Socioeconomic inequalities in heart and circulatory diseases in Wales

March 2024

Welsh-language version also available
Ar gael yn Gymraeg hefyd

Key Findings

- There are clear and consistent gaps between the most and least deprived populations across the cardiovascular pathway in Wales. This is evident in the prevalence of modifiable risk factors, the number of reported heart and circulatory conditions, and mortality rates in Wales.

- Many risk factors for cardiovascular disease (CVD) are more prevalent in Wales' most deprived areas, including smoking, obesity, insufficient levels of physical activity, eating less than five fruits and vegetables daily, and hazardous alcohol consumption. This undoubtedly contributes to higher cardiovascular morbidity and mortality in Wales' most deprived populations.

- Self-reported heart and circulatory complaints, as well as all-age and premature mortality rates, were consistently higher in the most deprived areas than the least deprived. However, cardiology hospital admissions were consistently higher in the least deprived areas, compared to the most deprived, from 2018 to 2023.

- For some measures, it was necessary to look at the association between CVD and deprivation using data at a local authority or health board level. This may have muted, overlooked, or amplified disparities seen in smaller population groups, particularly for measures seeking to assess the prevalence of CVD according to deprivation. This emphasises the need for national level deprivation data for further key CVD indicators.

Introduction

Around 340,000 people are living with heart and circulatory diseases (CVD) in Wales today, and with an aging population this could rise.[1] Heart and circulatory diseases account for more than one in four (27%) deaths in Wales. Of the roughly 9,600 deaths each year in Wales from CVD, 2,700 are in people under the age of 75.[2]

Thousands of people in Wales also have risk factors that put them at an increased risk of developing CVD. These include high-risk conditions like hypertension (high blood pressure) and diabetes, but also include things like having obesity, not getting enough physical activity, or smoking tobacco. Around 700,000 adults in Wales have high blood pressure, which is the

[1] Population projections by year and age (gov.wales)
[2] Health Insights - BHF Wales Factsheet Jan 2024.pdf - All Documents (sharepoint.com)

leading modifiable risk factor for heart and circulatory diseases.[3] However, only around 520,000 people in Wales are on their GP's hypertension register, which suggests that up to 180,000 could be undiagnosed. In addition, over 210,000 adults in Wales have been diagnosed with diabetes (90% with type 2), another risk factor for heart and circulatory diseases.[4]

Cardiovascular health and the wider determinants of health are strongly linked, with the disparities seen in heart and circulatory diseases being strongly influenced by income, housing, and the environment, as well as access to health services. Internationally, studies have found associations between comorbidities (i.e. people having more than one condition) and deprivation, with those with the lowest incomes found to be four times more likely to have multiple conditions than those with the highest incomes.[5] People in more deprived areas are also more likely to develop multiple conditions in the first place, with analysis in England finding that 28% of people aged 65-74 in the most deprived areas had four or more health conditions, compared to 16% in the most affluent.[6]

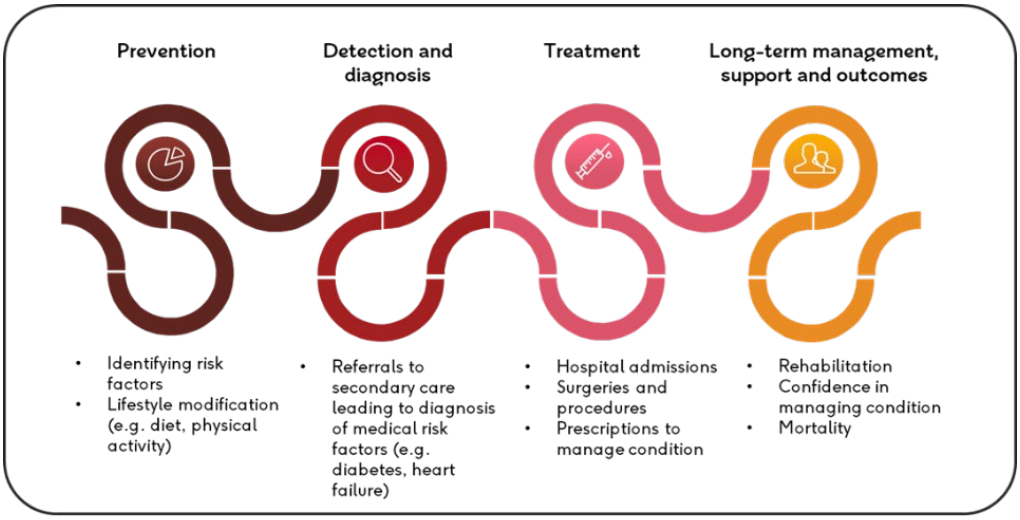
Health inequalities are differences in health status, healthcare, and health-related risks between different population groups that are unfair and avoidable.[7] They include:

- **Health-related risks**: e.g., some groups of people may find it harder to access healthy foods than others.
- **Healthcare**: e.g., some groups of people may find it harder to access healthcare services than others.
- **Health status**: e.g., some groups of people may have a shorter life expectancy than others.

[3] Health Insights - BHF Wales Factsheet Jan 2024.pdf - All Documents (sharepoint.com)
[4] Health Insights - BHF Wales Factsheet Jan 2024.pdf - All Documents (sharepoint.com)
[5] Multiple conditions and health inequalities: addressing the challenge with research (nihr.ac.uk)
[6] Stafford, M., Steventon, A., Thorlby, R., Fisher, R., Turton, C., & Deeny, S. (2018). Understanding the health care needs of people with multiple health conditions. Health Foundation. Available at: https://www.health.org.uk/publications/understanding-the-health-care-needs-of-people-with-multiple-health-conditions
[7] This definition of health inequalities is based on similar definitions provided by organisations including: Public Health Scotland, NHS England, The King's Fund, and the World Health Organization.

This analysis examines the trends of inequalities in cardiovascular disease pre- and post-COVID-19 pandemic at multiple points on the cardiac pathway (Table 1). This provides, for the first time, a holistic understanding of health inequalities surrounding cardiovascular disease, providing insight into the strengths in Wales' health system as well as where improvement is needed across all facets of healthcare.

Figure - 1 The Cardiovascular disease (CVD Pathway)



Methods

Three methods of measuring deprivation were used in this report:

- Welsh Index of Multiple Deprivation (WIMD)
- Population living in the 20% most deprived lower layer super output areas (LSOAs) in the health board
- GP cluster deprivation quintiles.

The WIMD is the official measure of relative deprivation for LSOAs in Wales, and ranks each small area from 1 (most deprived) to 1,909 (least deprived). Measuring both the social and material aspects of deprivation, WIMD incorporates income, employment, health, education, access to services, housing, community safety, and physical environment.[8] The GP cluster deprivation quintile measure takes the percentage of patients registered to practices in the cluster who live in the most deprived 20% of areas according to the WIMD, then separates them into quintiles. In some instances, the deprivation ranking of local health boards and local authorities were used when national level deprivation data was not available or applicable. In these cases, our findings may not truly represent the actual association between deprivation and the CVD metric in question, as outlying areas and populations in these local authorities or health boards may skew the results. Additionally, some local authorities or health boards may have older populations which may result in higher prevalence of CVD.

[8] https://www.gov.wales/welsh-index-multiple-deprivation-index-guidance

The following data sources were used:

- General practice and primary care cluster population and workforce by deprivation: on 31 December 2021 | GOV.WALES
- BHF analysis, in the 2023 Heart and Circulatory Disease Compendium, of QAIF (Framework for assessing and improving general medical services in Wales)
- Deprivation and health (nhs.wales)
- Adult lifestyles by area deprivation, 2020-21 onwards (gov.wales)
- Adult general health and illness by area deprivation, 2020-21 onwards (gov.wales)
- Hospital admissions data online: April 2022 to March 2023 | GOV.WALES
- Prescribing (gov.wales)
- Health Expectancies Wales
- Office for National Statistics (ons.gov.uk)
- Nomis - Official Census and Labour Market Statistics (nomisweb.co.uk)

Results

Prevention: risk factors for heart and circulatory diseases

Cardiovascular health is influenced by a range of risk factors, including—but not limited to—smoking, high body mass index (BMI), diet, and alcohol consumption. The prevalence of these risk factors at a population level are influenced by the social, physical, and environmental conditions in which individuals and communities live their lives. They may also be influenced by people's interactions with health and social care services.

Time series data for many CVD risk factors in Wales is limited, as the National Survey for Wales changed their data collection methods 2020 and onwards. This leaves only 3-4 data points, with two being measured in the same year for smoking, making it more challenging to understand trends over time.

Smoking

Smoking can lead to heart attack and stroke. In Wales, 26,000 hospital admissions and 5,000 deaths can be attributed to smoking each year.[9] Smoking prevalence is also clearly associated with deprivation. Figure 2 displays the smoking habits of each WIMD quintile. In 2022/23, the prevalence of smoking in the most deprived quintile was almost three times that of the least deprived quintile, at 22% and 8%, respectively. More people from the most deprived quintile were ex-smokers (32%) compared to the least deprived quintile (27%). Additionally, 65% of those in the least deprived group reported having never smoked, which is 19 percentage points more than the most deprived group (46%). From 2020-2023, the smoking prevalence gap between the most and least deprived quintiles increased (Figure 3), with smoking prevalence decreasing from 9% in 2020-21 to 8% in 2022-23 in the least deprived quintile, and increasing from 20% to 22% in the most deprived quintile.

[9] BHF Cymru - Wales CVD Factsheet

Figure 3 - Smoking habits of adults living in Wales by deprivation quintile in 2022/23

