A Public Health and Climate Change "Countdown" for Reading

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Elizabeth J Z Robinson[1*], James Baldock[2], Daniel Piears[2],
Claudia Di Napoli[1], Shouro Dasgupta[3,4]

[1] School of Agriculture, Policy, and Development, University of Reading
[2] School of Archaeology, Geography and Environmental Science, University of Reading
[3] Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC)
[4] Università Ca' Foscari Venezia, Italy

* Corresponding author, Professor Elizabeth J Z Robinson, e.j.robinson@reading.ac.uk

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1 Introduction and key messages

Across the planet, climate change is damaging our health. Vulnerable populations, including the elderly and outdoor workers, are increasingly susceptible to the more frequent and more intense heatwaves that are a consequence of global warming. Air pollution, principally driven by fossil fuel use, and exacerbated by climate change, damages our hearts, lungs, and other vital organs. The press and media are increasingly featuring the impacts of climate change on health, but often this is far from our locale. One such example is the recent extreme wildfires in Australia and the western United States that led to increased risk of severe asthma attacks; increased pressure on the health of those suffering from pre-existing respiratory or cardiovascular disease; post traumatic stress disorder, PTSD; and increased incidences of depression, anxety, suicidal thoughts, and suicide.

Here in Reading, the impacts of climate change on human health may not be so visible, but they are already being felt, harming people's livelihoods, and putting increased pressure on our local public health services which must work harder to deal with climate-related health problems, diverting resources that could be spent treating other illnesses and diseases. That we are writing this report in the middle of the Covid-19 pandemic only highlights the need for a better understanding of the links between climate change and health, and the contribution that towns and cities can make to climate change mitigation, that benefits the health of both the local and global population.

Climate change is a global public bad, and therefore global assessments, solutions, and actions are essential. But equally, local action is proving important for tackling global issues (Ireland and Clausen, 2019), and towns and cities are increasingly involved in driving climate change mitigation (Betsill, 2001; Lutsey and Sperling, 2008; Tang et al., 2010). Taking action at a local level makes sense, in no small part because

many of the actions required to mitigate climate change also have immediate local health benefits. For example, switching from private petrol and diesel cars to public transport or electric cars can reduce air pollution and thereby improve local health across a town, whilst also contributing to global reductions in greenhouse gas emissions. Similarly, switching to walking and cycling additionally improves an individual's health, and again contributes to global efforts to reduce climate change. Improved health outcomes reduce pressure on local hospitals and health services more generally, and have the potential to also enhance local livelihoods and improve the local economy.

The Lancet Countdown (Watts et al., 2017, 2018, 2019) tracks the links between health and climate change at a global scale. In doing so, it demonstrates the clear benefits to human health from climate change mitigation, particularly in terms of cleaner air, healthier diets, and more liveable cities. This report, the "Reading Countdown", is the first town or city level climate change and health "Countdown", and is directly inspired by the Lancet Countdown.[1] The report has been prepared as a contribution to the Reading Climate Action Network. With limited time and budget, and constrained by Covid-19, we recognise that this report cannot be a fully comprehensive assessment, but rather a proof of concept report. However, we hope that this report will inspire others to contribute to and expand on our first "Reading Countdown" for public health and climate change.

1.1 Key questions for climate and health in Reading

Our report asks the following questions. To what extent is climate change having a negative impact on the health of Reading town's residents, and is this getting worse or better over time. To what extent are actions by Reading town contributing to an improvement in, or worsening of, health outcomes and climate change mitigation, and how is this changing over time. To what extent is Reading city successfully adapting to the negative impact of climate change on public health. Finally, we ask the extent to which our local Berkshire MPs and local press are explicitly engaging with the links between climate change and health.

It should be noted that inconsistency in data coverage is a barrier to tracking climate impacts on health at the town-level in the UK as data availability varies between town/county/Unitary Authority/Clinical Commissioning Groups/hospitals. In this context, Reading and Berkshire are no exception.

1.2 Key messages

Data for Reading show clearly that mean temperatures, the frequency of heatwave events, and the number of heat stress days have increased in Reading over the past four decades. The period 2009-2018 was 0.3°C warmer than 1981-2010, and the number of heat stress days has increased by 1.2 days per year.

In parallel, the prevalence of diseases in Reading that are linked to heat and heat stress, including cardiovascular diseases and diabetes, have increased. Rates of mortality from respiratory (3.4%), communicable (5%), and chronic kidney diseases (1.5%), all of which are linked to heat stress, have increased over the last decade. These

[1] Three of the authors, Robinson, di Napoli, and Dasgupta, are co-authors on the Lancet Countdown.

data make clear that global warming appears to be having a measurable and negative impact on health outcomes in Reading.

These increases in disease prevalence put increased pressure on local health services. Hospital admissions due to respiratory, chronic obstructive pulmonary diseases, and asthma have steadily increased over the last decade in Berkshire and Reading. This makes it more difficult for Reading to improve its overall health outcomes.

Reading has not been a passive bystander while global climate change increasingly and directly harms the health of the town. Individuals have taken actions that make them less susceptible to climate-related illness. For example, smoking can lead to health complications and illnesses with consequent increased susceptibility to heatwave events, and smoking prevalence has declined since 2006. In Reading, in contrast to a general downwards trend in England, bus journeys have increased 38% over the past decade. Reading is also ahead of the curve with respect to investment in electric vehicle chargers, with 31 chargers per 100,000 people compared with 27 per 100,000 across England as a whole. Reading has invested in 62 bio-gas powered and 21 hybrid buses, that not only contribute to a reduction in overall vehicle miles and traffic, but also produce less particulate pollution.

However, "active transport" such as walking and cycling, that can contributed to reduced traffic congestion and offer further individual health co-benefits, has not increased between 2015 and 2018.

Reading reduced its CO_2 emissions by almost 50%, between 2005 and 2015, thereby contributing to global climate mitigation and the corresponding global health co-benefits; the UK's climate change commitments; and potentially directly improving local health outcomes.

However, emissions within the transport sector have not fallen so rapidly, and these are strongly linked to local air pollution and local air quality, with direct localised negative health impacts. This suggests that Reading could be missing out on important health co-benefits associated with reducing emissions from transport. Indeed, our findings may explain why, although overall emissions have been declining in Reading, the fraction of mortality attributable to particulate air pollution has been increasing since 2015.

Tracking Hansard's records of what is said in Parliament, we find that all Berkshire MPs have mentioned climate change in at least one debate since 2006, except for James Sunderland (Bracknell, 2019-present) and Laura Farris (Newbury, 2019-present), both of whom are very recently elected (December 2019) members of Parliament. Overall, the total number of debates participated in by Berkshire MPs in which "climate change" is mentioned is 121, equivalent to an average of just 2.28% of the total number of debates they have participated in. Out of these 121, in only 16 of these was a climate and health connection made, of which 14 can be considered implict and just two explicit. Both these explicit health mentions were by a single MP (Matt Rodda), Shadow Minister for Local Transport (2016-2020), who made a connection in both debates (25/06/2019 and 23/07/2019) between the need to reduce emissions and pollution and health benefits associated with consequent moves to walking and cycling.

The Reading Chronicle has increased its coverage of climate change considerably in the past three years. However, only 13% of articles that address climate change address the links between climate change and health.

Overall, in local media climate change has rapidly increased as a topic and arguably has become a key talking point over the last year. More MPs and candidates are talking about climate change, more policies and plans are being put forward and, perhaps most importantly, more change appears to be occurring. However, rarely are the health impacts associated with climate change addressed explicitly.

2 Methodology

To address these questions posed in this report, we select and track a subset of indicators from the 41 global indicators tracked by the Lancet Countdown, adapted where relevant to the local context. We first looked in detail at each of the 41 Lancet Countdown 2019 indicators (Watts et al. 2019) and ranked them according to their relevance to the town of Reading, the feasibility of collecting the relevant data given limited time and funds, and their potential interest to policy makers. We then selected the indicators to be included in this report, and adapted them to the local context. Each indicator that we finally selected has its own specific methodology that can be found in the appendices[2].

Where feasible, we follow the structure of the Lancet Countdown (Watts et al., 2019), dividing our selected indicators according to impacts, exposures, and vulnerability; adaptation and planning for resilience to health; mitigation actions and health co-benefits; and public and political engagement. We do not include a section on "economics and finance."

