



Public Health, Energy & Climate Change

A Maryland Statewide Survey | 2014

Investigators:

Karen Akerlof, PhD

Edward W. Maibach, MPH, PhD

George Mason University

Center for Climate Change Communication

4400 University Dr., MS 6A8

Fairfax, VA 22030

kakerlof@gmu.edu, (703) 993-6667

emaibach@gmu.edu, (703) 993-1587

This survey was funded by the Town Creek Foundation of Easton, MD. We thank the Town Creek Foundation and its Executive Director Stuart Clarke for their support.

The project benefitted from the expertise and hard work of many individuals. Members of the Climate Communication Consortium of Maryland (climatemaryland.org) assisted in the development of the survey. Ken Adams and Charles Coats provided invaluable help in coordinating its fielding. They—with additional assistance provided by Mason undergraduate and graduate students Aiya Al-Beyati, Refka Al-Beyati, Natasha S. Taliferro, Rebecca Lloyd, Deanna Kirby, Stacy Nelson, Roxana Kazemi, Claudia Harris, Kelly Hayden, Patrick Greenwalt, Brittany Grutter, Andy Sachs, Vera Solovyeva, Dhara Patel, Elloise L. Lotoc, Danielle Kirby, Suzanne Hewitt, Aileen S. Dierig and Sean Kelley— assembled the mailings over a series of long weekends. Paul Weiss from Emory University provided statistical support for the weights. Any errors are those of the authors.

Credits, cover photo:

Photo of a child with asthma using a nebulizer. Longer periods of high temperatures, such as anticipated with climate change, can result in increases in air pollution associated with asthma. Photo from istockphoto.com from Maryland Department of the Environment at climatechange.maryland.gov.

Suggested citation:

Akerlof, K., & Maibach, E. W. (2015). Public health, energy & climate change: A survey of Maryland residents, 2014. Fairfax, VA: Center for Climate Change Communication, George Mason University.

Table of Contents

Executive Summary.....	1
1. Most Marylanders say climate change harms human health	3
Breathing problems are seen as the most likely harm to health; infectious disease less so	3
Marylanders say other people than themselves and future generations are more vulnerable	4
People with medical conditions and the elderly are seen as vulnerable	5
People who are vulnerable due to medical conditions are more likely to understand the risk	6
2. Doctors and public health experts are trusted sources of information on climate change.....	7
3. The perceived risks to health from chemicals and pollution have grown.....	8
Health risks from climate change and flooding are perceived differently across regions	8
Many experienced loss of electricity and wind- or storm-related damage in the past year	8
4. Environmental health and health care access are ranked among top state priorities	11
5. Coal, oil, and nuclear power are seen as harmful to health.....	12
Residents say solar and wind are not at all harmful to health	12
6. Study methodology.....	14
Appendices.....	17
Correlation tables	18
Data tables	20
Sample demographics.....	44

Executive Summary

In 2013, George Mason University fielded the first survey of climate change, energy and public health in the state. We repeated some of the questions and added new measures in 2014. This report, focused on public health and climate change, is the last of four released from the 2014 data. Other reports highlight attitudes, behaviors, and policy preferences on sea-level rise and adaptation, energy, and climate change generally.¹ Below we highlight new findings regarding climate change and public health, and some of the most important changes that we found in the state over the past year.

Most Marylanders understand that climate change harms human health

- More than half of Marylanders (55%) say that they expect that people's health in their communities will be affected by climate change in the next several years.
- State residents say breathing and respiratory problems (72%), injuries from extreme weather (61%), and heat stroke (55%) are likely to become more common in the state due to climate change.
- Infectious disease is less likely to be cited as an increasing risk to health due to climate change. Less than half of state residents (42%) say that it will become more common, even though climate change is projected to affect the spread of disease.

Doctors and public health experts are trusted sources of climate change information

- Medical authorities are among the professionals trusted the most for information on climate change. Marylanders trust doctors and public health experts on climate change only slightly less strongly than scientists at Maryland universities (63% vs. 70%).

More Marylanders perceive chemicals and pollution as a risk to health

- More than half of Marylanders (55%) say that exposure to chemicals, including pesticides, in food and other products is a major risk to their personal health. This represents a sizeable shift—up 23 percentage points—since spring 2013.
- Polluted drinking water (52%), air pollution (47%) and second-hand smoke (41%) also showed considerable increases in public perceptions as major risks with 19, 16, and 12 percentage-point gains respectively.
- Sixty-three percent of Marylanders cite climate change as a moderate or major risk to their personal health—an increase of 11 percentage points from spring 2013.

Environmental health and health care access are among Marylanders' top policy priorities

- Three-quarters of Marylanders (74%) say that improving access to health care should be a high or very high priority for the state's General Assembly and governor.

¹ See the reports at <http://www.climatemaryland.org/survey/>

- Health care access ranks after creating jobs (89%) and reducing water pollution (81%) in Marylanders' priorities, and is about the same percentage as growing the middle class and reducing air pollution.

Fossil fuels and nuclear power are seen as harmful to health; solar and wind are not

- Almost three-quarters of Marylanders (72%) say that coal is somewhat or very harmful to people's health. Oil (64%) and nuclear power (58%) also raise health concerns.
- Over the past year, the number of people who say that coal is "very harmful" to health increased by 10 percentage points to 41%.
- Renewable energy sources such as wind and solar continue to be viewed by majorities as non-harmful (solar, 65%; offshore wind, 57%; land-based wind, 58%). In 2014, there was an increase of five percentage points in those people who say that solar has no negative effects on health.

