ORIGINAL ARTICLE

Comparing the decline in coronary heart disease and stroke mortality in neighbouring countries with different healthcare systems

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ABSTRACT

Objective To examine age and gender specific trends in coronary heart disease (CHD) and stroke mortality in two neighbouring countries, the Republic of Ireland (ROI) and Northern Ireland (NI).

Design Epidemiological study of time trends in CHD and stroke mortality.

Setting/patients The populations of the ROI and NI, 1985–2010.

Interventions None.

Main outcome measures Directly age standardised CHD and stroke mortality rates were calculated and analysed using joinpoint regression to identify years where the slope of the linear trend changed significantly. This was performed separately for specific age groups (25–54, 55–64, 65–74 and 75–84 years) and by gender. Annual percentage change (APC) and 95% CIs are presented.

Results There was a striking similarity between the two countries, with percentage change between 1985 and 1989 and between 2006 and 2010 of 67% and 69% in CHD mortality, and 64% and 62% in stroke mortality for the ROI and NI, respectively. However, joinpoint analysis identified differences in the pace of change between the two countries. There was an accelerated pace of decline (negative APC) in mortality for both CHD and stroke in both countries from the mid-1990s (APC ROI −8% (95% CI −9.5 to 6.5) and NI −6.6% (−6.9 to −6.3)), but the accelerated decrease started later for CHD mortality in the ROI. In recent years, a levelling off in CHD mortality was observed in the 25–54 year age group in NI and in stroke mortality for men and women in the ROI.

Conclusions While differences in the pace of change in mortality were observed at different time points, similar, substantial decreases in CHD and stroke mortality were achieved between 1985 and 1989 and between 2006 and 2010 in the ROI and NI despite important differences in health service structures. There is evidence of a levelling in mortality rates in some groups in recent years.

INTRODUCTION

The island of Ireland is made up of the Republic of Ireland (ROI) with a population of around 4.6 million inhabitants (2012 figures) and Northern Ireland (NI) with a population of approximately 1.8 million. The past two to three decades have seen a rapid decline in mortality from cardiovascular disease (CVD) and in particular coronary heart disease (CHD) in both the ROI and NI.[1 2] The ROI has seen an accelerated decrease in CHD mortality since the late 1990s up to 2006, with a similar pattern in NI and the UK in general.[3] However, elsewhere there has been evidence of a slowing down in the trend among younger aged populations, and CHD and stroke mortality trends vary by gender.[4] Previous work has attributed the decrease in CHD mortality to both improvements in treatment uptake and changes in levels of the main cardiovascular risk factors.[1 2]

Differences in social and economic circumstances and in healthcare systems are likely to contribute to changes in CVD mortality over time. In the ROI, the complex mix of public and private health services provides a two-tier system of healthcare. However, in NI the vast majority of care is provided by the universally accessible National Health Service.

Against this background, the purpose of this work was to compare trends in CHD and stroke mortality in NI and the ROI for the period 1985–2010 and specifically to describe the trends in mortality over time and the pace of change during this period, across age and gender.

METHODS

Directly age standardised (25–54, 55–64, 65–74 and 75–84 years) CHD and stroke mortality data for each year of the period from 1985 to 2010 were generated using CHD and stroke mortality data from the Public Health Information Systems database and the Northern Ireland Statistics and Research Agency for the ROI and NI, respectively.[5 6] The following International Classification of Diseases (ICD) codes were used to identify deaths from CHD, coded as ischaemic heart disease: ICD9 (410–414) and ICD10 (I20–I25), and stroke: ICD9 (430–438) and ICD10 (I60–I69).

The 5-year age standardised (age groups as above, and overall 25–84 years) CHD and stroke mortality rates for 1985–1989 and 2006–2010 and percentage decrease in 5-year age standardised mortality rates from 1985–1989 to 2006–2010 were calculated for each country. Combined and gender specific analyses were performed.

