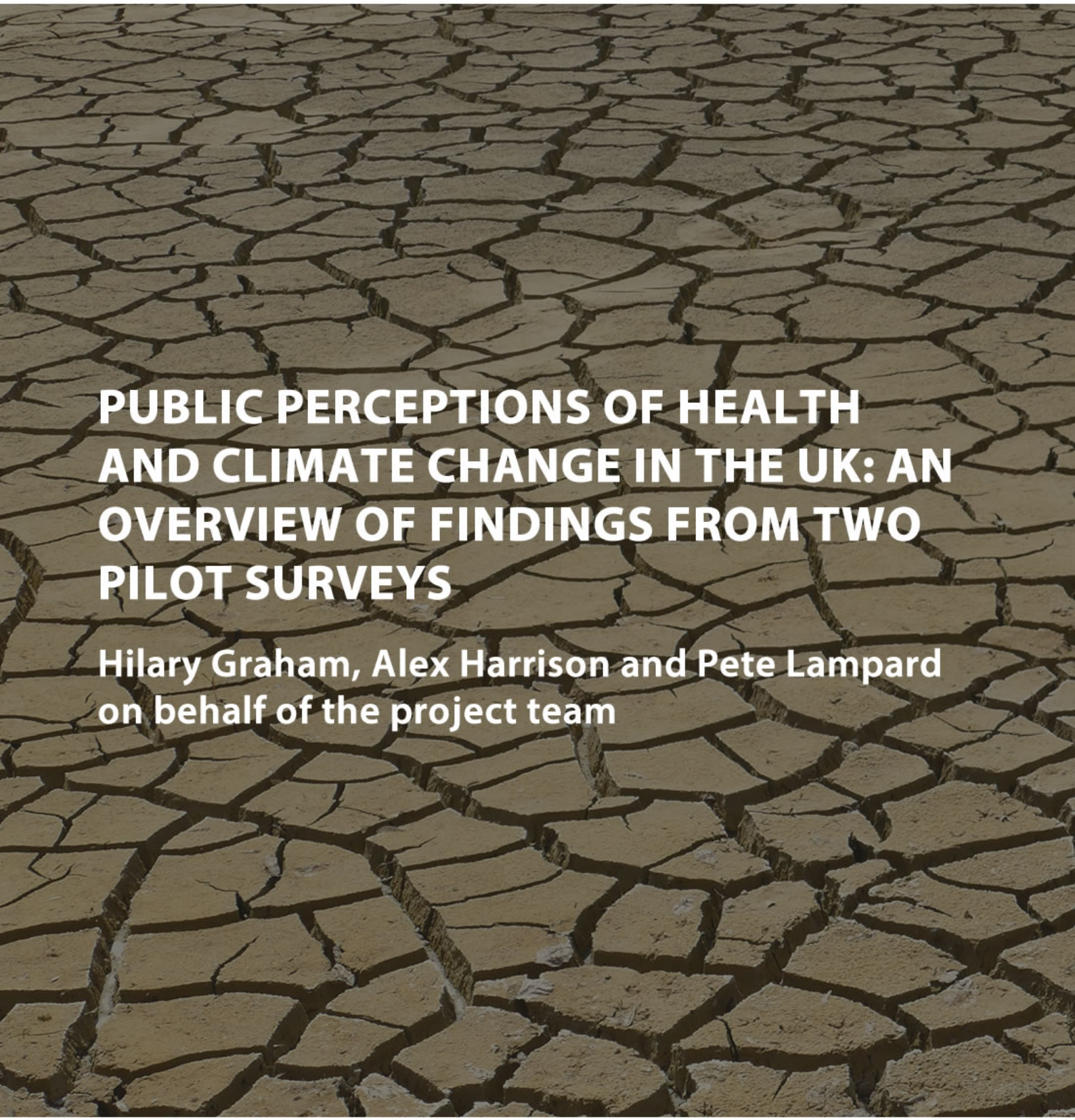
Public perceptions of the health risks of climate change and priorities for action: an interim report from the project, March 2021



PUBLIC PERCEPTIONS OF HEALTH AND CLIMATE CHANGE IN THE UK: AN OVERVIEW OF FINDINGS FROM TWO PILOT SURVEYS

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SUMMARY

This report draws on two pilot surveys conducted as part of the project on 'Public perceptions of the health risks of climate change and priorities for action'. The project is funded by the NIHR Public Health-Policy Research Unit.

The two UK surveys were carried out between December 2020 and February 2021. In each, 1000+ adults aged 18 and over took part.

The report presents headline findings relating to people's concerns about climate change and their perceptions of the health impacts of climate change. The report also presents findings on the climate-related exposures that the public consider the most important for the government to address in order to protect people's health. Finally, the report discusses people's moral values in relation to climate change, an area identified by the project Advisory Group as important but little researched.

We found that:

- *A large majority (88%) of participants were concerned about climate change: 49% were 'fairly concerned' and 39% were 'very concerned'. Being older and having a higher level of educational attainment were associated with being very concerned. However, the most significant factor predicting climate change concern was the experience of a climate-related exposure in the last 12 months (flooding to one's home/local area, heatwave that affected one's health and air pollution in the local area).*
- *Most participants (58%) considered that climate change was already having an impact on people's health in the UK; a further 28% considered that such impacts would occur within their lifetime. Those experiencing no climate-related exposures in the previous 12 months were less likely to consider climate change to already be having a health impact. Those experiencing air pollution in their local area were twice as likely to perceive climate change to be already affecting people's health.*
- *Air pollution was the exposure that participants considered the most important for government to address in order to protect people's health. Over half (52%) identified air pollution; a further 20% selected severe floods. Other climate-related exposures, including heatwaves, were identified as the most important by less than one in ten participants. Women, participants living in an urban setting and those who were not parents were more likely to select air pollution as their priority. The experience of air pollution in one's local area doubled the odds of identifying air pollution as the priority.*

In our exploratory analysis of people's moral values and climate change we found that:

- *The value statement relating to care ('we should take care of the planet for the sake of today's children and future generations') was most frequently identified as the most important (selected by 35% of participants). The value statement relating to purity ('climate change is damaging nature and upsetting the balance between the planet and its people') was chosen by 28% of participants. In contrast, a very small proportion (4%) selected fairness ('it is not fair that poorer countries are suffering most from the harmful impacts of climate change') as the most important. This suggests that a moral framing of climate change around fairness between nations – a value central to the 2015 Paris Agreement – may have limited public appeal.*

1. PROJECT BACKGROUND AND OVERVIEW

1.1 Background

Climate change is placing the health of current and future populations at risk. Greenhouse gas (GHG) emissions continue to drive up global temperatures [1], with impacts across a range of climate-related exposures, including extreme weather events, like floods and heatwaves, as well as air pollution [2, 3]. Climate change is also increasing the frequency, duration and severity of droughts [4, 5], disrupting agricultural production and the wider food system [6].

The UK's *National Risk Register 2020* highlights these climate-related risks, including flooding and severe weather (heatwaves, drought, storms and gales), and places their human health impacts at the top of its list of adverse consequences. In addition, it identifies air pollution as 'the largest environmental risk to public health in the UK' [7]. The emphasis on health risks is supported by evidence of the increasing toll that climate change is taking on people's health and wellbeing [8-10]. This includes air pollution [9, 11], heatwaves [10, 12, 13] and floods [14, 15].

The UK is committed to reducing GHG emissions to Net Zero[i] by 2050, a legally-binding target announced in June 2019. The achievement of this ambitious target would bring major benefits for public health [16, 17] – but requires public engagement and support. In December 2020, the Climate Change Committee, the statutory body advising government on reducing GHG emissions, published a 'route map' to enable the UK to become fully decarbonised[ii] by 2050 [18]. It emphasises the importance of public engagement, recommending that government communication and policies are informed by people's views and moral values. Moral values are 'beliefs infused with feeling' that serve as standards against which to evaluate actions, policies and people [19].

With respect to people's views, there is evidence that the UK public are concerned about climate change, a concern that has remained steady despite the COVID-epidemic. Across a range of surveys, only a small minority report little or no concern about climate change [20, 21]. In the 2020 UN *People's Voice* survey, over 80% of the UK participants agreed that climate change is a global emergency [22].

However, while the majority of UK adults are concerned about climate change, there are few studies of public perceptions of its health impacts [23, 24]. Most of the evidence comes from the US and Canada, with a paucity of UK studies [25]. Additionally, studies have paid insufficient attention to people's experiences of climate-related exposures as a potential influence on their perceptions of climate change and its health risks [26].

With respect to people's values, there is a similar evidence gap. Few UK studies explore the connections between people's moral values and their views on climate change and climate action [27, 28]. The wider literature has focused on the values of fairness/justice and

[i] Net zero means any remaining emissions would need to be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere, such as planting trees or using technology like carbon capture and storage

[ii] Carbon dioxide is the most common GHG emitted by human activities, both in terms of the quantity released and the contribution to rising global temperatures.

care/protection, values that underpin the 2015 Paris Agreement [29] and the UN Convention on Climate Change within which it sits [30]. However, US studies point to the importance of other values, including the importance of personal freedom and the purity of nature, in shaping people's engagement with climate change and their support for climate action [31, 32]. A moral framing grounded only in fairness and care may therefore limit the appeal of policies to achieve net zero and protect public health [31, 32]. To our knowledge, there have been no UK studies of how this wider set of values relate to people's perceptions of climate change and health.

1.2 Aims

The interim report draws on two UK-based pilot surveys that form part of the wider project. The aim of the overall project is to provide evidence on people's perceptions of the health risks of climate change and their priorities for action. In line with these aims, the interim report provides initial findings on people's perceptions and priorities.

An appreciation of people's concerns can, in turn, assist those developing national policies and local plans to reduce climate-related impacts on health. The project team have been supported by an Advisory Group who provided feedback on the scope of the surveys (see Appendix 1).

1.3 The pilot surveys

Two pilot surveys of adults aged 18 and over were conducted between December 2020 and February 2021, each with a minimum sample of 1000. Quotas were set for each survey for gender, age group, ethnic group, educational attainment and location (UK country/English region) in line with proportions in the UK population.

A further pilot survey is testing ways of measuring people's willingness to pay for interventions to reduce the health risks of climate change. Following this set of pilot surveys, main surveys are planned for summer 2021. A qualitative study is also underway, based on one-to-one interviews, to explore people's perceptions of climate change, its health impacts and their priorities for action. The project is also establishing a public involvement group to enable community input into the content of the UK surveys.

1.4 Overview of the interim report

The report presents findings related to four areas. The fourth area was added in response to advice from the project Advisory Group; it was noted that an appreciation of people's values was important in understanding their views on health and climate change and therefore in informing the direction for policy.

The four areas discussed in the report are:

1. Public concerns about climate change
2. Public perceptions of the health impacts of climate change
3. Climate-related exposures that the public consider the most important for the government to address to protect people's health
4. Moral values and climate change

The sections of the report summarise the survey methods (section 2) and highlight key findings relating to the four areas (sections 3-6). Conclusions and next steps are outlined in the final section.

2. METHODS

2.1 Where do our data come from?

We had planned to include questions on people's perceptions of health and climate change in the Opinions and Lifestyle Survey run by the Office for National Statistics (ONS) [33]. However, the survey was suspended in March 2020 to enable ONS to prioritise COVID-related data collection.

The project is therefore using Qualtrics [34], a survey platform increasingly used by health and climate change researchers [35-38]. It provides access to a UK-wide panel of people aged 18 and over who have agreed to be contacted about participation in online surveys. Our surveys involve a double-consent process: firstly, to be part of the Qualtrics panel and, secondly, to participate in the survey. The surveys have ethics and governance approval.[iii]

Potential participants were given an information sheet and invited to consent (or decline) to take part in the survey. An opening 'filter' question asked the participants whether they had taken part in a survey on climate change in the last 12 months; those who indicated that they had were excluded.[iv]

The two pilot surveys were conducted in November/December 2020 (18th Nov-10th Dec) and January/February 2021 (20th Jan-15th Feb). The period of the first survey overlapped with the two-week inquest (30th November to 16th December) into death of Ella Adoo-Kissi-Debrah, who lived near the South Circular Road in south-east London, and died in 2013. Southwark Coroner's Court concluded that air pollution 'made a material contribution' to Ella's death [39]. The second pilot survey ran across the period when the UK was hit by storm Christoph (18th-20th January) and its aftermath of floods [40]. Each survey had a minimum sample of 1000.

For each survey, quotas were set to match the UK population with respect to gender, age group, ethnic group, educational attainment and UK country/English region. The sample profiles are summarised in Table A1.

Along with standard questions asked of all participants, the two pilot surveys were designed to test different question formats. This restricts the extent to which data from the surveys can be combined for the interim report.

2.2 What topics does our report cover?

The surveys covered a broader range of issues than presented in this interim report. In the report, we present findings related to four areas:

1. Public concerns about climate change
2. Public perceptions of the impacts of climate change on people's health in the UK

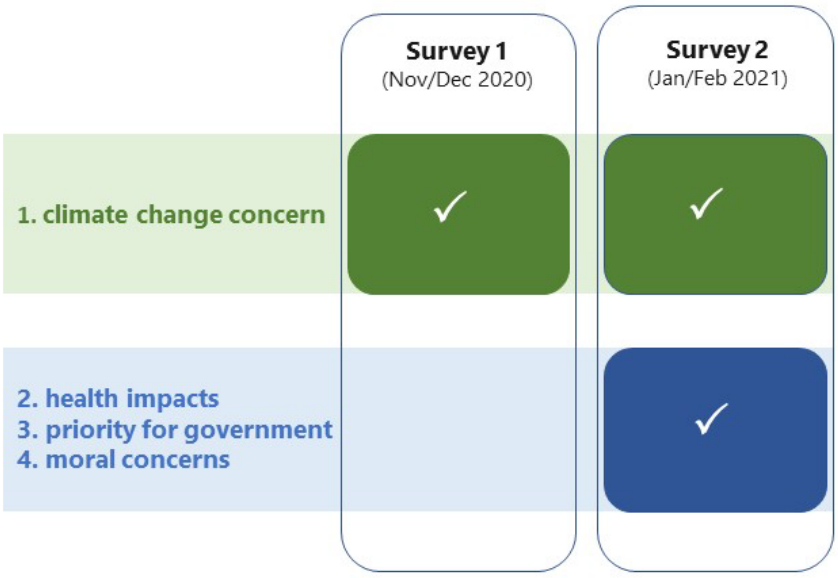
[iii] From the Health Sciences Research Governance Committee, ref. no: HSRGC/2020/409/C https://www.york.ac.uk/healthsciences/research-information/rsg/

[iv] Qualtrics applied an additional check with respect to particpants' inclusion in climate change-related surveys that used their survey platform or one of their panel partners.

3. Climate-related exposures that the public consider the most important for the government to address to protect people's health
4. Moral values and climate change

As Figure 2.1 indicates, data from the two surveys were combined for the analysis of public concerns about climate change. Participants in both surveys were asked the same question and at the same early stage of the survey (following the opening set of standard socio-demographic questions). From this point, differences in question phrasing and sequencing meant data from the two surveys could not be combined. Findings for the remaining three areas are therefore drawn from the second pilot survey which also explored moral values and climate change.