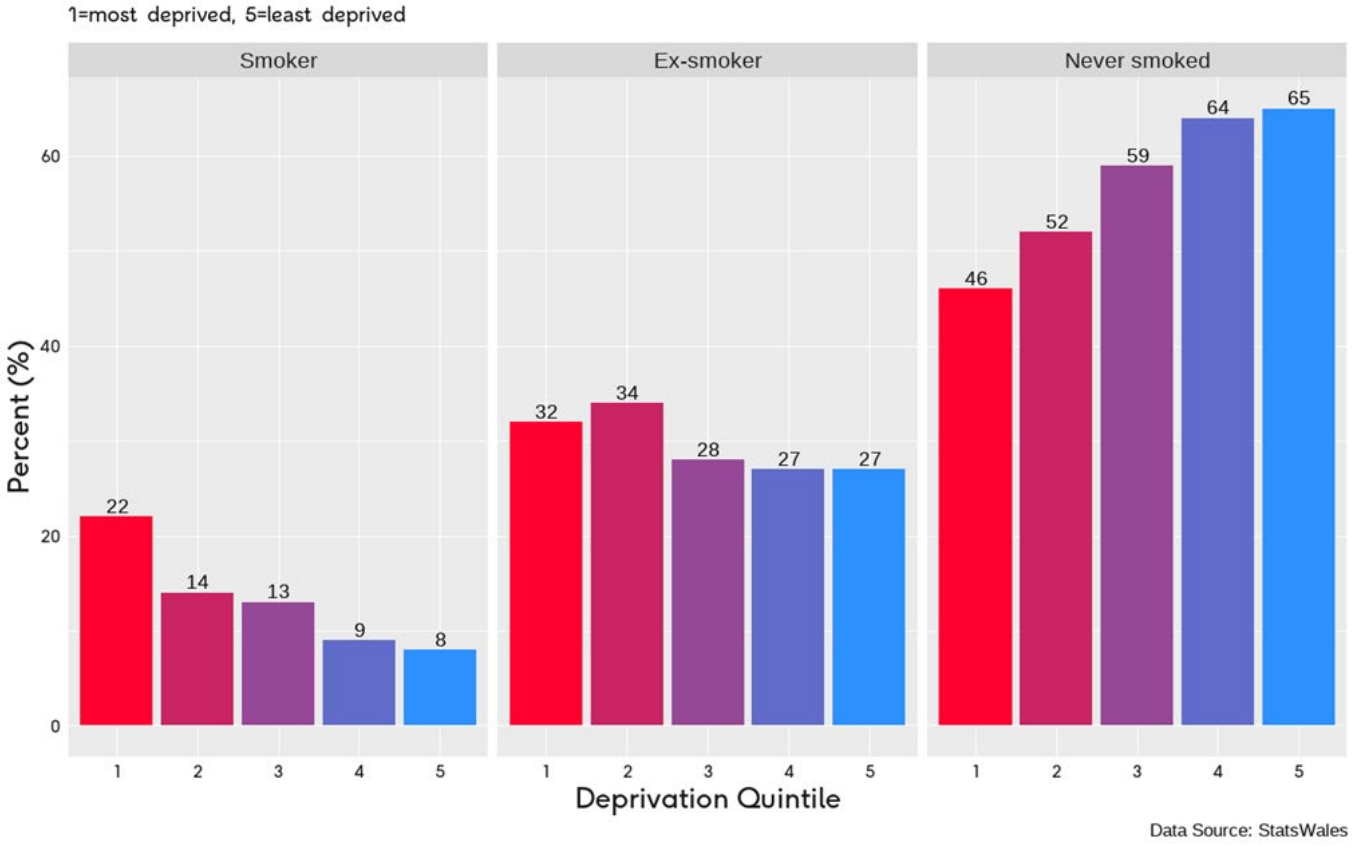
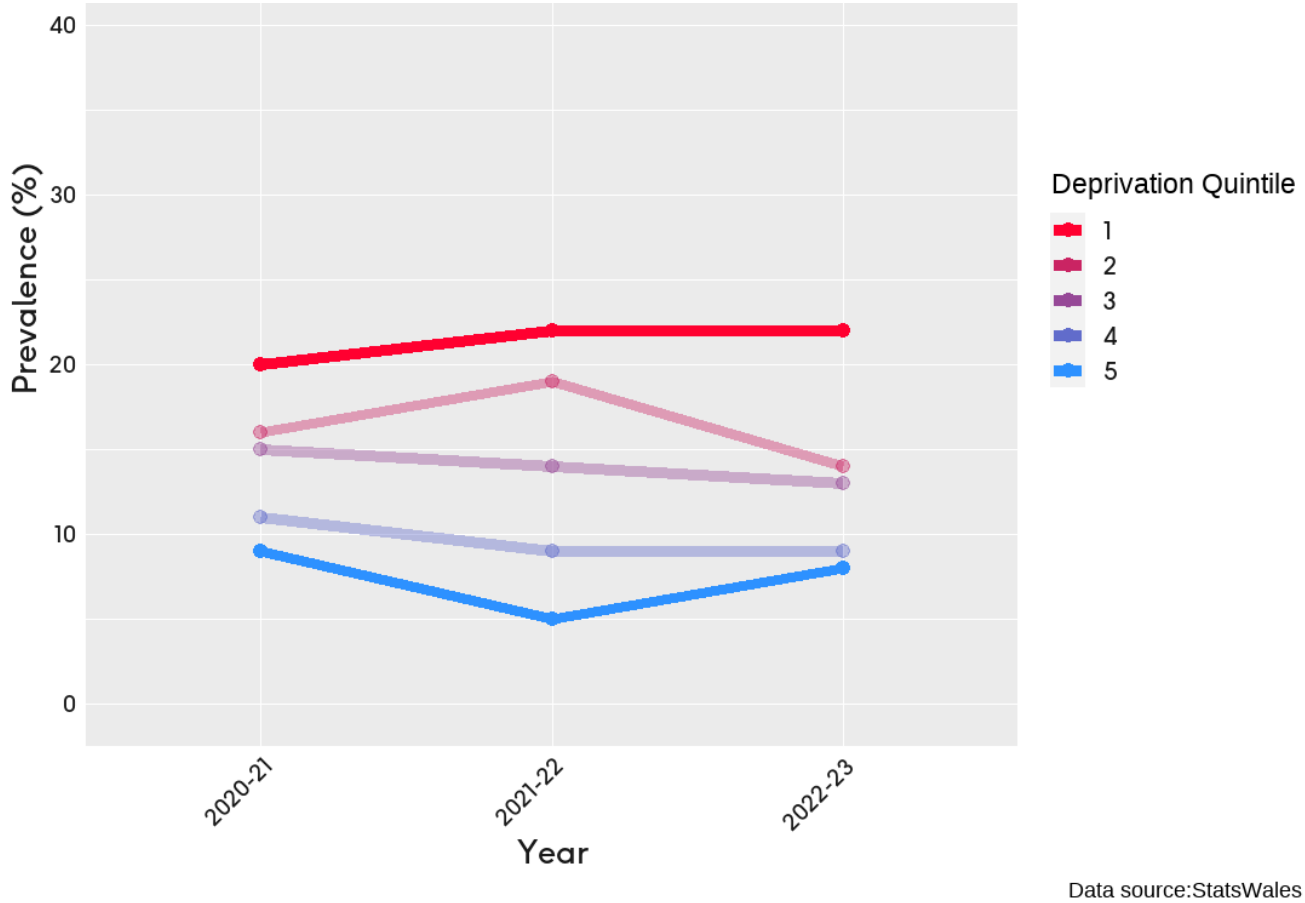


Figure 2 - Smoking prevalence in Wales from 2020 to 2023, by deprivation quintile



Alcohol consumption

Drinking more than the recommended amount of alcohol can be detrimental to heart and general health, with people regularly consuming 14 units or more of alcohol at increased risk of abnormal heart rhythms, heart muscle damage, stroke, high blood pressure, and vascular dementia.[10] Figure 4 displays reported levels of alcohol consumption for each WIMD quintile in the previous week. In 2022/23, there was a clear association between weekly alcohol consumption and deprivation. A higher percentage of the least deprived quintile are moderate (up to 14 units) and hazardous (above 14 units) drinkers with a 3 and 6 percentage point difference, respectively, compared to the most deprived quintile. The prevalence of non-drinkers in the most deprived quintile is double that of the least deprived quintile, which could be attributed to the cost of alcohol. Those in the least and most deprived quintiles are equally as likely to drink harmfully, consuming over 50 units for males or 35 units for females per week, with a reported prevalence of 3%.

Figure 5 shows the percentage of the population consuming more than 14 units of alcohol in the previous week by deprivation quintile. From 2020-21 to 2022-23 the prevalence of drinking more than the recommended amount has increased in the most and least deprived quintiles, however the gap between them has decreased.

[10] Alcohol - BHF

Figure 4 - Weekly alcohol consumption of adults living in Wales, by deprivation quintile, in 2022/23

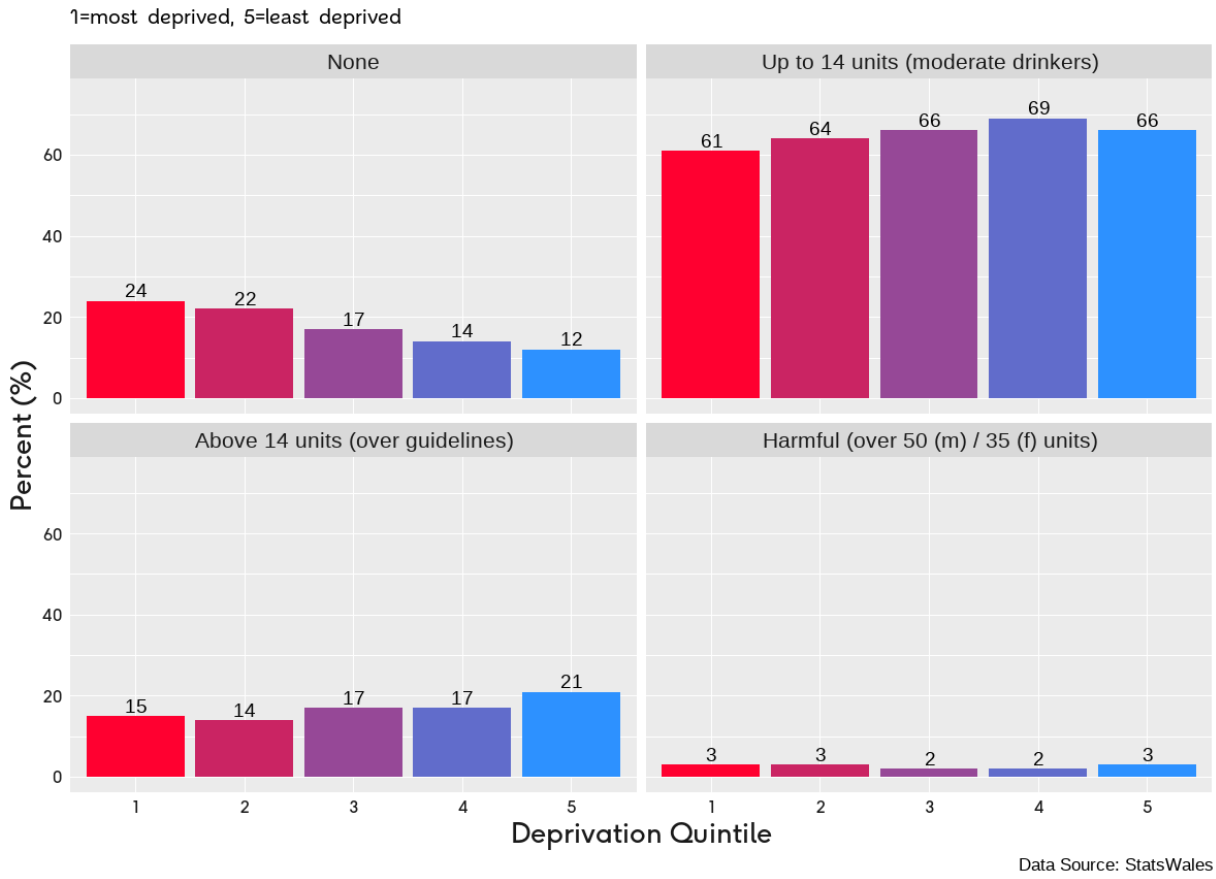
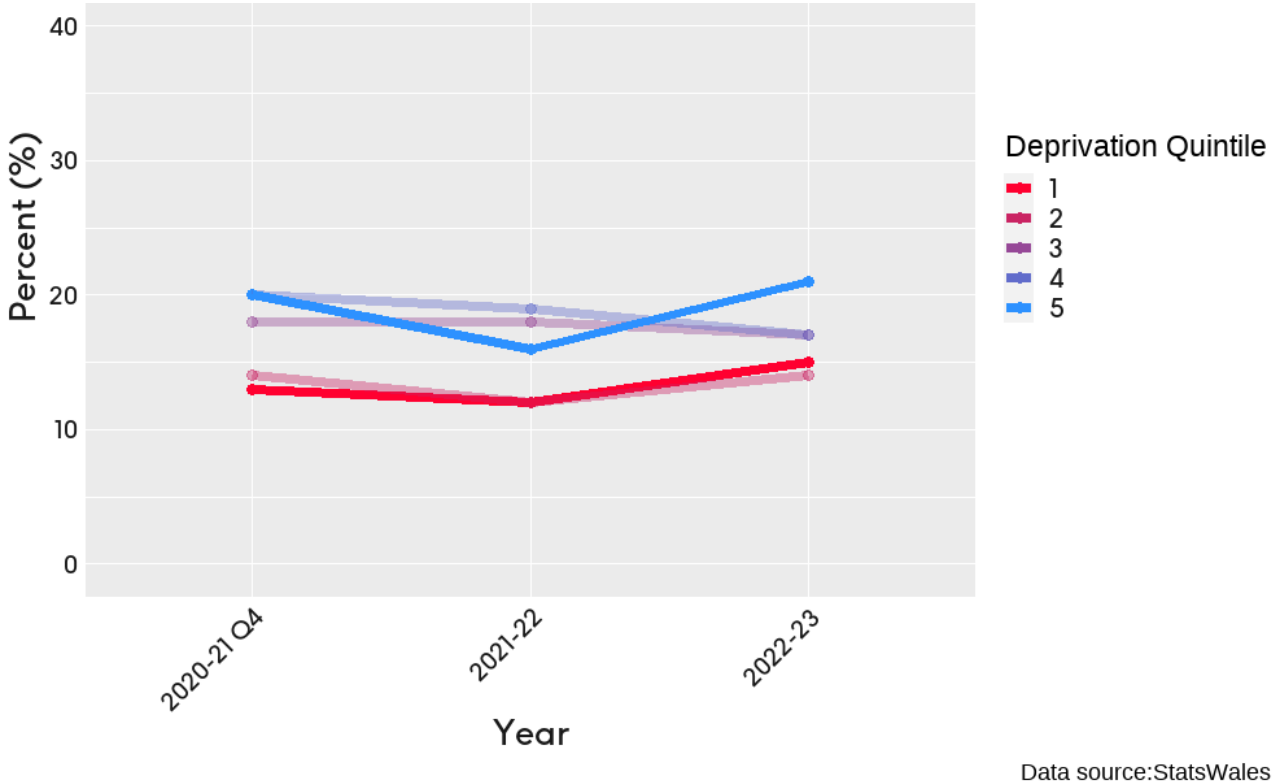