Study methodology

The survey was mailed to 6,401 households in the state of Maryland, randomly selected from within each of four regions of the state.² We sampled at the regional level to ensure the final data was generalizable to these distinctly different geographic and cultural areas as well as to the state as a whole, weighting the data at both the state and regional levels in accordance with U.S. Census population distributions. Households that responded to the survey in 2013 were not re-contacted in 2014. The survey was fielded from March 17 to June 10, 2014 with a response rate of 35%. The unweighted sample margin of error is +/- 2 percentage points at the 95% confidence interval for the state and less than +/- 5 percentage points for each region. (See study methodology, page 14). This report includes survey data from 2013 as a basis for comparison; statistical comparisons between years were assessed for significance. Survey reports from 2013 can be found at climatemaryland.org and include a description of the sample and methodology. Both were consistent across years.

² **Western Region** – Allegany, Frederick, Garrett and Washington counties; **Central Region** – Baltimore, Carroll, Cecil, Harford, Howard, Montgomery counties and Baltimore City; **Southern Region** – Anne Arundel, Calvert, Charles, Prince George's and St. Mary's counties; **Eastern Region** – Caroline, Dorchester, Kent, Queen Anne's, Somerset, Talbot, Wicomico and Worcester counties.

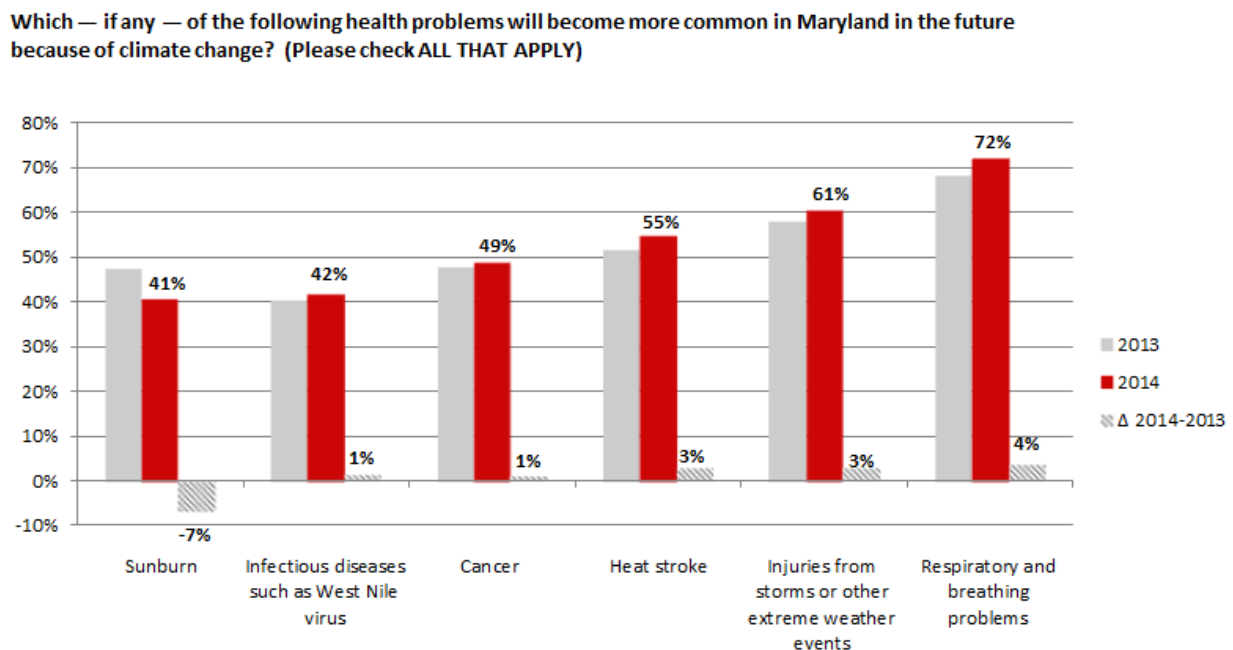
1. Most Marylanders say climate change harms human health

More than half of Marylanders (55%) say that they expect that people’s health in their communities will be affected by climate change in the next several years (see Appendices, Table 1, p. 21). Indeed, many state residents continued in 2014 to see breathing and respiratory problems (72%), injuries from extreme weather (61%), and heat stroke (55%) as likely to become more common in the state due to climate change (see Figure 1). In 2013, they were significantly less likely, however, to think that sunburns would be a consequence, down by seven percentage points to 41%. Climate change has long been confused with ozone depletion,³ which increases the amount of ultraviolet light passing through the atmosphere and the risk of sunburn and skin cancers. (Recently, some studies have suggested that climate change actually might affect UV exposure and related cancers.⁴)

Breathing problems are seen as the most likely harm to health; infectious disease less so

On average, 72% of Marylanders say that breathing and respiratory problems will increase with climate change, but those who live in the Southern region of the state, stretching from Anne Arundel to St. Mary’s counties, are 10 percentage points more likely to say so than the more

Figure 1 | Heat stroke, injuries and breathing problems are expected to increase



Unweighted base: 2013, n=2,126; 2014, n=2,035

³ Read, D., Bostrom, A., Morgan, M. G., Fischhoff, B., & Smuts, T. (1994). What Do People Know About Global Climate Change? 2. Survey Studies of Educated Laypeople. *Risk Analysis*, 14(6), 971–982.

⁴ Hui, Y., Thong, H.-Y., & Maibach, H. I. (2011). Global warming and its dermatologic impact. *Expert Review of Dermatology*, 6(5), 521–523.

