Lange, S. and Rehm, J. (2020), 'The role of alcohol use and drinking patterns in socioeconomic inequalities in mortality: a systematic review', *The Lancet Public Health*, 5(6), pp. e324–e332.

Propper, C., Jones, K., Bolster, A., Burgess, S., Johnston, R. and Sarker, R. (2005), 'Local neighbourhood and mental health: evidence from the UK', *Social Science and Medicine*, 61(10), pp. 2065–2083.

Public Health Agency. (2025a), *Public Health Agency Corporate Plan 2025–2030*. Belfast: Public Health Agency.

Public Health Agency. (2025b), *Northern Ireland Tobacco Control Annual Report 2022–2023*. Belfast: Public Health Agency.

Rao, S., Van Assche, J., McKeown, S. and Sagherian-Dickey, T. (2026), 'Political trust in divided societies: who trusts whom in Northern Ireland?', *Peace and Conflict: Journal of Peace Psychology*, 32(3), pp. 296–299.

Remes, O., Lafortune, L., Wainwright, N., Surtees, P., Khaw, K. and Brayne, C. (2019), 'Association between area deprivation and major depressive disorder in British men and women: a cohort study', *BMJ Open*, 9(11), pp. 1–12.

Ribeiro, A.I., Fraga, S., Severo, M., Kelly-Irving, M., Delpierre, C., Stringhini, S., Kivimaki, M., et al. (2022), 'Association of neighbourhood disadvantage and individual socioeconomic position with all-cause mortality: a longitudinal multicohort analysis', *Lancet Public Health*, 7(5), pp. 447–457.

Riva, M., Gauvin, L. and Barnett, T.A. (2007), 'Toward the next generation of research into small area effects on health: a synthesis of multilevel investigations

published since July 1998', *Journal of Epidemiology & Community Health*, 61(10), pp. 853–861.

Rutter, H., Savona, N., Glonti, K., Bibby, J., Cummins, S., Finegood, D.T., Greaves, F., et al. (2017), 'The need for a complex systems model of evidence for public health', *The Lancet*, 390, pp. 2602–2604.

Salvatore, M.A. and Grundy, E. (2021), 'Area deprivation, perceived neighbourhood cohesion and mental health at older ages: a cross lagged analysis of UK longitudinal data', *Health and Place*, 67, p. 102470.

Schwaller, E., Green, M., Patterson, G., Flaherty, P.M.O. and Kypridemos, C. (2021), 'Area inequalities in fruit and vegetable intake in England: a spatial microsimulation, cross-sectional study', *The Lancet*, 398, p. S78.

Seeman, N., Trent, J. and Murty, K. (2025), 'Trust in community as a predictor of public health measure adherence: insights from a national Canadian survey', *Canada Communicable Disease Report*, 51(10), pp. 413–419.

Selvakumaran, S., Lin, C., Hadgraft, N., Chandrabose, M., Owen, N. and Sugiyama, T. (2023), 'Area-level socioeconomic inequalities in overweight and obesity: systematic review on moderation by built-environment attributes', *Health and Place*, 83, p. 103101.

Shohaimi, S., Welch, A., Bingham, S., Luben, R., Day, N. and Khaw, K. (2004), 'Residential area deprivation predicts fruit and vegetable consumption independently of individual educational level and occupational social class: a cross sectional population study in the Norfolk cohort of the European Prospective Investigation into Cancer (EPIC-Norfolk)', *Journal of Epidemiology and Community Health*, 58(8), pp. 686–691.

Shortt, N.K., Tisch, C., Pearce, J., Mitchell, R., Richardson, E.A., Hill, S. and Collin, J. (2015), 'A cross-sectional analysis of the relationship between tobacco and alcohol outlet density and neighbourhood deprivation', *BMC Public Health*, 15(1), p. 1014.

Smith, C.E., Hill, S.E. and Amos, A. (2020), 'Impact of specialist and primary care stop smoking support on socio-economic inequalities in cessation in the United Kingdom: a systematic review and national equity analysis', *Addiction*, 115(1), pp. 34–46.