3 Findings

We present here our findings that together build a narrative of how climate change is affecting the health of Reading's residents, the extent to which climate change is putting pressure on local health services, and the efforts that Reading – the people, the town, the council – are taking to both improve local health and contribute to global climate change mitigation. We include novel approaches, designed by the University of Reading student co-authors of this report (Piears and Baldock) to track the extent to which our parliamentary representatives and local press are engaging with climate change and its impact on health, and how this has evolved over time.

3.1 Climate change impacts exposures and vulnerability

Temperatures are increasing in Reading, which is consistent with national and global data, and not surprising. As for many regions in the world, the UK has been witnessing an increase in temperatures. The most recent decade (2009–2018) has been on average 0.3°C warmer than the 1981–2010 climate reference period and all the top 10 warmest years the country has ever experienced have occurred since 2002 (Kendon et al. 2019). Heatwave events in Reading are also increasing in frequency. This, combined with increasing heat stress, and an increasing number of people aged over 65

[2] The appendices to this report are available at this link.

living in the area, makes Reading's population increasingly vulnerable to heat-related diseases, and is likely to put increasing pressure on public health services. We explore the relevant data in more detail in this section.

3.1.1 Maximum temperatures

Historic recorded climate data from 1980 to recent years show that maximum temperatures in Reading have been on the rise (Figure 1).

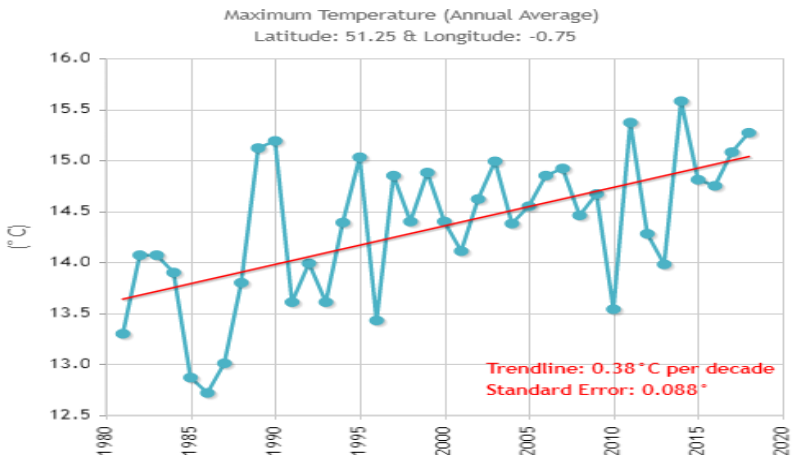


Figure 1: Maximum temperatures trend for Reading (latitude: 51.25°N, longitude: 0.75°W).

Source: Data have been compiled by the Climatic Research Unit (CRU) at the University of East Anglia, UK by combining, validating and interpolating available weather station data into a global grid (image © 2020 ClimateCHIP)

Over a longer time period (1908 to present day), the data suggest that that 17 of Reading's 20 warmest years since 1908 have been in the most recent 30-year period (Figure 2).

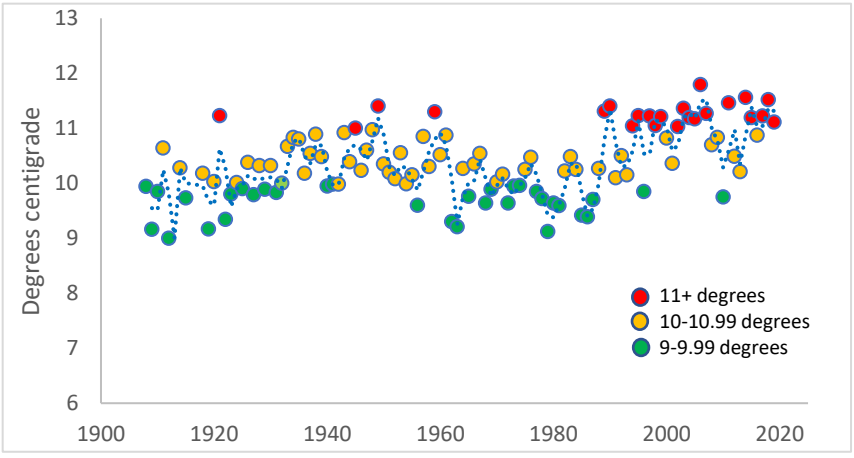


Figure 2: Yearly mean daily temperature averages in Reading (1908-2019)

Source: Data drawn from University of Reading Meteorology Departments' weather station recordings

3.1.2 Heatwaves and vulnerability

Because heatwaves are of considerable importance for public health, heatwave events in Reading have been calculated. Here a heatwave event is defined based on the Met Office definition – which is that a heatwave occurs when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding their established heatwave temperature threshold. This threshold varies by county and is 27^{O}C for Berkshire (Figure 3, LHS).

Data gathered and collated from the University of Reading's weather station records suggest that the number of heatwave events (i.e. 3+ days at or above 27^{O}C) has been steadily increasing on a decade by decade basis since 1961 (Figure 3, RHS).

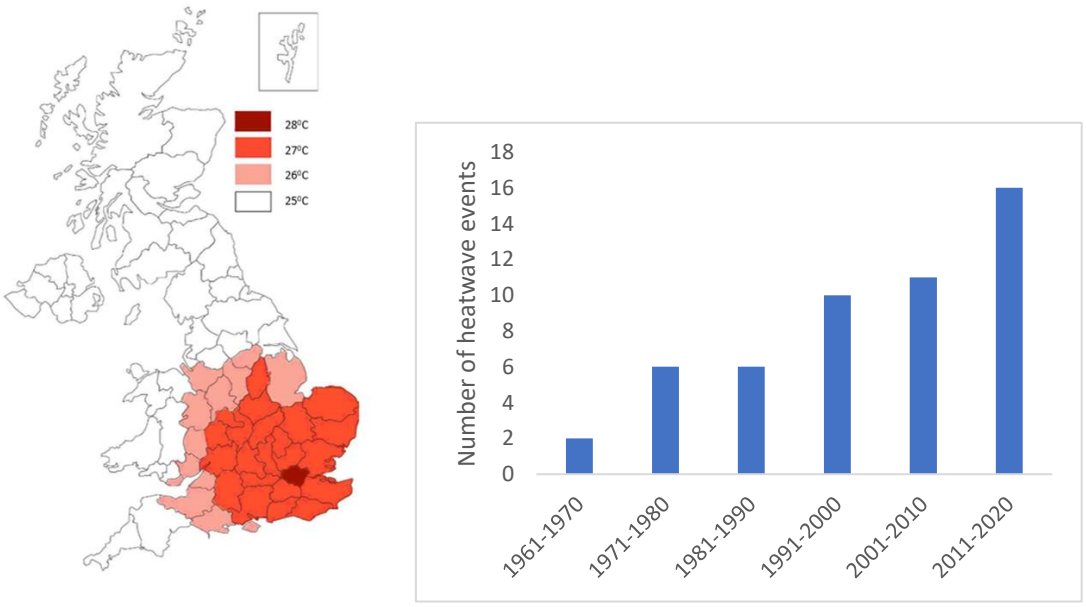


Figure 3: (LHS) Met Office temperature threshold graphic, and (RHS) Number of heatwave events by decade (1961- Oct 2020)

Source: Met office (https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/temperature/heatwave) (LHS); University of Reading Meteorology Departments' weather station recordings (RHS)

Increasing temperatures represent a threat to human health. Warmer summers and more extreme temperatures potentially expose populations in affected areas to heat-related disorders such as dehydration and sunstroke, and ultimately death (WHO 2020). The worst impacts of temperature on human wellbeing occur during heatwaves, unusual extended periods of hot weather, which have been hitting the UK with increasing frequency, duration and severity since the late 19th century (Chapman et al., 2019). This trend has been recently demonstrated as human-induced (Christidis et al., 2020).

There are several years during this 60-year period where local heatwave events have been particularly prevalent or extreme. For example, 1995 and 2018 both saw a record (since 1961) 5 heatwave events, with 1995's heatwaves averaging 4.4 days in duration and 2018's heatwaves averaging 5 days in duration. The longest continual heatwave events during this period took place between the 23rd June and 8th July 1976 and the 3rd and 13th August 2003, totalling 16 and 11 days in duration, respectively. In contrast to these statistics, in no single year in the 1960s or the 1980s did more than one heatwave event occur.