Direct age standardised CHD and stroke mortality rates from 1985 to 2010 for each country were analysed using joinpoint regression analysis to identify points (years) where the slope of the linear trend changed significantly.[7] This was performed separately for each of the age-standardised rates (25–54, 55–64, 65–74 and 75–84 years) and for

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men and women. The joinpoints (also referred to as turning points) are the calendar years at which the rate of change in CHD mortality changed significantly. Each joinpoint subdivides the time trend into distinct time periods, for example, if there is one joinpoint, there are two distinct time periods. The analysis begins with the assumption that there are no joinpoints, that is, the slope of the regression line fitted to the age standardised mortality rates does not change over the time period. It tests for at least one statistically significant joinpoint in the model. The joinpoint regression employed the permutation method.[8] The model with the optimum number of joinpoints is selected by iteratively fitting models with no joinpoint up to a maximum of three joinpoints. We chose three joinpoints, or three changes in mortality, between 1985 and 2010 as visually this appeared to reflect the trends in CHD and stroke mortality data most accurately. The objective is to choose the model with the smallest number of joinpoints such that if an extra joinpoint is added the resulting improvement in the fit of the model is not statistically significant.

The pace of change in the CHD and stroke mortality rates was measured using annual percentage change (APC). The APC was computed for each distinct time period by fitting a regression line to the natural log of the age standardised mortality rates (response variable, y) and year (predictor variable, x) for each time period, that is, $y = mx + c$, where m is the slope, and c is the intercept of the regression line. The APC was then estimated using $100\times(e^{m}-1)$ where e is the inverse of the natural log function. A 95% CI for the APC is also computed.

The analysis was performed using software developed by the Surveillance Research Programme of the US National Cancer Institute.[7]

RESULTS

Time trends

There was a striking similarity between the two countries in the overall decline in CHD and stroke mortality. The percentage change in CHD mortality between 1985 and 1989 and between 2006 and 2010 was 67% and 69% for the ROI and NI, respectively (table 1). The percentage of CHD mortality decrease was less evident in the 75–84-year age group for both countries and for women in the 25–54-year age group in NI only (table 1).

There was a similar pattern of decline in stroke mortality across both countries, with 64% and 62% fall in the ROI and NI, respectively (table 1). NI had higher rates of stroke mortality in both 1985–1989 and 2006–2009 across most age and gender groups. The percentage stroke mortality decline was lower for the youngest age group, 25–54 years, in both countries and in the 75–84-year age group for CHD mortality rates in the ROI and NI (except in women) (table 1). The numbers of associated CHD and stroke deaths for each period are provided in the online supplementary table 1.

Pace of change in mortality

Results from the joinpoint analyses examining the pace of change in CHD and stroke mortality including APC and turning points for the period 1985–2010 are given in tables 2 and 3,

Table 1 Average age standardised rates (ASR) for the period 1985–1989 and 2006–2010 and % changes for CHD and stroke mortality by gender in the Republic of Ireland and Northern Ireland