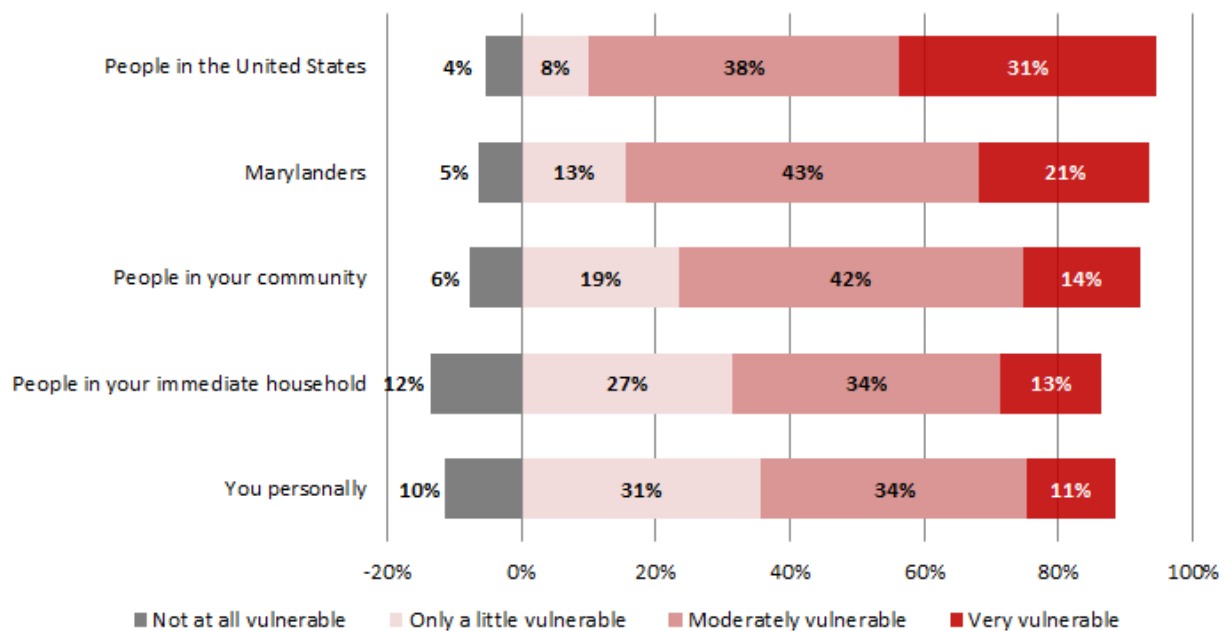
rural Eastern and Western portions of the state (Southern, 76%; Western, 66%; Central, 71%; Eastern, 66%) (see Appendices, Table 2, p. 23). Infectious disease is less likely to be thought of as a health effect from climate change (42%), with little variation from survey respondents across the state’s regions (Western, 40%; Central, 41%; Southern, 44%; Eastern, 43%), even though climate change is projected to affect the spread of disease.⁵

Marylanders say other people than themselves and future generations are more vulnerable

Research has shown that people tend to see climate change as something that happens to people in places far away from them.⁶ In this survey we asked respondents who they believe are most vulnerable to potential health impacts from climate change—themselves, people in their households, people in their communities, Marylanders, or people in the United States—and the degree to which they will be harmed. Consistent with prior research, Marylanders are more likely to say that people in the U.S. generally are “very vulnerable” (31%) or even people in Maryland (21%), than they themselves (11%) or those in their households (13%) (see Figure 2). Of note, few people say that they or people in their household are not at all vulnerable to health threats from climate change (10% and 12% respectively).

Figure 2 | People in the U.S. are seen as more vulnerable than those people close to home

How vulnerable — if at all — are the following people to potential health impacts of climate change?



Unweighted base, n=2,035

⁵ Luber, G., Knowlton, K., Balbus, J., Frumkin, H., Hayden, M., Hess, J., McGeehin, M., Sheats, N., Backer, L., Beard, C. B., Ebi, K. L., Maibach, E., Ostfeld, R. S., Wiedinmyer, C., Zielinski-Gutiérrez, E., & Ziska, L. (2014). *Ch. 9: Human health. Climate change impacts in the United States: The third National Climate Assessment*. U.S. Global Change Research Program, p. 220-256.

⁶ Leiserowitz, A. (2005). American Risk Perceptions: Is Climate Change Dangerous? *Risk Analysis*, 25(6), 1433-1442.

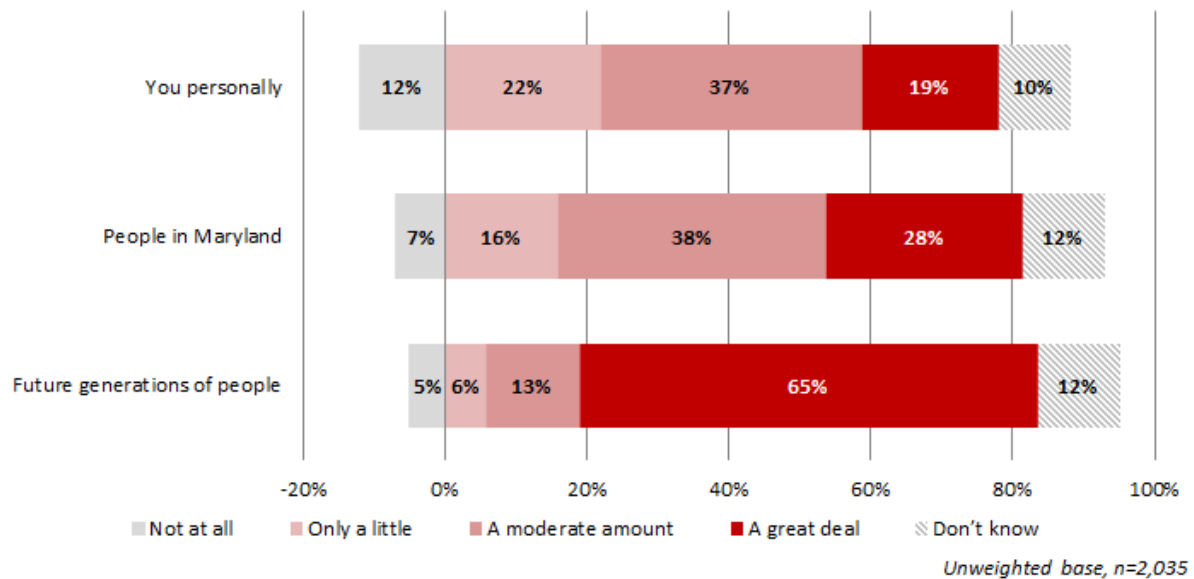
Most Marylanders (65%) believe that future generations of people will be harmed “a great deal,” while only small minorities feel that people in Maryland (28%) or they themselves (19%) will be harmed to the same extent. Conversely, few Marylanders say that they (12%), other Marylanders (7%) and future generations of people (5%) will not be harmed at all by climate change (see Figure 3).