Three years, 1995, 2003 and 2018, are three of the most significant years for heatwaves observable in the University of Reading's weather station data. These, broadly speaking, follow similar temperature trends, peaks and troughs, to the UK more broadly, and to other European towns and regions. For example, during the UK's 1995 heatwave an estimated 619 extra deaths were observed in England and Wales, representing an 8.9% increase relative to the expected number during that period (Rooney, et al., 1995). Similarly, a study of 9 French cities during the 2003 European heatwave suggests that an extra 3,096 deaths occurred than would have been expected in these cities (Tertre, et al., 2006), with likely up to 15,000 excess deaths across the whole of France (Fouillet, et al., 2006). More recently, a study of the impacts of the 2018 heatwave on the mortality rate in Sweden suggests that between the 2nd July and the 5th of August, 635 more deaths (an 8.2% increase, which moves up to 13.5% during the warmest week) took place than would be expected in the country (Astrom, et al., 2019).

3.1.3 Heat stress

The health disorders and excess mortality observed during heatwaves are due to a heat load, called *heat stress*, that can undermine the human body's ability to maintain its core temperature within the range of optimal physiological performance during a prolonged exposure to extremely hot conditions (McGregor and Vanos 2018). In Reading the number of days per year when heat stress occurred have increased in the past 40 years. According to the Universal Thermal Climate Index (UTCI), a state-of-the-art parameter that assess the heat stress from the energy–thermal exchange between multiple environmental factors and the human body, Reading experienced 23.4 days/year of heat stress in the last 5 years (2015–2019), with 3.2 days/year characterised by high heat stress. These numbers indicate an increase by 1.7 days/year and 1.2 days/year respect the average climate reference period (1981–2010, Figure 4**Error! Reference source not found.**).

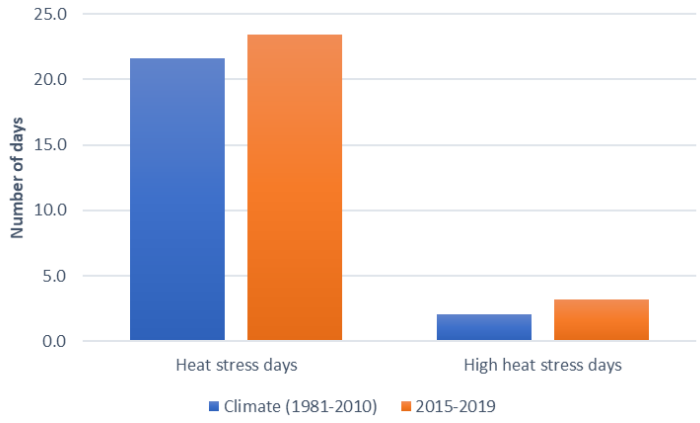


Figure 4: Histograms of days when conditions of heat stress were achieved in Reading for indicated periods and according the Universal Thermal Climate Index (UTCI > 26°C for heat stress days and UTCI > 32°C for high heat stress days)

Source: Data have been extracted from the ERA5-HEAT database (https://doi.org/10.24381/cds.553b7518).

3.1.4 Vulnerabilities to heat

Certain groups are disproportionately susceptible to heatwave events. Here we consider age; diabetes; coronary heart disease, CHD; chronic kidney disease, CKD; and smoking prevalence. Older people tend to have more chronic diseases with often interlinked weakened thermoregulation responses and less of an ability to protect themselves from heat stress (Oudin Astrom, et al., 2015). Various studies have validated this connection between heat and age, with, for example, mortality ratios in France during the European heatwave of 2003, demonstrably increasing with age (Kenny, et al., 2009). Thus, the number of over-65s in the local population is particularly worth studying as an indicator of the town's vulnerability to heat. We find that overall there is some evidence that Reading's population has been ageing over the past ten years (Figure 5). Given an increase in the prevalence of heatstress in Reading, more lives are at risk of heat related ill-health and mortality, which will also put inceased pressure on healthcare services in Reading.

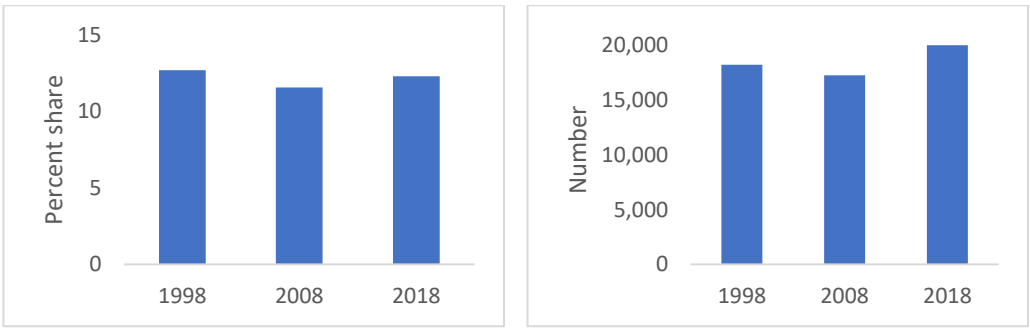


Figure 5: Estimates for share of population and number of people over 65 in Reading

Source: Office for National Statistics

Various studies have highlighted a link between diabetes and vulnerability to high temperatures, with studies in different localities suggesting that hospitalisations (Xu, et al., 2019) and deaths (Kenny, et al., 2009) are significantly higher for people with diabetes during heatwave events. Several suggestions have been put forward as to why. These include an impaired ability for blood vessels in the skin to dilate, be brought to the surface and dissipate heat amongst types 1 and 2; poor glucose control with consequent impaired sweating responses amongst type 2; and vascular impairments amongst type 1 (Kenny, et al., 2009).

PHE (Public Health England) estimates diabetes prevalence (types 1 and 2) in Reading in 2020 to be 7.6%, encompassing a total of 10,079 individuals; increasing both in absolute terms (from 9,323 individuals) and as a percentage of the overall population (from 7.2%) since 2015 (Figure 6).

The prevalence rate for diabetes estimated in the PHE model is 1.3% higher for England as a whole, at 8.9%, as compared with Reading. We do recognise that there is a considerable likelihood of overlap between this group, the over 65s, and other groups that are particularly vulnerable to heatwaves.

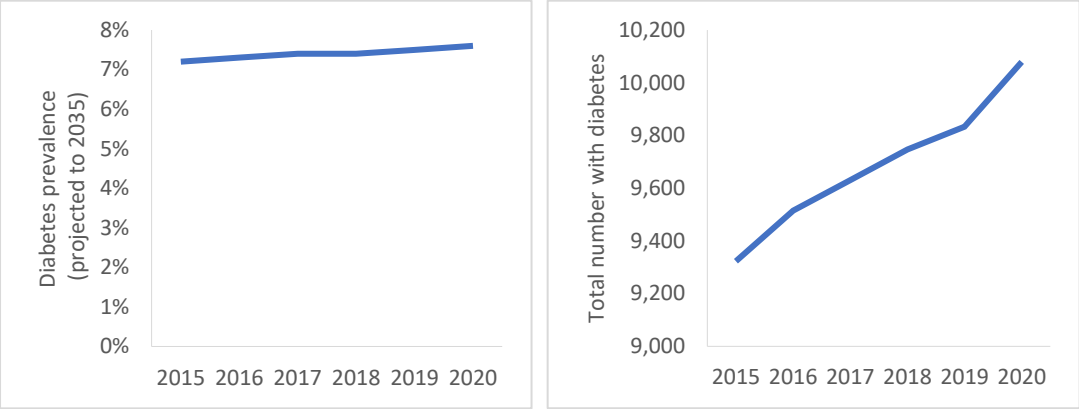


Figure 6: Diabetes Rates (LHS) and total number (RHS) in Reading since 2015

Source: Based on estimates from Public Health England; includes both type 1 and type 2 diabetes.

Cardiovascular diseases, including CHD (coronary heart disease) have been shown to reduce tolerance to heat, largely due to factors such as decreased sweating mechanisms and ineffectual elevations in skin blood flow (Cui and Sinoway, 2014). Therefore, risk amongst these groups is likely to be greater during heatwaves. Temporal data for CHD is not available at a local level. However, the West Berkshire CCG (Clinical Commissioning Group) prevalence rate for heart disease in 2018/19 stands at 2.1% (306.7 per 100,000), compared to 3.1% for England (488 per 100,000). Prevalence of cardiovascular diseases (Figure 7, LHS) in Reading has been on an increasing trend since 2014 after a sustained decline since 1990. Similarly, the prevalence of diseases related to environmental heat and cold exposure (Figure 7, RHS) has increased since 2010 following two decades of decline. Both these increases can be partially attributed to the increase in the heat stress and the increased frequency of heatwave events in Reading (see Figures 3 and 4).