	Average ASR Republic of Ireland					Average ASR Northern Ireland				
	25–54	55–64	65–74	75–84	25–84	25–54	55–64	65–74	75–84	25–84
CHD										
Overall										
1985–1989	50.7	430.4	1111.7	2371.3	345.4	57.1	482.0	1236.2	2320.0	370.0
2006–2010	15.3	110.9	327.5	1015.6	114.3	19.8	119.2	327.7	937.5	115.1
% change	−69.8%	−74.2%	−70.5%	−57.2%	−66.9%	−65.2%	−75.3%	−73.5%	−59.6%	−68.9%
Males										
1985–1989	83.8	668.9	1602.8	3163.2	501.4	95.3	757.5	1809.9	3060.5	542.7
2006–2010	25.6	177.4	500	1400.4	170.3	31.9	190.7	477.2	1317.4	170.3
% change	−69.4%	−73.5%	−68.8%	−55.7%	−66.0%	−66.5%	−74.8%	−73.6%	−56.9%	−68.6%
Females										
1985–1989	16.3	203.4	687.4	1812.8	209.1	20.4	240.8	795.4	1898.1	234.4
2006–2010	5	43.3	165	735.4	64.2	8.0	50.6	197.0	684.6	68.7
% change	−69.3%	−78.7%	−76.0%	−59.4%	−69.3%	−60.6%	−79.0%	−75.2%	−63.9%	−70.7%
Stroke										
Overall										
1985–1989	9.8	78.4	312.0	1108.9	107.7	12.7	89.9	352.8	1127.8	116.4
2006–2010	5.8	23.2	91.5	429.1	38.5	5.8	30.6	113.1	490.3	44.7
% change	−41.5%	−70.5%	−70.7%	−61.3%	−64.3%	−54.2%	−66.0%	−68.0%	−56.5%	−61.6%
Males										
1985–1989	9.6	92.1	361.1	1167.5	118.2	12.9	107.0	392.1	1197.6	127.9
2006–2010	5.9	25.8	107.4	467.2	42.6	7.0	33.8	119.3	541.9	49.6
% change	−38.7%	−72.0%	−70.3%	−60.0%	−64.0%	−45.8%	−68.4%	−69.6%	−54.8%	−61.2%
Females										
1985–1989	10.1	65.5	269.7	1065.7	98.9	12.0	79.3	302.6	1097.9	107.7
2006–2010	5.6	20.5	76.5	403.1	35.0	5.9	25.2	97.5	453.9	40.8
% change	−44.3%	−68.8%	−71.6%	−62.2%	−64.6%	−50.4%	−68.2%	−67.8%	−58.7%	−62.1%

CHD, coronary heart disease.

Table 2 Annual percentage change (APC) and 95% CIs for age standardised coronary heart disease mortality rates between 1985 and 2010 for Republic of Ireland and Northern Ireland by age and gender from joinpoint regression

	Republic of Ireland						Northern Ireland					
	Overall		Males		Females		Overall		Males		Females	
	Years	APC	Years	APC	Years	APC	Years	APC	Years	APC	Years	APC
25–54	1985–2010	−5.5 (−5.8 to −5.2)	1985–2010	−5.5 (−5.8 to −5.2)	1985–2010	−5.2 (−5.9 to −4.5)	1985–1996	−6.7 (−8.2 to −5.2)	1985–1996	−6.9 (−8.2 to −5.5)	1985–2010	−4.2 (−5.2 to −3.3)
									1996–2010	−3.6 (−4.7 to −2.6)	1996–2010	−3.9 (−4.8 to −2.9)
55–64	1985–1995	−4.7 (−6.0 to −3.4)	1985–1995	−4.5 (−5.8 to −3.2)	1985–1998	−5.9 (−7.2 to −4.6)	1985–1994	−4.7 (−6.6 to −2.8)	1985–2010	−6.5 (−6.9 to −6.1)	1985–1994	−4.2 (−6.7 to −1.6)
	1995–2010	−7.3 (−8.0 to −6.6)	1995–2010	−7.2 (−7.9 to −6.5)	1998–2001	−16.4 (−36.1 to 9.3)	1994–2010	−7.4 (−8.2 to −6.7)			1994–2010	−8.9 (−9.9 to −7.9)
					2001–2010	−4.7 (−7.0 to −2.3)						
65–74	1985–1996	−3.0 (−3.7 to −2.3)	1985–1995	−2.7 (−3.8 to −1.6)	1985–1997	−3.6 (−4.4 to −2.8)	1985–1996	−3.7 (−4.2 to −3.1)	1985–1996	−3.8 (−4.3 to −3.3)	1985–1995	−3.5 (−4.7 to −2.4)
	1996–2006	−8.2 (−9.1 to −7.4)	1995–2010	−7.1 (−7.7 to −6.6)	1997–2006	−10 (−11.4 to −8.6)	1996–2004	−8.8 (−9.8 to −7.8)	1996–2006	−8.4 (−9.1 to −7.8)	1995–2006	−8.3 (−8.9 to −7.7)
	2006–2010	−4.3 (−7.3 to −1.2)			2006–2010	−4.8 (−9.0 to −0.3)	2004–2010	−6.0 (−7.2 to −4.7)	2006–2010	−4.9 (−7.2 to −2.5)		
75–84	1985–1999	−2.1 (−2.5 to −1.7)	1985–1999	−2.1 (−2.4 to −1.7)	1985–1998	−2 (−2.6 to −1.3)	1985–1997	−1.9 (−2.5 to −1.3)	1985–1997	−1.9 (−2.7 to −1.1)	1985–1996	−1.7 (−5.2 to −0.9)
	1999–2005	−7.6 (−9.4 to −5.8)	1999–2005	−7.5 (−9.2 to −5.7)	1998–2010	−6.7 (−7.4 to −6.0)	1997–2010	−6.3 (−6.8 to −5.8)	1997–2010	−5.8 (−6.5 to −5.1)	1996–2010	−6.9 (−7.4 to −6.4)
	2005–2010	−3.9 (−5.7 to −2.0)	2005–2010	−3.2 (−4.9 to −1.4)								
25–84	1985–1998	−3.5 (−3.9 to −3.0)	1985–1998	−3.4 (−3.9 to −2.9)	1985–1997	−3.5 (−4.2 to −2.7)	1985–1995	−3.5 (−4.0 to −2.9)	1985–1995	−3.8 (−4.4 to −3.1)	1985–1995	−3.0 (−3.7 to −2.4)
	1998–2005	−8 (−9.5 to −6.5)	1998–2005	−7.9 (−9.3 to −6.4)	1997–2010	−7.3 (−8.0 to −6.7)	1995–2010	−6.6 (−6.9 to −6.3)	1995–2010	−6.4 (−6.7 to −6.0)	1995–2010	−7.3 (−7.7 to −7.0)
	2005–2010	−4.5 (−6.5 to −2.4)	2005–2010	−4.2 (−6.2 to −2.2)								

