



National end of life care
INTELLIGENCE NETWORK

NHS

*National End of Life
Care Programme*

Improving end of life care



Deaths from cardiovascular diseases Implications for end of life care in England

February 2013

Foreword

This report provides an excellent summary of the current trends and patterns in cardiovascular deaths. Historically, cardiovascular disease has been the biggest single killer in England. However, as this report shows, in 2011 the proportion of all deaths attributable to circulatory diseases fell below that of cancer for the first time.

But at the same time as we applaud the significant gains of reducing premature mortality it is important to note that stroke remains a significant cause of disability.

This report describes the pattern of mortality and hospital admission for cardiovascular disease looking at variation by age, sex, region, socioeconomic deprivation and disease group. This sort of information is invaluable to both commissioners and providers of healthcare. Intelligence that, for example, the proportion of death due to acute coronary heart disease has fallen, while the proportion due to chronic coronary heart conditions has risen, is a helpful prompt to consider where service development might be needed.

It highlights the need for the right end of life care for people with these conditions. The proportion who are able to die in their usual place of residence has been increasing, and stood at 43% in 2011 compared with 37% in 2004. The majority of people – surveys consistently report about 70% - indicate they would prefer to die in their usual place of residence. Commissioners and providers can use the insights and compelling information provided, in this report, to support people in a way that respects their wishes and meets their needs. Giving people both dignity and respect at the end of their lives is an ambition the NHS should continually strive for.



A handwritten signature in black ink, appearing to read 'Martin McShane'.

Dr Martin McShane
Director - Domain 2 - NHS Commissioning Board

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Summary

This report describes patterns in mortality from cardiovascular diseases in England, highlighting variation in place and cause of death by age, sex, socioeconomic deprivation and disease group. It complements earlier reports on end of life care published by the National End of Life Care Intelligence Network.

The report was commissioned to support the development of a new national strategy for tackling cardiovascular diseases. It will also be of interest to commissioners and providers of end of life care focused on supporting and caring for patients with cardiovascular diseases, as well as the patients themselves, their carers and families.

Key findings

Variations by disease category

- The number of circulatory disease deaths has fallen: from 178,067 in 2004 to 130,192 in 2011
- The proportion of deaths from circulatory diseases has also fallen, from 37.2% 2004 to 28.9% in 2011.
- The proportion of all cardiovascular disease deaths due to acute coronary heart disease has fallen, whilst the proportion due to chronic coronary heart conditions has risen over the same period.

Variations by age and sex

- After controlling for the age and sex of the population, there is some regional variation in cardiovascular disease mortality in England, with higher directly standardised mortality rates in the North of England (North West, North East and Yorkshire and the Humber) and lower rates in the South (South West and South East).
- More men than women die of acute and chronic coronary heart disease but considerably more women die of cerebrovascular diseases (including stroke) than men.
- The number of cardiovascular disease deaths increases with age. This is especially marked for cerebrovascular diseases. However, congenital heart disease has an inverse relationship with age, the largest proportion of deaths occurring in the youngest age band.

Variations by place of death

- Between 2004 and 2011 a large proportion of cardiovascular disease deaths occurred in hospital (59%).
- Only 0.3% of all cardiovascular disease deaths in this period occurred in a hospice.
- The proportion of deaths in usual place of residence (DiUPR) for all cardiovascular diseases has increased from 37.4% in 2004 to 42.6% in 2011.

Comorbidities

- The proportion of cardiovascular disease deaths with a hospital record of Type II diabetes has also risen, from 16% to 19%, between 2004 and 2008.
- Diabetes was most commonly mentioned on the hospital records of patients dying of acute or chronic coronary heart disease or vascular dementia.

Conclusions

This report provides useful and descriptive overview of the current trends in mortality from cardiovascular diseases including circulatory diseases, congenital heart disease and vascular dementia. Based on the results of the analysis, this report concludes that:

- although deaths from cardiovascular diseases as a proportion of all deaths has decreased in recent years, this disease group remains a leading cause of death in England and the end of life care needs for this patient group is significant
- whilst the proportion of deaths in usual place of residence for cardiovascular diseases has increased, more work is required to ensure that cardiovascular disease patients are supported to die with dignity in their preferred place of death
- patients who die of cardiovascular diseases may also die with other comorbidities and may therefore have complex end of life care needs
- cardiovascular disease is difficult to classify into meaningful categories for analysis using the ICD-10 codes structure alone – the taxonomy developed for this report may be a useful frame of reference for future reports.

Recommendations

Based on these conclusions, this report recommends that:

- the key findings from this report inform the development of national policy and strategy around cardiovascular diseases and end of life care
- the National End of Life Care Intelligence Network publishes further analyses of cardiovascular disease mortality statistics as they become available.

Future investigations

The following future investigations are proposed:

- Further analysis of elective and emergency admissions in the last year of life, bed days and cost of hospital stays;
- Proportion of patients with acute cardiovascular disease and cardiac arrhythmias dying with inserted pacemaker and defibrillator devices and subsequent implications for advance care planning;
- Variation in the prevalence of heart failure in England and the implications for end of life care planning;
- Comparison of modelled indicators of end of life care need for cardiovascular disease patients against spend on palliative and supportive care.

1 Introduction

Cardiovascular diseases are the most common cause of death in England and stroke is the most significant cause of disability. Although significant gains have been made in reducing premature mortality from cardiovascular diseases in recent years, significant concerns around increased behavioural risk factors within the population (for example, smoking, poor diet) prompted the Secretary of State for Health to announce, in 2011, the development of an outcomes strategy for cardiovascular diseases.

1.1 Aim

The aim of this report is to provide up-to-date intelligence on deaths from cardiovascular diseases in England. This report was commissioned by the National Clinical Director for End of Life Care to support the development of a new national strategy to tackle cardiovascular diseases.

1.2 Objectives

In meeting this aim, the report:

- defines clear epidemiological categories for cardiovascular diseases which support the analysis of linked routine data available to the National End of Life Care Intelligence Network
- describes patterns of mortality and hospital admissions for patients with cardiovascular diseases by analysing variations by age, sex, region, socioeconomic deprivation and disease group
- summarises the key conclusions and makes recommendations for policy development and further investigation.

1.3 Scope

This report includes analysis of mortality and hospital admissions data for cardiovascular diseases in England in the context of end of life care for the period 2004–11 (deaths) and 2004–08 (hospital admissions). It complements other recent publications, including but not limited to:

- National End of Life Care Profiles (National End of Life Care Intelligence Network, 2012a)
- Cardiovascular Disease Profiles (South East Public Health Observatory, 2012)
- First national VOICES survey of bereaved people: key findings report (Department of Health, 2012)
- What do we know now that we didn't know a year ago? New intelligence on end of life care in England (National End of Life Care Intelligence Network, 2012b);
- Deprivation and death: Variation in place and cause of death (National End of Life Care Intelligence Network, 2012c).

2 Methodological notes

2.1 Source data

All statistics presented in this report draw on the Office for National Statistics (ONS) public health annual mortality extract, which is produced from information obtained from death certificates. Key data fields used for this analysis include:

- date of birth
- date of death registration
- cause of death
- place of death
- sex
- postcode of normal place of residence.

Statistics for admissions to hospital in the final year of a patient's life are calculated from a dataset linking ONS mortality data to Hospital Episode Statistics (HES) data produced by the NHS Information Centre.

2.2 Analysis

Statistics reproduced in this report include:

- absolute numbers
- proportions
- directly standardised rates (derived using the European Standard Population)
- mean events (admissions) per patient.

2.3 Disease categories

A taxonomy for the classification of cardiovascular diseases into specific disease categories was devised for the analysis and has been used consistently throughout this report. The categories are defined as follows:

- all circulatory diseases as defined by Chapter IX of the International Classification of Diseases, tenth issue (ICD-10)
- all cardiovascular diseases including the categories below:
 - abdominal aortic aneurysm and dissection
 - cerebrovascular diseases, including stroke, transient ischaemic attacks and other cerebral haemorrhages
 - acute coronary heart disease
 - cardiac arrhythmias including atrial fibrillation
 - chronic coronary heart disease, including heart failure, angina and other chronic ischaemic heart diseases
 - congenital heart disease
 - vascular dementia exclusive of other forms of dementia.

The single 'underlying' cause of death for each patient is determined from the death certificate by the ONS and coded using the ICD-10 system (World Health Organisation (WHO), 2007). The underlying cause of death is defined by the World Health Organisation WHO as "the disease or injury that initiated the train of events directly linked to death; or the circumstances of the accident or violence that produced the fatal injury" and is the cause of death data recorded on a death certificate.

The table below shows the ICD-10 codes used for each defined disease category:

Category	ICD-10 Code
All circulatory diseases	All I codes
All cardiovascular diseases	All codes listed below (i.e. all I codes plus other codes)
<i>Abdominal aortic aneurysm (AAA)</i>	I71
<i>Acute coronary heart disease</i>	I12 - I14; I30; I40; I44; I46
<i>Cardiac arrhythmias</i>	I47 - I49
<i>Cerebrovascular disease</i>	G45; I60 - I64; I66 - I67; I69
<i>Chronic coronary heart disease</i>	I05 - I11; I13; I20; I25; I31; I34 - I36; I38; I42; I45; I50 - I51; I70; I95
<i>Congenital heart disease</i>	Q20 - Q26
<i>Vascular dementia</i>	F01
<i>Other circulatory diseases</i>	I00 - I12; I15; I26 - I28; I37; I72 - I74; I77 - I78; I80 - I89; I99

Note: All four digit codes are included in the three digit codes given in the table.

The term 'circulatory diseases' is used specifically in this report where all codes from Chapter IX of the ICD-10 system have been included in the analysis (all I codes). This is to ensure consistency with other reports. The term 'cardiovascular diseases' includes all circulatory diseases (I codes) plus all other disease codes listed in the table above, including those for congenital heart disease, transient ischaemic attacks and vascular dementia. As the numbers in these latter categories represent a small proportion of all cardiovascular disease deaths, the values of the 'circulatory diseases' and 'cardiovascular diseases categories' are similar.

See Appendix 1 for a further explanation of the taxonomy used in this report.

2.4 Place of death

For the purposes of this report, place of death is categorised as follows:

- Hospital: All acute and community hospitals/units but not psychiatric hospitals or institutions.
- Home: the death occurred in the place of usual residence where this is not a communal establishment.
- Care home: Local Authority/private residential home or NHS/private nursing home.
- Hospice: many hospices are 'free standing' but some are found within NHS hospitals. At present ONS classifies the place of death as hospice only when the event occurred in a free standing hospice premises. These data will therefore under-report deaths in hospices as some will be recorded as a death in hospital.
- Other places: other communal establishment (including psychiatric hospitals) or a private address other than normal place of residence or outdoor location or nil recorded.

Additionally, the term 'deaths in usual place of residence' (DiUPR) is used within this report and is consistent with the definition used for the quality indicator of the same name – specifically deaths reported in 'home' and 'care' home settings as defined above.

2.5 Analysis by deprivation quintile

Lower Super Output Areas (LSOAs) are small geographical areas specifically devised to improve the reporting and comparison of local statistics. In England there are 32,482 LSOAs (minimum population 1,000). The Index of Multiple Deprivation (IMD 2007) is a measure of how deprived each LSOA is, based on income, employment, health deprivation, education, skills, training and geographical access to services. LSOAs are grouped into quintiles (fifths) according to the rank of their deprivation score such that each quintile has an equal resident population.

The residential postcode recorded on the death certificate was used to place each deceased person in an LSOA and assign that death to the deprivation quintile of the LSOA.

2.6 ICD-10 v2010

In 2011 the ONS updated the classification system it uses to assign underlying cause of death from ICD-10 v2001.2 to v2010. Changes to the coding rules have had a slightly disproportionate effect on the mortality statistics for some disease groups, including a number of categories discussed in this report (ONS, 2011).

A summary of the statistical impact is provided below:

- The total number of deaths attributed to circulatory diseases in 2011 (ICD-10 Chapter IX) has reduced by 5% when compared to the number calculated using the previous version of the software. This is due to a change in the coding rules for cardiomyopathy (I42), heart failure (I50) and cerebrovascular diseases (I60–I69). This is illustrated by an accelerated reduction in the proportion of deaths attributed to circulatory diseases when compared to other major disease groups, most noticeably cancer which now represents a higher overall fraction (see figure 1b).
- There has been a correction to the coding of vascular dementia which was assigned the underlying cause cerebrovascular disease (I67.9) in ICD–10 v2001.2, but is corrected to vascular dementia (F01) in ICD–10 v2010. This contributes to the reduction in the proportion of deaths attributed to circulatory diseases, but also to an apparent tenfold rise in deaths due to vascular dementia (see figures 2 and 10).