Smith, D.M., Cummins, S., Taylor, M., Dawson, J., Marshall, D., Sparks, L. and Anderson, A.S. (2010), 'Neighbourhood food environment and area deprivation: spatial accessibility to grocery stores selling fresh fruit and vegetables in urban and rural settings', *International Journal of Epidemiology*, 39(1), pp. 277–284.

Soerjomataram, I., Barendregt, J.J., Gartner, C., Kunst, A., Møller, H. and Avendano, M. (2011), 'Reducing inequalities in lung cancer incidence through smoking policies', *Lung Cancer*, 73(3), pp. 268–273.

Spyreli, E., McGowan, L., Heery, E., Kelly, A., Croker, H., Lawlor, C., Neill, R.O., et al. (2022), 'Public beliefs about the consequences of living with obesity in the Republic of Ireland and Northern Ireland', *BMC Public Health*, 22(1), p. 1910.

Staatz, C.B., Kelly, Y., Lacey, R.E. and Hardy, R. (2021), 'Area-level and family-level socioeconomic position and body composition trajectories: longitudinal analysis of the UK Millennium Cohort Study', *The Lancet Public Health*, 6(8), pp. e598–e607.

Stafford, M., Brunner, E.J., Head, J. and Ross, N.A. (2010), 'Deprivation and the development of obesity: a multilevel, longitudinal study in England', *American Journal of Preventative Medicine*, 39(2), pp. 130–139.

Stafford, M. and Marmot, M. (2003), 'Neighbourhood deprivation and health: does it affect us all equally?', *International Journal of Epidemiology*, 32(3), pp. 357–366.

Stallings-Smith, S., Goodman, P., Kabir, Z., Clancy, L. and Zeka, A. (2014), 'Socioeconomic differentials in the immediate mortality effects of the national Irish smoking ban', *PLoS ONE*, 9(6), p. e98617.

Strachan, E., Duncan, G., Horn, E. and Turkheimer, E. (2017), 'Neighborhood deprivation and depression in adult twins: genetics and gene×environment interaction', *Psychological Medicine*, 47(4), pp. 627–638.

Swinburn, B.A., Sacks, G., Hall, K.D., Mcpherson, K., Finegood, D.T., Moodie, M.L. and Gortmaker, S.L. (2011), 'The global obesity pandemic: shaped by global drivers and local environments', *The Lancet*, 378(9793), pp. 804–814.

Townsend, P. (1987), 'Deprivation', *Journal of Social Policy*, 16(2), pp. 125–146.

Tseliou, F., Maguire, A., Donnelly, M. and Reilly, D.O. (2016), 'The influence of mobility on mental health status in young people: the role of area-level deprivation', *Health and Place*, 42, pp. 96–103.

Tsimpida, D., Tsakiridi, A. and Oliver, E.J. (2026), 'An ecology of depression: place-specific pathways between socioeconomic and environmental deprivation and mental health inequality', *Journal of Environmental Psychology*, 111, p. 102978.

Valentelyte, G., Sheridan, A., Kavanagh, P., Doyle, F. and Sorensen, J. (2025), 'Socioeconomic variation in tobacco smoking among the adult population in Ireland', *Nicotine and Tobacco Research*, 27(7), pp. 1218–1226.

Van Lenthe, F.J. and Mackenbach, J.P. (2002), 'Neighbourhood deprivation and overweight: the GLOBE study', *International Journal of Obesity*, 26(2), pp. 234–240.

Warburton, D.E.R., Nicol, C.W. and Bredin, S.S.D. (2006), 'Health benefits of physical activity: the evidence', *Canadian Medical Association Journal*, 174(6), pp. 801–809.

Watts, P., Phillips, G., Petticrew, M., Hayes, R., Bottomley, C., Yu, G., Schmidt, E., et al. (2013), 'Physical activity in deprived communities in London: examining individual and neighbourhood-level factors', *PLoS ONE*, 8(7), pp. 1–8.

Weich, S., Twigg, L., Lewis, G. and Jones, K. (2005), 'Geographical variation in rates of common mental disorders in Britain: prospective cohort study', *British Journal of Psychiatry*, 187(1), pp. 29–34.