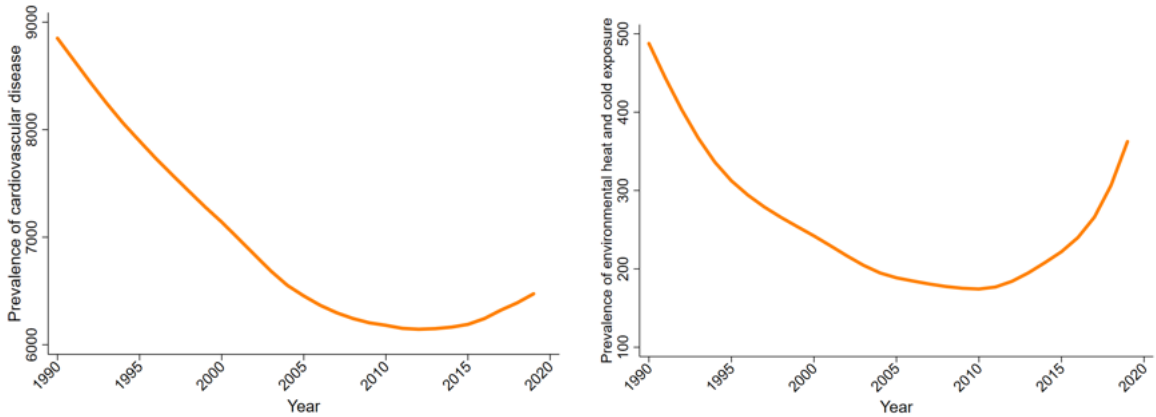
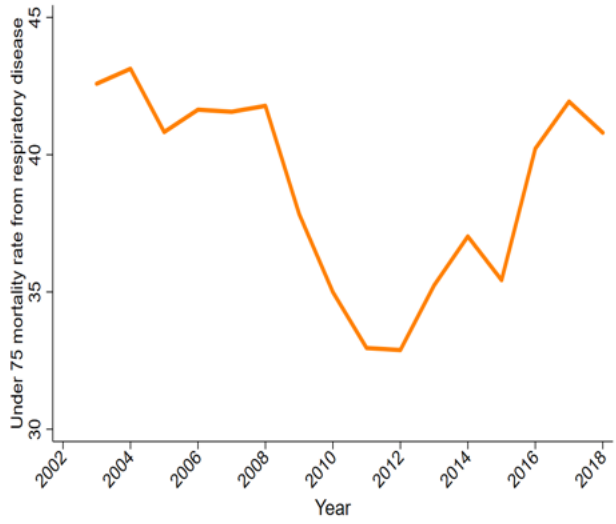


Figure 7: Prevalence of cardiovascular diseases (LHS) and environmental heat and cold exposure (RHS) in Reading

Source: Global Burden of Disease (2019)

High temperatures and increased frequency of extreme heat events contribute directly to respiratory diseases. Data suggest (Figure 8) that the under-75 mortality rate from respiratory diseases, considered preventable, in Reading has started to increase since 2011-2013 before which there had been a fairly steady decline since 2001-2003. This may be attributable to climatic stressors and additional stress being exerted on the health system. The Reading mortality rate has been consistently higher compared to South East England since 2010.



Time period	Rate of death	Comparison with South East
2001 - 03	861.6	Similar
2002 - 04	836.5	Similar
2003 - 05	762.5	Similar
2004 - 06	756.1	Similar
2005 - 07	703.2	Similar
2006 - 08	759.4	Similar
2007 - 09	745.0	Similar
2008 - 10	782.6	Worse
2009 - 11	723.2	Similar
2010 - 12	721.2	Worse
2011 - 13	758.9	Worse
2012 - 14	732.0	Worse
2013 - 15	752.5	Worse
2014 - 16	708.2	Worse
2015 - 17	741.4	Worse
2016 - 18	724.4	Worse

Figure 8: Under 75 mortality rate from respiratory disease in Reading (2003 –2018), (LHS panel); and rate of deaths from Respiratory Disease among people aged 65 years+ (compared with South East England and England) (RHS panel)

Source: Public Health England Local Authority Health Profiles

Though emergency hospital admissions for respiratory disease in NHS Berkshire West CCG declined slightly from 2017/18 to 2018/19, the trend has been worsening since 2013/14 (Table 1).

Time period	A&E for respiratory disease
2013/14	964.0
2014/15	1079.1
2015/16	1156.2
2016/17	1234.9
2017/18	1230.3
2018/19	1139.2

Table 1: Emergency hospital admissions for respiratory disease in NHS Berkshire West CCG - Directly age standardised rate per 100,000 population

Source: Public Health England Local Authority Health Profiles

Data from PHE also shows that the mortality rate from a range of communicable diseases including influenza has been higher over the past 5 years than during the ten years before that (Figure 9).

Figure 9: Mortality rate from communicable diseases included influenza

Source: Public Health England Local Authority Health Profiles

Increases in renal disease and acute renal failure have be shown to be greater during heatwaves (Hansen, et al., 2008). Thus, CKD (chronic kidney disease) is also worth a brief consideration. Though no temporal trends can be established for CKD at a Reading-only level, a Public Health England 2014 estimate for CKD prevalence placed the total numbers of over 16s with CKD in Reading at 5,803, with a prevalence rate of 4.6%. This compares with a South East rate from the same model of 6.4% and an England rate of 6.1%. Similarly, in 2018/2019 16,969 individuals over the age of 18 were diagnosed with CKD in NHS West Berkshire CCG. This represents 3.9% of the registered population over the age of 18 and compares with an England average of 4.1% across CCGs. Prevalance of chronic kidney diseases in Reading had been declining from aroung 1995 through to 2015. However, in the past few years the prevalence has started to increase. Similarly concerning, falling mortality rates in the 1990s have been replaced with increasing rates from 2000 onwards (Figure 10).

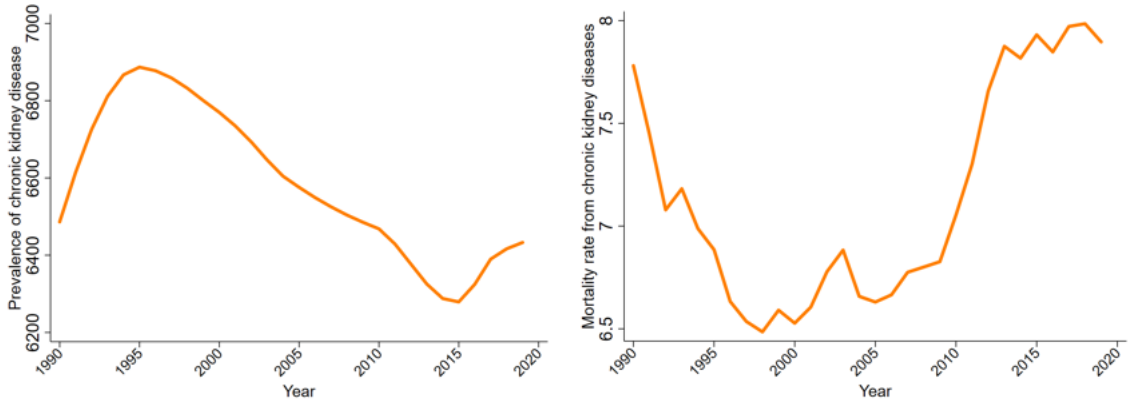
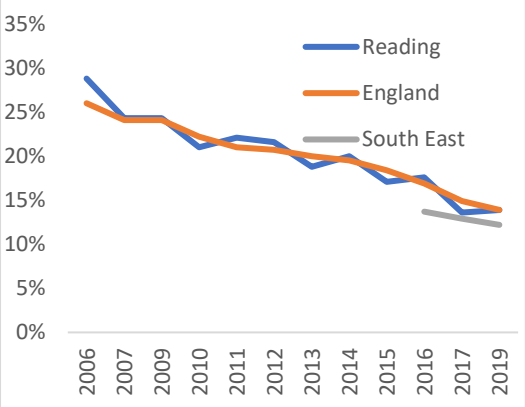


Figure 10: Prevalence of chronic kidney diseases in Reading (LHS panel); mortality from chronic kidney diseases in Reading (RHS panel)

Source: Global Burden of Disease (2019)

Smoking can lead to health complications and illnesses with consequent increased susceptibility to heatwave events. For example, smoking increases a person's likelihood of developing cardiovascular diseases and complications, including coronary heart disease, blood clots and resultant strokes (McBride, 1992). Smoking can also lead to respiratory disease through damage to airways and small air sacs in the lungs (Willemse, et al., 2004). The trends in Reading and nationwide for smoking are much more positive than, for example, trends in diabetes rates. Smoking prevalence in the past 14 years has fallen from a high of 28.8% in Reading in 2006 to 13.9% in 2019 (equivalent to an estimated reduction of 22,685 smokers). This is a similar pattern to that found for England as a whole, but notably higher than the South East average of 12.2% and has been for the three years (2017-19) where this comparison could be made (Figure 11).