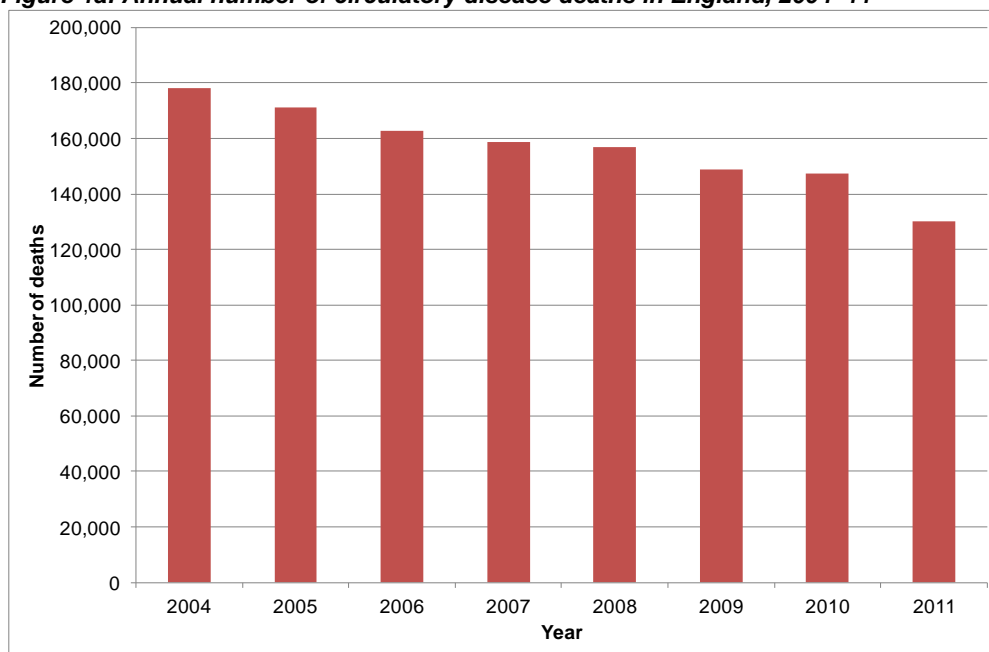
Whilst this update appears to show anomalous findings for 2011 in the mortality trend data in this report, the change is an improvement to the way in which underlying cause of death is recorded for circulatory diseases. Further information is available on the ONS website in a Statistical Bulletin titled 'Results from the ICD–10 v2010 bridge coding study (ONS, 2011).

3 Results

3.1 The number of deaths from all circulatory diseases

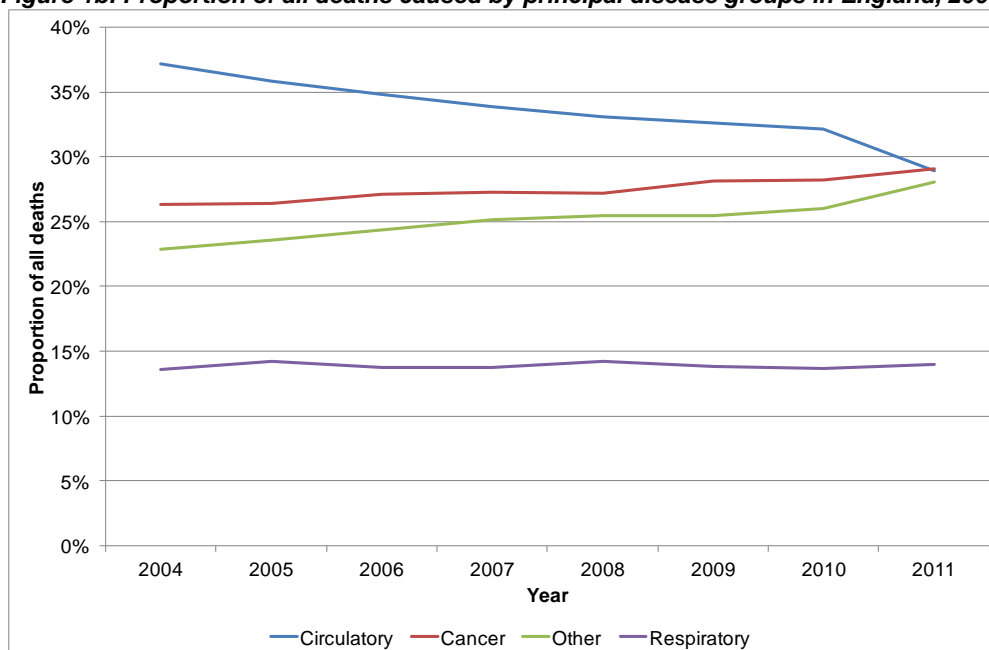
The number of deaths from all circulatory diseases in England has declined consistently each year from 178,067 in 2004 to 130,192 in 2011. This is an overall reduction of 23% over eight years as illustrated in Figure 1a. The proportion of all circulatory disease deaths has also reduced consistently over this period (see Figure 1b) and is shown to be less than the proportion attributable to cancer in 2011 (28.9% compared to 29.1%).

Figure 1a: Annual number of circulatory disease deaths in England, 2004–11



Source: Office for National Statistics mortality data

Figure 1b: Proportion of all deaths caused by principal disease groups in England, 2004–11

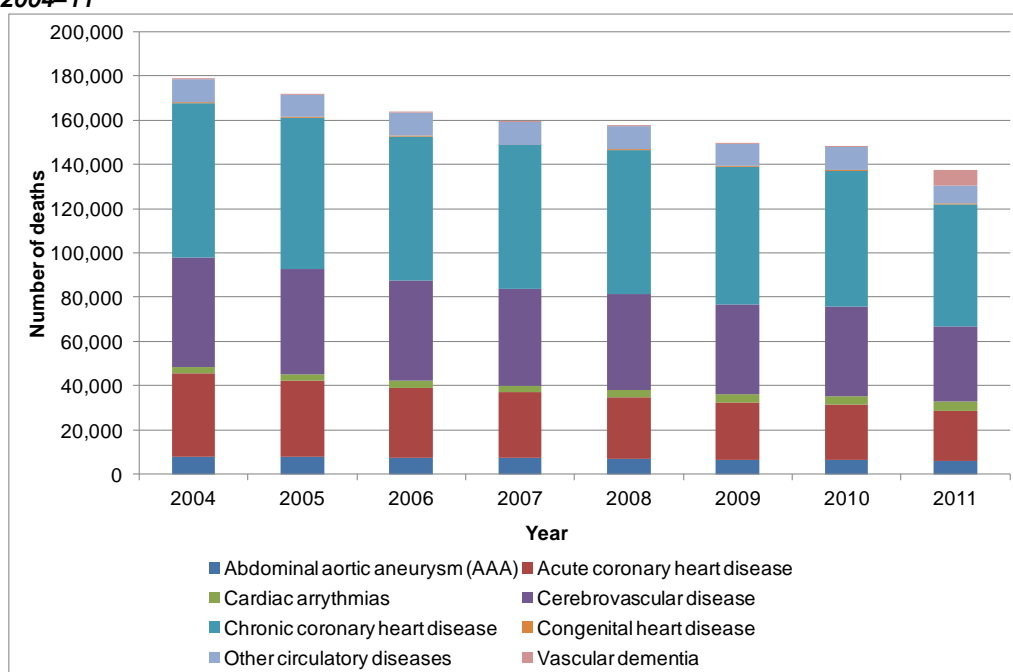


Source: Office for National Statistics mortality data

Figure 2 shows the annual number of deaths across the same period divided into disease categories. It shows that:

- the number of deaths from abdominal aortic aneurysms, acute cerebrovascular disease, acute coronary heart disease, chronic coronary heart disease and congenital heart disease have all decreased in line with the overall trend for cardiovascular diseases as a whole
- the number of deaths from cardiac arrhythmias increased over the same period (from 2,845 in 2004 to 4,179 in 2011)
- the number of deaths recorded with vascular dementia as an underlying cause of death has also increased (from 122 in 2004 to 628 in 2010 then 6,814 in 2011). A change to the coding of deaths with an underlying cause of vascular dementia is discussed in detail in section 2.6 of this report.

Figure 2: Annual number of cardiovascular disease deaths by disease category in England, 2004–11



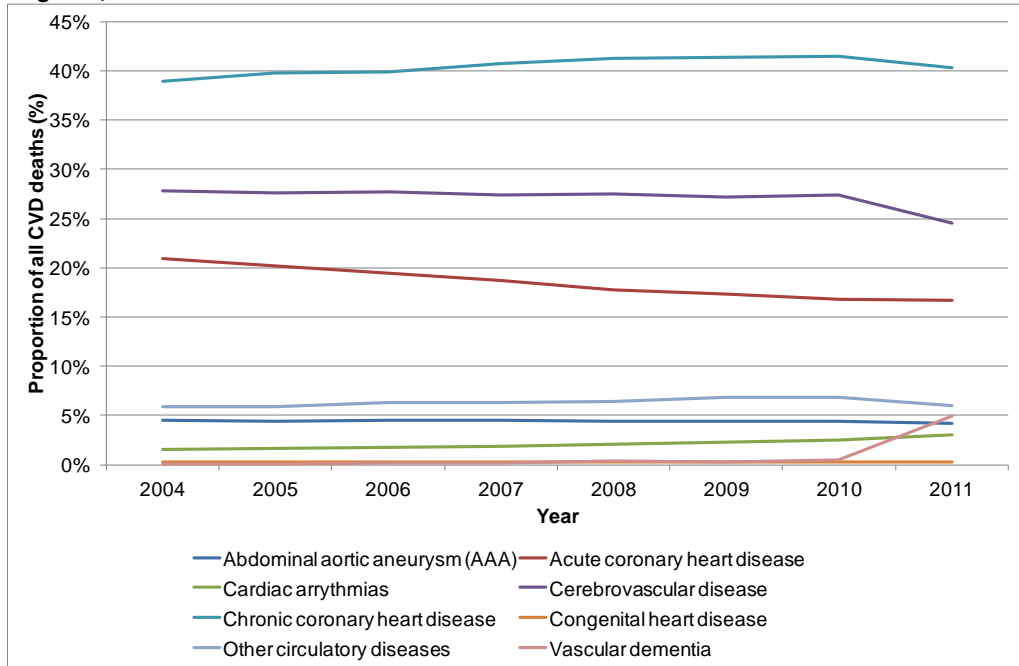
Source: Office for National Statistics mortality data

Figures 3 and 4 show the change in the number of deaths by cardiovascular disease category as a proportion of all cardiovascular deaths and all deaths respectively, further illustrating the relative reduction over time.

Figure 3 shows that the proportion of cardiovascular disease deaths attributable to chronic coronary heart disease has increased steadily since 2004, most likely due to improved health care and survival rates of patients following acute cardiovascular events. This finding is reinforced by a corresponding reduction in the proportion of cardiovascular deaths due to acute coronary heart disease, shown in the same chart.

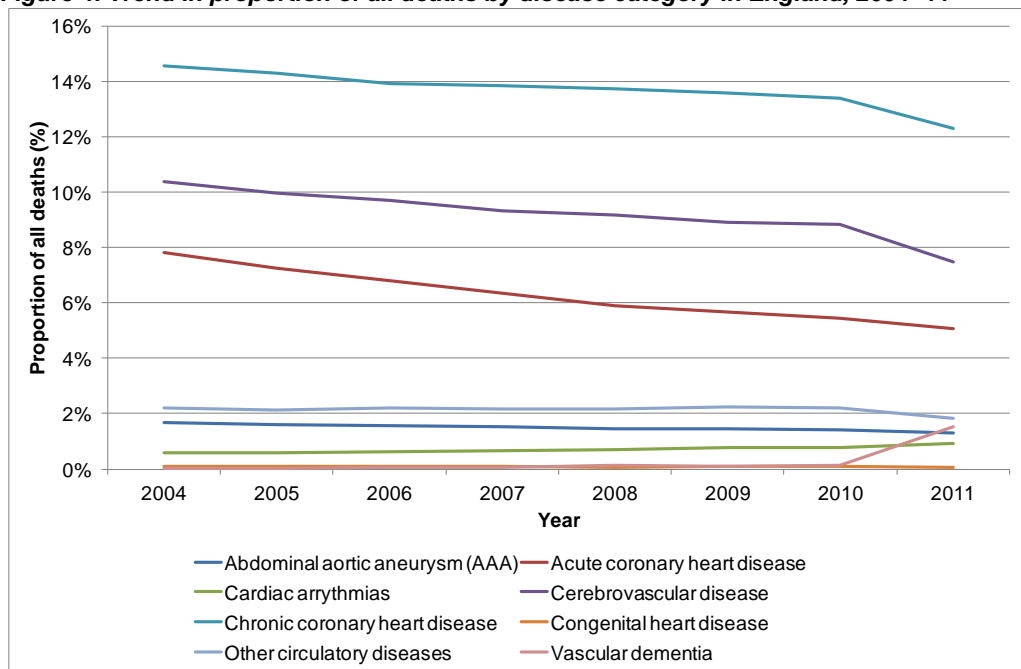
However, despite the relative increase in chronic coronary heart disease deaths, the overall contribution of cardiovascular diseases to all cause mortality has decreased over time (from 14.5% in 2004 to 12.3% in 2011) (Figure 4).