Figure 5 - Percentage of those who drink more than weekly guidelines (above 14 units) in Wales by deprivation quintile from 2020 to 2023



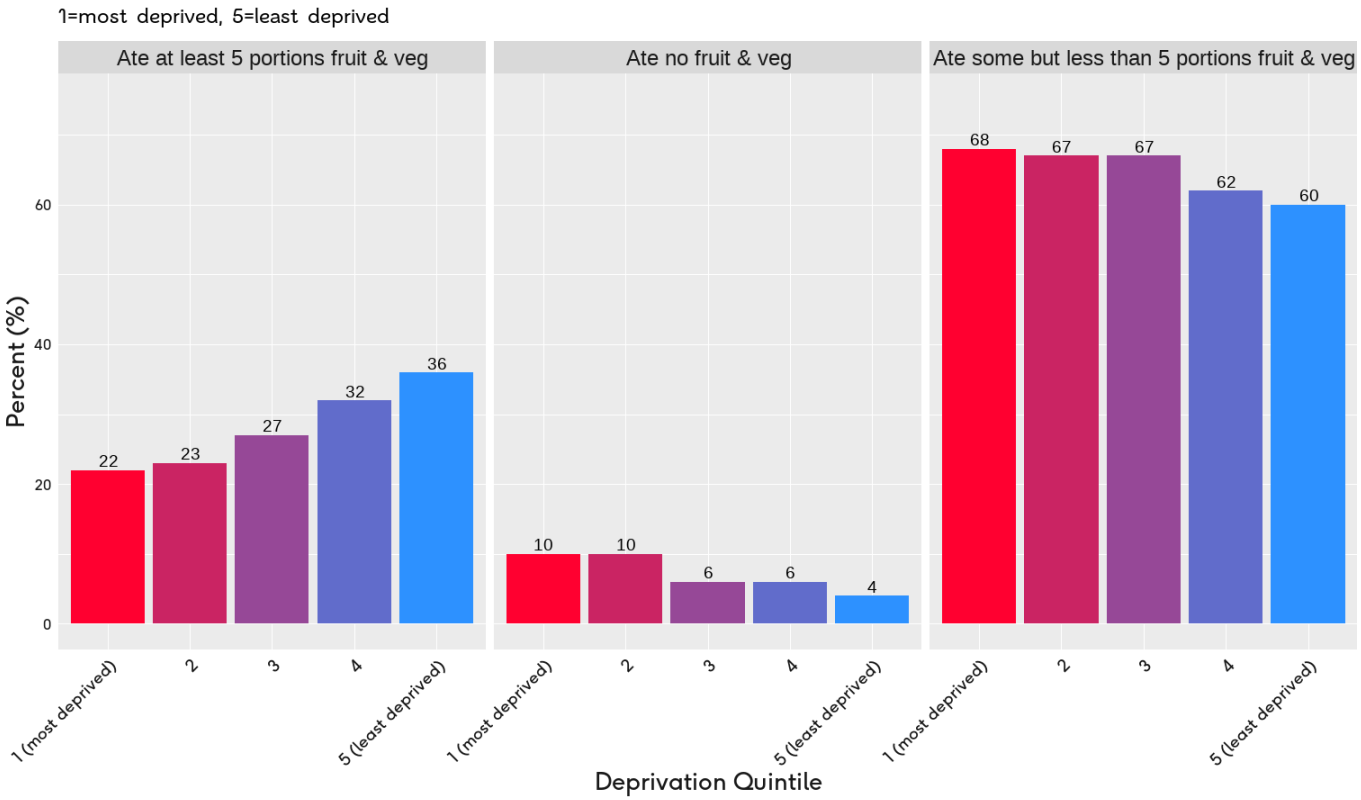
Fruit and vegetable consumption

Studies show that low consumption of fruit and vegetables is associated with an increased risk of both cardiovascular morbidity and mortality.[11,12] Figure 6 shows the reported levels of fruit and vegetable consumption of each WIMD quintile. There is a strong association between deprivation and fruit and vegetable consumption, with 22% of those in the most deprived quintile reporting that they ate at least 5 portions of fruit and vegetables in the last day compared to 36% in the least deprived quintile. Those in the most deprived group were also more likely to have not eaten any portions of fruit and vegetables in the previous day compared to the least deprived quintile. Since 2020-21, the gap between the most and least deprived quintile, in terms of the percentage of people eating at least five portions a day, has increased by 2 percentage points (Figure 7). Additionally, despite a drop in 2021/22, the most deprived quintile has consistently had a higher percentage of people consuming less than 5 fruits and vegetables in the previous day compared to the least deprived quintile.

[11]Zhan J, Liu YJ, Cai LB, Xu FR, Xie T, He QQ. Fruit and vegetable consumption and risk of cardiovascular disease: A meta-analysis of prospective cohort studies. Critical reviews in food science and nutrition. 2017 May 24;57(8):1650-63. https://doi.org/10.1080/10408398.2015.1008980

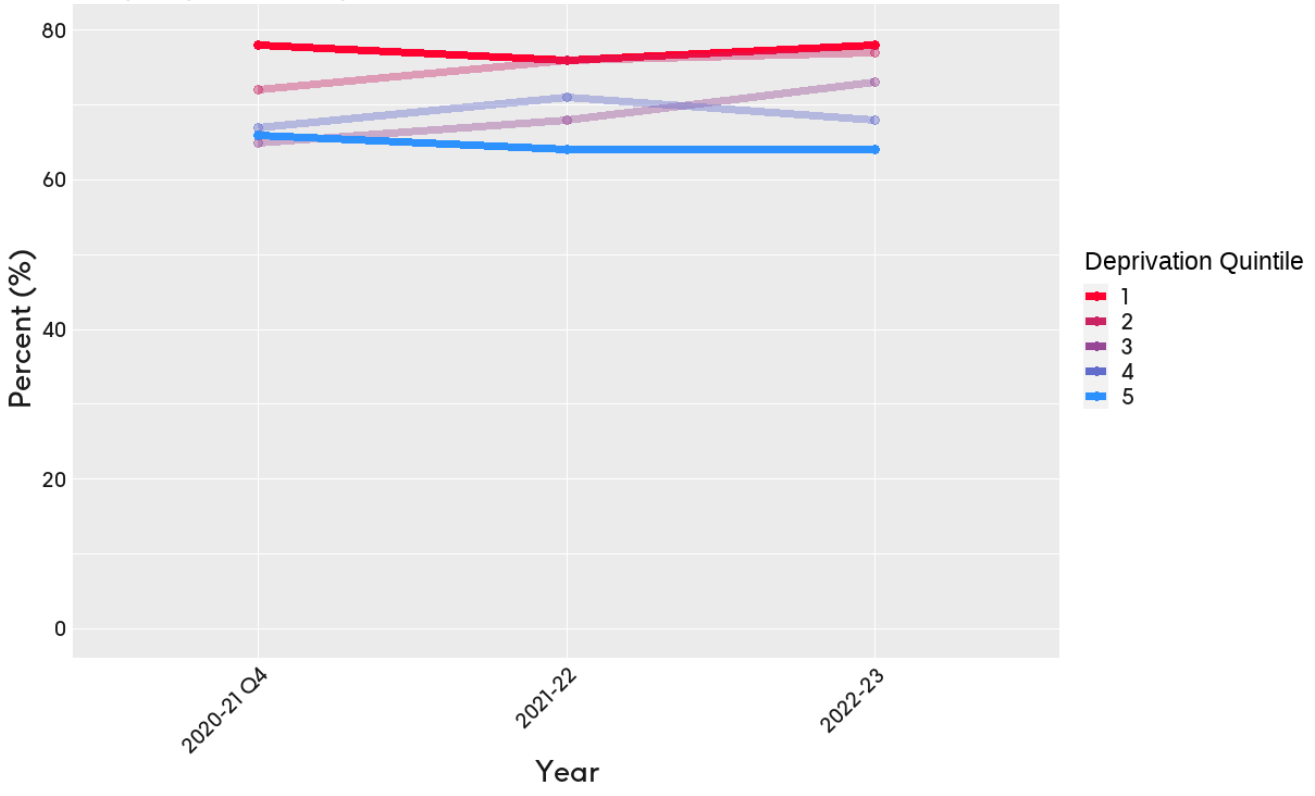
[12] Wang X, Ouyang Y, Liu J, Zhu M, Zhao G, Bao W, Hu FB. Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies. Bmj. 2014 Jul 29;349. https://doi.org/10.1136/bmj.g4490

Figure 6 - Fruit and vegetable consumption of adults living in Wales in the previous day, by deprivation quintile, in 2022/23



Data Source: StatsWales

Figure 7 - Percentage of those who ate less than 5 fruits vegetables in the previous day in Wales by deprivation quintile from 2020-23



Data source:StatsWales

Physical activity

Low levels of physical activity are associated with an increased risk of cardiovascular disease and cardiovascular mortality.[13,14,15] The UK Chief Medical Officers' Guidelines recommend 150 minutes of moderate physical activity, or 75 minutes of vigorous physical activity a week.[16] In Wales, there is a clear association between deprivation and physical inactivity. Figure 8 shows the most deprived quintile are more likely to have been physically active for less than 30 minutes in the previous week compared to the least deprived quintile (38% and 25% respectively). In the most deprived quintile, 48% were active for at least 150 minutes in the previous week compared to 61% in the least deprived quintile. In both the most and least deprived quintiles, 14% were active for between 30 and 149 minutes in the previous week.

