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UNEQUAL CHANCES? INEQUALITIES IN MORTALITY IN IRELAND

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ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

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FOREWORD

I would like to thank the ESRI for their work on this report, *Unequal Chances? Inequalities in Mortality in Ireland*. It has yielded a substantive report at a time when significant work to reshape the health data landscape in Ireland is underway.

The Institute of Public Health (IPH), a North South agency working in the health improvement aspect of public health, has focused on addressing the challenge of health inequalities since its foundation in 1998. This study *Unequal Chances? Inequalities in Mortality in Ireland* further builds on the 2001 report on *Inequalities in Mortality: A Report on All-Ireland Mortality Data 1989-1998* published by IPH.

Over the past century, significant strides have been made in public health. The playing field, however, remains uneven. There is considerable evidence of health inequalities across the social gradient both in Ireland and around the world. Reducing health inequalities, avoidable differences in people's health status, and achieving health equity, providing everyone with the opportunity to reach their full potential for health and wellbeing, are critical to health improvement at a population level.

The social determinants of health, that is where we are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life, are sometimes overlooked in the consideration of health outcomes. To understand and mitigate these complex and linked factors it is vital that a range of health data are available at national, regional and local level.

The findings of this report on inequalities in mortality strengthen the case for better health data in pursuit of the strategic objectives set out in the Healthy Ireland Framework 2019-2025 and the Sláintecare Implementation Strategy and Action Plan 2021-2023.

Finally, I would also like to thank my colleague Dr Helen McAvoy, Director of Policy at IPH, who envisioned this research project, and the other members of the Research Programme Steering Group, Dr Paul Kavanagh, Health Service Executive, Professor Richard Layte, Trinity College Dublin, and Professor Dermot O'Reilly, Queen's University Belfast.

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ABBREVIATIONS

BMI	Body mass index
CIDR	Computerised Infectious Disease Reporting
CMDE	Confidential Maternal Death Enquiry (UK and Ireland)
CMR	Crude mortality rate
COP	Census of Population
CSO	Central Statistics Office
ELSA	English Longitudinal Study on Ageing
ENND	Early neonatal death
EU	European Union
FGR	Foetal growth restriction
GRO	General Register Office
HPO	Healthcare Pricing Office
HSE	Health Service Executive
IMD	Index of Multiple Deprivation
IPH	Institute of Public Health
MDE	Maternal Death Enquiry (Ireland)
NHS	National Health Service
NPEC	National Perinatal Epidemiology Centre
NPRS	National Perinatal Reporting System
OECD	Organisation of Economic Co-operation and Development
ONS	Office for National Statistics
PAF	Population attributable fraction
PAYE	Pay as you earn
RII	Relative index of inequality
RMF	Research microdata file
RR	Relative risk
SEG	Socio-economic group
SES	Socio-economic status
SMR	Standardised mortality rate
SOC	Standard Occupational Classification
TILDA	The Irish Longitudinal Study on Ageing
UK	United Kingdom
US	United States
VS	Vital Statistics
WHO	World Health Organization

EXECUTIVE SUMMARY

BACKGROUND

Life expectancy and mortality are some of the most widely available indicators of population health and are commonly used by governments and international organisations as key indicators of social progress. In addition to being unfair, inequalities in mortality and life expectancy across population groups are a key policy concern as they are potentially avoidable. In this report, data from a variety of sources are used to examine inequalities in mortality in Ireland over the period since 2000, focusing on two broad dimensions of inequality: socio-economic status (SES) (proxied by socio-economic group, which is derived from occupation), and ethnicity/country of birth/nationality. Due to data availability, the analyses of inequalities focus on two key population groups (young infants, and adults). An analysis of emerging patterns in relation to COVID-19 mortality is also undertaken.

KEY FINDINGS

- There has been a substantial decline in the perinatal mortality rate (the number of stillbirths and deaths in the first week of life per 1,000 births) since 2000; the rate declined from 8.3 in 2000 to 5.4 in 2019.
- However, this improvement was not experienced equally by all groups. The perinatal mortality rate for unemployed mothers was between 1.6 and 2.2 times the rate of mothers in the higher professional group, and this rate remained elevated throughout the period 2000-2019.
- Similarly, African-born mothers experienced significantly higher rates of perinatal mortality throughout the period (between 1.5 and 2 times higher than mothers born in Ireland).
- The data show that the crude adult (15+) mortality rate declined from 10.5 per 1,000 population in 2000 to 8.1 in 2018, with males having higher rates than females throughout the period.
- In 2000, 41 per cent of deaths were due to circulatory disease, with cancers (or neoplasms) (25 per cent), respiratory disease (16 per cent) and other causes (18 per cent) accounting for the remainder of deaths. By 2018, the proportion of total deaths attributed to circulatory disease (29 per cent) had declined sharply, while there was also a decline in the share of deaths accounted for by respiratory disease (to 13 per cent). Cancers (30 per cent) and other causes (28 per cent) had a corresponding increase.
- The analysis of SES inequalities showed that less advantaged socio-economic groups had higher age standardised mortality rates throughout the period. For example, the standardised mortality rate for those in the least advantaged socio-economic group was twice as high as those in the most advantaged

group in 2018. However, definitive conclusions about trends over time cannot be made with certainty due to differences across time in how socio-economic groups were coded in the death registration data.

- However, for the first time in Ireland, adult mortality inequalities across ethnic, country of birth and nationality groups could be examined; the data (for 2016 only) revealed substantially lower mortality in non-White Irish ethnic groups, as well as in those born outside Ireland or with non-Irish nationality.
- Analysis of COVID-19 mortality showed that for the period from March 2020 to May 2021, those in less advantaged socio-economic groups accounted for higher proportions of deaths relative to their shares in the population aged 65 and older.
- While the numbers of deaths in non-White groups were very small overall, those with Black or Asian Irish ethnicity accounted for slightly higher proportions of COVID-19 deaths than their respective shares in the 65+ population.
- Those born in the EU-East (or with EU-East nationality) also accounted for a slightly higher share of total COVID-19 deaths than their proportion in the population aged 65+.

POLICY IMPLICATIONS

Despite the overall improvement in mortality rates in Ireland in recent decades, the findings in this report highlight a number of groups that are vulnerable to higher mortality rates, and which require policy attention. In the perinatal period, the significantly higher risk of perinatal mortality for children of African-born mothers is striking. Research from the UK shows that South Asian and Black mothers have higher proportions of premature and low birthweight babies than White mothers. Explanations for these ethnic variations in infant outcomes are complex, involving the interplay of environmental, physiological and socio-cultural factors. Across the population groups examined in detail (young infants and adults), those from less advantaged social backgrounds had substantially higher mortality rates than those from more advantaged social backgrounds.

In contrast to the findings for perinatal mortality, the data (while limited) on adult mortality disaggregated by ethnicity, country of birth and nationality show that non-White and non-Irish groups have lower mortality rates than White and/or Irish-born/Irish nationals. However, there was evidence that some non-White and non-Irish-born/Irish nationals accounted for a higher share of COVID-19 deaths than their respective shares of the 65+ population. The findings in relation to overall adult mortality are consistent with those from other European countries, and from the UK, where minority ethnic groups tended to have lower mortality rates prior to the pandemic. A possible ‘healthy immigrant effect’ may explain these findings, whereby those migrating are healthier on average than those in the destination country. While the COVID-19 mortality data provided by the CSO to the research team are provisional and not adjusted for age, and covered the period to May 2021 only, further monitoring of the data is required to confirm the emerging patterns of relatively higher COVID-19 deaths in non-Irish ethnic and country of birth/nationality groups.

In addition to continued focus on vulnerable groups, the findings in this report also highlight the importance of improved data collection, harmonisation and access for the monitoring of inequalities in mortality. For the analysis of inequalities in adult mortality, unlinked data from death registrations and the Census of Population were used. This approach has limitations, the most pressing of which is that information on the indicator of SES (in our case, occupational group) reported by the individual at the time of the Census may differ from the information on SES provided after his/her death by the person filling out the death registration form. In addition, in Ireland, different occupational coding schemes are used in the Census and death registration systems. We therefore recommend that Ireland moves towards a system of longitudinal follow-up of mortality after the Census of Population. A limited follow-up (of one year) has already been undertaken after the 2006 and 2016 Census of Population (CSO, 2010; 2019d). Longitudinal follow-up of the Census of Population allows analysts to overcome many of the difficulties that are encountered in using unlinked Census-mortality data. The availability of multiple indicators of SES in the Census would also allow for a more detailed monitoring of inequalities by examining the possible mechanisms underlying the observed patterns in mortality. In the meantime, there are a number of steps that can be taken by the Central Statistics Office and other data providers (e.g. Healthcare Pricing Office) to improve the current data environment for the monitoring of health inequalities, including harmonising the measures of SES and ethnicity/nationality/country of birth across data sources.

The difficulties in tracking and monitoring inequalities in (excess) mortality due to the COVID-19 pandemic have been well documented both in Ireland and internationally. In future, data from the Central Statistics Office COVID-19 Data Research Hub offers the potential to support further analyses of inequalities in COVID-19 mortality in Ireland. In time, analyses of inequalities in excess mortality will allow researchers and policymakers to understand if disparities arose predominantly from differences in the direct effects of COVID-19 infection, such as higher infection rates or higher case fatality rates, or, alternatively, if disparities were driven by the indirect effects of the pandemic, such as disparities in the effect of the pandemic on livelihoods, disruptions to healthcare, etc.

The latest Healthy Ireland and Sláintecare Strategic Action Plans contain strong commitments to reduce health inequalities, and the Healthy Ireland Outcomes

Framework contains a set of indicators that will allow the Government to monitor progress on the actions needed to improve health and wellbeing across the population (Department of Health, 2018; Government of Ireland, 2021a; 2021b). However, timely and comprehensive access to improved data on mortality inequalities is required to monitor progress over time on the various indicators proposed.

CHAPTER 1
Introduction

1.1 BACKGROUND

At the beginning of the 20th Century, life expectancy at birth in Ireland was just under 50 years of age.[1] By 2019, life expectancy at birth in Ireland had reached 82.8 years, 1.5 years above the EU27 average and the eighth highest in the EU27 (European Observatory on Health Systems and Policies, 2021).[2] Worldwide, improvements in life expectancy at birth over the last 100 years have been attributed to increased living standards, the introduction of public health measures, improved healthcare, advances in medical technologies and more positive health behaviours (Raleigh, 2019).

Across most developed countries however, gains in life expectancy at birth have slowed in the period since 2010 (Hiam et al., 2018; Raleigh, 2019; Marmot et al., 2020; Minton et al., 2020). For example, in England, the decade since 2010 has been characterised by a slowdown in the rate of improvement in life expectancy, particularly among women; between 2011 and 2018, life expectancy at birth increased by just 0.5 years for males, and 0.2 years for females (Raleigh and Goldblatt, 2019).[3] Increases in life expectancy at birth have also slowed in Ireland since 2010, although the increase over the decade (2 years) is higher than the 1.5 years observed for the EU27 (European Observatory on Health Systems and Policies, 2021). While data for 2020 are not yet available for Ireland, data from numerous countries show that the COVID-19 pandemic resulted in a *fall* in life expectancy at birth between 2019 and 2020 (Arias et al., 2021; OECD, 2021; Raleigh, 2021b).[4]

Despite the impressive performance of Ireland in recent decades, and in particular since 2000 (Eighan et al., 2020), inequalities in life expectancy and mortality rates persist. A comprehensive analysis of socio-economic inequalities in mortality in the Republic and Northern Ireland published in 2001 indicated that in the Republic over the period 1989-1998, those in the highest occupational class (professional workers) had a standardised mortality rate (SMR)[5] that was approximately one-

1 In 1901, life expectancy at birth for men was 49.3 and for women was 49.6 (https://data.cso.ie/table/VSA30).

2 Women live longer than men in all EU27 countries, by an average of 5.6 years, although the gender gap in Ireland (3.9 years) is amongst the lowest in the EU27 (European Observatory on Health Systems and Policies, 2021).

3 In contrast, life expectancy at birth increased by 2.2 (for males) and 1.7 years (for females) in the preceding seven-year period 2004 to 2011.

4 It is important to note that year-to-year changes in life expectancy may be influenced by changes in age-specific mortality rates for certain causes (Xu et al., 2021). For example, 2015 saw a reduction in life expectancy in many European countries due to excess winter mortality from influenza that year (Raleigh, 2021b).

5 The standardised mortality rate (SMR) adjusts for the age composition of different groups when making comparisons across groups, e.g. occupation (CSO, 2019d).

third the rate for those in the lowest occupational class group (semi- and unskilled manual workers) (Balanda and Wilde, 2001). More recent research since 2000 using Census and mortality data has identified persistent socio-economic inequalities (CSO, 2010; Layte and Banks, 2016; Layte and Nolan, 2016; CSO, 2019d). These inequalities translate into stark differences in life expectancy by various measures of socio-economic status (SES).[6] For example, data from the 2016 Census of Population, matched to administrative data from death certificates, shows that life expectancy at birth for males living in the most deprived areas of the country was five years shorter than for those living in the most advantaged areas (79.4 years versus 84.4 years). For women, the differential was 4.5 years (CSO, 2019d).

There is also evidence that SES inequalities in mortality have been increasing over time, both in Ireland and other countries (Kondo et al., 2014; Toch-Marquardt et al., 2014; Mackenbach et al., 2015c; 2016; Currie and Schwandt, 2016; Layte and Banks, 2016; Layte and Nolan, 2016; Marmot et al., 2020; Office for National Statistics, 2020; Case and Deaton, 2021).[7] An analysis of inequalities in SMRs across occupational groups over the period 1984-2008 in Ireland showed that both absolute and relative differentials in SMRs between the professional and manual occupational classes increased over time, even though SMRs were falling for both groups over the period. While some of this increase reflected larger falls in cardiovascular-related mortality among more advantaged groups, the trend was largely accounted for by increasing inequalities in mortality in digestive, neoplasm (cancer) and external causes of deaths due to absolute increases in SMRs for these causes among less advantaged occupational groups (Layte and Banks, 2016; Layte and Nolan, 2016).

The discussion so far has concentrated on overall trends in life expectancy and mortality. Mortality in early life, including perinatal (i.e. stillbirths and deaths in the first week of life), infant (i.e. mortality under the age of one) and child (i.e. mortality under the age of 15) mortality are important indicators of social and economic development. McGovern (2016) provides an overview of child health in Ireland over the 20th Century, focusing in particular on the relatively late decline in infant mortality in Ireland in comparison with other countries. Over the period 1950-1955, the infant mortality rate in Ireland was 41.5 per 1,000 live births. The comparable figures for the UK and US were 28.7 and 30.5 respectively. By 2019

6 In this report, we use the general term 'socio-economic status' (SES) to refer to a person's position in the social stratification system. Section 1.3 provides further details on the conceptual and measurement issues involved in research on SES inequalities in health.

7 Interpretation of trends in inequalities over time is difficult. In most European countries, the evidence for widening inequalities is clear for relative inequalities (i.e. inequalities measured as a ratio of the mortality rates in less advantaged as compared to more advantaged SES groups), but less so for absolute inequalities (i.e. inequalities measured as a difference of the mortality rates comparing less advantaged and more advantaged SES groups). The discrepancy usually arises when the mortality rates of more advantaged SES groups fall at a faster pace than rates among less advantaged SES groups. See Chapter 2 for a more detailed overview of these issues.

however, Ireland was amongst the best performers globally, with an infant mortality rate (2.8) that was lower than the EU27 average (3.4) and considerably lower than England and Wales (3.7) and the US (5.6).[8] However, while rates of perinatal, infant and child mortality are now very low in Ireland, socio-economic inequalities persist. Data from the National Perinatal Reporting System (NPRS) show that children of mothers in the higher professional class had a perinatal mortality rate[9] of 3.7 per 1,000 births in 2019, compared to a rate of 10.7 per 1,000 births for those in the semi-skilled manual class (Healthcare Pricing Office, 2020).

Other dimensions of inequality, including race/ethnicity[10] have been relatively neglected in previous Irish research. Net immigration in Ireland has been a relatively recent phenomenon, with the reversal of the decades-long pattern of net emigration occurring only from the mid-1990s (McGinnity et al., 2020a). However, while the proportion of the population that was born outside Ireland has increased steadily over time (from 7.0 per cent in 1996 to 17.3 per cent in 2016), the vast majority of the population are still of a White ethnic background (92.4 per cent in 2016).[11] In general, racial/ethnic disparities in life expectancy and mortality differ between the US and Europe (Schwandt et al., 2021). For example, in 2018, the gap in life expectancy between Black and White Americans was 3.6 years (Schwandt et al., 2021). In Europe, in contrast, ethnic minorities often display a more advantaged profile in relation to life expectancy and mortality. Recent data from England and Wales have shown that, despite their higher levels of deprivation, male and female life expectancy in 2011-2014 was higher in minority ethnic groups than in the White and mixed-ethnicity groups.[12] This may be due in part to the 'healthy migrant effect', whereby people who migrate tend to be in good health, and lower rates of smoking and alcohol consumption in ethnic minority groups, which may mitigate some of the impacts of socio-economic disadvantage (Scott and Timæus, 2013; Raleigh, 2021b). Similar findings have also been identified for Northern Ireland (Connolly et al., 2011) and Scotland (Gruer et al., 2016). While previous research on Irish migrants and minority ethnic groups has tended to find evidence for a 'healthy immigrant effect' for other outcomes (such as self-assessed health) (Nolan, 2012; McGinnity et al., 2020b), one ethnic group, Irish Travellers, has been

8 Data for Ireland and the EU27 obtained from Eurostat (table DEMO_MINFIND). Data for England and Wales obtained from (Office for National Statistics, 2022a). Data for the US were obtained from (Xu et al., 2021). Furthermore, the data for England and Wales show that infant mortality rates have been largely unchanged over the period since 2014, with an *increase* in infant mortality between 2015 and 2017 accounted for by increases in poorer areas of the country (Batcheler et al., 2021).

9 The perinatal mortality rate is the number of stillbirths and early neonatal deaths (under one week) expressed as a proportion of all births.

10 See Flanagin et al. (2021) for a discussion of the concepts of race and ethnicity.

11 See https://data.cso.ie/table/A0427, https://data.cso.ie/table/E7058 and https://data.cso.ie/table/E7057 for data on country of birth and ethnicity from the 1996-2016 Census of Population. See Fahey et al., 2019 and McGinnity et al., 2020a for a more detailed discussion of the conceptual and measurement issues involved in using data on ethnicity, nationality and country of birth in Ireland. To the extent that the data allow, we examine mortality inequalities across all three dimensions (ethnicity, nationality and country of birth) in this report (see Section 1.3).

12 These headline figures mask differences across ethnic groups; for example, rates of infant and maternal mortality, as well as mortality from cardiovascular disease and diabetes are higher among Black ethnic groups (Raleigh and Holmes, 2021).

found to be consistently disadvantaged (Government of Ireland, 2010; Watson et al., 2017). In particular, the All-Ireland Traveller Health Study, conducted over the period 2007-2010, found significantly lower life expectancy among Irish Travellers (Government of Ireland, 2010). It also found that the relative gap in infant mortality between Travellers and the general population increased between 1987 and 2008.

Mortality as a result of the COVID-19 pandemic has added another dimension to the discussion of inequalities in mortality (Health Information and Quality Authority, 2020). As noted, there is evidence that the pandemic has led to a fall in life expectancy at birth in many countries (Arias et al., 2021; OECD, 2021; Raleigh, 2021b). Excess mortality, i.e. the number of deaths during the pandemic compared with a baseline level of what would have been expected if the pandemic had not occurred, captures both the direct effects of the COVID-19 pandemic on mortality, as well as the indirect effects of wide-reaching societal changes associated with the pandemic such as disruptions to healthcare provision (Aburto et al., 2021; Polyakova et al., 2021). Using data on excess mortality to monitor the impact of the pandemic also removes the difficulty in comparing COVID-19 deaths across time and countries due to differences in the way in which COVID-19 deaths are measured and reported (Karanikolos and McKee, 2020; OECD, 2021; Aizenman et al., 2022). Data for numerous countries indicate substantial excess mortality throughout 2020 and 2021 as a result of the pandemic (Aburto et al., 2021; Alsan et al., 2021; Polyakova et al., 2021; Rossen et al., 2021; Wang et al., 2022).[13]

While published data on COVID-19 deaths in Ireland are not disaggregated by SES or racial/ethnic background, evidence from other countries has shown that COVID-19 mortality rates have been higher for more disadvantaged groups (MacLaren, 2020; Raleigh, 2021a).[14] Evidence from the US also points to substantially higher excess mortality among Black and Hispanic ethnic groups (Alsan, 2021; Rossen, 2021). Data from England and Wales show that, in comparison with the White British ethnic group, the risk of mortality from COVID-19 during the third wave (from June - December 2021) was highest for people from the Bangladeshi, Pakistani, Black Caribbean and Black African ethnic groups. Adjusting for known risk factors for COVID-19 mortality (e.g. age, location, occupation, vaccination status, etc.) eliminated the elevated risk for most ethnic groups, but not for Bangladeshi men and women, and Pakistani men (Office for National Statistics, 2022b).[15] An early analysis of data on COVID-19 cases and

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13 Due to the relatively long period allowed for registration of deaths in Ireland (three months), excess mortality has been quantified by the CSO using data from online postings of funeral arrangements (CSO, 2019c). These data have been used by Eurostat in comparing excess mortality across the EU27: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Excess_mortality_-_statistics.

14 See also : https://www.iza.org/publications/pp/159/socioeconomic-determinants-of-covid-19-infections-and-mortality-evidence-from-england-and-wales

15 Data from England and Wales show that while most ethnic minority groups had lower overall mortality than the White population in the decade before the pandemic, that differential was reversed between January 2020 and March 2021

mortality up to the end of November 2020 in Ireland has shown that while the risk of infection differed across ethnic groups, the White Irish ethnic group had the highest mortality rate, largely reflecting the higher average age of this group (McGinnity et al., 2020b).

1.2 POLICY CONTEXT

Life expectancy and mortality are some of the most widely available indicators of population health, and are commonly used by governments as key indicators of social progress (Hiam et al., 2018; Baker et al., 2019; Raleigh, 2019). In addition to being unfair, inequalities in mortality and life expectancy across population groups are a key policy concern as they are potentially avoidable (Whitehead, 2007).[16] Interventions to improve the health of more disadvantaged groups offer an opportunity to improve not only the health and wellbeing of those in poorer circumstances, but also to improve average population health (Marmot, 2010; Satz and White, 2021).

The social determinants of health, the conditions in which people are born, grow up, work, live, and age and people's access to power, money and resources, are the major drivers of health inequalities (World Health Organization, 2021). It is increasingly recognised that the processes underlying health inequalities operate across the life course, with a number of theories put forward to explain health inequalities in later life (Whitehead, 2007; Kendig and Nazroo, 2016). The 'critical period' theory emphasises the role of exposures in critical periods, with the focus generally on early childhood and the prenatal period. The 'accumulation' hypothesis describes how socially patterned exposures to health-damaging factors accumulate across the life course, while the 'pathways' hypothesis emphasises how events and circumstances at one point in the life course might indirectly influence those at a later point. Health-damaging exposures may be material resources (e.g. lack of income), behavioural factors (e.g. smoking) or psychosocial resources (e.g. social isolation) (Cable, 2014). Furthermore, it is also well established internationally that socio-economic differences in health are not confined to poor health for those at the bottom and good health for everyone else. Rather, there is a social gradient in health: the more advantaged the social position, the better the health (Marmot, 2006). Tackling health inequalities requires intervention not only on specific determinants (e.g. smoking), but also on the 'fundamental' causes, such as poverty, unemployment, and inequalities in access to education and other resources (Whitehead, 2007).

in some groups (Pakistani and Bangladeshi men and women, and Black Caribbean men) because of their higher mortality from COVID-19 (Raleigh, 2021b).

16 While we use the term health inequalities throughout this report, the narrower but related term health inequity is often used in the literature to refer to differences in health which are also considered unfair and unjust (Maden, 2016).

One of the four key goals of the current Irish government health strategy, Healthy Ireland, is to 'reduce health inequalities' (Government of Ireland, 2013). The Healthy Ireland Outcomes Framework contains a set of indicators, grouped into three areas: health status, health outcomes and social determinants, that will allow the Government to monitor progress on the actions needed to improve population health and wellbeing. Furthermore, it is noted that

> *the indicators will be disaggregated where possible in terms of age, gender, SES and geography and will be subject to comparison with national and international data* (Department of Health, 2018).

Currently, five mortality-related indicators are proposed: healthy life years, premature non-communicable disease mortality, excess winter mortality, road traffic mortality and drug-induced mortality (Government of Ireland, 2021a).

The most recent Healthy Ireland Strategic Action Plan (covering the period 2021-2025) reiterates this commitment to reduce health inequalities (Government of Ireland, 2021a). In addition, one of the two reform programmes of the current Sláintecare Strategic Action Plan 2021-2023 is 'addressing health inequalities' (Government of Ireland, 2021b). Under the 'reduce health inequalities' theme of the Healthy Ireland Strategic Action Plan, specific actions for the period 2021-2025 include implementing the Sláintecare Healthy Communities Programme to facilitate an area-based approach to health and wellbeing and developing initiatives to address health inequalities in marginalised groups.

The National Maternity Strategy 2016-2026 notes that while adverse perinatal outcomes are rare in Ireland, additional supports will be provided to pregnant women from vulnerable, disadvantaged groups or ethnic minorities, and will take account of the family's determinants of health, e.g. socio-economic circumstances (Department of Health, 2016; 2021). However, the nature of these supports is not specified. The National Intercultural Health Strategy 2018-2023 contains a commitment to ensure access to the Maternity and Infant Child Scheme for all pregnant women living in Ireland, regardless of immigration status (Health Service Executive, 2018). This reflects the fact that while all pregnant women who are 'ordinarily resident' in Ireland are entitled to free public maternity care, barriers to accessing maternity services for some pregnant women from minority backgrounds may remain (Polakowski and Quinn, 2022).

In summary, there is an increasing focus on health inequalities in national strategies, with health inequalities a key component of the most recent Sláintecare Strategic Action Plan 2021-2023. However, timely and comprehensive access to appropriate data is needed to monitor progress in addressing health inequalities. This is an issue we return to in the concluding chapter of this report.

1.3 MEASURING INEQUALITY

The purpose of this report is to examine inequalities in mortality in Ireland over the period since 2000. Where possible, two broad dimensions of inequality are examined: SES, and ethnicity/nationality/country of birth. Data availability determines the indicators that are used to proxy SES and ethnicity/nationality/ country of birth. Table 1.1 summarises the main data sources and indicators used in this report.

TABLE 1.1 OVERVIEW OF DATA SOURCES AND INDICATORS

Mortality Rates	Report Chapter	Age Range	Time Period	SES Indicator	Ethnicity, etc. Indicator	Data Sources
Perinatal	3	Under 1 week	2000-2019	Socio-economic group (SEG)	Country of birth	NPRS
Infant	3	Under 1 year	2000-2018	-	-	COP & VS
Child	3	Under 15 years	2000-2018	-	-	COP & VS
Maternal	3	Various	2000-2019	-	-	CMDE
All-cause adult	4	Aged 15+	2000-2012 & 2013-2018	SEG	Ethnicity, country of birth & nationality (2016 only)	COP, VS & 2016 matched COP-VS
Cause-specific adult	4	Aged 15+	2000-2012 & 2013-2018	SEG	-	COP & VS
COVID	5	All	March 2020 – May 2021	SEG	Ethnicity, country of birth & nationality	Matched COP-CIDR

Source: Authors' analysis.
Notes: NPRS = National Perinatal Reporting System; COP = Census of Population; VS = Vital Statistics; CMDE = Confidential Maternal Death Enquiry; CIDR = Computerised Infectious Disease Reporting System.

While further details on the indicators used are available in the subsequent chapters, it is worth highlighting the main conceptual issues that arise in measuring these dimensions of inequality. SES refers broadly to a person's position in the social stratification system (Bartley et al., 1999; d'Errico et al., 2017; McCartney et al., 2019). A variety of metrics have been used to proxy SES in the health inequalities literature including individual, household and area-based indicators (Krieger, 1997). Individual- or household-level indicators include those relating to education, income, wealth, poverty/deprivation, occupation, social class and housing. Area-based indicators can be aggregates of individual- or household-level measure of SES (e.g. the proportion of the population in a particular area that are unemployed) or composite measures (e.g. deprivation indices) that aggregate a number of indicators (Galobardes, 2007). Different measures can provide different assessments about the mechanisms underlying the association between SES and health (e.g. via material resources, occupational exposures, etc.). Ideally the choice of measure should be driven by the objective of the particular piece of analysis and by the underlying social processes being examined (McCartney et al., 2019). In this report, due to the nature of the data available in the different sources, SES is proxied by socio-economic group (SEG), a measure of SES derived from occupation. Ideally, alternative indicators of SES would be available, allowing the researcher to explore potential mechanisms linking SES to mortality outcomes.[17]

Ethnicity refers to a shared culture and way of life, especially as reflected in language, folkways, religious and other institutional forms, material culture such as clothing and food, and cultural products such as music, literature, and art (Johnson, 2000). The inequalities literature examines other aspects of cultural identity in addition to ethnicity, such as nationality, race and country of birth. The terms are not interchangeable and can reflect different aspects of identity such as citizenship, culture or country of birth. For example, while country of birth is fixed, nationality can change over a person's lifetime. Previous research for Ireland has documented high rates of Irish nationality among some migrant groups in Ireland (McGinnity et al., 2020a). This research also notes that information on ethnicity should be collected separately from nationality or country of birth because people in ethnic minorities may be Irish nationals, and/or may be born in Ireland (e.g. second-generation migrants). In this report, depending on the data source, ethnicity, nationality and country of birth are all used (see Chapters 3, 4 and 5 for further details).