Time period	Emergency hospital admissions for COPD	Comparison with South East
2010/11	358.4	Similar
2011/12	393.1	Similar
2012/13	401.4	Similar
2013/14	359.5	Similar
2014/15	411.1	Similar
2015/16	463.7	Worse
2016/17	521.7	Worse
2017/18	496.2	Worse
2018/19	474.6	Worse

Figure 11: Smoking prevalence in Reading and across England since 2006 (LHS panel); Emergency hospital admissions COPD in Reading - directly age standardised rate per 100,000 population (RHS panel)

Source: PHE Local Authority Health Profiles (2006-2019)

Emergency hospital admissions rate for chronic obstructive pulmonary disease (COPD) is considerably higher in Reading compared to both South East region and England. Although the rate has declined since 2016/17, the latest figure of 475 remains rather high compared to the beginning of the decade.

3.2 Mitigation actions and health co-benefits

In the 2019 Lancet Countdown, six indicators addressing climate change mitigation and health co-benefits were included, that spanned energy systems and health; access and use of clean data; air pollution and health impacts; sustainable and healthy transport; food and agriculture; and mitigation in the healthcare sector. Here, focusing on Reading, we address carbon emissions, renewable energy generation, healthy and sustainable transport, and air pollution levels.

3.2.1 Carbon emissions

Carbon dioxide emissions often come with the release of other particulates that can have adverse health effects. Efforts across Reading to reduce carbon dioxide emissions, such as from vehicles or energy generation, therefore have important local health co-benefits due to cleaner air in addition to contributing to global warming mitigation and the UK's national commitments, and global reductions in climate-based negative health impacts.

Reading reduced its CO_2 emissions by 46% between 2005 and 2018 (a larger percentage decrease in emissions than for England as a whole), suggesting that the town is on track to achieve its 2030 net zero carbon target, thereby contributing to global efforts to mitigate climate change. However, the majority of this reduction has come from reducing emissions related to electricity generation, whilst transport related emissions have only reduced by 18% (Figure 12). Emissions within the transport sector are strongly linked to air pollution and air quality which has immediate localised negative health impacts. This suggests that Reading could be missing out on important health co-benefits associated with reducing emissions from transport. Data on the fraction of mortality attributable to particulate air pollution (Figure 12), again provides evidence that the reduction in emissions may not have translated into local health benefits.

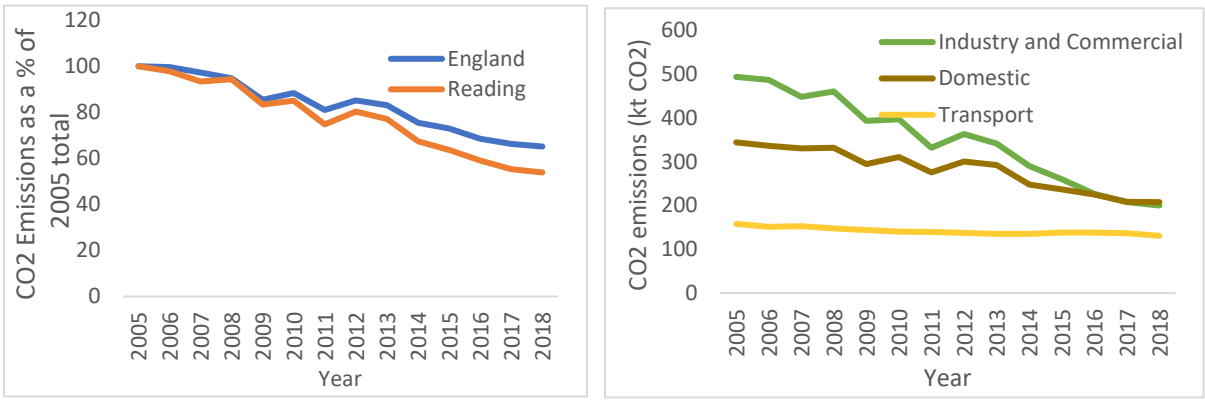


Figure 12: Carbon emissions for Reading and England (LHS panel); Grouped by domestic, transport, industry and commercial, 2005-2018 (RHS panel)

Source: Department for Business, energy and Industrial Strategy

Our findings may explain why, although overall emissions have been declining in Reading, the fraction of mortality attributable to particulate air pollution has been increasing since 2015 (Figure 13).

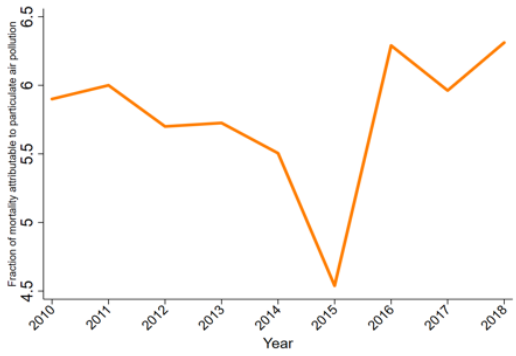


Figure 13: Fraction of mortality attributable to particulate air pollution (RHS panel)

Source: Public Health England Local Authority Health Profiles

Finally, comparing the CO_2 emissions which form these different categories reveals that, across the whole of Reading's CO_2 emissios, most reductions have occurred with respect to electricity generation (Figure 14), in line with the emergence of renewable energy solutions. These findings suggest that more needs to be done to find solutions to moving away from gas, which is the next largest producer of CO_2 emissions, and has only reduced slightly over the time period.

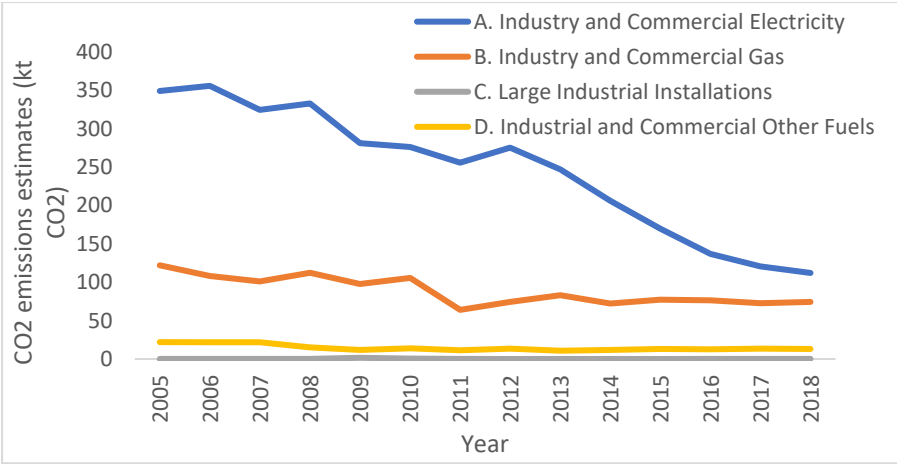


Figure 14: Reading carbon emissions further categorized, 2005-2018

Source: Department for Business, energy and Industrial Strategy

3.2.2 Healthy and Sustainable Transport

Road traffic not only adds to the global warming but also emits particulates which cause air pollution that is harmful to breathe. Lowering the level of polluting traffic on the roads can be achieved in two main ways: firstly, removing the number of vehicles by using other forms of transport; and secondly, using a non-polluting form of transport on the roads. In Reading, we can see that road miles increased from 2010 through 2016, but more recently have been falling (Figure 15). At the same time, across England as a whole, vehicle miles have risen suggesting that whilst Reading vehicle miles are still higher than in the eary 2010s, the locale is outperforming England as a whole.