Figure 3: Trend in proportion of all cardiovascular disease deaths by disease category in England, 2004–11



Source: Office for National Statistics mortality data

Figure 4: Trend in proportion of all deaths by disease category in England, 2004–11



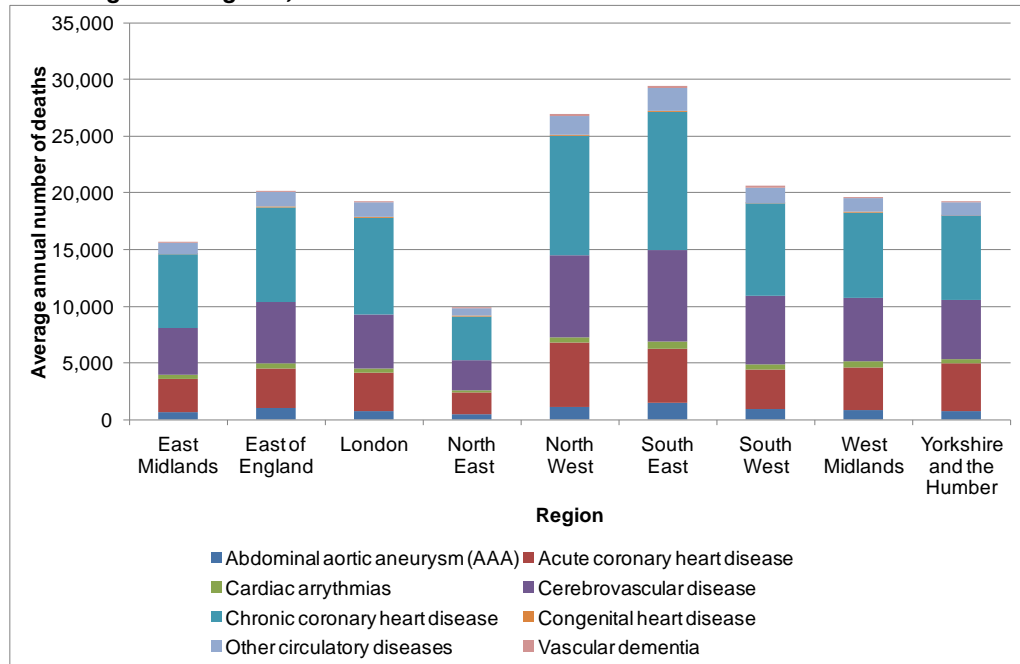
Source: Office for National Statistics mortality data

3.2 Regional variation

Regional variation was analysed by calculating both the number and standardised rates for each disease category by former Government Office Region. Although these areas no longer represent administrative boundaries in England, they are epidemiologically useful for this analysis.

Figure 5 shows the variation in cardiovascular disease deaths by disease category and region between 2004 and 2011. It highlights the large number of deaths in the North West and South East of England.

Figure 5: Average annual number of deaths by disease category and former Government Office Region in England, 2004–11



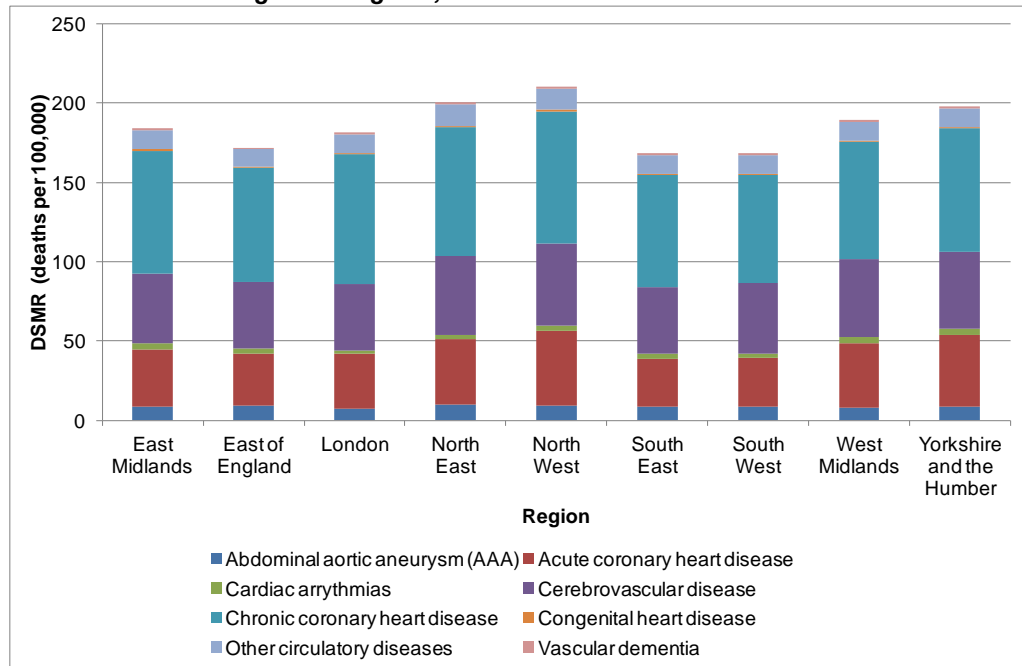
Source: Office for National Statistics mortality data

The variation shown in Figure 5 can be partly explained by the variation in resident population and demographic distribution in each region.

Direct standardisation is a tool used to control for these differences by applying the age and sex specific rates in each region to a single standard population.

Figure 6 shows the directly standardised mortality rates (DSMRs) for each former Government Office Region, broken down by disease category. It shows less profound variation between regions than that shown in Figure 4, but highlights higher overall rates in the North West of England, Yorkshire and the Humber and the North East of England.

Figure 6: Directly standardised mortality rate (DSMR) by cause of death and former Government Office Region in England, 2004–11



Source: Office for National Statistics mortality data

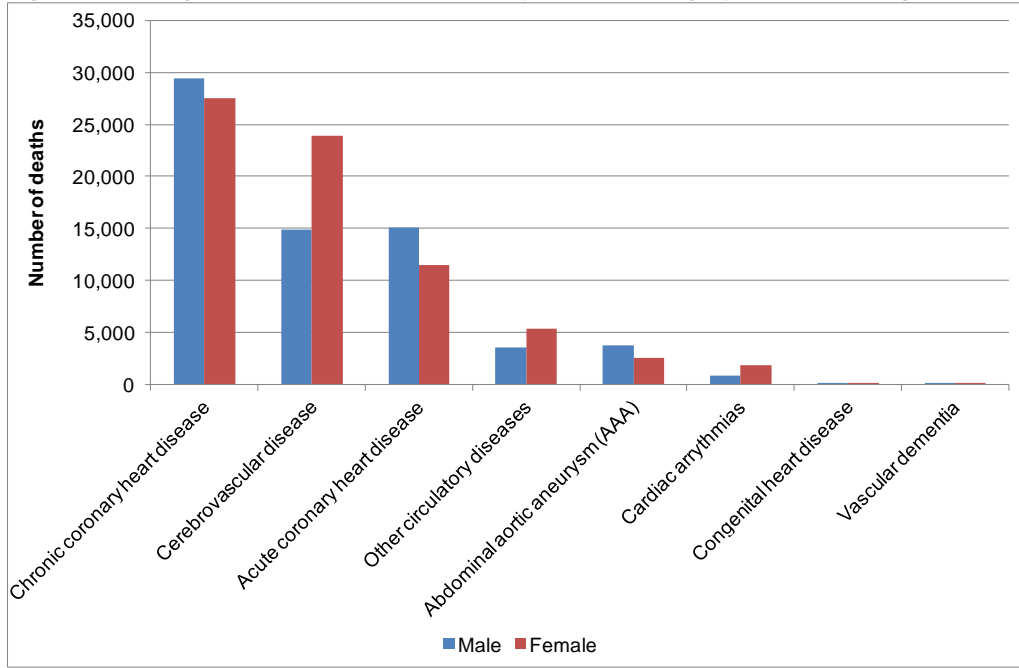
3.3 Variation by sex

Figure 7 shows the average annual number of deaths for each disease category by sex: and highlights that:

- more men die of acute and chronic coronary heart disease than women
- more women die of acute cerebrovascular disease (stroke and transient ischaemic attacks) and cardiac arrhythmias than men.

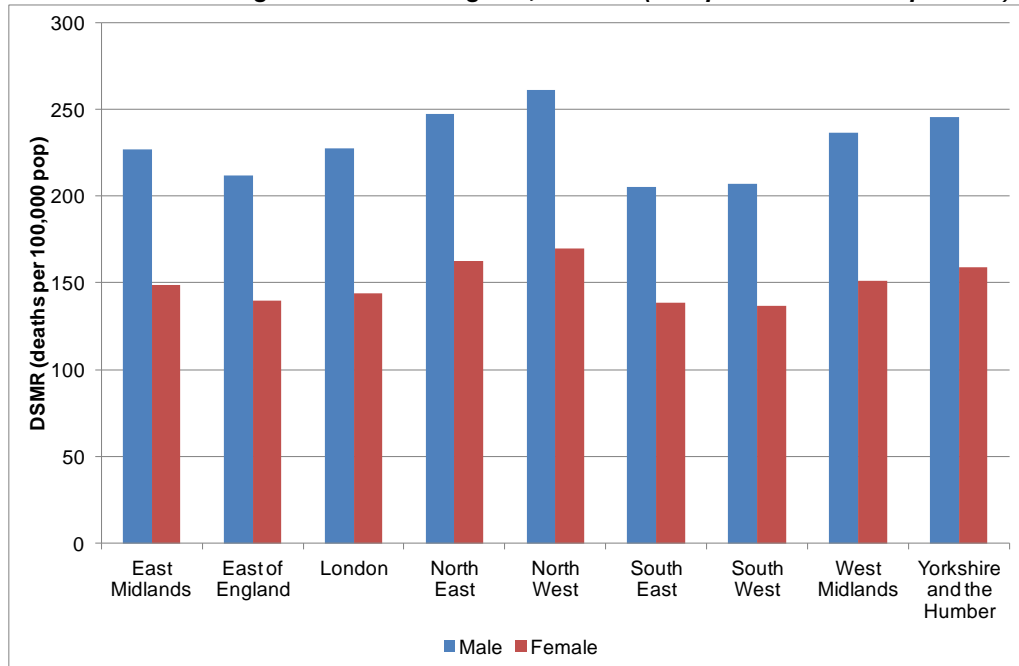
Figure 8 shows directly standardised mortality rates for males and females in each region, clearly illustrating consistently higher mortality rates for men than women across all cardiovascular disease deaths.