People with medical conditions and the elderly are seen as vulnerable

A majority of Marylanders say that people with medical conditions (59%) and the elderly (55%) are very vulnerable to the potential health impacts of climate change (see Figure 4). They are less likely to identify young children and people on low incomes as very vulnerable (42% and 36%, respectively). In reality, as noted in the key messages of the human health chapter of the National Climate Assessment, “(c)ertain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color.”⁷ Middle-aged individuals are not considered a particularly vulnerable group unless they have other characteristics that put them at risk, such as a medical condition or low income.

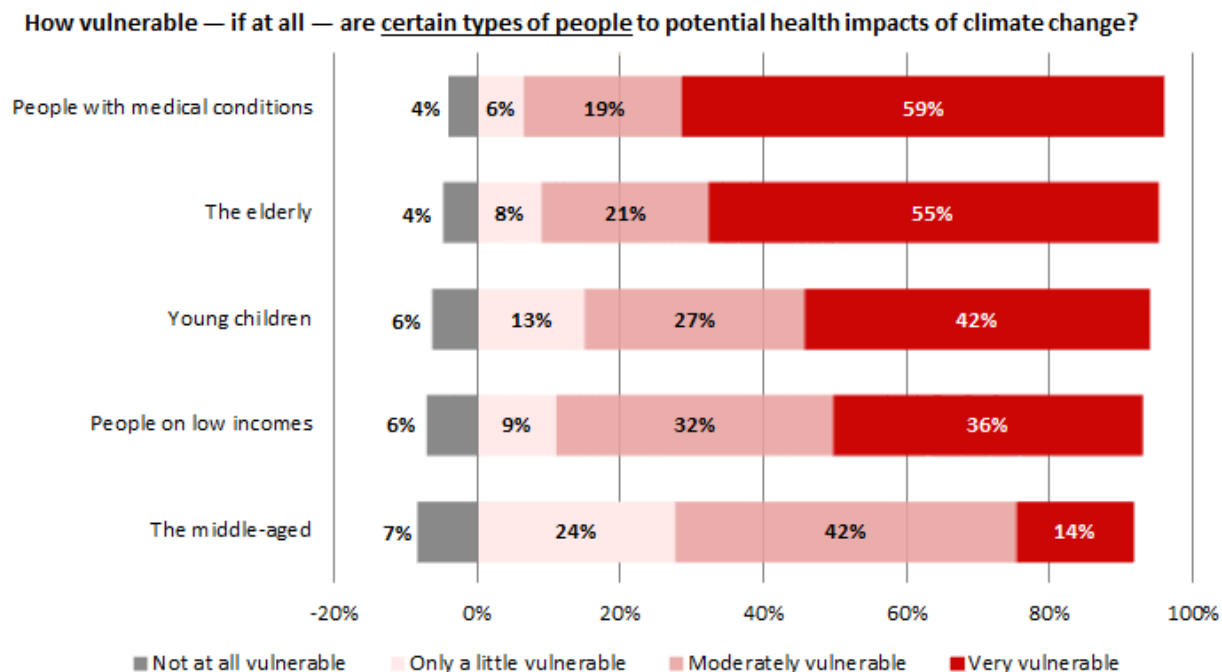
Figure 3 | Climate change is perceived most strongly as a threat to future generations

How much do you think climate change will harm ... ?



⁷ Luber, G., Knowlton, K., Balbus, J., Frumkin, H., Hayden, M., Hess, J., McGeehin, M., Sheats, N., Backer, L., Beard, C. B., Ebi, K. L., Maibach, E., Ostfeld, R. S., Wiedinmyer, C., Zielinski-Gutiérrez, E., & Ziska, L. (2014). *Ch. 9: Human health. Climate change impacts in the United States: The third National Climate Assessment*. U.S. Global Change Research Program, p. 220-256.

Figure 4 | Young children and people on low incomes are less frequently identified as at high risk



Unweighted base, n=2,035

People who are vulnerable due to medical conditions are more likely to understand the risk