1.4 REPORT STRUCTURE

The report is structured as follows. Chapter 2 provides a detailed overview of relevant literature. Chapter 3 focuses on trends over time (2000-2018/2019) in mortality for:

- stillbirths and deaths of infants under one week old (perinatal mortality);
- infants under one year old (infant mortality);
- children under 15 years of age (child mortality);
- mothers during pregnancy and in the six weeks after birth (maternal mortality).

Due to data availability, and the small numbers of child and maternal deaths, analysis of inequalities (by socio-economic group and country of birth of the mother)[18] can only be undertaken for perinatal mortality. Chapter 4 examines

[17] Recommendations for enhanced data collection and availability are discussed in greater detail in Chapter 6.
[18] As detailed in Chapter 3, the National Perinatal Reporting System contains data on country of birth of the parents, but not ethnicity or nationality.

trends in adult (15+) mortality, focusing on trends across socio-economic groups over the period 2000-2018 and, to a more limited extent, by ethnic background, country of birth and nationality. Chapter 5 focuses on emerging patterns in COVID-19 mortality, disaggregated by socio-economic group and ethnic background, country of birth and nationality. Each of these chapters contains a detailed description of the various data sources and methods that are used in this report, as well as a discussion of the different indicators of SES and ethnicity, nationality and country of birth that are available to enable such analyses. The analyses in these chapters build on previous research in the Irish context that has examined SES inequalities in mortality for adults (Nolan, 1990; O'Shea, 1997; 2002; Balanda and Wilde, 2001; Barry et al., 2001; Layte and Banks, 2016; Layte and Nolan, 2016) and in the perinatal period (Nolan and Magee, 1994; Layte and Clyne, 2010). Chapter 6 concludes by summarising the main findings and discusses implications for policy.

CHAPTER 2

Literature review

This chapter discusses the Irish and international literature which has examined socio-economic and ethnic[19] inequalities in mortality. In terms of socio-economic status (SES), results tend to be consistent across countries and time, with those in more disadvantaged situations consistently experiencing higher mortality rates than those in more advantaged situations. A more mixed picture emerges in terms of ethnic inequalities in mortality. In Ireland, much of the previous research has been limited to an assessment of male socio-economic inequalities in mortality due to data availability. This chapter briefly reviews both the Irish and international literature on socio-economic and ethnic inequalities in mortality, including perinatal and maternal mortality, infant and child mortality, adult mortality and COVID-19 mortality.

2.1 INEQUALITIES IN PERINATAL MORTALITY[20]

In this section, the Irish and international literature on socio-economic and ethnic inequalities in perinatal mortality is reviewed. A variety of approaches and methods have been used to assess inequalities including different data types and different measures of inequalities. As noted in Chapter 1, a variety of metrics have been used to proxy SES in the health inequalities literature, including education, occupation, social class, area-level deprivation, etc. A further consideration when examining socio-economic inequalities in mortality in infants and children is whose SES is the most relevant, that of the mother or father? Internationally, inequalities have been found using both fathers' and mothers' SES. However, some research has found that inequalities are more strongly related to mothers' SES (at least when measured by education) than fathers' (Devlieger et al., 2005; Balaj et al., 2021). A limitation of using fathers' SES is that information on fathers may not be available for all children. In Ireland, the National Perinatal Reporting System (NPRS) does not require information on the occupation of the father to be recorded when the father is not married to the mother. Previous research (Nolan and Magee, 1994; Layte and Clyne, 2010) in Ireland however using the NPRS has tended to examine inequalities in perinatal mortality based on fathers' occupation, due to relatively low labour market participation among women in the past.

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19 In this chapter, we use the broad term 'ethnic inequalities', which can refer also to inequalities in mortality across country of birth or nationality groups.

20 Perinatal mortality includes both stillbirths and early neonatal deaths. Stillbirths refer to deaths of foetuses weighing at least 500g before or during labour. Early neonatal death refers to death during the first week of life.

2.1.1 Irish Studies

Socio-economic inequalities in perinatal mortality

Nolan and Magee (1994) assessed socio-economic inequalities in perinatal mortality between 1984 and 1988 using data from the NPRS. Using father's occupation as a measure of SES, they found that the risk of a perinatal death was higher for those whose occupational group was categorised as manual or unemployed. Layte and Clyne (2010) also used the NPRS dataset to quantify inequalities in perinatal mortality by father's occupational group between 1984 and 2006. Similar to Nolan and Magee (1994), they found differences across occupational groups over the period of analysis with those unemployed and in farming occupations having the highest perinatal mortality rates. They also present some evidence to suggest that the differential had decreased slightly between 1984-1988 and 1999-2006. The National Perinatal Epidemiology Centre (NPEC) at University College Cork collect data on perinatal deaths[21] and have produced annual reports on perinatal deaths in Ireland since 2008 (O'Farrell et al., 2021). With limited data on occupation, O'Farrell et al. (2019) found that women who were unemployed were consistently over-represented in perinatal deaths over the period 2017-2019.

Using data from University Hospital Galway and the Coombe Women's Hospital in Dublin from pregnant women attending pre-natal care, Niedhammer et al. (2009, 2011) examined socio-economic inequalities in the risk of adverse pregnancy outcomes (pre-term delivery, low birthweight and small for gestational age). Adverse pregnancy outcomes are correlated with perinatal and infant mortality (Kramer et al., 2000; Callaghan et al., 2006) and as such, these studies help to understand possible socio-economic inequalities in perinatal mortality. One of the Niedhammer studies found that women with lower levels of education tended to have a higher risk of pre-term delivery, even after adjustment for other characteristics such as material deprivation, behavioural and nutritional factors (Niedhammer et al., 2011). Using similar data, Niedhammer et al. (2009) found a correlation between physically demanding work and low birthweight; in addition, shift work and working more than 40 hours a week were also found to be correlated with low birthweight.

Ethnic inequalities in perinatal mortality

Layte and Clyne (2010) also examined perinatal mortality by mothers' country of birth using the NPRS data and found that mothers born in Africa were much more likely than any other group to experience a perinatal death.[22] The analysis did not find any other statistically significantly different risk of perinatal mortality among

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[21] NPEC uses a different methodology for the collection of data on perinatal death than the NPRS, however the two bodies consolidate perinatal death data annually as recommended by the Chief Medical Officer.

[22] As outlined in Chapter 3, the NPRS collects information on mother's country of birth only.

the country of birth groups. A report from the NPEC (O'Farrell et al., 2019) also examined how perinatal mortality is distributed across ethnic groups. Comparing the number of perinatal deaths within a particular group with a comparable group from the 2016 Census of Population (using only women aged between 15-49), they have shown that the proportion of perinatal deaths allocated to non-White and Irish Traveller mothers is greater than their proportion in the 2016 Census of population (O'Farrell et al., 2019).

2.1.2 UK, European and US studies

Socio-economic inequalities in perinatal mortality

In the UK, Smith et al. (2010) examined the association between area-level deprivation and cause-specific neonatal mortality (death within the first four weeks of life) between 1997 and 2007. While the absolute rates of neonatal mortality fell between 1997 and 2007, the neonatal mortality gap between areas with different levels of deprivation increased. Borrell et al. (2003) examined inequalities in perinatal mortality in Spain by mothers' educational level and both parents' social class for the years 1993-1997. They found that those from lower social classes or with lower levels of education had higher probabilities of perinatal mortality.

Jardine et al. (2021) estimated the percentage of adverse pregnancy outcomes (stillbirths, pre-term births and foetal growth restrictions (FGR)) that could have been avoided in England between 2015 and 2017 if all groups had the same risk of an adverse outcome as the least deprived[23] group. They found that 23.6 per cent of stillbirths, 18.5 per cent of pre-term births and 31.1 per cent of births with FGR could be attributed to socio-economic inequality. However, adjustment for ethnicity, smoking status and body mass index (BMI) reduced these to 11.6 per cent, 11.9 per cent and 16.4 per cent respectively (Jardine et al., 2021).

Ethnic inequalities in perinatal mortality

Jardine et al.'s (2021) study in England estimated the proportion of adverse pregnancy outcomes that could have been avoided between 2015 and 2017 if all ethnic groups had the same risk of adverse outcomes as White mothers. The authors also found that 11.7 per cent of stillbirths, 1.2 per cent of pre-term births and 16.9 per cent of births with FGR could be attributed to ethnic inequalities. Adjusting for socio-economic deprivation, smoking and BMI had very little impact on these findings for ethnic inequalities.

23 Deprivation in this study uses the Index of Multiple Deprivation (IMD) which is an area-level measure based on information about income, education, employment, crime and living environment in that area.

In the Netherlands, van Enk et al. (1998) investigated differences in perinatal death among ethnic minority groups using data from the National Obstetric Registry for 1990-1993. They found that Black mothers had the highest perinatal mortality rate. Other European and Asian mothers had comparable perinatal mortality rates to Dutch mothers. Adjusting for SES did not significantly change the risk of a perinatal death across ethnic groups.

Interaction between socio-economic and ethnic inequalities

Green and Hamilton (2019) examined whether the relationship between maternal education and infant, neonatal and post neonatal mortality in the US varied by race/ethnicity. They found that higher maternal education was associated with a lower likelihood of infant/neonatal/post-neonatal mortality.[24] When the authors analysed the educational gradients across different ethnicities, they found that non-Hispanic White populations benefited the most from increasing education level in terms of lower infant/neonatal/post-neonatal mortality rates. This benefit from higher education was not experienced by non-Hispanic Black populations, meaning that even Black women with high levels of education still faced similar perinatal mortality risks as Black women with low levels of education.

A recent analysis for the UK examined adverse pregnancy outcomes (pre-term birth, neonatal death, and infant death) across ethnic groups and areas with differing levels of deprivation based on mother's place of residence (Opondo et al., 2019). They found that there was a higher rate of adverse birth outcomes in deprived areas and, additionally, ethnic minority children were more likely to be born in these deprived areas. A third of the variation in birth outcomes across ethnic groups was explained by relative area-level deprivation.

2.2 INEQUALITIES IN MATERNAL MORTALITY

In high income countries, relatively small numbers of maternal deaths have meant that studies examining inequalities in maternal mortality are sparse. In Ireland, the CSO has registered no maternal deaths for 2018 and 2019 and the maternal death rate (per 100,000) in 2017 is shown to be 1.6 (CSO, 2019b). Using a different methodology to that used by the CSO, the Maternal Death Enquiry Ireland estimates a maternal death rate of 6.7 per 100,000 maternities in the period 2017-2019 (O'Hare et al., 2021); this is examined in greater detail in Chapter 3. The World Health Organization (2019) showed that the average rate of maternal death in 2017 for Europe and North America is 12 per 100,000 while it is 7 (per 100,000) in Australia and New Zealand.

[24] Post-neonatal mortality is death occurring between 28 days and one year after birth.

The Confidential Maternal Death Enquiry (CMDE) in the UK and Ireland analyses maternal death for each triennium (a period of three years). For the years 2017-2019, Knight et al. (2021) showed that Black women in the UK have more than five times the risk of maternal death compared with White women, while Asian women have almost twice the risk of maternal death of White women. Using the Index of area-level Multiple Deprivation, the most deprived quintile is shown to have the highest rate of maternal deaths.

2.3 INEQUALITIES IN INFANT[25] AND CHILD MORTALITY

Focusing on infant mortality, Nath et al. (2020) used an area deprivation measure (Index of Multiple Deprivation) to calculate deprivation quintiles and calculate the infant mortality risk ratios for each quintile. They found that the risk of an infant death was almost 94 per cent higher in the most deprived quintile compared to the least deprived quintile. However, this was reduced to 55 per cent when gestational age, a risk factor for infant death, was taken into account. The authors suggest that the underlying causes of socio-economic inequalities may be due to physical health, age, smoking and nutritional habits of the mother prior to and during pregnancy.

In Scotland, Wood et al. (2012) found that pregnant individuals living in areas of low deprivation showed a sharp decline in sudden infant death syndrome[26] between 1990-1993. For those living in areas with higher rates of deprivation, the decline in sudden infant death syndrome was much slower.

Pattenden et al. (2011) examined inequalities by area-level deprivation in stillbirth, infant mortality, and low birthweight in Northern Ireland between 1992 and 2002. Data from the Child Health System were matched to registrar general data. They found significant variation in infant mortality across geographical areas. This was robust to individual-level risk factors and area-level deprivation. The authors conclude that variation was largely attributed to differences in environmental and social factors across areas.

Studies on child mortality in high income countries including Ireland, the UK, Europe and the US are not common due to low rates of child mortality in these countries. The CSO reports that the number of deaths of children aged between 1 and 14 years of age in 2020 was 74. In 2021, the number of deaths for children between 1 and 14 years of age was 49 (CSO, 2021c). The majority of these deaths were due to neoplasms (cancer), followed by respiratory system diseases and

25 Infant mortality refers to deaths where an infant is less than one year old.
26 Sudden infant death syndrome (also known as cot death) is the sudden death of an infant (< 1 year old) during sleep.

congenital abnormalities. External causes of death[27] were common for children aged between 5 and 14 years of age.

2.4 INEQUALITIES IN ADULT MORTALITY

This section examines the Irish and international literature on socio-economic and ethnic inequalities in adult mortality. A variety of SES indicators are used across the literature. It is worth noting that the number of Irish studies in this area is small because of limited data. Unlike other European countries, linked mortality data (i.e. mortality data from the death registration system linked to the Census of Population) are not routinely available in Ireland. Using unlinked data from the Census of Population and the CSO death registration can lead to errors in calculating mortality rates (Nolan, 1990) across SES groups because the data for the numerator (deaths) and denominator (population) come from different sources (see Chapter 6 for a more detailed discussion of these issues). The international studies reviewed in this section tend to use longitudinal data and also use a greater variety of measures for SES than Irish studies.

One of the only Irish mortality studies to examine ethnic inequalities is the All-Ireland Traveller Health Study. For studies on ethnic inequalities in mortality, this literature review focuses primarily on the international literature. European, UK and US studies are better equipped to study these inequalities alongside SES inequalities. It is worth noting that there tends to be an interaction between socio-economic and ethnic inequalities in mortality (Bos et al., 2005; Krieger et al., 2008).

The literature reviewed in this section also examines cause-specific mortality, which is relevant to the analysis in Chapter 4 of this report.

2.4.1 Irish studies

Socio-economic inequalities in adult mortality

The seminal research paper on this topic for Ireland is from Nolan (1990) who analysed socio-economic inequalities in mortality for Irish men aged 15-64 years in 1981. Using an occupation based measure of SES, the analysis used unlinked Census of Population data and CSO death registration data to calculate standardised mortality rates (SMRs) for each socio-economic group (Nolan, 1990). Similar analysis was undertaken by O'Shea for the years 1986-1991 (O'Shea, 1997). Both analyses showed that unskilled and semi-skilled manual workers had higher SMRs than higher/lower professional groups. Nolan (1990) found that the SMR for higher professionals was 55 compared to 117 and 163 for semi-skilled and unskilled manual groups respectively. O'Shea (1997) found that SMRs for higher

[27] External causes of death refer to incidents including accidents (injury, poisoning), assault and self-harm.

professionals was 49 compared to 111 and 139 for semi-skilled and unskilled manual groups respectively. Nolan (1990) suggests that the inequalities in mortality are due to factors such as poverty, deprivation and work conditions that are detrimental to health. He also highlights the fact that lifestyle choices of socio-economic groups may also help to explain the inequalities.

Layte and Nolan (2016) examined socio-economic differentials in mortality for men in Ireland between 1984 and 2008. Similar to Nolan (1990) and O'Shea (1997), they used unlinked data from the death registry and population census counts to construct SMRs. Again, those allocated to manual occupational groupings were found to have a higher risk of mortality relative to those in professional categories. Examining inequalities over time, they found that the differential between occupational groups decreased until the early 1990s, after which it began to increase (Layte and Nolan, 2016). It is notable that while the mortality rate for professional men continued to decrease from 1990 onwards, over the same period the mortality rate increased for the unskilled manual group.

Layte et al. (2015) examined SMRs for men and women in different occupational groups over the period 1984-2008. They found a significant gradient in mortality rates across occupational groups for both men and women with the differential between professional and manual occupational groups increasing between the 1980s and 2000s. The differential for women, however, was lower than that for men (Layte et al., 2015). The authors suggest that these differences across sex are potentially due to social patterning of health behaviours that differ between males and females.

Ethnic inequalities in adult mortality

The All-Ireland Traveller Health Study, covering the period 2007-2010, identified significantly lower life expectancy among Irish Travellers relative to the overall population (Government of Ireland, 2010). Life expectancy at birth for male members of the Irish Traveller community in 2008 was 61.7 years compared to 76.8 for the overall population. For women, the corresponding figures were 70.1 years for Irish Traveller women compared to 81.6 years for the overall population. For Traveller men the mortality rate has increased between 1987 to 2008. Respiratory conditions and heart disease are the most common causes of death for the Traveller community; however the second most common cause of death is external, for example, accidents, poisonings and suicide. External causes of death are 5.5 times higher for Irish Traveller men than for the overall male population (Government of Ireland, 2010).

Inequalities in cause-specific mortality

Overall, mortality in Ireland has been converging over time on the EU15 average due to reductions in mortality from circulatory and respiratory diseases, particularly for older age categories (Eighan et al., 2020). However, Eighan et al. (2020) found that Ireland still had the highest death rates from respiratory disease in 2014 out of all EU15 countries. Although death rates from cancer (neoplasm) for males were lower than the EU15 average, females had higher death rates than the EU15 average for cancer. The authors suggest that improved education rates and better living standards likely account for Ireland's convergence with the EU15, but inequalities between Ireland and the EU15 remain despite these improvements.

A report published by the Institute of Public Health (IPH) examined inequalities in cause-specific mortality over the ten-year period 1989-1998 for Northern Ireland and the Republic of Ireland by occupational class,[28] region and gender (Balanda and Wilde, 2001). They found that all-cause mortality rate in the lowest occupational class was 100 per cent to 200 per cent higher than the rate in the highest occupational class. The mortality rate for respiratory diseases were over 200 per cent higher for the lowest occupational class compared to the highest. It was over 100 per cent higher for circulatory diseases, cancers and external causes (Balanda and Wilde, 2001).

2.4.2 European, UK and US studies

Socio-economic inequalities in mortality

For education and occupational measures of SES, there tends to be a clear negative relationship between SES and mortality: manual occupational groups or groups with lower education tend to have higher mortality rates, on average (Kulhánová et al., 2014; Mackenbach et al., 2003; 2015b; 2017).

European studies of socio-economic inequalities in mortality tend to use longitudinal survey data.[29] Mackenbach et al. (2003; 2015a; 2015b; 2017) have conducted a number of cross-European studies that have assessed mortality risk across education groups (as a proxy measure for SES). Overall, these studies tended to find that despite absolute mortality rates falling over time for all groups, the relative gap in mortality between high-educated and low-educated groups widened (Mackenbach et al., 2003; 2015b; 2017). The authors suggest that more beneficial health behaviours in the higher-educated groups explain these health inequalities (including lower levels of smoking and alcohol consumption among higher-educated groups).

28 Balanda and Wilde (2001) used a ratio comparing 'highest' occupational class to 'lowest' occupational class for examining inequalities in mortality. For Northern Ireland, this was based on Social Class (using SC1-2 as the 'highest' occupational class and SC4-5 as the 'lowest' occupational class); for the Republic of Ireland, this was based on Socio-economic Group (using SEG A as the 'highest' occupational class and SEG D as the 'lowest' occupational class).

29 Ireland is generally excluded from these analyses due to lack of longitudinal or linked mortality data.

Connolly et al. (2010) propose that studies of health inequalities in older populations should consider life-time socio-economic position. The authors suggest that house value would fill this role. Using the Northern Ireland Census in 2001, their results show that house value is a powerful indicator of wealth and is highly correlated with health status and predicted future mortality in the older population (Connolly et al., 2010). Demakakos et al. (2016) and Stringhini et al. (2018) use data from the English Longitudinal Study on Ageing (ELSA) and analysed inequalities in mortality using wealth and life course SES respectively. The authors find that wealth is highly predictive of both all-cause mortality and cause-specific mortality, but it is only applicable for older adults who are at the end of their working life. They argue that these inequalities likely reflect homeownership, which is a large component of someone's wealth (Demakakos et al., 2016). Stringhini et al. (2018) examines life course SES using four indicators: father's social class; own education; occupation and wealth. The authors found that, in general, the longer someone remained in a lower SES position during their lifetime, the higher the mortality risk they faced. They propose that SES may have a direct effect on mortality through its effect on psychosocial factors stemming from negative social support networks which affects smoking, alcohol consumption and diet.

Ethnic inequalities in mortality

Examining ethnic inequalities in mortality, Rafnsson et al. (2013) examined the variation and inequalities in mortality due to circulatory disease, ischaemic heart disease and cerebrovascular disease by country of birth for six European countries (Denmark, England and Wales, France, the Netherlands, Scotland and Sweden). Patterns across circulatory disease and ischaemic heart disease were similar: those born in South Asia and Eastern Europe had higher mortality rates than local-born populations in Denmark, England and Wales and France. There were also higher mortality rates for those born in East and West sub-Saharan Africa compared to local-born populations in England and Wales and France. Those born in East Asian countries had lower mortality compared to local-born populations in France, Scotland and Sweden. The authors point to health behaviours such as smoking and obesity trends being higher in some migrant groups (those born in Eastern Europe and Turkey) which may lead to these disparities between minority groups and local-born populations.

Bos et al. (2004) use Dutch data to identify the factors that determine whether ethnic minority groups have higher or lower mortality than the native population of the host country. The native Dutch population were compared to those who were born in Turkey, Morocco, Surinam and the Dutch Antilles or had parents born there. These countries account for the majority of migration into the Netherlands. The authors found that mortality among men was higher among Turkish, Surinamese and Antillean men and lower among Moroccan men. Inequalities in mortality among women were small; only Surinamese women showed higher mortality rates compared to Dutch women. Minority groups are, on average, younger than the Dutch population and the authors found that age was a confounding factor in mortality. Most minority groups showed high mortality at young ages and low mortality at older ages.

Interaction between socio-economic and ethnic inequalities in mortality

From their analysis of ethnic inequalities in the Netherlands, Bos et al. (2004) argue that it is likely that socio-economic inequalities underpin the observed inequalities, as well as differences in lifestyle and risk factors – smoking is much more prevalent among Turkish, Surinamese and Antillean men compared to Dutch men. This link is examined by Bos et al. (2005) who undertook a study using Dutch data to examine socio-economic inequalities across ethnic groups in the Netherlands. They use municipal population registers linked with death registration data to calculate SMRs by mean neighbourhood income. They found that the socio-economic differentials were comparatively small among Turkish and Moroccan male groups. The authors suspected that less heterogeneity in income levels was the reason for the small differentials, but adjusting for this did not affect the results (Bos et al., 2005). The authors also draw comparisons between the small Turkish and Moroccan differentials to the similar patterns shown for Spanish and Italian data (discussed below).

Further examining the links between socio-economic and ethnic inequalities, an American study (Krieger et al., 2008) analysed the rates of premature mortality by income quintiles, stratifying the population samples by race/ethnicity. They found that the declining trend in mortality was statistically significant for White populations at the highest income quintiles. They estimated that if all persons experienced the same yearly premature mortality rates as the highest income quintile of the White population, 14 per cent of White premature deaths and 30 per cent of premature deaths for the non-White population would not have occurred.

Inequalities in cause-specific mortality

Looking at cause-specific mortality, Mackenbach et al. (2015a) examine how cause-specific mortality rates differ between high- and low-education groups. The paper discusses these causes through the lens of 'preventable'[30] and 'non-preventable' mortality.[31] According to the authors, their findings show that there are greater socio-economic inequalities for preventable mortality. The mortality causes showing the greatest socio-economic inequalities for men are throat/lung cancer, alcohol abuse and pulmonary heart disease. For women, causes with the greatest socio-economic inequalities are alcohol abuse, diabetes, cervical cancer and

30 Eurostat definitions of preventable mortality are deaths that could be avoidable with greater public health intervention that focus on altering lifestyle/behavioural/environmental factors.

31 Authors' definition of 'preventable' and 'non-preventable' mortality do not align with OECD/Eurostat definitions, see Table 2 in Mackenbach et al. (2015a) for details on preventable causes.

pulmonary heart disease (Mackenbach et al., 2015a). The authors suggest that these socio-economic inequalities in cause-specific mortality are due to differing health behaviours across SES groups such as smoking and alcohol consumption.

Spain and Italy are shown to have narrower socio-economic differentials in mortality than many European countries (Mackenbach et al., 2003; 2015b; 2017). Kulhánová et al. (2014) examined educational inequalities in cause-specific mortality in Spain, while Federico et al. (2013) specifically examined whether smoking habits explain the narrower socio-economic differentials in Italy. Kulhánová et al.'s (2014) study showed that there were relatively small socio-economic inequalities in both cardiovascular disease and cancer. They propose that this is the reason Spanish mortality SES differentials are smaller than those observed in other countries. Federico et al. (2013) examined specifically whether uniform smoking habits across all education levels contributed to the lower socio-economic inequalities seen in Italian data compared to other European countries. They found that smoking did not explain these smaller mortality differentials. Lewer et al. (2017) tested a similar hypothesis using data from the ELSA and found that the effect of smoking on mortality was greater for those in lower socio-economic groups.

2.5 COVID-19 EXCESS MORTALITY

As noted in Chapter 1, a literature is now emerging on trends in excess mortality across time and countries during the COVID-19 pandemic. In countries with the ability to link death registrations to individual-level population data, analyses of patterns of inequalities in COVID-19 mortality can also be undertaken. In Ireland, the CSO has used data on COVID-19 cases and deaths from the Computerised Infectious Disease Reporting (CIDR) system linked to data from the Revenue PAYE (Pay as You Earn) system to provide an analysis of how COVID-19 cases and deaths are distributed across employment categories, age and gender from 28 February 2020 to 30 April 2021 (CSO, 2021b). They found that those with higher rates of COVID-19 infection were those in employment in human health and social work activities, followed by those working in the wholesale/retail trade. The age profile of COVID-19 deaths and cases show a clear disparity, where older populations had higher rates of mortality but made up a small proportion of the overall population. For example, 3 per cent of the overall population was over 90 (according to 2016 Census figures) and yet they made up 62 per cent of average weekly deaths over this period. Similarly, 65-79 year-olds made up 10 per cent of the population and 30 per cent of the weekly deaths from COVID-19. Across male and female populations, it was found that females constitute more of the cases overall compared to male populations, but they had lower mortality rates from COVID-19.

Although the CSO does not publish data on the ethnicity, country of birth or nationality of those who contracted or died from COVID-19, a report from

McGinnity et al. (2020b) uses CIDR data linked with 2016 Census of Population data. Their analysis shows that although non-White ethnic groups were more likely to have contracted COVID-19, they were less likely to die from the disease (McGinnity et al., 2020b). The authors propose that this is likely due to the younger age distribution of non-White/migrant populations in Ireland as well as the fact that they are more likely to work in occupations that give rise to higher risk of infection.

Similar to the CSO data showing how COVID-19 cases and mortality are distributed across the population, Aburto et al. (2021) showed that 55 per cent of excess deaths due to COVID-19 in the UK occurred among men. Other studies tend to use municipal data with area level deprivation measures. Brandily et al. (2020) examined how COVID-19 mortality was distributed across socio-economic groups, combining administrative data sources to estimate the relationship between mortality from COVID-19 and income at a very local level in France. They found that mortality rates were twice as large for municipalities in the bottom income quartile of the national income distribution than in municipalities above this threshold. Sá (2020) looked at the same relationship for England and Wales using Census and public health data by local authority district. Their analysis showed that districts with a higher percentage of Black or Asian population had higher rates of death from COVID-19.

For the US, Figueroa et al. (2021) examined the association of race/ethnicity with COVID-19 cases/deaths across US counties. They found that a 10 per cent increase in the Latino population was associated with 293.5 additional COVID-19 cases per 100,000 people and 7.6 additional COVID-19 deaths per 100,000 people. Millet et al. (2020) also found similar results in their analysis whereby Black communities in the US were more at risk of mortality from COVID-19. They suggest that Black individuals are disproportionately more likely to hold occupations that carry increased risk of exposure to the virus, echoing the early Irish findings by McGinnity et al. (2020b) and Whelan et al. (forthcoming).

2.6 SUMMARY

Despite using a variety of indicators of SES, the available literature has consistently shown that those in more disadvantaged socio-economic positions have higher mortality rates. In terms of ethnicity/race/country of birth, the literature shows a more mixed association with mortality, with some groups experiencing lower levels of mortality than the majority group, and others experiencing higher levels of mortality. While the literature is still emerging, higher rates of COVID-19 (excess) mortality have been observed among some ethnic minority groups in the UK and US. The next chapter examines inequalities in perinatal, infant, child and maternal mortality.

CHAPTER 3

Inequalities in perinatal, infant, child and maternal mortality

3.1 INTRODUCTION

This chapter examines inequalities in perinatal, infant, child and maternal mortality. Where the data allow, inequalities by socio-economic status (SES) and country of birth are examined. The next section (Section 3.2) details the relevant data and methods, Section 3.3 presents the main findings and Section 3.4 concludes.

3.2 DATA AND METHODS

3.2.1 Perinatal mortality

Data source

In Ireland, births are notified and registered on a four-part Birth Notification Form which is used to notify local registrars of all live births and stillbirths. The third part of this form has all identifying information removed and is sent to the Healthcare Pricing Office for registration on the National Perinatal Reporting System (NPRS) dataset (Healthcare Pricing Office, 2021). Data for the analysis of perinatal mortality in this report were derived from the NPRS.