Williams, P.J. and Hopkinson, N.S. (2026), 'The 2026 Tobacco and Vapes Act: on to the tobacco endgame', *Thorax*, 81(7), pp. 635–637.

Woods, C.B., Crowley, E., Powell, C., Brien, W.O., Murphy, H., Belton, S., Saunders, J., et al. (2021), 'Socio-ecological correlates of physical activity in a nationally representative sample of adolescents across Ireland and Northern Ireland', *Preventive Medicine Reports*, 23, p. 101472.

World Health Organization. (2006), *Commission on Social Determinants of Health*. Geneva: World Health Organization.

World Health Organization. (2021), *WHO Technical Manual on Tobacco Tax Policy and Administration*. Geneva: World Health Organization.

World Health Organization. (2025), *World Report on Social Determinants of Health Equity*. Geneva: World Health Organization.

Xiao, Q., Berrigan, D. and Matthews, C.E. (2017), 'A prospective investigation of neighborhood socioeconomic deprivation and self-rated health in a large US cohort', *Health and Place*, 44, pp. 70–76.

Zhang, Y., Liu, N., Li, Y., Long, Y., Baumgartner, J., Adamkiewicz, G. and Bhalla, K. (2023), 'Neighborhood infrastructure-related risk factors and non-communicable diseases: a systematic meta-review', *Environmental Health*, 22(2), pp. 1–15.

# Appendix

## A.1 Additional information on the datasets

Table A.1 shows that missing data across the Health Survey Northern Ireland (HSNI, n = 3,582) and the Irish Health Survey (IHS, n = 5,100) are very small for core demographic and general health indicators, but substantial for specific lifestyle measures. Non-response was most severe for the 'meets five-a-day' dietary metric, affecting more than half of respondents in Northern Ireland and approximately one-third in Ireland. Obesity data also show notable regional disparity, with missingness reaching almost 10 per cent in the HSNI compared to 1.2 per cent in the IHS.

**Table A.1 Missingness table**

| | Northern Ireland (HSNI) | Ireland (IHS) |
|---|---|---|
| **Variable** | **% missing** | **% missing** |
| Area-level deprivation | 0.0 | 0.04 |
| Female | 0.0 | 0.0 |
| Age | 0.0 | 0.0 |
| Good self-rated health | 0.0 | 1.2 |
| Long-term illness | 0.0 | 1.2 |
| Poor mental health | 0.6 | 1.2 |
| Meets five-a-day | 52.8 | 33.9 |
| Physical activity | 0.0 | 1.2 |
| Smoker | 0.2 | 1.2 |
| Frequent drinker | 0.2 | 1.2 |
| Obese | 9.9 | 1.2 |
| N | 3,582 | 5,100 |

*Source:* The IHS 2024 and the HSNI 2022/23.
*Note:* Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

Table A.2 demonstrates the impact of survey weighting across the analytical samples for Northern Ireland (n = 3,216) and Ireland (n = 4,875), adjusting initial sample overrepresentations to align closer with population averages. Weighting primarily corrects for an unweighted overrepresentation of females (55.3 per cent to 48.5 per cent in NI; 53.6 per cent to 50.7 per cent in Ireland) and older individuals (mean age dropping from 54.8 to 49.2 years in NI, and 50.5 to 47.8 years in Ireland). Consequently, weighted estimates adjust health metrics downwards in severity, yielding higher rates of good self-rated health (72.0 per cent in NI; 76.3 per cent in Ireland) and lower proportions of long-term illness (40.5 per cent in NI; 41.6 per cent in Ireland). The rates of physical activity, smoking, frequent drinking and obesity shift marginally post-weighting in Northern Ireland. Weighting the sample for Ireland resulted in a lower prevalence on the physical activity and frequent drinking measures, and a higher prevalence on smoking.