Figure 7: Average annual number of deaths by disease category and sex in England, 2004–11



Source: Office for National Statistics mortality data

Figure 8: Directly standardised mortality rate (DSMR) for cardiovascular diseases by former Government Office Region and sex in England, 2004–11 (European Standard Population)

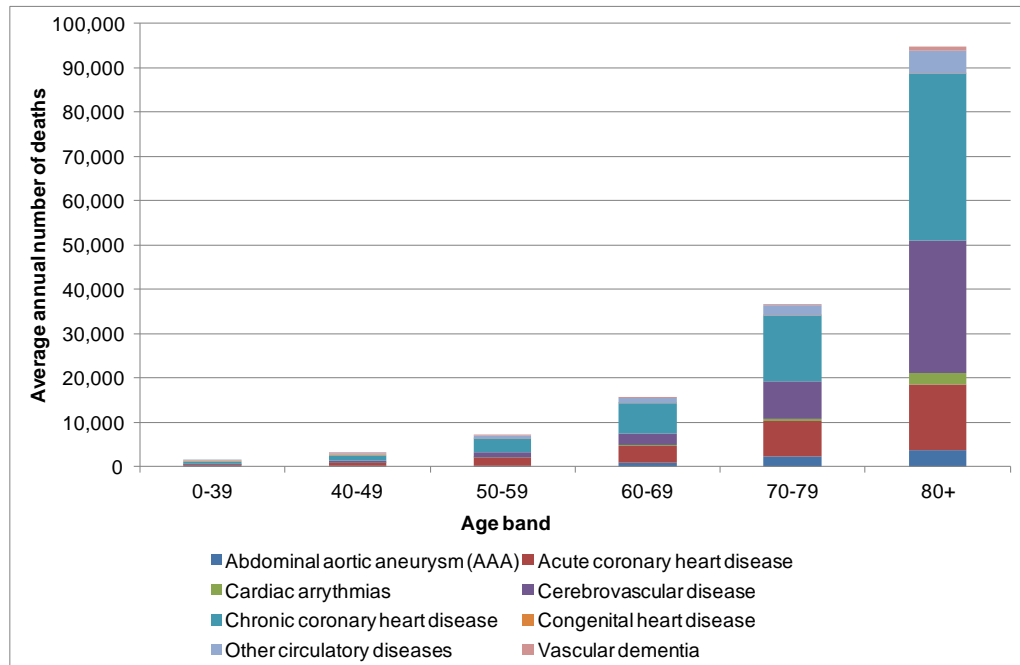


Source: Office for National Statistics mortality data

3.4 Variation by age at death

Figure 9 shows the average annual number of cardiovascular disease deaths by age band and disease category, emphasising the clear relationship between cardiovascular mortality and age. Note that not all age bands are equal in the number of years they span.

Figure 9: Average annual number of deaths by disease category and age band for England, 2004–11

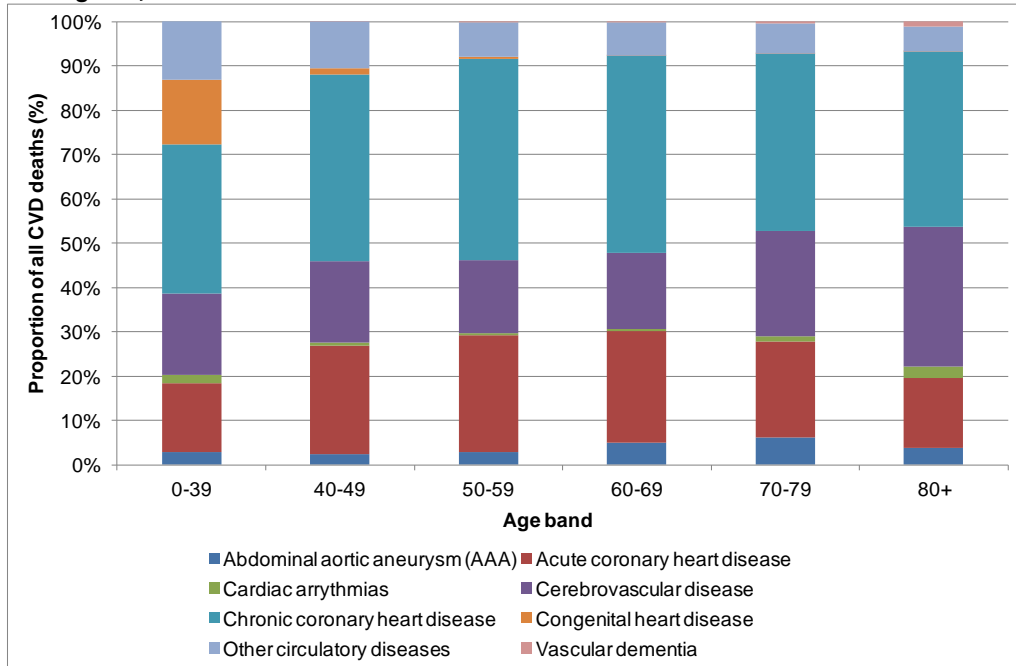


Source: Office for National Statistics mortality data

Figure 10 uses the same data to show the number of deaths in each disease category as a proportion of all cardiovascular disease deaths in each age band. It shows that:

- the largest proportion of deaths from acute coronary heart disease occurs in those aged 40–49 and 50–59
- the largest proportion of deaths from acute cerebrovascular diseases occurs in those aged 80+
- the largest proportion of deaths from congenital heart disease occurs in the youngest age group (0–39), an inverse association with age.

Figure 10: Proportion of all cardiovascular disease deaths by disease category and age band for England, 2004–11

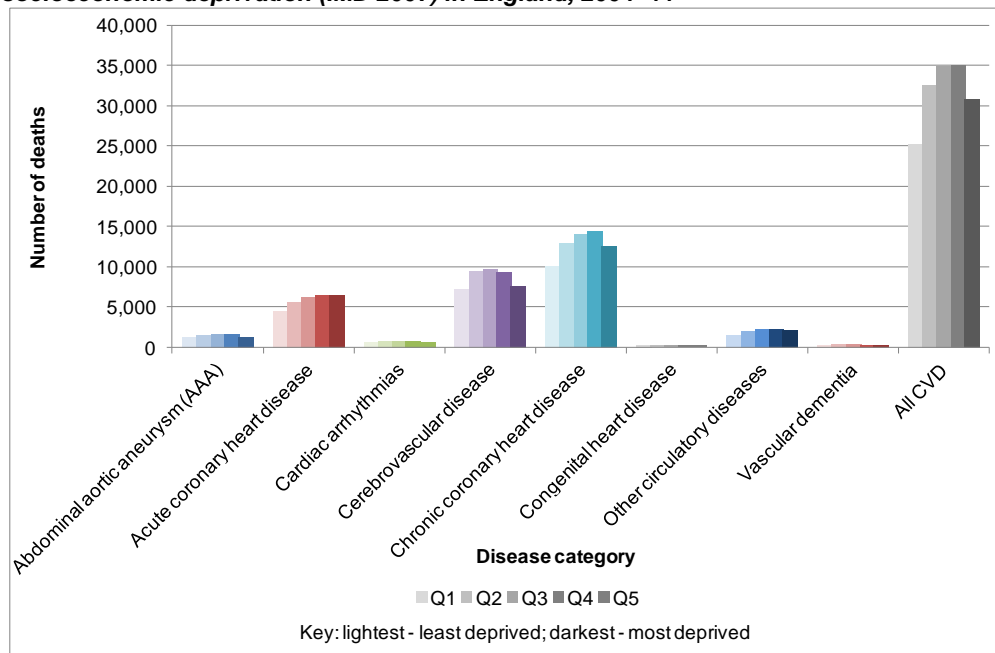


Source: Office for National Statistics mortality data

3.5 Variation by deprivation

Figure 11 shows the distribution of deaths across the quintiles of socioeconomic deprivation in each disease category, where Q1 is the least deprived quintile and Q5 is the most deprived quintile. Note that the distribution of age within each quintile of socioeconomic deprivation is not constant.

Figure 11: Average annual number of deaths by disease category and quintile of socioeconomic deprivation (IMD 2007) in England, 2004–11



Source: Office for National Statistics mortality data

It shows:

- no obvious social gradient for abdominal aortic aneurysms or cardiac arrhythmias
- evidence of a social gradient for acute coronary heart disease
- some evidence of a social gradient for chronic coronary heart disease, potentially offset by the age distribution in the most deprived quintile.

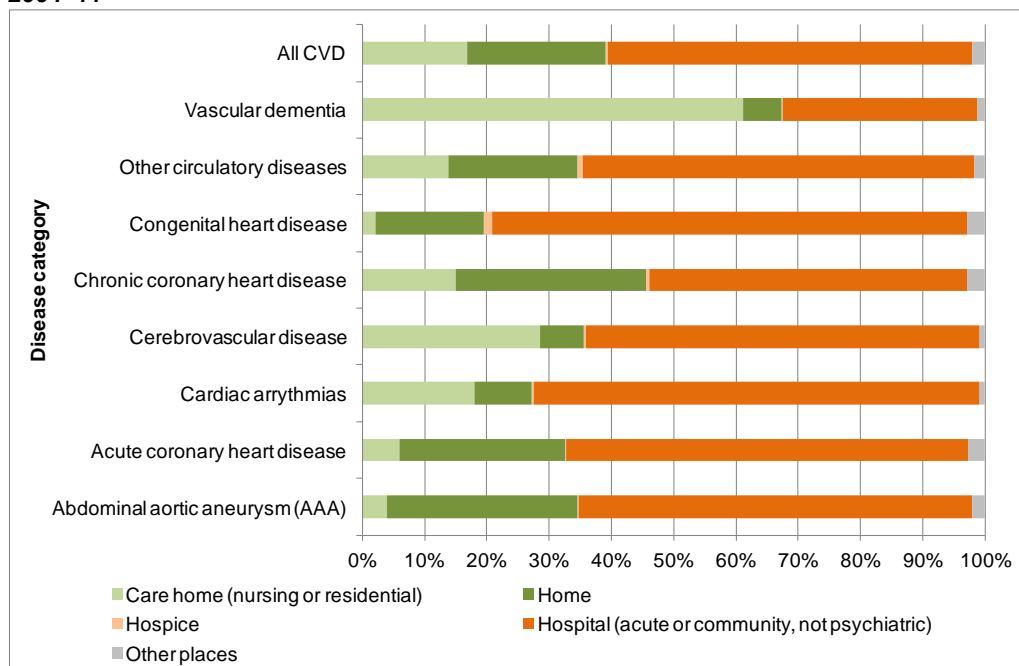
3.6 Variation in place of death

Place of death is particularly important for end of life care planning.

Figure 12 shows the differences in place of death by disease category:

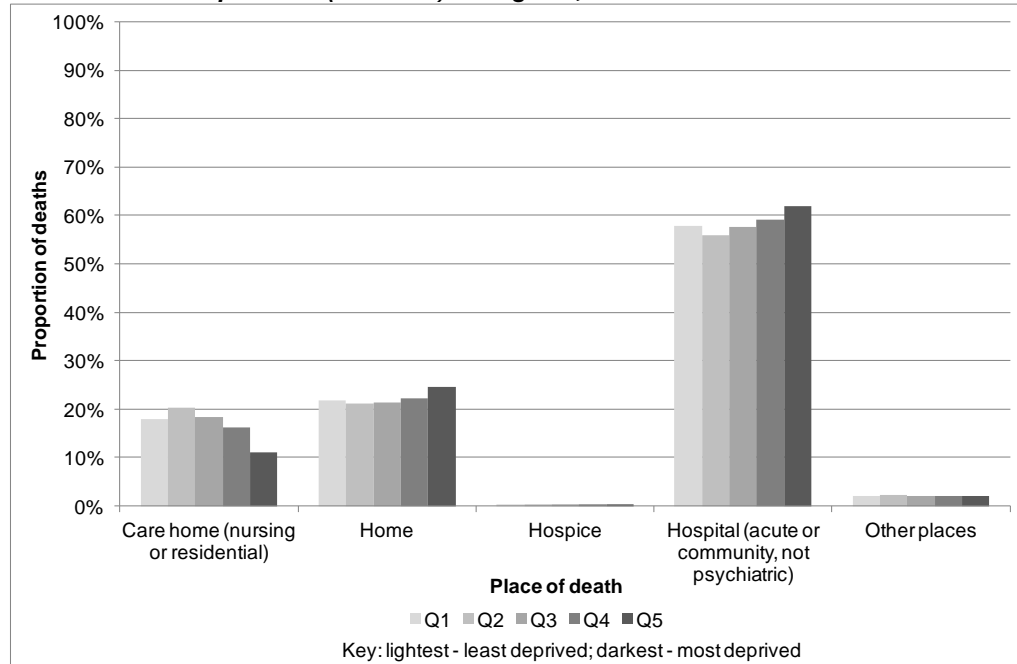
- a large proportion of cardiovascular disease deaths occur in hospital (59%), followed by home (22%), care home (17%), other (2%) and then hospice (less than 1%)
- the disease categories with the highest proportions of deaths at home are chronic (31%) and acute (27%) coronary heart disease and abdominal aortic aneurysms (31%)
- the majority of deaths recorded with an underlying cause of vascular dementia occur in a care home.