Figure 2.1 Surveys informing each section of the interim report



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At the end of the two surveys, we asked participants to indicate from a list of exposures any they had experienced in the last 12 months; more than one could therefore be recorded (Box 2.1). The question avoided terms that may elicit a strong association with climate change, for example 'climate' or 'extreme weather events' [46]. Adapting questions from other studies, the response options represented a mix of personal and area-level exposures. Along with no exposures, responses included individual-level exposures: heatwave 'where your health is significantly affected' and damage to the home from flooding or coastal erosion [38]. The area-level exposures were flooding, damage from coastal erosion and air pollution (poor air quality) 'in your local area'. Participants could also describe an exposure not listed; very few (8 of >2000) did so.

The overall pattern of responses is described in Table A2. Over 50% of participants reported no exposures. The most commonly reported were air pollution and flooding in the local area, along with heatwave 'where your health is significantly affected'.

Box 2.1: question on experience of flooding, heatwave and other exposures in the last 12 months

Have you experienced any of the following in the last 12 months?

- ☐ Damage to your home from flooding (not including rain leaking through the roof or burst pipes)
- ☐ Flooding in your local area
- ☐ Heatwave (where your health is significantly affected)
- ☐ Damage to your home from coastal erosion (where the sea wears away the land
- ☐ Damage to your local area from coastal erosion (where the sea wears away the land
- ☐ Air pollution (poor air quality) in your local area
- ☐ Other - please specify
- ☐ None of the above

2.3 What factors did we include in the analyses?

The surveys enabled analysis of the patterning of perceptions of health and climate change by:

- Individual factors: gender, age group, ethnic group, parental status (parent/guardian of a child under 18 in the household), self-reported health status, employment status, educational attainment based on the International Standard Classification of Education (ISCED) [47] and housing tenure.
- Area-level factors: UK country/England region of residence, type of area (e.g. urban, rural)
- Climate-related exposures in the last 12 months

Questions were based on those used in other surveys, including surveys run by the Office for National Statistics. Details of the individual and area-level factors are provided in Table

A1, along with the sample profiles. Small numbers in some groups meant these were combined for the analyses. A summary of the combined groups is given in Table A3.

For our analyses, we began with bivariate analyses to identify factors significantly associated with the outcome of interest (e.g. perceptions of the impact of climate change on people's health in the UK). With the exception of our exploratory study of moral values, we then undertook multivariate analyses to identify factors that remained significant after account was taken of all the factors.

For these multivariate analyses, we used logistic regression models. The initial models included all the individual and area-level factors; factors were removed if they did not significantly improve the model fit ($p<0.05$). To these final models, we then added climate-related exposures. These models therefore took account of individual and area-level factors as well as the individual's experience of climate-related exposures and events, retaining those that were significant. The final models are included in the report; full initial models are available in the supplementary tables.

2.4 Strengths and limitations

The interim report is based on surveys that are representative of the UK population. The surveys provide an overview of people's concerns and perceptions of climate change and health in late 2020 and early 2021. The second survey also provides insights into people's views of climate change as a moral issue, an issue central to climate change communication in the run-up to the forthcoming UN Conference of the Parties (CoP) meeting. Like other social surveys, the surveys rely on participant-reported data. They capture participants' perspectives on climate change and health, together with their reported exposures to climate-related stressors over the previous 12 months.

In addition to the topics of interest, the surveys collected a range of sociodemographic data, including gender, age group, educational attainment and parental status, enabling analysis of the patterning of concerns about climate change, perceptions of its health impacts and priorities for government.

Some limitations of our survey design should also be noted. Firstly, as a survey of adults, it excludes those under the age of 18, the group that, without strong, near-term policies, will bear the brunt of climate change and its health impacts. This key population group are only indirectly represented in the surveys by participants who are parents caring for children. The project's qualitative study is recruiting young people aged 15 and over.

Secondly, because potential participants are recruited through an online survey agency, it excludes those without access to the internet (either via a smartphone or through a connection in their homes). This means that the views and concerns of some of the UK's most vulnerable populations are likely to be under-represented. The large majority of those without internet access face other forms of social disadvantage [41], disadvantages intensified by the COVID-19 restrictions [42]. It is a limitation shared with other surveys. The last 12 months have accelerated the shift towards online data collection, including in surveys administered by the Office for National Statistics where participants complete an online questionnaire or, if required, are interviewed by telephone [43]. The project's public involvement component – based on in-person and community-based inputs – may help to address this bias.

Thirdly, while each survey recruited over 1000 participants, there were insufficient numbers to permit analysis of important dimensions of social inequality and cultural diversity. With respect to ethnic group, the composition of the surveys reflects the wider UK population – and small numbers of participants in some minority groups meant that groups needed to be combined for the analyses. Again, this is an important limitation, particularly in the context of the wider under-representation of ethnic minority groups in health research [44, 45].

3. PUBLIC CONCERNS ABOUT CLIMATE CHANGE

3.1 Introduction

This section is based on the two surveys (n=2074). Our question about people's concerns about climate change was based on one used in the BEIS climate tracker survey [21]. As in the BEIS survey, we asked participants 'how concerned, if at all, are you about climate change?' and provided four response options: not at all concerned, not very concerned, fairly concerned and very concerned. The order of these responses was randomly reversed for 50% of the survey participants; for this group, the options ran from 'very concerned' to 'not at all concerned'. There were no significant difference in the responses between the two groups.

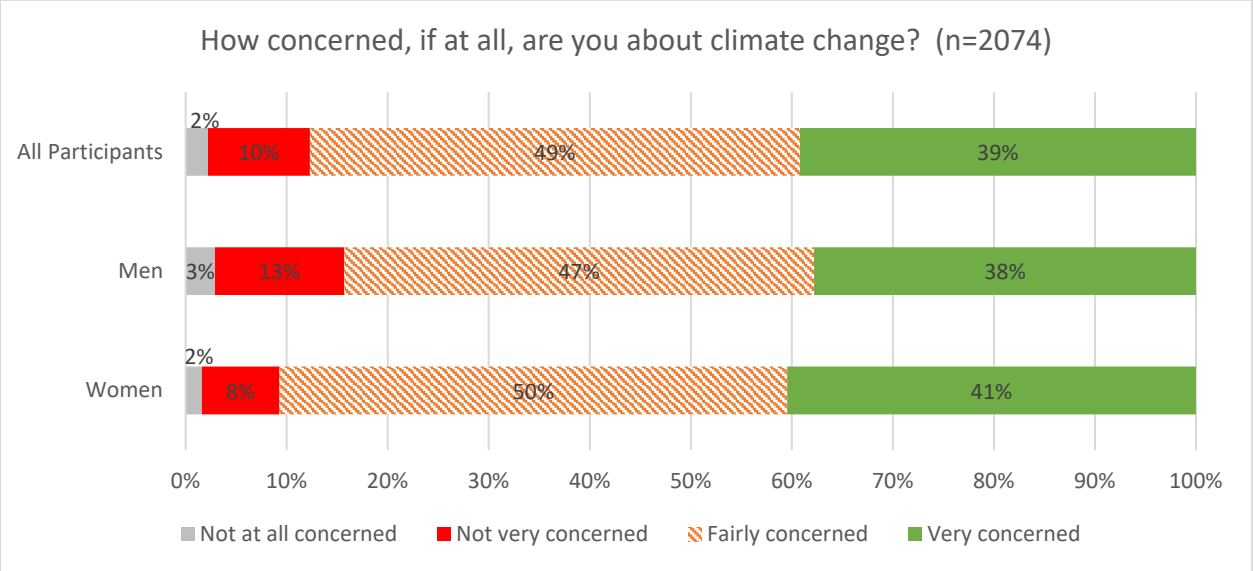
In the sub-sections below, we begin by looking at the overall patterns of climate change concern (sub-section 3.2) before noting factors in the bivariate analyses that were significantly associated with differences in concern (sub-section 3.3). In sub-section 3.4, we present the multivariate analyses, identifying factors that were independently associated with climate change concern (so after account is taken of other factors).

3.2 How concerned are the public about climate change?

A large majority (88%) of the public were concerned about climate change and nearly four in ten (39%) were very concerned

As Figure 3.1 indicates, only a small proportion reported that they were not at all (2%) or not very concerned (10%). Those who were fairly concerned made up the largest group (49%), with a further 39% reporting that they were very concerned about climate change. The pattern of responses is broadly similar to the December 2020 BEIS climate tracker survey, where the proportions were 4% (not at all concerned), 13% (not very concerned), 44% (fairly concerned) and 37% (very concerned) [48].

Figure 3.1 Concern about climate change



In the second pilot study, we additionally asked participants whether COVID-19 had changed the way they thought about climate change. The majority reported that it had either not changed how concerned they were (56%) or it had made them more concerned (32%). Only a small proportion (7%) reported that they were less concerned; a smaller proportion still stated that they did not know if COVID-19 had changed the way they thought about climate change.

In the sub-sections below, the two surveys are combined (n=2074). Because of small numbers, participants who were 'not at all concerned' and 'not very concerned' were combined into a 'not concerned' group. This produced three groups: not concerned (12%), fairly concerned (49%) and very concerned (39%).

3.3 What factors are associated with climate change concern?

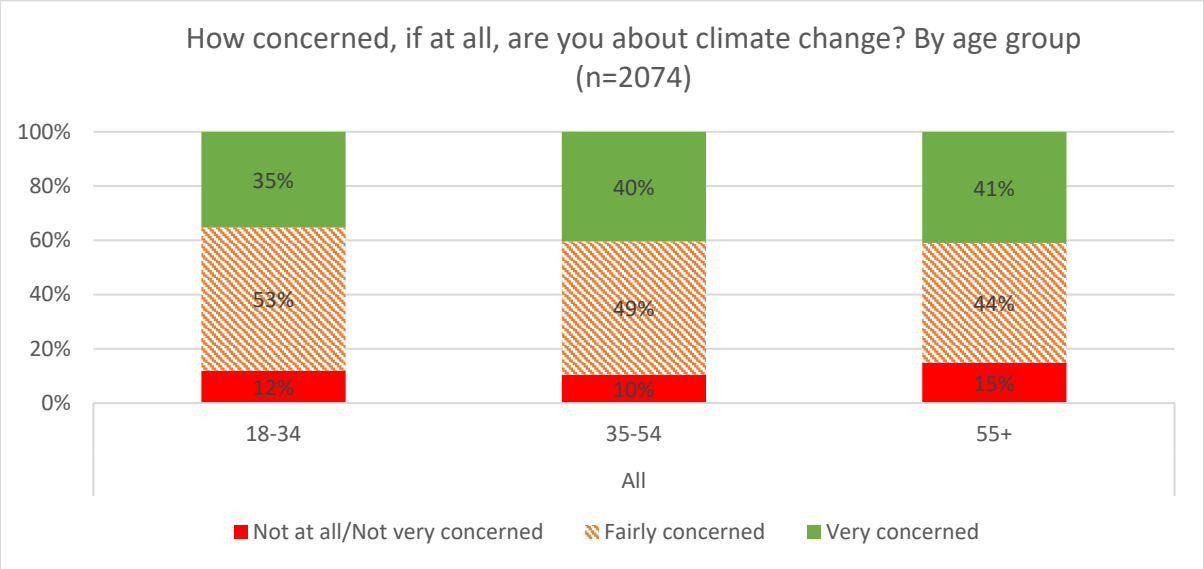
> ***In the bivariate analyses, climate change concern was significantly associated with gender, age group, parental status, educational attainment, employment status and region of residence. It was also associated with experiencing one or more climate-related exposures in the previous 12 months, including flooding to one's home and in the local area, air pollution/poor air quality in the local area and the experience of heatwave (where one's health is significantly affected).***

Below, we note the factors that were significantly associated with climate change concern in the bivariate analyses.

Gender (Figure 3.1; p<0.001): a higher proportion of men reported that they were not concerned (16%) than women (10%). The proportion of men in the very concerned group was lower (38% vs 41%).

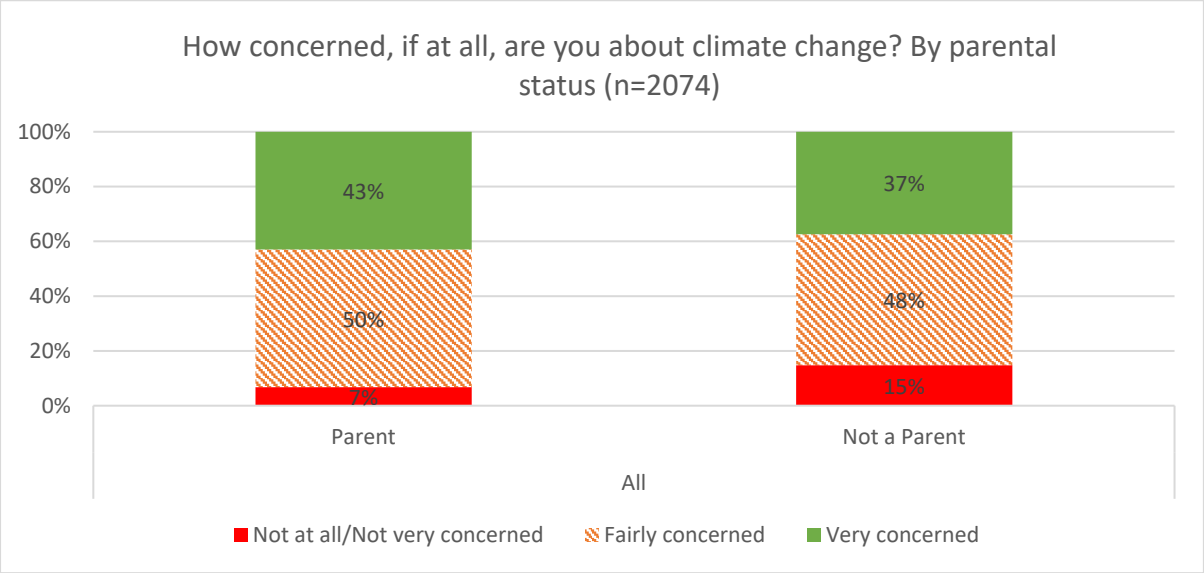
Age group (Figure 3.2; p<0.05): younger participants (aged 18-34 years) were less likely to report that they were very concerned (35%) about climate change than older age groups (40% and 41% respectively for those aged 35-54 years and those aged 55 and older).