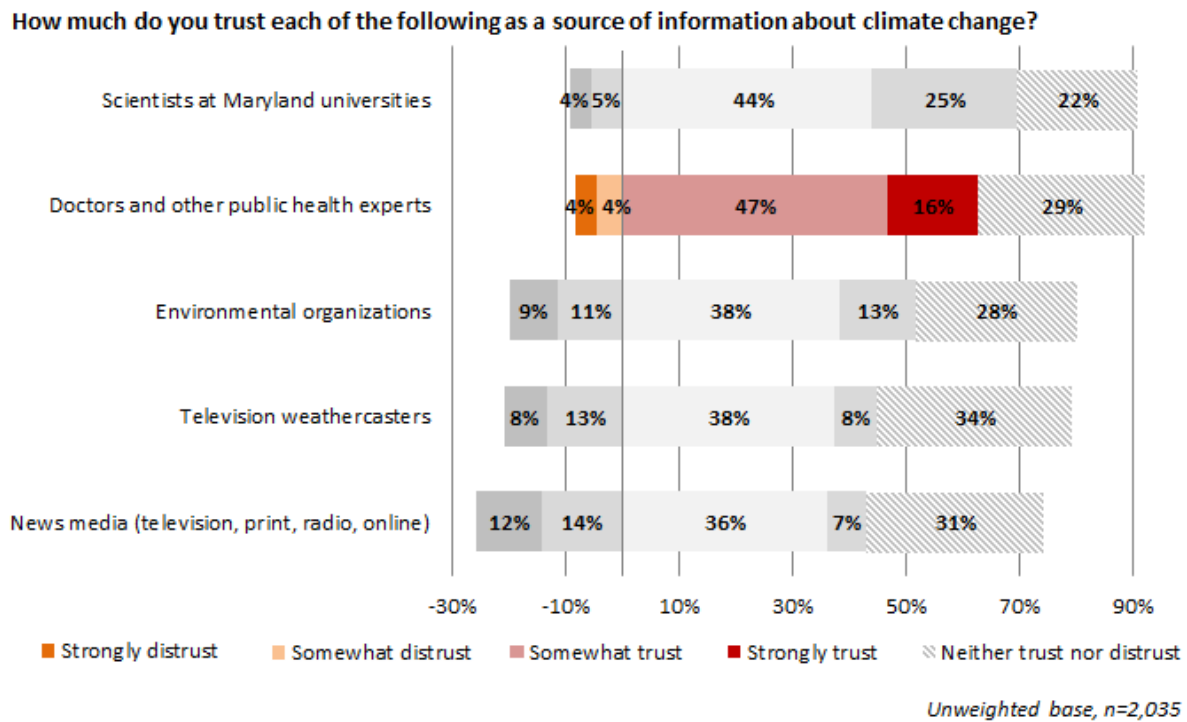
Marylanders who say that they—or members of their household—have not been diagnosed with one or more of five types of medical conditions are less likely to understand that people with medical conditions are more vulnerable to health threats from climate change (see Appendices, Correlation Table 1, p. 18-19).⁸ Indeed, each of the five medical conditions—coronary heart disease, obesity, diabetes, respiratory illness (asthma), a physical or mental disability—are correlated at the personal and/or household level with increased understanding that people with medical conditions are more vulnerable to climate change. The correlations between self-reported diagnoses and recognizing that medical conditions make people more vulnerable to climate change suggest that people who are vulnerable are more likely to realize it, though the effect size is relatively small.

⁸ No personal medical conditions, Pearson’s correlation, $r = -.109$, $p < .001$; no household medical conditions, $r = -.107$, $p < .001$. For an explanation of correlation, see p. 21.

2. Doctors and public health experts are trusted sources of information on climate change

Among the 11 groups of professionals and organizations assessed in this survey as sources of information about climate change, medical authorities are among the most trusted. Marylanders trust doctors and public health experts as sources of information about climate change only slightly less strongly than scientists at Maryland universities (63% vs. 70%) (see Figure 5). Few residents in the state say that they distrust doctors and public health experts on climate change (8%) or Maryland’s scientists (9%). While environmental organizations, weathercasters and news media are also among the top five most trusted sources of information on climate change, more Marylanders say that they distrust them—about one-fifth to a quarter of the state.

Figure 5 | Marylanders trust doctors and public health experts on climate change



3. Perceived risks from chemicals and pollution have grown

More than half of Marylanders (55%) say that exposure to chemicals, including pesticides, in food and other products is a major risk to their health (see Figure 6). This represents a sizeable shift upward—23 percentage points—since spring 2013. In 2013, obesity was considered the largest personal health risk among Marylanders (major risk, 37%). This year, obesity dropped to fifth after exposure to chemicals in food and products, polluted drinking water (52%), air pollution (47%) and second-hand smoke (41%). Public perceptions of obesity changed little over the past year (major risk, 39%), but beliefs about the personal health risks posed by polluted drinking water, air pollution and second-hand smoke considerably increased with gains of 19, 16, and 12 percentage points respectively.

Climate change ranked eighth as a “major” personal health risk that concerns Marylanders. Sixty-three percent of Marylanders cited climate change as a moderate or major risk to their personal health—an increase of 11 percentage points from spring 2013 (see Figure 7). Almost a quarter—23%—say that it is a major risk to their health, on par with violent storms (23%).

Health risks from flooding and climate change are perceived differently across regions

Marylanders across the state’s four regions generally make similar judgments about personal health risks. Exposure to chemicals in food and other products, and air pollution, are consistently ranked the top moderate or major health risks in all four regions (Western, 82%/74% respectively; Central, 85%/86%; Southern, 81%/81%; Eastern, 80%/75%) (see Appendices, Table 9, p. 33). However, there are differences. Flooding is perceived as less of a concern in the mountainous Western region and more of a concern on the low-lying Eastern Shore (Western, 37%; Central, 51%; Southern, 52%; Eastern, 60%). Climate change is most likely to be listed as a moderate or major personal health risk by those in the urban Central region of the state (67%), where it is ranked 6th of 11 risks, and least likely in the Eastern region (49%), where it is ranked lowest (Southern, 59%, ranked 8th; Western, 52%, ranked 10th).

Many experienced loss of electricity and wind- or storm-related damage in the past year

More than three-quarters of Marylanders (76%) say that they have experienced power outages at least once or more in the last 12 months with almost another two-fifths (39%) saying that they have had wind- or storm-related damage over the same period (see Figure 8). Power outages were reported by large majorities regardless of geographic location (Western, 83%; Central, 74%; Southern, 79%; Eastern, 72%) (see Appendices, Table 10, p. 37). Wind and storm damage afflicted between 37% and 45% of residents across each region of the state (Western, 42%; Central, 38%; Southern, 37%; Eastern, 45%). Other types of storm-related experiences are reported less frequently: 19% lost drinking water, and 9% suffered flood damage. Self-reported flood damages for the previous 12 months overall are low across most of the state, but show a

Figure 6 | Marylanders became more concerned about health risks in the past year

Below is a list of potential risks to people's health. How much of a risk do you feel each of the following poses to your health?