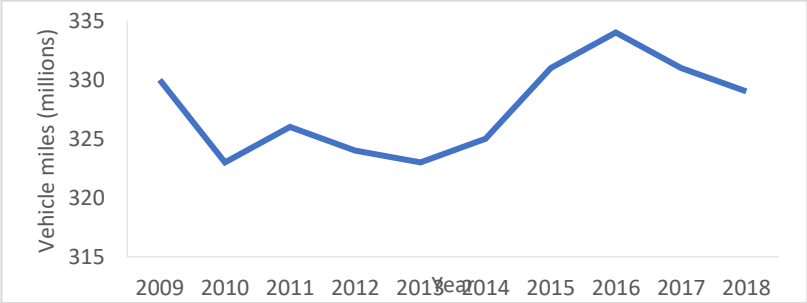


Figure 15: Vehicle miles (2009-2018)

Source: Department for Transport, https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra#traffic-by-local-authority-tra89 - TRA8901

Alternative methods of transport such as walking and cycling reduce traffic and have further health co-benefits. However, Reading has seen no change in the number of people cycling or walking between 2015 and 2018 (www.gov.uk/government/collections/walking-and-cycling-statistics). Although overall Reading has not managed to lower traffic on its roads since the levels in 2009, nor to improve the percentage of its population which travel via walking and cycling, it has been proactive in providing cleaner public transport and is improving its charging infrastructure for electric vehicles. Focusing on public transport, the general trend in England between 2009 and 2018 timeframe has been a downward trend in usage. Across the country there were 4,613 million journeys made in 2009/10 but only 4,318 million in 2018/19, a fall of 6%. In contrast, in Reading, bus journeys rose from 16 to 22 million in the same timeframe, a 38% increase. This increase, combined with a bus fleet which includes 62 bio-gas powered and 21 hybrid buses, not only reduces overall vehicle miles and traffic, but also produce less particulate pollution (Reading Buses, no date).

Whilst electric vehicles contribute to congestion, and may use electricity that originates from a polluting source, they do not pollute the local environment as do petrol and diesel vehicles. As such, if electric vehicles replace fossil fuel-based vehicles, air quality should improve. There is some evidence that provision of public charging infrastructure can increase the growth of electric vehicle sales (Wolbertus et al., 2018). We therefore track installations of electric car chargers as an important indicator of Reading's commitment to reducing air pollution caused by petrol and diesel cars. In 2019, Reading was in line with England at 22 charge points per 100,000 of the population. So far in 2020, Reading has increased access to charge points to 31 per 100,000 of its population, whilst England as a whole has only increased to 27 per 100,000.

3.2.3 Air pollution levels

Air pollution and poor air quality pose a clear threat to health and climate change. We explore the extent to which overall Reading has responded to a need for cleaner air. We do this by using historical datasets that record annual mean concentrations of both large and fine particulate matter, nitrogen oxide, and ozone. PM2.5 has been recorded in Reading since 2009 and PM10 since 1998.

The latest annual mean concentration for PM2.5 shows levels have fallen slightly over the timeframe but appear to have plateaued or even increased in the past few years, rising from 7µg/m3 in 2015 to 9µg/m3 in 2018 (Figure 16, LHS). The concentrations for Reading are, however, lower than the mean across all sites across England. In Reading, PM10 annual mean concentration has fallen somewhat steadily from 23µg/m3 in 1998 to 13µg/m3 in 2018 (Figure 16, RHS). However, as for PM2.5, in the past few years the concentration has plateaued. For most of the period for which we have data, Reading has had a slightly lower concentration than the mean of all sites. These levels are below what is considered dangerous, however, there are likely to be specific times during the day when levels were higher.

Figure 16: Annual mean PM2.5 (LHS) and PM10 (RHS) concentration (2009-2018)

Source: Department for Environment, Food and Rural Affairs

Annual mean concentrations of nitrogen oxide in Reading fell steadily from 41µg/m3 in 1998 to 22µg/m3 in 2008, but since then have started to trend upwards (Figure 17, LHS). Nitrogen oxide is heavily linked to fossil fuel powered vehicles, and these data are perhaps not surprising given the increase in vehicle miles since 2010. Finally, ozone is formed when nitrogen oxide combines with particulates and other gases. Ozone levels are recorded as annual average maximum daily 8-hour mean O3 concentration, and recent data suggest that ozone levels in Reading have barely changed since the late 1990s, and increased between 2016 and 2018 (Figure 17, RHS).

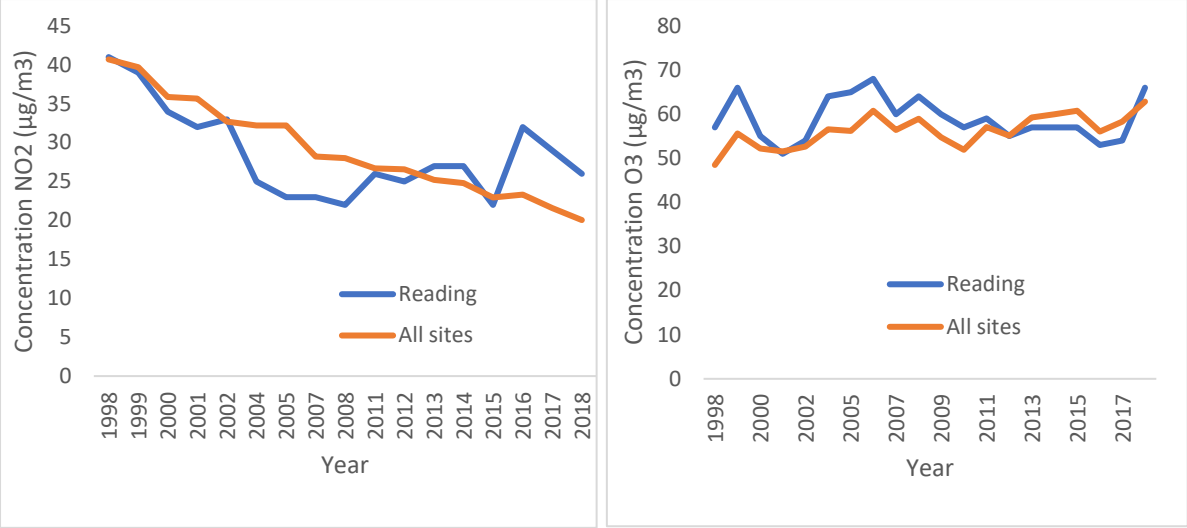


Figure 17: Annual mean NO2 concentration, mu-g per m^3, for Reading and across England (LHS); Annual average maximum daily 8-hour mean O3 concentration, mu-g per m^3, for Reading and across England (RHS)

Source: Department for Environment, Food and Rural Affairs

According to the British Lung Foundation, each of these pollutants can cause damage to lungs of both healthy individuals as well as those suffering with lung or respiratory conditions. Particulate matter has been linked to lung cancer, and admissions to hospitals for asthma related problems as well as bronchitis and pneumonia (BLF, not dated). Nitrogen oxide can cause respiratory conditions in younger and older people (BLF, not dated). Admission rates for asthma for children (0-9 years) decreased year-on-year between 2017/18 and 2018/19 but remain higher than 2010/11 through 2013/14 (Table 2).

Time period	Emergency hospital admissions
2010/11	145.7
2011/12	165.1
2012/13	158.2
2013/14	144.0
2014/15	209.2
2015/16	184.0
2016/17	163.1
2017/18	192.9
2018/19	175.2

Table 2: Admission rate for asthma for children (0-9 years); crude rate - per 100,000

Source: Public Health England Local Authority Health Profiles

3.3 Public and political engagement

In the Lancet Countdown 2019, four indicators were included: media coverage of health and climate change; individual engagement in health and climate change; engagement in health and climate change in the UN General Assembly; engagement in

health and climate change in the corporate sector. In our Reading Countdown, we take a novel approach, focusing on local print media and local politician engagement.

3.3.1 Media coverage

One method to understand the extent to which the local community is engaging with climate change and its links to health impacts and outcomes is to track the mentions of climate change within local newspapers, and how often climate change is explicity linked to health. Here we track articles that mention climate change, and climate change and health, in the Reading Chronicle from 2008 to 2020 (Figure 18).

What is most striking is that 45% of all articles which mention climate change over the past 12 years are from 2019, and the only year which comes close is 2020 (for which we have data up to July). We found that of these articles, only 13% featured a reference to health and just 2.5% of articles featured a strong overt link to health, the majority of which come from 2019.