Figure 3.2 Climate change concern by age group



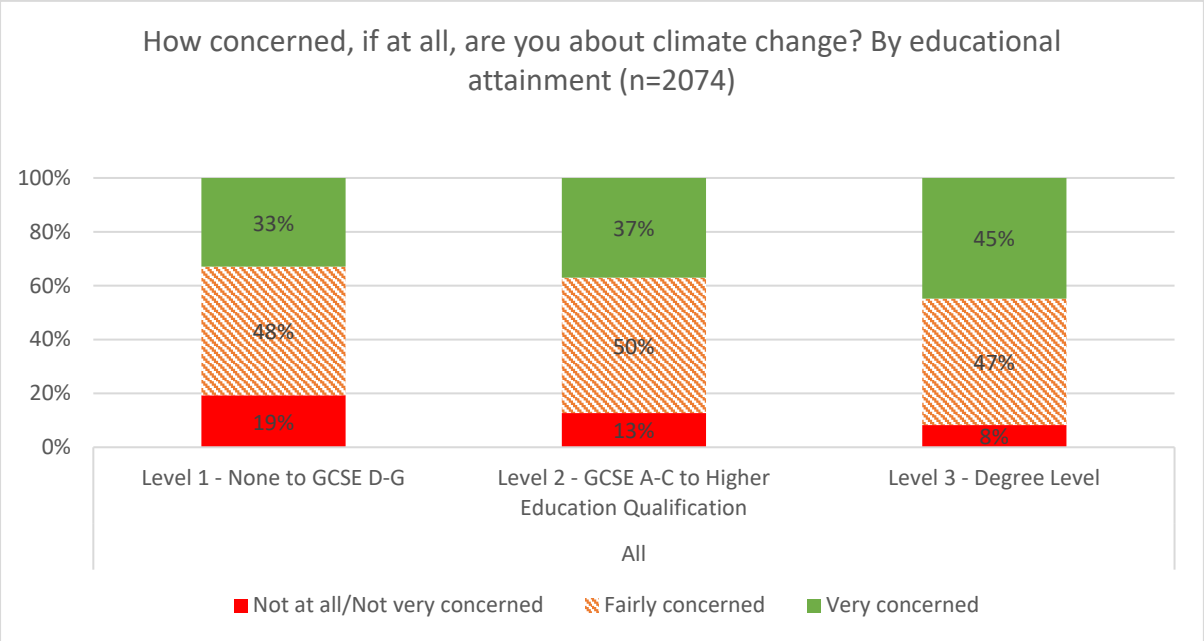
Parental status (Figure 3.3; p<0.001): parents (43%) were more likely to be very concerned about climate than non-parents (37%). Conversely, non-parents (14%) were more likely to report being not concerned than parents (7%).

Figure 3.3 Climate change concern by parental status



Educational attainment (Figure 3.4; p<0.01): those in the highest attainment level (level 3) were more likely to be very concerned about climate change (45%) than those in level 2 (37%) and level 1 (33%).

Figure 3.4 Climate change concern by educational attainment (based on ISCED)



Employment status (p<0.05): based on a 3-category measure of employment status (employed/retired/not in paid employment), the retired group and those not in paid employment were more likely to report they were not concerned about climate change (14% and 18%) than participants who were employed (10%).

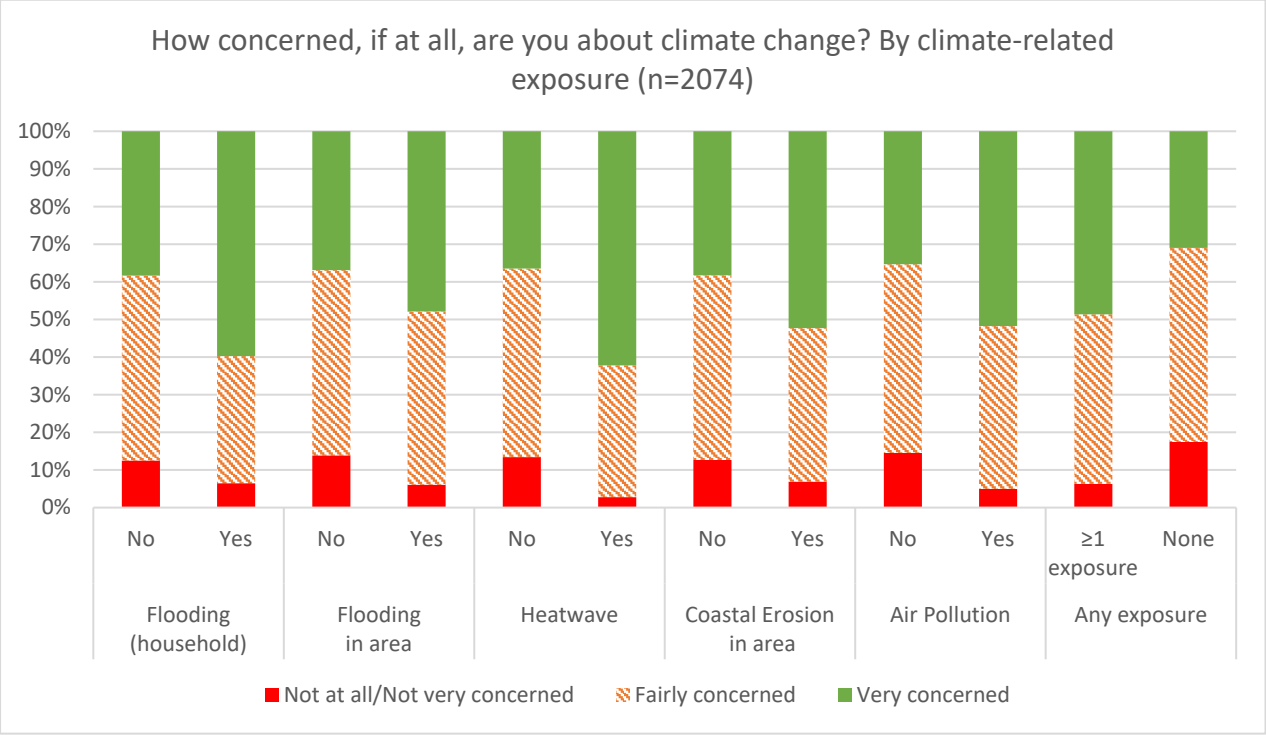
Region of residence (p<0.05): the proportion who reported being very concerned was higher in Greater London and the South East (43%) and lowest in the combined group of Scotland, Northern Ireland and Wales (34%). Conversely, the proportion reporting that they were not concerned was higher in Scotland, Northern Ireland and Wales (17%) than in Greater London and the South East (10%) and South West England (10%).

Climate-related exposures in the previous 12 months: survey participants were asked if they had experienced any of a set of climate-related events and exposures in the previous 12 months (Box 2.1). The overall pattern of responses is described in Table A2.

No reported exposure (p<0.001): those reporting no exposures were more likely to report they were not concerned (18%) about climate change than those noting one or more exposures (6%). They were also less likely to report they were very concerned about climate change (31% vs 49%).

Reported exposure (Figure 3.5): all exposures were significantly associated with climate change concern, with the exception of damage to one's home from coastal erosion, where numbers were small. For each of the other exposures, those reporting it were more likely to be very concerned and less likely to be not concerned.

Figure 3.5 Climate change concern by climate-related exposure in the last 12 months



Damage to one's home from flooding (p<0.05): those who had experienced flooding in their home were more likely to be very concerned (60% vs 38%) and less likely to be not concerned (7% vs 13%) than those who did not report this experience.

Flooding in one's local area (p<0.01): compared to those who did not report flooding in their local area, those reporting this exposure were more likely to be very concerned (48% vs 39%) and less likely to be not concerned (6% vs 14%) about climate change.

Heatwave (p<0.01): of all the exposures, the proportion who reported being very concerned about climate change was highest among those whose health had been significantly affected by heatwave (62%).

Coastal erosion in area (p<0.05): the proportion who were very concerned about climate change was higher among those reporting coastal erosion in their area.

Air pollution (p<0.01): the proportion who were very concerned about climate change was higher among those reporting air pollution/poor air quality in their local area (52% vs 35%). The proportion who not at all/not very concerned was lower (5% vs 15%).

3.4 Findings from the multivariate analyses

The first set of regression analyses compared those who were very concerned (39% of the total) with those who were fairly concerned (49%). The second set compared those who were fairly concerned with those who were not concerned (12%). Both sets took account of individual and area-level factors – and then additionally took account of reported climate-related exposures.

While social factors, and particularly educational level, were important, climate-related exposures had the largest effect on climate change concern.

The analyses focus in turn on those who were very concerned and fairly concerned about climate change (**A.** below) and those who were fairly concerned and not concerned about climate change (**B.** below). The full initial models are available here.

A. Very concerned (39%) compared with fairly concerned (49%) about climate change

In the regression model that included all individual and area-level factors, two factors were significantly associated with being 'very concerned' in comparison to 'fairly concerned' about climate change (Table 3.1).

Age group: in comparison to the 18-34 group, those aged 55 and older were 44% more likely to be very concerned (OR 1.44, 95% CI 1.13, 1.84, p<0.01). The model showed no significant difference between the 18-34 and the 35-54 age groups.

Education attainment: in comparison to those in the lowest education level (Level 1), those in the top level (Level 3) were 42% more likely to be very concerned (OR 1.42, 95% CI 1.09, 1.86, p<0.05). There was no significant difference between the lowest and middle education levels.

Table 3.1: Logistic regression model predicting the likelihood of being 'very concerned' in comparison to 'fairly concerned' about climate change (without climate-related exposures)

Included are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Age Group	Comparison 18-34		0.013		
		35-54	1.227	0.084	0.973	1.548
		55 and Older	1.442	0.003	1.129	1.842
	Education	Base - Level 1		0.006		
		Level 2	1.063	0.654	0.815	1.386
		Level 3	1.422	0.010	1.088	1.860
		Constant	0.559	0.000		

For the next stage of analysis, climate-related exposures were added to the model (Table 3.2). In line with Figure 3.5, this included no exposure as well as exposures like air pollution and heatwave. In this updated model, age group and educational attainment continued to be significant factors. Age became a stronger predictor of climate change concern; compared with those aged 18-34 years, being in an older age group (35-54 years and 55+ years) was significantly associated with greater concern (OR 1.62, 95% CI 1.26, 2.09, $p<0.05$). The association between the lowest and highest levels of education remained largely unchanged; those in the highest level were more likely to be very concerned (OR 1.39, 95% CI 1.06, 1.83, $p<0.05$).

In this updated model, climate-related exposure was a significant predictor of being very concerned about climate change.

Damage to one's home from flooding: the reporting of flooding in the home doubled the odds of being very concerned about climate change (OR 2.12, 95% CI 1.26, 3.55, $p<0.05$).

Flooding in one's local area: the experience of flooding in the local area was associated with a 33% increased likelihood of being very concerned about climate change (OR 1.33, 95% CI 1.01, 1.67, $p<0.05$).

Heatwave: exposure to heatwave doubled the odds of being very concerned about climate change (OR 2.19, 95% CI 1.60, 3.00, $p<0.05$).

Air pollution: air pollution in the local area was associated with a 55% increased likelihood of being very concerned about climate change (OR 1.55, 95% CI 1.24, 1.93, <0.01).

Table 3.2: Logistic regression model predicting the likelihood of being 'very concerned' in comparison to 'fairly concerned' about climate change (with climate-related exposures)

Included below are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Age Group	Base-18-34		0.001		
		35-54	1.284	0.040	1.012	1.629
		55 and Older	1.624	0.000	1.262	2.089
	Education	Base - Level 1		0.011		
		Level 2	1.047	0.739	0.799	1.373
		Level 3	1.391	0.018	1.058	1.829
	Exposure in last 12 months	Flooding Household	2.118	0.004	1.262	3.554
		Flooding Area	1.329	0.015	1.056	1.671
		Heatwave	2.192	0.000	1.604	2.998
		Air Pollution	1.545	0.000	1.239	1.927
	Constant		0.401	0.000		

B. Fairly concerned (49%) compared with not/not very concerned (12%) about climate change

In the regression model that included all individual and area-level factors, three factors were significantly associated with being 'not/not very concerned' (abbreviated to 'not concerned' below) in comparison to 'fairly concerned' about climate change (Table 3.3).

Gender (p<0.01): in comparison to women, men were 69% more likely to be not concerned than women (OR 1.69, 95% CI 1.27, 2.25, p<0.001).

Education attainment: when compared to those in the highest education level (level 3), those in level 1 were over twice as likely to be not concerned (OR 2.15, 95% CI 1.47, 3.15, p<0.001).

Parental status: not being a parent doubled the odds of not being concerned about climate change (OR 2.34, 95% CI 1.56, 3.20, p<0.001).

Table 3.3: Logistic regression model predicting the likelihood of being 'not concerned/not very concerned' in comparison to 'fairly concerned' about climate change (without climate-related exposures)

Included below are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Gender	Male	1.691	0.000	1.271	2.251
	Educational Attainment	Base - Level 3		0.000		
		Level 2	1.377	0.065	0.980	1.934
		Level 1	2.151	0.000	1.471	3.146
	Parental Status	Not being a Parent	2.235	0.000	1.563	3.196
		Constant	0.559	0.000		

In the final model, climate-related exposures such as heatwave and no exposure were included. None of the included exposures were significant, whereas no recorded exposure

was. Gender, educational attainment and parental status remained significant and their associations with climate change were largely unchanged.

> **No reported exposure:** there was a significant association between not reporting a climate-related exposure and being in the 'not concerned' group. The odds of not being concerned about climate change were 2.2 times higher for those who reported no exposures in the previous 12 months than for those reported one or more exposure in this period (OR 2.20, 95% CI 1.58, 3.07, p<0.01).

Table 3.4: Logistic regression model predicting the likelihood of being 'not concerned/not very concerned' in comparison to 'fairly concerned' about climate change (with climate-related exposures)

Included below are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Gender	Male	1.691	<0.01	1.271	2.251
	Educational Attainment	Base - Level 3		<0.01		
		Level 2	1.377	0.065	0.98	1.934
		Level 1	2.151	<0.01	1.471	3.146
	Parental Status	Not being a Parent	2.235	<0.01	1.563	3.196
	Exposure in last 12 months	No Prior Exposure	2.202	<0.01	1.577	3.074
		Constant	0.559	<0.01		

3.4 Conclusion

Most participants (88%) were concerned about climate change and a large minority (39%) were very concerned.

Climate change concern was socially patterned. Higher levels of concern were found among older age groups and among those in the highest educational group; lower levels of concern were found among men, non-parents and those in the lowest educational group.

In addition, reporting a climate-related exposure within the last 12 months was a strong predictor of greater climate change concern. Flooding in one's home, flooding in one's local area, air pollution in one's local area and the experience of heatwave that significantly affected one's health all increased the likelihood of being very concerned about climate change. Reporting no climate-related exposures was associated with not being concerned about climate change.

4. PUBLIC PERCEPTIONS OF THE HEALTH IMPACTS OF CLIMATE CHANGE

4.1 Introduction

Our analysis of people's perceptions of the health impact of climate change in the UK is based on the second pilot survey, conducted in January/February 2021. Because of differences in the question sequencing in the two surveys, data from the surveys could not be combined. The smaller sample size (n=1004) may mean that some significant associations between factors are not evident in the analyses.