The NPRS includes information on approximately 70,000 birth records in Ireland each year from 19 maternity units and all practicing self-employed community midwives (Healthcare Pricing Office, 2021). In accordance with the World Health Organization (WHO) guidelines, only infants weighing 500 grams or more are included in the dataset (Healthcare Pricing Office, 2021). The dataset includes a range of demographic, clinical and administrative data (Healthcare Pricing Office, 2021), including mothers' occupational group and country of birth. In some instances, fathers' occupational group and country of birth are also included in the dataset.[32]

Study population

The analysis of perinatal mortality includes data from 2000 to 2019. In keeping with similar analyses (Nolan and Magee, 1994; Opondo et al., 2020; Jardine et al., 2021), this analysis is restricted to singleton births. While the NPRS dataset includes information on stillbirths and early neonatal deaths (death of a live-born infant in the first week of life), it was necessary to combine these two categories (thereby estimating perinatal deaths) due to small numbers in some categories.

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[32] When the mother is married to the father, it is a requirement to collect the father's information. When the mother is not married to the father, it is not a requirement to include the father's details but, in some cases, these are recorded.

Variables

The focus of this analysis is on inequalities by mothers' (and to a lesser extent fathers') SES (derived from information on occupation) and country of birth.

Mothers' (and fathers') occupational group in the NPRS dataset is coded and grouped, with minor modifications, according to the system of socio-economic groups used by the Central Statistics Office (CSO) in the 1991 Census of Population (Healthcare Pricing Office, 2021). In the NPRS dataset, the CSO category of 'Unknown' is differentiated into five distinct groups. These are 'Unemployed', 'Not Classifiable', 'Not Applicable', 'Home Duties', and 'Not Stated'. Occupation is coded to the 'Unemployed' group when occupation is given as unemployed and where no previous occupation is stated. If a previous occupation is stated then occupation is coded to the relevant occupational group (Healthcare Pricing Office, 2021). 'Not Classifiable' is used to categorise indecipherable, unclear, or unlisted occupations where efforts to clarify the information have failed. 'Home Duties' is recorded as the occupational group where occupation has been entered as 'full-time mother/parent', 'stay at home mother/parent', 'housewife', 'home duties', etc. 'Not Stated' applies to those cases where either the mother's occupation has been left blank or has been recorded as 'Unknown' (Healthcare Pricing Office, 2021).

For the purpose of the analysis based on occupational group, data are grouped into four time periods; 2000-2003, 2004-2008, 2009-2013 and 2014-2019. Due to small numbers in some categories (and consequently a small number of perinatal deaths), it was necessary to aggregate some categories (Table 3.1). This was done by aggregating categories that are deemed to be similar in terms of the nature of the work undertaken, based on previous research in the Irish context (Nolan and Magee, 1994; Layte and Clyne, 2010).

TABLE 3.1 RE-CLASSIFICATION OF OCCUPATIONAL GROUPS

Categorisations as per NPRS	Categorisations for this analysis
Higher Professionals	Higher Professionals
Lower Professionals	Lower Professionals
Employers and Managers	Employers and Managers
Intermediate Non-Manual Workers	Intermediate Non-Manual Workers
Other Non-Manual Workers	Other Non-Manual Workers and Salaried Employees
Salaried Employees	
Skilled Manual Workers	Manual Workers, Farming, and Agriculture
Semi-Skilled Manual Workers	
Unskilled Manual Workers	
Farmers and Farm Managers	
Other Agri Occupations	
Unemployed	Unemployed
Not Classifiable	Not Classifiable
Home Duties	Home Duties
Not Stated	Not Stated

Source: Authors' analysis.

In the NPRS, information on country of birth of mother/father was collected from 2004 onwards. For the purpose of the analysis based on country of birth, data are grouped into three time periods; 2004-2008, 2009-2013 and 2014-2019.

There have been some changes in the categories of country of birth used over time largely reflecting the expansion of the European Union (EU) over the period of analysis. Consequently, the Europe category combines EU-West, EU-East and Rest of Europe together to ensure consistency in included countries through time. In addition, given small numbers in some groups, some countries were aggregated together (Table 3.2).

TABLE 3.2 RE-CLASSIFICATION OF COUNTRY OF BIRTH

Original Categorisations	New Classification
Ireland	Ireland
UK	UK
EU-West	Europe
EU-East	
Rest of Europe	
Africa	Africa
Asia	Asia
America	Other
Australia	
New Zealand and Other Oceania	
Multi-Nationality	
Not Stated	Not Stated

Source: Authors' analysis.

Methods

Perinatal mortality rates and relative risks (including confidence intervals) are estimated for each socio-economic (i.e. occupational) and country of birth group for each of the relevant time periods. The perinatal mortality rate is the number of perinatal deaths per 1,000 births (including stillbirths and early neonatal deaths). The relative risk is a ratio of the risk of a perinatal death occurring in one group relative to the risk in another group. In this analysis, the risk for each socio-economic group is compared to the reference category 'Higher professionals', while the risk for each country-of-birth group is compared to the reference category 'Ireland'. A relative risk of one indicates identical risk among the two groups; a relative risk greater than one indicates an increased risk among a particular group relative to the reference category, while a relative risk less than one indicates a decreased risk in a particular group relative to the reference category. The 95 per cent confidence interval associated with the relative risks shows a range of values where there is a 95 per cent chance that the range contains the relative risk.

Sensitivity analysis

Initial analysis shows that approximately one-in-five of every mother's occupation is recorded as 'unemployed', 'home duties', 'not classifiable' and 'not stated'.[33] To assess the sensitivity of the estimates to the use of an alternative categorisation of socio-economic group, fathers' occupation (where available) was used as an alternative when mothers' occupation was recorded as 'unemployed', 'home duties', 'not classifiable' and 'not stated'.

33 Approximately 37 per cent of mothers in period 2000-2003, 32 per cent in period 2004-2008, 30 per cent in period 2009-2013 and 28 per cent in period 2014-2019 were classified as unemployed, in home duties, not classifiable or not stated.

3.2.2 Infant and child mortality

Data source, study population and variables

The analysis of infant and child mortality uses unlinked data on mortality from Vital Statistics and population from the Census of Population obtained from the Central Statistics Office (CSO).

The dataset includes the annual number of deaths (2000-2018) by sex for two age groups; <1 and 1-14. Corresponding population counts are derived from the 2002-2016 Census of Population, with interpolation of population counts for intercensal years.[34] Given the small number of deaths in those aged less than 15, further disaggregation by socio-economic group is not possible.[35] In addition, as the Vital Statistics data do not contain information on ethnicity/country of birth/ nationality, further disaggregation for these categories was not possible.

Methods

Mortality rates (per 1,000 population) are calculated by sex for those aged <1 and 1-14 for each of the years 2000-2018.

3.2.3 Maternal mortality

Data source, study population and variables

The analysis of maternal mortality is based on data from the Confidential Maternal Death Enquiry (CMDE) for the UK and Ireland (Knight et al., 2021). The CMDE is a national programme investigating maternal deaths in the UK and Ireland. It was initiated in England and Wales in 1952, with Scotland and Wales joining by the 1980s. Given the relatively small number of maternal deaths in Ireland each year and the need for confidentiality, Ireland joined with this larger cohort in 2009 to maintain anonymity. The aim of the CMDE is to investigate why some women die during or shortly after pregnancy (Knight et al., 2021).

Maternal Death Enquiry Ireland collects the Irish data used in the UK CMDE report and publishes reports on Irish maternal death. In the CMDE, a proactive approach to case ascertainment is employed (O'Hare et al., 2020). The data are collected primarily from maternity units as well as general hospitals, general practitioners and other healthcare professionals in the community (O'Hare et al., 2020). Consequently, the number of maternal deaths recorded in the CMDE has always been greater than the number of deaths identified by death registration alone,

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34 Interpolation was done using STATA.

35 In addition, attribution of a socio-economic group for the population aged under 15 is more difficult than for those aged 15+. It is based on the socio-economic group of another person in the family unit using a priority table used by the CSO to characterise relationships within the family. For example, if the Census reference person of a family was at work, unemployed or retired, other persons were assigned to his/her socio-economic group. See https://www.cso.ie/en/releasesandpublications/ep/p-cp11eoi/cp11eoi/bgn/ for further details.

which is used by the CSO in their quantification of maternal deaths (Appendix 1). Each report published by the CMDE covers three years in aggregate because numbers in any individual year are too small to report in terms of socio-demographic characteristics and cause.

A maternal death is defined as the death of a woman while pregnant or within 42 days/6 weeks of the pregnancy ending from any cause related to the pregnancy or its management (but not including accidental causes) (CSO, 2021c; Knight et al., 2021).

Methods

In this analysis, data on the number of maternal deaths and the maternal death rates are extracted from the various CMDE reports.

3.3 RESULTS

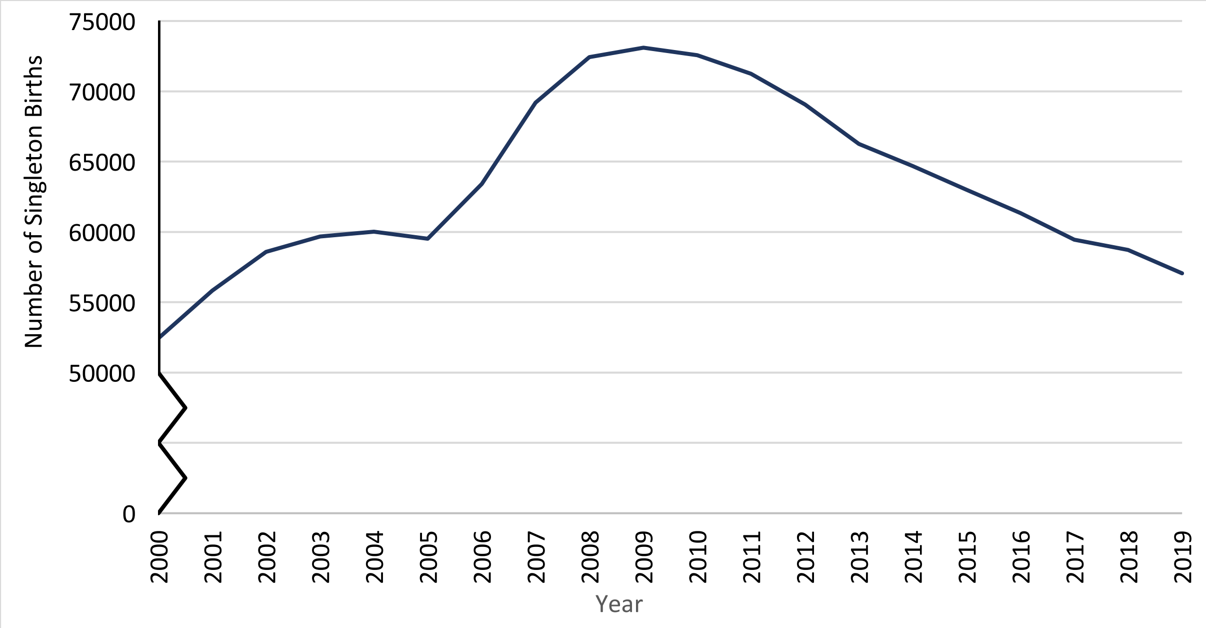
3.3.1 Perinatal mortality

Trends in perinatal mortality over time

Figure 3.1 shows the total number of singleton births (including stillbirths and early neonatal deaths) in each year between 2000 and 2019. The number of births per year was increasing up to 2009; however, the number of births has been steadily declining since, with the result that the number of births in 2019 was similar to that in 2001.[36]

[36] These trends in the overall number of singleton births broadly mirror those for birth rates (Maden, 2016; Healthcare Pricing Office, 2021).

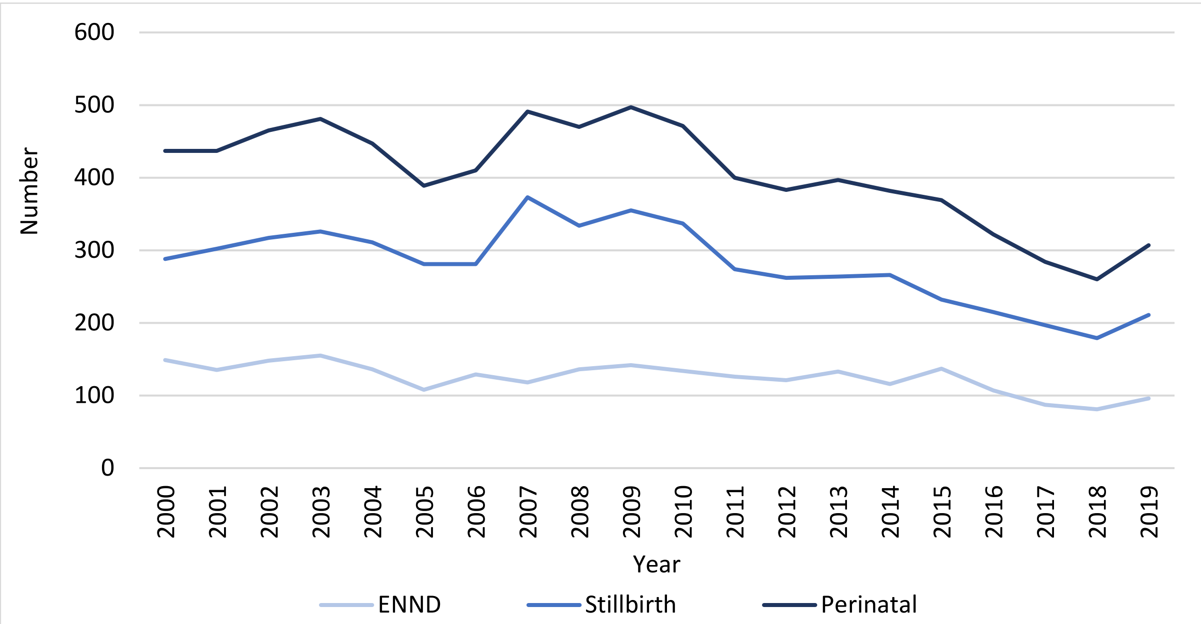
FIGURE 3.1 TOTAL SINGLETON BIRTHS IN IRELAND, 2000-2019



Source: NPRS data; authors' analysis.
Notes: Data exclude multiple births.

Figure 3.2 shows the number of singleton stillbirths, early neonatal deaths (ENND) and perinatal deaths (stillbirths and early neonatal deaths combined) in each year between 2000 and 2019. Tracking the number of births over this period, the number of perinatal deaths peaked in 2009 and subsequently decreased. However, an increase in perinatal deaths is observed in 2019.

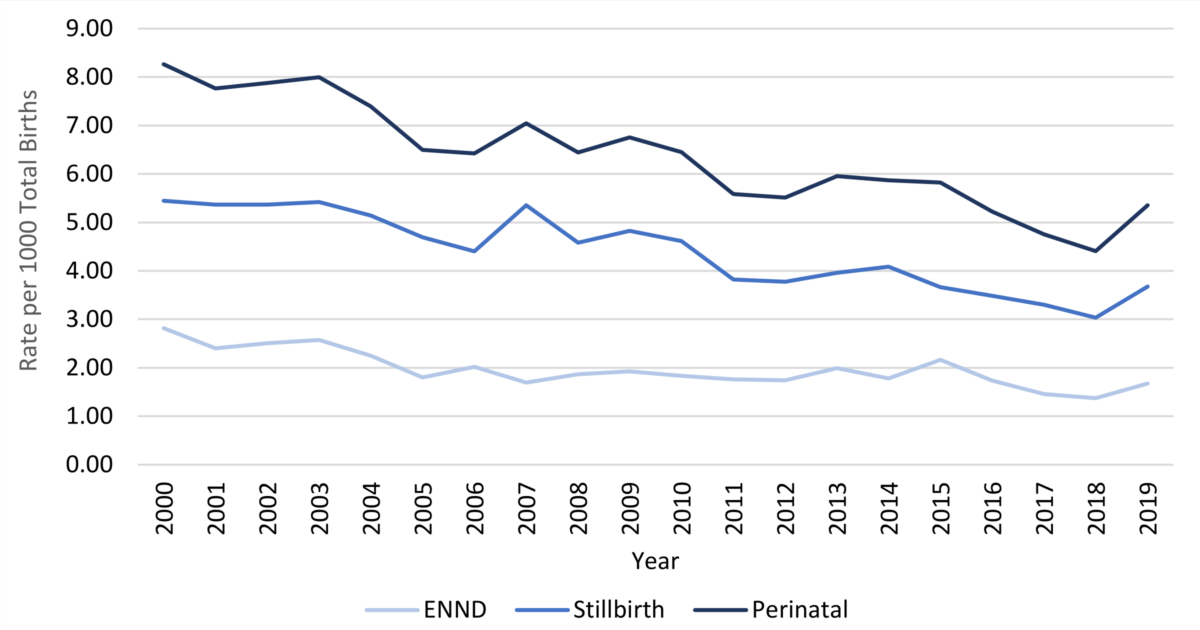
FIGURE 3.2 STILLBIRTHS, EARLY NEONATAL DEATHS AND PERINATAL DEATHS, 2000-2019



Source: NPRS data; authors' analysis.
Notes: Data exclude multiple births.

Figure 3.3 shows the stillbirth, early neonatal death and perinatal mortality rate per 1,000 total births. While in general the rates have been decreasing over time, consistent with the increase in the number of perinatal deaths in 2019, the perinatal mortality rate increased in 2019 but more annual data are needed to confirm any pattern of recent increase.

FIGURE 3.3 STILLBIRTH, EARLY NEONATAL AND PERINATAL MORTALITY RATES PER 1,000 BIRTHS, 2000-2019



Source: NPRS data, authors' analysis.
Notes: Data exclude multiple births. In line with NPRS reporting, stillbirth and perinatal mortality rates are presented as a percentage of total births. Early neonatal deaths (ENND) are normally presented as a percentage of live births, but for ease of presentation, ENND are presented here as a percentage of total births also.

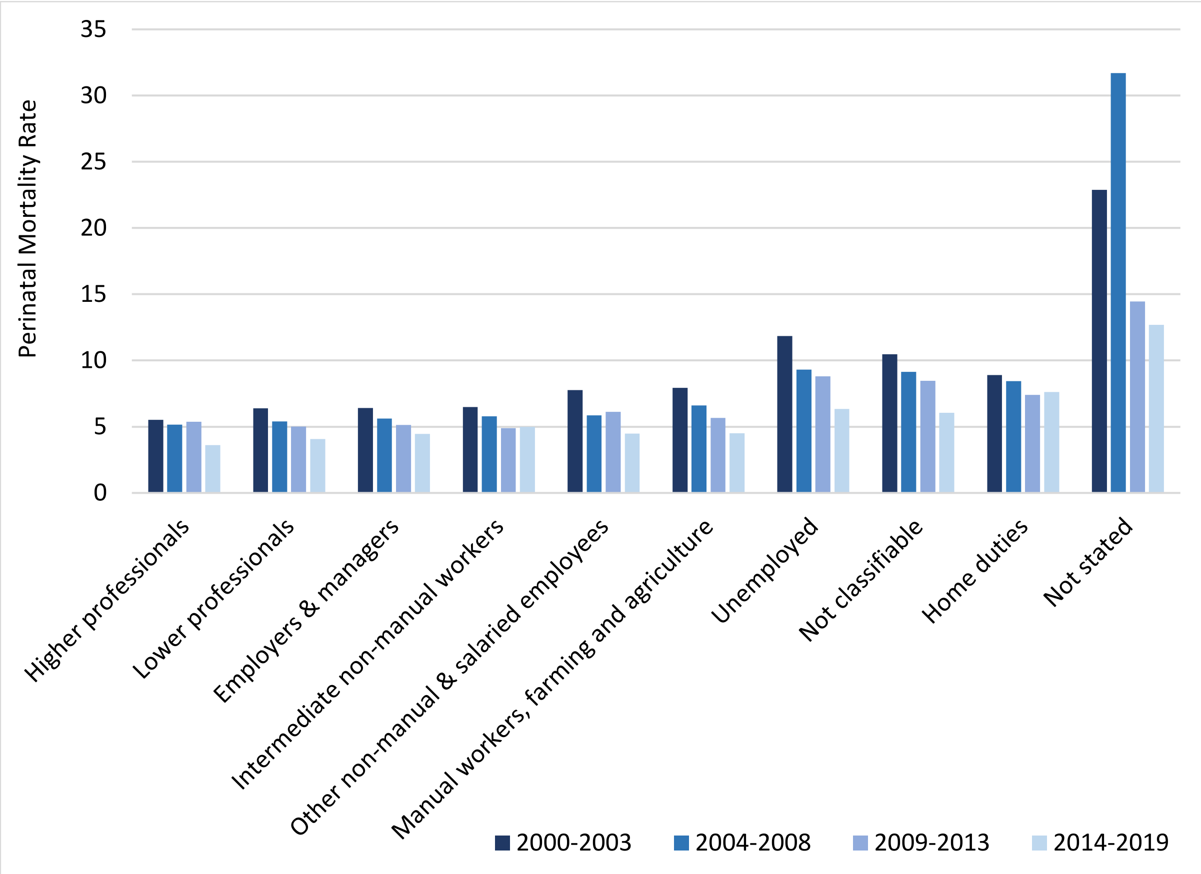
Inequalities in perinatal mortality by socio-economic group

Table 3.3 shows the number of births and perinatal deaths, as well as the perinatal mortality rate, for each socio-economic group in each of the four time periods of analysis. In terms of mothers' occupation, the most commonly recorded occupational groups are 'lower professionals', 'intermediate non-manual workers', 'other non-manual and salaried employees' and 'home duties'. Relatively few women are allocated to the 'farm and farm managers', 'other agricultural occupations and fishermen' and 'unskilled manual workers' categories. There have been some changes over time with an increase, for example, in the proportion of mothers allocated to the professional categories and a decrease in the proportion allocated to home duties.

Table 3.3 and Figure 3.4 show that the perinatal mortality rate has decreased for all occupational groups over time, however significant inequalities between groups remain. For example, in the period 2000-2003, the perinatal mortality rate was 5.52 in the 'higher professional' group, 7.93 in the 'manual workers, farming and agricultural' group and 11.85 for the 'unemployed' group. By 2014-2019, the corresponding rates were 3.61, 4.51 and 6.35.

The rate of decrease differs across groups with, for example, the rate decreasing by 42 per cent over the period of analysis for those classified as 'other non-manual and salaried employees' relative to 14 per cent for those allocated to the 'home duties' category.

FIGURE 3.4 PERINATAL MORTALITY RATE BY OCCUPATIONAL GROUP, 2000-2019



Source: NPRS data; authors' analysis.
Notes: Data exclude multiple births.

TABLE 3.3 NUMBER OF SINGLETON BIRTHS, PERINATAL DEATHS AND PERINATAL MORTALITY RATE BY OCCUPATIONAL GROUP, 2000-2019

	2000-2003			2004-2008			2009-2013			2014-2019		
	Births	Deaths	Rate	Births	Deaths	Rate	Births	Deaths	Rate	Births	Deaths	Rate
Higher professionals	9,426	52	5.52	18,461	95	5.15	23,063	124	5.38	26,564	96	3.61
Lower professionals	27,091	173	6.39	43,450	235	5.41	56,158	281	5.00	71,168	290	4.07
Employers and managers	12,338	79	6.40	22,924	129	5.63	25,699	132	5.14	26,913	120	4.46
Intermediate non-manual workers	53,788	349	6.49	74,599	431	5.78	74,347	363	4.88	67,980	339	4.99
Other non-manual and salaried employees	26,503	206	7.77	45,117	264	5.85	53,209	326	6.13	56,597	253	4.47
Manual workers, farming and agriculture	15,646	124	7.93	18,017	119	6.60	17,676	100	5.66	16,180	73	4.51
Unemployed	9,962	118	11.85	12,350	115	9.31	14,786	130	8.79	17,009	108	6.35
Not classifiable	7,349	77	10.48	12,798	117	9.14	14,162	120	8.47	11,746	71	6.04
Home duties	62,522	557	8.91	77,555	654	8.43	73,282	543	7.41	67,086	511	7.62
Not stated	3,714	85	22.89	1,514	48	31.70	2,005	30	14.96	4,960	63	12.70
Total	**228,339**	**1,820**	**7.97**	**326,785**	**2,207**	**6.75**	**354,387**	**2,148**	**6.06**	**366,203**	**1,924**	**5.25**

Source: NPRS data; authors' analysis.
Notes: Data exclude multiple births.

Table 3.4 and Figure 3.5 show the relative risk of a perinatal death in each occupation group (relative to higher professionals) in each of the four time periods. Consistent with the observed inequalities in perinatal mortality rates across occupational groups, the relative risk for all occupation groups (with minor exceptions in the third time period) is greater than for higher professionals. However, the excess risk is only statistically significant across all time periods for the 'unemployed', 'not stated', 'home duties' and the 'not classifiable' groups. In the final period, the risk of a perinatal death for those involved in home duties is more than twice that of higher professionals.

In general, relative risks are decreasing for most groups from the first to the third period; however, all groups experienced an increase in their risk (relative to higher professionals) between the third (2009-2013) and fourth periods (2014-2019). This appears to be driven by a large decrease in the perinatal mortality rate for the higher professional group between the third and fourth periods (from 5.38 to 3.61).

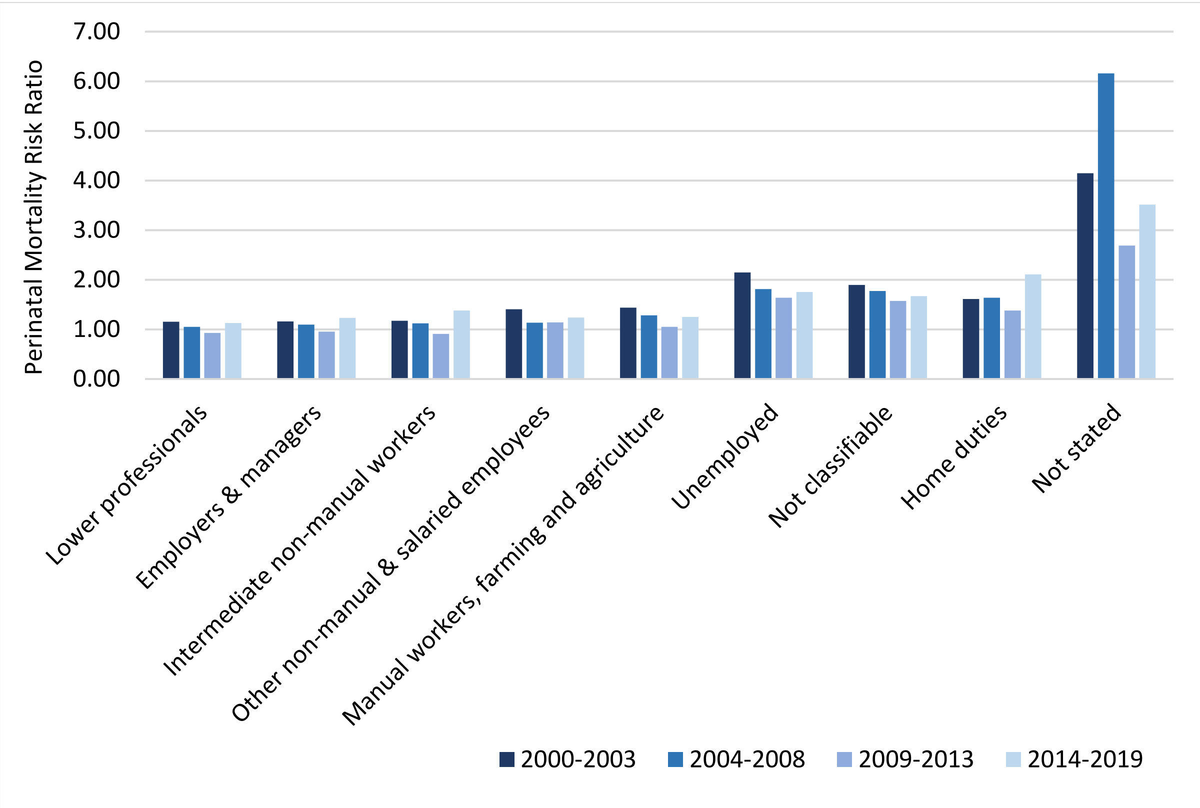
In the earliest period, two groups – 'Other non-manual and salaried employees' and 'manual workers, farming and agricultural' also have a statistically significant higher risk of a perinatal death relative to higher professionals. However, this elevated risk is no longer statistically significant in the later periods.

TABLE 3.4 PERINATAL MORTALITY RELATIVE RISK RATIO AND 95 PER CENT CONFIDENCE INTERVALS BY OCCUPATIONAL GROUP, 2000-2019

	2000-2003	2004-2008	2009-2013	2014-2019
Higher professionals	1.00	1.00	1.00	1.00
Lower professionals	1.16 (0.85- 1.58)	1.05 (0.83-1.33)	0.93 (0.75-1.15)	1.13 (0.90-1.42)
Employers and managers	1.16 (0.82-1.65)	1.09 (0.84-1.42)	0.96 (0.75-1.22)	1.23 (0.94-1.61)
Intermediate non-manual workers	1.18 (0.88-1.57)	1.12 (0.90-1.40)	0.91 (0.74-1.11)	1.38* (1.10-1.73)
Other non-manual and salaried employees	1.41* (1.04-1.91)	1.14 (0.90-1.44)	1.14 (0.93-1.40)	1.24 (0.98-1.56)
Manual workers, farming and agriculture	1.44* (1.04-1.98)	1.28 (0.98-1.68)	1.05 (0.81-1.37)	1.25 (0.92-1.69)
Unemployed	2.15* (1.55-2.97)	1.81* (1.38-2.37)	1.64* (1.28-2.09)	1.76* (1.34-2.31)
Not classifiable	1.90* (1.34-2.70)	1.78* (1.36-2.33)	1.58* (1.23-2.02)	1.67* (1.23-2.27)
Home duties	1.61* (1.22-2.14)	1.64* (1.32-2.03)	1.38* (1.13-1.67)	2.11* (1.70-2.62)
Not stated	4.15* (2.94-5.85)	6.16* (4.37-8.68)	2.69* (1.80-4.02)	3.51* (2.56-4.82)

Source: NPRS data; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Data exclude multiple births.