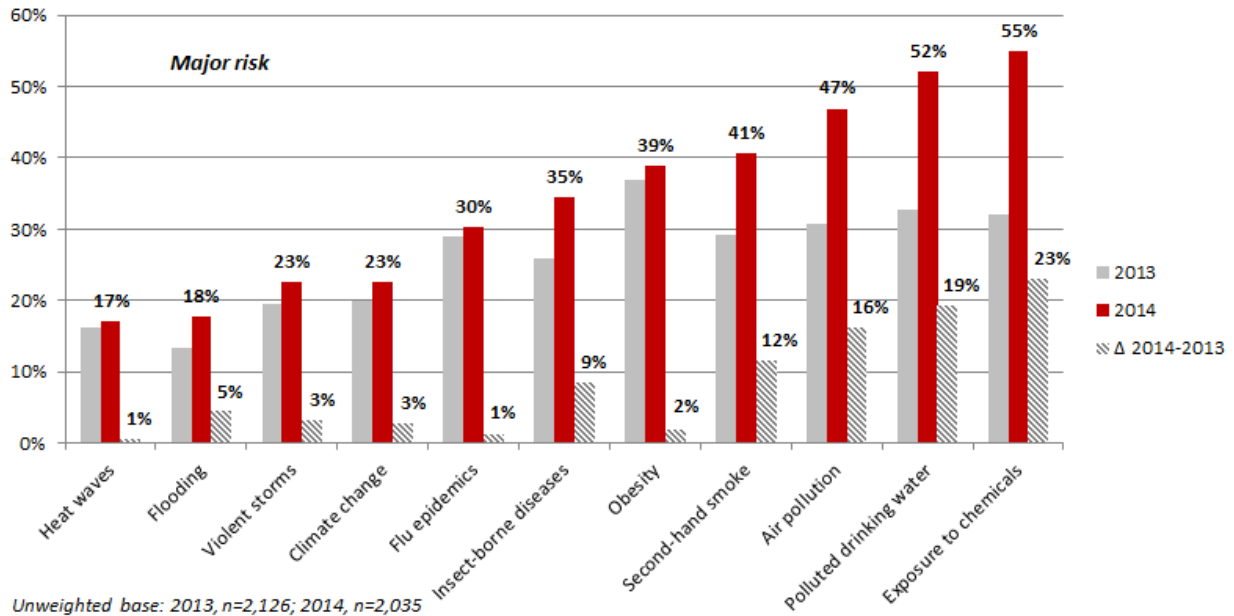
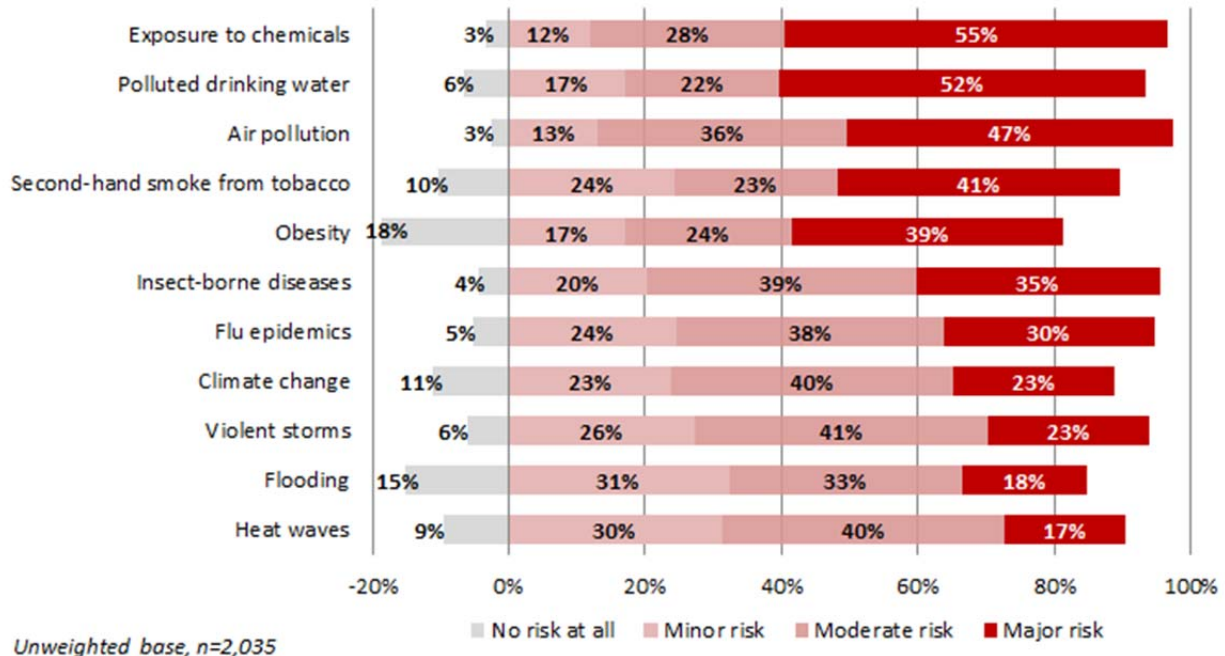


Figure 7 | Chemicals, polluted water and air pollution are perceived as major health threats