We took a two-staged approach to capturing public perceptions (Box 4.1). An initial question asked participants about their views on the impact of climate change in the UK - without mention of health (question A in Box 4.1). For this question, we used one from the BEIS climate tracker survey. The follow-up question then asked participants about their views on its impacts on people's health in the UK (question B in Box 4.1). We took this two-staged approach because only asking people about their views on the health impacts of climate change may prompt responses that capture their concerns about climate change in general, thereby overestimating public concern about its health impacts.[v]

Box 4.1: Questions on participants' views on (i) the impacts of climate change in the UK and (ii) the impacts of climate change on people's health in the UK

(A) Which of these statements best describes your views about the impact of climate change in the UK?

- ○ Climate change is already having an impact in the UK
- ○ Climate change is not yet having an impact in the UK, but will do in my lifetime
- ○ Climate change will not have an impact in my lifetime, but will do for future generations in the UK
- ○ Climate change will never have an impact in the UK

(B) Thinking now about people's health, which of these statements best describes your views about the impacts of climate change on people's health in the UK?

- ○ Climate change is already having an impact on people's health in the UK
- ○ Climate change is not yet having an impact on people's health in the UK, but will do in my lifetime
- ○ Climate change will not have an impact on people's health in the UK in my lifetime, but will do for future generations in the UK
- ○ Climate change will never have an impact on people's health in the UK

[v] The first pilot survey in Nov/Dec 2020 tested whether the patterns of responses to the health impacts question (question B in Box 4.1) differed between those asked and not asked a prior general question about perceptions of climate change impacts (question A in Box 4.1). We found significant differences between the two groups ($p<0.5$). We therefore retained the initial question about climate change in the second survey.

In the sub-sections below, we begin by summarising participants' views about the impacts of climate change on people's health in the UK (sub-section 4.2). We then compare those who considered climate change to be already having a health impact with those holding other views (as having future impacts or no impacts on health). In sub-section 4.3, we note the factors in the bivariate analyses that were significantly associated with differences between these two groups. In sub-section 4.4, we present multivariate analyses that identify factors that remain significant after account is taken of other factors.

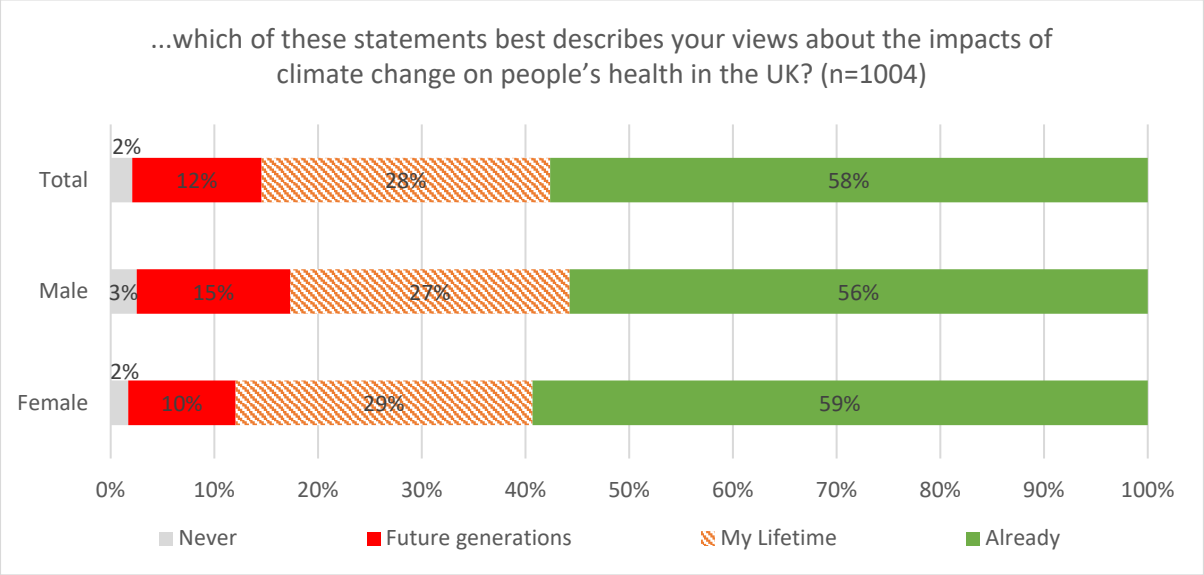
4.2 Perceptions of climate change impacts on people's health in the UK

Over half (58%) of participants considered that climate change was already having an impact on people's health; a further 28% considered that, while not yet having an impact, climate change would have an impact within their lifetime.

As Figure 4.1 indicates, a very small proportion (2%) were of the view that climate change would never have an impact on people's health in the UK. In response to the earlier question about climate change concern (discussed in section 3), none of this group reported that they were 'very concerned' about climate change. Most of the group reported that they were 'not at all' or 'not very concerned'.

The majority (58%) of survey participants considered that climate change was already having a health impact in the UK. A further 40% anticipated impacts in the future: within their lifetime (28%) or for future generations (12%). While there were some differences between women and men in their views of current and future health impacts, these differences were not significant.

Figure 4.1. Views on the health impacts of climate change



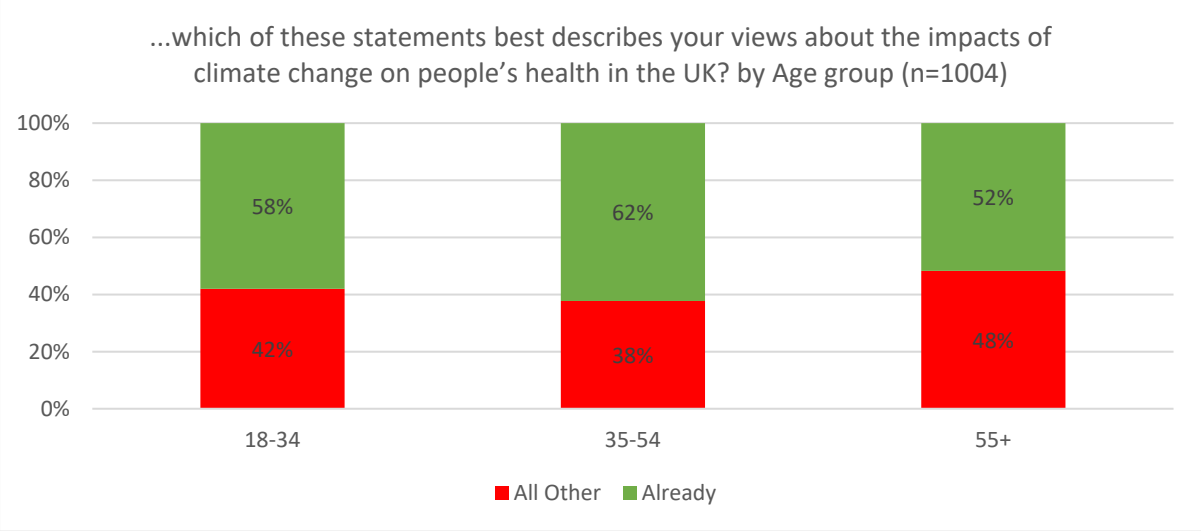
In the sub-sections below, we compare those who considered climate change to be already having a health impact with those holding other views about its impacts. The groups thus represent 58% and 42% of participants respectively.

4.3 What factors are associated with regarding climate change as already having an impact on people's health in the UK?

In the bivariate analyses, perceiving that climate change was already having an impact on people's health was significantly associated with age. In addition, those reporting one or more climate-related exposures in the previous 12 months were more likely to consider climate change to be 'already having an impact' on people's health. This perception was also associated with the experience of flooding and area pollution in one's local area and of heatwave 'where your health is significantly affected'.

Age group (Figure 4.2; p<0.05): a lower proportion (52%) of those aged 55 and older considered that climate change was already having a health impact than those aged 18-34 years (58%) and 35-54 years (62%).

Figure 4.2. Views on the health impacts of climate change by age group



With respect to ethnic group, participants in the Black and mixed heritage group were more likely to consider that climate change was already having a health impact (71%) than the other two groups (White 57% and Asian/Asian British 60%). However, the association was not significant.

Climate-related exposures in the previous 12 months[vi] (Figure 4.3; p<0.001): those reporting no climate-related exposures were less likely to hold the view that climate change was 'already having an impact' on people's health (47%) than those who reported one or more exposures (71%).

[vi] Survey participants were asked if they had experienced any of a set of climate-related events and exposures in the previous 12 months (Box 2.1). The overall pattern of responses is described in Table A2.

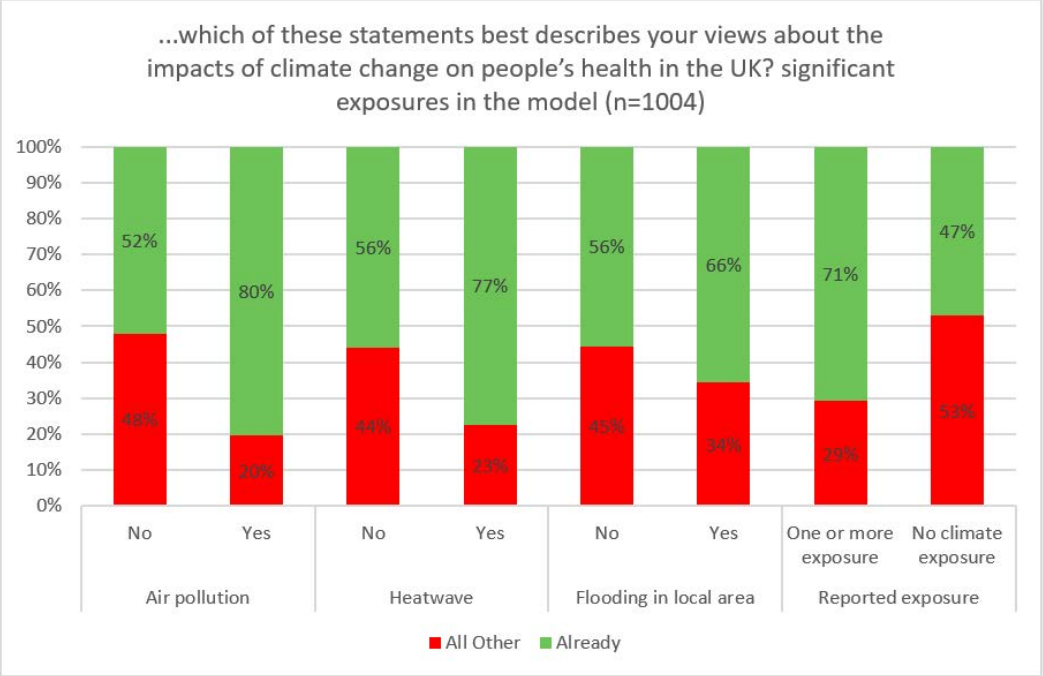
Reported exposures:

Flooding in one's local area (p<0.01): those who reported the experience of flooding in their local area were more likely to consider climate change to already be having a health impact (66%) than those who did not report this exposure (56%).

Heatwave (p<0.01): participants who reported experiencing heatwave 'where your health is significantly affected' were more likely to consider climate change to already be having a health impact (77%) than those who did not report this experience (56%).

Air pollution in one's local area (p<0.01): a higher proportion of those reporting air pollution/poor air quality in their local area (80%) considered that climate change was already having a health impact in the UK than those who did not report this exposure (52%).

Figure 4.3. Proportion considering that climate change was already having a health impact in the UK by climate-related exposures in the previous 12 months



4.4 Findings from the multivariate analyses

The regression analyses compared those who considered that climate change was already having an impact (58%) with those who held other view about its health impacts (42%). The initial analyses took account of individual and area-level factors. The final model additionally took account of reported climate-related exposures. Climate-related exposures had the largest effect on perceptions of health impacts. Those experiencing no climate-related exposures in the previous 12 months were less likely to consider climate change to be already having a health impact, while those experiencing air pollution in their local area had twice the odds of perceiving climate change to be already affecting people's health.

Regression models were built to identify factors independently associated with perceptions of the health impact of climate change after accounting for other factors. The models compared those who selected climate change as 'already' having an impact with those who selected another response. The initial models included individual and area-level factors. The second model additionally included climate-related exposures. This included no reported exposure, together with all reported exposures (with the exception of 'other' excluded because of the small number of responses). (The full initial models are available here).

A. Initial analysis including all individual and area-level factors (Table 4.1). Two factors were significantly associated with considering climate change to 'already' be having an impact on people's health (Table 4.1).

Age group: In comparison to the oldest group (55 and older), the 35-54 age group were 55% more likely to consider climate change to be already having an impact (OR 1.59, 95% CI 1.14, 2.10, $p<0.05$). The model showed no significant difference between the 18-34 age group and those age 55 and older.

Self-reported health status: in comparison to participants in good/very good health, those reporting their health to be fair/bad/very bad had a 37% higher likelihood of considering that climate change was already having an impact on people's health (OR 1.37, 95% CI 1.03, 1.83, $p<0.05$).

Table 4.1: Logistic regression model predicting the likelihood of considering that climate change is already impacting on people's health in the UK in comparison with not holding this view (without reported climate-related exposures)

Included are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Age Group	Base-55 and older		0.019		
		18-34	1.286	0.140	0.920	1.797
		34-54	1.548	0.005	1.142	2.099
	Self-reported Health	Fair to Very Bad	1.373	0.029	1.033	1.826
		Constant	0.936	0.602		

B. Analysis additionally taking account of reported climate-related exposures (Table 4.2).

In the updated model, age group continued to be a significant factor; however, the strength of the association was reduced. Self-reported health was no longer significant.

In this updated model, participants' experience of climate-related exposures in the previous 12 months was a significant predictor of whether they considered climate change to be already affecting people's health in the UK.

No reported exposure: reporting no climate-related exposure reduced the likelihood of considering that climate change was 'already' impacting on health by 43% (OR 0.57, 95% CI 0.41, 0.78, p<0.001).

Air pollution: the reporting of air pollution in one's local area more than doubled the odds of considering climate change to be already impacting on people's health (OR 2.43, 95% CI 1.57, 3.76, p<0.001).

Table 4.2: Logistic regression model predicting the likelihood of considering that climate change is already impacting on people's health in the UK in comparison with not holding this view (with reported climate-related exposures)

Included are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Age Group	Base-55 and older		0.041		
		18-34	1.101	0.582	0.781	1.552
		34-54	1.466	0.016	1.073	2.003
	Exposure in last 12 months	Air Pollution	2.427	0.000	1.568	3.759
		None	0.567	0.001	0.410	0.783
	Constant	Constant	1.213	0.290		

4.5 Conclusion

Most participants (58%) considered climate change to already be having an impact on people's health in the UK.

Compared to older respondents, the middle-aged group (35-54 years) were more likely to hold this view. Reporting no climate-related exposures significantly reduced the odds of considering that people's health was already being affected by climate change. Reporting air pollution in one's local area significantly increased the odds

5. WHICH CLIMATE-RELATED EXPOSURES DO THE PUBLIC CONSIDER THE MOST IMPORTANT FOR THE GOVERNMENT TO ADDRESS?

5.1 Introduction

The second pilot survey, conducted in January/February 2021, asked participants about the harmful impacts that climate change may have on people's health (Box 5.1) – and what in their view was the most important exposure for the government to address in order to protect people's health (Box 5.2).