**Table A.2 Descriptive statistics, unweighted and weighted samples**

| | Northern Ireland | | Ireland | |
|---|---|---|---|---|
| **Variable** | **Unweighted** | **Weighted** | **Unweighted** | **Weighted** |
| Female | 55.3 | 48.5 | 53.6 | 50.7 |
| Age | 54.8 | 49.2 | 50.5 | 47.8 |
| Good self-rated health | 68.1 | 72.0 | 78.7 | 76.3 |
| Long-term illness | 45.6 | 40.5 | 42.9 | 41.6 |
| Poor mental health | 20.4 | 20.1 | 15.1 | 18.0 |
| Meets five-a-day[+] | 47.0 | 46.8 | 60.8 | 58.0 |
| Physical activity | 10.0 | 10.3 | 70.0 | 66.0 |
| Smoker | 13.1 | 13.9 | 13.4 | 16.3 |
| Frequent drinker | 39.6 | 39.1 | 45.4 | 40.6 |
| Obese | 24.9 | 23.1 | 25.3 | 25.8 |
| N | 3,216 | 3,216 | 4,875 | 4,875 |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* [+] n = 1,532 NI; n = 1,669 Ireland.

Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## A.2 Further details on the variables across the IHS and HSNI

### A.2.1 Mental health indicators

Different mental health measures were employed in the IHS and HSNI. For the purposes of this report, the 'poor mental health' measure was constructed using the PHQ-8 for Ireland and the GHQ-12 for Northern Ireland. However, Table A.3 details several alternative mental health and wellbeing measures captured across the two surveys.

**Table A.3 Mental health variables**

| IHS | HSNI |
|---|---|
| Self-rated mental health (5-point scale) | Have you had concerns about your mental health in the past year? 'Y/N' |
| Patient Health Questionnaire (PHQ-8) depression screening | General Health Questionnaire (GHQ-12) screening |
| World Health Organization (WHO-5) well-being index | Life satisfaction (10-point scale) |
| 'Depression' as a long-standing condition | Feel things you do in life worthwhile (10-point scale) |
| | Happiness yesterday (10-point scale) |
| | Anxious yesterday (10-point scale) |

*Source:* The IHS 2024 and the HSNI 2022/23.

### A.2.2 Alcohol consumption

**Table A.4 Wording of alcohol consumption questions in surveys**

| IHS | HSNI |
|---|---|
| **Alcohol consumption frequency** | |
| In the past 12 months, how often have you had an alcoholic drink of any kind?<br>• Every day or almost<br>• 5–6 days a week<br>• 3–4 days a week<br>• 1–2 days a week<br>• 2–3 days in a month<br>• Once a month<br>• Less than once a month<br>• Not in the past 12 months, as I no longer drink alcohol<br>• Never, or only a few sips or tries, in my whole life | How often have you had an alcoholic drink of any kind during the last 12 months?<br>• Almost every day<br>• 5 or 6 days a week<br>• 3 or 4 days a week<br>• Once or twice a week<br>• Once or twice a month<br>• Once every couple of months<br>• Once or twice a year<br>• Not at all in last 12 months |
| **Binge drinking frequency** | |
| In the past 12 months, how often have you had [6 or more] drinks containing alcohol on one occasion?<br>• Every day or almost every day<br>• 5–6 days a week<br>• 3–4 days a week<br>• 1–2 days a week<br>• 2–3 days in a month<br>• Once a month<br>• Less than once a month<br>• Not in the past 12 months<br>• Never in my whole life | |

*Source:* The IHS 2024 and the HSNI 2022/23.

### A.2.3 Control variables

**Table A.5 Wording of questions relating to control variables from surveys**

| IHS | HSNI |
|---|---|
| **Sex** | |
| What is your sex?<br>• Male<br>• Female | Please enter sex<br>• Male<br>• Female |
| **Age** | |
| What is your age? | What is your age? |

*Source:* The IHS 2024 and the HSNI 2022/23.