Table 3 Annual percentage change (APC) and 95% CIs for age standardised stroke mortality rates between 1985 and 2010 for Republic of Ireland and Northern Ireland by age and gender from joinpoint regression

	Republic of Ireland						Northern Ireland					
	Overall		Males		Females		Overall		Males		Females	
	Years	APC	Years	APC	Years	APC	Years	APC	Years	APC	Years	APC
25–54	1985–2010	−2.5 (−3.0 to −2.0)	1985–2010	−2.1 (−2.9 to −1.2)	1985–2010	−2.9 (−3.9 to −1.9)	1985–2010	−3.6 (−3.7 to −3.6)	1985–2010	−3.5 (−4.8 to −2.2)	1985–2010	−3.8 (−4.7 to −2.9)
55–64	1985–2000	−4.3 (−5.3 to −3.3)	1985–1998	−4.5 (−5.7 to −3.3)	1985–2010	−5.5 (−6.2 to −4.7)	1985–2010	−5.0 (−5.0 to −5.0)	1985–2010	−5.1 (−6.0 to −4.3)	1985–2010	−4.9 (−5.8 to −4.0)
	2000–2005	−10.5 (−17.9 to −2.9)	1998–2010	−7.3 (−8.6 to −6.0)								
	2005–2010	−2.5 (−7.9 to 3.2)										
65–74	1985–2000	−4.3 (−5.0 to −3.6)	1985–2000	−4 (−4.8 to −3.1)	1985–2000	−4.7 (−5.5 to −3.9)	1985–2010	−5.3 (−5.3 to −5.3)	1985–2010	−5.3 (−5.9 to −4.6)	1985–2010	−5.4 (−5.8 to −4.9)
	2000–2005	−11.4 (−16.1 to −6.4)	2000–2005	−11.2 (−16.7 to −5.5)	2000–2005	−11.9 (−17.3 to −6.1)						
	2005–2010	−1.7 (−5.4 to 2.2)	2005–2010	−3 (−7.2 to 1.5)	2005–2010	0 (−4.4 to 4.5)						
75–84	1985–2001	−3.3 (−3.7 to −2.8)	1985–2001	−3 (−3.6 to −2.4)	1985–2004	−3.5 (−3.9 to −3.0)	1985–2002	−2.9 (−2.9 to −2.9)	1985–2001	−2.7 (−3.3 to −2.0)	1985–1999	−2.6 (−3.5 to −1.7)
	2001–2005	−9.4 (−14.4 to −4.1)	2001–2006	−8.7 (−13.3 to −3.9)	2004–2005	−9.7 (−14.8 to −4.3)	2002–2010	−6.4 (−6.4 to −6.4)	2001–2010	−5.6 (−7.0 to −4.1)	1999–2010	−5.9 (−7.1 to −4.7)
	2005–2010	−2.6 (−5.0 to −0.1)	2006–2010	−1.2 (−6.2 to 4.0)	2005–2010	−2.3 (−4.8 to 0.3)						
25–84	1985–1998	−6.5 (−11.5 to −1.2)	1985–2001	−3.5 (−4.0 to −3.0)	1985–1987	−9.7 (−19.3 to 1.1)	1985–1999	−3.5 (−4.2 to −2.9)	1985–1999	−3.4 (−4.2 to −2.7)	1985–2010	−4.5 (−4.8 to −4.1)
	1998–2000	−3.2 (−3.9 to −2.5)	2001–2006	−9.1 (13.0 to −5.0)	1987–2000	−3.4 (−4.0 to −2.7)	1999–2010	−5.5 (−6.4 to −4.6)	1999–2010	−5.5 (−6.5 to −4.4)		
	2000–2005	−9.3 (−12.4 to −6.1)	2006–2010	−2 (−6.2 to 2.4)	2000–2005	−9.8 (−13.0 to −6.5)						
	2005–2010	−2.6 (−4.9 to −0.1)			2005–2010	−1.4 (−3.9 to 1.1)						