Since 2020-21, the gap between the most and least deprived quintiles has narrowed, with more people from the least deprived quintile being active for at least 150 minutes (Figure 9). However, there is still a significant gap in the percentage of people meeting the recommended levels of physical activity, to the disadvantage of the most deprived areas in Wales.

[13] Oguma Y, Shinoda-Tagawa T. Physical activity decreases cardiovascular disease risk in women: review and meta-analysis. American journal of preventive medicine. 2004 Jun 1;26(5):407-18. https://doi.org/10.1016/j.amepre.2004.02.007

[14] Nocon M, Hiemann T, Müller-Riemenschneider F, Thalau F, Roll S, Willich SN. Association of physical activity with all-cause and cardiovascular mortality: a systematic review and meta-analysis. European Journal of Preventive Cardiology. 2008 Jun 1;15(3):239-46. https://doi.org/10.1097/HJR.0b013e3282f55e09

[15] Cheng W, Zhang Z, Cheng W, Yang C, Diao L, Liu W. Associations of leisure-time physical activity with cardiovascular mortality: a systematic review and meta-analysis of 44 prospective cohort studies. European journal of preventive cardiology. 2018 Nov;25(17):1864-72. https://doi.org/10.1177/2047487318795194

[16] Physical activity guidelines for adults aged 19 to 64 - NHS (www.nhs.uk)

Figure 8 - Levels of physical activity of adults living in Wales in the previous week, by deprivation, quintile in 2022/23

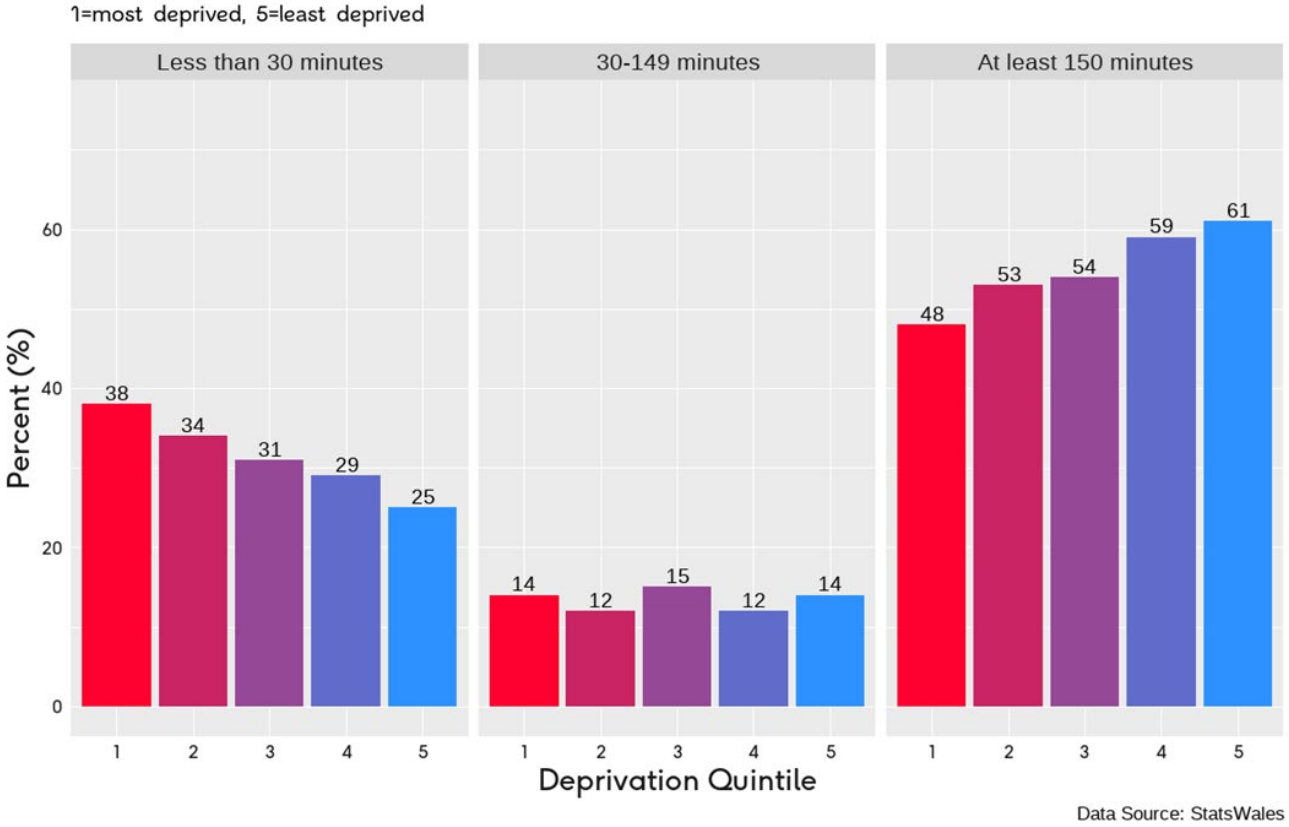
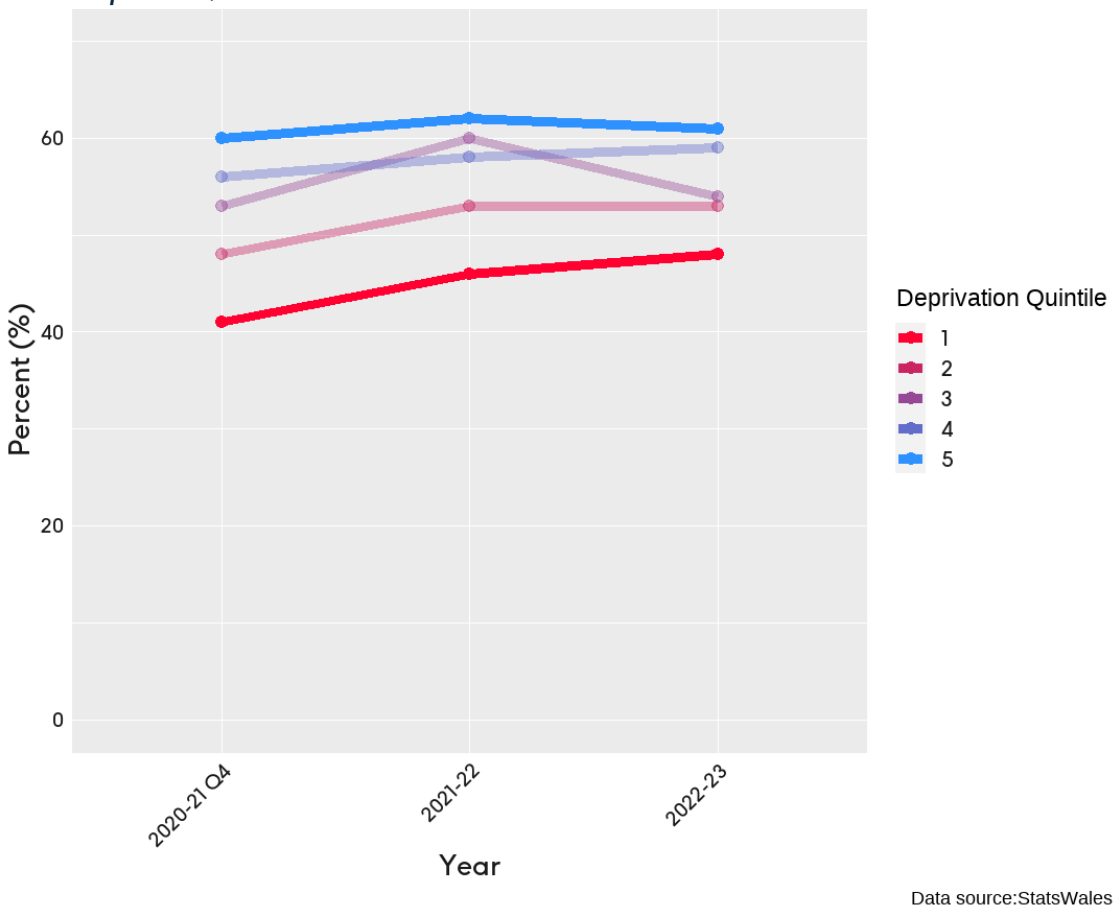


Figure 9 - Percentage of adults active for at least 150 minutes in the previous week, by deprivation quintile, from 2020 to 2023

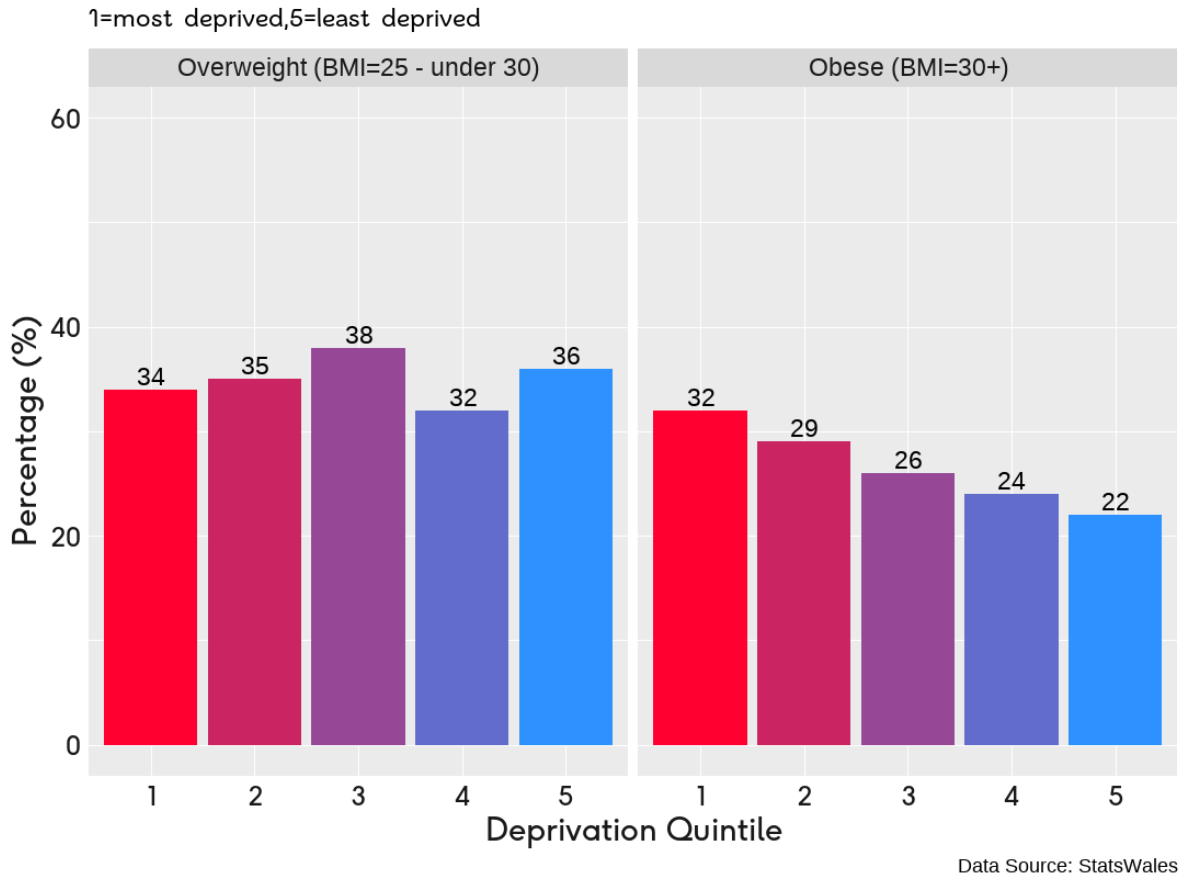


Overweight and obesity

Living with excess weight and obesity can increase the risk of heart and circulatory diseases including stroke, heart attack, and vascular dementia.[17] Figure 10 examines the association between BMI and WIMD quintile, where a BMI of under 18.5 is underweight, 18.5-25 is a healthy weight, 25+ is overweight or obese, and 30+ is obese. Prevalence is similar in the most and least deprived quintiles for overweight (34% and 36% respectively) . Those in the least deprived quintile are more likely to have a healthy weight (BMI of 18.5-under 25) compared to the most deprived quintile, with prevalences of 41% and 32%, respectively. Those in the most deprived quintile are more likely to have a weight defined as obese compared to the least deprived quintile (32% and 22% respectively). Since 2020-21 overweight and obesity has decreased slightly overall. However, the gap between the most and least deprived quintiles has widened with a prevalence of 66% and 58% in the most and least deprived quintiles respectively (Figure 11).