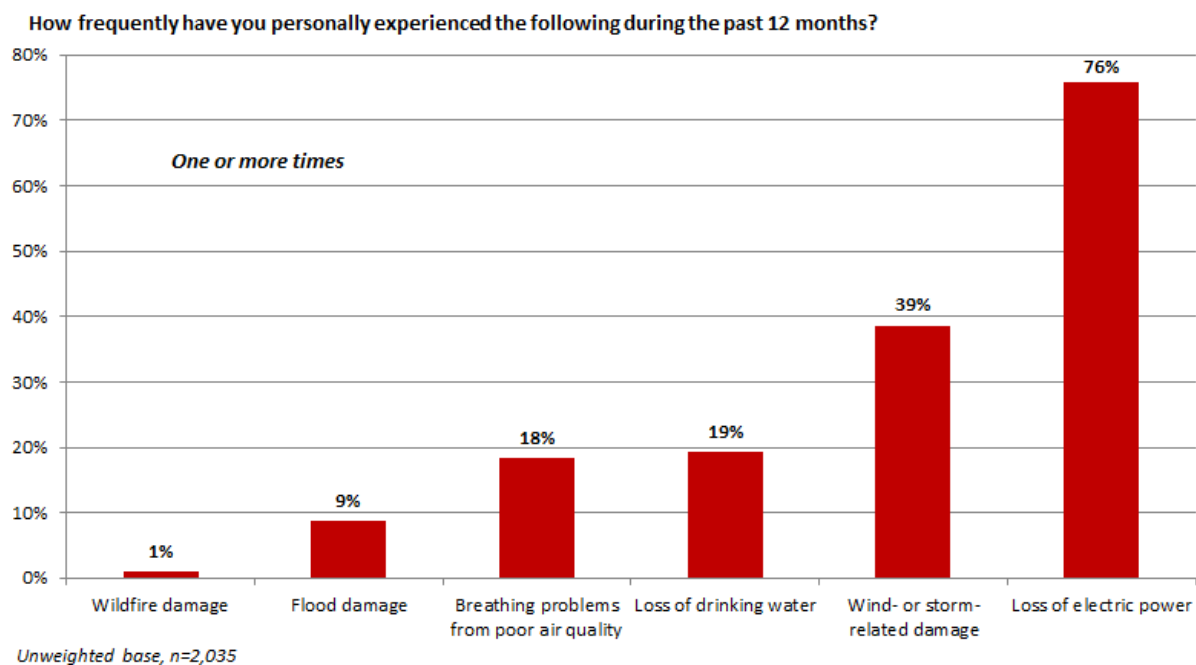
Below is a list of potential risks to people's health. How much of a risk do you feel each of the following poses to your health?



similar pattern as the regional perceptions of flood risks reported above with 18% of residents from the low-lying Eastern Shore reporting damages, but just 5% of the Western region (Central, 9%; Southern, 9%). Very few Marylanders say that they have experienced wildfire damage (1%).

Personally experiencing harm or loss can influence the way in which people weigh future risks, and motivate them to take protective actions.⁹ Having experienced difficulty breathing due to air pollution during the 12 months prior to the survey is associated with perceiving 11 potential health threats—from second-hand smoke to flu epidemics, obesity, and climate change—as more significant personal risks,¹⁰ and is most strongly correlated with believing oneself to be at risk from air pollution and heat waves,¹¹ although the correlations are relatively weak (see Appendices, Correlation Table 2, p. 18-19). Incidents of recent flood damage are also associated—though not strongly—with higher risk perceptions regarding seven types of health threats, but particularly flooding.¹² Believing oneself to be being personally at risk from the health impacts of climate change is also weakly correlated with previous experiences of flood and wind- or storm-related damage.

Figure 8 | Large majority of Marylanders experienced electric power disruption in the past year



⁹ Whitmarsh, L. (2008). Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *Journal of Risk Research*, 11(3), 351–374.

¹⁰ Pearson’s correlation, $r=.147$, $p<.001$. For an explanation of correlation, see p. 21.

¹¹ Air pollution, $r=.220$, $p<.001$; heat waves, $r=.195$, $p<.001$

¹² $r=.154$, $p<.001$

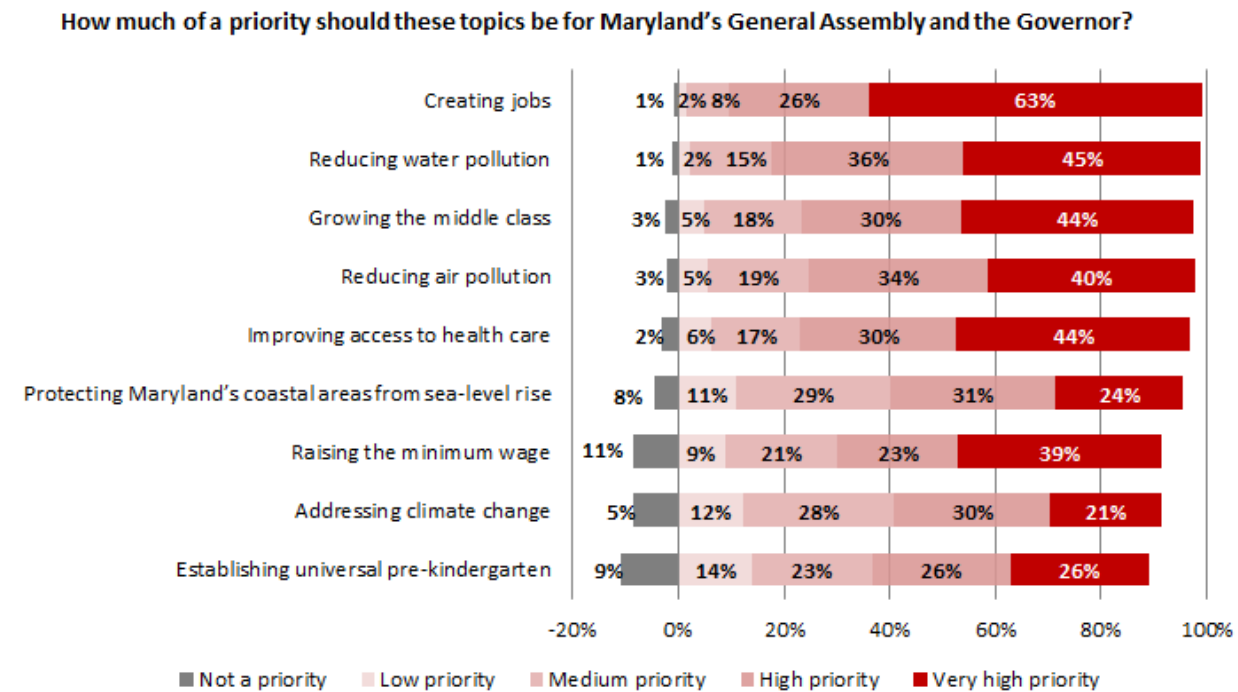
4. Environmental health and health care access are ranked among top state priorities

Maryland residents rank health care access and environmental health along with jobs and growing the middle class at the top of their list for state policymakers to address.