The list of climate-related concerns was refined in the first pilot survey to ensure they included those of public concern. Participants were asked the question in Box 5.1 and randomly assigned either to select exposures from a list or to complete a response in their own words. We were therefore able to compare the pattern of concerns prompted by the closed and open-ended questions. In the self-completion arm, only a small minority (1%) gave answers that suggested they considered that climate change had no harmful health impacts ('No direct impact on health', 'Nothing'), a pattern matched in the fixed-response arm. In the self-completion arm, the majority of participants described climate exposures of concern that were also listed in the fixed-response arm of the survey, including fires (wild/forest), storms, drought and dry weather, sea level rise and coastal erosion. Additionally, some noted increasing temperatures, an exposure not listed in the fixed-response arm.

For the second pilot survey, the self-completion arm was removed. All respondents were asked the same question and given the same set of responses, which included increasing temperatures (Box 5.1).[i]

In this second survey, only a small minority (2%) selected 'none of these concern me'. With the exception of this small group, a follow-up question asked participants which, from the climate-related exposures they had noted, was in their view the most important for government to address (Box 5.2).

> *'Thinking about these problems and the harmful impacts they may have on people's health, which in your view would be the most important for the government to address in order to protect people's health? Please select one answer'*

Because the follow-up question had a single-item response, it does not encompass all the climate-related exposures that the public may wish to government to address in order to protect people's health. The full survey will enable multiple responses.

At the end of the survey, participants were asked about whether they had experienced a range of climate-related events in the last 12 months. The range of events included flooding

[i] For the main surveys, the question will be revised to more clearly signal the 'no concerns' option

to their home and/or local area, heatwave (where their health is significantly affected) and air pollution (poor air quality) among other exposures (Box 2.1 and Table A1).

In this section, we begin by describing the climate-related exposures of concern with respect to people's health (sub-section 5.2) before looking at the exposures that participants considered most important for the government to address (sub-section 5.3). We then turn to consider the factors that were significantly associated with identifying air pollution and floods as the priorities, the two most frequently-selected exposures of concern (sub-section 5.4). For the multivariate analyses, we then focus on air pollution, which was identified as the priority by over 50% of the participants (sub-section 5.5).

Box 5.1 Question on harmful impacts of climate change on people's health

Thinking now about the harmful impacts that climate change may have on people's health in the UK, what kind of changes in the climate concern you? You can select more than one.

Response options*

- ○ Air pollution (poor air quality)
- ○ Severe storms
- ○ Drought (a prolonged period without rain)
- ○ Severe floods
- ○ Heat waves
- ○ Coastal erosion (where the sea wears away the land)
- ○ Increasing temperatures
- ○ Sea level rises
- ○ Wildfires
- ○ Other – please describe _____
- ○ None of these concern me

**the order of the first nine response options was randomised*

Box 5.2 Question on harmful impacts of climate change on people's health

Thinking about these problems [the ones selected by the survey participant] and the harmful impacts they may have on people's health, which in your view would be the most important for the government to address in order to protect people's health? Please select one answer.

Response options*

- ○ Air pollution (poor air quality)
- ○ Severe storms
- ○ Drought (a prolonged period without rain)
- ○ Severe floods
- ○ Heat waves
- ○ Coastal erosion (where the sea wears away the land)
- ○ Increasing temperatures
- ○ Sea level rises
- ○ Wildfires
- ○ Other – please describe _____

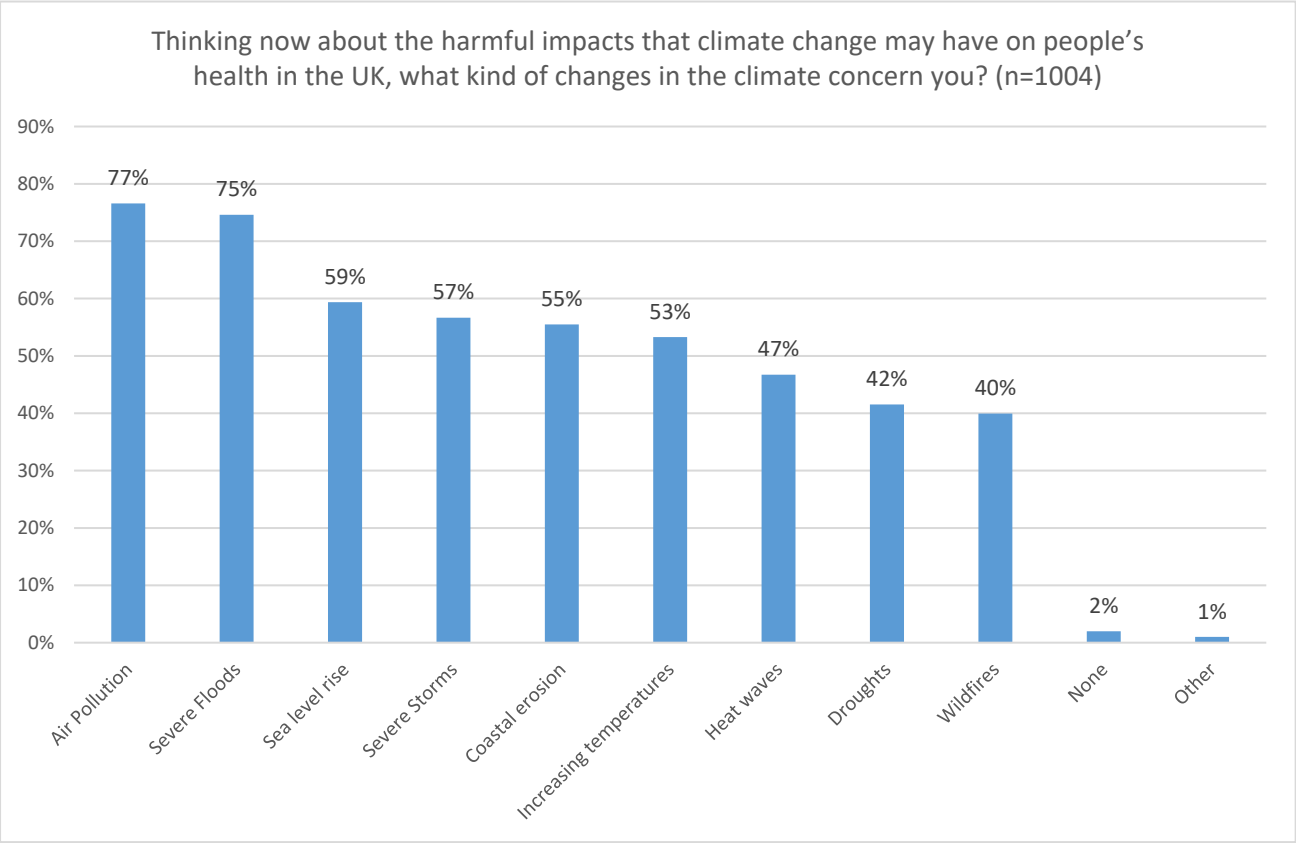
**the order of the first nine response options was randomised*

5.2 What climate-related exposures are of public concern with respect to people's health?

Air pollution and severe flooding were the most frequently identified concerns with respect to protecting people's health. Other climate-related factors, including severe storms, sea level rise, coastal erosion and increasing temperatures, were also identified by the majority of participants.

A large majority of participants selected air pollution (76%) and severe floods (74%) as dimensions of climate change of concern for people's health. Over half also noted sea level rise, severe storms, coastal erosion and increasing temperatures (Figure 5.1). A small minority (2%) selected 'none of these concern me' and smaller proportion selected 'other' (1%).

Figure 5.1 Changes in the climate of concern with respect to people's health (participants could select more than one)

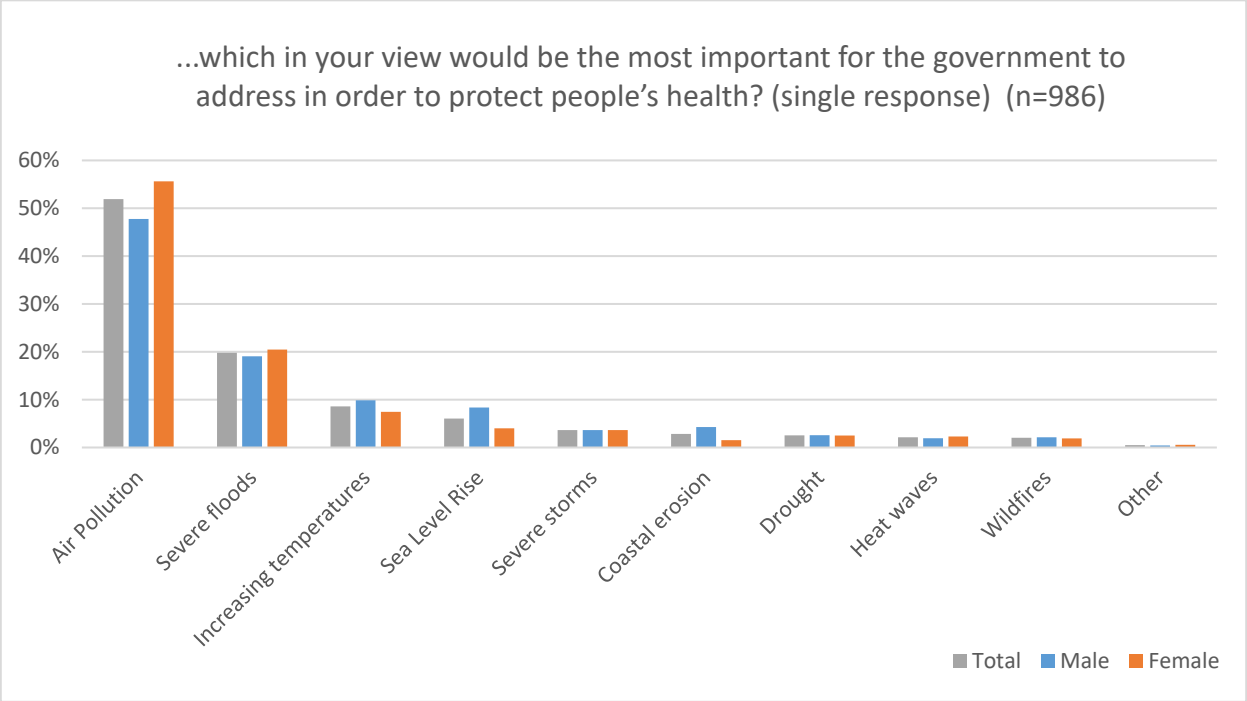


5.3 Which climate-related exposures do the public consider the most important for the government to address?

The majority of participants (52%) identified air pollution as the most important for the government to address. One in five (20%) considered that severe floods were the priority.

As Figure 5.2 indicates, air pollution stands out as the exposure that participants would most like government to address in order to protect people's health. Only a small proportion identified another priority issue, with severe floods the only one selected by more than 10% of the participants. In sub-section 5.4 below, we focus on air pollution and floods and note the factors that were significantly associated with identifying these exposures as the priority for government to address.

Figure 5.2: Most important change in the climate for the government to address to protect people's health



5.4 What factors are associated with identifying air pollution and floods as the priority for government to address?

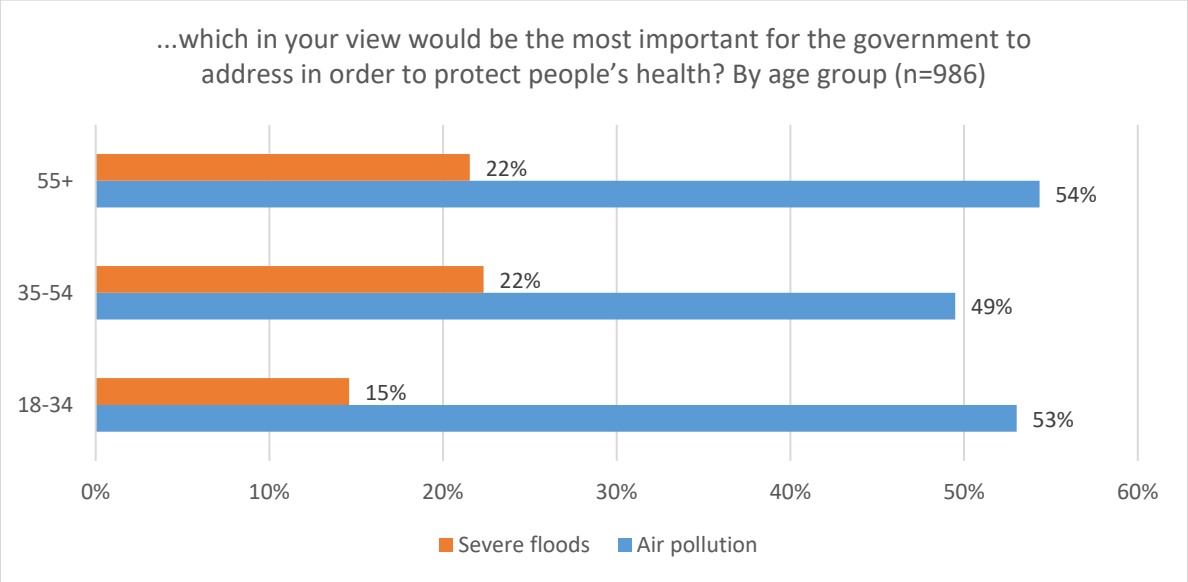
In the bivariate analysis, those identifying air pollution to be the most important priority were significantly more likely to be women, non-parents and living in an urban area. Severe floods were significantly more likely to be identified as the priority for government by those in the older age groups (35 years and older).

People's experiences of climate-related exposures were particularly important. Two-thirds (66%) of those reporting air pollution/poor air quality in their local area identified this as the priority for the government to address. For those with experience of flooding in the previous 12 months, either in their local area or of their home, almost a quarter (23%) selected severe floods.

Gender (Figure 5.2 p<0.05): as Figure 5.2 indicates, women were more likely to select air pollution as the priority for government to address: 56% of women compared with 48% of men.