respectively. Overall, in the age range 25–84 years, there was an accelerated pace of decline in mortality for both CHD and stroke in both countries from the mid-1990s onwards (APC; CHD NI −6.6% (1995), ROI −8.0% (1998); stroke NI −5.5% (1999), ROI −9.3% (2000)). However, these periods of acceleration were observed up to 4 years later for CHD mortality in the ROI compared with NI. For stroke mortality, the decline continued in NI over the study period. In the ROI, there was a significant slowing in the rate of change in stroke mortality from 2005 onwards in both men and women (table 3).

Figure 1 shows the age standardised rates and final joinpoint regressions superimposed for CHD mortality and stroke mortality for age groups 55–64, 65–74 and 75–84 years only. The CHD and stroke mortality rates for 25–54 years were lower overall and showed a steady decline over time with the exception of CHD mortality in men in NI, which showed a significant slowing down with one turning point in 1996 (table 2).

For the age group 55–64 years there was an even pace (linear trend) observed in male and female stroke mortality in NI, and in male CHD mortality in NI and female stroke mortality in the ROI (tables 2 and 3). However, an accelerated pace was found in men in the ROI for (i) CHD mortality after 1995 (table 2) and (ii) stroke mortality after 1998 (table 3). A similar accelerated pace was also found in women in NI for CHD mortality after 1994 (table 2). One exception was noted in the ROI for CHD mortality in women with a more rapid pace of decline from 1998 to 2001 (APC=16.4%) followed by a slowing down (table 2).

For age group 65–74, again, a linear downward trend was observed in NI for stroke mortality in both men and women (table 3). For the ROI, an accelerated pace in stroke mortality was noted for men and women, though occurring later, in 2000. For CHD mortality there was an acceleration of pace after the mid-1990s in NI for men (turning point 1996) and women (1995), and the ROI for men (1995) and women (1997) (table 2).

For the age group 75–84 years, the pattern differed across the two countries. In NI, the pace of decline in CHD mortality accelerated from 1997 onwards in both men and women (table 2) and for stroke mortality accelerated from 2001 for men and from 1999 for women (table 3). In the ROI, a pattern of accelerated pace in CHD mortality was observed after 1999 and 1998 for men and women, respectively (table 2), and for stroke mortality from 2001 for men and 2004 for women (table 3). This period of acceleration was followed by a sharp slowing of pace for all except CHD mortality in women.