Figure 12: Proportion of all deaths in each disease category by place of death in England, 2004–11



Source: Office for National Statistics mortality data

Figure 13: Proportion of cardiovascular disease deaths by place of death and quintile of socioeconomic deprivation (IMD 2007) in England, 2004–11



Source: Office for National Statistics mortality data

Figure 13 shows the proportion of cardiovascular disease deaths by place of death and quintile of socioeconomic deprivation (where Q1 is the least deprived quintile and Q5 is the most deprived quintile). Note that the sum of proportions in each quintile totals 100%.

This result is consistent with previous analyses (National End of Life Care Intelligence Network, 2012c) and confirms that:

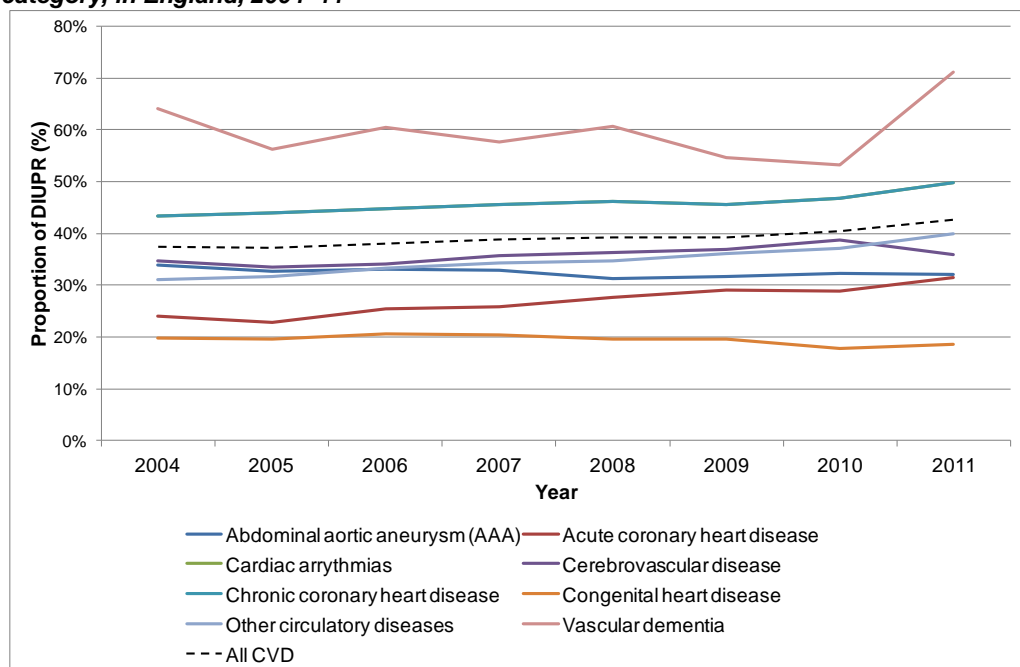
- as with other principal causes of death (cancer, respiratory and other), the highest proportion of cardiovascular disease deaths in hospital occurs in the most socioeconomically deprived quintile
- the gradient observed for deaths at home is the inverse of that observed for cancer patients (i.e. fewer cardiovascular disease deaths occur at home)
- the proportion of cardiovascular disease deaths occurring in a hospice is low for all quintiles of deprivation (less than 0.5%).

See Appendix 2 for further analysis of place of death by quintile of socioeconomic deprivation and disease category.

Figure 14 shows the trend in the proportion of deaths in usual place of residence (DIUPR) for each disease category. It shows:

- the disease category with the largest overall increase in the proportion of deaths in usual place of residence is other circulatory diseases
- an increase in the proportion of deaths in usual place of residence for acute coronary heart disease, chronic coronary heart disease (which includes patients with heart failure), cardiac arrhythmias and vascular dementia
- little change in the proportion of deaths in usual place of residence for all cardiovascular disease deaths, as well as deaths attributed to abdominal aortic aneurysm, acute coronary heart disease, acute cerebrovascular diseases and congenital heart disease
- a high degree of variability in the proportion of vascular dementia deaths in usual place of residence which can be partially explained by the low numbers of deaths in this category and the changes to coding practices discussed in section 2.6.

Figure 14: Trend in the proportion of deaths in usual place of residence (DIUPR) by disease category, in England, 2004–11



Source: Office for National Statistics mortality data

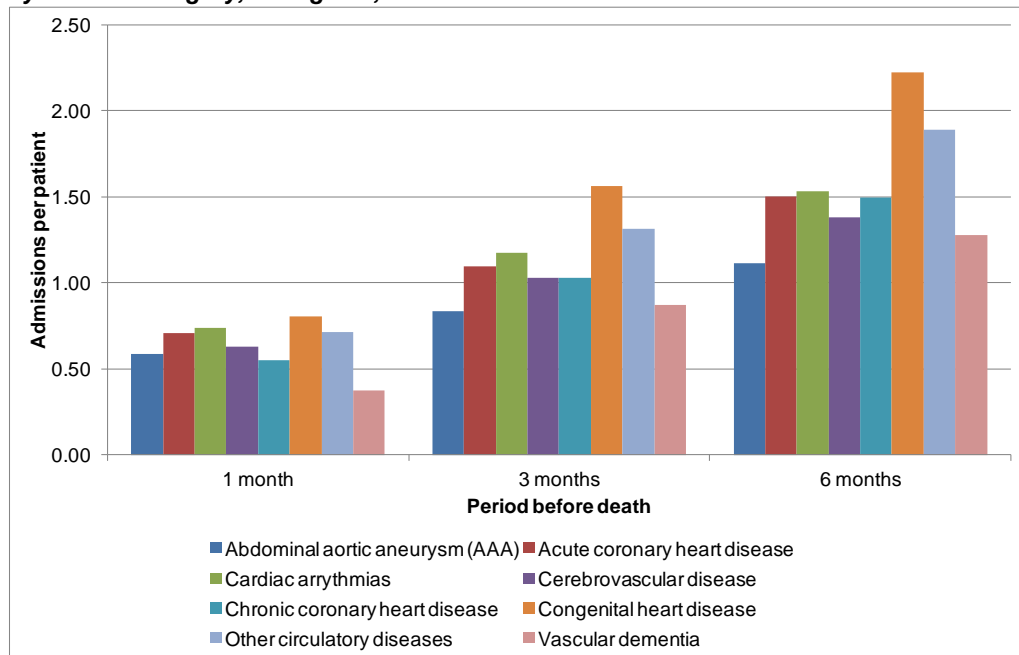
3.7 Hospital admissions

Figure 15 shows the mean number of hospital admissions per patient in each disease category for the period 2004–08 (the period for which linked mortality and hospital admissions data were available).

It should be noted that:

- admissions include all emergency and planned admissions
- values at each interval are cumulative (i.e. admissions at 3 months include those for 1 month and at 6 months those for 3 months)
- the mean hides a wide range of values. This is illustrated in Figure A3 (Appendix 3), which shows a range of 0 to 20 for the number of admissions in the last month of life
- other than congenital heart disease, the highest mean numbers of admissions were consistently for patients whose underlying cause of death was 'other circulatory diseases' – a group which includes peripheral arterial disease.

Figure 15: Mean number of hospital admissions per patient in the last 1, 3 and 6 months of life by disease category, in England, 2004–08



Source: *Linked Hospital Episode Statistics and Office for National Statistics mortality data*

3.8 Comorbidities

End of life care provision requires a holistic, patient-centred, multidisciplinary approach. However, clinical guidance and funding may be disease specific. It is therefore important to recognise that patients with multiple conditions are likely to have complex end of life care needs.

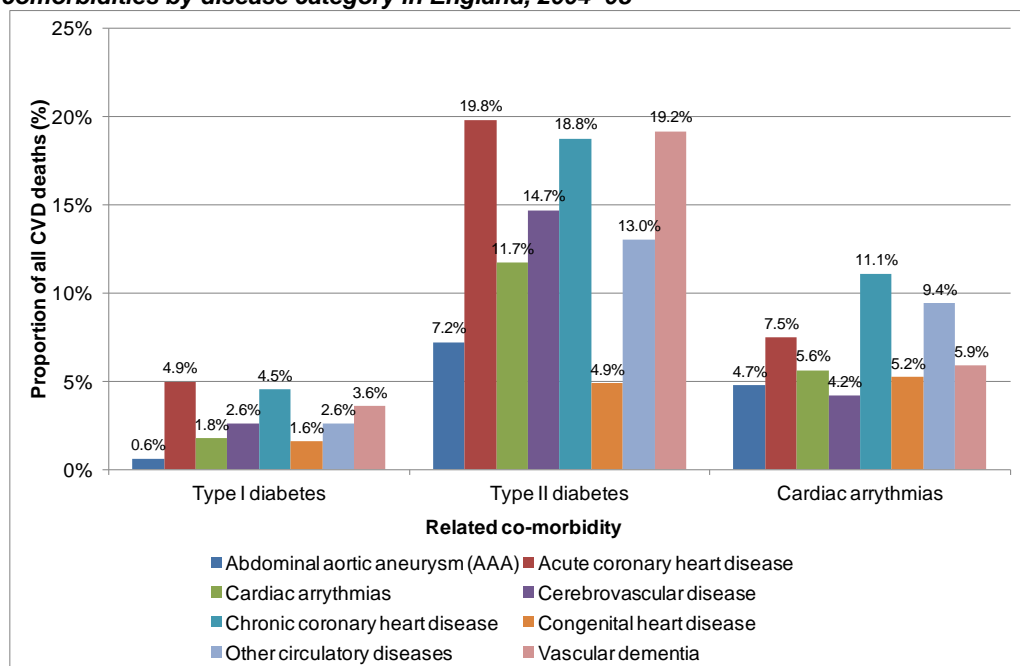
Figure 16 shows the proportion of patients in each disease category that had a record of one of the following related comorbidities on their hospital records:

- Type I diabetes
- Type II diabetes
- Cardiac arrhythmias.

It shows that:

- diabetes was most commonly mentioned on the records of patients whose underlying cause of death was acute or chronic coronary heart disease or vascular dementia
- 11% of all patients dying of chronic coronary heart disease (including heart failure) also had a mention of cardiac arrhythmia on their hospital record.

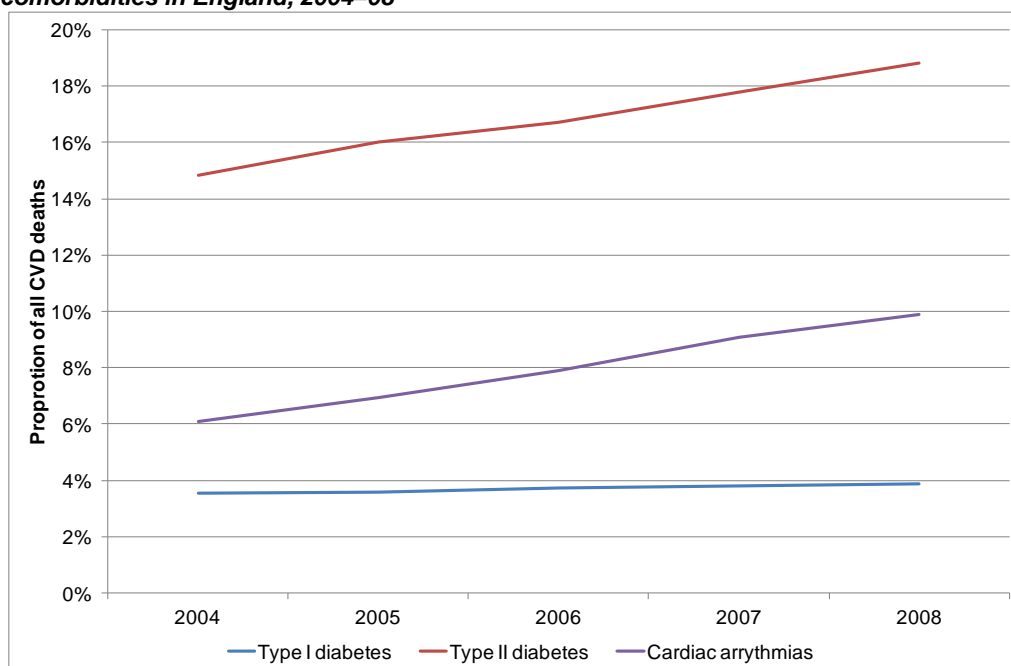
Figure 16: Proportion of cardiovascular disease deaths with mentions of related comorbidities by disease category in England, 2004–08



Source: Linked Hospital Episode Statistics and Office for National Statistics mortality data

Figure 17 shows how the trend in comorbidities has changed over time. It shows a clear, gradual increase in the proportion of patients dying of cardiovascular diseases with hospital records showing a diagnosis of Type II diabetes. This is consistent with a known increase in population prevalence for this condition. A similar increase is also observed for cardiac arrhythmias. However, the increase for Type I diabetes is far less pronounced, as would be expected for a hereditary disease.