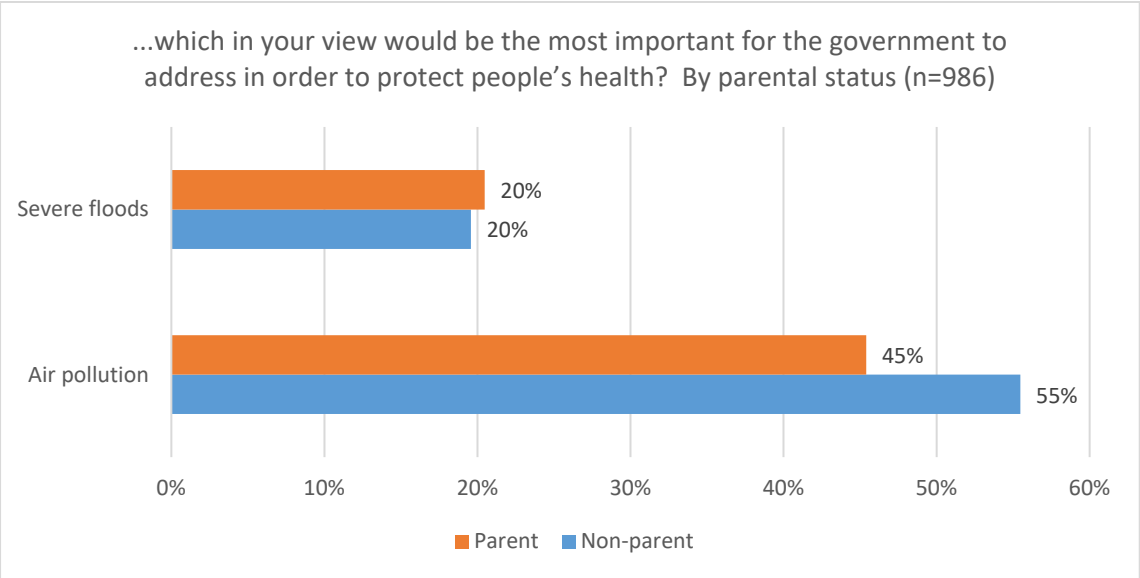
Age group (Figure 5.3, p<0.01): older age groups (35-54 years and ≥55 years) were more likely to select severe floods as the priority (22% in both age groups) than those aged 18 to 34 years (15%). The oldest and youngest groups (55% and 54%) were more likely to select air pollution than the 35-54 group (49%).

Figure 5.3. Proportion of participants selecting air pollution and severe floods as the priority for government to address by age group



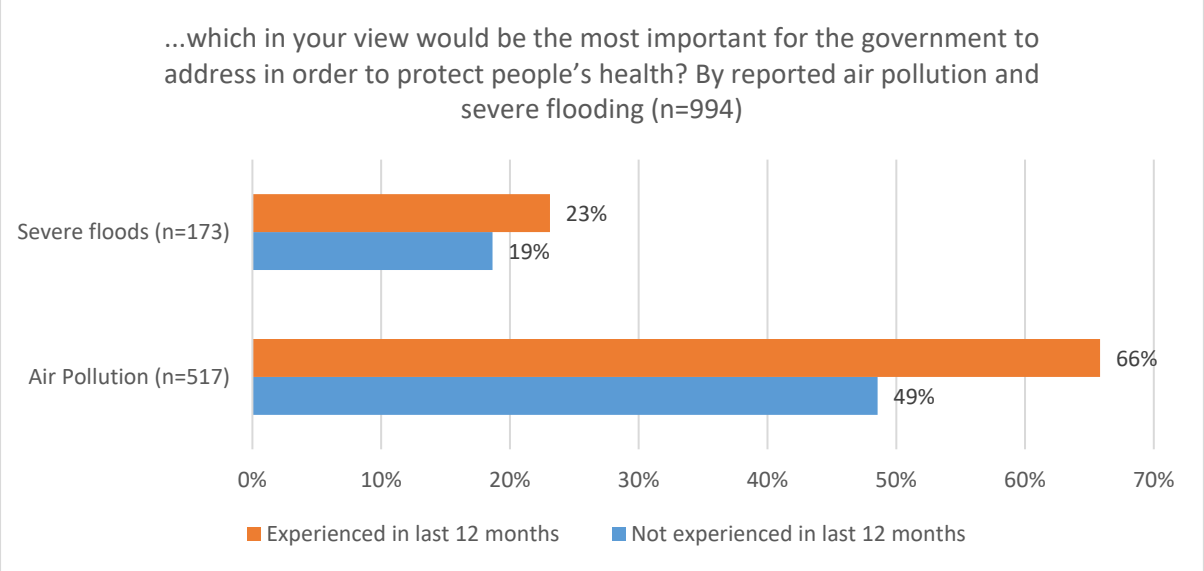
Parental status (Figure 5.4; p<0.05): parents were less likely to select air pollution than non-parents: 45% of parents identified air pollution as their top priority, compared to 55% of non-parents.

Figure 5.4. Proportion of participants selecting air pollution and severe floods as the priority for government to address by parental status



Climate-related exposures in the previous 12 months (Figure 5.5; p<001): those reporting air pollution in their local area were more likely to select it as the priority for action by government. Among this group, two-thirds (66%) identified it as the priority.[ii]

Figure 5.5. Proportion of participants selecting air pollution and severe floods as the priority by exposure to air pollution (in local area) and severe flooding (in local area/to their home) in the last 12 months



5.5 Findings from the multivariate analyses

In analyses that took account of individual and area-level factors (but not climate-related exposures), identifying air pollution as the priority for government was associated with being female, not being a parent and being from an urban setting.

When the analyses additionally took account of people's experiences of climate-related exposures, identifying air pollution as the most important for the government continued to be associated with these factors. However, the reporting of air pollution in the local area had the largest effect on the odds of identifying it as the most important for government to address.

The multivariate analyses focused on air pollution as the priority only; there were insufficient numbers for analyses of other climate-related priorities for government action. Selecting air pollution as the priority for government action was treated as a binary outcome i.e. 'air pollution not identified by the participant' (48%) vs 'air pollution identified by the participant' (52%). Regression models initially included all individual and area-level factors. Factors were removed if they did not significantly improve the model. The final model included reported exposures. (The full initial models are available here).

[ii]With respect to flooding, 23% of those reporting flooding to their home or in the local area identified severe flooding as the priority, compared with 19% of those not reporting this exposure. The difference is not significant.

A. Initial analysis including all individual and area-level factors: in the regression model that included all individual and area-level factors, three factors were significantly associated with selecting air pollution as the priority for government action (Table 5.1).

Gender: in comparison to men, women were 42% more likely to be select air pollution as their top priority (OR 1.42, 95% CI 1.11, 1.84, p<0.05).

Area of residence (rural/urban): those from urban areas were 58% more likely to identify air pollution as the priority in comparison to those from rural settings (OR 1.58, 95% CI 1.16, 2.14, p<0.01).

Parental status: not being a parent increased the odds of identifying air pollution as the priority for government by 59% in comparison to those who were parents (OR 1.59, 95% CI 1.22, 2.08, p<0.01).

Table 5.1: Logistic regression model predicting the likelihood of selecting air pollution as the priority for government (without climate-related exposures)

Included are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Gender	Female	1.424	0.006	1.105	1.836
	Urban/Rural	Urban	1.577	0.003	1.163	2.138
	Parental Status	Not being a Parent	1.589	0.001	1.216	2.078
		Constant	0.466	0.000		

For the next stage of analysis, climate-related exposures were added to the model (Table 5.2). In this updated model, gender, urban/rural location and parental status continued to be significant factors. Gender became a stronger predictor of air pollution as the main priority for government; compared with men, women had significantly higher odds of selecting air pollution (OR 1.43, 95% CI 1.10, 1.86, p<0.05). The association with area of residence remained, with those living in an urban area having a greater likelihood of selecting air pollution than those in rural areas (OR 1.40, 95% CI 1.03, 1.92, p<0.05). Not being a parent was also still positively associated with selecting air pollution, in comparison to being a parent (OR 1.55, 95% CI 1.18, 2.04, p<0.01).

In the updated model, two climate-related exposures had a significant effect on the odds of identifying air pollution as the priority for government action.

Coastal erosion in one's local area: the experience of coastal erosion in the local area was associated with a 77% reduction in the likelihood of selecting air pollution as the priority (OR 0.23, 95% CI 0.10, 0.56, p <0.01).

Air pollution: experiencing air pollution was associated with a twofold increase in the odds of selecting air pollution as the priority (OR 2.20, 95% CI 1.56, 3.07, p<0.001).

Table 5.2: Logistic regression model predicting the likelihood of selecting air pollution as the priority for government (with climate-related exposures)

Included are significant factors in the model						
			Odds ratio	Sig.	95% Confidence interval	
					Lower	Upper
Backwards Model	Gender	Female	1.431	0.007	1.104	1.855
	Urban Rural	Urban	1.403	0.035	1.025	1.920
	Parent	Not being a Parent	1.553	0.002	1.181	2.041
	Exposure in last 12 months	Coastal Erosion in Area	0.231	0.001	0.096	0.557
		Air Pollution	2.187	0.000	1.560	3.065
		Constant	0.492	0.000		

5.6 Conclusion

Over half (52%) of the survey participants considered that air pollution was their top priority for government to address. One in five (20%) identified severe floods.

Women, participants living in an urban setting and those who were not parents were more likely to select air pollution as their priority. The experience of coastal erosion in one's local area reduced the odds of selecting air pollution as the priority for government action. Air pollution in one's local area significantly increased the odds.

6. MORAL VALUES AND CLIMATE CHANGE

6.1 Introduction

It is increasingly recognised that information is not the determining factor in shaping people's perceptions of climate change and their support for climate policies. Perceptions and support are more strongly influenced by people's moral values [49, 50]. Our values often have a strong emotional dimension: they express an important part of who we are [19]. Unlike opinions which can change as our circumstances change, our core values tend to be stable over time.

While individuals vary in the values they consider important, studies suggest that these values form part of a set found across cultures and societies [51, 52]. These common values include fairness/justice, care/protection, liberty/freedom and purity/sanctity. They also include loyalty/patriotism (for example, loyalty to one's community and pride in one's country) and authority/respect. Their breadth requires the policy community to be 'fluent in a variety of moral languages' [32], framing climate change messages in ways that are inclusive and affirm the different values that people hold [51, 53].

However, climate change communication tends to be grounded in a more limited set of values. In particular, it rests on fairness/justice and care/protection. The 2015 Paris Agreement, and the wider UN framework on climate change in which it sits, is anchored in the principles of justice and equity between nations [54], and particularly between early-industrialising countries where 'the major part of emissions originate' [55] and the poorer countries of the global south. These values – fairness, justice and equity – are central to international climate politics [54, 56]. The values of care and protection also play a prominent role in climate change communication. Climate action is often represented by national and global leaders in terms of protecting children and caring for future generations [57, 58].

In a survey of European countries, a question on moral concerns about climate change was framed around these twin values. The survey provided a short definition of moral concerns: 'some people have moral concerns about climate change. For example, because they think that its harmful impacts are more likely to affect poorer countries, or because they feel a moral responsibility towards future generations'. Participants were then asked 'to what extent, if at all, do you have moral concerns about climate change?' [59]. Greater concern was associated with stronger support for climate policies. However, only a small proportion of UK participants expressed strong moral concerns about climate change.

Studies in the US have pointed to the importance of using a wider 'variety of moral languages'. A fairness/justice framing of climate change has been found to have a partisan appeal, aligning with the values of left-leaning groups but alienating those with different, or no strong, political views [32, 60]. Conversely, framing climate change around values that may appeal to a wider group – for example, freedom, purity, respect for authority and loyalty - may garner more support. However, to our knowledge, no UK study has explored people's moral stance on climate change using this larger and more inclusive set of values.

To explore this question, participants in the second pilot survey were presented with 'some statements that express a range of views about climate change' and asked 'to what extent

do you agree or disagree with them?' The statements were adapted from other studies and, as Box 6.1 indicates, each statement was designed to relate to one of the foundational values found across societies [38, 52].

Along with statements relating to fairness/justice and care/protection, was one relating to purity/sanctity. It is a value embedded in religious teaching on the environment and climate change (for example, *The Islamic Declaration on Global Climate Change* and Pope Francis' Encyclical *On Care for Our Common Home*). It is central, too, to David Attenborough's 'witness statement' to the planet [61-63]. The statements also includes ones connected to the values of liberty, loyalty and respect for authority. The values in brackets in Box 6.1 were not included in the questions asked of participants.

Box 6.1 Question on moral values and climate change

Here are some statements that express a range of views about climate change. To what extent do you agree or disagree with them?

- Climate change is damaging nature and upsetting the balance between the planet and its people (purity)
- My country is taking action to tackle climate change and supporting my country is important to me (loyalty)
- It is not fair that poorer countries are suffering most from the harmful impacts of climate change (fairness)
- We should take care of the planet for the sake of today's children and future generations (care)
- Everyone should have the freedom to live on a planet that isn't damaged and polluted (liberty)
- We should respect the shared natural heritage we have inherited from past generations (authority)

Response options*:

○ Completely agree

○ Agree a little

○ Neither agree or disagree

○ Disagree a little

○ Completely disagree

* The order of these responses was reversed for 50% of the participants

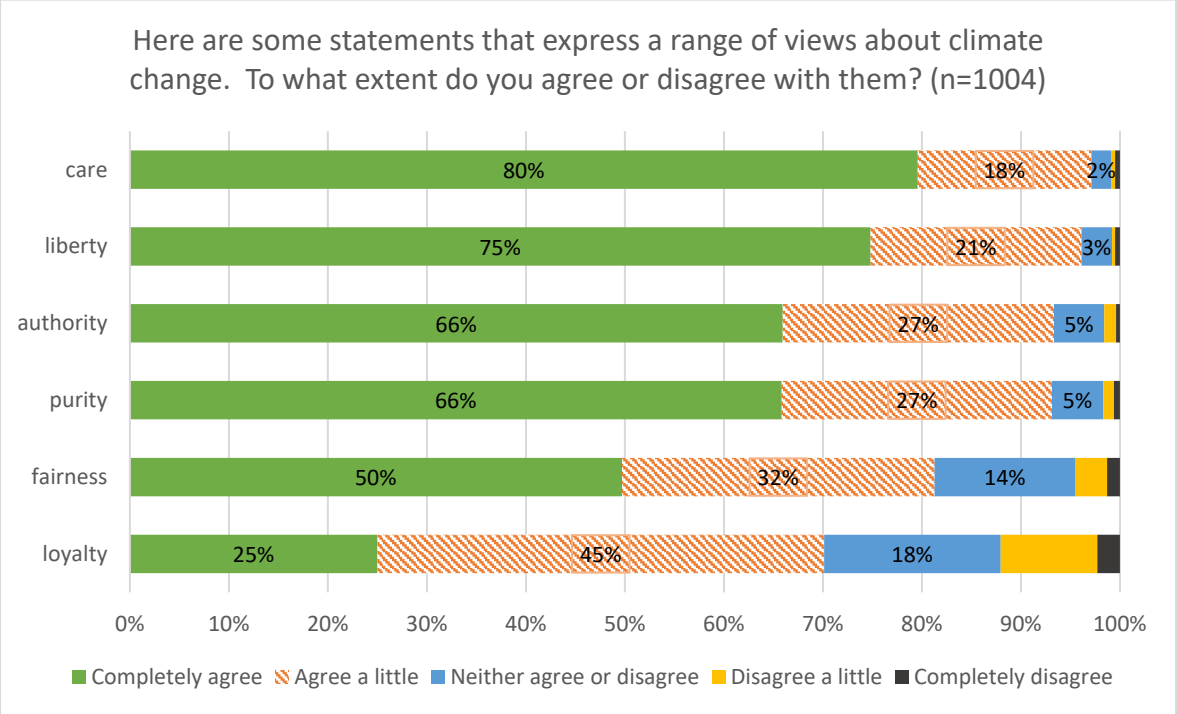
As a follow-up question, participants were presented with the statements with which they had agreed (completely agree, agree a little). They were asked to identify the statement 'that is the most important to you' and the statement that is 'the second most important'.