DISCUSSION

This study, examining the extent and pace of change in CHD and stroke mortality over time in two different countries on the same island, has shown striking similarities and some differences over the past 25 years. The decline in CHD mortality appeared to start earlier in NI, but by 2010 the two countries had similar overall reductions. The largest reductions for both CHD and stroke mortality in both countries was found in those aged 55–74 years. The main difference between the two countries for CHD mortality was for the youngest age group (25–54 years) where there appeared to be some levelling off in mortality in NI as observed elsewhere.[4] For stroke mortality, the ROI has shown accelerated decline over the period 1985–2005, but this has levelled off sharply in more recent years, particular among women. The ROI rate is now similar to NI, which had been steadily declining over the study period.

The joinpoint regression method employed the permutation method and a maximum of three joinpoints over the period and therefore may have resulted in fewer inflection points being selected as a result. Also, there were changes between the versions of ICD coding (from V.9 to V.10) used to classify deaths at different points in time in the ROI (2004) and NI (2001) during the study period that might have led to artefactual changes due to shifts within the coding frame. However, it has been shown previously that CHD mortality coding discontinuities were minimal for both NI and the ROI.[9]

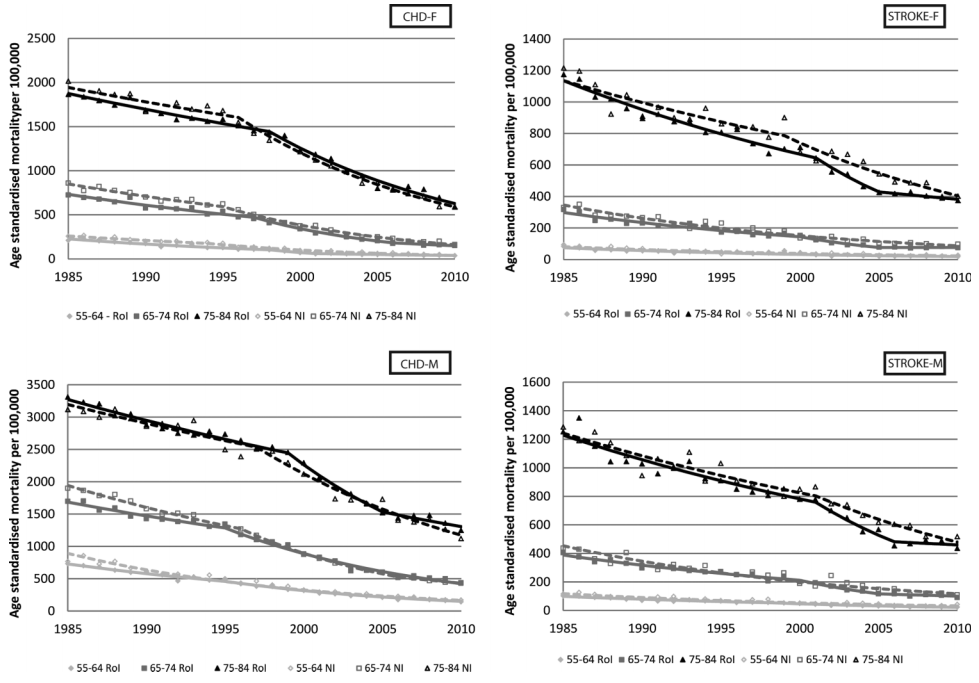

Figure 1 Age standardised coronary heart disease mortality rates for females and males and stroke for females and males 1985–2010 by age groups (55–65, 65–74 and 75–84 years) for both Republic of Ireland (solid line) and Northern Ireland (dashed line).