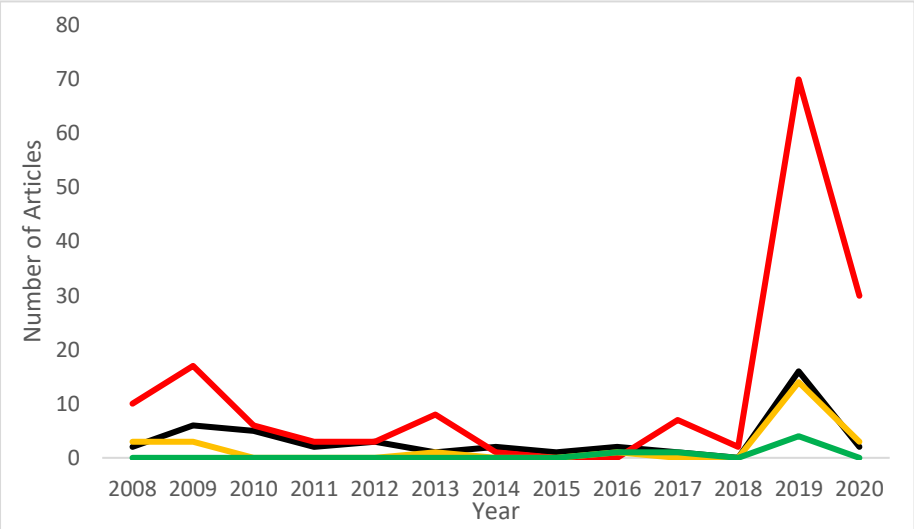


Figure 18: Reading Chronicle mentions of "climate change," alongside a health connection

Red is for articles which are about climate change but have no connection to health impacts. Amber is for articles which have an ambiguous connection to health impacts. These articles may mention elements of climate change and climate change mitigation which have health impacts but do not explicitly state this connection to health. Green is for articles which explicitly connect climate change and health. Finally, a black rating was applied to articles which were not about climate change but mention the words climate change within the article such as an article featuring a jazz band called climate change.

Source: Reading Chronicle

There are a number of reasons as to why 2019 may have seen such an increase in the number of articles addressing climate change, and a number linking climat change and health. At the start of 2019, the major driver behind articles was the emergence of Extinction Rebellion (XR) and the changes which they caused councils to make. For

example, on the 6th of February XR called for Reading Borough Council to declare a climate emergency and by the 27th of February, it was reported they had done so. From March onwards, a combination of articles streamed through regularly about plans and policies to reduce carbon emissions in Reading as well as climate protests both on a local and national level. On the 1st of October a shift occurred and the major theme from the articles published was parliamentary candidates for the upcoming general election speaking about climate change. The focus brought to climate change by XR may have led to climate change being an important element in the then upcoming general election, which was mentioned by almost every candidate at every possible time, and consequently reported on. This is reflected in the articles published in the Chronicle in 2019, with 17 articles that feature candidates' views on climate change.

3.3.2 Linking political and media engagement

We track articles in the Reading Chronicle that report on MPs addressing climate change. The number of mentions follows a very similar trend to the general trend of the articles with 10% of articles in 2019 featuring a sitting MP (Figure 19). This would suggest that Berkshire's MPs tend to be in line with the level of interest in climate change which has been seen in the number of articles published each year.

Overall, in local media, climate change has rapidly increased as a topic and arguably has become a key talking point over the last year. More MPs and candidates are talking about it, more policies and plans are being put forward and most importantly, more change is occurring. However, rarely are the health impacts associated with climate change addressed explicitly.

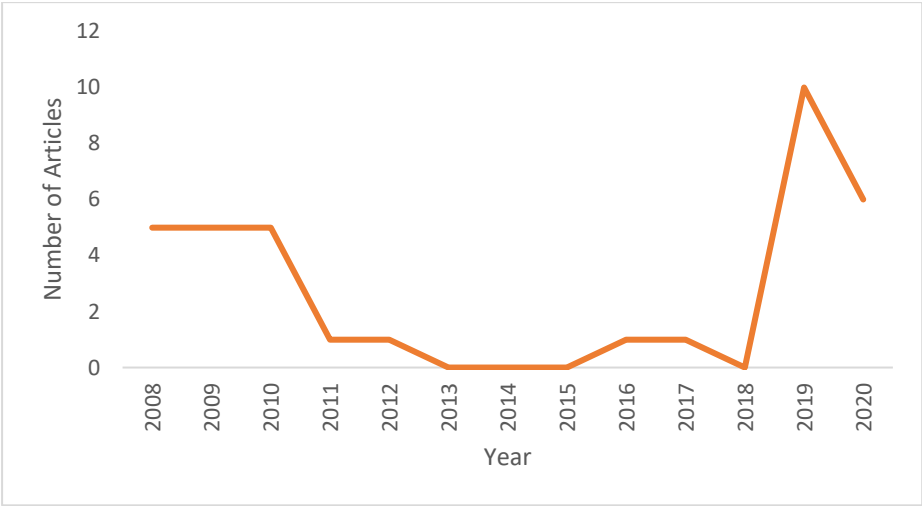


Figure 19: Reading Chronicle mentions of "climate change" and links with Berkshire MPs

Source: Reading Chronicle

3.3.3 Political engagement

To monitor political engagement, we considered all members of parliament representing a Berkshire constituency since 2006. We looked at how many of their individual debate participations mentioned "climate change", based on written Hansard records for all parliamentary speeches since 2006, and how many of those speeches also mentioned health, either explicitly or implicitly.

For consistency, "climate change" mentions were considered within the confines of a debate, rather than an individual contribution. For example, if an MP mentioned climate change on five separate occasions during a debate, this would have been counted as "one debate with a mention of climate change." This method effectively dissipates the ministerial effect, whereby a larger number of individual contributions tend to be made in debates than with backbenchers or lower-level ministers. This gives a reasonable proxy for how actively engaged individual MPs are with climate change and health issues.

All Berkshire MPs have mentioned climate change in at least one debate since 2006 (Figure 20), barring James Sunderland (Bracknell, 2019-present) and Laura Farris (Newbury, 2019-present), both of whom are very recent MPs (since December 2019) and therefore one would not necessarily expect them to have mentioned climate change at this early stage. Overall, the total number of debates participated in by each Berkshire MP in which "climate change" is mentioned is 121. This compares with a combined total of 5297 debates participated in by Berkshire MPs during this period. Therefore, taken as a whole, Berkshire MPs mention climate change in an average of 2.28% of debates they have participated in.

For this indicator implicit connections are largely based on human judgment. However, any possible arguable connection with human health and wellbeing, no matter how small, has been counted as an implicit climate and health connection.

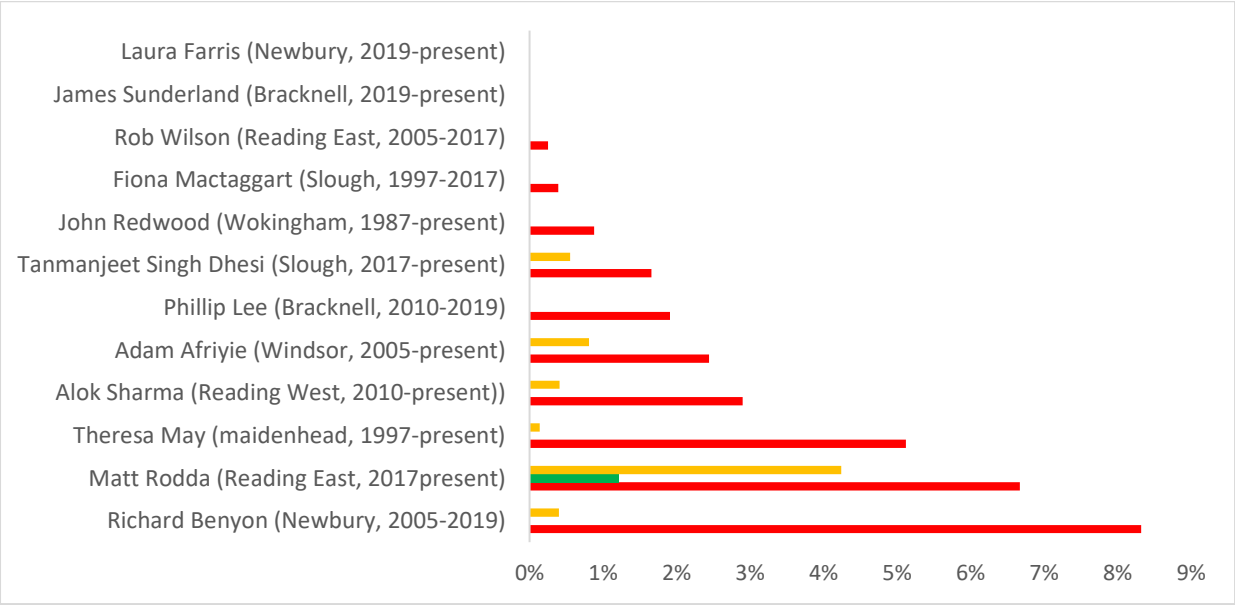


Figure 20: Percentage of Debates participated in by each Berkshire MP since 2006

Red bars represent debates where the named MP mentioned climate change, but not health. Amber bars represent debates where the named MP made implicit links

between climate change and health. Green bars represent debates where the named MP explicitly mentions and connects climate change and health. Percentages are determined by comparing the number of debates mentioning "climate change," (alongside "climate change" and "health" and implicit climate and health) with the total number of individual debates participated in by each Berkshire MP.