In the sections below, we note the value statements with widest public appeal (sub-section 6.2) and the ones regarded as most important (sub-section 6.3). We also explore associations with climate change concern, noting those that are significant. As reported in section 3, 39% of participants were 'very concerned' about climate change and 49% were 'fairly concerned'. A small proportion (10%) were 'not very concerned' and 2% were 'not at all concerned'; these groups were combined into a 'not concerned' group (12%).

6.2 Which value statements have widest public appeal?

As Figure 6.1 indicates, the value statement with the widest appeal related to care. Nearly everyone (98%) agreed with the statement and 80% completely agreed. There was also a high level of agreement for the statements linked to liberty (96% overall; 75% in complete agreement), purity (95%; 66%) and authority (95%, 66%). A lower proportion agreed with the fairness statement (72%), with 50% completely agreeing with it.

Figure 6.1 Agreement/disagreement with climate change statements (see Box 6.1)

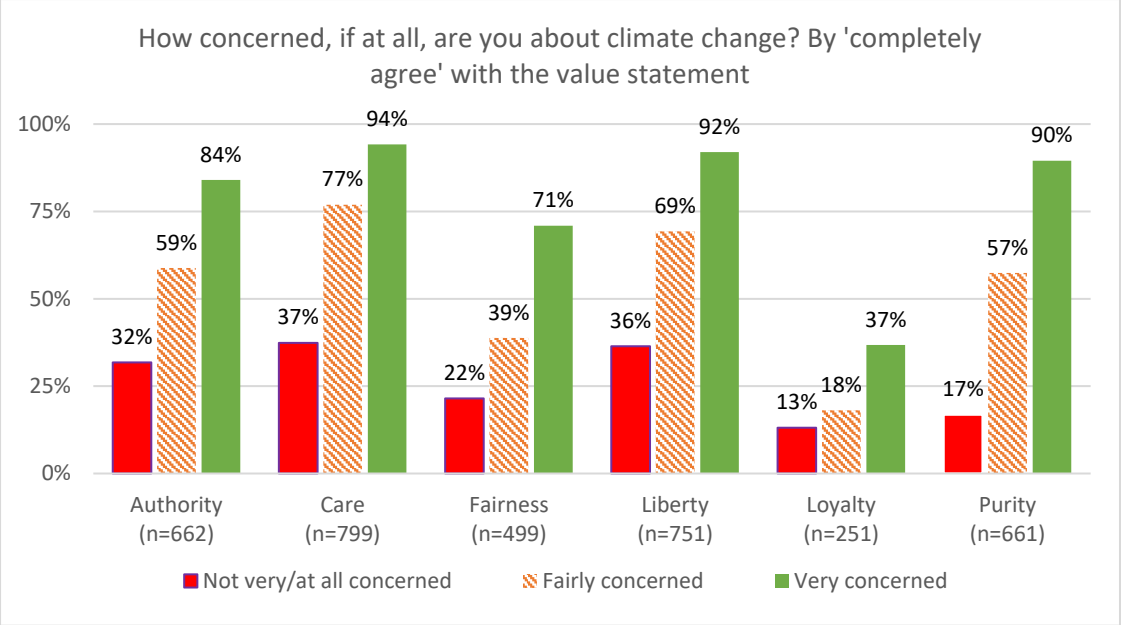


Complete agreement with the statements was associated with climate change concern (Figure 6.2). Those who were very concerned about climate change were more likely to completely agree with all the statements.

With the exception of the loyalty statement ('my country is taking action to tackle climate change and supporting my country is important to me'), a large majority (over 70%) of those very concerned about climate change were in complete agreement with the statements. While only an exploratory study, the patterns suggest that this group are open to the framing of climate change in 'a variety of moral languages'. Value statements linked to care (94%), liberty (92%) and purity (90%) elicited the highest levels of agreement.

In contrast, for those who were not concerned about climate change ('not very concerned'/'not at all concerned'), no value statement had majority appeal. The proportions in complete agreement were highest for the statements linked to care (37%), liberty (36%) and authority (32%).

Figure 6.2 Complete agreement with the climate change statements by climate change concern



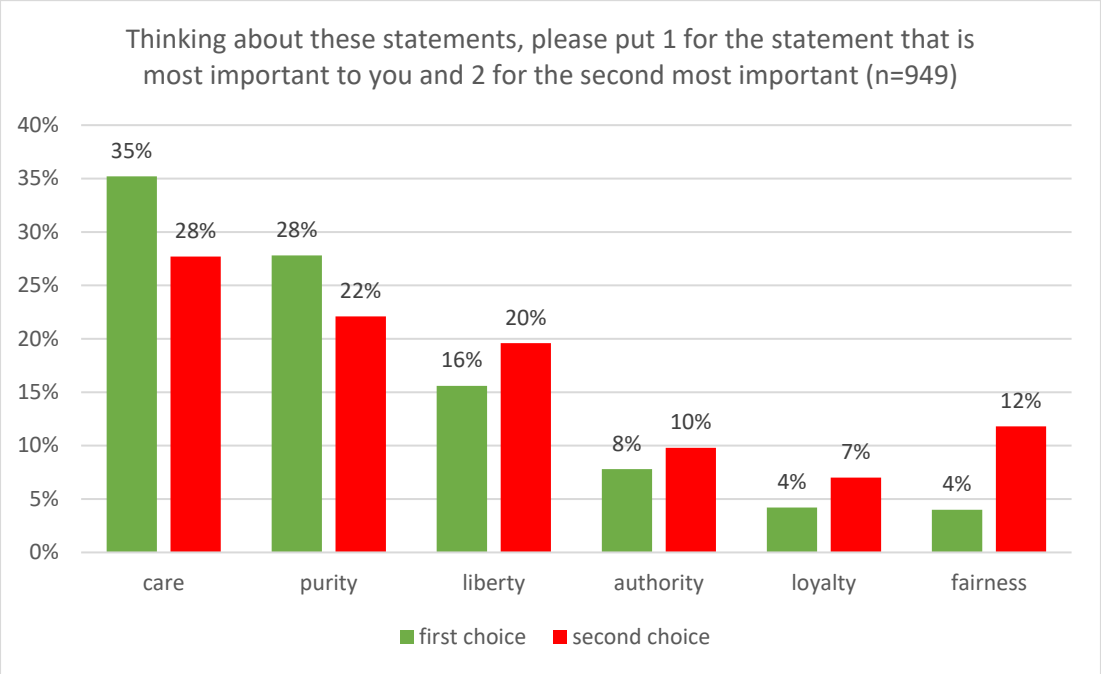
6.3 Which value statements were selected as most important?

Participants who selected 'completely agree' or 'agree a little' to two or more value statements were asked to identify the statement that they considered 'the most important' and 'the second most important'. This excluded a small proportion (6%) of participants.

As Figure 6.3 indicates, the statement related to care was most frequently identified as 'the most important', selected by over a third (35%) of participants. The purity statement was selected by 28% - but the statement related to fairness by less than one in twenty (4%).

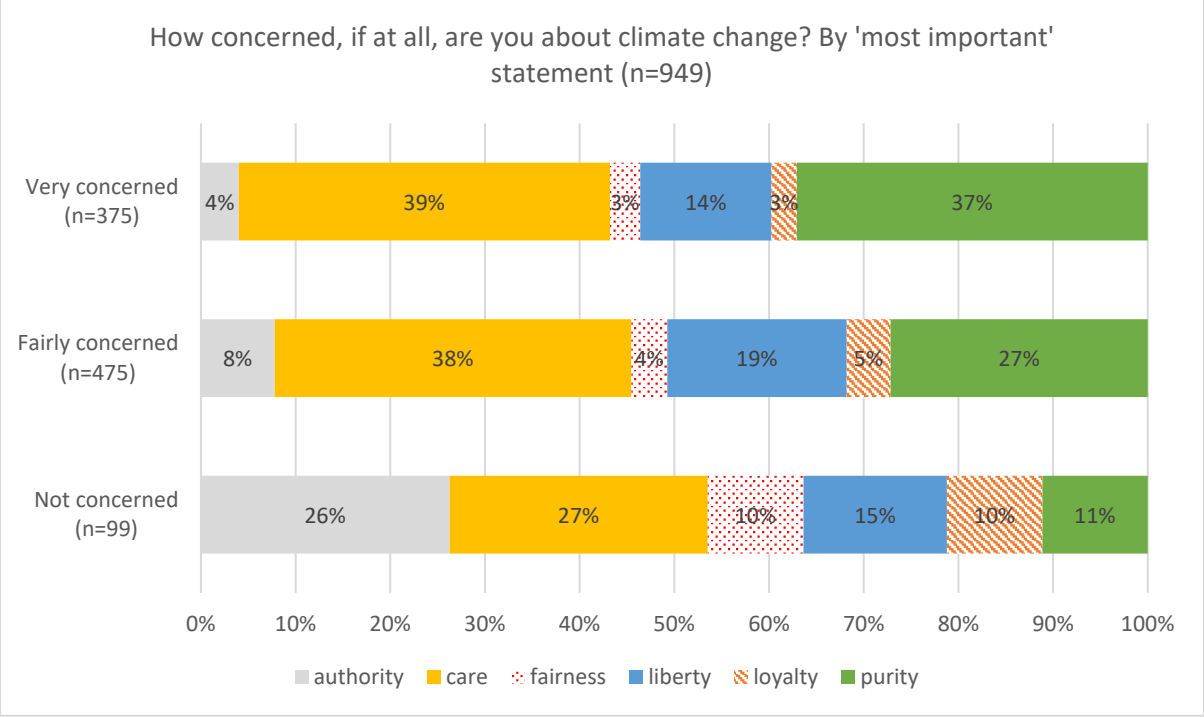
Looking at the value statements regarded as either the most or the second most important, the popular appeal of care, and to a lesser extent purity, is confirmed (Figure 6.3). A large majority (63%) of participants identified the care statement as their first or second most important. The statement related to purity was selected by 50%, while a third (36%) selected the statement related to liberty. By comparison, only a minority placed the statements connected to authority, loyalty and fairness among their two most important. The fairness statement, the one expressing values central to the Paris Agreement, was picked as the first or second most important by one in six (16%) of the participants.

Figure 6.3 'Most important' value statement



Focusing on the value statements that participants considered to be the most important, we examined associations with climate change concern (Figure 6.4; $p<0.001$).

Figure 6.4 'Most important' climate change statement by climate change concern



Those who were very concerned about climate change were more likely to select purity (37%) than those who were fairly concerned (27%) or not concerned (11%). The very concerned group were also more likely to select care (39%) than those who were not concerned (27%).

Compared to those who were very concerned about climate change, those in the 'not concerned' group were more likely to select the value statements relating to authority, fairness and loyalty as the most important. The authority statement ('We should respect the shared natural heritage we have inherited from past generations') was identified as the most important by 26% of those in this group, compared to 4% in the very concerned group; the proportions for fairness and loyalty were both 10% (not concerned) and 3% (very concerned).

6.4 Building on the analysis

It is widely accepted that attending to people's values is an important part of ethical policy making [50]. An appreciation of people's values can help inform the direction of policy, enabling national and local policy makers to harness public support to address climate change and its health impacts [65].

Our exploratory study suggests that those who are very or fairly concerned about climate change engage with a moral framing of climate change to a greater extent than those who are not concerned. None of the moral framings provided in the survey appeared to resonate with those who were not very or not at all concerned about climate change.

Care, when framed around children and future generations, was the value statement that was most frequently identified as the most important. This pattern was found across groups expressing different degrees of concern about climate change. But in all the groups, the majority selected one of the other value statements as the most important. In the 'very concerned' and 'fairly concerned' groups, care was paired with purity; in the 'not concerned' group, care and authority were the value statements most frequently selected. For all three groups, fairness was chosen by only a small minority. This suggests that a moral framing of climate change around fairness between nations may not have wide public appeal. Climate change communication may be better aligned with public sentiment if it embraces multiple moral perspectives on climate change.

In drawing these conclusions, we are aware that the pilot survey provides only an initial exploration of a complex area [28]. We will build on this initial analysis in two ways.

Firstly, we will review and refine the value statements. In the pilot survey, each value was represented by a single statement. While the statements and their associated values were informed by earlier studies, the statements may have wider moral resonance.

For example, would a statement relating to children and future generations elicit a similar level of support if framed around fairness rather than care ('it is not fair that children and future generations will suffer most from the harmful impacts of climate change')? Or would a statement about the unequal global impacts of climate change garner more support if framed around liberty (for example, 'everyone – regardless of whether they live in a richer or poorer country – should have the freedom to live on a planet that isn't damaged and polluted')? Or, as another example, would a statement related to loyalty framed around 'my community' secure more support than the one framed around 'my country'? As a next step, we will seek to test whether a value's appeal is contingent on the statement through which it is expressed. We will explore this question in a further pilot survey, in preparation for the main surveys planned for summer 2021.

Secondly, we will investigate whether those endorsing different moral values with respect to climate change cluster into distinctive groups. For this analysis, we would use latent modelling techniques, for example Latent Class Analysis (LCA), to identify connections between the moral values that people hold. This would enable us to establish whether the groups varied in systematic ways, including in their social composition, their perceptions of health and climate change, and the priorities for action by government which they identify.

7. CONCLUSIONS AND NEXT STEPS

7.1 Conclusions

This report draws on findings from two pilot surveys of adults in the UK conducted in late 2020/early 2021.

The findings suggest that the majority of adults are concerned about climate change and consider that it is already having an impact on people's health in the UK. There is evidence of some social differences in these perceptions; for example, being in an older age group was a significant predictor of being very concerned about climate change and living in an urban area increased the odds of selecting air pollution as the priority for government to address in order to protect people's health. But, in contrast to other areas of public health, there is an absence of clear social gradients in perceptions.

Instead, what stands out is the importance of people's experiences of climate-related exposures. Thus, the most significant predictor of climate change concern was reporting an environmental exposure in the last 12 months (e.g. flooding to one's home/local area, heatwave that affected one's health and air pollution in the local area). With respect to perceiving climate change to be already affecting people's health, personal experience was again key. Those experiencing air pollution/poor air quality in their local area had twice the odds of perceiving climate change to be already affecting people's health. Conversely, participants reporting no climate-related exposures in the previous 12 months were significantly less likely to hold this view.

The importance of personal experience emerged again in people's views of the exposures that were the most important for government to address in order to protect people's health. Over half (52%) identified air pollution - and the experience of air pollution in one's local area doubled the odds of identifying this as the priority.