Historically, the two countries have had high levels of CVD mortality and were among the highest in Europe, but, similar to most of Europe, mortality from CVD has been on the decline.[10] Evaluation of trends comparing the two countries is complex, with broadly similar dietary and cultural factors, but differing healthcare systems and policies on CVD and risk factors, and the diverging pace of economic growth and political developments over the period.[11]

Changing trends in CHD and stroke mortality have been broadly attributed to the common adverse lifestyles, including diets high in saturated fat and high levels of smoking. A comparison of risk factors in the mid-1980s with mid-1990s using the Kilkenny Health Project in the ROI and WHO MONICA Project in Belfast in NI found similar high levels of systolic blood pressure, cholesterol and smoking, with declines in most risk factors by the mid-1990s except for blood pressure in NI.[12] NI's participation in WHO MONICA project,[13] which ran from the mid-1980s to mid-1990s, and NI's involvement as the UK representative in WHO CINDI Programme generated considerable media coverage regarding high CVD rates in NI.[14]

More recently, a report '*One Island—One Lifestyle?*' compared risk factor levels using health surveys from 2007 (ROI) and 2005 (NI) and found similar levels of risk factors across the two countries.[11] The levels of obesity were comparable at 24% and 25%, though the levels of sedentary behaviour were more marked in NI (29%) compared with the ROI (24%). Interestingly, the main differences in obesity levels were in the younger and older age groups, with NI showing higher levels in those 30–44 years (26%) compared with the ROI (22%) but lower levels in those 65+ years (23%) compared with the ROI (31%). These findings may explain, in part, the slowing down of CHD mortality in younger men in NI. Smoking rates from the same surveys were higher in the ROI at 29% compared with 26% in NI, with less smoking cessation advice provided in the ROI (34%) compared with NI (58%), and a stronger social gradient in the ROI. However, alcohol consumption was higher in NI compared with the ROI, with more reporting drinking weekly in NI (65%) compared with the ROI (46%) and above the weekly limit (19% vs 10% for NI and the ROI, respectively), but this may be due to the more detailed information available from NI surveys. Reported levels of eating a portion of fruit or vegetable at least once per day were higher in the ROI (fruit 83%; vegetable 95%) compared with NI (fruit and vegetable 58%), although the definitions differed in the surveys used.[11]

Contributory risk factors were found to explain similar proportions of the decline in CHD mortality in both countries over the period 1985–2000 (ROI) and 1987–2007 (NI).[1 2] Overall, 44% of the decline in the ROI and 35% in NI could be attributed to improvements in treatment uptake, and 48% and 60% to risk factor changes in the ROI and NI, respectively. Decreases in smoking prevalence explained 25.6% and 20.3% of the decline in CHD mortality and for cholesterol 30.2% and 25.8% in the ROI and NI, respectively. However, there was a larger difference for systolic blood pressure which had a greater reduction in NI than the ROI over the periods studied (28% compared with 6.1% in NI and ROI, respectively), although NI had higher levels of blood pressure in the initial year. This may help explain the flattening in stroke mortality observed in the ROI in more recent years. The Irish LongituDinal study on Ageing in the ROI (TILDA) found that 58% of men and 49% of women over 50 years were unaware they had hypertension as defined by the European Society of Cardiology criteria.[15]

Contributions of increased treatment uptake to declining CHD mortality were also found to be similar between the two countries. Increased use of secondary preventative therapies was found to contribute to 15% and 18% of the mortality decline, and similarly, interventions including coronary artery bypass grafting and Percutaneous transluminal coronary angioplasty (PTCA) had relatively small contributions of 3% and 5% in NI and the ROI, respectively.[1 2]

Different healthcare systems exist across the two countries, with a private (approximately 46% population coverage) and public mixed economy in the ROI and a public service in NI, free at the point of access (only 10% private healthcare in NI).[16] In addition, NI has had a greater emphasis towards improving management of chronic disease in primary care. Despite this, the rate of GP consultation was found to be similar, with 74% of the population in the ROI and 73% in NI visiting their GP in the last year.[11] Hospitalisation rates were also found to be similar.[11 17]