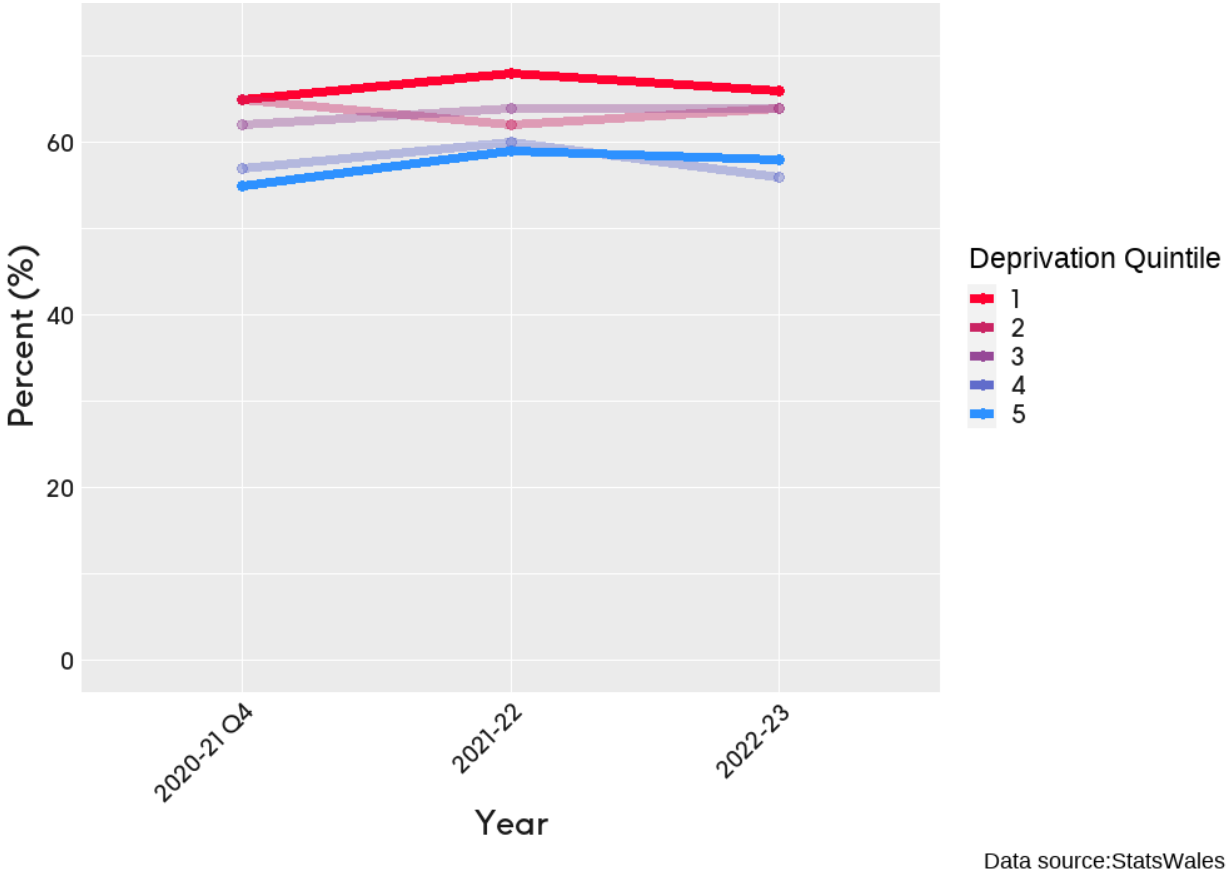
[17] Your weight and heart and circulatory conditions - BHF

Figure 10 - BMI levels of adults living in Wales, by deprivation quintile, in 2022/23



Data Source: StatsWales

Figure 11 - Percentage of those classified as overweight or obese (BMI of 25+) in Wales, by deprivation quintile, from 2020 to 2023



Data source:StatsWales

Prevalence of heart and circulatory diseases and high-risk conditions

To assess the association between CVD prevalence and deprivation in Wales, we used WIMD deprivation quintile as well as the GP cluster deprivation quintile. Figure 12 shows the prevalence of heart and circulatory self-reported complaints by WIMD deprivation quintile. It shows an association between level of deprivation and prevalence of heart and circulatory diseases, with 11% of the most deprived quintile having a heart and circulatory complaint, compared to 9% in the least deprived.

However, the opposite trend is seen when using an alternative measure of prevalence, and a different approach to stratifying by deprivation (Figure 13). QAIF data incorporates GP clusters that are then divided into deprivation quintiles. The data provided by QAIF measures various heart and circulatory conditions and risk factors, as well as CVD as a whole. The BHF CVD estimate found that CVD is 2.5 percentage points more prevalent in the least deprived quintile compared to the most deprived (Figure 13). Atrial fibrillation and hypertension are more prevalent in the least deprived quintile, with a difference of one and two percentage points, respectively. The differing findings presented here, based on the two approaches used, makes it hard to ascertain the true association between deprivation and CVD prevalence. Several factors could explain the different findings, including: the fact that self-reported CVD complaints may better capture undiagnosed cases; and the differing methods of stratifying by deprivation. Ultimately, further analysis is needed to better understand the true association between deprivation and CVD prevalence in Wales. It would be of benefit to have age-standardised prevalence data for CVD and its risk factors, akin to what is produced in England via CVDPREVENT.[18]

[18] https://www.cvdprevent.nhs.uk/

Figure 12 - Percentage of those in Wales with a heart and circulatory complaint in 2022/23

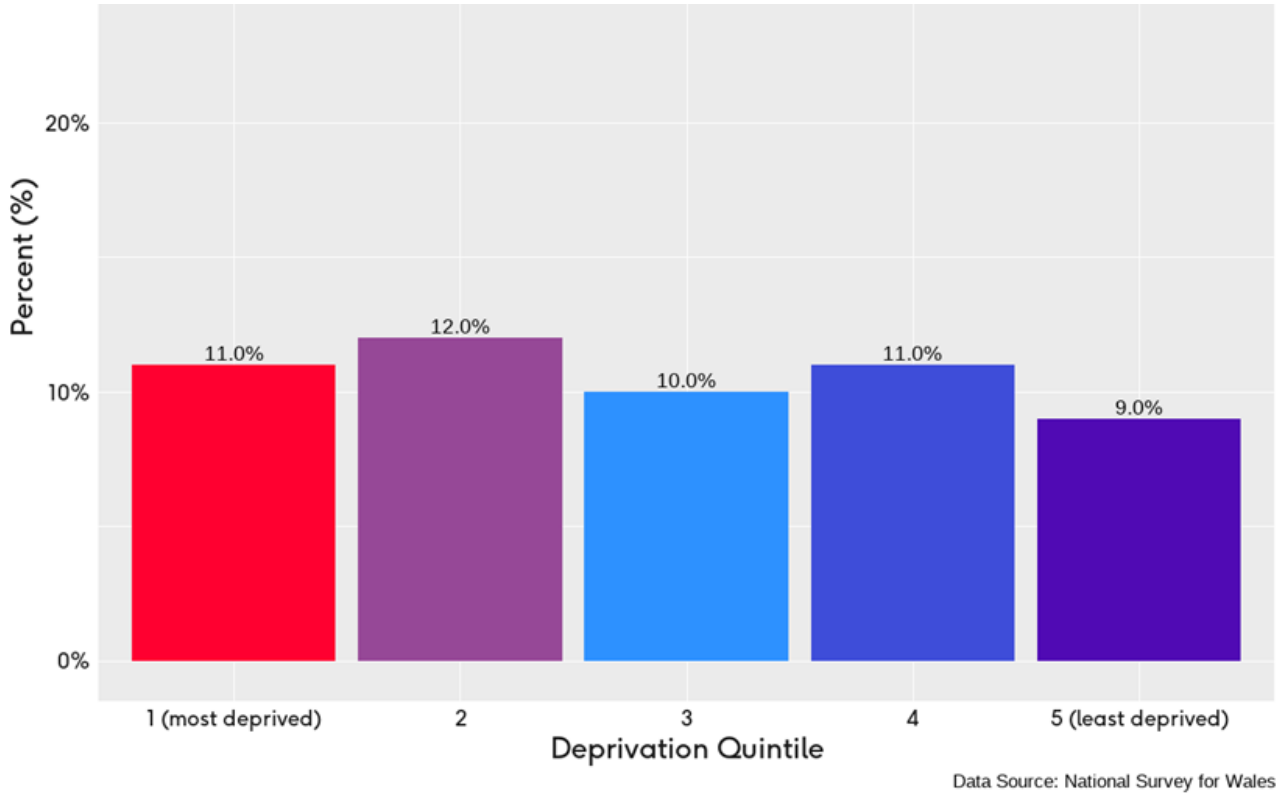
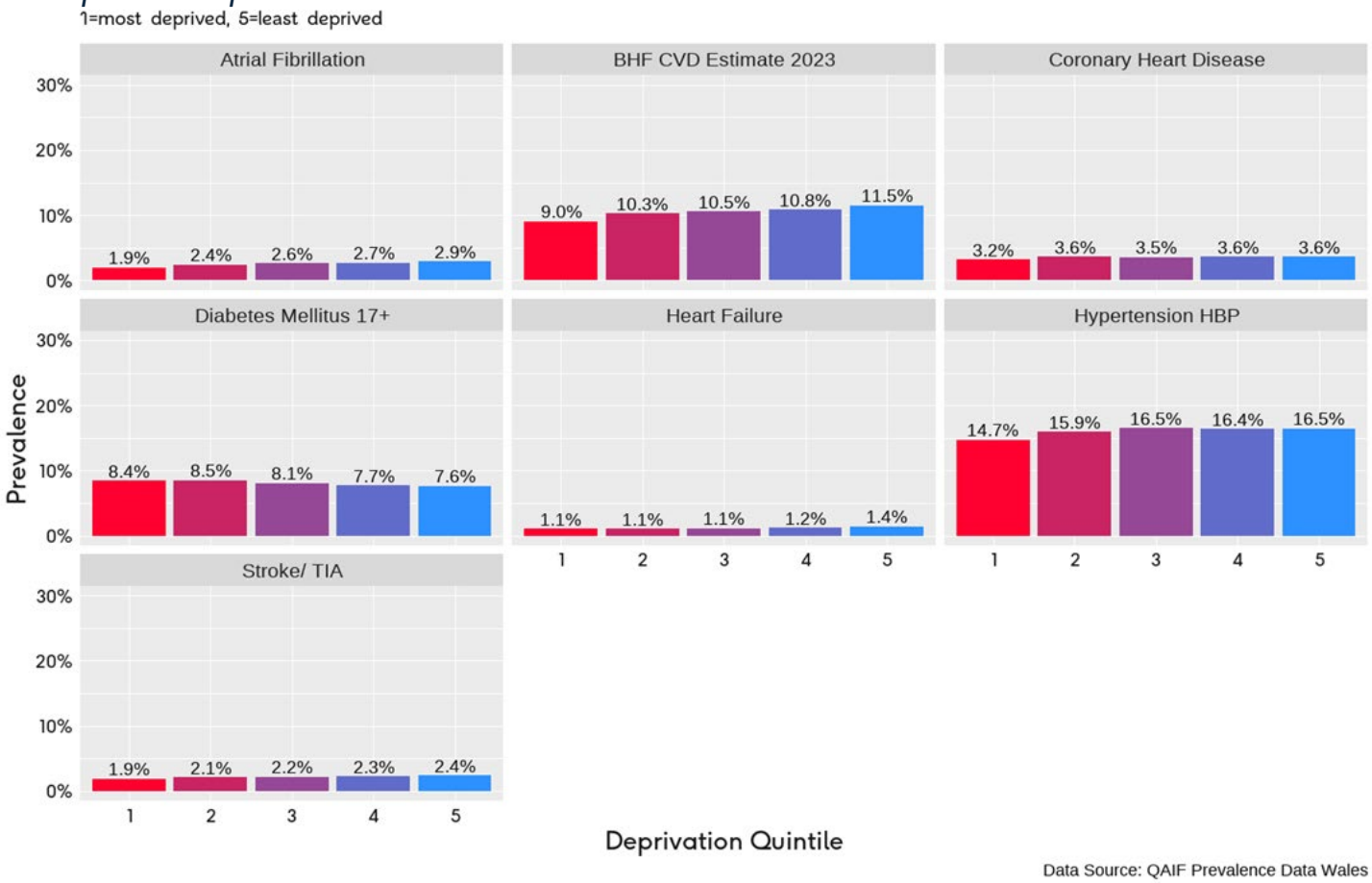