FIGURE 3.5 PERINATAL MORTALITY RELATIVE RISK RATIO* BY OCCUPATIONAL GROUP, 2000-2019



Source: NPRS data; authors' analysis.
Notes: * Relative to higher professional group. Data exclude multiple births.

Additional analysis, detailed in Appendix 2, shows the relative risk ratios of perinatal death across occupational groups for two time periods (2004-2011 and 2012-2019) controlling for age of mother, parity, marital status and country of birth. The results indicate that inequalities across occupational groups are relatively consistent even after adjustment for these additional factors, suggesting that the observed differences are not driven by these socio-demographic factors.

Sensitivity analysis

By way of sensitivity analysis, observations allocated to the categories 'not stated', 'not classifiable', 'unemployed' and 'home duties' based on mothers' occupation are re-classified (where data were available) using information on father's occupation.

Detailed in Appendix 3*,* the analysis shows that the breakdown of home duties by father's occupation allocates the majority of observations to the 'manual workers, farming and agriculture' group. The second most common group is the 'other non-manual and salaried employees' group. Appendix 3 shows that in the re-allocation of the unemployed group based on fathers' occupation, most observations are allocated into the 'not stated' category.

Table 3.5 shows the perinatal mortality rates and relative risks (similar to those shown in Tables 3.3 and 3.4) using fathers' occupation for those previously allocated (based on mothers' occupation) to the 'unemployed', 'home duties', 'not-classifiable' and 'not-stated' groups. Small numbers in the categories 'non-classifiable' and 'home duties' means that it is not possible to report these numbers. In general, the re-allocation does not change the rates and relative risks (observed in Tables 3.3 and 3.4) based on mothers' occupational group for most categories. However, the rate decreases from 22.89 to 12.43 for the 'not stated' category in the first time period, with reductions also observed in later periods. In addition, the rate, and relative risk, for the 'manual workers, farming and agriculture group' is higher, particularly in the later three time periods.

TABLE 3.5 PERINATAL MORTALITY RATES AND RELATIVE RISKS BY OCCUPATIONAL GROUP USING FATHER'S OCCUPATIONAL GROUP FOR THOSE PREVIOUSLY ALLOCATED TO THE GROUPS UNEMPLOYED, NOT CLASSIFIABLE, HOME DUTIES AND NOT STATED, 2000-2019

	2000-2003		2004-2008		2009-2013		2014-2019	
	Rate	Relative risk (95% CI)	Rate	Relative risk (95% CI)	Rate	Relative risk (95% CI)	Rate	Relative risk (95% CI)
Higher professionals	5.71	1.00	5.35	1.00	5.71	1.00	3.83	1.00
Lower professionals	6.49	1.14 (0.87-1.48)	5.63	1.05 (0.85-1.30)	5.00	0.88 (0.72-1.06)	4.16	1.09 (0.90-1.32)
Employers and managers	6.64	1.16 (0.87-1.55)	5.80	1.08 (0.86-1.37)	5.18	0.91 (0.73-1.13)	4.57	1.19 (0.95-1.50)
Intermediate non-manual workers	6.67	1.17 (0.91-1.49)	5.78	1.08 (0.89-1.32)	4.92	0.86 (0.72-1.04)	4.95	1.29 (1.07-1.56)
Other non-manual and salaried employees	8.22	1.44* (1.12-1.85)	6.35	1.19 (0.97-1.46)	6.16	1.08 (0.90-1.30)	4.53	1.18 (0.98-1.44)
Manual workers, farming and agriculture	7.93	1.39* (1.08-1.79)	7.38	1.38* (1.12-1.69)	6.18	1.08 (0.89-1.32)	5.31	1.39* (1.12-1.71)
Unemployed	11.97	2.09* (1.52-2.88)	10.37	1.94* (1.47-2.55)	9.25	1.62* (1.27-2.07)	9.74	2.54* (1.98-3.27)
Not classifiable	7.01	1.23 (0.64-2.37)	6.87	1.28 (0.85-1.93)	5.42	0.95 (0.62-1.46)	7.04	1.84* (1.30-2.60)
Home duties	-	-	-	-	-	-	-	-
Not stated	12.43	2.18* (1.70-2.78)	11.19	2.09* (1.71-2.56)	9.94	1.74* (1.44-2.10)	9.05	2.36* (1.96-2.85)
Total	7.97		6.75		6.06		5.25	

Source: NPRS data; authors' analysis.
Notes: (-) indicates where the underlying numbers for that category are based on a cell size less than or equal to 5 and cannot be reported due to data agreement with the data custodians.
Data exclude multiple births.

Inequalities in perinatal mortality by country of birth

Table 3.6 shows the number of births and perinatal deaths, as well as the perinatal mortality rate, for each country of birth category in each of the three time periods of analysis. In each time period, more than three-quarters of mothers were born in Ireland. Over time there has been a decrease in the proportion of mothers born in Ireland and Africa and an increase in the proportion born in EU-East.

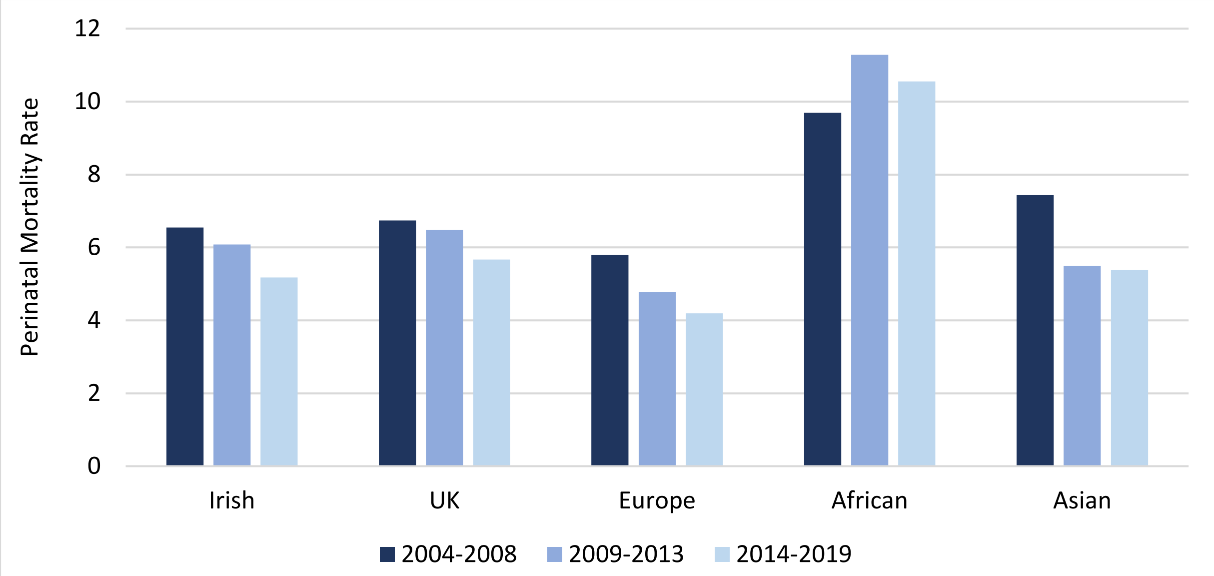
The perinatal mortality rate has increased over time for women born in Africa and decreased over time for all other country of birth groups (Table 3.6 and Figure 3.6). Inequalities remain throughout the period of analysis with the lowest rates observed in women born in European countries; relatively similar rates across women born in Ireland, UK and Asia; and the highest rates observed among women born in Africa and those whose country of birth is not stated.

TABLE 3.6 NUMBER OF SINGLETON BIRTHS, PERINATAL DEATHS AND PERINATAL MORTALITY RATE BY COUNTRY OF BIRTH GROUP, 2004-2019

	2004-2008			2009-2013			2014-2019		
	Births	Deaths	Rate	Births	Deaths	Rate	Births	Deaths	Rate
Ireland	262,456	1,719	6.55	269,282	1,637	6.08	280,556	1,453	5.18
UK	9,940	67	6.74	8,643	56	6.48	8,291	47	5.67
Europe	24,520	142	5.79	48,021	229	4.77	48,705	204	4.19
Africa	13,307	129	9.69	10,015	113	11.28	8,244	87	10.55
Asia	10,487	78	7.44	13,842	76	5.49	13,377	72	5.38
Other	3,461	14	4.05	3,815	15	3.93	5,305	25	4.71
Not stated	2,614	58	22.19	769	22	28.61	1,725	36	20.87
Total	**326,785**	**2,207**	**6.75**	**354,387**	**2,148**	**6.06**	**366,203**	**1,924**	**5.25**

Source: NPRS data; authors' analysis.
Notes: Data exclude multiple births.

FIGURE 3.6 PERINATAL MORTALITY RATE BY COUNTRY OF BIRTH GROUP, 2004-2019



Source: NPRS data; authors' analysis.
Notes: Data exclude multiple births. 'Not Stated' excluded because the rates are much higher than for other groups.

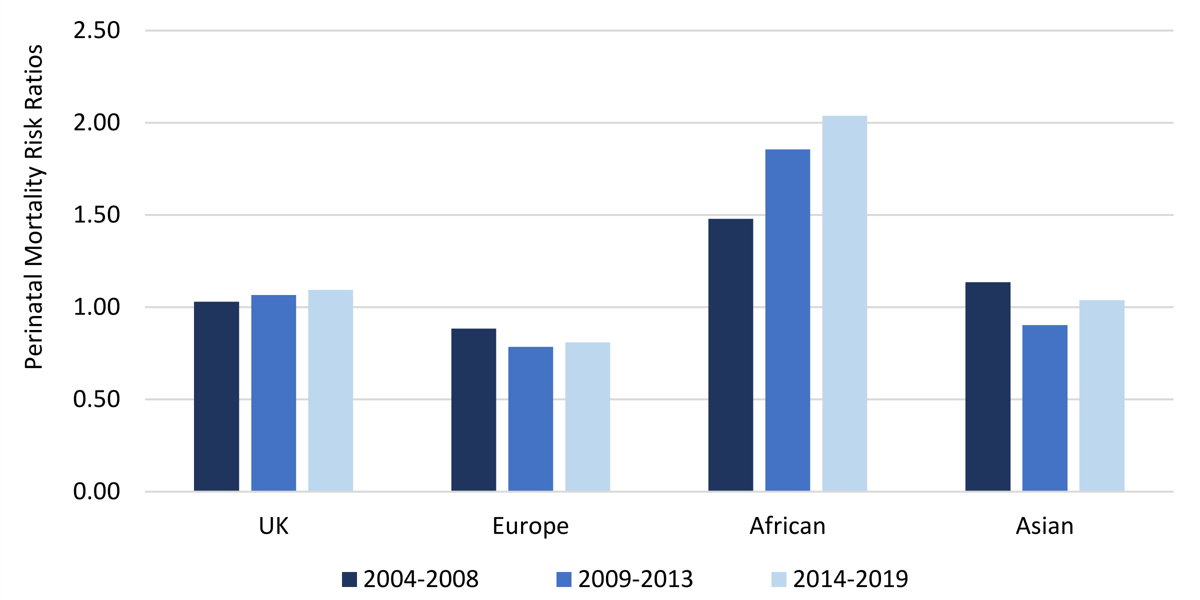
Table 3.7 and Figure 3.7 show the relative risk of a perinatal death in each country of birth group (relative to mothers born in Ireland) in each of the three time periods. The relative risk of European mothers is significantly lower than that of Irish mothers in the latest two time periods, while the relative risk of African mothers is significantly greater than Irish mothers in all three time periods, with the additional risk increasing over time from 1.48 in the first time period to 2.04 in the final time period. This increased relative risk for African mothers relative to Irish mothers is driven by a decrease in the perinatal mortality rate for Irish mothers and an increase in the rate for African mothers over time.

TABLE 3.7 PERINATAL MORTALITY RELATIVE RISK RATIOS AND 95 PER CENT CONFIDENCE INTERVAL BY COUNTRY OF BIRTH GROUP, 2004-2019

	2004-2008	2009-2013	2014-2019
Ireland	1.00	1.00	1.00
UK	1.03 (0.81-1.31)	1.07 (0.82-1.39)	1.09 (0.82-1.46)
Europe	0.88 (0.75-1.05)	0.78* (0.68-0.90)	0.81* (0.70-0.94)
Africa	1.48* (1.24-1.77)	1.86* (1.54-2.24)	2.04* (1.64-2.53)
Asia	1.14 (0.91-1.42)	0.90 (0.72-1.14)	1.04 (0.82-1.32)
Other	0.62 (0.37-1.04)	0.65 (0.39-1.07)	0.91 (0.61-1.35)
Not stated	3.39* (2.62-4.39)	4.71* (3.11-7.12)	4.03* (2.90-5.59)

Source: NPRS data; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Data exclude multiple births.

FIGURE 3.7 PERINATAL MORTALITY RELATIVE RISK RATIO BY COUNTRY OF BIRTH GROUP, 2004-2019

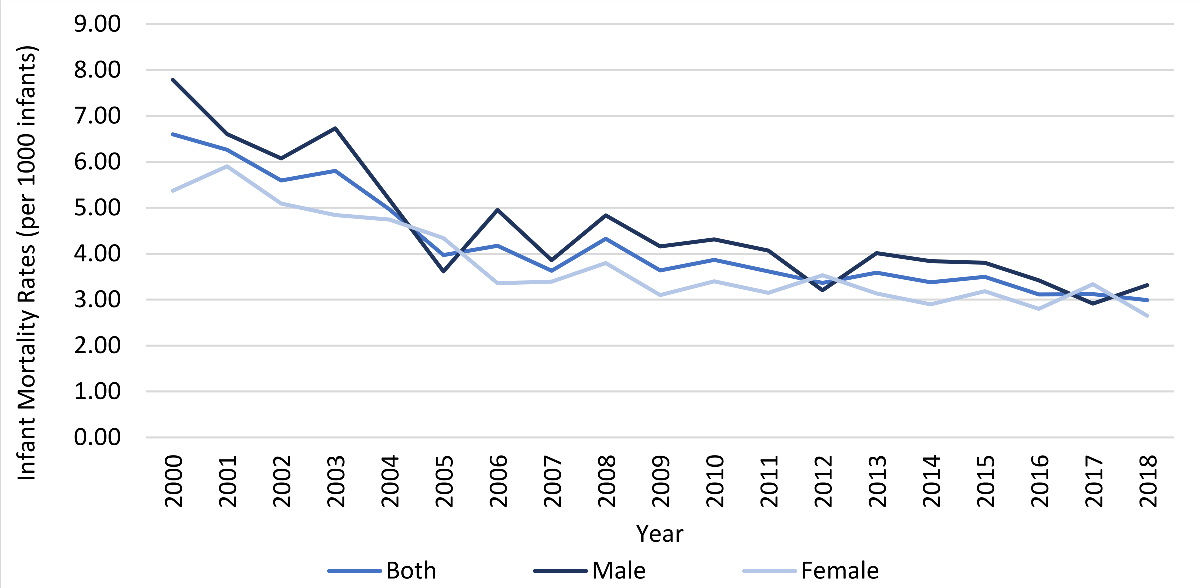


Source: NPRS data; authors' analysis.
Notes: Data exclude multiple births. 'Not Stated' excluded because of much higher risk ratios.

3.3.2 Infant and child mortality

Figure 3.8 shows the infant mortality rate for males and females separately and combined from 2000 to 2018. Over this period there has been a significant decline in the infant mortality rate from 6.60 to 2.99. While the infant mortality rate for males was greater than that for females for most of the included years (except 2005, 2012 and 2017), differences between the groups tended to decrease through time.

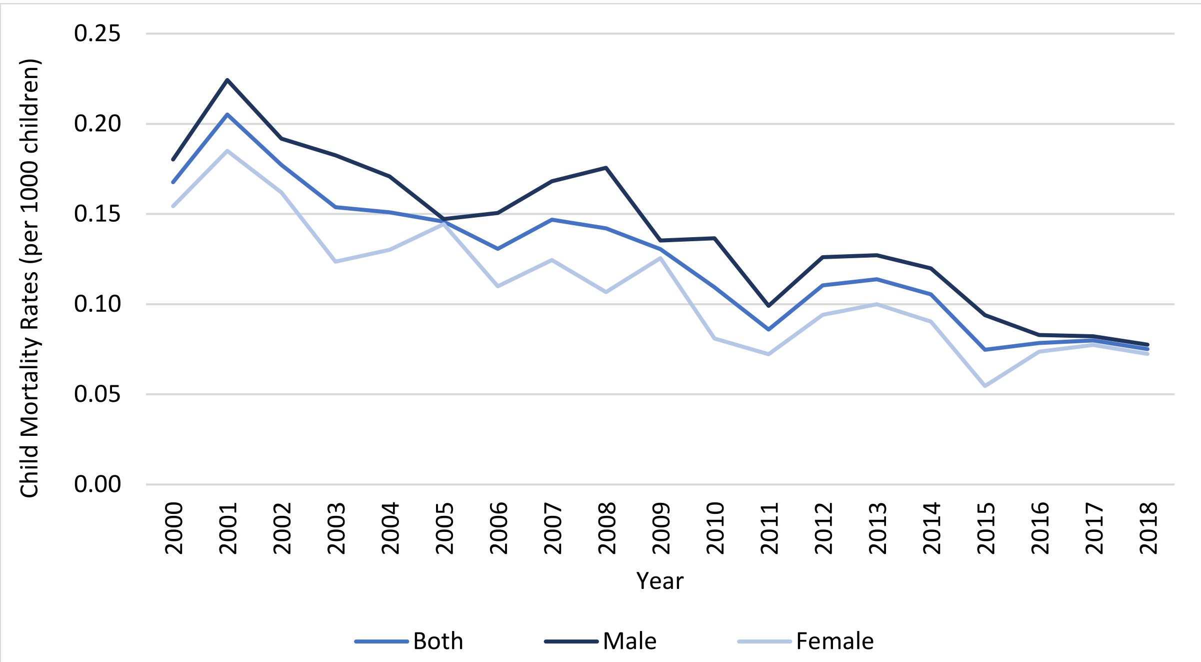
FIGURE 3.8 INFANT MORTALITY RATE BY SEX, 2000-2018



Source: Vital Statistics Data and Population Data from CSO; authors' analysis.

Figure 3.9 shows the mortality rate for children aged 1-14 years for males and females separately and combined from 2000 to 2018. The child mortality rate is significantly lower than the infant mortality rate. Over the period of analysis there has been a decline in the child mortality rate from 0.17 to 0.08 for males and females combined. Similar to the infant mortality rate, the child mortality rate for males tends to be higher than for females; however, this differential has decreased over time with very little gender difference observed in the years 2016-2018.

FIGURE 3.9 CHILD (1-14 YEARS) MORTALITY RATE BY SEX, 2000-2018



Source: Vital Statistics Data and Population Data from CSO; authors' analysis.

3.3.3 Maternal mortality

Table 3.8 shows the number of maternal deaths and the maternal death rate (per 100,000 maternities) by triennium from 2000-2019, based on data compiled for the CMDE. As noted, the number of maternal deaths recorded by the CMDE generally exceeds that from the CSO[37] given the proactive approach to case ascertainment employed by the CMDE; consequently, in this report, only data from the CMDE are reported.

For the years 2017 to 2019, 12 maternal deaths were recorded as occurring during or within 42 days of pregnancy end from 179,376 maternities, giving a maternal mortality rate of 6.7 per 100,000 maternities (O'Hare et al., 2021). This marked a decrease from the observed maternal mortality rate of 8.6 over the period 2009-2011; however, the decrease was not statistically significant (O'Hare et al., 2021).

Given the small number of maternal deaths in Ireland, further disaggregation by SES or ethnicity/nationality/country of birth for each triennium is not possible. However, previous analysis has shown that for the period 2009-2018, of the 54 maternal deaths recorded, 30 per cent occurred in women born outside of Ireland, while these women accounted for 23.4 per cent of all maternities in Ireland for that time period (O'Hare et al., 2020). While this suggests over-representation of non-Irish-born in Irish maternal deaths, the difference in the rate of maternal death between Irish- and non-Irish-born mothers was not statistically significant, most likely due to small numbers (O'Hare et al., 2020).

TABLE 3.8 MATERNAL DEATHS FROM THE CMDE, 2000-2019

Triennium	Number of Maternal Deaths	Maternal Death Rate
2009 – 2011	19	8.6
2010 – 2012	23	10.6
2011 – 2013	22	10.4
2012 – 2014	20	9.8
2013 – 2015	13	6.5
2014 – 2016	12	6.2
2015 – 2017	10	5.3
2016 – 2018	10	5.4
2017 – 2019	12	6.7

Source: O'Hare et al. (2020; 2021).

37 See Appendix 1 for further details.

3.4 SUMMARY

This chapter examines perinatal, infant and child and maternal mortality in Ireland over the period since 2000. In general, mortality in these groups has been declining over time. An assessment of inequalities based on socio-economic group and country of birth was only possible for perinatal mortality due to the small number of infant, child and maternal deaths.

In keeping with previous research in this area, inequalities in perinatal mortality were found across socio-economic group and country of birth groupings. In general, higher and lower professional mothers experienced the lowest rates of perinatal mortality, while those allocated to the groups 'unemployed', 'home duties', 'not stated' and 'not classifiable' had the highest rates. While perinatal mortality rates decreased for most groups over time, the risk of a perinatal death (relative to the higher professional group) for some groups (including those allocated to the 'unemployed' and 'home duties' groups) remained elevated over time.

The perinatal mortality rate increased over time for African born mothers, while it decreased for all other groups. The risk of a perinatal death for African born mothers (relative to Irish-born) increased from 1.48 in the period 2004-2008 to 2.04 in the period 2014-2019.

CHAPTER 4

Inequalities in adult mortality, 2000-2018

4.1 INTRODUCTION

This chapter examines inequalities in adult mortality in Ireland from 2000 to 2018. Where the data allow, inequalities in adult mortality are presented by gender, socio-economic group and nationality/country of birth/ethnicity. We particularly focus on inequalities in all-cause mortality but as well by specific causes of death and also the trends in mortality inequalities over time. Section 4.2 describes the data and methods, Sections 4.3 to 4.4 present the results from the analyses and Section 4.5 summarises.

4.2 DATA AND METHODS

4.2.1 Data source

The data sources for the analysis are the Vital Statistics (VS) and the Census of Population. Both data sources are used for the calculation of mortality rates. The VS data are used for the numerator and the Census of Population for the denominator. Both data sources use different socio-economic classifications making the calculation of harmonised and comparable mortality rates challenging. The VS data use also two different socio-economic classifications over time; one classification for the period 2000-2012 and one for the period 2014-2018. As a consequence, the analysis based on the socio-economic classification is split in these two different periods unlike the gender inequality analysis. We describe below the VS data and the methodology we adopted to reconcile the different socio-economic classifications across data sources.

Vital Statistics

In Ireland, the General Register Office (GRO) is in charge of recording life events; births, stillbirths, adoptions, marriages, civil partnerships and deaths. The GRO records all deaths from the death certificates that are used by the CSO to compile the VS data on mortality. The VS mortality data are collected under the Vital Statistics Act 1952 and Section 73 of the Civil Registration Act 2004. The data on death records include detailed socio-demographic information about the deceased: date and place of death, cause of death, residence, gender, age, marital status and occupation. On average, there are over 30,000 deaths every year in Ireland (for example 31,765 deaths in 2020). At the time of the analysis for this report, the VS microdata on individual deaths were not available to researchers. Rather than having single individual death records, the CSO provided the research team with aggregated data for the population aged 15 and over in the form of tabulations.

The last section of the chapter about the nationality/country of birth/ethnic mortality analysis is based on a special tabulation of standardised mortality rates (SMRs) (per 100,000) done by the CSO. In Ireland there is no nationality/country of birth/ethnicity information available in the VS data. In order to analyse the nationality/country of birth/ethnicity mortality inequalities, the CSO matched the information from a deceased person for the years 2016/2017 to their nationality/country of birth/ethnicity background information that was collected in the Census 2016, provided that the person was in Ireland at the time of the Census 2016. The tabulation data are based on an 80 per cent match rate between the death records and the Census of Population 2016 (see CSO, 2019e for further details on the matching procedure). The CSO tabulation data include the SMRs in 2016/2017 broken down by gender, ethnicity, nationality, location of birth, and area of deprivation (Dublin and outside of Dublin). The latter also allows us to examine socio-economic inequalities in 2016 using an alternative indicator of socio-economic status (SES).

4.2.2 Study population

The tabular VS data provided by the CSO include the total number of deaths every year from 2000 to 2018 for the population aged 15+. There is no socio-economic information for the year 2013.[38] For this reason, we exclude the year 2013 from our analysis of socio-economic inequalities in mortality. The analysis of gender inequalities in adult mortality is done over one period from 2000 to 2018. The analysis of socio-economic inequalities in adult mortality distinguishes two different periods due to the different socio-economic classifications used over time. The first period goes from 2000 to 2012 and the second period from 2014 to 2018.

4.2.3 Variables

The tabular Vital Statistics data provided by the CSO include the total number of deaths every year (2000 to 2018) with the following breakdown variables:

- gender;
- age groups as used in the Census of Population (15 groups of 5 years range, from 15-19 to 85+);
- socio-economic groups (derived from occupation); and
- four causes of death (neoplasm, circulatory disease, respiratory disease and other causes of death).

[38] The CSO introduced a new IT processing system in 2013. As a consequence, occupation/SEG coding was not processed at that time (CSO, personal communication, 25 March 2022).

The CSO tabular data are split into two separate periods as the information collected about the deceased's occupation for producing a socio-economic group (SEG) classification is different before and after 2012, preventing us from having a harmonised socio-economic group measure over the full period 2000 to 2018.

Indeed, the socio-economic group classification available in the VS data for the years 2000 to 2012 is identical to the classification used in the Census of Population up to 1996 as described in Table 4.1 (first column).[39]

However, for the period 2014 to 2018, the socio-economic classification is different to the one used up to 2012 as the deceased's occupation has not been recoded into a socio-economic group in the VS data. The VS data for that period include only the SOC2010 occupational code of the deceased (Table 4.1 second column).[40] In order to construct a socio-economic group for the deceased derived from the SOC2010 record, we would need to have some employment information about the deceased person (employment status, size of the firm), information which is not available in the data provided to the research team.

Due to the absence of a harmonised SEG over the full period 2000 to 2018, it is therefore not possible to analyse adult mortality over the full period but only by looking separately at the years 2000-2012 and 2014-2018.

The calculation of the mortality rates therefore uses unlinked data from the VS data for the numerator (number of deaths in a specific group of the population) and the Census of Population for the denominator (total number of people in the same specific group of the total population). The Census of Population (years 2002, 2006, 2011 and 2016) also uses a different SEG classification than the one used in the VS data for the years 2000 to 2012. The SEG in the Census of Population is based on the SOC90 occupational codes (the SOC version before SOC2010). We describe below in the methodological section our approach to harmonising the different SEG and occupation classifications used in the VS data for the numerator and the Census of Population for the denominator.

39 This is based on the UK Standard Occupational Classification (SOC) and adjusted to the Irish labour market (see *Standard Occupational Classification*, Second edition, HMSO, London, 1995).

40 SOC2010 is an occupation classification that was used for the first time in Census 2011.

TABLE 4.1 SOCIO-ECONOMIC GROUP CLASSIFICATION IN THE VITAL STATISTICS DATA, 2000-2018

Vital Statistics 2000-2012	Vital Statistics 2014-2018
Socio-economic group based on SOC90	**SOC2010 occupations**
a. Farmers, farm/stud managers, relatives assisting	a. Managers, directors and senior officials
b. Farm labourers, fishermen, agricultural worker, stud farm/groom	b. Professional
c. Higher professionals	c. Associate professional and technical
d. Lower professionals	d. Admin and secretarial
e. Employers and managers	e. Skilled trades
f. Salaried employees	f. Caring, leisure and other service
g. Non-manual wage earners	g. Sales and customer service
h. Other non-manual wage earners	h. Process, plant and machine operatives
i. Skilled manual workers	i. Elementary
j. Semi-skilled manual workers	j. Unemployed, Retired, Student and occupation unknown
k. Unskilled manual workers	
l. Unknown	

Source: Vital Statistics.

4.2.4 Methods

The analysis in this chapter is based on two measures of mortality rates. The crude mortality rate (CMR) is expressed as the number of deaths (numerator) divided by the total population at that age (or age group) (denominator), multiplied by 1,000. The age standardised mortality rate (or SMR) takes account of the different age structures across different groups of the population in order to provide meaningful comparisons between groups of the population. We do this standardisation by using the 2013 European Standard Population (Eurostat, 2012) to produce age standardised mortality rates. These rates report the number of deaths per 100,000 persons.[41]

Finally, in order to estimate the level of inequality in the risk of mortality between one group of the population versus another group, we report also relative risk ratios based on the ratios of standardised mortality rates. A ratio greater than one means that a specific group of the population has a higher mortality risk compared to a reference group of the population. A ratio lower than one means that this specific group has a lower mortality risk than the reference group. Ideally, we choose as a reference group the most advantaged group on the issue we are interested in; here this would be individuals that would report the lowest mortality risk.

41 The standard population is an age distribution of an arbitrary population of 100,000 individuals. The standardised mortality (or death) rate is then expressed per 100,000.