Approaches to public health policy in the two countries show similarities and differences. In NI in 2001 a wide ranging 'Investing for health' public health policy framework was introduced across all Government Departments.[18] From 2004, payment for performance (the Quality and Outcomes Framework) was introduced in NI as in the UK, which includes a structured approach to risk factor modification in marked contrast to the ROI. This was followed in 2009 by the development of a Service Framework for Cardiovascular Health and Wellbeing.[19] No clear association is seen between these initiatives and the turning points in NI. In the ROI during the late 1980s, a general health policy and later a health promotion strategy were published.[20] However, it was not until 1999 that the first national CHD strategy was published, followed by the more recent CVD policy (2010) which included stroke.[21 22] The turning points for improvements in CHD and stroke mortality in the ROI are too early to be explained by the 1999 strategy but appear to coincide with increased economic growth during the 1990s and early 2000s. Others have reported that introducing innovation in medical care does not always coincide with improvements in cardiovascular mortality and that the effects are likely to be incremental over time.[23]

While public policy over the last two to three decades in both countries has included food and nutrition advice as well as physical activity strategies, it is only in the last decade that obesity has largely gained strategic focus. The all island body, *Safefood* (http://www.safefood.eu), has launched several initiatives since its inception in 1999 with the aim of raising awareness of obesity and promoting healthy eating across both jurisdictions. Strategies tackling obesity and physical activity were instigated in both the ROI and NI in 2005.[24]

There are several similar government initiatives in both countries including policies on taxation of smoking and alcohol. Similar policies on banning smoking in public places were adopted in both countries, though introduced at different times (March 2004 in the ROI, and April 2007 in NI). Changes in licensing laws in both countries have been accompanied by greater access to cheap alcohol and higher levels of consumption.[25 26]

Historically, Ireland would have been considered economically disadvantaged, and NI one of the most disadvantaged areas in the UK. However, economic growth in both countries, followed by a recession more recently in the ROI, suggests a divergence in economic growth between the two countries. Although unemployment rates were similar in 1985 (16.7% ROI; 16.9% NI), 1990 (12.9% ROI; 11.6% NI) and 2000 (4.5% ROI; 6.6% NI), by 2010 a very different pattern had emerged with a doubling of rates in the ROI (13.6% ROI; 6.9% NI).[27 28] Other

studies have shown the link between prevailing economic conditions and health related outcomes,[29] and the greater pace of decline and more recent levelling off in mortality trends in the ROI coincide with periods of rapid economic growth and subsequent economic recession as observed in Finland.[3] Previous research on mortality trends across the island of Ireland (1989–1998) has shown threefold differences in mortality between the lowest and highest socioeconomic groups.[30] In the UK, the social gradient in CHD mortality was found to be almost twofold in 2000 and 2007, with the greater accelerated decline in the most affluent group during this time.[31]

The political landscape has also changed over time, particularly in NI, following a period of prolonged civil conflict from the 1970s referred to as 'the Troubles'. One reported effect of this period has already been shown, with poorer mental health in individuals who reported this had an important impact on them and the area in which they lived.[32] The '*One-island One lifestyle?*' report also examined differences in mental health and found evidence suggestive of higher levels of psychological distress in NI.[11]

The strengths of the study are the similar quality and duration of mortality data available in both countries. The finding of a flattening in CHD and stroke mortality in some groups in recent years is supported by evidence from other studies and warrants further attention.[4]

CONCLUSIONS

Similar substantial decreases in CHD and stroke mortality were achieved in the ROI and NI despite important differences in health service structures and in social, economic and political systems across the two countries. There is evidence of a flattening of trends in the past 10–15 years for CHD mortality in NI for the youngest age group 25–54 years and for stroke mortality in the ROI, which supports evidence from other studies that this phenomenon is real.

The very similar reductions in CHD and stroke mortality over the time period in the ROI and NI highlight the importance of lifestyle factors in the aetiology and prevention of CVD. Flattening of mortality in some groups in recent years warrants further attention, including prevention of obesity in the population and management of hypertension in clinical practice. Public health messages on promotion of healthier lifestyles and early intervention will continue to have a critical role in CVD prevention.

Monitoring trends in CVD mortality can inform public health strategies and targeted interventions in groups where mortality trends appear to be slowing, in order to improve future health.

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