As this suggests, perceptions of climate change and heath are closely tied to personal experiences of environmental stressors, like air pollution and flooding, for which there is increasing evidence of adverse health effects.

While only an exploratory study, our analysis of people's moral values points to their potential importance with respect to perceptions of climate change and priorities for action. As discussed in section 6, we will be refining the value statements to test whether their appeal lies in the statements themselves or in the value included in the statement.

Like other survey-based studies, there are limitations. As noted in the Methods section, the surveys capture the perceptions and priorities of adults who have access to the internet (via a smartphone or a home internet connection). The perspectives of children and young people and of adults without internet access are not represented. Additionally, quotas were set for key aspects of identity, including ethnic group, to match the wider UK population. Although each survey was relatively large (1000+), we lacked statistical power to examine potential differences between ethnic groups in any depth.

7.2 Next steps

The two pilot surveys form part of a set of three. The third pilot survey, exploring people's willingness to pay to address the risks of climate change to health, is currently in progress (April 2021).

Building on the set of three pilot studies, the main surveys will again focus on the areas central to the project: people's perceptions of the health risks of climate change and their preferences and priorities for action, including those expressed through their willingness to pay. The set of main surveys will also include one shaped by the project's public involvement input.

Evidence from the pilot surveys will be used to refine the design of the main surveys. Three examples are given here.

Firstly, we will refine the question on environmental stressors (exposure to floods, air pollution etc.). As Box 2.1 indicates, there is currently a single question asking about participants' experience of a range of exposures, at local and individual level, across the previous 12 months. Given the importance of the reported experiences in predicting concerns about climate change, perceptions of its health impacts and priorities for government action, the main surveys will ask a wider set of questions. These will more clearly separate out experiences of exposures in the local area and personal exposure, particularly in relation to air pollution. The questions will also seek to capture whether the experience was of a single event or one repeated across the year.[iii]

Secondly, we will refine our questions on individual health. As well as self-reported health status, the second pilot survey included a question on individual health conditions (not reported in the interim report). Preliminary analysis points to an association between health conditions and both perceptions of the health risks of climate change and priorities for action. We will expand the health conditions question to enable these potential associations to be examined in more detail.

Thirdly, we will review our questions on climate change concerns with respect to people's health and on priorities for government action. We will refine the climate change concern question to more clearly signal the 'no concerns' option (Box 5.1). For the priorities question, this is currently framed in terms of 'the government' and 'the most important' priority (Box 5.2). The question will be reframed around action at the national level (including by the devolved governments for participants in Northern Ireland, Scotland and Wales) and local level; participants will also have the option of identifying more than one priority.

[iii] The pilot surveys already include a question on individual's concerns about the impact of environmental exposures on their own health (not reported here) which we will refine to match changes in the questions on exposures.

Beyond the main surveys, the project will draw on findings from the qualitative study and advice from the project Advisory Group. Both the surveys and the qualitative study, together with insights from the project's public involvement input, will feed into the project final report, research papers and wider communication activities.

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APPENDIX

1. Project team and project Advisory Group

Project team:

Lead: Hilary Graham

Co-investigators: Sue Chilton, Jytte Nielsen, Mark Petticrew

Researchers: Alex Harrison, Pete Lampard, Jackie Martin-Kerry, Caroline Ward

Project administrator: Helen Haynes

Membership of the Advisory Group (Dec 2020)

- Dr Jacqui Cotton, Principal Scientist, Environment Agency
- Ben Walker, Department for Business, Energy and Industrial Strategy (BEIS)
- Dr Dagmar Zeuner, Director of Public Health, London Borough of Merton
- Joel Moffat, Lead Analyst Public Health Systems and Strategy, Department of Health and Social Care (DHSC)
- Dr Emer O'Connell, Consultant in Public Health, Public Health England (PHE)
- Adele Rae, General Manager, Kirkstall Valley Development Trust (community member)
- Dr Rupert Suckling, Director of Public Health, Doncaster Metropolitan Borough Council
- Jennifer Bostock, Public Health Policy Research Unit co-lead for public involvement
- Members of the project team

2. Tables

Table A1: social profiles of the two surveys

Individual/Area Factor	Categories	Survey					
		Survey 1		Survey 2		Total	
		Count	%	Count	%	Count	%
Sex	Male	513	48.0%	479	47.2%	992	47.6%
	Female	552	51.7%	531	52.4%	1083	52.0%
	Prefer not to share this information*	1	0.1%	3	0.3%	4	0.2%
	Prefer to self-define*	2	0.2%	1	0.1%	3	0.1%
Age	18-24	116	10.9%	102	10.1%	218	10.5%
	25-34	161	15.1%	192	18.9%	353	17.0%
	35-44	206	19.3%	189	18.6%	395	19.0%
	45-54	212	19.9%	210	20.7%	422	20.3%
	55-64	195	18.3%	173	17.1%	368	17.7%
	65-74	147	13.8%	127	12.5%	274	13.2%
	75 and over	31	2.9%	21	2.1%	52	2.5%
Parental Status	Not living with a child/ren under 18 years	735	68.8%	646	63.7%	1381	66.3%
	Yes and I am their parent/guardian	308	28.8%	342	33.7%	650	31.2%
	Yes and I am not their parent/guardian	25	2.3%	26	2.6%	51	2.4%
Education Attainment	Level 1 - None to GCSE D-G	216	20.2%	188	18.5%	404	19.4%
	Level 2 - GCSE A-C to Higher Education Qualification	472	44.2%	420	41.4%	892	42.8%
	Level 3 - Degree Level	380	35.6%	406	40.0%	786	37.8%
Tenure	Own (with a mortgage or own outright)	554	51.9%	609	60.1%	1163	55.9%
	Rent from a private landlord	219	20.5%	208	20.5%	427	20.5%
	Rent from a housing authority/local council	194	18.2%	109	10.7%	303	14.6%
	Other rent	13	1.2%	8	0.8%	21	1.0%
	Other (including living with parents)	88	8.2%	80	7.9%	168	8.1%
Self-reported Health Status	Very Good	180	16.9%	190	18.7%	370	17.8%
	Good	477	44.7%	524	51.7%	1001	48.1%
	Fair	308	28.8%	246	24.3%	554	26.6%
	Bad	86	8.1%	46	4.5%	132	6.3%
	Very Bad	17	1.6%	8	0.8%	25	1.2%
Ethnic group	White - Includes any White background	893	83.6%	900	88.8%	1793	86.1%
	Mixed or multiple ethnic groups - Includes White and Black Caribbean, White and Black African, White and Asian or any other Mixed ethnic group	28	2.6%	23	2.3%	51	2.4%
	Asian or Asian British - Includes Indian, Pakistani, Bangladeshi, Chinese or any other Asian background	101	9.5%	55	5.4%	156	7.5%
	Black, African, Caribbean or Black British - Includes African, Caribbean or any other Black background	42	3.9%	27	2.7%	69	3.3%
	Other - For example Arab or any other background	4	0.4%	9	0.9%	13	0.6%
Employment Status	Employed	538	50.4%	640	63.1%	1178	56.6%
	Retired	209	19.6%	164	16.2%	373	17.9%
	Student in full-time education	52	4.9%	40	3.9%	92	4.4%
	Looking after the family or home	98	9.2%	68	6.7%	166	8.0%
	Unemployed and looking for work	99	9.3%	70	6.9%	169	8.1%
	Other	72	6.7%	32	3.2%	104	5.0%
Country of Residence	England, Isle of Wight and Scilly Isles	846	79.2%	856	84.5%	1702	81.8%
	Northern Ireland	87	8.1%	22	2.2%	109	5.2%
	Scotland and Scottish Isles	85	8.0%	87	8.6%	172	8.3%
	Wales and Anglesey	50	4.7%	48	4.7%	98	4.7%
	Isle of Man and Channel Isles	0	0.0%	0	0.0%	0	0.0%
Region within England	North East	40	4.7%	51	6.0%	91	5.3%
	North West	114	13.5%	111	13.0%	225	13.2%
	Yorkshire and The Humber	87	10.3%	79	9.2%	166	9.8%
	East Midlands	76	9.0%	82	9.6%	158	9.3%
	West Midlands	83	9.8%	69	8.1%	152	8.9%
	East of England	72	8.5%	95	11.1%	167	9.8%
	London	149	17.6%	135	15.8%	284	16.7%

	South East	144	17.0%	142	16.6%	286	16.8%
	South West	80	9.5%	91	10.6%	171	10.0%
	Other	1	0.1%	1	0.1%	2	0.1%
Rural/urban Status	**Urban**	345	32.3%	337	33.3%	682	32.8%
	Outskirts of town or city	506	47.4%	448	44.3%	954	45.9%
	Small village	139	13.0%	139	13.7%	278	13.4%
	Rural	78	7.3%	88	8.7%	166	8.0%
* the numbers of participants who preferred to define their gender or not to share information on their gender were too small to include in the analysis							

Table A2 reported climate-related exposures

For the question on climate-related exposures, see Box 2.1

Reported in prior 12 months	Categories	Survey					
		Survey 1		Survey 2		Total	
		Count	%	Count	%	Count	%
Damage to your home from flooding	No	1028	96.3%	976	96.3%	2004	96.3%
	Yes	40	3.7%	38	3.7%	78	3.7%
Flooding in your local area	No	858	80.3%	798	78.7%	1656	79.5%
	Yes	210	19.7%	216	21.3%	426	20.5%
Heatwave (where your health is significantly affected)	No	938	87.8%	927	91.4%	1865	89.6%
	Yes	130	12.2%	87	8.6%	217	10.4%
Damage to your home from coastal erosion	No	1050	98.3%	982	96.8%	2032	97.6%
	Yes	18	1.7%	32	3.2%	50	2.4%
Damage to your local area from coastal erosion	No	1013	94.9%	939	92.6%	1952	93.8%
	Yes	55	5.1%	75	7.4%	130	6.2%
Air pollution (poor air quality) in your local area	No	782	73.2%	815	80.4%	1597	76.7%
	Yes	286	26.8%	199	19.6%	485	23.3%
Other	No	1063	99.5%	1011	99.7%	2074	99.6%
	Yes	5	0.5%	3	0.3%	8	0.4%
No reported exposure	No	509	47.7%	456	45.0%	965	46.3%
	Yes	559	52.3%	558	55.0%	1117	53.7%

Note

The surveys were conducted between November 2020 and February 2021, giving a time window for exposures from mid-November 2019 to early February 2021.

We do not have environmental monitoring data to match against the self-reported data. We have therefore relied on other sources of evidence relating to the experiences listed above.

- Damage to your home from flooding: the proportion of participants reporting flooding to their home in the previous year (4%) is in line with a national probability survey of mental health [14].

- Flooding in the local area: one in five (21%) participants reported flooding in their local area in the previous 12 months. The relevant time period saw severe winter flooding between November 2019 and February 2020, flash flooding in August 2020 and winter floods in January 2021.

- Heatwave 'where your health is significantly affected': the time window of the surveys included three heatwaves (June, July, August 2020) associated with a cumulative all-cause excess mortality in England of 2500 [66], which provides context for the 10% of participants who reported experiencing heatwave where their health was significantly affected.

- Poor air quality in the local area: annual monitoring data indicate that many urban areas fail to meet WHO guidelines on air quality [11]. Based on population-weighted estimates, 28% of local authorities had levels $PM_{2.5}$ above WHO guidelines (annual mean of 10 µgm-3) in 2019, the latest year for which data are available [67]. In the surveys, 23% of participants reported air pollution/poor air quality in their local area.

Table A3 combined groups for the analyses

		New Categories						
		New Categories	Perceptions			Moral Concerns	Total	
		Code	Counts	%	Counts	%	Counts	%
Sex	Male	Male	693	46.0%	482	47.4%	1175	46.6%
	Female	Female	814	54.0%	535	52.6%	1349	53.4%
	Prefer not to share this information	Excluded	N/A					
	Prefer to self-define							
Age	18-24	18-34	277	25.9%	294	29.0%	571	27.4%
	25-34							
	35-44	35-54	418	39.1%	399	39.3%	817	39.2%
	45-54							
	55-64	55+	373	34.9%	321	31.7%	694	33.3%
	65-74							
	75 and over							
Parental Status	No	Not a Parent	760	71.2%	672	66.3%	1432	68.8%
	Yes and I am not their parent/guardian							
	Yes and I am their parent/guardian	Parent	308	28.8%	342	33.7%	650	31.2%
Do you own or rent your home?	Own (with a mortgage or own outright)	Own	554	51.9%	609	60.1%	1163	55.9%
	Rent from a private landlord	Rent	514	48.1%	405	39.9%	919	44.1%
	Rent from a housing authority/local council							
	Other rent							
	Other (including living with parents)							
Would you say your health in general is?	Very Good	Good to Very Good	657	61.5%	714	70.4%	1371	65.9%
	Good							
	Fair	Fair to Very Bad	411	38.5%	300	29.6%	711	34.1%
	Bad							
	Very Bad							
What is your ethnic group?	White*	White	893	83.6%	900	88.8%	1793	86.1%
	Asian or Asian British***	Asian or Asian British	101	9.5%	55	5.4%	156	7.5%
	Mixed or multiple ethnic groups**	Black/mixed heritage	74	6.9%	59	5.8%	133	6.4%
	Black, African, Caribbean or Black British****							
	Other*****							
Which best describes your employment status?	Employed	Employed	538	50.4%	640	63.1%	1178	56.6%
	Retired	Retired	209	19.6%	164	16.2%	373	17.9%
	Student in full-time education	Not in paid employment	321	30.1%	210	20.7%	531	25.5%
	Looking after the family or home							

	Unemployed and looking for work							
	Other							
Education question recoded into ISCED	Level 1 - None to GCSE D-G	Same	98	9.2%	68	6.7%	166	8.0%
	Level 2 - GCSE A-C to Higher Education Qualification		99	9.3%	70	6.9%	169	8.1%
	Level 3 - Degree Level		72	6.7%	32	3.2%	104	5.0%
Country of Residence	England, Isle of Wight and Scilly Isles	England, Isle of Wight and Scilly Isles	845	79.2%	855	84.5%	1700	81.8%
	Northern Ireland	Combined non-England Country	222	20.8%	157	15.5%	379	18.2%
	Scotland and Scottish Isles							
	Wales and Anglesey							
	Isle of Man and Channel Isles							
Region within England	North East	Northern England (North West, North East, Yorkshire & the Humber)	241	22.6%	241	23.8%	482	23.2%
	North West							
	Yorkshire and The Humber							
	East Midlands	Mid England (West Midlands, East Midlands & East of England)	231	21.6%	246	24.3%	477	22.9%
	West Midlands							
	East of England							
	London	Greater London and South East	293	27.5%	277	27.4%	570	27.4%
	South East							
	South West	South West	80	7.5%	91	9.0%	171	8.2%
	Other	Excluded	N/A					
How would you describe the area in which you live?	Urban	Urban	851	79.7%	785	77.6%	1636	78.7%
	Outskirts of town or city							
	Small village	Rural	217	20.3%	227	22.4%	444	21.3%
	Rural							