Figure 13 - Prevalence of cardiovascular conditions and risk factors in Wales by GP cluster deprivation quintile in 2021/22



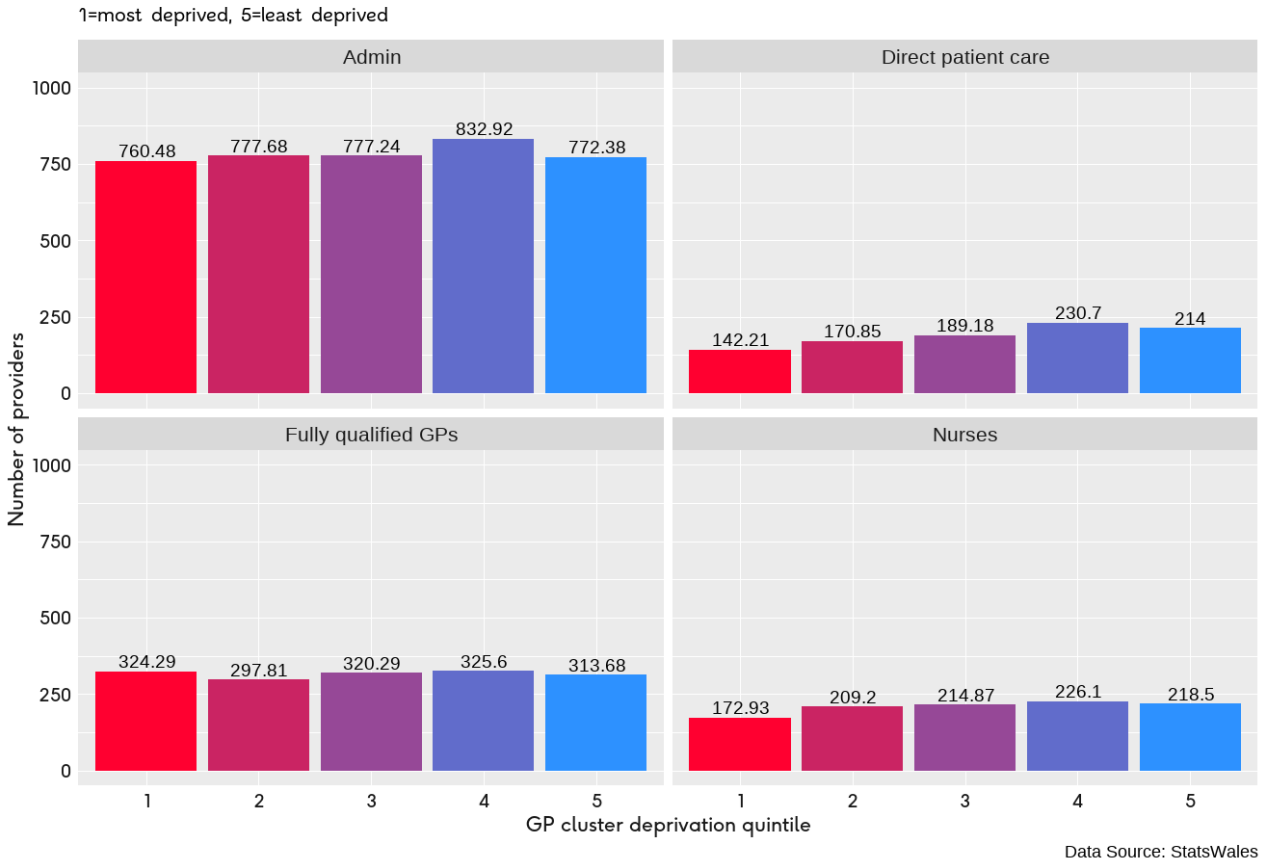
Primary care

GP workforce

Examining the GP workforce and how it is affected by deprivation is essential to understand the detection and diagnosis step in the cardiovascular pathway. It may also provide insight into precursors into the treatment step. Figure 14 shows the number of full-time equivalents (FTEs) of the general practice workforce by cluster deprivation quintile in 2023 in Wales. There are slightly more fully qualified GP FTEs in the most deprived quintile compared to the least deprived quintile with 324 and 314 FTEs, respectively. However, the least deprived quintile has more direct patient care, nurses and admin FTEs compared to the most deprived quintile.

The fact that there are more fully qualified GPs in the most deprived quintile may suggest that these areas face higher health needs. However, the lack of support staff (direct patient care, nurses, and administration) could strain the overall efficiency of healthcare services. Insufficient support staff may lead to longer waiting times, administrative delays, and reduce the overall efficiency of healthcare delivery and the quality of patient care services.

Figure 14 - Full-time equivalents of general practice workforce by cluster deprivation quintile in April 2023

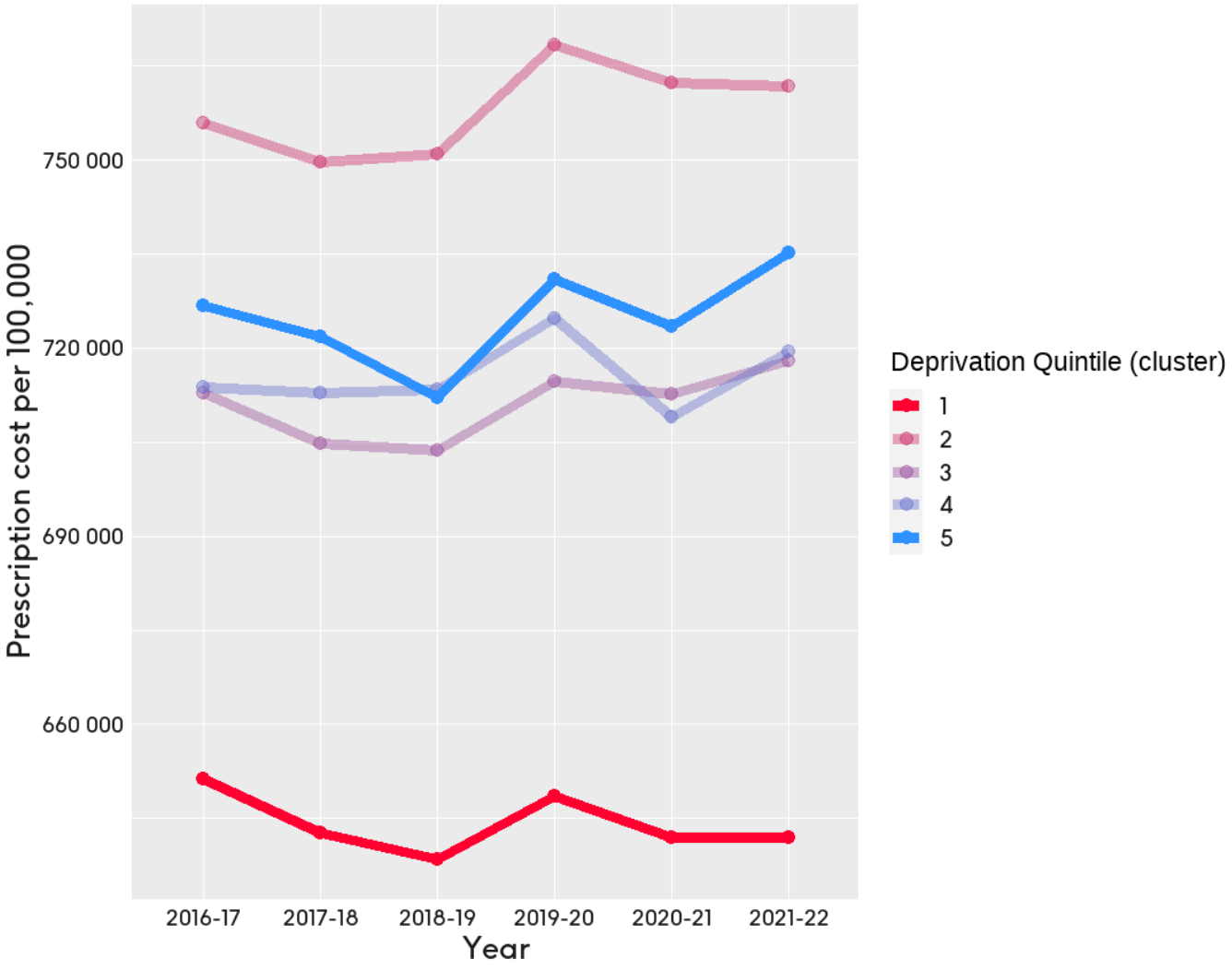


Data Source: StatsWales

Prescriptions

The prescription rate for CVD medications was calculated by taking the prescription costs from each GP cluster and dividing by the population of that cluster. Figure 15 shows the cost per 100,000 of CVD medications by GP cluster deprivation quintile. Prescription cost rates have increased across GP cluster deprivation quintiles in the 6-year period. There is a clear difference between the cost of CVD prescriptions per 100,000 population between the most and least deprived GP cluster, with the most deprived having lower prescription costs. However, the overall association between deprivation and the cost of CVD prescriptions per 100,000 population is unclear, with the second most deprived GP cluster notably having the highest CVD prescription costs). The reasons for this are unclear but may include differing demographic profiles (particularly relating to age) of the GP clusters.