## A.3. Additional descriptive statistics

Table A.6 demonstrates statistically significant social patterns across most health indicators in both Northern Ireland and Ireland, with poorer outcomes concentrated in the most deprived quintile (Q1). Across both jurisdictions, respondents in Q1 report significantly lower rates of good self-rated health (60.1per cent in NI; 71.8% in Ireland) alongside higher rates of long-term illness, poor mental health and smoking compared to the least deprived quintile (Q5, $p<0.05$). Conversely, frequent alcohol consumption increases with affluence in both jurisdictions, reaching its highest prevalence in Q5 (45.1 per cent in NI; 49.6% in Ireland, $p<0.05$). While physical activity improves significantly across quintiles from Q1 to Q5 in both territories, notable differences emerge for dietary and weight metrics: meeting the 'five-a-day' fruit and vegetable recommendation shows no significant association with deprivation in either jurisdiction, and obesity exhibits a strong socio-economic association in Ireland (33.4 per cent in Q1 vs 20.3 per cent in Q5, $p<0.001$) that is absent in Northern Ireland.

**Table A.6 Descriptive statistics by area-level deprivation quintile with chi-square tests**

| Variable | Area-level deprivation quintile (%) | | | | | Pearson chi² | p-value |
|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q5 | | |
| **Northern Ireland (N = 3,216)** | | | | | | | |
| Good self-rated health | 60.1 | 71.8 | 72.5 | 76.0 | 77.1 | 50.6 | <0.001 |
| Long-term illness | 52.3 | 39.0 | 41.5 | 35.1 | 37.5 | 42.6 | <0.001 |
| Poor mental health | 27.3 | 23.1 | 18.9 | 16.1 | 16.6 | 33.1 | <0.001 |
| Meets five-a-day[+] | 40.3 | 45.9 | 49.7 | 50.7 | 45.1 | 7.7 | 0.215 |
| Physical activity | 6.2 | 8.0 | 9.3 | 13.7 | 13.4 | 29.3 | <0.001 |
| Smoker | 24.8 | 16.0 | 12.1 | 11.4 | 7.2 | 13.9 | <0.001 |
| Frequent drinker | 35.6 | 36.0 | 41.1 | 37.6 | 45.1 | 16.1 | 0.015 |
| Obese | 25.7 | 24.5 | 24.3 | 21.4 | 20.0 | 7.6 | 0.149 |
| **Ireland (N = 4,875)** | | | | | | | |
| Good self-rated health | 71.8 | 72.9 | 77.5 | 78.1 | 83.3 | 46.2 | <0.001 |
| Long-term illness | 45.5 | 43.0 | 39.8 | 40.9 | 37.3 | 16.4 | 0.014 |
| Poor mental health | 22.2 | 19.0 | 16.4 | 15.2 | 15.6 | 24.8 | 0.002 |
| Meets five-a-day[+] | 55.9 | 56.4 | 60.5 | 58.7 | 58.7 | 1.8 | 0.847 |
| Physical activity | 58.2 | 61.5 | 67.2 | 70.7 | 75.8 | 88.7 | <0.001 |
| Smoker | 20.0 | 18.7 | 13.0 | 13.8 | 14.8 | 29.5 | <0.001 |
| Frequent drinker | 35.4 | 36.3 | 39.7 | 44.5 | 49.6 | 56.4 | <0.001 |
| Obese | 33.4 | 26.1 | 23.0 | 23.5 | 20.3 | 57.2 | <0.001 |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* [+] n = 1,532 NI; n = 1,669 Ireland. Weights applied.

Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## A.4. Heterogeneity by sex, age and urban/rural location

For each outcome and each jurisdiction, the interaction between deprivation quintiles and sex, age category and urban/rural location were estimated. Each cell presents an interaction odds ratio measuring whether the deprivation gradient at that quintile (relative to Q1) is steeper or flatter for the subgroup relative to the baseline reference group: females relative to males (Table A.7), older age groups relative to those aged 16–34 (Table A.8), and towns or rural areas relative to urban areas (Table A.9). An odds ratio above 1 indicates a steeper gradient in the subgroup than in the reference group, an odds ratio below 1 a flatter gradient, and an odds ratio indistinguishable from 1 indicates that the deprivation gradient does not differ significantly across the groups.