The previous section described the different SEG (or SOC2010) classifications used in the VS data over time as well as the SEGs used in the Census of Population. To calculate mortality rates we need to have comparable classification for the numerator and the denominator. Following the classification used by Smyth et al. (2013), we report in Table 4.2 a correspondence between the SEGs in the VS data for the years 2000 to 2012 and the SEGs in the Census of Population. The SEG in the VS data has 12 categories originally (Table 4.2, left column) and we group 11 of them into an aggregated version of the SEGs to correspond to the nine categories of the Census (Table 4.2, right column).[42] Without having any other source of information to produce a reliable table of correspondence between the SEGs in the VS data (numerator) and the SEGs in the Census of Population (denominator) we acknowledge that this a broad approximation which is likely to either overestimate or underestimate the size of the groups used for the denominator and therefore impact on the calculation of the mortality rates. In this chapter we will report mortality rates for the period 2000 to 2012 with the SEG classification as used in the VS data for that period (Table 4.2 left column).[43] The corresponding SEG in the Census of Population is presented also (Table 4.2, right column).

TABLE 4.2 RECONCILIATION OF SOCIO-ECONOMIC CLASSIFICATION IN THE VITAL STATISTICS AND CENSUS OF POPULATION DATA, 2000-2012

Vital Statistics 2000-2012	Census of Population
Socio-economic group based on SOC	**Socio-economic group based on SOC90**
a. Farmers, farm/stud managers, relatives assisting	Farmers
b. Farm labourers, fishermen, agricultural worker, stud farm/groom	Agricultural workers
c. Higher professionals + d. Lower professionals	Higher professional + Lower professional
e. Employers and managers	Employers and managers
g. Non-manual wage earners + h. Other non-manual wage earners	Non-manual
i. Skilled manual workers	Manual skilled
j. Semi-skilled manual workers	Semi-skilled
k. Unskilled manual workers	Unskilled
l. Unknown	All others gainfully occupied and unknown

Sources: Vital Statistics, Census of Population, authors' analysis.

For the period 2014 to 2018, in order to establish a correspondence between the SOC2010 information from the VS data (numerator) and the SEG from the Census of Population (denominator), we use a specific wave of the Quarterly National

42 Of the 12 SEG categories in the VS data, we drop the 'f. Salaried employees' category as there is no clear assignment into an SEG Census category. Therefore, we will not present mortality rates for this specific group. Over the period 2000 to 2012 there was an annual average of 467 deaths among the 'f. Salaried employees' (an average of 1.6 per cent of all annual deaths).

43 While the denominator can be approximative, the death records under the labelling of the SEGs in the VS data for 2000 to 2018 are accurate so we prefer to use this labelling for reporting mortality rates for that period.

Household Survey data from the CSO that contains for the same individuals their SOC2010 and SEG classifications. While imperfect, we use a cross-tabulation of both classifications to proceed to a modal allocation of SOC2010 to the SEG (based on SOC90). For example, the cross-tabulation of SOC2010 with SEG shows that almost 85 per cent of 'managers, directors and senior officials' (SOC2010) are also in the 'employers and managers' category in the SEG, so we decide to allocate the group of 'managers, directors and senior officials' from SOC2010 into the 'employers and managers' SEG category. For many categories of SOC2010, the overlap is not perfect, as individuals can be spread across several SEG categories. In order to minimise the misclassification of SOC2010 into SEG we need to aggregate several categories of SEG into a smaller number of SEGs. We show in Table 4.3 the correspondence we use between the SOC2010 from the VS data and the SEG from the Census of Population. We match the ten categories from SOC2010 with five aggregated categories of SEG as described in Table 4.3. Like for the correspondence we use between the SEG from the VS data from 2000 to 2012, the misclassification of cases can be a source of overestimation or underestimation of the size of the denominator impacting on the mortality rates. However, both for the VS data for 2000 to 2012 and from 2014 to 2018 we expect that the relativities are preserved.

In order to calculate CMRs and SMRs, the corresponding population counts in each SEG are also required. The right columns of Tables 4.2 (2000-2012) and 4.3 (2014-2018) show the denominator SEGs used in this analysis. The denominator used for the number of people is drawn directly from the Census of Population for the years 2002, 2006, 2011 and 2016. Interpolation was used to derive population counts for the non-Census years, as done in Chapter 3.

TABLE 4.3 AGGREGATED CORRESPONDENCE BETWEEN SOC2010 AND SEG (SOC90) FOR VS DATA, 2014-2018

Vital Statistics 2014-2018	Census of Population
SOC2010	**Socio-economic group based on SOC90**
Managers, directors and senior officials	Employers and managers
Professional	Higher professional + Lower professional
Associate professional and technical	Non-manual
Admin and secretarial	
Sales and customer service	
Skilled trades	Manual skilled
Caring, leisure and other service	
Process, plant and machine operatives	
Elementary	
Unemployed, Retired, Student and occupation unknown	All others gainfully occupied and unknown

Sources: Vital Statistics, Census of Population, authors' analysis.

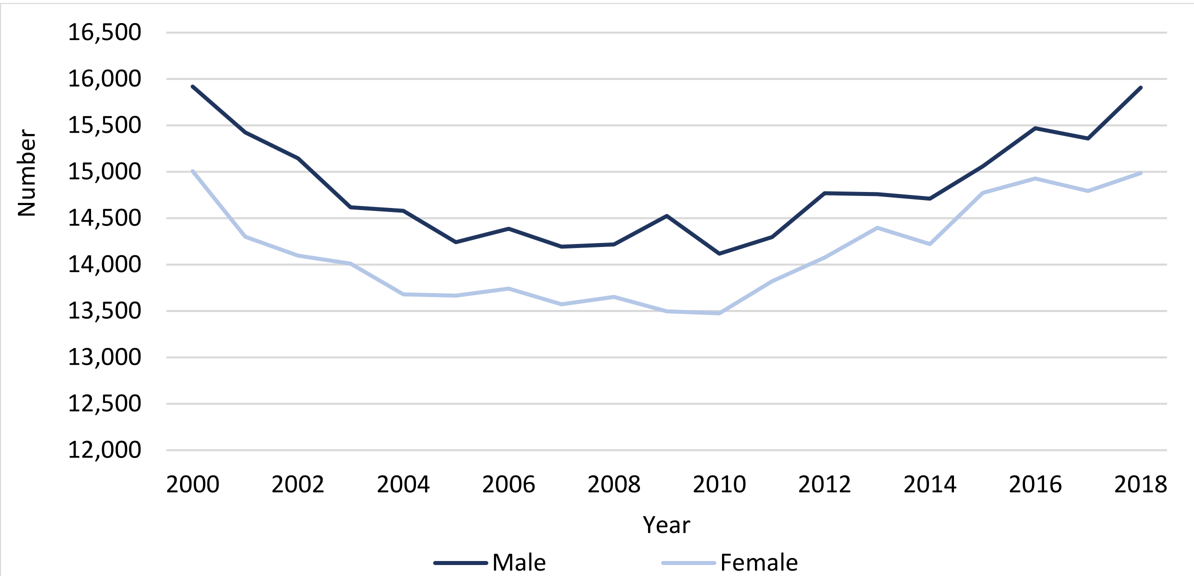
In the next sections we explore first mortality inequality by gender over the period 2000-2018, and then by SEG separately for the period 2000-2012 and for the period 2014-2018 due to differences in SEG classifications as described above. The chapter ends with the analysis of nationality/country of birth/ethnicity mortality inequality.

4.3 ADULT MORTALITY 2000-2018

4.3.1 Mortality by gender

Over the period 2000-2018 there are more male deaths than female deaths with an annual average of 14,826 for males and 14,142 for females (Figure 4.1). Male deaths account on average for 51 per cent of all deaths. Over time, the number of deaths declines sharply for both genders between 2000 and 2004/2005, stabilises then up to 2010, before rising sharply to reach 2000 levels in 2018.

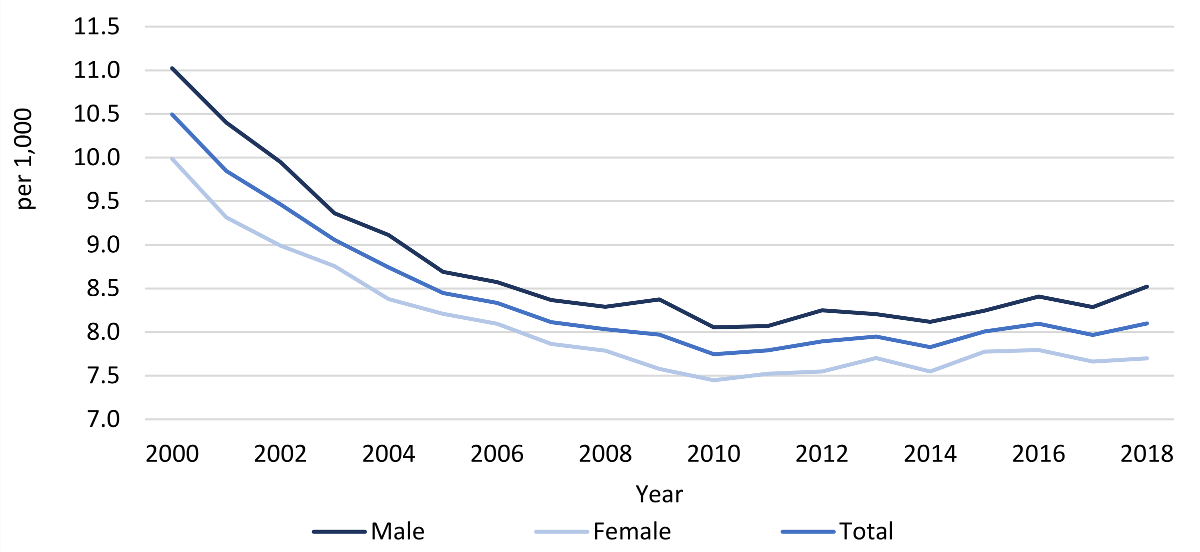
FIGURE 4.1 DEATHS BY GENDER IN IRELAND 2000-2018



Source: Central Statistics Office.

Taking account of their respective population sizes, the crude mortality rates in Figure 4.2 show a downward trend for both genders but with higher mortality rates for males. For males it falls from 11 deaths per 1,000 in 2000 to 8.1 per 1,000 in 2014 and for females from 10 deaths per 1,000 to 7.5 per 1,000. Then from 2014 onwards, the total crude mortality rate increases from 7.8 per 1,000 in 2014 to 8.1 per 1,000 in 2018 but it increases more for males than females. It goes from 7.5 per 1,000 in 2014 to 7.7 per 1,000 in 2018 for females, while for males it goes respectively from 8.1 per 1,000 to 8.5 per 1,000. As a consequence, the gender CMR gap increased in 2018.

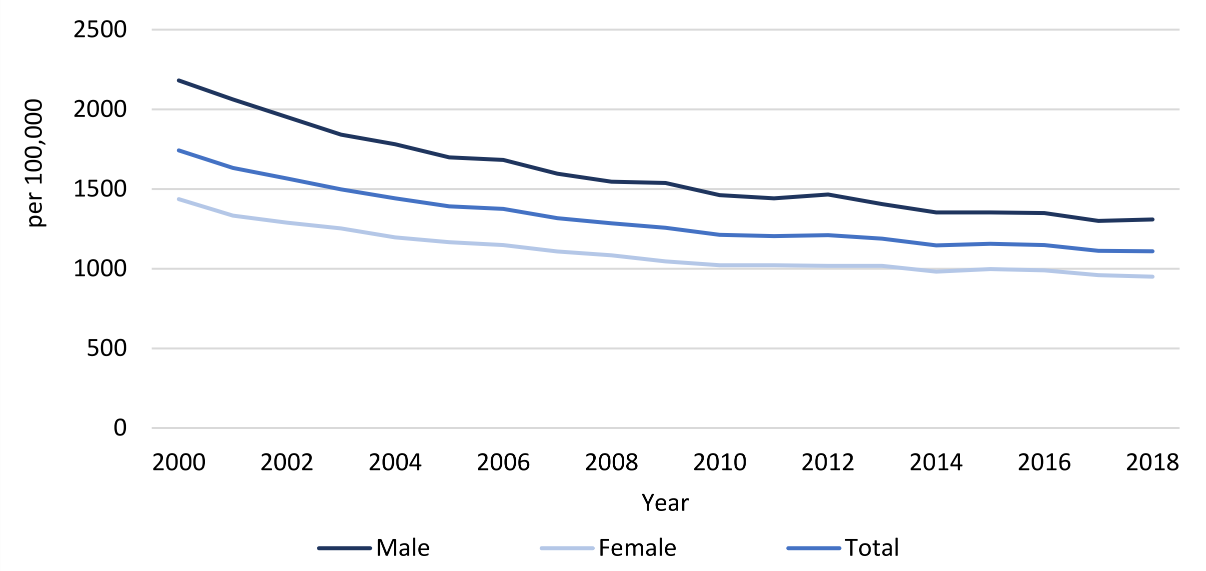
FIGURE 4.2 CRUDE MORTALITY RATES BY GENDER IN IRELAND 2000-2018 (PER 1,000 POPULATION)



Source: Central Statistics Office; authors' analysis.

Taking account of the different distribution of the population by age group, the standardised mortality rates in Figure 4.3 show a downward trend for the whole period. The SMRs fall before stabilising between 2014 and 2016 and then decrease slightly after in the most recent period. However, the gender gap observed in Figure 4.2 persists throughout the period. The SMRs for males range from 2,181 per 100,000 in 2000 to 1,309 per 100,000 in 2018, while for females it is respectively 1,436 per 100,000 and 950 per 100,000. Interestingly, while the absolute SMR gender gap has been halved between 2000 and 2018, there is very little reduction in the relative difference. The ratio of male to female SMRs stands at around 1.5 throughout the period.

FIGURE 4.3 STANDARDISED MORTALITY RATES BY GENDER IN IRELAND 2000-2012 (PER 100,000 POPULATION)



Source: Central Statistics Office; authors' analysis.

4.3.2 Causes of mortality by gender

The VS data also include the number of deaths caused by neoplasm, circulatory disease, respiratory disease and all other causes. We show in Table 4.4 the causes of death by gender and for the total population over time.[44]

For both genders, the greatest number of deaths is due to circulatory and neoplasm disease, each accounting respectively for an annual average of 4,400-5,000 deaths for males and 3,900-4,900 deaths for females. Over the period 2000 to 2018, there is an increase of 18-19 per cent in the number of deaths due to neoplasm for both genders and a large decrease of deaths due to circulatory disease of 25 per cent for males and 31 per cent for females. As a consequence, we note over time a convergence in the number of deaths for both diseases and for both genders.

The third largest cause is due to 'all other causes' with an annual average of just over 3,000 deaths for both genders while it is approximately half that for respiratory disease. There is also a very strong increase due to all other causes for males and females but particularly for females with an increase of 63 per cent for females and 41 per cent for males.

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44 For ease of presentation, we only report the number of deaths every three years. Tables with the full period 2000 to 2012 are available from the authors.

The number of deaths due to respiratory disease falls over time for both genders up to 2010 for males and 2014 for females and then increases slightly for both genders.

Expressed in terms of relative contribution to the total number of deaths across the period 2000 to 2018, the main cause of deaths is circulatory disease as it falls from 41 per cent of the total number of deaths in 2000 to 29 per cent in 2018. The second largest cause of deaths is neoplasm; it increases from 18 per cent of total deaths in 2000 to 30 per cent in 2018. The third most common cause of deaths is respiratory disease, which falls slightly from 16 per cent in 2000 to 13 per cent in 2018. Finally, all other causes of deaths increase from 18 per cent in 2000 to 26 per cent in 2018. A breakdown by gender shows that there is very little gender difference in the distribution of main causes of death.

TABLE 4.4 CAUSES OF DEATHS BY GENDER IN IRELAND 2000-2018 (N AND PERCENTAGE)

Causes of deaths	2000	2003	2006	2009	2012	2015	2018
Male							
Neoplasm	4,130 (26%)	4,030 (28%)	4,285 (30%)	4,558 (31%)	4,551 (31%)	4,728 (31%)	4,926 (31%)
Circulatory disease	6,445 (40%)	5,568 (38%)	5,027 (35%)	4,774 (33%)	4,776 (32%)	4,739 (31%)	4,806 (30%)
Respiratory disease	2,321 (15%)	2,143 (15%)	1,895 (13%)	1,765 (12%)	1,682 (11%)	1,849 (12%)	1,919 (12%)
All other causes	3,023 (19%)	2,875 (20%)	3,181 (22%)	3,426 (24%)	3,762 (25%)	3,742 (25%)	4,257 (27%)
All	15,919 (100%)	14,616 (100%)	14,388 (100%)	14,523 (100%)	14,771 (100%)	15,058 (100%)	15,908 (100%)
Female							
Neoplasm	3,641 (24%)	3,626 (26%)	3,860 (28%)	3,756 (28%)	3,989 (28%)	4,128 (28%)	4,314 (29%)
Circulatory disease	6,213 (41%)	5,462 (39%)	4,943 (36%)	4,729 (35%)	4,700 (33%)	4,630 (31%)	4,274 (29%)
Respiratory disease	2,528 (17%)	2,297 (16%)	2,171 (16%)	1,836 (14%)	1,811 (13%)	2,006 (14%)	2,128 (14%)
All other causes	2,625 (17%)	2,627 (19%)	2,766 (20%)	3,176 (24%)	3,577 (25%)	4,010 (27%)	4,270 (28%)
All	15,007 (100%)	14,012 (100%)	13,740 (100%)	13,497 (100%)	14,077 (100%)	14,774 (100%)	14,986 (100%)
Total							
Neoplasm	7,771 (25%)	7,656 (27%)	8,145 (29%)	8,314 (30%)	8,540 (30%)	8,856 (30%)	9,240 (30%)
Circulatory disease	12,658 (41%)	11,030 (39%)	9,970 (35%)	9,503 (34%)	9,476 (33%)	9,369 (31%)	9,080 (29%)
Respiratory disease	4,849 (16%)	4,440 (16%)	4,066 (14%)	3,601 (13%)	3,493 (12%)	3,855 (13%)	4,047 (13%)
All other causes	5,648 (18%)	5,502 (19%)	5,947 (21%)	6,602 (24%)	7,339 (25%)	7,752 (26%)	8,527 (28%)
All	30,926 (100%)	28,628 (100%)	28,128 (100%)	28,020 (100%)	28,848 (100%)	29,832 (100%)	30,894 (100%)

Source: Central Statistics Office.

We report in Figure 4.4 the standardised mortality rates (SMRs) by gender for each of the causes of deaths described above. Across all causes of deaths, the SMRs for males are consistently higher than for females, and both genders follow the same downward trend over time. However, there are large variations overall in the levels of SMRs across causes of deaths. The SMR values are the highest for circulatory disease, neoplasm, all other causes and finally respiratory disease, in that order.

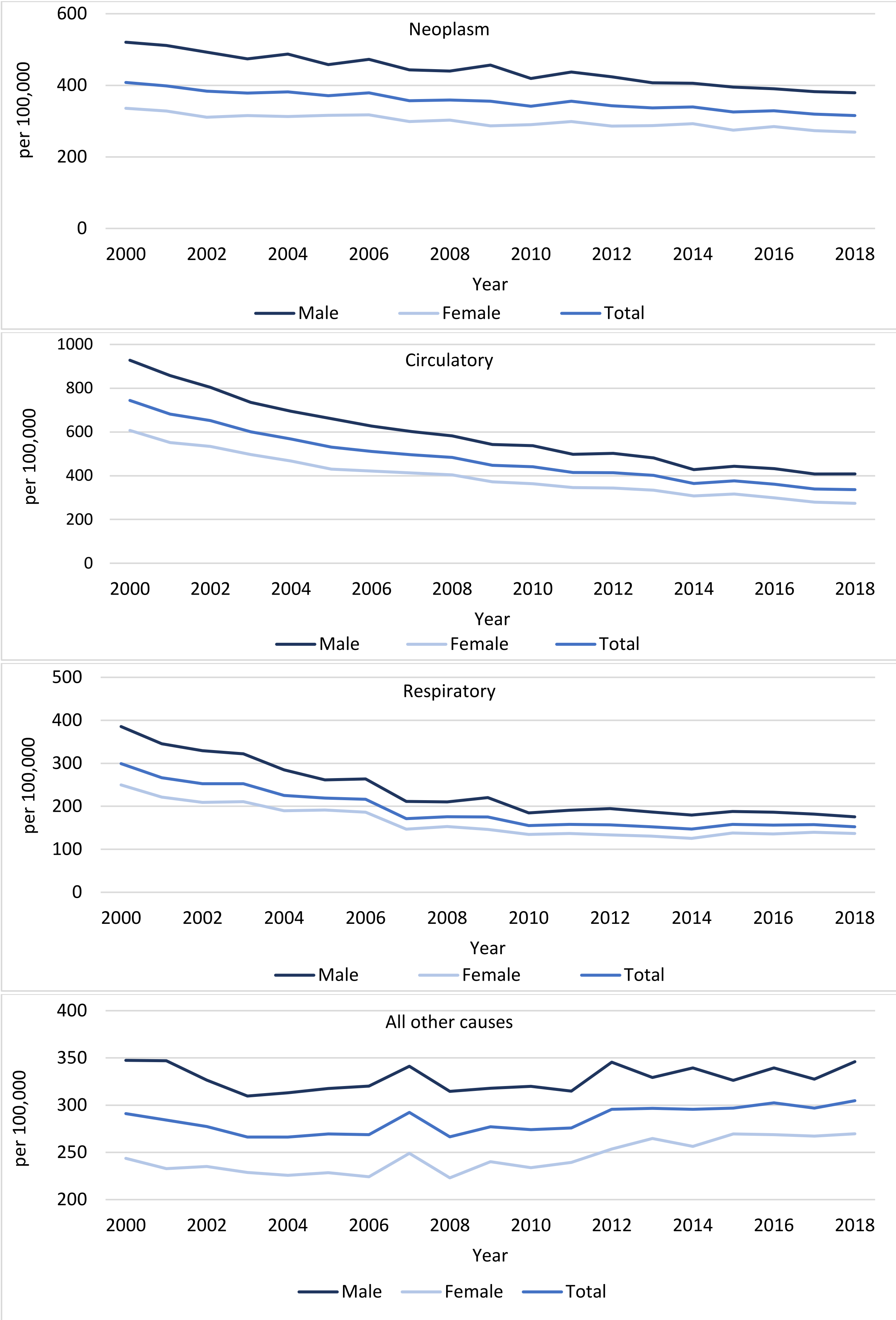
Looking first to the neoplasm causes of deaths; the SMR for males in 2000 is 520 per 100,000 males, while it is 336 for females per 100,000 females. Both SMRs decline slowly over time to reach 379 per 100,000 for males and 269 cases per 100,000 for females. While the chart shows a reduction over time in the absolute difference in the SMRs between males and females, the relativities have changed very little over time, and in 2018 the SMR for males is 1.4 times that of females, while it is 1.5 times in 2000.

For both genders, in 2000 the SMRs for circulatory causes of deaths are almost twice the SMRs for neoplasm, at 928 per 100,000 for males and 607 per 100,000 for females. This represents the strongest SMR reduction of all causes of deaths as the SMRs fall sharply for both genders over time with similar reduction rates of 56 per cent and 55 per cent for males and females respectively over the period. As a consequence, the gender relative risk of deaths due to circulatory disease has not changed over time; the rates are 1.5 times higher for males than for females overall.

The gender pattern for death due to respiratory disease is very similar to the pattern for circulatory disease. Indeed, while the absolute values of SMRs for both genders are 2.5 times lower than for circulatory disease, the SMRs for both genders fall sharply between 2000 and 2010 and then stabilise by the end of the period. Indeed, for males it goes from 386 per 100,000 to 185 per 100,000, and for females from 250 per 100,000 in 2000, to 134 per 100,000 over the period 2000-2010; it then remains at these levels on average up to 2018. This represents the second strongest SMR reduction of all causes of deaths, at 54 per cent for males and 45 per cent for females. As a consequence of the greater reduction of SMRs for males, the gender mortality inequality due to respiratory disease falls over time. In 2000, males are 1.5 times more likely to die of respiratory disease than females and it is only 1.3 times in 2018. However, this is partly due to the stable SMRs for females in the last years while the SMRs for males kept falling.

There is a slight downward trend in the SMRs for all other causes of deaths overall up to 2011. The rates for males fall as well between 2000 and 2011, going from 347 per 100,000 to 315 per 100,000 before increasing to reach the 2000 level in 2018 with 346 per 100,000. The pattern is very similar for females as it goes from 244 per 100,000 in 2000 to 239 per 100,000 in 2011, increasing then to 270 per 100,000 in 2018. However, while there is an increase of SMRs for both genders from 2011 onwards, the pace of increase for females is greater than for males. Indeed, between 2011 and 2018, the SMR for females increases by 13 per cent while it is 10 per cent for males. The absolute SMR gender gap has been reduced only slightly over time and males have overall an SMR 1.3 times that of females.

FIGURE 4.4 SMRS BY CAUSES OF DEATHS AND GENDER IN IRELAND 2000-2018 (PER 100,000 POPULATION)



Source: Central Statistics Office; authors' analysis.

4.3.3 Socio-economic group mortality

4.3.3.1 SEG mortality in 2000-2012

Table 4.5 shows the number and corresponding percentage of deaths and the crude mortality rates across socio-economic groups from 2000 to 2012. Due to the large number of years and for ease of representation we only report the results every three years, but all the calculations reported in the analysis such as averages are calculated over the full period from 2000 to 2012.

As seen in Table 4.1, the number of deaths fell between 2000 and 2012 from 30,500 cases to 28,000 cases respectively. Across all the years, the SEG with the highest number of deaths is the 'unknown' group. Over time the number of deaths for this group falls by 41 per cent to represent 23 per cent of all deaths in 2012 while it was 36 per cent in 2000. Over the period 2000 to 2012 the 'unknown' group represents on average 38 per cent of female deaths while it is only 21 per cent for males. The second SEG with the largest number of deaths is the 'non-manual' and the number of deaths within this group increases by 41 per cent between 2000 and 2012, moving from 14 per cent of all total deaths in 2000 to 22 per cent in 2012. The 'farmers' group reports the third largest number of deaths; the number of deaths as well as its proportion of the total number of deaths has been quite stable over time at between 15-16 per cent of the total. All the other groups represent less than 10 per cent of the total number of deaths and 'agricultural workers' and the 'semi-skilled manual' groups report 2-3 per cent and 3-5 per cent of all total deaths each respectively. The number of deaths is also quite stable over time for 'employers and managers' and 'skilled manual' to a lesser extent. Finally, there is a large increase of 53 per cent of the number of deaths among 'higher and lower professionals' between 2000 and 2012 as they represent now 11 per cent of all deaths in 2012 while it was 7 per cent in 2000. However, as the proportion of 'unknown' deaths was falling over this period, it is hard to determine whether the trends in the other SEGs are a true reflection of the underlying trends or represent other trends, e.g. more accurate coding of occupations over time. This highlights the core difficulty in using unlinked data on deaths and population to examine mortality inequalities (see Chapter 6 for a more detailed discussion of the issues).

TABLE 4.5 DEATHS BY SOCIO-ECONOMIC GROUP IN IRELAND 2000-2012 (N AND PERCENTAGE AND RATE)

	2000		2003		2006		2009		2012	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
Farmers	4,889 (16%)	24.8	4,191 (15%)	24.3	4,454 (16%)	30.2	4,100 (15%)	27.6	4,139 (15%)	27.7
Agricultural workers	768 (3%)	24.9	675 (2%)	24.2	663 (2%)	26.6	562 (2%)	24.8	510 (2%)	25.0
Higher & lower professional	1,990 (7%)	4.7	1,915 (7%)	4.0	2,664 (10%)	4.9	2,805 (10%)	4.7	3,042 (11%)	4.6
Employers and managers	1,551 (5%)	3.7	1,529 (5%)	3.5	1,683 (6%)	3.7	1,332 (5%)	2.8	1,565 (6%)	3.1
Non-manual	4,397 (14%)	9.0	4,330 (15%)	7.6	5,512 (20%)	8.5	6,178 (23%)	8.8	6,138 (22%)	8.2
Skilled manual	2,679 (9%)	8.7	2,614 (9%)	7.8	2,945 (11%)	8.1	2,615 (10%)	7.7	2,984 (11%)	9.4
Semi-skilled manual	1,010 (3%)	4.3	941 (3%)	3.5	1,196 (4%)	4.0	1,365(5%)	4.5	1,505 (5%)	5.0
Unskilled manual	2,337 (8%)	13.3	1,823 (6%)	11.6	1,953 (7%)	14.1	1,805 (7%)	13.5	1,772 (6%)	13.7
Unknown	10,908 (36%)	20.8	10,327 (36%)	18.3	6,484 (24%)	10.7	6,526 (24%)	10.4	6,438 (23%)	9.8
Total	**30,529 (100%)**		**28,345 (100%)**		**27,554 (100%)**		**27,288 (100%)**		**28,093 (100%)**	

Source: Central Statistics Office; authors' analysis.

The crude mortality rates in Table 4.5 highlight the very high risk of mortality among ‘farmers’ and ‘agricultural workers’ with values ranging from 24 to 30 cases per 1,000. It is approximately half that for ‘unskilled manual’. Excluding the ‘unknown’ group, the CMRs are then much lower for all the other groups with values of 8-9 cases for ‘non-manual’ and ‘skilled manual’. ‘Employers and managers’ have the lowest CRMs of all SEGs, followed then by ‘semi-skilled manual’ and the ‘higher and lower professional’. With the exception of the ‘unknown’ group where the CMRs fall sharply, the CMRs are quite stable over time for all SEGs.