Figure 17: Trend in the proportion of cardiovascular disease deaths with mentions of related comorbidities in England, 2004–08



Source: Linked Hospital Episode Statistics and Office for National Statistics mortality data

4 Conclusions and recommendations

4.1 Conclusions

This report provides a useful and descriptive overview of the current trends in mortality from cardiovascular diseases, including circulatory diseases, congenital heart disease and vascular dementia. Based on the results of the analysis, this report concludes that:

- although deaths from cardiovascular diseases as a proportion of all deaths has decreased in recent years and was overtaken by cancer as the leading cause of death in England, the end of life care needs for this patient group is significant
- whilst the proportion of deaths in usual place of residence for cardiovascular disease patients has increased, more work is required to ensure that they are supported to die with dignity in their preferred place of death
- patients who die of cardiovascular diseases may also die with other comorbidities and may therefore have complex end of life care needs
- cardiovascular disease is difficult to classify into meaningful categories for analysis using the ICD-10 codes structure alone – the taxonomy developed for this report may be a useful frame of reference for future reports.

4.2 Recommendations

Based on these conclusions, this report recommends that:

- the key findings from this report inform the development of national policy and strategy around cardiovascular diseases and end of life care
- the National End of Life Care Intelligence Network publishes further analyses of cardiovascular disease mortality statistics as they become available.

5 Future investigations

The following future investigations are proposed:

- further analysis of elective and emergency admissions in the last year of life, bed days and cost of hospital stays
- proportion of patients with acute cardiovascular disease and cardiac arrhythmias dying with inserted pacemaker and defibrillator devices and subsequent implications for advance care planning
- variation in the prevalence of heart failure in England and the implications for end of life care planning
- comparison of modelled indicators of end of life care need for cardiovascular disease patients against spend on palliative and supportive care.

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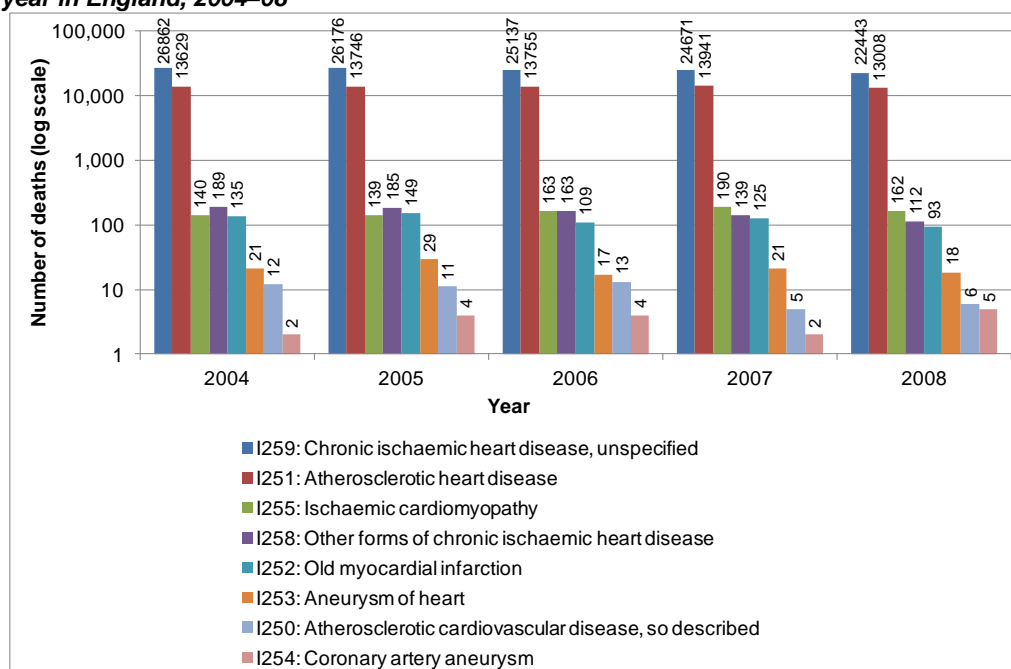
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Appendix 1: Taxonomy

A preliminary taxonomy for the classification of disease categories for cardiovascular diseases used the definitions outlined in the table below. However, the number of deaths within the 'Other ischaemic heart disease' category suggested that this was not an appropriate unit for analysis (see Figure A1, noting log scale on vertical axis). Subsequent discussions around the usefulness of 'chronic' as opposed to 'acute' coronary heart disease determined that the taxonomy outlined in section 2.3 would be more appropriate – this has subsequently been applied through this report.

Category	ICD-10 Code
All cardiovascular diseases	All codes listed below
Abdominal aortic aneurysm (AAA)	I71*
Acute myocardial infarction (AMI)	I21* - I22*
Angina (non-AMI)	I20*
Heart failure	I50*
Other ischaemic heart disease	I24* - I25*
Congenital heart disease	Q20* - Q26*
Transient ischaemic attacks (TIA)	G45*
Stroke	I61*, I63*, I64*
Vascular dementia	F01*

Figure A1: Frequency of deaths from 'other ischaemic heart diseases', by sub-category and year in England, 2004–08

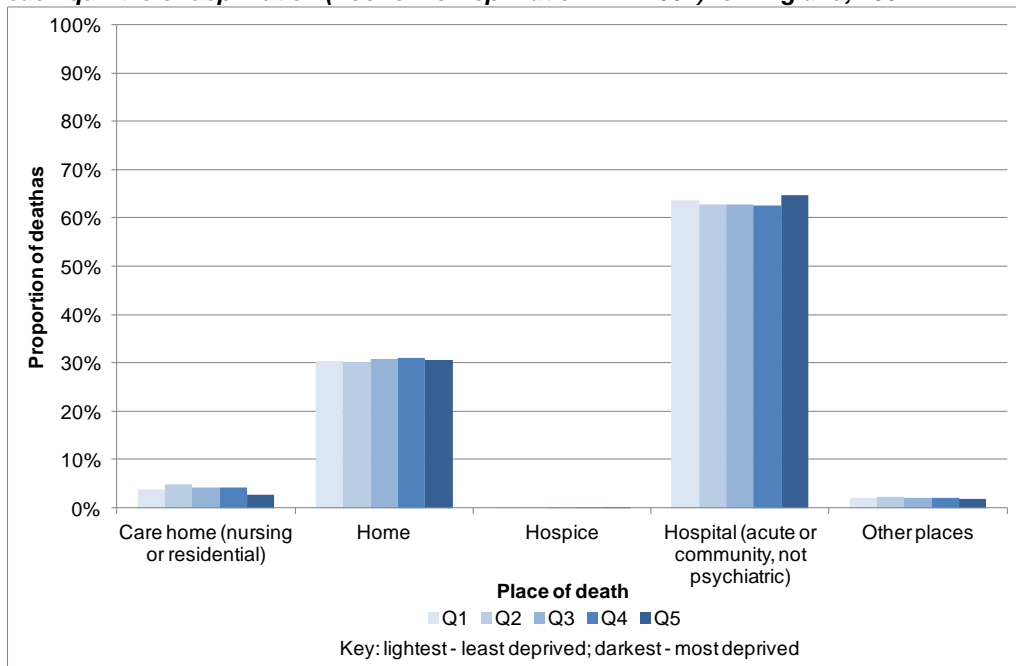


Source: Linked Hospital Episode Statistics and Office for National Statistics mortality data

Appendix 2: Variation in place of death by deprivation and disease category

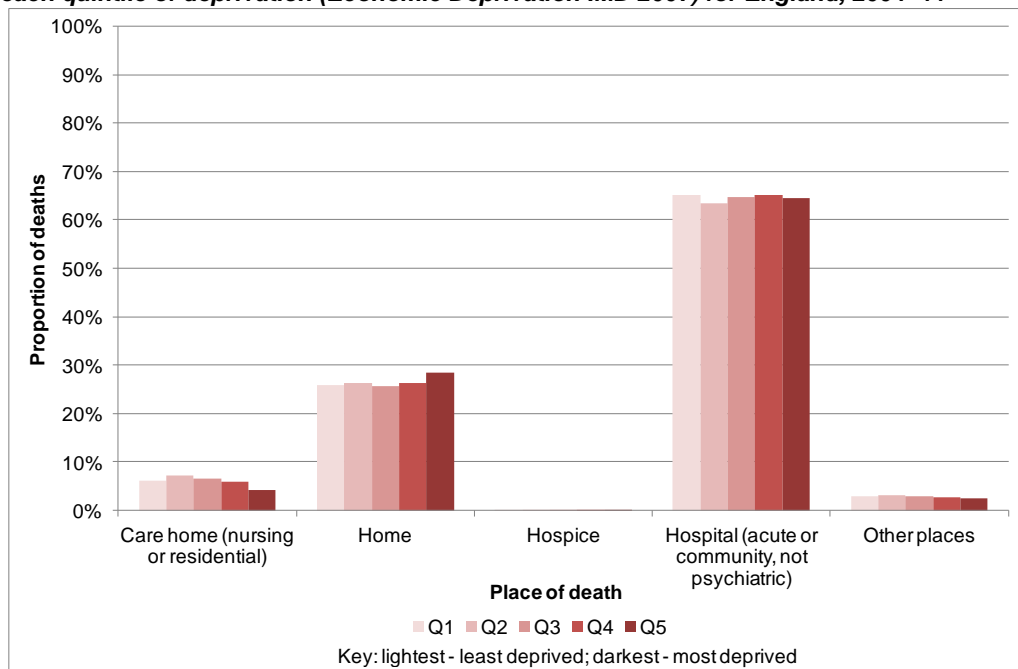
The following charts provide further analysis of variation in place of death described in section 3.6 of the main report.

Figure A2a: Proportion of all deaths from Abdominal aortic aneurysm by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



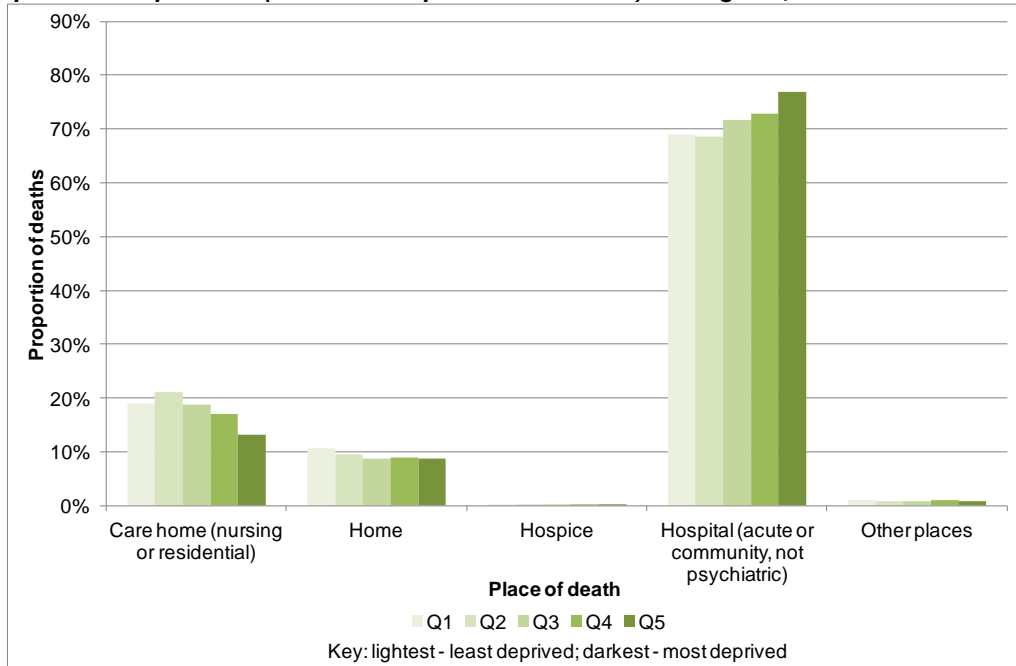
Source: Office for National Statistics mortality data

Figure A2b: Proportion of all deaths from Acute coronary heart disease by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