## Table A.7 Area-level deprivation × sex interaction

| | Good self-rated health | | Long-standing illness | | Poor mental health | | Meets five-a-day | | Physical activity | | Smoker | | Frequent drinker | | Obese | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interaction | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire |
| Q2 × Female | 0.79 | 1.01 | 0.96 | 1.36 | 0.99 | 0.92 | 0.76 | 2.25* | 1.37 | 1.31 | 0.79 | 0.88 | 1.37 | 0.85 | 1.07 | 0.84 |
| | (0.21) | (0.21) | (0.26) | (0.26) | (0.31) | (0.23) | (0.31) | (0.77) | (0.68) | (0.25) | (0.28) | (0.22) | (0.38) | (0.16) | (0.30) | (0.17) |
| Q3 × Female | 0.77 | 1.01 | 1.03 | 1.23 | 1.26 | 1.25 | 1.02 | 1.86 | 1.50 | 1.23 | 1.45 | 1.07 | 0.98 | 1.15 | 1.12 | 0.89 |
| | (0.21) | (0.22) | (0.28) | (0.23) | (0.39) | (0.33) | (0.40) | (0.63) | (0.70) | (0.24) | (0.50) | (0.29) | (0.27) | (0.22) | (0.32) | (0.18) |
| Q4 × Female | 0.74 | 0.98 | 0.93 | 1.14 | 1.60 | 0.95 | 0.86 | 2.19* | 1.02 | 0.89 | 0.93 | 0.71 | 1.22 | 1.22 | 1.07 | 0.73 |
| | (0.21) | (0.20) | (0.25) | (0.22) | (0.52) | (0.25) | (0.33) | (0.74) | (0.47) | (0.17) | (0.34) | (0.19) | (0.22) | (0.23) | (0.31) | (0.16) |
| Q5 × Female | 0.95 | 0.92 | 1.13 | 1.08 | 1.20 | 1.14 | 1.38 | 1.09 | 1.00 | 0.76 | 0.77 | 0.66 | 1.30 | 1.01 | 0.68 | 1.06 |
| | (0.27) | (0.21) | (0.32) | (0.20) | (0.40) | (0.38) | (0.55) | (0.37) | (0.47) | (0.16) | (0.35) | (0.17) | (0.36) | (0.19) | (0.20) | (0.22) |
| N | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 1,532 | 1,669 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Interaction odds ratios from survey-weighted logit with deprivation × sex; adjusted for age. Standard errors in parentheses.
Reference: Q1, Male.
Statistical significance indicated by p-value: * p<0.05, ** p<0.01, *** p<0.001.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## Table A.8 Area-level deprivation × age group interaction