Taking account of the age distribution specific to each SEG, we report the SMRs for all SEGs in Table 4.6. It shows that ‘farmers’ and ‘agricultural workers’ have by far the highest SMRs of all SEGs. They have SMRs varying between 1,800 and 2,800 per 100,000 persons. The ‘non-manual’ and ‘skilled manual’ have the second highest SMRs with values over 2,000 per 100,000 at the beginning of the period. Just below we find the ‘unskilled manual’ with SMR values above 1,500 per 100,000 approximately. Finally, ‘semi-skilled manual’ and ‘employers and managers’ have the lowest SMRs with average values at about 1,000 per 100,000 while ‘higher and lower professional’ are just above at 1,100 on average per 100,000. With the exception of the ‘unskilled manual’ where the SMRs are quite stable, there is a decrease of the SMRs for all SEGs over time. ‘Employers and managers’ record the sharpest reduction of 45 per cent between 2000 and 2012.

TABLE 4.6 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIO BY SOCIO-ECONOMIC GROUP IN IRELAND 2000-2012

	2000		2003		2006		2009		2012	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Farmers	2,315	1.7* (1.61-1.80)	2,104	1.9* (1.79-2.01)	2,393	2.1* (1.99-2.22)	1,988	2.7* (2.54-2.87)	1,836	2.4* (2.27-2.54)
Agricultural workers	2,673	2.0* (1.89-2.12)	2,487	2.2* (2.08-2.33)	2,606	2.3* (2.18-2.43)	2,390	3.2* (3.01-3.40)	2,297	3.1* (2.93-3.28)
Higher and lower professional	1,302	1.0 (0.94-1.06)	1,066	1.0 (0.94-1.06)	1,302	1.1* (1.04-1.16)	1,091	1.5* (1.41-1.60)	995	1.3* (1.23-1.38)
Employers and managers	1,325	1.0	1,106	1.0	1,143	1.0	739	1.0	751	1.0
Non-manual	2,376	1.8* (1.70-1.90)	2,032	1.8* (1.70-1.91)	2,327	2.0* (1.89-2.11)	2,096	2.8* (2.63-2.98)	1,780	2.4* (2.27-2.54)
Skilled manual	2,263	1.7* (1.61-1.80)	1,950	1.8* (1.70-1.91)	2,120	1.9* (1.80-2.01)	1,602	2.2* (2.07-2.34)	1,648	2.2* (2.08-2.33)
Semi-skilled manual	1,316	1.0 (0.94-1.06)	915	0.8* (0.75-0.85)	1,011	0.9* (0.85-0.95)	1,004	1.4* (1.32-1.49)	1,026	1.4* (1.32-1.48)
Unskilled manual	1,688	1.3* (1.23-1.38)	1,543	1.4* (1.32-1.48)	2,115	1.9* (1.80-2.01)	1,766	2.4* (2.26-2.55)	1,611	2.1* (1.98-2.23)
Unknown	1,898	1.4* (1.32-1.48)	1,633	1.5* (1.42-1.59)	974	0.9* (0.85-0.95)	1,016	1.4* (1.32-1.49)	1,041	1.4* (1.32-1.48)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

Focusing on mortality inequality across SEGs, Table 4.6 compares the SMRs of SEGs with the SMRs of 'employers and managers' as this is the SEG with the lowest SMR. Overall, 'higher and lower professional' as well as 'semi-skilled manual' report similar or slightly greater mortality risk than 'employers and managers'. The risk is then on average almost 1.3 times that for the 'unknown' and it is approximately on average 2 times that for 'unskilled manual', 'skilled manual', 'non-manual' and 'farmers'. The mortality inequality is the largest for 'agricultural worker' as they are almost three times more likely to die at any given age than 'employers and managers'.

We explore in Table 4.7 the gender differences in SMRs by SEG. With a few exceptions, the SMR values are lower for females than for males and the pattern of distribution of the risk of mortality across SEGs tends also to be the same between males and females. For example, for both genders, 'farmers' and 'agricultural workers' have the highest SMRs while it is the lowest among 'employers and managers', 'higher and lower professional' and 'semi-skilled manual'. However, we note that 'unskilled manual' and 'non-manual' females report much lower SMRs than their male counterparts, non-manual males having the highest mortality rates on average.

TABLE 4.7 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) BY SOCIO-ECONOMIC GROUP AND GENDER IN IRELAND 2000-2012

Male	2000		2003		2006		2009		2012	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Farmers	2,417	1.8* (1.67-1.94)	2,172	2.0* (1.86-2.15)	2,259	2.3* (2.14-2.48)	1,865	2.8* (2.58-3.03)	1,653	2.6* (2.41-2.81)
Agricultural workers	3,039	2.3* (2.14-2.47)	2,914	2.7* (2.51-2.91)	2,988	3.0* (2.78-3.23)	2,078	3.2* (2.95-3.47)	1,989	3.1* (2.87-3.35)
Higher and lower professional	1,628	1.2* (1.12-1.29)	1,189	1.1* (1.02-1.18)	1,528	1.5* (1.39-1.62)	1,292	2.0* (1.85-2.17)	1,185	1.8* (1.67-1.95)
Employers and managers	1,313	1.0	1,076	1.0	997	1.0	656	1.0	644	1.0
Non-manual	4,370	3.3* (3.07-3.55)	3,674	3.4* (3.16-3.66)	4,009	4.0* (3.71-4.31)	3,916	6.0* (5.54-6.50)	3,557	5.5* (5.09-5.94)
Skilled manual	2,312	1.8* (1.67-1.94)	1,946	1.8* (1.67-1.94)	1,818	1.8* (1.67-1.94)	1,408	2.1* (1.94-2.28)	1,407	2.2* (2.04-2.38)
Semi-skilled manual	1,246	0.9* (0.84-0.97)	1,001	0.9* (0.84-0.97)	1,054	1.1* (1.02-1.18)	1,098	1.7* (1.57-1.84)	1,064	1.7* (1.57-1.84)
Unskilled manual	2,099	1.6 (1.49-1.72)	2,010	1.9* (1.76-2.05)	2,684	2.7* (2.51-2.91)	2,224	3.4* (3.14-3.69)	2,102	3.3* (3.05-3.57)
Unknown	2,489	1.9* (1.77-2.04)	2,000	1.9* (1.76-2.05)	1,075	1.1* (1.02-1.18)	1,318	2.0* (1.85-2.17)	1,403	2.2* (2.04-2.38)

Contd.

TABLE 4.7 CONTD.

Female	2000		2003		2006		2009		2012	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Farmers	2,119	1.6* (1.46-1.75)	1,949	1.7* (1.55-1.87)	2,618	2.0* (1.84-2.18)	2,176	2.6* (2.36-2.86)	2,128	2.4* (2.20-2.62)
Agricultural workers	2,021	1.6* (1.46-1.75)	1,728	1.5* (1.37-1.65)	1,907	1.5* (1.38-1.63)	3,181	3.8* (3.45-4.18)	3,643	4.1* (3.76-4.47)
Higher and lower professional	1,142	0.9* (0.82-0.99)	996	0.9* (0.82-0.99)	1,171	0.9* (0.83-0.98)	982	1.2* (1.09-1.32)	886	1.0 (0.92-1.09)
Employers and managers	1,304	1.0	1,116	1.0	1,287	1.0	829	1.0	885	1.0
Non-manual	1,720	1.3* (1.19-1.42)	1,490	1.3* (1.18-1.43)	1,767	1.4* (1.29-1.52)	1,532	1.8* (1.64-1.98)	1,273	1.4* (1.28-1.53)
Skilled manual	2,121	1.6* (1.46-1.75)	1,895	1.7* (1.55-1.87)	2,699	2.1* (1.93-2.29)	2,011	2.4* (2.18-2.64)	2,202	2.5* (2.29-2.73)
Semi-skilled manual	1,369	1.0 (0.91-1.10)	817	0.7* (0.64-0.77)	945	0.7* (0.64-0.76)	905	1.1 (1.00-1.21)	971	1.1* (1.01-1.20)
Unskilled manual	1,161	0.9* (0.82-0.99)	970	0.9* (0.82-0.99)	1,480	1.2* (1.10-1.31)	1,258	1.5* (1.36-1.65)	1,097	1.2* (1.10-1.31)
Unknown	1,681	1.3* (1.19-1.42)	1,492	1.3* (1.18-1.43)	899	0.7* (0.64-0.76)	858	1.0 (0.91-1.10)	865	1.0 (0.92-1.09)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

In Table 4.7 we also compare with the RRRs the mortality inequality across SEGs by gender. Taking the ‘employers and managers’ as a reference for both genders, we see that the range of inequality in mortality across SEGs is much wider among males than among females. It goes from an average high of 4 for the ‘non-manual’ males while it is an average of 2.4 for female ‘agricultural worker’. The mortality inequality is also higher across SEGs for males than females. The difference in the ratios is particularly large for ‘non-manual’ as it is on average 4 times greater for males and only 1.4 on average for females. The mortality ratio is 2.5 times among ‘unskilled manual’ males while it is only 1.1 times for their female counterparts. However, there are very little gender differences for ‘farmers’ and ‘semi-skilled manual’. Finally, while mortality inequality increases over time among males between ‘employers and managers’ and all other SEGs (but less so for ‘semi-skilled manual’), it increases for ‘farmers’, ‘agricultural workers’ and ‘skilled manual’ among females. In spite of the fact that the SMRs are decreasing over time for all SEGs (Table 4.7), the reason for the increase in relative risks has to do with a slower improvement in some SEGs relative to the reference category of ‘employers and managers’.

4.3.4 Causes of deaths by socio-economic group

We explore in the next set of tables the mortality rates across SEGs by cause of death. We report in this set of tables the SMRs and relative risk ratios to measure mortality inequality by causes of death. Table 4.8 shows the mortality rates caused by neoplasm. Excluding the ‘unknown’ group, ‘semi-skilled manual’ and ‘employers and managers’ have the lowest average SMRs with respective values of 256 and 280 per 100,000 while ‘agricultural workers’ and ‘non-manual’ have the highest at 663 and 601 per 100,000. For all the other groups, it ranges from 312 per 100,000 for ‘higher and lower professional’ to 542 per 100,000 for ‘skilled manual’. With the exception of the ‘unskilled manual’ the SMRs for neoplasm fall over time with ‘employers and managers’ experiencing the largest reduction of 29 per cent between 2000 and 2012.

Expressed in terms of relative risk ratio to the SMRs of ‘employers and managers’, ‘non-manual’, ‘skilled manual’ and ‘agricultural workers’ are roughly two times more likely to die of neoplasm than ‘employers and managers’. On the contrary, there is almost no difference on average between ‘employers and managers’ and the ‘unknown’, ‘semi-skilled manual’ and ‘higher and lower professional’. Over time the mortality inequality with ‘employers and managers’ increases for all other SEGs with the exception of the ‘unknown’.

TABLE 4.8 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR NEOPLASM BY SOCIO-ECONOMIC GROUP IN IRELAND 2000-2012

	2000		2003		2006		2009		2012	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Farmers	480	1.5* (1.35-1.67)	460	1.5* (1.35-1.67)	578	1.9* (1.72-2.10)	494	2.3* (2.06-2.56)	454	2.0* (1.80-2.22)
Agricultural workers	611	2.0* (1.80-2.23)	572	1.9* (1.71-2.11)	691	2.3* (2.08-2.55)	582	2.8* (2.51-3.12)	551	2.5* (2.26-2.77)
Higher and lower professional	322	1.0 (0.90-1.11)	281	0.9 (0.81-1.00)	370	1.2* (1.08-1.33)	334	1.6* (1.44-1.78)	291	1.3* (1.17-1.44)
Employers and managers	313	1.0	303	1.0	299	1.0	211	1.0	222	1.0
Non-manual	619	2.0* (1.80-2.23)	592	2.0* (1.80-2.22)	696	2.3* (2.08-2.55)	638	3.0* (2.69-3.34)	555	2.5* (2.26-2.77)
Skilled manual	542	1.7* (1.53-1.89)	559	1.8* (1.62-2.00)	598	2.0* (1.81-2.21)	486	2.3* (2.06-2.56)	507	2.3* (2.07-2.55)
Semi-skilled manual	325	1.0 (0.90-1.11)	242	0.8* (0.72-0.89)	266	0.9 (0.81-1.00)	297	1.4* (1.26-1.56)	274	1.2* (1.08-1.33)
Unskilled manual	388	1.5* (1.35-1.67)	362	1.5* (1.35-1.67)	479	1.9* (1.72-2.10)	473	2.3* (2.06-2.56)	411	2.0* (1.80-2.22)
Unknown	440	2.0* (1.80-2.23)	393	1.9* (1.71-2.11)	231	2.3* (2.08-2.55)	225	2.8* (2.51-3.12)	250	2.5* (2.26-2.77)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

In Table 4.9, we report the SMRs and relative mortality risk ratios caused by circulatory disease. We note that the mortality rates for circulatory are higher than for neoplasm across all SEGs. As in the case of neoplasm, with the exception of the 'unknown', the groups with the lowest average mortality rates are the 'semi-skilled manual', the 'employers and managers' followed then by the 'higher and lower professional', all with average rates not exceeding 420 cases per 100,000. At the other side of the spectrum 'farmer' and 'agricultural workers' have the highest SMRs on average with respective values of 883 and 926 per 100,000. For the other SEGs, the average SMRs vary between 486 and 770 per 100,000 for the 'unknown' and 'non-manual'. As seen in Figure 4.5, there is a very sharp decrease in the SMRs for circulatory disease across all SEGs between 2000 and 2012. However, this reduction in mortality rates is not shared equally across all SEGs. Indeed, the 'unskilled manual' have the lowest reduction of 19 per cent while it is 55 per cent for the 'employers and managers'.

Similar to the results for neoplasm, 'agricultural workers' and 'farmers' are on average over 2.4 and 2.3 times more likely to die of circulatory disease than 'employers and managers'. It is roughly between 1.7 and 2 times more on average for 'unskilled-manual', 'skilled manual' and 'non-manual'. There is very little difference between 'employers and managers' and the 'unknown' and 'higher and lower professional' groups. With the exception of the latter two groups, mortality inequality has increased mostly because the mortality rate for the 'employers and managers' fell at a much faster rate in comparison with the other groups.[45]

[45] Another explanation could be due to the improvement over time of the coding of the 'unknown'. See Table 4.5 showing the sharp decline in the number of deaths recorded among the 'unknown'.

TABLE 4.9 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR CIRCULATORY DISEASE BY SOCIO-ECONOMIC GROUP IN IRELAND 2000-2012

	2000		2003		2006		2009		2012	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Farmers	1,039	1.7* (1.56-1.86)	897	2.0* (1.82-2.20)	982	2.1* (1.92-2.30)	798	3.0* (2.70-3.34)	695	2.6* (2.35-2.87)
Agricultural workers	1,097	1.8* (1.65-1.97)	1,023	2.3* (2.09-2.53)	885	1.9* (1.73-2.08)	856	3.3* (2.97-3.67)	848	3.2* (2.89-3.54)
Higher and lower professional	581	1.0 (0.92-1.09)	430	1.0 (0.91-1.10)	477	1.0 (0.91-1.10)	385	1.5* (1.35-1.67)	330	1.2* (1.09-1.33)
Employers and managers	599	1.0	449	1.0	461	1.0	263	1.0	269	1.0
Non-manual	983	1.6* (1.46-1.75)	784	1.7* (1.55-1.87)	852	1.9* (1.73-2.08)	737	2.8* (2.52-3.12)	568	2.1* (1.90-2.32)
Skilled manual	984	1.6* (1.46-1.75)	755	1.7* (1.55-1.87)	758	1.6* (1.46-1.75)	560	2.1* (1.89-2.34)	527	2.0* (1.81-2.21)
Semi-skilled manual	541	0.9* (0.82-0.98)	373	0.8* (0.73-0.88)	378	0.8* (0.73-0.88)	351	1.3* (1.17-1.45)	359	1.3* (1.18-1.44)
Unskilled manual	690	1.2* (1.10-1.31)	620	1.4* (1.27-1.54)	798	1.7* (1.55-1.86)	617	2.3* (2.07-2.56)	558	2.1* (1.90-2.32)
Unknown	768	1.3* (1.19-1.42)	623	1.4* (1.27-1.54)	349	0.8* (0.73-0.88)	346	1.3* (1.17-1.45)	357	1.3* (1.18-1.44)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

In comparison with the SMRs for circulatory disease, the SMRs for respiratory disease in Table 4.10 are between two and three times lower. Excluding the ‘unknown’, there is a clear mortality gradient with the ‘employers and managers’ and ‘higher and lower professional’ having the lowest SMRs with average values below 155 per 100,000 while ‘farmers’ and ‘agricultural workers’ have the highest SMR values of 327 per 100,000 and 426 per 100,000. Between 2000 and 2012, all SEGs experience a very sharp reduction in their respective SMRs. With the exception of the ‘unknown’, ‘employers and managers’ have the strongest reduction of 58 per cent while the ‘unskilled manual’ have the lowest at 21 per cent. In spite of the reduction in mortality risk, there is still a strong mortality inequality across SEGs. On average, ‘non-manual’, ‘skilled manual’ and ‘unskilled manual’ are two times more likely to die of respiratory disease than ‘employers and managers’ and it is almost three times for ‘agricultural workers’. Finally, compared to ‘employers and managers’, mortality inequality has increased over time for most of the SEGs.

TABLE 4.10 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR RESPIRATORY DISEASE BY SOCIO-ECONOMIC GROUP IN IRELAND 2000-2012

	2000		2003		2006		2009		2012	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Farmers	421	2.0* (1.71-2.34)	374	2.1* (1.79-2.47)	382	2.2* (1.88-2.57)	300	2.9* (2.43-3.46)	267	3.0* (2.52-3.57)
Agricultural workers	545	2.6* (2.22-3.05)	451	2.6* (2.21-3.06)	421	2.5* (2.14-2.92)	374	3.7* (3.10-4.41)	325	3.6* (3.02-4.29)
Higher and lower professional	183	0.9 (0.77-1.05)	166	0.9 (0.77-1.06)	206	1.2* (1.03-1.40)	135	1.3* (1.09-1.55)	120	1.3* (1.09-1.55)
Employers and managers	214	1.0	175	1.0	171	1.0	102	1.0	89	1.0
Non-manual	427	2.0* (1.71-2.34)	338	1.9* (1.62-2.24)	358	2.1* (1.80-2.46)	292	2.9 * (2.43-3.46)	229	2.6* (2.18-3.10)
Skilled manual	411	1.9* (1.62-2.23)	319	1.8* (1.53-2.12)	362	2.1* (1.80-2.46)	251	2.5* (2.10-2.98)	243	2.7* (2.27-3.21)
Semi-skilled manual	232	1.1 (0.94-1.29)	167	1.0 (0.85-1.18)	191	(1.1 (0.94-1.29)	151	1.5* (1.26-1.79)	138	1.5* (1.26-1.79)
Unskilled manual	314	1.5* (1.28-1.76)	289	1.7* (1.45-2.00)	408	2.4* (2.05-2.81)	280	2.7* (2.26-3.22)	247	2.8* (2.35-3.33)
Unknown	301	1.4* (1.20-1.64)	258	1.5* (1.28-1.76)	135	0.8* (0.68-0.94)	120	1.2* (1.01-1.43)	112	1.3* (1.09-1.55)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

As seen previously with the other causes of deaths, there is again a mortality gradient for the ‘all other causes’ of deaths (Table 4.11). ‘Employers and managers’ and ‘higher and lower professional’ but also ‘semi-skilled manual’ have the lowest SMRs with average values ranging from 185 to 214 per 100,000. At the opposite end of the range ‘farmers’ and ‘agricultural workers’ have the highest average values at 393 and 524 per 100,000 cases. Over time the SMRs increase for all SEGs with the exception of ‘employers and managers’ and the ‘unknown’ who experience a reduction in their SMRs. By far ‘agricultural workers’ have the highest relative risk ratio as they are almost three times more likely to die of ‘all other causes’ than ‘employers and managers’ and mortality inequality has increased over time for all SEGs in comparison to ‘employers and managers’.

TABLE 4.11 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR ALL OTHER CAUSES BY SOCIO-ECONOMIC GROUP IN IRELAND 2000-2012

	2000		2003		2006		2009		2012	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Farmers	375	1.9* (1.65-2.19)	374	2.1* (1.82-2.42)	451	2.1* (1.85-2.39)	395	2.4* (2.10-2.75)	420	2.5* (2.21-2.83)
Agricultural workers	420	2.1* (1.82-2.42)	441	2.5* (2.17-2.88)	609	2.9* (2.55-3.30)	578	3.5* (3.06-4.01)	574	3.4* (3.01-3.85)
Higher and lower professional	216	1.1 (0.95-1.27)	189	1.1 (0.95-1.27)	250	1.2* (1.05-1.37)	238	1.5* (1.31-1.72)	255	1.5* (1.33-1.70)
Employers and managers	200	1.0	179	1.0	213	1.0	163	1.0	170	1.0
Non-manual	348	1.7* (1.47-1.96)	318	1.8* (1.56-2.08)	420	2.0* (1.76-2.28)	428	2.6* (2.27-2.98)	428	2.5* (2.21-2.83)
Skilled manual	326	1.6* (1.39-1.84)	316	1.8* (1.56-2.08)	401	1.9* (1.67-2.16)	304	1.9* (1.66-2.18)	372	2.2* (1.94-2.49)
Semi-skilled manual	217	1.1 (0.95-1.27)	133	0.7* (0.61-0.81)	176	0.8* (0.70-0.91)	206	1.3* (1.14-1.49)	255	1.5* (1.33-1.70)
Unskilled manual	297	1.5* (1.30-1.73)	272	1.5* (1.30-1.73)	430	2.0* (1.76-2.28)	395	2.4* (2.10-2.75)	395	2.3* (2.03-2.60)
Unknown	390	1.9* (1.65-2.19)	359	2.0* (1.73-2.31)	258	1.2* (1.05-1.37)	325	2.0* (1.75-2.29)	322	1.9* (1.68-2.15)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent significance. Figures in parentheses are 95 per cent confidence intervals.

4.3.4.1 SEG mortality in 2014-2018

Table 4.12 shows the number of deaths for each of the five aggregated categories of SEGs and their corresponding percentages in the total number of deaths (percentage in brackets). Due to the aggregation of several SEG categories, the number of deaths is higher among these groups (‘manual skilled to agricultural workers’). ‘Employers and managers’ have the lowest number of deaths with an annual average of almost 1,700 deaths followed then by ‘higher and lower professional’ with almost 2,800 deaths and ‘non-manual’ with 3,200 deaths. The number of deaths becomes very large with the ‘manual skilled to agricultural workers’ with an annual average of over 11,300 deaths which is quite similar to the 11,000 deaths among the ‘all other gainfully occupied and unknown’. On average females account for 80 per cent of the deaths among the ‘all other gainfully occupied and unknown’. On average ‘manual skilled to agricultural workers’ and ‘all others gainfully occupied and unknown’ account respectively for 38 and 37 per cent of the total number of deaths. ‘Employers and managers’ and ‘higher and lower professional’ account for 9 and 11 per cent respectively.

Over time, there is an increase in the number of deaths among all SEGs, but the increase is the greatest among ‘higher and lower professional’ (12 per cent) followed then by the ‘non-manual’ (9 per cent) while we observe the lowest increases for the ‘manual skilled to agricultural workers’ (4 per cent) and ‘employers and managers’ (5 per cent).

The CMRs in Table 4.12 show that there is a clear social gradient in mortality going from ‘employers and managers’ with the lowest CMRs to ‘all others gainfully occupied and unknown’ having the highest CMRs. On average over the period, ‘employers and managers’ have a CMR of 3.3 per 1,000. ‘Higher and lower professional’ and ‘non-manual’ have similar CMRs with respective annual averages of 3.9 and 4.1 per 1,000. It is then much higher for the last two and least advantaged SEGs as it is on average 10.7 and a very high 16.4 per 1,000.

TABLE 4.12 DEATHS BY SOCIO-ECONOMIC GROUP IN IRELAND 2014-2018 (N AND PERCENTAGE AND RATE)

	2014		2015		2016		2017		2018	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
Employers and managers	1,593 (6%)	3.2	1,711 (6%)	3.4	1,694 (6%)	3.3	1,722 (6%)	3.3	1,672 (5%)	3.2
Higher and lower professional	2,607 (9%)	3.8	2,712 (9%)	3.8	2,785 (9%)	3.9	2,917 (10%)	4.0	2,915 (9%)	3.9
Non-manual	3,018 (10%)	3.9	3,083 (10%)	4.0	3,304 (11%)	4.2	3,283 (11%)	4.1	3,295 (11%)	4.1
Manual skilled to agricultural workers	10,972 (38%)	10.2	11,294 (38%)	10.6	11,596 (38%)	10.9	11,272 (37%)	10.7	11,447 (37%)	10.9
All others gainfully occupied and unknown	10,740 (37%)	16.2	11,032 (37%)	16.5	11,020 (36%)	16.3	10,960 (36%)	16.1	11,565 (37%)	16.8
Total	28,930 (100%)		29,832 (100%)		30,399 (100%)		30,154 (100%)		30,894 (100%)	

Source: Central Statistics Office; authors' analysis.

The standardised mortality risk pattern across SEGs is quite similar as shown in Table 4.13. ‘Employers and managers’ have an annual average of SMR of 680 per 100,000. Slightly above and with similar SMR values we find the ‘higher and lower professional’ and ‘non-manual’ with annual average of 779 and 752 per 100,000. The average annual SMRs for the two bottom SEGs are almost twice that from the previous two SEGs (‘higher and lower professional’ and ‘non-manual’) with respective values of 1,334 and 1,579 per 100,000. Over time, all SEGs except the ‘all others gainfully occupied and unknown’ report a decrease in SMRs. Between 2014 and 2018, ‘employers and managers’ as well as ‘non-manual’ have the largest SMR reduction of almost 10 per cent and 8 per cent respectively while the SMR increases by almost 3 per cent for ‘all others gainfully occupied and unknown’.

TABLE 4.13 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIO BY SOCIO-ECONOMIC GROUP IN IRELAND 2014-2018

	2014		2015		2016		2017		2018	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Employers and managers	693	1.0	719	1.0	690	1.0	674	1.0	625	1.0
Higher and lower professional	786	1.1* (1.03-1.18)	791	1.1* (1.03-1.18)	776	1.1* (1.03-1.18)	787	1.2* (1.12-1.28)	755	1.2* (1.12-1.28)
Non-manual	772	1.1* (1.03-1.18)	759	1.1* (1.03-1.18)	781	1.1* (1.03-1.18)	736	1.1* (1.03-1.18)	710	1.1* (1.03-1.18)
Manual skilled to agricultural workers	1,347	1.9* (1.77-2.04)	1,362	1.9* (1.78-2.03)	1,367	2.0* (1.87-2.14)	1,302	1.9* (1.78-2.03)	1,291	2.1* (1.96-2.25)
All others gainfully occupied and unknown	1,574	2.3* (2.15-2.46)	1,592	2.2* (2.06-2.35)	1,575	2.3* (2.15-2.46)	1,541	2.3* (2.15-2.46)	1,615	2.6* (2.43-2.78)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

In Table 4.14 we show the SMRs across SEGs for males and females separately. In all cases and for the same SEGs, male SMRs are higher than female SMRs but there is some variation in the distribution of SMRs across SEGs. Indeed, ‘employers and managers’ and ‘higher and lower professional’ have the lowest SMRs among males while for females it is the ‘non-manual’ that have the lowest SMRs, followed then by ‘employers and managers’ and ‘higher and lower professional’. The SMRs for ‘non-manual’ males are on average above four times that of females’ SMRs. The low SMR for ‘non-manual’ females must explain the low SMR for ‘non-manual’ in the overall population (Table 4.13). The pattern is also quite similar for ‘manual skilled to agricultural workers’ as the males SMRs are on average twice that of their female counterparts. However, the situation for the ‘all others gainfully occupied and unknown’ is reversed as now it is the female SMRs that are twice those of male SMRs.

Over time and for both genders, there is a reduction in the SMRs for all SEGs with the exception of the ‘all others gainfully occupied and unknown’ where the SMRs are quite stable, and it is even higher in 2018 than in 2014.

TABLE 4.14 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIO BY SOCIO-ECONOMIC GROUP AND GENDER IN IRELAND 2014-2018

Male	2014		2015		2016		2017		2018	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Employers and managers	793	1.0	815	1.0	783	1.0	770	1.0	725	1.0
Higher and lower professional	975	1.2* (1.10-1.30)	933	1.1* (1.02-1.19)	935	1.2* (1.11-1.30)	966	1.3* (1.20-1.41)	935	1.3* (1.20-1.41)
Non-manual	1,858	2.3* (2.12-2.50)	1,928	2.4* (2.22-2.60)	1,922	2.5* (2.31-2.71)	1,840	2.4* (2.22-2.60)	1,775	2.4* (2.22-2.60)
Manual skilled to agricultural workers	1,718	2.2* (2.03-2.39)	1,727	2.1* (1.94-2.27)	1,725	2.2* (2.03-2.38)	1,645	2.1* (1.94-2.27)	1,653	2.3* (2.12-2.49)
All others gainfully occupied and unknown	973	1.2* (1.10-1.30)	937	1.2* (1.11-1.30)	953	1.2* (1.11-1.30)	920	1.2* (1.11-1.30)	1,052	1.5* (1.39-1.62)

Female	2014		2015		2016		2017		2018	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Employers and managers	539	1.0	564	1.0	542	1.0	513	1.0	460	1.0
Higher and lower professional	680	1.3* (1.14-1.48)	705	1.3* (1.15-1.47)	679	1.3* (1.15-1.47)	682	1.3* (1.15-1.47)	654	1.4* (1.23-1.59)
Non-manual	465	0.9 (0.79-1.02)	438	0.8* (0.71-0.90)	467	0.9 (0.80-1.02)	431	0.8* (0.71-0.91)	416	0.9 (0.79-1.02)
Manual skilled to agricultural workers	753	1.4* (1.23-1.59)	777	1.4* (1.24-1.58)	787	1.5* (1.33-1.70)	746	1.5* (1.32-1.70)	711	1.5* (1.32-1.71)
All others gainfully occupied and unknown	1,780	3.3* (2.91-3.75)	1,825	3.2* (2.83-3.62)	1,804	3.3* (2.92-3.73)	1,773	3.5* (3.09-3.96)	1,829	4.0* (3.52-4.55)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

4.3.5 Causes of deaths by socio-economic group

We describe in the next set of tables the SMRs by SEGs for each of the four causes of death available in the data starting with neoplasm. Table 4.15 shows that there is a clear mortality gradient by SEGs due to neoplasm. Indeed, it goes from an average of just above 200 per 100,000 for ‘employers and managers’ to twice that approximately for ‘manual skilled to agricultural workers’ and ‘all others gainfully occupied and unknown’. Over time the SMRs decrease across all SEGs but ‘employers and managers’ have the sharpest reduction of all. The relative risk ratios show that, on average, the ‘all others gainfully occupied and unknown’ are two times more likely to die of neoplasm than ‘employers and managers’.