Figure 15 - Cost of cardiovascular disease prescriptions in Wales per 100,000 by GP cluster and deprivation quintile, from 2016-2022



Data Source: StatsWales

Secondary care

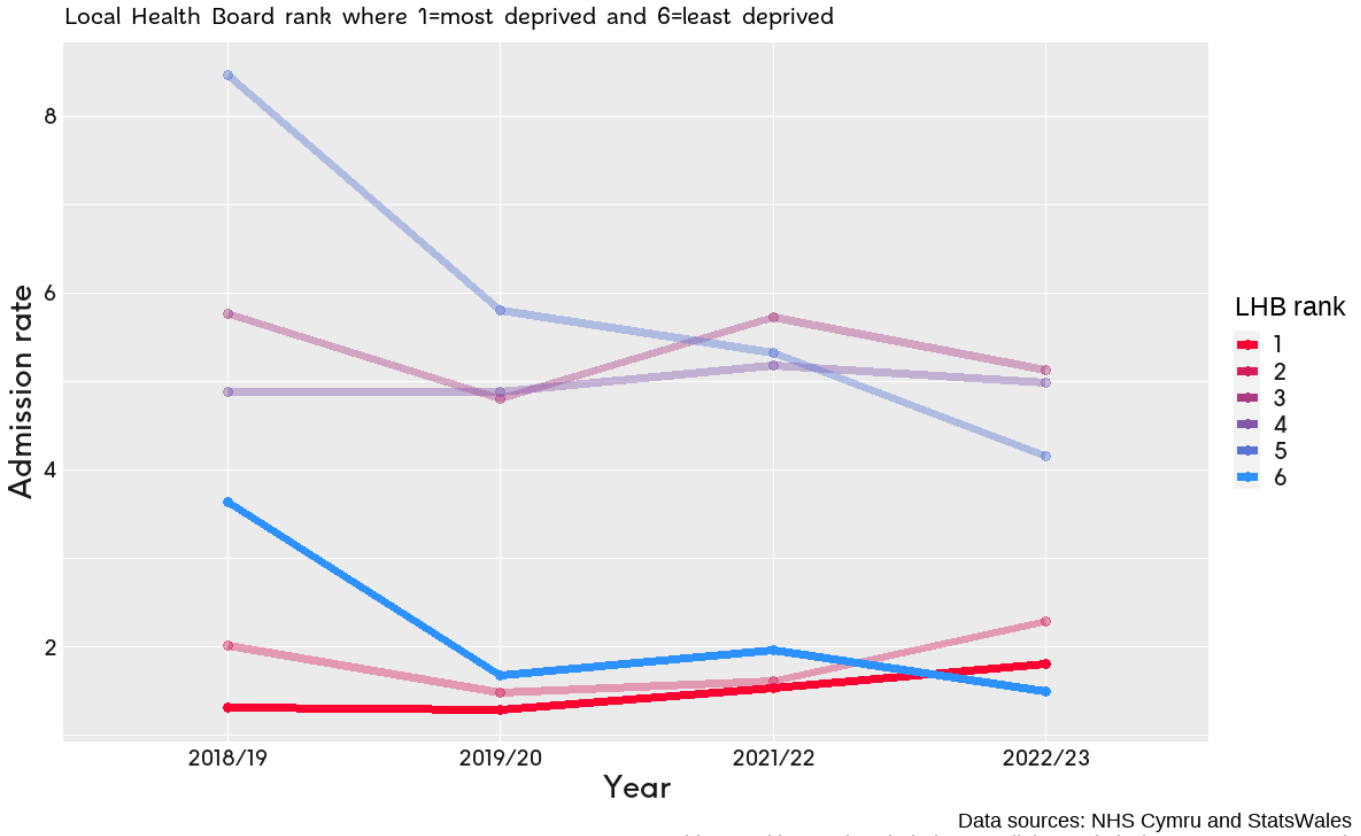
Data surrounding the connection between CVD in secondary care and deprivation is Wales is limited. In Figures 16 and 17, local health boards were plotted by the percentage of patients living in the 20% most deprived parts of Wales, alongside the number of cardiology admissions per 1,000 population. The below graphs show these cardiology general admissions rates by gender (Figure 16), as well as the emergency CVD admissions rate (Figure 17). Local health boards were ranked, with 1 being the most deprived. For non-emergency cardiology admissions, rates were higher amongst the least deprived health board, compared to the most deprived.

A similar trend is seen for emergency cardiology admissions (Figure 17). However, in 2022-23 there were more emergency admissions in the most deprived LHB compared to the least deprived LHB. It is important to note that examining at the cardiology admissions at a local level means that we cannot account for other factors that impact admission rates, particularly age, which may skew results.

Figure 16 - Cardiology admissions rate per 1,000 by Wales local health board and gender from 2018 to 2023

Data sources: NHS Cymru and StatsWales
*Powys Teaching Health Board excluded as Cardiology admissions were not reported.

Figure 17 - Cardiology emergency admissions rate per 1,000 by Wales local health board from 2018 to 2023



Data sources: NHS Cymru and StatsWales
*Powys Teaching Health Board excluded as Cardiology admissions were not reported.

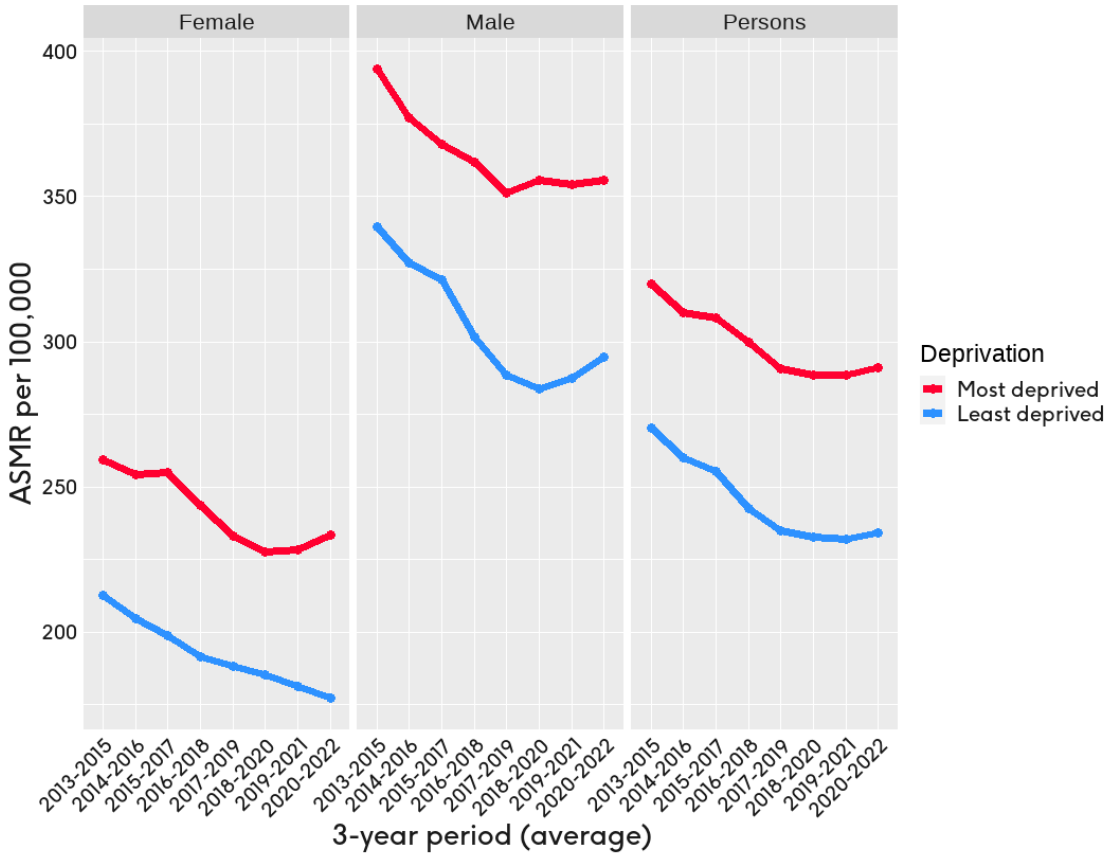
Mortality

There is no publicly available, national-level CVD mortality data stratified by deprivation in Wales. To examine the association between CVD mortality and deprivation in Wales, we used local authority-level mortality data, and ranked each local authority from most to least deprived (WIMD, with 1 being the most deprived and 22 being the least deprived). We then used the 3-year average CVD mortality rates for each local authority to create an average 3-year mortality rate for the five most and least deprived local authorities.

There is a strong association between deprivation and CVD mortality in Wales, both for all-age (Figure 18) and under-75 mortality (Figure 19). All-age CVD mortality rates decreased from 2013/15 in the most and least deprived local authorities in Wales, until the onset of the Covid-19 pandemic in 2020. Since the onset of the pandemic, all-age CVD mortality rates have increased somewhat across the board, with the exception of women in the least deprived areas (for whom rates have continued to decline).

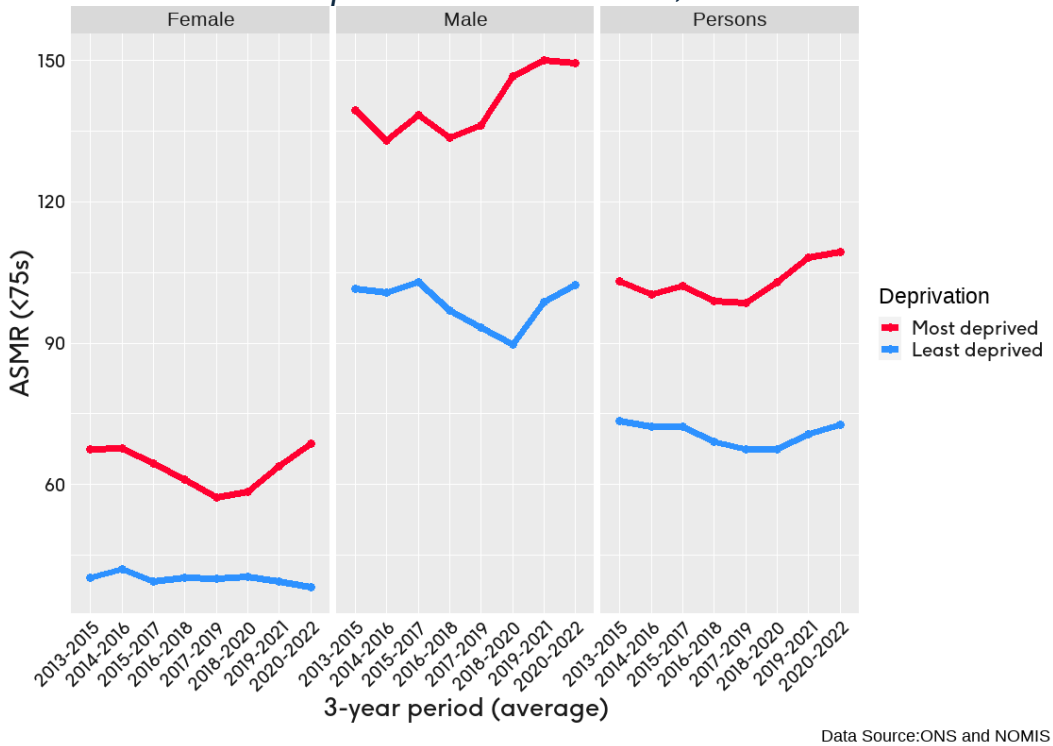
Under-75 CVD mortality rates also decreased in Wales from 2013/15 until the onset of the Covid-19 pandemic. However, since the onset of Covid-19, premature mortality rates have increased, particularly in the most deprived local authorities. Premature CVD mortality rates increased to 109 per 100,000 population in the most deprived local authorities in 2020-22, up from 103 per 100,000 population in 2013-2015. A significant increase was seen in the most deprived areas amongst both men and women. Additionally, the gap in mortality rates between the most and least deprived local authorities has increased by 7 per 100,000 population from 2013-15 to 2020-22 for both premature and all-age CVD mortality.