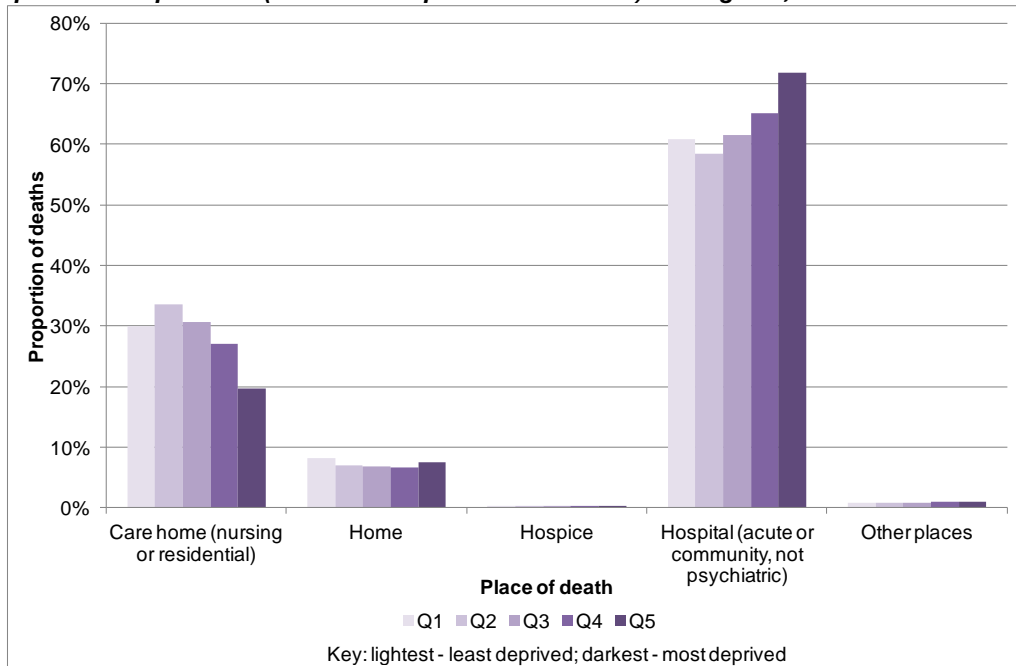
Source: Office for National Statistics mortality data

Figure A2c: Proportion of all deaths from Cardiac arrhythmias by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



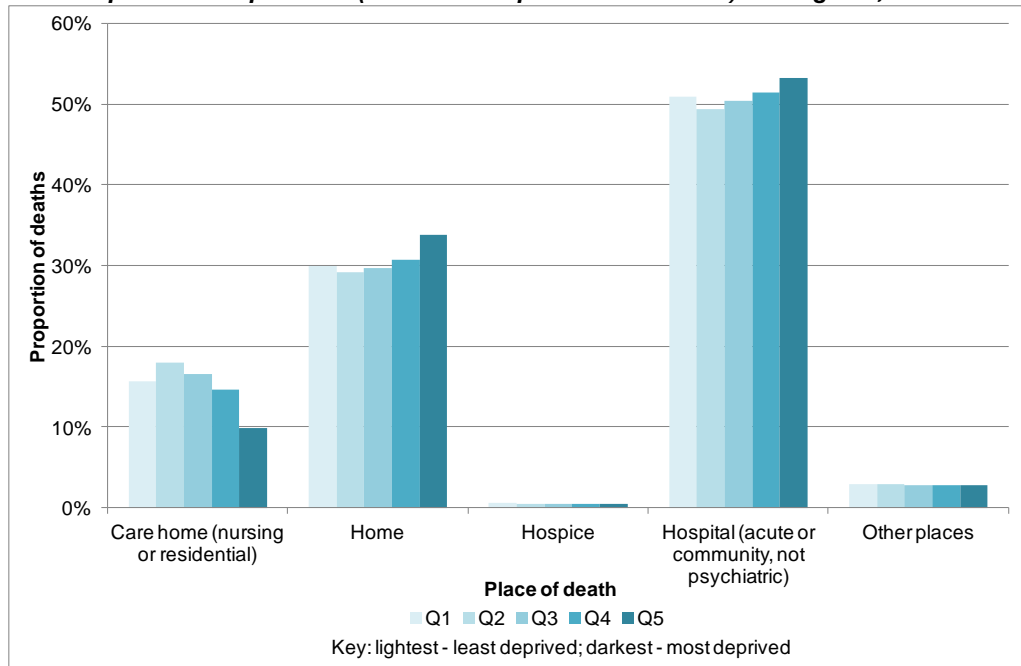
Source: Office for National Statistics mortality data

Figure A2d: Proportion of all deaths from Cerebrovascular disease by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



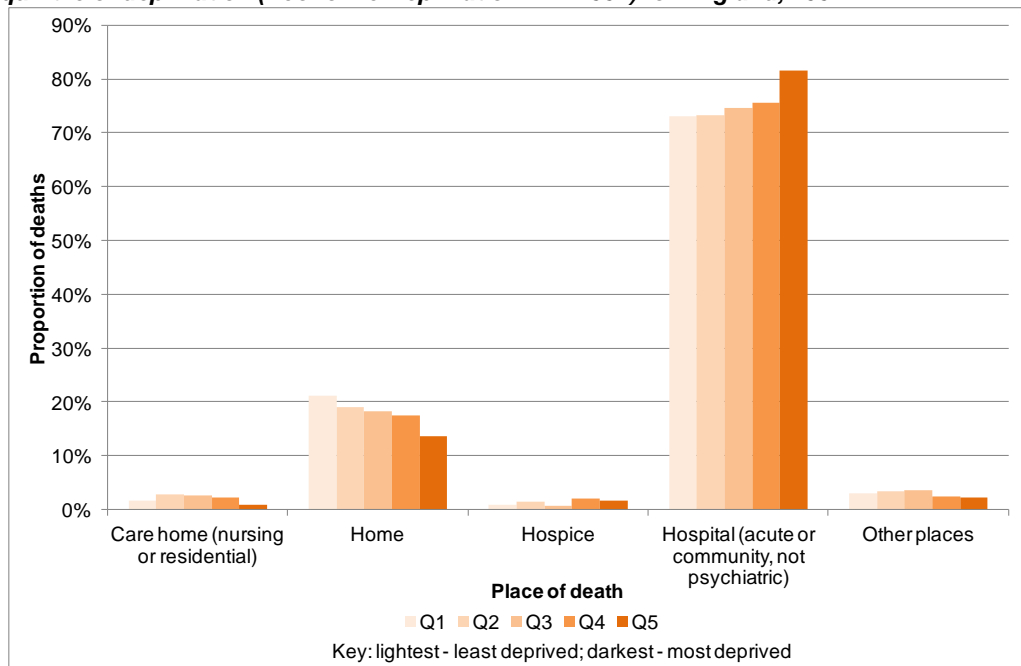
Source: Office for National Statistics mortality data

Figure A2e: Proportion of all deaths from Chronic coronary heart disease by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



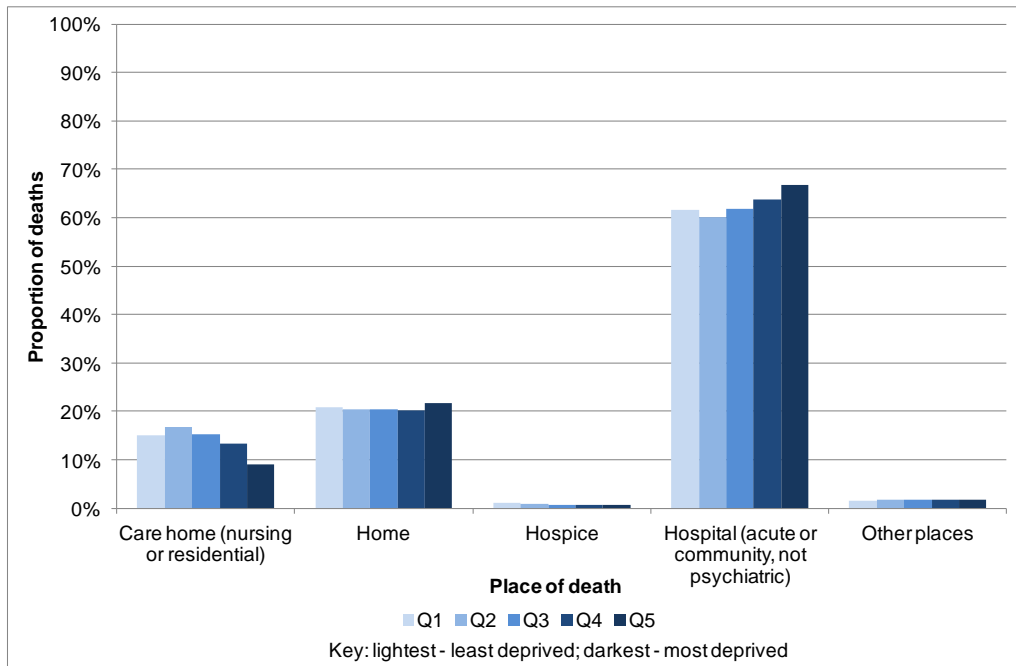
Source: Office for National Statistics mortality data

Figure A2f: Proportion of all deaths from Congenital heart disease by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



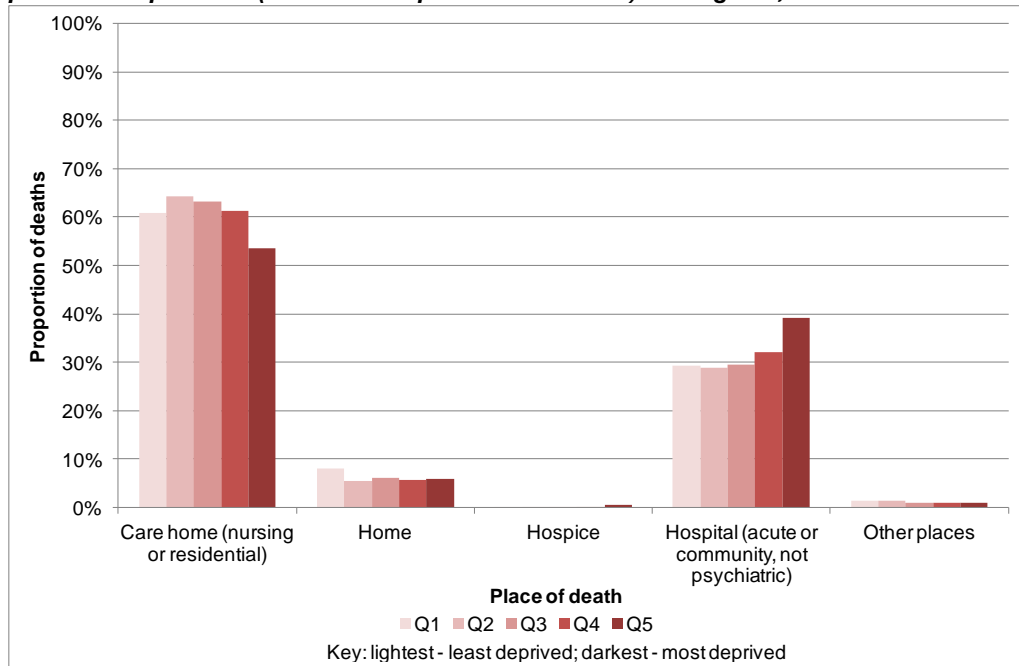
Source: Office for National Statistics mortality data

Figure A2g: Proportion of all deaths from Other circulatory diseases by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



Source: Office for National Statistics mortality data

Figure A2h: Proportion of all deaths from Vascular dementia by place of death for each quintile of deprivation (Economic Deprivation IMD 2007) for England, 2004–11



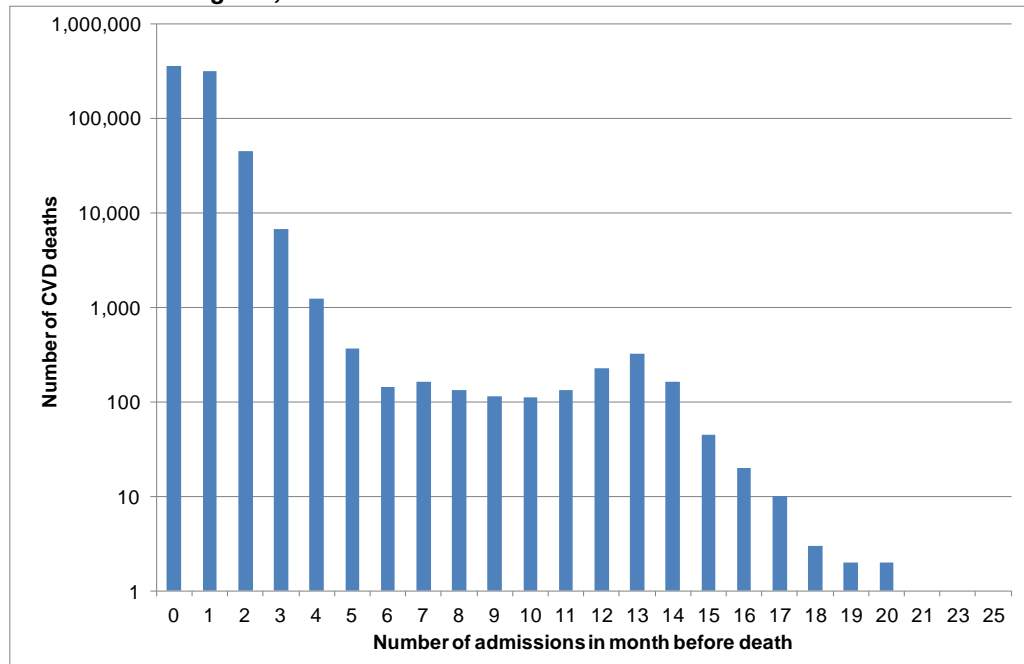
Source: Office for National Statistics mortality data

Appendix 3: Frequency of admissions

Figure A3 shows the frequency distribution of cardiovascular disease deaths by the number of admissions in the last month of life. Note the log scale on the vertical axis.