TABLE 4.15 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR NEOPLASM BY SOCIO-ECONOMIC GROUP IN IRELAND 2014-2018

	2014		2015		2016		2017		2018	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Employers and managers	215	1.0	216	1.0	208	1.0	198	1.0	185	1.0
Higher and lower professional	253	1.2* (1.07-1.35)	237	1.1 (0.98-1.23)	238	1.1 (0.98-1.23)	238	1.2* (1.07-1.34)	224	1.2* (1.07-1.35)
Non-manual	267	1.2* (1.07-1.35)	251	1.2* (1.07-1.34)	253	1.2* (1.07-1.34)	237	1.2* (1.07-1.34)	239	1.3* (1.16-1.46)
Manual skilled to agricultural workers	408	1.9* (1.69-2.13)	401	1.9* (1.70-2.13)	398	1.9* (1.70-2.13)	391	2.0* (1.78-2.24)	380	2.1* (1.87-2.36)
All others gainfully occupied and unknown	426	2.0* (1.78-2.24)	397	1.8* (1.61-2.02)	417	2.0* (1.78-2.24)	405	2.0* (1.78-2.24)	420	2.3* (2.05-2.58)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

The SMRs are slightly higher for circulatory disease than for neoplasm (Table 4.16). With the exception of the two bottom SEGs, the mortality gradient by SEG is weaker than for neoplasm. However, comparing both sides of the SEG spectrum, it goes from an average of 217 per 100,000 for ‘employers and managers’ to a high 493 per 100,000 for ‘all others gainfully occupied and unknown’. Excluding the ‘higher and lower professional’ group, all the other SEGs experience a reduction in the SMRs over time, but the reduction is largest for ‘employers and managers’. Compared to ‘employers and managers’, on average the relative risk of death due to circulatory disease is only slightly greater or identical for ‘higher and lower professional’ and ‘non-manual’. However, it is roughly twice that for the two bottom SEGs.

TABLE 4.16 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR CIRCULATORY DISEASE BY SOCIO-ECONOMIC GROUP IN IRELAND 2014-2018

	2014		2015		2016		2017		2018	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Employers and managers	223	1.0	233	1.0	226	1.0	209	1.0	194	1.0
Higher and lower professional	238	1.1 (0.97-1.25)	250	1.1 (0.97-1.24)	238	1.1 (0.97-1.24)	236	1.1 (0.97-1.24)	243	1.3* (1.15-1.47)
Non-manual	222	1.0 (0.88-1.14)	225	1.0 (0.89-1.13)	213	0.9 (0.80-1.02)	208	1.0 (0.88-1.13)	202	1.0 (0.88-1.13)
Manual skilled to agricultural workers	414	1.9* (1.67-2.16)	439	1.9* (1.68-2.14)	437	1.9* (1.68-2.15)	392	1.9* (1.68-2.15)	386	2.0* (1.77-2.27)
All others gainfully occupied and unknown	510	2.3* (2.01-2.60)	523	2.2* (1.99-2.53)	486	2.2* (1.90-2.43)	466	2.2* (1.97-2.52)	478	2.5* (2.18-2.79)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

Table 4.17 shows that the SMRs for respiratory disease are by far the smallest of all causes of deaths. The SMRs are particularly low from 'employers and managers' to the 'non-manual' group. For the first three SEGs the SMR range is quite narrow too going from an annual average of 86 per 100,000 for 'employers and managers' to a high of 94 per 100,000 for 'higher and lower professional'. The SMRs then double on average for the last two SEGs. Excluding the 'employers and managers' and the 'non-manual' groups for 2018, the SMRs tend to increase over time and the increase is particularly strong for the 'all others gainfully occupied and unknown'. So, while there is almost no mortality inequality due to respiratory disease between the first three SEGs, mortality inequality increases over time for 'manual skilled to agricultural workers' and 'all others gainfully occupied and unknown' and on average they are over two times more likely to die of respiratory disease than 'employers and managers'.

TABLE 4.17 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR RESPIRATORY DISEASE BY SOCIO-ECONOMIC GROUP IN IRELAND 2014-2018

	2014		2015		2016		2017		2018	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Employers and managers	87	1.0	89	1.0	86	1.0	94	1.0	73	1.0
Higher and lower professional	89	1.0 (0.81-1.24)	101	1.1 (0.90-1.35)	93	1.1 (0.90-1.35)	96	1.0 (0.82-1.21)	92	1.3* (1.05-1.61)
Non-manual	86	1.0 (0.81-1.24)	90	1.0 (0.82-1.22)	100	1.2 (0.98-1.47)	96	1.0 (0.82-1.21)	81	1.1 (0.89-1.36)
Manual skilled to agricultural workers	189	2.2* (1.78-2.72)	199	2.2* (1.80-2.69)	197	2.3* (1.88-2.82)	189	2.0* (1.65-2.43)	188	2.6* (2.10-3.21)
All others gainfully occupied and unknown	190	2.2* (1.78-2.72)	209	2.4* (1.96-2.94)	210	2.4* (1.96-2.94)	220	2.3* (1.90-2.79)	224	3.1* (2.51-3.83)

Source: Central Statistics Office; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

Table 4.18 shows that like the three previous causes of deaths, there is also a social gradient in mortality due to ‘all other causes’. The SMRs increase gradually on average from a low of 173 per 100,000 for the ‘employers and managers’ to a high 463 per 100,000 for the ‘all others gainfully occupied and unknown’. Over time, the SMRs increase for ‘employers and managers’ and ‘all others gainfully occupied and unknown’, while there is no clear trend for the other groups. There is very little mortality inequality between the top three SEGs but as seen previously for the other causes of death, it is much higher for the bottom two SEGs. Indeed, ‘manual skilled to agricultural workers’ and ‘all others gainfully occupied and unknown’ are respectively on average, almost two times and almost three times more likely to die of ‘all other causes’ than ‘employers and managers’.

TABLE 4.18 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) AND RELATIVE RISK RATIOS FOR ALL OTHER CAUSES BY SOCIO-ECONOMIC GROUP IN IRELAND 2014-2018

	2014		2015		2016		2017		2018	
	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR	SMR	RRR
Employers and managers	169	1.0	181	1.0	170	1.0	173	1.0	174	1.0
Higher and lower professional	205	1.2* (1.04-1.39)	202	1.1 (0.96-1.26)	208	1.2* (1.05-1.38)	216	1.2* (1.05-1.37)	196	1.1 (0.96-1.25)
Non-manual	197	1.2* (1.04-1.39)	193	1.1 (0.96-1.26)	215	1.3* (1.13-1.49)	194	1.1 (0.96-1.26)	188	1.1 (0.96-1.25)
Manual skilled to agricultural workers	336	2.0* (1.73-2.31)	324	1.8* (1.57-2.06)	335	2.0* (1.74-2.30)	329	1.9* (1.66-2.17)	338	1.9* (1.67-2.17)
All others gainfully occupied and unknown	447	2.7* (2.34-3.12)	463	2.6* (2.27-2.98)	461	2.7* (2.35-3.10)	450	2.6* (2.27-2.97)	493	2.8* (2.46-3.19)

Source: Central Statistics Office; authors’ analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals.

4.4 ETHNIC INEQUALITIES IN MORTALITY

The previous analysis uses unlinked Census and mortality data to construct mortality rates for the population aged 15+. The CSO was able to match death certificate records to Census of Population 2016 records to enable an analysis of standardised mortality rates by ethnicity, nationality and location of birth (for the entire population).[46] The match rate between death certificate records and the 2016 population was 80 per cent. The CSO notes that care must be taken when interpreting the statistics in this study as the match rate across various age groups differed: for example, there is a significantly lower match rate for deaths in younger age groups (CSO, 2019e). Due to the 80 per cent matching rate causing significant variations between the matched population of deaths and the total population of deaths, the standardised mortality rates cited in this section are not comparable with other published Irish national age standardised mortality rates (CSO, 2019e).

Table 4.19 presents the standardised mortality rates (per 100,000) by ethnicity, nationality and country of birth status for the population aged 15 and over. The first panel showing ethnicity status only differentiates between two groups – this was because of numbers that were too small to report for more disaggregated ethnicity status. The standardised mortality rates for the White Irish group are higher than those for the 'Black or Black Irish, Asian or Asian Irish, Other including mixed background, or Not Stated' group. In the second panel, there is differentiation between four nationalities: Ireland, UK, Rest of Europe and Rest of World. Once more, it is evident that Irish nationalities have higher standardised mortality rates than all other nationality groups. A similar pattern is exhibited in the third panel, where standardised mortality rates for those born in Ireland are higher than any other country of birth group.[47] As suggested by McGinnity et al. (2020b), the lower mortality rates for non-Irish and non-White Irish groups are likely due to a 'healthy immigrant effect'.

46 See Appendix 4 for an analysis of SMRs by alternative indicators of SES (social class, education and area-level deprivation).

47 The differences in standardised mortality rates for 'Rest of Europe' and 'Rest of World' in 'nationality' and 'location of birth' could be due to incomplete information of the same individuals in one classification and not the other.

TABLE 4.19 STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) BY ETHNICITY/ NATIONALITY/LOCATION OF BIRTH STATUS FOR 2016-2017

Ethnicity[1]	All	Males	Females
White Irish	662	678	646
Black or Black Irish, Asian or Asian Irish, Other including mixed background or not stated	483	530	450
Nationality[2]	**All**	**Males**	**Females**
Irish	662	678	646
UK	585	574	590
Rest of Europe	511	544	471
Rest of World, other nationality and not stated	606	674	538
Location of Birth[3]	**All**	**Males**	**Females**
Irish	666	683	650
UK	598	597	598
Rest of Europe	493	551	431
Rest of World, other nationality and not stated	443	536	354

Source: Central Statistics Office.
Notes: 1. Census variable 'Ethnicity' was used. Due to the small number of cases for several categories, aggregations were applied. Note that due to the differences in structures and definitions, 'Nationality', 'Ethnicity' and 'Place of birth' are not directly comparable.
2. Census variable 'Nationality' was used. Again, due to the small number of cases for several categories, aggregations were applied. 'Other nationalities' include dual nationalities.
3. Census variable 'Location of birth' was used. As with Ethnicity and nationality, aggregations were applied due to the presence of small numbers in several categories.

4.5 SUMMARY

Chapter 4 explores inequalities in mortality among the adult population aged 15 and over for the period 2000 to 2018. We analyse the period 2000 to 2018 in two parts, going from 2000 to 2012 first and then from 2014 to 2018 as the socio-economic classification of the deceased persons is different in these two periods (we omit the year 2013 as there is no socio-economic information available for that year).

Over the period 2000 to 2018 the annual average number of deaths is 29,000 and male deaths accounts on average for over 51 per cent of all deaths. The number of deaths declined for both genders between 2000 and 2004-2005 and stabilised then before increasing slightly from 2010 onward. The standardised mortality rates fell sharply for males and females over the whole period. For both genders the standardised mortality rates in 2018 are 1.5 times lower than those in 2000. However, in spite of this significant improvement in mortality, male mortality rates are on average 1.4 times higher than those of females and gender mortality inequality decreased only slightly from 1.5 in 2000 to 1.4 in 2018. The analysis of the causes of deaths also highlights a strong gender divide. Indeed, males are on average 1.5 times more likely to die of neoplasm and circulatory disease than females and it is 1.4 times for respiratory and all other causes. Finally, the gender mortality inequality on these four causes of deaths narrowed only slightly over the period 2000-2018.

While the analysis on inequalities in mortality across socio-economic groups is split into two time periods with different socio-economic classifications in each period, both periods show that there is a strong social gradient in mortality. Across both time periods, the ‘employers and managers’ and the ‘higher and lower professional’ groups have the lowest mortality rates, while ‘farmers’ and ‘agricultural workers’ have the highest mortality rates. Taking the group of ‘employers and managers’ as a reference group to measure mortality inequality, the analysis shows that for the period 2000 to 2012, ‘farmers’ and ‘agricultural workers’ have mortality risks that are respectively 2 times and over 2.5 times those of ‘employers and managers’. While the socio-economic group classification changes over the period 2000 to 2018, the results still suggest that the mortality rates fell across all the groups over the whole period but with no real improvement in inequalities in mortality.

There is also a strong social inequality in mortalities by cause of deaths. Focusing on the longest first period 2000 to 2012 and looking at the groups with the highest mortality rates, ‘farmers’ and ‘agricultural workers’ are on average two times more likely to die of neoplasm and circulatory disease than ‘employers and managers’ and it is almost three times for respiratory and all other causes for ‘agricultural workers’.

Finally, the chapter explores mortality inequalities by nationality, country of birth and ethnicity based on a special tabulation done by CSO. It shows that compared to White Irish, the mortality rates in 2016/2017 are lower for Black or Black Irish, Asian or Asian Irish and Other. Irish nationals have also higher mortality rates than other nationality groups and it is true also for people born in Ireland compared to those born abroad.

CHAPTER 5

COVID-19 mortality, 2020-2021

5.1 INTRODUCTION

A growing body of international research has identified poorer COVID-19 outcomes (including an increased risk of death) among those from less advantaged socio-economic positions and particular ethnic groups (Chaudhuri et al., 2021; Pathak et al., 2022). To date, there has been relatively little research in Ireland examining inequalities in COVID-19 mortality. Consequently, this chapter examines mortality from COVID-19 in Ireland in 2020 and 2021. While the data are exploratory, the analysis provides some insights into emerging patterns in relation to COVID-19 mortality by socio-economic status (SES) (using information on socio-economic group, which is derived from occupation) and by ethnicity, nationality and country of birth.

5.2 DATA AND METHODS

5.2.1 Data source, study population and variables

For the purpose of this analysis, the CSO linked data on COVID-19 cases and deaths (from 1 March 2020 to 12 May 2021) to Census data from 2016, with a match rate of 70 per cent (CSO, 2021a). Data on COVID-19 deaths are sourced from the Computerised Infectious Disease Reporting (CIDR) information system, while population data (with information on occupation, ethnicity, nationality and country of birth) are available from the 2016 Census of Population. The CIDR information system is used to manage the surveillance and control of infectious disease in Ireland.

Using these data to infer patterns of COVID-19 mortality is subject to a number of caveats. First, the information recorded by the individual on the Census record in 2016 may no longer be relevant in 2020/2021 (for example, if an individual changed jobs, or acquired Irish citizenship in the period after 2016). Second, there will be no corresponding Census record for individuals who came to Ireland in the period after the administration of the Census in 2016, and consequently no match. However, in the absence of disaggregated data on COVID-19 mortality in Ireland in 2020 and 2021 by SES and ethnicity/nationality/country of birth, the linked data provide useful information about how COVID-19 mortality might affect different groups.

In keeping with the analysis in Chapter 4, the indicator of SES, socio-economic group (SEG), is based on the CSO's SOC90 occupational classification codes, with 11 categories and an added 'not-stated' category (Table 5.1) (CSO, 2021a).

Ethnicity, nationality and country of birth are also recorded as per the 2016 Census (Table 5.2). The EU-East category includes the European Union (EU) Member States that joined the EU between 2004 and 2007, while the EU-West category includes the older EU15 Member States (excluding Ireland and the UK) (CSO, 2021a).

5.2.2 Methods

In keeping with McGinnity et al. (2020b), the analysis examines the percentage of cases, deaths and population in each socio-economic, ethnic, nationality and country of birth group. If there are no differences across groups, the percentage of cases and deaths would be similar to the percentage of the population in each group.

Given that the age composition of the groups is likely to differ, and given the higher probability of a COVID-19 related death in older age groups, the analysis also looks at the proportion of those aged over 65 years and its composition across socio-economic groups and ethnicity, nationality and country of birth.

5.3 RESULTS

5.3.1 Socio-economic group

Table 5.1 shows the percentage of COVID-19 cases, COVID-19 deaths, the population, and the population aged 65 and over in each socio-economic group. In terms of the age composition of the different groups, a greater proportion of the population aged 65 and older are in the ‘skilled manual’, ‘unskilled manual’, ‘farmers’, and ‘all other gainfully occupied and unknown’ groups relative to the overall population, suggesting that these groups are older on average. Conversely, a smaller proportion of the population aged 65 and older are in the categories ‘employers and managers’, ‘higher professionals’, ‘lower professionals’, ‘non-manuals’ and ‘skilled manual’ relative to the overall adult population.

The proportion of deaths is unevenly distributed across the groups. For example, ‘higher professionals’ make up 7.1 per cent of the population and 3.6 per cent of the deaths, while ‘lower professionals’ make up 13.1 per cent of the population and 6.9 per cent of the deaths. Conversely, the ‘skilled manual’ group comprise 7.6 per cent of the population and 11.5 per cent of the deaths, while the ‘all other gainfully occupied and unknown’ category comprises 17.0 per cent of the population and 29.5 per cent of the deaths.

Some of the uneven distribution is reduced when the proportion of the group aged 65 and older is examined. For example, ‘higher professionals’ comprise 4.4 per cent of the population aged 65 and older which is closer to their proportion of deaths of 3.6 per cent. However, in general, inequalities in the distribution of COVID-19 related deaths are observed. Employers and managers, higher professionals, lower professionals, non-manual, own-account workers and farmers experienced a lower proportion of deaths than their corresponding proportion of the population aged 65 and over, while skilled-manual, semi-skilled manual, unskilled manual and all other gainfully occupied and unknown had a higher proportion of deaths relative to the proportion of the population aged 65 and older.

TABLE 5.1 COVID-19 DEATHS BY SOCIO-ECONOMIC GROUP IN IRELAND 1 MARCH 2020 – 21 MAY 2021

Socio-economic Group	% Cases	% Deaths	% Population (2016)[1]	% Population aged over 65 (2016)[2]
Employers and managers	14.8	9.0	15.5	11.1
Higher professionals	5.5	3.6	7.1	4.4
Lower professionals	13.1	6.9	13.1	10.2
Non-manual	21.6	14.0	21.1	15.8
Skilled manual	7.6	11.5	7.6	9.1
Semi-skilled manual	9.0	7.5	7.8	7.0
Unskilled manual	3.3	6.7	3.2	5.2
Own account workers	3.5	3.1	3.8	4.0
Farmers	2.3	5.4	3.3	8.6
Agricultural workers	0.4	0.7	0.5	0.7
All others gainfully occupied and unknown	15.0	29.5	17.0	23.8
Not Stated[3]	4.0	2.1	*	*

Source: CSO CIDR data matched to 2016 Census data as of 12 May 2021.
Notes: (*) indicates that there was no corresponding category in the tabulations.
1. Census Population dataset from CSO used to calculate percentages of total population for 2016 (E7018).
2. Census Population dataset from CSO used to calculate percentages of population aged 65+ for 2016 (EB076).
3. Not Stated is not available as a category in 2016 Census of Population.

5.3.2 Ethnicity, nationality and country of birth

Table 5.2 shows the percentage of COVID-19 cases, COVID-19 deaths, the population, and the population aged 65 and over in each of the groups for ethnicity, nationality and country of birth. The sample is dominated by those classified as having a 'White Irish' ethnicity, 'Irish' nationality and 'Ireland' as country of birth. In addition, these groups are, on average, older than the general population, as shown by their relatively greater shares of the population aged 65 and older.

In terms of ethnicity, given the dominance of the 'White Irish' group, (with 93.5 per cent of the population aged 65 and older and 91.5 per cent of the deaths), it is difficult to identify consistent patterns across the other ethnic groups. However, there is some evidence to suggest that some ethnic groups experienced a higher number of COVID-19 deaths than might have been expected given the age profile of the group. For example, 0.3 per cent of COVID-19 deaths were among those in the ‘Black or Black Irish – African’ group, while this group comprised only 0.1 per cent of the population aged 65 and older in 2016. Irish Travellers accounted for 0.2 per cent of the 2016 population aged 65+ but comprised 0.3 per cent of the deaths from COVID-19.

Table 5.2 also shows COVID-19 cases and deaths by nationality and country of birth. As outlined in Chapter 1, the concepts of ethnicity, nationality and country of birth are not interchangeable. For example, while country of birth is fixed, nationality can change over a person’s lifetime. Previous research has documented high rates of Irish nationality among some migrant groups in Ireland (McGinnity et al., 2020a), such as those born in the UK or outside the EU. This is evident in the data in Table 5.2 where 5.9 per cent of the population in 2016 were born in the UK but UK nationals accounted for a much lower proportion of the population (2.2 per cent).

Despite these conceptual differences, the patterns of COVID-19 mortality by nationality and country of birth are broadly similar. For example, for both the Irish national and Ireland country of birth groups, the proportion of COVID-19 deaths is very similar to the proportion of the population aged 65 and older.

For some nationality groups, differences between the proportion of deaths and proportion of the population aged 65 and over are observed. For example, those with a recorded nationality of ‘EU-East’ comprise 0.5 per cent of deaths and 0.3 per cent of the population aged 65 and older. A similar pattern is evident in the country of birth data; those born in the EU-East comprise 0.7 per cent of deaths but only 0.3 per cent of those aged 65+ in 2016. This is despite their risk of COVID infection (per cent of total cases) being slightly lower than that observed for the population as a whole.

Those with a nationality of ‘Non-EU/UK’ comprise only 0.2 per cent of the deaths and 1.4 per cent of the population aged 65 and over. In contrast, the analysis by country of birth shows that the ‘Non-EU/UK’ group comprise 1.2 per cent of deaths and 1.1 per cent of the population aged 65 and older. While the numbers involved are small, these patterns may reflect differences in the composition of the population born outside the EU and UK by whether they are Irish nationals or not.

TABLE 5.2 COVID-19 DEATHS BY ETHNICITY, NATIONALITY AND COUNTRY OF BIRTH 1 MARCH 2020 – 21 MAY 2021

Ethnicity	% Cases	% Deaths	% Population (2016)[1]	% Population aged over 65 (2016)[1]
White Irish	80.9	91.5	82.2	93.5
White Irish Traveller	2.0	0.3	0.7	0.2
Any Other White Background	6.6	2.7	9.5	3.5
Black or Black Irish – African	1.7	0.3	1.2	0.1
Black or Black Irish – Any other Black background	0.1	*	0.1	0.0
Asian or Asian Irish – Chinese	0.2	*	0.4	0.1
Asian or Asian Irish – Any other Asian background	2.5	0.4	1.7	0.1
Other incl. Mixed Background	1.1	0.4	1.5	0.3
Not Stated	5.1	4.3	2.6	2.3
Nationality	**% Cases**	**% Deaths**	**% Population (2016)[2]**	**% Aged over 65 (2016)[2]**
Irish	87.2	93.3	84.8	93.2
UK	1.5	2.4	2.2	3.0
EU-West	1.1	0.5	1.3	0.4
EU-East	4.2	0.5	5.2	0.3
Non-EU/UK	1.3	0.2	5.0	1.4
Not Stated incl. No Nationality	4.7	3.1	1.5	1.7
Country of Birth	**% Cases**	**% Deaths**	**% Population (2016)[3]**	**% Aged over 65 (2016)[3]**
Ireland	84.9	92.2	82.7	92.3
UK	5.5	5.5	5.9	5.9
EU-West	0.5	0.5	1.3	0.5
EU-East	4.2	0.7	4.9	0.3
Non-EU/UK	0.2	1.2	5.2	1.1
Not Stated	4.7	0.0	**	**

Source: CSO CIDR data matched 2016 Census data as of 12 May 2021.
Notes: (*) indicates that the number was too small to disclose. (**) indicates that there was no corresponding category in the tabulations. 1. Census Population dataset from CSO used to calculate percentages for 2016 (E8006). 2. Census Population dataset from CSO used to calculate percentages for 2016 (E7013). 3. Census Population dataset from CSO used to calculate percentages for 2016 (E7055).

5.4 SUMMARY

This chapter examines how COVID-19 deaths are distributed across socio-economic group and ethnicity/nationality/country of birth groups. Some caution is required in interpreting the findings given that 30 per cent of COVID-19 cases and deaths could not be ‘matched’ to a Census record (from which the data on socio-economic group and ethnicity/nationality/country is derived). Nonetheless, the analysis is suggestive of higher COVID-19 deaths in some groups (including those involved in manual occupations and those whose nationality is recorded as EU-East) given their share of the population aged 65 and over.

The following chapter discusses the main findings from the report and the policy implications.

CHAPTER 6

Discussion and policy implications

6.1 SUMMARY OF MAIN FINDINGS

Life expectancy and mortality are some of the most widely available indicators of population health and are commonly used by governments and international organisations as key indicators of social progress. In addition to being unfair, inequalities in mortality and life expectancy across population groups are a key policy concern as they are potentially avoidable. In this report, data from a variety of sources are used to examine inequalities in mortality in Ireland over the period since 2000, focusing on two broad dimensions of inequality wherever possible: socio-economic status (SES) (proxied by socio-economic group, which is derived from occupation), and ethnicity/country of birth/nationality.

Focusing first on mortality in the perinatal period (i.e. the period before birth up to and including the first week of life), the analysis showed that the perinatal mortality rate (the number of stillbirths and deaths in the first week of life per 1,000 births) fell from 8.3 in 2000 to 5.4 in 2019. However, this improvement was not experienced equally by all groups. The perinatal mortality rate for unemployed mothers was between 1.6 and 2.2 times the rate of mothers in the higher professional group, and this rate remained elevated throughout the period 2000-2019. Similarly, African-born mothers experienced significantly higher rates of perinatal mortality throughout the period. Further modelling suggests that adjustment for a limited set of risk factors such as age, marital status and SES reduced but did not eliminate the differential in perinatal mortality risk between Irish and African born mothers. While the number of deaths was too small to examine SES and ethnic/country of birth/nationality inequalities in infant, child and maternal mortality, the analysis showed a strong reduction in infant mortality rates (i.e. the number of deaths in the first year of life expressed as a proportion of live births) over the period 2000-2018, from 6.6 to 3.

The analysis of inequalities in adult mortality was hampered significantly by data difficulties (outlined in greater detail in Section 6.2). Nonetheless, the data show that the overall mortality rate declined from 10.5 per 1,000 in 2000 to 8.1 in 2018. The analysis of SES inequalities had to be separated into two time periods due to major differences in the coding of occupation in the death registration system in the two periods. The resulting analysis shows that while less advantaged SES groups had higher mortality rates throughout the period, trends over time cannot be analysed with certainty due to the break in the series in 2013, and the coding differences before and after that year. This analysis was supplemented with data from the matched Census-death registration system for 2016, which provided standardised mortality rates (SMRs) disaggregated by different dimensions of SES (education, social class, area-level deprivation) and race/ethnicity (ethnicity, country of birth and nationality). While limited to one year, the data confirm the patterns identified in terms of SES inequalities, with those in less advantaged SES positions having higher SMRs than those in more advantaged SES positions. For the first time in Ireland, adult mortality inequalities across ethnic, country of birth and nationality groups could also be examined; the data revealed substantially lower SMRs in non-White Irish ethnic groups, as well as in those born outside Ireland or with non-Irish nationality.

The COVID pandemic has added a further dimension to the discussion of inequalities in mortality. Using data from the Computerised Infectious Disease Reporting (CIDR) System matched to the 2016 Census of Population, the analysis showed that for the period from March 2020 to May 2021, those in less advantaged socio-economic groups (skilled-manual, semi-skilled manual, unskilled manual and all other gainfully occupied and unknown) had higher proportions of deaths relative to the proportion of the population aged 65 and older in these groups. While the numbers of deaths in non-White groups were very small overall, those with Black or Asian Irish ethnicity accounted for slightly higher proportions of deaths than their respective shares in the 65+ population. Those born in the EU-East (or with EU-East nationality) also accounted for a slightly higher share of total deaths than their proportion in the population aged 65+.

6.2 STRENGTHS AND LIMITATIONS

Before discussing the policy implications of these results, it is worth reflecting on the strengths and limitations of this research. Despite major data limitations, in particular for the analyses of adult mortality inequalities (detailed below), this report has brought together a number of different data sources to examine inequalities not only by SES but also by ethnicity/country of birth/nationality, for infants and adults, and emerging patterns in relation to COVID mortality. The issue of ethnic inequalities in mortality has been brought into sharper focus as a result of the COVID pandemic, but to date there has been little or no research on ethnic inequalities in mortality in the Irish context. Given the homogeneity in the ethnic background of Irish residents, we also examined inequalities by country of birth and nationality, where possible.