| | Good self-rated health | | Long-standing illness | | Poor mental health | | Meets five-a-day | | Physical activity | | Smoker | | Frequent drinker | | Obese | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interaction | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire |
| Q2 × 35–59 | 0.59 | 0.83 | 1.03 | 0.89 | 0.70 | 1.14 | 1.05 | 2.07 | 0.56 | 1.28 | 0.60 | 0.85 | 1.07 | 1.00 | 1.09 | 1.14 |
| | (0.30) | (0.25) | (0.43) | (0.24) | (0.34) | (0.33) | (0.61) | (0.17) | (0.41) | (0.34) | (0.28) | (0.25) | (0.45) | (0.29) | (0.54) | (0.35) |
| Q2 × 60+ | 0.42 | 1.42 | 1.30 | 0.73 | 0.56 | 0.89 | 1.22 | 1.28 | 0.19* | 1.12 | 0.49 | 0.95 | 0.95 | 1.27 | 0.87 | 1.11 |
| | (0.20) | (0.45) | (0.53) | (0.21) | (0.26) | (0.31) | (0.68) | (0.73) | (0.14) | (0.31) | (0.22) | (0.37) | (0.38) | (0.38) | (0.42) | (0.35) |
| Q3 × 35–59 | 1.21 | 1.19 | 0.51 | 0.94 | 0.60 | 0.64 | 0.70 | 2.67 | 1.96 | 1.55 | 0.78 | 0.70 | 0.66 | 0.84 | 1.37 | 1.37 |
| | (0.56) | (0.37) | (0.21) | (0.25) | (0.29) | (0.19) | (0.42) | (1.42) | (1.51) | (0.41) | (0.38) | (0.23) | (0.28) | (0.23) | (1.74) | (0.41) |
| Q3 × 60+ | 1.04 | 1.14 | 0.47 | 0.99 | 0.55 | 0.74 | 1.07 | 1.08 | 0.75 | 1.31 | 0.86 | 1.74 | 0.49 | 0.86 | 0.81 | 1.21 |
| | (0.46) | (0.35) | (0.19) | (0.28) | (0.26) | (0.26) | (0.60) | (0.58) | (0.56) | (0.36) | (0.40) | (0.68) | (0.20) | (0.24) | (0.43) | (0.38) |
| Q4 × 35–59 | 1.40 | 1.49 | 0.97 | 0.62 | 0.68 | 0.68 | 1.00 | 1.79 | 0.41 | 0.99 | 0.96 | 1.01 | 1.33 | 0.83 | 0.60 | 0.91 |
| | (0.66) | (0.46) | (0.41) | (0.16) | (0.35) | (0.21) | (0.58) | (0.93) | (0.30) | (0.28) | (0.49) | (0.33) | (0.57) | (0.23) | (0.30) | (0.27) |
| Q4 × 60+ | 1.55 | 1.69 | 0.89 | 0.62 | 0.57 | 0.99 | 1.74 | 0.78 | 0.31 | 1.01 | 0.53 | 1.34 | 1.15 | 0.90 | 0.30* | 0.90 |
| | (0.69) | (0.53) | (0.36) | (0.18) | (0.28) | (0.35) | (0.94) | (0.41) | (0.21) | (0.30) | (0.26) | (0.57) | (0.48) | (0.26) | (0.14) | (0.29) |
| Q5 × 35–59 | 1.87 | 1.41 | 0.50 | 0.69 | 0.33* | 0.60 | 0.92 | 1.32 | 0.57 | 0.25 | 0.65 | 0.82 | 1.12 | 0.65 | 0.95 | 0.70 |
| | (0.96) | (0.45) | (0.23) | (0.18) | (0.17) | (0.18) | (0.57) | (0.67) | (0.43) | (0.35) | (0.44) | (0.25) | (0.49) | (0.17) | (0.53) | (0.21) |
| Q5 × 60+ | 1.40 | 1.42 | 0.59 | 0.73 | 0.33* | 0.67 | 1.38 | 0.91 | 0.48 | 1.21 | 0.61 | 1.49 | 1.25 | 0.56 | 0.44 | 0.79 |
| | (0.68) | (0.47) | (0.26) | (0.21) | (0.16) | (0.26) | (0.82) | (0.48) | (0.35) | (0.36) | (0.40) | (0.62) | (0.52) | (0.16) | (0.23) | (0.25) |
| N | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 1,532 | 1,669 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 |

*Source:* The IHS 2024 and the HSNI 2022/23.*Notes:* Interaction odds ratios from survey-weighted logit with deprivation × age categories; adjusted for sex.
*Notes:* Standard errors in parentheses.
Reference: Q1, age 16–34.
Statistical significance indicated by p-value: * p<0.05, ** p<0.01, *** p<0.001.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