There are similar distributions for the last three and six months of life.

Figure A3: Frequency of cardiovascular disease deaths by number of admissions in the last month of life in England, 2004–08



Source: Linked Hospital Episode Statistics and Office for National Statistics mortality data

Appendix 4: Data tables

The number of deaths from all circulatory diseases

Table A4.1: Deaths by ICD-10 Chapter in England, 2004–11

ICD-10 Chapter	Year							
	2004	2005	2006	2007	2008	2009	2010	2011
Circulatory diseases	178,067	171,535	163,263	158,833	156,681	148,771	143,554	130,192
Cancer	129,163	129,723	130,159	130,805	131,797	131,267	130,194	131,032
Respiratory diseases	64,992	68,109	64,567	64,961	67,570	62,685	61,192	126,366
Other (number)	106,858	110,017	111,654	115,777	117,151	112,168	105,984	63,180
Total	479,080	479,384	469,643	470,376	473,199	454,891	440,924	450,770

Source: Office for National Statistics mortality data

Table A4.2 Deaths by disease category in England, 2004–11

Category	Year							
	2004	2005	2006	2007	2008	2009	2010	2011
Abdominal aortic aneurysm (AAA)	8,090	7,656	7,400	7,241	6,857	6,590	6,307	5,794
Acute coronary heart disease	37,321	34,673	31,859	29,797	27,882	25,972	24,371	22,912
Cardiac arrhythmias	2,845	2,881	2,920	3,020	3,250	3,489	3,579	4,179
Cerebrovascular disease	49,641	47,674	45,419	43,689	43,384	40,724	40,031	33,732
Chronic coronary heart disease	69,733	68,532	65,453	65,105	65,167	61,932	59,527	55,385
Congenital heart disease	439	449	391	413	364	375	337	340
Other circulatory diseases	10,544	10,246	10,310	10,088	10,237	10,170	9,847	8,255
Vascular dementia	122	186	210	333	579	454	628	6,814
All cardiovascular deaths	178,735	172,297	163,962	159,686	157,720	149,706	144,627	137,411

Source: Office for National Statistics mortality data

Regional variation

Table A4.3: Total number of deaths by disease category and former Government Office Region in England, 2004–11

Category	Former Government Office Region								
	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire and the Humber
Abdominal aortic aneurysm (AAA)	4,828	6,932	5,352	3,365	7,969	10,049	6,608	5,534	5,451
Acute coronary heart disease	20,312	24,790	23,912	13,222	39,525	33,639	24,392	26,618	28,970
Cardiac arrhythmias	2,470	3,291	2,209	1,177	3,594	4,206	2,841	3,602	2,795
Cerebrovascular disease	29,081	37,906	33,118	18,731	50,699	56,585	42,526	39,373	36,736
Chronic coronary heart disease	45,442	58,223	60,208	27,337	73,498	85,814	57,132	52,838	51,763
Congenital heart disease	298	286	402	130	432	484	336	382	378
Other circulatory diseases	6,973	8,957	8,844	4,520	11,496	13,827	9,325	8,123	7,850
Vascular dementia	711	888	788	559	1,628	1,626	1,272	1,049	806
All cardiovascular diseases	110,115	141,273	134,833	69,041	188,841	206,230	144,432	137,519	134,749

Source: Office for National Statistics mortality data

Variation by sex

Table A4.4: Total number of deaths by disease category and sex in England, 2004–11

Category	Sex	
	Male	Female
Chronic coronary heart disease	235,095	220,354
Cerebrovascular disease	119,386	191,176
Acute coronary heart disease	120,292	91,583
Other circulatory diseases	28,721	42,721
Abdominal aortic aneurysm (AAA)	30,029	20,112
Cardiac arrhythmias	6,804	15,180
Congenital heart disease	1,482	1,286
Vascular dementia	1,036	1,476
All cardiovascular diseases	542,845	583,888

Source: Office for National Statistics mortality data

Variation by age

Table A4.5: Total number of deaths by disease category and age band in England, 2004–11

Category	Age band						All ages
	0-39	40-49	50-59	60-69	70-79	80+	
Abdominal aortic aneurysm (AAA)	321	553	1,521	6,060	18,078	29,555	56,088
Acute coronary heart disease	1,827	5,756	14,674	31,353	63,383	118,387	235,380
Cardiac arrhythmias	224	141	237	789	3,740	21,054	26,185
Cerebrovascular disease	2,128	4,319	9,147	21,188	69,044	238,929	344,755
Chronic coronary heart disease	3,927	9,887	25,092	55,248	117,544	300,557	512,255
Congenital heart disease	1,724	332	269	265	274	264	3,128
Other circulatory diseases	1,519	2,450	4,396	9,254	19,550	42,746	79,915
Vascular dementia	-	1	17	149	1,374	7,786	9,327
All cardiovascular diseases	11,670	23,439	55,353	124,306	292,987	759,278	1,267,033

Source: Office for National Statistics mortality data

Variation by deprivation

Table A4.6: Total number of deaths by disease category and quintile of socio-economic deprivation in England, 2004–11

Cause	Quintile of socio-economic deprivation				
	Q1 (least deprived)	Q2	Q3	Q4	Q5 (most deprived)
Abdominal aortic aneurysm (AAA)	9,524	11,515	12,610	12,344	10,095
Acute coronary heart disease	36,044	45,540	49,980	51,909	51,907
Cardiac arrhythmias	4,530	5,713	5,971	5,537	4,434
Cerebrovascular disease	57,429	75,267	77,609	73,989	60,461
Chronic coronary heart disease	80,119	103,572	112,124	115,248	101,192
Congenital heart disease	457	556	639	650	826
Other circulatory diseases	12,077	15,858	17,420	18,188	16,372
Vascular dementia	1,586	2,153	2,171	1,959	1,458
All cardiovascular diseases	201,766	260,174	278,524	279,824	246,745

Source: Office for National Statistics mortality data

Variation in place of death

Table A4.7: Proportion of deaths in each place of death by disease category for England, 2004–10

Category	Place of death				
	Care home (nursing or residential) %	Home %	Hospice %	Hospital (acute or community, not psychiatric) %	Other places %
Abdominal aortic aneurysm (AAA)	4.0	30.6	0.1	63.2	2.1
Acute coronary heart disease	6.0	26.6	0.1	64.5	2.8
Cardiac arrhythmias	18.0	9.3	0.2	71.6	0.9
Cerebrovascular disease	28.5	7.2	0.2	63.3	0.8
Chronic coronary heart disease	14.9	30.7	0.5	51.0	2.9
Congenital heart disease	2.0	17.5	1.4	76.2	2.9
Other circulatory diseases	13.9	20.8	0.8	62.9	1.7
Vascular dementia	61.1	6.2	0.2	31.4	1.1
All cardiovascular diseases	16.8	22.2	0.3	58.5	2.1

Source: Office for National Statistics mortality data

Table A4.8: Proportion of deaths in usual place of residence (DiUPR) by disease category for England, 2004–10

Category	Year							
	2004 %	2005 %	2006 %	2007 %	2008 %	2009 %	2010 %	2011 %
Abdominal aortic aneurysm (AAA)	33.0	33.2	34.7	34.8	34.9	34.5	36.4	32.2
Acute coronary heart disease	33.7	32.6	33.0	32.7	31.4	31.7	32.0	31.5
Cardiac arrhythmias	24.2	22.7	25.6	25.9	27.8	29.0	28.9	49.7
Cerebrovascular disease	34.7	33.5	34.2	35.6	36.4	36.9	38.8	35.9
Chronic coronary heart disease	43.3	44.1	44.9	45.5	46.2	45.6	46.6	49.7
Congenital heart disease	18.5	20.0	20.5	20.1	19.5	20.8	17.5	18.5
Other circulatory diseases	31.1	31.7	33.6	34.1	34.6	36.3	36.9	40.0
Vascular dementia	64.8	57.0	59.5	57.7	60.6	54.4	53.3	71.0
All cardiovascular diseases	37.4	37.2	38.1	38.8	39.3	39.3	40.4	42.6

Source: Office for National Statistics mortality data

Admissions

Table A4.9: Mean hospital admissions per patient in months preceding death by cause of death in England, 2004–2008

Category	Months before death					
	1 month (95% CI)		3 months (95% CI)		6 months (95% CI)	
Abdominal aortic aneurysm (AAA)	0.58	(0.57 to 0.59)	0.84	(0.82 to 0.85)	1.11	(1.08 to 1.14)
Acute coronary heart disease	0.71	(0.70 to 0.71)	1.10	(1.08 to 1.11)	1.50	(1.48 to 1.52)
Cardiac arrhythmias	0.74	(0.73 to 0.75)	1.17	(1.15 to 1.20)	1.53	(1.50 to 1.57)
Cerebrovascular disease	0.63	(0.62 to 0.63)	1.03	(1.02 to 1.03)	1.38	(1.37 to 1.39)
Chronic coronary heart disease	0.55	(0.55 to 0.55)	1.03	(1.02 to 1.04)	1.49	(1.48 to 1.51)
Congenital heart disease	0.81	(0.76 to 0.85)	1.56	(1.48 to 1.65)	2.22	(2.14 to 2.31)
Other circulatory diseases	0.71	(0.70 to 0.72)	1.31	(1.29 to 1.34)	1.89	(1.85 to 1.93)
Vascular dementia	0.37	(0.34 to 0.41)	0.87	(0.78 to 0.96)	1.28	(1.20 to 1.35)

Source: Linked Hospital Episode Statistics and Office for National Statistics mortality data

Co-morbidities

Table A4.10: Proportion of all cardiovascular disease deaths with mentions of related co-morbidities in England, 2004–2008

Category	Year				
	2004 %	2005 %	2006 %	2007 %	2008 %
Type I diabetes	3.6	3.6	3.7	3.8	3.9
Type II diabetes	14.8	16.0	16.7	17.8	18.8
Cardiac arrhythmias	6.1	6.9	7.9	9.1	9.9

Source: Linked Hospital Episode Statistics and Office for National Statistics mortality data



National end of life care INTELLIGENCE NETWORK



National End of Life Care Programme

Improving end of life care

If you would like to know more about the National End of Life Care Intelligence Network:

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Author contact details

Dominic Mellon, Specialty Registrar - Public Health,
Andy Pring, Senior Analyst and Julia Verne, Director

South West Public Health Observatory
Grosvenor House
149 Whiteladies Road
Bristol BS8 2RA

T: 0117 970 6474
F: 0117 970 6481
E: info@swpho.nhs.uk

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About the National End of Life Care Intelligence Network

The Department of Health's National End of Life Care Strategy, published in 2008, pledged to commission a National End of Life Care Intelligence Network (NEoLCIN). The Network was launched in May 2010. It is tasked with collating existing data and information on end of life care for adults in England. This is with the aim of helping the NHS and its partners commission and deliver high quality end of life care, in a way that makes the most efficient use of resources and responds to the wishes of dying people and their families.

Key partners include the National Cancer Intelligence Network (NCIN), which will work closely with the Network to improve end of life care intelligence; and the South West Public Health Observatory, lead public health observatory for end of life care, which hosts the NEoLCIN website. The SWPHO has been commissioned to produce key outputs and analyses for the Network, including the national End of Life Care Profiles.

See www.endoflifecare-intelligence.org.uk for more information about the Network and its partners.