As noted, the major limitation of this research concerned data deficiencies, which were particularly acute for the analyses of adult mortality inequalities. In the absence of longitudinal data on mortality (usually obtained via linkage to population-level data such as the Census), unlinked data from the death registration system and the Census are often the only source of data available to those carrying out research on mortality inequalities in Ireland. The many difficulties in conducting research on mortality inequalities using unlinked Census-mortality data have been articulated previously, both in Ireland (Nolan, 1990; O'Shea, 1997; 2002; Layte and Banks, 2016; Layte and Nolan, 2016) and elsewhere (Williams et al., 2006; Mackenbach, et al., 2015c). The most pressing issue is numerator-denominator bias, which occurs when the data used to calculate mortality rates comes from two different sources (in our case, the numerator from the death registration system, and the denominator from the Census of Population). In particular, the information on the indicator of SES (in our case, occupational group) reported by the individual at the time of the Census may differ from the information on SES provided after his/her death by the person filling out the death registration form. Additionally, different indicators of SES may be used in the Census and death registration systems (as was the case in our analysis). Even with comparable indicators and coding schemes, numerator-denominator bias may still arise due to the time lag between the Census and death registration,[48] due to different levels of missing data in the death registration and Census files, and due to inaccuracies or misinformation on the part of informants on the SES (e.g. occupation) of the decedent.[49]

These types of issues can be seen in our data; in 2016 for example, 36 per cent of deaths were coded to the 'all others gainfully occupied and unknown' socio-economic group (SEG) while the comparable figure from the 2016 Census of Population was 18 per cent (for the population aged 15+). Therefore, the data do suggest that a higher proportion of deaths are allocated to the 'unknown' category than would be the case if linkage to the Census were possible. As others have noted, deaths with missing or unknown SES are more likely to be from groups with higher mortality rates. The exclusion of these cases from analysis is likely to lead to bias in the estimation of SES mortality differentials (O'Shea, 1997; 2002; Layte and Banks, 2016; Layte and Nolan, 2016).

Mackenbach et al. (2015c) note that the 'optimal way' of assessing SES inequalities in mortality is by conducting a longitudinal mortality follow-up after a population census, in which the population has been enumerated and classified by sex, age and SES. This approach avoids possible numerator-denominator bias as information on SES (and age and sex) is generated from the same source, i.e. the Census. However, in the absence of a unique population identifier, the matching rate may be incomplete, and is likely to be non-random. In addition, the infrequency of a Census (every five years in Ireland) means that certain population

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48 Generally, census records refer to 'current' occupation, while death certificate records refer to 'last known' or 'usual' occupation. Comparisons of time trends for different groups may be affected by this discrepancy; for example, in periods of high unemployment, there may be a decrease in the numbers in particular occupations, but no commensurate decrease in the deaths of persons previously employed in those occupations, thereby potentially inflating the mortality rate of the economically disadvantaged in periods of high unemployment (Williams et al., 2006).

49 Occupation is often recorded by next of kin, who may be unsure of the exact occupation of the deceased, or 'promote the dead' by inflating the occupation of the deceased (Nolan, 1990).

groups can be missed (e.g. very young children, immigrants). In Northern Ireland linkage rates were found to be lowest in young adults, males, the unmarried, people living in communal establishments, or living in areas that were more deprived or had recorded low census enumeration (O'Reilly, 2008). The CSO conducted two such exercises for Ireland after the 2006 and 2016 Census of Population (CSO, 2010; 2019d), with match rates of 85 and 80 per cent respectively. Another approach is to use mortality follow-up in a longitudinal population survey, as is currently being done with the Irish Longitudinal Study on Ageing (TILDA) (Ward et al., 2020).

A final issue with unlinked mortality-Census data is the fact that just one indicator of SES, generally occupation, is available on death certificates. A number of difficulties arise when using occupation to proxy for SES. First, occupation can be often difficult to ascertain for the unemployed, students, those engaged in caring duties, retired people and people in unpaid, illegal or voluntary jobs.[50] Second, reverse causality (ill-health leading to lower occupational attainment, instead of vice versa) is a possibility (in contrast to education for example, which tends to remain fixed after early adulthood). Ideally, multiple indicators of SES (occupation, income/wealth, education, etc.) would be available. Analyses of mortality inequalities across multiple dimensions of SES may shed light on the mechanisms underlying these inequalities. For example, older married women who have never worked are generally coded to the occupational group of their husband; while this captures the influence of household SES on mortality, it potentially misses any effects of occupation per se on mortality risk of older women (Nolan, 1990).

In many respects, analyses of COVID-19 mortality have highlighted ongoing issues that have hampered research on mortality inequalities for many years. Delays in death registration, ambiguity over the attribution of COVID-19 as a cause of death, and the lack of information on important demographic and socio-economic characteristics all complicate the quantification of excess mortality and inequalities due to COVID (Polyakova et al., 2021). While many countries have struggled to quantify the impact of the COVID pandemic on mortality, and data on excess mortality are only now beginning to be analysed (Wang et al., 2022), the relatively long period between the occurrence and registration of death in Ireland (up to three months) has hampered the ability of researchers to examine emerging patterns in relation to COVID (and excess) mortality in Ireland.[51] Nonetheless, the matching exercise carried out by the CSO, which matched data from the

50 This is particularly relevant for the NPRS; in the period 2014-2019, nearly 30 per cent of mothers were not classified to a socio-economic group but were instead classified as unemployed, home duties, not classifiable or not stated (see Table 3.1). While information on fathers' occupation was used to provide additional information on these observations, it does highlight the difficulty in relying on occupation, particularly for women, as a sole proxy for SES.

51 In England and Wales in contrast, deaths must be registered within five days of occurrence: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/impactofregistrationdelaysonmortalitystatisticsinenglandandwales/2020.

Computerised Infectious Disease Reporting System (CIDR) to the 2016 Census, allowed for an analysis of emerging patterns in relation to COVID mortality, disaggregated by various indicators of SES and ethnicity/country of birth/ nationality.

6.3 POLICY IMPLICATIONS

Vulnerable groups

Despite the overall improvement in mortality rates in Ireland in recent decades, the findings in this report highlight groups that are vulnerable to higher mortality rates, and which require policy attention. In the perinatal period, the significantly higher risk of perinatal mortality for children of African-born mothers is striking. In addition, despite a reduction in the overall perinatal mortality rate over the period 2000-2019, the relative position of African-born mothers deteriorated over the period. Further modelling of the mortality rates showed that some but not all of the disadvantage faced by African-born women could be explained by observable factors such as age, marital status and SES. This implies that other factors, such as health behaviours in pregnancy, access to healthcare, and environmental factors (e.g. housing conditions, exposure to pollution, etc.) may be driving the observed inequalities. In Ireland, there is some evidence of lower healthcare utilisation among young children from migrant backgrounds (Mohan, 2021). Research from the UK shows that South Asian and Black mothers have higher proportions of premature and low birthweight babies than White mothers. Explanations for these ethnic variations in infant outcomes are complex, involving the interplay of environmental, physiological and socio-cultural factors (Batcheler et al., 2021). Poverty and deprivation were identified as significant risk factors: compared with White groups, a higher proportion of mothers from ethnic minority groups, especially Black groups, lived in deprived areas (Raleigh and Holmes, 2021).

Confirming previous national and international findings, the analysis in this report shows that those from less advantaged social backgrounds have substantially higher mortality rates than those from more advantaged social backgrounds. There is a large literature discussing the mechanisms by which poorer SES is linked to higher mortality (Chetty et al., 2016; Lewer et al., 2020; Deryugina and Molitor, 2021). In their review of the 'determinants of mortality', Cutler et al. (2006) discuss a number of possible explanations for within-country differences in mortality across SES groups: access to healthcare, other resources (e.g. income, wealth), health-related behaviours, stress (i.e. the wear and tear that comes from subordinate status and from having little control over one's own life), and finally, reverse causality (sometimes referred to as 'health selection'). In addition, it has been suggested that the persistence of health inequalities in different time periods and different national conditions suggests that high SES provides 'flexible resources', such as knowledge, money, power, and prestige, which can be used to avoid disease risks or to minimise the consequences of disease once it occurs (Link et al., 2008; Mackenbach et al., 2015c). The design of appropriate interventions requires an understanding of the underlying mechanisms; for example while improvements in health behaviours such as smoking have accounted for much of the decline in mortality over the last few decades, differences in health behaviours across SES groups do not explain all of the variation in mortality across SES groups (Cutler, 2006; Stringhini et al., 2011; Gallo et al., 2012; Eikemo et al., 2014; Lewer et al., 2017). Instead, it has been suggested that the search for explanations for SES inequalities in mortality (and health outcomes more generally) may benefit from a movement away from individualism (the notion that health inequalities can be explained exclusively by individual characteristics) and toward an approach that recognises the broader social, economic and cultural factors that shape individuals' lives (McGovern, 2014; Montez and Berkman, 2014; Marmot et al., 2020).

The complexity and interrelated nature of the determinants of ill-health and mortality are a challenge for policymakers. In addition, the influence of social conditions on health is a dynamic process, where inequalities in conditions, opportunities and health play out in different ways at different stages throughout the life course (Lundberg, 2020). The 'critical period' theory emphasises the role of exposures in critical periods, with the focus generally on early childhood and the prenatal period. The 'accumulation' hypothesis describes how socially-patterned exposures to health-damaging factors accumulate across the life course, while the 'pathways' hypothesis emphasises how events and circumstances at one point in the life course might indirectly influence those at a later point (Kendig and Nazroo, 2016). Health-damaging exposures may be material resources (e.g. lack of income), behavioural factors (e.g. smoking) or psychosocial resources (e.g. social isolation) (Cable, 2014).

The evidence base for the effectiveness of specific public health interventions to reduce overall ill health in a society, while also reducing health inequalities by SES, is not well developed (Frank et al., 2020). A recent report for Public Health England surveyed the evidence on interventions that would 'level up', i.e. ensure that deprived areas would prosper in the same way as more advantaged areas (Ford et al., 2021). They noted that initiatives that make healthy choices the default and services easy to use tend to be 'upstream interventions' that do not require much agency to improve health (i.e. individuals do not need to invest much of their own resources or effort to benefit). On the other hand, high agency interventions (e.g. smoking cessation programmes) tend to increase inequalities.

In contrast to the findings for perinatal mortality, the data (while limited) on adult mortality disaggregated by ethnicity, country of birth and nationality show that non-White and non-Irish groups have lower mortality rates than White and/or Irish-born/Irish nationals. However, there was evidence that some non-White and non-Irish-born/Irish nationals accounted for a higher share of COVID-19 deaths than their respective shares of the 65+ population. The findings in relation to overall adult mortality are consistent with those from other European countries, and from the UK, where minority ethnic groups tended to have lower mortality rates prior to the pandemic (Raleigh and Holmes, 2021). A possible 'healthy immigrant effect' may explain these findings, whereby those migrating are healthier on average than those in the destination country (see also Nolan, 2012; McGinnity et al., 2020b). While the COVID-19 mortality data provided by the CSO to the research team are provisional and not adjusted for age, and covered the period to May 2021 only, further monitoring of the data is required in order to confirm the emerging patterns of relatively higher COVID-19 deaths in some non-Irish ethnic and country of birth/nationality groups.

It is also important to note that the COVID-19 pandemic was also an economic crisis; evidence from previous economic downturns has shown that all-cause mortality is pro-cyclical, i.e. is lower in recessions, although more recent evidence has suggested a more nuanced picture (Ruhm, 2015; 2000; Suhrcke and Stuckler, 2012; Stevens et al., 2015).[52] Inequality in COVID-19 infection and mortality may be due to social determinants (such as differences in occupation, income, or education), medical determinants (including differences in comorbidities, healthcare quality, and insurance), and long-standing institutional features that perpetuate systemic racism and intergenerational poverty (Alsan et al., 2021). The provisional data in this report show that those in less advantaged socio-economic positions had a higher risk of COVID-19 mortality in Ireland; other data have shown that certain occupations had much higher risks of COVID-19 infection and severe disease than others (CSO, 2020; Walsh et al., 2020). As the effects of recessions and economic downturns can take many years to manifest, continued monitoring of inequalities in COVID-19 and excess mortality in Ireland is required in order to identify particularly vulnerable groups.

Data collection, harmonisation and access

As outlined in Chapter 1, the latest Healthy Ireland and Sláintecare Strategic Action Plans contain strong commitments to reduce health inequalities, and the Healthy Ireland Outcomes Framework contains a set of indicators that will allow the Government to monitor progress on the actions needed to improve health and wellbeing across the population (Department of Health, 2018; Government of Ireland, 2021a; 2021b). Currently, five mortality-related indicators are proposed: healthy life years, premature non-communicable disease mortality, excess winter

52 In particular, updated analysis of US patterns by Ruhm, 2015 shows that deaths from cardiovascular disease and transport accidents continue to be pro-cyclical; however, countercyclical patterns have emerged for fatalities from cancer mortality and external causes. Among the latter, non-transport accidents, particularly accidental poisonings, play an important role. Stevens et al. (2015) suggest that as most of the cyclical variation in mortality is concentrated in deaths in those aged 65+, and particularly women, cyclical changes in the quality, quantity, or nature of healthcare inputs that are relatively heavily utilised by those over age 65 explain the pro-cyclical patterns in mortality.

mortality, road traffic mortality and drug-induced mortality (Government of Ireland, 2021a). Furthermore, it is noted that:

> *the indicators will be disaggregated where possible in terms of age, gender, SES and geography and will be subject to comparison with national and international data* (Department of Health, 2018).[53]

The WHO has also recommended that countries undertake regular reporting and public scrutiny of inequities in health and its social determinants at all governance levels, including transnational, country and local (World Health Organization, 2014).

While the various national plans do not contain precise targets to be achieved,[54] timely and comprehensive access to appropriate data is required to monitor progress. For the analysis of inequalities in adult mortality, we recommend that Ireland moves towards a system of longitudinal follow-up of mortality after the Census of Population. A limited follow-up (of one year) has already been undertaken after the 2006 and 2016 Census of Population (CSO, 2010; 2019d). As discussed earlier, longitudinal follow-up of the Census of Population allows analysts to overcome many of the difficulties that are encountered in using unlinked census-mortality data. Most importantly however, it would allow for a more detailed monitoring of inequalities; for example, the availability of data on multiple dimensions of SES (e.g. occupation, education, area-level deprivation) in the Census would allow for an examination of the possible mechanisms underlying the observed patterns in mortality. Ideally, follow-up would be ongoing, with all deaths matched to the latest Census available.

In the meantime, there are a number of steps that can be taken by the CSO to improve the current data environment, including ensuring that the occupational coding scheme for the Vital Statistics (death registration) data is consistent with that used in the Census, restoring access to the 2000-2018 Vital Statistics research microdata files (RMFs),[55] and making the 2016 matched Census-Vital Statistics data available to researchers as an RMF. Similarly, the HPO should consider harmonising the measure of socio-economic group used in the NPRS with that employed by the

[53] Mackenbach et al., 2016 highlight the importance of defining what we mean by mortality inequalities; in a context of declining mortality, a narrowing of relative inequalities is very rare, but a narrowing of absolute inequalities in mortality is not. Policymakers are therefore more likely to achieve their quantitative targets if they aim to reduce absolute inequalities.

[54] There was an explicit goal in the 2001 Health Strategy for a reduction in mortality differentials by socio-economic group (SEG); the target was a reduction in premature mortality between the lowest and the highest socio-economic groups of at least 10 per cent for circulatory diseases, cancers and injuries and poisonings by 2007. However, as O'Shea (2002) notes, the data were not sufficient to enable this target to be monitored.

[55] During the period of this research, access to the Vital Statistics RMF was suspended pending a legal review by the CSO. As of March 2022, researchers can again apply for RMF access to Vital Statistics data (CSO personal communication, 25 March 2022).

CSO. With increased moves towards administrative data linkage more broadly, ensuring that demographic and socio-economic indicators are harmonised will become ever more important.[56] Indeed, the Sláintecare Implementation Plan highlights the importance of engaging with appropriate government departments and agencies to ensure that the suite of survey instruments across government and the CSO align appropriately to eliminate duplication, ensure consistency in methodology and allow comparison across demographics (Government of Ireland, 2021b). In addition, 'Wellbeing and Social Cohesion' and 'Health and Social Care' have been identified as priority areas for development by the National Statistics Board under the latest National Statistics Board Strategy 2021-2023. The Board also recommends the further use of administrative data for statistical use, and the use of CSO pathfinder projects[57] to progress data linkage (National Statistics Board, 2021). While the increased availability of data on ethnicity, country of birth and nationality is to be welcomed, previous reports in the Irish context have highlighted the inconsistency in how data on migrant integration in Ireland is collected and recorded (Fahey et al., 2019; McGinnity et al., 2020a).

The difficulties in tracking and monitoring inequalities in (excess) mortality due to the COVID pandemic have been well documented (Health Information and Quality Authority, 2020; Wang et al., 2022). However, there are a number of initiatives that offer the potential to do so in the Irish context. The matching exercise carried out by the CSO, which matched data on cases and deaths from CIDR with the 2016 Census (CSO, 2021a), allowed us to ascertain whether the distribution of COVID deaths across socio-economic, ethnic, country of birth and nationality groups was greater or lesser than their respective shares in the 2016 Census of Population. In future, data from the COVID Data Research Hub offer the potential to support further analyses of inequalities in COVID mortality in Ireland.[58] The availability of multiple sources of data, many of which can be linked together, will enable researchers to examine possible mechanisms underlying identified inequalities. For example, data from England and Wales have shown that much (but not all) of the higher COVID mortality experienced by minority ethnic groups in the UK could be explained by lower vaccination rates (Office for National Statistics, 2022b); the future availability of vaccination and mortality data on the COVID-19 Data Research Hub would facilitate a similar analysis in the Irish context. In time, analyses of inequalities in excess mortality will allow researchers and policymakers to understand if disparities arose predominantly from differences in the direct effects of COVID infection, such as higher infection rates or higher case fatality rates, or,

56 For example, the national strategy for babies and young children, First Five, notes that consideration will be given to the establishment of a technical group tasked with making recommendations on the harmonisation and alignment of data collected to allow for more effective analysis and comparison (Government of Ireland, 2019).

57 The NSB recognises the importance of the CSO's pathfinder projects which are policy-relevant research projects that bring together data from CSO and administrative sources. The NSB recommends that the CSO, public sector bodies and other stakeholders continue to identify useful research projects that harness linked datasets, and that deepen an appreciation of enabling such data linkages.

58 https://www.cso.ie/en/aboutus/lgdp/csodatapolicies/dataforresearchers/covid-19dataresearchhub/.

alternatively, if disparities were driven by the indirect effects of the pandemic, such as disparities in the effect of the pandemic on livelihoods, disruptions to healthcare, etc. (Polyakova et al., 2021).

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APPENDIX 1 CSO DATA ON MATERNAL DEATHS

Table A1.1 shows the number of deaths and the maternal death rate for each year between 2000 and 2018 as recorded by the Central Statistics Office (CSO, 2019a).

TABLE A1.1 MATERNAL DEATHS FROM VITAL STATISTICS, 2000-2018

Year	Number of Maternal Deaths	Maternal Death Rate
2000	1	1.8
2001	3	5.2
2002	5	8.3
2003	0	-
2004	1	1.6
2005	1	1.6
2006	0	-
2007	2	2.8
2008	3	4.0
2009	3	4.0
2010	1	1.3
2011	2	2.7
2012	2	2.8
2013	3	4.4
2014	1	1.5
2015	1	1.5
2016	4	6.2
2017	1	1.6
2018	0	-

Source: CSO Vital Statistics Report 2018: Infant Mortality, Stillbirths and Maternal Mortality 2018.

APPENDIX 2 ADDITIONAL ANALYSIS OF PERINATAL MORTALITY INEQUALITIES

Additional analysis was undertaken using the NPRS dataset to examine inequalities in perinatal mortality between 2004 and 2019 while controlling for a range of other demographic variables. Details of the methods and results of this analysis are provided below.

Methods

Logistic regression models were used to calculate risk ratios for each of the categories of SEG and country of birth included in the main report. The models included the age group of the mother, marital status of the mother, parity, SEG (for the analysis concerned with country of birth) and country of birth (for the analysis of SEG). Inequalities were examined for two time periods; 2004-2011 and 2012-2019.

In contrast to the main analysis in this report, the following analysis omits all missing values and 'not stated' information. However, this did not substantially alter the unadjusted risk ratios reported in the main report.

Results

Table A2.1 shows the adjusted risk ratios for perinatal mortality across socio-economic groups, while Table A2.2 shows the adjusted risk-ratios across country of birth groups. The observed inequalities across socio-economic groups in the main report are maintained after adjustment for mother's age and marital status, parity and country of birth (Table A2.1).

TABLE A2.1 ADJUSTED RISK RATIOS FOR SEG CONTROLLING FOR AGE, PARITY, MARITAL STATUS AND COUNTRY OF BIRTH

Socio-economic Group	2004-2011	2012-2019
Higher professionals	1.00	1.00
Lower professionals	1.01 (0.85 – 1.23)	1.02 (0.87 – 1.27)
Employers and managers	1.11 (0.90 – 1.28)	1.11 (0.86 – 1.34)
Intermediate non-manual	1.06 (0.91 – 1.28)	1.08 (1.03 – 1.50)
Other non-manual and salaried employees	1.25* (1.07 – 1.53)	1.28 (0.93 – 1.39)
Manual and farming	1.24 (1.05 – 1.61)	1.30 (0.93 – 1.56)
Unemployed	1.80* (1.41 – 2.19)	1.76* (1.30 – 2.10)
Home Duties	1.55* (1.37 – 1.93)	1.62* (1.59 – 2.31)

Source: NPRS data; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals. Data exclude multiple births.

Similarly, the disparity for African mothers compared to Irish mothers still persists even after controlling for factors such as age, parity and SEG (Table A2.2).

TABLE A2.2 ADJUSTED RISK RATIOS FOR COUNTRY OF BIRTH CONTROLLING FOR AGE, PARITY, MARITAL STATUS AND SOCIO-ECONOMIC GROUP

Nationality	2004-2011	2012-2019
Ireland	1.00	1.00
UK	1.03 (0.84 – 1.25)	0.92 (0.70 – 1.20)
European	0.81* (0.71 – 0.92)	0.77* (0.67 – 0.88)
African	1.49* (1.26 – 1.73)	1.64* (1.34 – 2.00)
Asian	1.07 (0.89 – 1.30)	0.97 (0.78 – 1.20)
Other	0.61* (0.40 – 0.93)	0.72 (0.49 – 1.07)

Source: NPRS data; authors' analysis.
Notes: (*) indicates statistical significance at the 95 per cent level. Figures in parentheses are 95 per cent confidence intervals. Data exclude multiple births.

APPENDIX 3 PERINATAL MORTALITY INEQUALITY - SENSITIVITY ANALYSIS

Table A3.1 shows the distribution of occupational groups when mothers whose occupation group is ‘home duties’ are re-allocated based on fathers’ occupation. Tables A3.2, A3.3 and A3.4 similarly show the distribution when mothers whose occupation group is ‘unemployed’, ‘not stated’ and ‘not classifiable’ respectively are re-allocated based on fathers’ occupation.

Table A3.1 shows that most of the observations where mothers occupation was recorded as ‘home duties’ have been re-allocated to the category ‘manual workers, farming and agriculture’.

TABLE A3.1 RE-ALLOCATION OF ‘HOME DUTIES’ ACCORDING TO FATHER’S OCCUPATION

Occupation	2000-2003	2004-2008	2009-2013	2014-2019
Higher professionals	3,339	4,184	3,399	2,587
Lower professionals	1,771	2,026	2,233	2,573
Employers and managers	4,357	4,768	3,738	2,943
Intermediate non-manual workers	4,205	4,715	4,353	3,874
Other non-manual and salaried employees	7,158	9,049	8,402	6,852
Manual workers, farming and agriculture	19,051	25,176	19,511	14,653
Unemployed	4,397	6,075	7,748	6,661
Not classifiable	914	2,612	2,425	3,907
Home duties	108	249	239	374
Not stated	17,222	18,701	21,234	22,662
Total	62,522	77,555	73,282	67,086

Source: NPRS Data; authors’ analysis.

Unlike the re-allocation from ‘home duties’, most of the re-allocations for the other categories are re-allocated to the ‘not stated’ category. For the re-allocation of ‘unemployed’ mothers based on fathers’ occupation, most of the observations have been re-allocated to the ‘not stated’ category, followed by the ‘unemployed’ category (Table A3.2).

TABLE A3.2 RE-ALLOCATION OF 'UNEMPLOYED' ACCORDING TO FATHER'S OCCUPATION

Occupation	2000-2003	2004-2008	2009-2013	2014-2019
Higher professionals	102	81	102	118
Lower professionals	70	82	130	223
Employers and managers	57	114	183	211
Intermediate non-manual workers	244	234	385	540
Other non-manual and salaried employees	365	555	855	917
Manual workers, farming and agriculture	704	1,572	1,906	2,186
Unemployed	1,689	1,801	2,908	3,265
Not classifiable	95	241	314	320
Home duties	-	-	-	-
Not stated	6,629	7,662	7,995	9,208
Total	9,962	12,350	14,786	17,009

Source: NPRS Data; authors' analysis.
Notes: (-) denotes figures that were not disclosable because they are too small.

For the re-allocation of 'not classifiable' mothers based on fathers' occupation, 72 per cent are re-allocated to the 'not stated' category (Table A3.3).

TABLE A3.3 RE-ALLOCATION OF 'NOT CLASSIFIABLE' ACCORDING TO FATHER'S OCCUPATION

Occupation	2000-2003	2004-2008	2009-2013	2014-2019
Higher professionals	153	399	504	447
Lower professionals	105	264	406	521
Employers and managers	115	428	422	502
Intermediate non-manual workers	140	470	605	624
Other non-manual and salaried employees	255	755	857	747
Manual workers, farming and agriculture	739	2,265	2,031	1,790
Unemployed	130	351	614	389
Not classifiable	385	1,173	1,637	1,384
Home duties	-	-	-	-
Not stated	5,324	6,677	7,075	5,326
Total	7,349	12,798	14,162	11,746

Source: NPRS Data; authors' analysis.
Notes: (-) denotes figures that were not disclosable because they are too small.

Finally, for the re-allocation of mothers' occupation 'not stated' based on fathers' occupation, over half of the observations are re-allocated to the 'not stated' category (Table A3.4). The category with the second highest number of re-allocated observations is the 'manual workers, farmers and agriculture' group.

TABLE A3.4 RE-ALLOCATION OF 'NOT STATED' ACCORDING TO FATHER'S OCCUPATION

Occupation	2000-2003	2004-2008	2009-2013	2014-2019
Higher professionals	104	38	80	63
Lower professionals	90	-	61	87
Employers and managers	151	47	77	63
Intermediate non-manual workers	213	64	113	84
Other non-manual and salaried employees	266	100	177	178
Manual workers, farming and agriculture	684	283	443	434
Unemployed	132	68	82	56
Not classifiable	33	52	52	69
Home duties	-	-	-	-
Not stated	2,038	845	918	3,924
Total	3,714	1,514	2,005	4,960

Source: NPRS Data; authors' analysis.
Notes: (-) denotes figures that were not disclosable because they are too small.

APPENDIX 4 ADDITIONAL ANALYSIS OF INEQUALITIES IN ADULT MORTALITY USING ALTERNATIVE INDICATORS OF SES

The CSO's (2019) publication on Mortality Differentials 2016/2017 also examines standardised mortality rates across social class for all persons in the Census of Population 2016 and across education levels for all persons aged over 15 in the Census of Population 2016. This publication shows that the managerial and technical group have the lowest standardised mortality rates of all social classes, while professional workers show similar but slightly higher standardised mortality rates. The most disadvantaged social class are those allocated to the 'unknown' group. Aside from the unknown group, manual workers have the highest standardised mortality rates of all social classes. Unskilled manual workers have the highest standardised mortality rate of the manual workers.

Standardised mortality rates are calculated across the highest level of education obtained by a person. The categories are primary, secondary and third level (as well as a 'not stated' category). Standardised mortality rates are highest for the 'not stated' category. However, aside from this group, we see an education gradient across education levels where those who ceased education at primary level have the highest standardised mortality rate and those with third-level education have the lowest standardised mortality rate.

The CSO also provided the research team with tabulations of standardised mortality rates by area-level deprivation, for those living in and outside Dublin. Table A4.1 shows the standardised mortality rates (per 100,000 persons) by area of deprivation quintiles for 2016-2017. First, it presents standardised mortality rates on a regional level: outside Dublin and within Dublin. On average, standardised mortality rates are shown to be lower in Dublin than outside of Dublin for all quintiles except for the third quintile which, for all persons, has a rate of 654 per 100,000 persons in Dublin compared to 632 per 100,000 persons outside of Dublin. Overall, in this table, there is a clear pattern where standardised mortality rates are higher in more deprived areas. It is also worth noting that across quintiles for those outside of Dublin, females have consistently lower standardised mortality rates. The same cannot be said for those in Dublin where there are two instances where female standardised mortality rates are higher than male standardised mortality rates (second and fourth quintiles).

TABLE A4.1 STANDARDISED MORTALITY RATES[59] (PER 100,000 POPULATION) BY AREA OF DEPRIVATION (QUINTILES) FOR 2016-2017

Outside Dublin	All	Males	Females
First quintile (least deprived)	539	549	530
Second	594	618	572
Third	632	649	611
Fourth	690	690	684
Fifth quintile (most deprived)	813	843	787

Dublin	All	Males	Females
First quintile (least deprived)	497	533	475
Second	565	562	573
Third	654	702	615
Fourth	644	623	660
Fifth quintile (most deprived)	807	832	783

Source: Central Statistics Office.
Notes: Deprivation quintiles are based on the estimated deprivation in the Census of Population 2016 small areas. A high deprivation quintile will have prosperous households and vice versa, so care must be taken in interpreting these figures as applying to groups of individuals and should not be interpreted as a precise representation of individual person or individual household deprivation levels. One other complication with quintile comparisons between Dublin and non-Dublin areas is the significant difference in proportions in each quintile for Dublin and non-Dublin populations.

59 Standardised Mortality Rate calculation was used based on the EU2013 Standard Population.

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