## Table A.9 Area-level deprivation × urban/rural interaction

| | Good self-rated health | | Long-standing illness | | Poor mental health | | Meets five-a-day | | Physical activity | | Smoker | | Frequent drinker | | Obese | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interaction | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire | NI | Ire |
| Q2 × Towns/mixed | 0.67 | 0.87 | 3.05 | 0.76 | 0.78 | 0.92 | 0.25 | 1.37 | 0.29 | 1.22 | 0.94 | 1.44 | 0.59 | 1.16 | 0.48 | 0.93 |
| | (0.41) | (0.25) | (2.01) | (0.20) | (0.89) | (0.30) | (0.22) | (0.65) | (0.25) | (0.32) | (0.68) | (0.48) | (0.39) | (0.31) | (0.33) | (0.26) |
| Q2 × Rural | 0.43* | 0.90 | 1.59 | 0.90 | 0.89 | 1.09 | 0.57 | 0.53 | 0.84 | 0.80 | 1.69 | 1.41 | 1.13 | 0.81 | 1.46 | 1.26 |
| | (0.14) | (0.24) | (0.49) | (0.22) | (0.35) | (0.35) | (0.28) | (0.23) | (0.53) | (0.20) | (0.85) | (0.48) | (0.40) | (0.20) | (0.53) | (0.33) |
| Q3 × Towns/mixed | 1.46 | 1.51* | 1.28 | 1.34 | 2.30 | 1.42 | 0.72 | 0.76 | 0.44 | 0.73 | 0.17 | 1.50 | 1.72 | 1.17 | 0.26 | 0.83 |
| | (0.96) | (0.15) | (0.82) | (0.34) | (1.89) | (0.46) | (0.62) | (0.36) | (0.36) | (0.19) | (0.16) | (0.52) | (1.12) | (0.30) | (0.18) | (0.23) |
| Q3 × Rural | 0.52* | 0.61 | 1.24 | 1.50 | 1.24 | 1.61 | 0.68 | 0.44 | 1.30 | 0.59* | 2.01 | 1.52 | 0.91 | 0.80 | 1.31 | 1.23 |
| | (0.17) | (0.17) | (0.38) | (0.35) | (0.46) | (1.52) | (0.33) | (0.19) | (0.79) | (0.14) | (0.95) | (0.53) | (0.32) | (0.19) | (0.47) | (0.31) |
| Q4 × Towns/mixed | 0.73 | 0.95 | 2.94 | 0.88 | 3.31 | 0.92 | 0.47 | 1.26 | 1.61* | 0.90 | 0.70 | 0.94 | 0.62 | 1.25 | 0.34 | 0.82 |
| | (0.43) | (0.26) | (1.76) | (0.21) | (2.55) | (0.29) | (0.37) | (0.53) | (1.12) | (0.22) | (0.48) | (0.31) | (0.36) | (0.31) | (0.20) | (0.22) |
| Q4 × Rural | 0.34*** | 0.93 | 1.54 | 1.14 | 1.95 | 1.58 | 0.31* | 0.54 | 1.36 | 0.52*** | 5.75*** | 1.79 | 0.84 | 0.83 | 2.13* | 1.74* |
| | (0.12) | (0.25) | (0.47) | (0.26) | (0.75) | (0.50) | (0.15) | (0.22) | (1.83) | (0.13) | (2.90) | (0.59) | (0.29) | (0.19) | (0.79) | (0.43) |
| Q5 × Towns/mixed | 0.56 | 1.00 | 2.26 | 0.94 | 1.48 | 0.80 | 0.43 | 0.84 | 0.21* | 0.70 | 0.89 | 1.46 | 0.60 | 1.48 | 0.30* | 1.17 |
| | (0.33) | (0.28) | (1.36) | (0.22) | (1.12) | (0.24) | (0.34) | (0.34) | (0.16) | (0.17) | (0.68) | (0.43) | (0.34) | (0.34) | (0.18) | (0.29) |
| Q5 × Rural | 0.22*** | 0.74 | 2.39* | 1.34 | 1.05 | 0.97 | 0.46 | 0.71 | 1.51 | 0.65 | 12.68*** | 1.23 | 0.58 | 0.85 | 1.46 | 1.77* |
| | (0.09) | (0.22) | (0.83) | (0.34) | (0.49) | (0.38) | (0.26) | (0.30) | (0.96) | (0.18) | (7.94) | (0.49) | (0.23) | (0.21) | (0.66) | (0.48) |
| N | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 1,532 | 1,669 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 | 3,216 | 4,875 |

*Source:* The IHS 2024 and the HSNI 2022/23.

*Notes:* Interaction odds ratios from survey-weighted logit with deprivation × urban/rural terms; adjusted for age and sex. Standard errors in parentheses.
Reference: Q1, Urban.
Statistical significance indicated by p-value: * p<0.05, ** p<0.01, *** p<0.001.
Caution: Side-by-side displays evaluate within-jurisdiction estimates. Direct cross-border comparisons should be avoided due to non-identical survey items, differing administration modes and item missingness.

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