Figure 18 - All-age age-standardised mortality rate (ASMR) per 100k from CVD for Wales' 5 most and least deprived local authorities, from 2013 to 2022



Data Source:ONS and NOMIS

Figure 19 - Under-75 age-standardised mortality rate (ASMR) per 100k from CVD for Wales' 5 most and least deprived local authorities, from 2013 to 2022

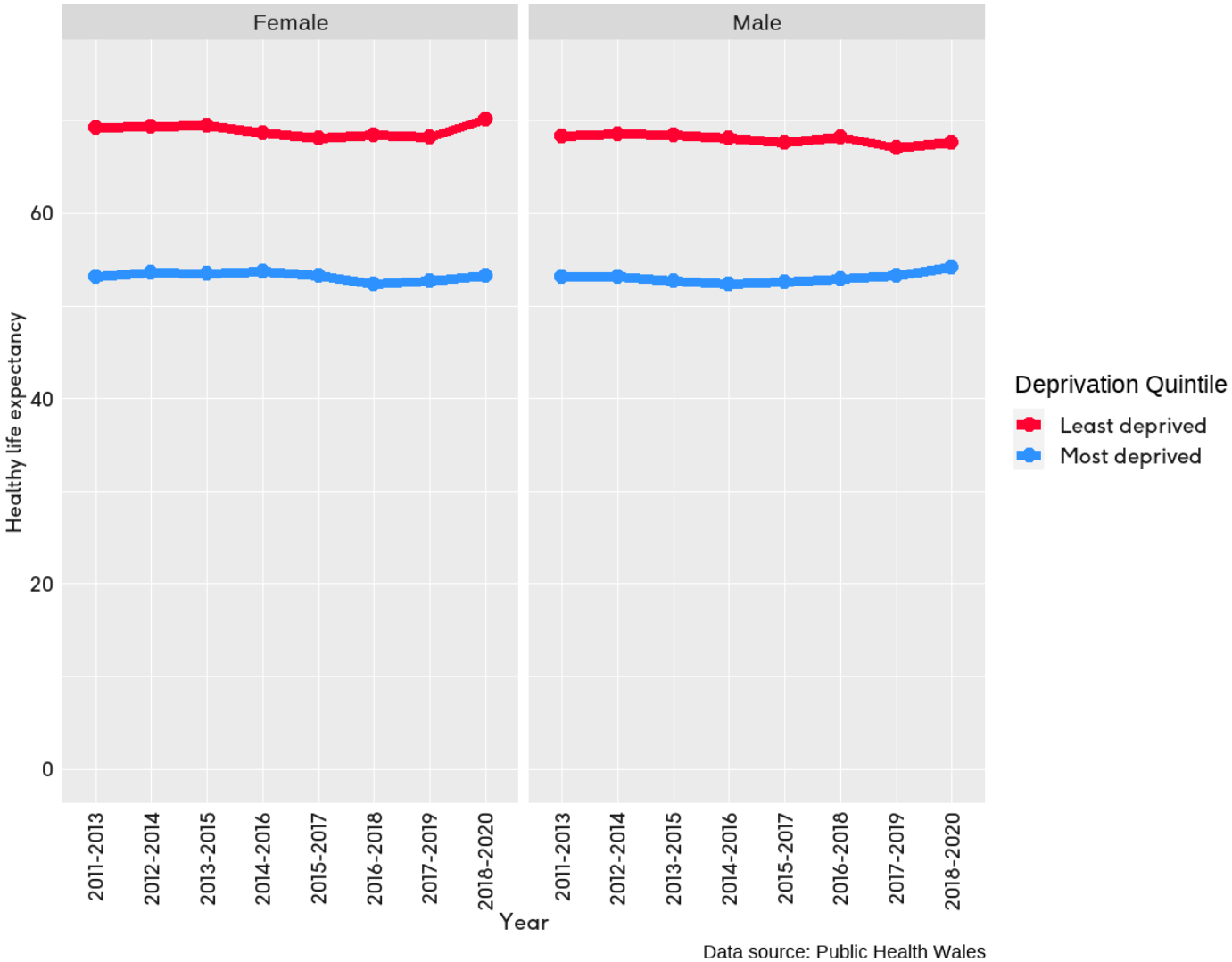


Data Source:ONS and NOMIS

Life expectancy

Inequalities relating to cardiovascular disease in Wales undoubtedly contribute to the glaring differences in life expectancy between those in the most and least deprived quintiles in Wales. The healthy life expectancy from 2018-2020 was 53 for females and 54 years for males in the most deprived quintile, while in the least deprived quintile it was 67 and 70 years, respectively. Healthy life expectancy represents the average number of years a person can expect to live in full health, without being hindered by disabling illnesses or injuries. In other words, it reflects the duration of life spent in good health. Figure 20 shows healthy life expectancy in Wales has remained relatively constant from 2011-2020, however the gap between the most and least deprived quintile has remained large. In 2018-2020 the healthy life expectancy gap between the most and least deprived quintile was 13.4 and 15.1 years for males and females, respectively.

Figure 20 - Healthy life expectancy at birth by deprivation quintile in Wales in from 2011 to 2020



Discussion

Cardiovascular heath inequalities in Wales are influenced by a variety of factors, including deprivation. Indeed, there are clear gaps between the most and least deprived areas in Wales across the CVD pathway, largely to the disadvantage of the most deprived populations. This is particularly true for modifiable risk factors and mortality from CVD.

The higher prevalence of modifiable risk factors undoubtedly contributes to CVD mortality in the most deprived groups in Wales. The gap between the most and least deprived groups was shown to be evident in smoking, obesity, physical exercise, and fruit and vegetable consumption. These gaps are consistently to the disadvantage of the most deprived populations, which have higher rates of smoking, a higher prevalence of obesity, and lower reported levels of fruit and vegetable consumption. As for alcohol, consumption over guidelines and at hazardous levels was more prevalent in the least deprived quintile compared to the most deprived, with the most harmful alcohol consumption being equal for both groups. Additionally, the prevalence of being overweight (but not having obesity) was slightly higher in the least deprived quintile compared to the most deprived quintile. This highlights that while modifiable risk factors are a bigger problem in the most deprived population groups, work to reduce the prevalence of CVD risk factors is essential across Wales.

Our analysis also found an association between deprivation and the prevalence of heart and circulatory diseases, with 11% of the most deprived quintile having a heart and circulatory complaint, compared to 9% in the least deprived. However, when measured using GP clusters CVD prevalence was higher in the least deprived quintile. This highlights the need for further research to better understand the association between deprivation and CVD prevalence in Wales, particularly in a way that account for differences in the age structure between the most and least deprived parts of Wales.

There are more FTE GPs in the most deprived GP cluster quintile compared to the least deprived cluster quintile, which may be a response to higher health needs in more deprived areas. However, the most deprived GP cluster has fewer support staff including direct patient care professionals, nurses, and administrative staff, which may impact the relative quality of service in more deprived areas. Those in the least deprived GP cluster quintile incurred higher CVD medication prescription costs each year compared to the most deprived quintile, yet the second most deprived had the highest cost by a large margin.

As for cardiology services in hospital settings, at the local health board (LHB) level, the most deprived health board had fewer cardiology admissions overall, and when stratified by gender, compared to the least deprived LHB. Interestingly, the admission rate generally increased as deprivation decreased, except for the two least deprived LHBs. A similar trend is observed for emergency cardiology admissions. However, in 2022-23, there were more emergency admissions in the most deprived LHB compared to the least deprived LHB. The lack of a strong association between deprivation and cardiology admissions, alongside the unclear association between deprivation and CVD prevalence in Wales, based on the data available, is interesting when considered alongside the clear evidence of significantly worse CVD mortality rates

amongst the most deprived populations in Wales. This points to the need for further analysis to better understand the true association between deprivation and CVD prevalence (ideally, via age-standardised prevalence data), and which aspects of the cardiac pathway would benefit most from interventions to reduce inequalities in CVD mortality.

Limitations

As discussed in the methods and results section, multiple measures of deprivation were used in this report. For the data on risk factors, self-reported CVD prevalence, and primary care, it was possible to look at the association with deprivation using country wide deprivation data. This is the ideal means of measuring how different factors are associated with deprivation. Differences in mortality and secondary care were measured using local authority and local health board deprivation ranks. Looking at depriving using lower level geographics can result in true disparities in health outcomes being muted, overlooked, or amplified. There is evidence that this approach may disguise—to some extent—the presence of CVD inequalities according to deprivation, that may be present when CVD measures are mapped to country-wide deprivation data. It is important to note that there was no country-wide data for mortality rates, which was unique compared to the other nations in the UK.

It is important to acknowledge that the methodology of measuring deprivation using GP clusters, local health boards, and local authorities may not yield a true understanding of these geographies and how deprived they are, and how this affects their CVD burden. This is partly because of their differing demographics, particularly given how CVD incidence and prevalence are strongly associated with age. The influence of deprivation could be further complicated by other social factors. The concept of intersectionality, which considers how factors such as ethnicity, socioeconomic status, and sex or gender intersect and interact, can also play a significant role in health outcomes. However, it was not possible to analyse this with the data available.

The data collected also provided little information surrounding multiple conditions, which contribute greatly to health and wellbeing, and are linked to deprivation.

Conclusion

Overall, a clear association is present between deprivation and cardiovascular outcomes in Wales. A lack of national deprivation data for primary and secondary care including emergency and elective cardiovascular admissions and prescriptions makes it challenging to draw concrete conclusions along the detection and diagnosis and treatment stages of the CVD pathway. However, the clear trends seen at the prevention and outcomes stages as well as self-reported prevalence highlights the burden and potential to improve the management of CVD in Wales' most deprived groups.

Appendix

Appendix A: Deprivation rankings

When measuring mortality, referrals, and admissions, deprivation was measured at a local health board or local authority level. Below are tables listing each local health board or authority and their respective rank. Local authorities were ranked based on the Index of Multiple Deprivation while local health boards were ranked based on the percent of the population that are in the 20% most deprived LSOAs in Wales.

Table 1 - Local authority rankings

Local authority	IMD – index of multiple deprivation rank (1= most deprived)
Blaenau Gwent	1
Merthyr Tydfil / Merthyr Tudful	2
Neath Port Talbot / Castell-nedd Port Talbot	3
Rhondda Cynon Taf / Rhondda Cynon Taf	4
Newport / Casnewydd	5
Caerphilly / Caerffili	6
Torfaen / Tor-faen	7
Carmarthenshire / Sir Gaerfyrddin	8
Denbighshire / Sir Ddinbych	9
Bridgend / Pen-y-bont ar Ogwr	10
Cardiff / Caerdydd	11
Pembrokeshire / Sir Benfro	12
Swansea / Abertawe	13
Wrexham / Wrecsam	14
Isle of Anglesey / Ynys Môn	15
Ceredigion	16
Conwy	17
Gwynedd	18
Powys	19
Flintshire / Sir y Fflint	20
Vale of Glamorgan / Bro Morgannwg	21
Monmouthshire / Sir Fynwy	22

Table 2 - Local health board deprivation rankings

Health board	Most deprived 20% LSOAs in Wales (ranks 1 - 382)	LHB Rank (1= most deprived)
Betsi Cadwaladr University Health Board	48	5
Hywel Dda University Health Board	22	6
Aneurin Bevan University Health Board	100	1
Cardiff and Vale University Health Board	69	3
Cwm Taf Morgannwg University Health Board	73	2
Swansea Bay University Health Board	65	4