Source: Data drawn from Hansard parliamentary speech record

Looking at the debates in more detail, there are several observable common themes and topics of discussion. These include important pieces of national and international legislation, such as the 2001 Climate Change Levy (Redwood, 2013; Adam Afriyie, 2006), the 2008 Climate Change Act (May, 2019; Benyon, 2008), the 2016 Paris Climate Agreement (mentioned by Theresa May in seven separate debates between 2016 and 2019), and the 2019 Net-Zero carbon emissions target (May, 2019). Clearly, these pieces of legislation have engendered discussion, though the confines of these discussions are not limited only to years when these pieces of legislation were passed.

Broader climate themes commonly brought up include renewable energy (Rodda, 2019; Sharma, 2019; Dhesi, 2019; May, 2019; Benyon, 2011) deforestation (May, 2019; Wilson, 2009), biodiversity impacts (Benyon, 2009,2010), flooding (Richard Benyon mentions flooding alongside climate change in six separate debates) and lower/no-carbon transport (Matt Rodda mentions this in eight separate debates). A notable omission here is that there has been very little focus on the effects of temperature rises and heatwaves, with no explicit mentions (or, arguably, implied) of the issue in any debate.

Clearly MPs have been discussing climate change, to varying degrees, since 2006. However, when it comes to making connections between climate change and public health, the numbers are considerably lower. Out of the 121 debates participated in by all MPs where "climate change" was mentioned, in only 16 of these was a climate and health connection made. Out of these 16 debates participated in, 14 involve a climate and health connection deemed to be only implicit, while only two involve the mention of "health" in relation to climate change, and therefore make an explicit climate change and health connection. Both these explicit health mentions were by a single MP (Matt Rodda) who makes a connection in both debates (25/06/2019 and 23/07/2019) between the need to reduce emissions and pollution and health benefits associated with consequent moves to walking and cycling. Six MPs made connections between climate change and health deemed as implicit. The primary examples of climate and health links made are extreme foreign hurricane events impacting on Pacific islanders (Sharma, 2019; May, 2018), air pollution, particularly from Heathrow expansion (Afriyie, 2008, 2009; Dehsi, 2018; Rodda, 2019), flood and drought risks (Benyon, 2010, 2013) and further links between low/non-carbon transportation and improved health (Rodda, 2019, 2020).

Important within the framework of this indicator is whether awareness and discussion of climate change and health has changed over time amongst local representatives. Based on combined numbers of total debates participated in by each Berkshire MP on a year on year basis, a trend can be seen in which mentions of climate change are fairly steady between 2006 and 2018 before spiking in 2019 (Figure 21). Data for 2020 are of course incomplete. It is clear that there are very few links made between climate change and health, but there is a hint of an upward trend since 2017.

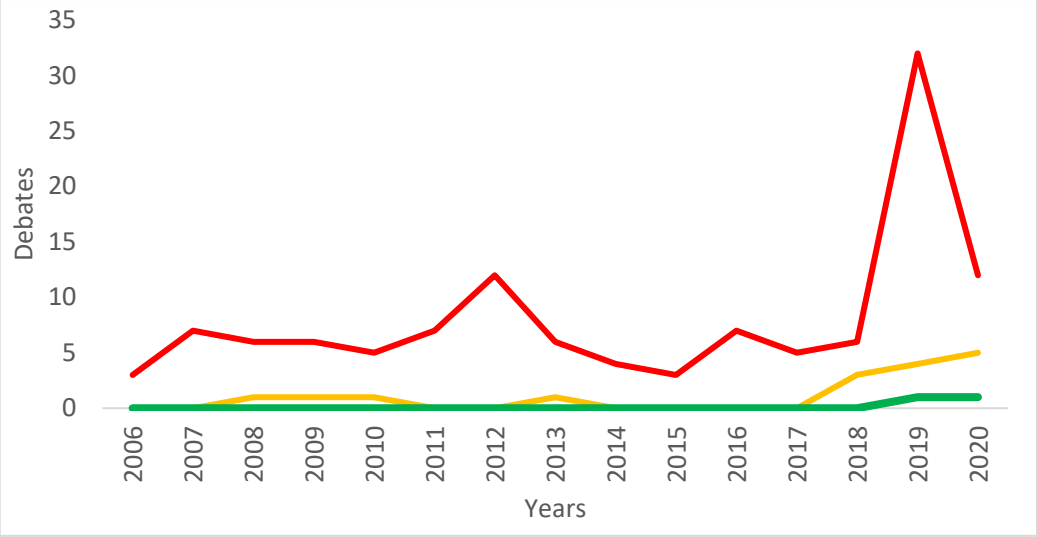


Figure 21: Combined Numbers of Debates Where Berkshire MPs mention Climate change (red), climate and health explicitly and implicitly (amber) and climate change and health explicitly (green). Data analysed from 2006-June 2020.

Source: Hansard records

There are two likely reasons for this 2019 spike. Firstly, 2019 was a year with notable and widely-covered climate strikes (starting on the 15th March 2019), with influential figures such as Greta Thunberg raising awareness of the issue. Politicians across the world and across the political spectrum reacted strongly to this, positively and negatively, thus undoubtedly having a major impact by boosting awareness and focus on the issue. Secondly, and arguably partly as a consequence of this, 2019 was the year the government (led by Berkshire MP and former Prime Minister Theresa May) committed to a net-zero carbon emissions target by 2050. These events are likely to have had an impact on Berkshire MPs. However, in no debates do any Berkshire MPs directly refer to these events.

It is difficult to discuss a set of MPs without mentioning the different political and professional roles held by these MPs. The responsibilities and, in the case of ministers, briefs of these MPs vary. For example, during this period John Redwood, Adam Afriyie, James Sunderland, Laura Farris and Fiona Mactaggart have been backbenchers. Therefore, these MPs are more likely to bring up topics of their own volition. In contrast, the other Berkshire MPs have, since 2006, held junior or senior shadow ministerial or ministerial roles, alongside other senior political roles.

For example, Matt Rodda was Shadow Minister for Local Transport (2016-2020) and Shadow Minister for Buses (since 2020). This may explain his considerable focus on transportation issues relevant to climate change. Alok Sharma was appointed COP26 president and three of his seven debates with climate change mentions focus on this fact, Richard Benyon was Parliamentary Under-Secretary of State for Natural Environment and Fisheries between 2010-2013 and is the primary reason for the 2012 spike, a year in which he mentions climate change in a total of 10 parliamentary debates (out of 12 for the year). Therefore, the individual roles and responsibilities of MPs during specific years should be taken somewhat into account. However, it is notable that despite changes in the lives and responsibilities of individual MPs there is a clear and undeniable spike in 2019 which supersedes this.

National issues and legislation relevant to climate change are clearly mentioned by Berkshire MPs. However, considering the focus here is on a local area, it should be considered how often local Berkshire issues relevant to climate change have been mentioned. Overall, the answer is relatively infrequently. Out of the 121 debate participations, in only three is a local Berkshire-specific issue related to climate change mentioned. The three examples are Matt Rodda mentioning a bridge in Reading across the Thames as an example of encouraging walking and cycling (04/02/2020); and Theresa May mentioning a green flag winning school in her constituency of Maidenhead (10/04/2019), as well as an increase of driving due to a decreased train service in Maidenhead (05/02/2020). When it comes to parliamentary speeches (at least on this issue) national issues and national and global events vastly supersede local issues and local events. Overall, few connections have been made between climate change and public health by Berkshire's politicians.

There are notable key legislation, topics and events related to climate change which have engendered discussion. However, these are mostly national or international events, with little focus on local issues relevant to climate change. This, therefore, in part highlights the importance of this report in encouraging discussion of the issues of climate change and public health at a local level as well as a national and international one.

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