Three-quarters of Marylanders (74%) say that improving access to health care should be a high or very high priority, about the same percentage as growing the middle class and reducing air pollution. These three priorities fall just after creating jobs (89%) and reducing water pollution (81%) (see Figure 9). The Central and Southern regions of the state—the corridor stretching from Cecil County to the Washington, D.C. suburbs and St. Mary’s County—are most likely to cite access to health care as a high or very high priority issue (Western region, 59%; Central, 75%; Southern, 79%; Eastern, 58%) (see Appendices, Table 11, p. 38).

Reducing environmental threats such as water pollution (81%), air pollution (73%), and climate change (51%) also provides direct public health benefits. Climate change ranks toward the bottom of the list of nine issues that Marylanders were asked to prioritize, but even so, half of the state (51%) describes it as a high or very high priority for policymakers.

Figure 9 | Health concerns are among top priorities for the General Assembly and Governor



5. Coal, oil, and nuclear power are seen as harmful to health

A majority of Marylanders say that the fossil fuels coal and oil, and nuclear power, are somewhat or very harmful to people's health. Almost three-quarters of Marylanders (72%) say that coal is somewhat or very harmful, followed by oil (64%) and nuclear power (58%) (see Figure 10). Over the past year, the number of people who say that coal is "very harmful" to health increased by 10 percentage points to 41%. Oil and natural gas extracted from hydraulic fracturing also became more strongly viewed as a health hazard in the last year with increases of six percentage points of those who say they are very harmful (respectively, 26% and 23%). Of note, substantial percentages of Marylanders—14% to 39%—report that they do not know whether or not each of 10 named sources of electrical energy in the survey are potentially harmful to people's health. Wood fuel or switchgrass are the least-well known by the public; 39% don't know whether they are harmful or not to health.

Coal and nuclear are ranked as "very harmful" sources of energy by approximately one-third of residents in three of the state's regions, and there are generally only slight regional differences (Western, nuclear/35%, coal/32%; Southern, coal/39%, nuclear/33%; Eastern, 38%/nuclear, 33%/coal) (see Appendices, Table 12, p. 40). In the Central region of the state, however, there is a 16 percentage point difference between those who say that coal is very harmful to health (45%) and those who say nuclear is (29%). More than a quarter (26%) of Central Maryland's residents also say that they don't know what the health implications of nuclear power are. This compares to 19% in Western and Eastern Maryland, and 17% in the Southern region. Calvert Cliffs, the state's only nuclear power plant, is located 40 miles south of Annapolis in the Southern region.

Marylanders say solar and wind are not at all harmful to health

Renewable energy sources such as wind and solar continue to be viewed as non-harmful to people's health. Large majorities say solar (65%) and wind (land-based, 58%; offshore, 57%) are not at all harmful. In 2014, there was an increase of five percentage points—up to 65% from 60% the previous year—in those people who say that solar has no negative effects on health (see Figure 11).

Figure 10 | Coal, oil and nuclear power are perceived as harmful to health

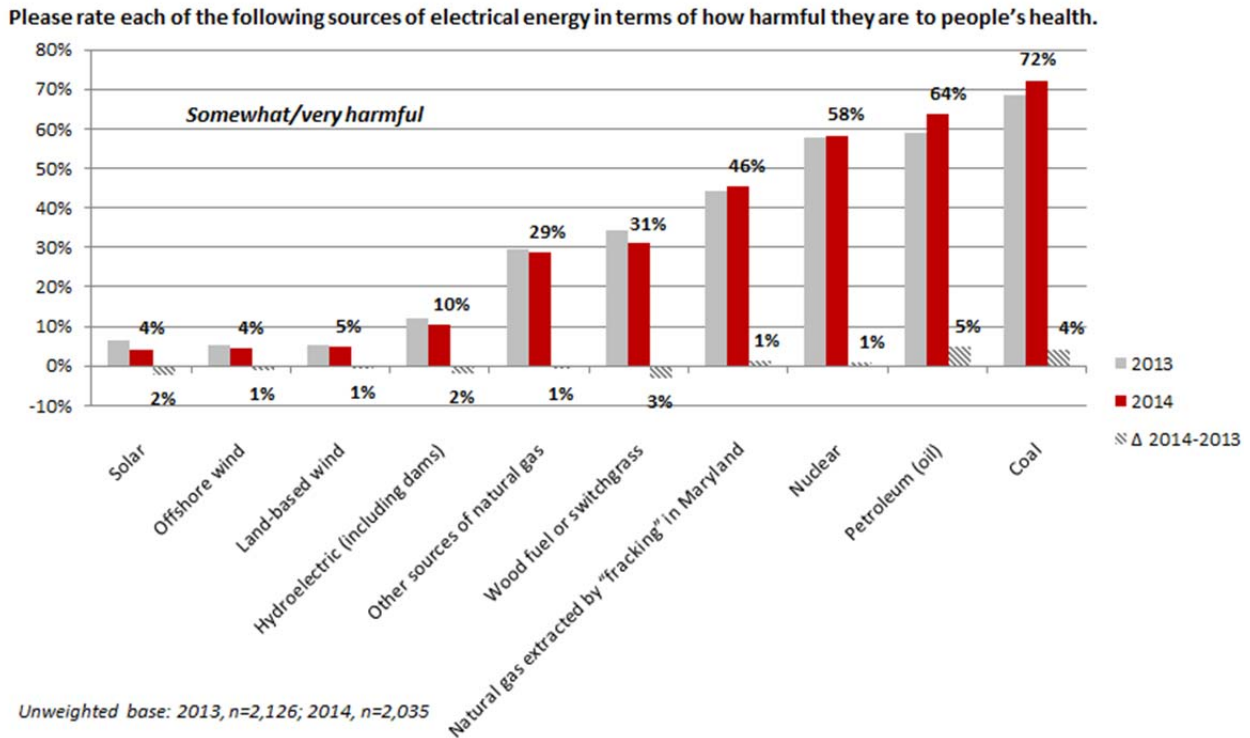
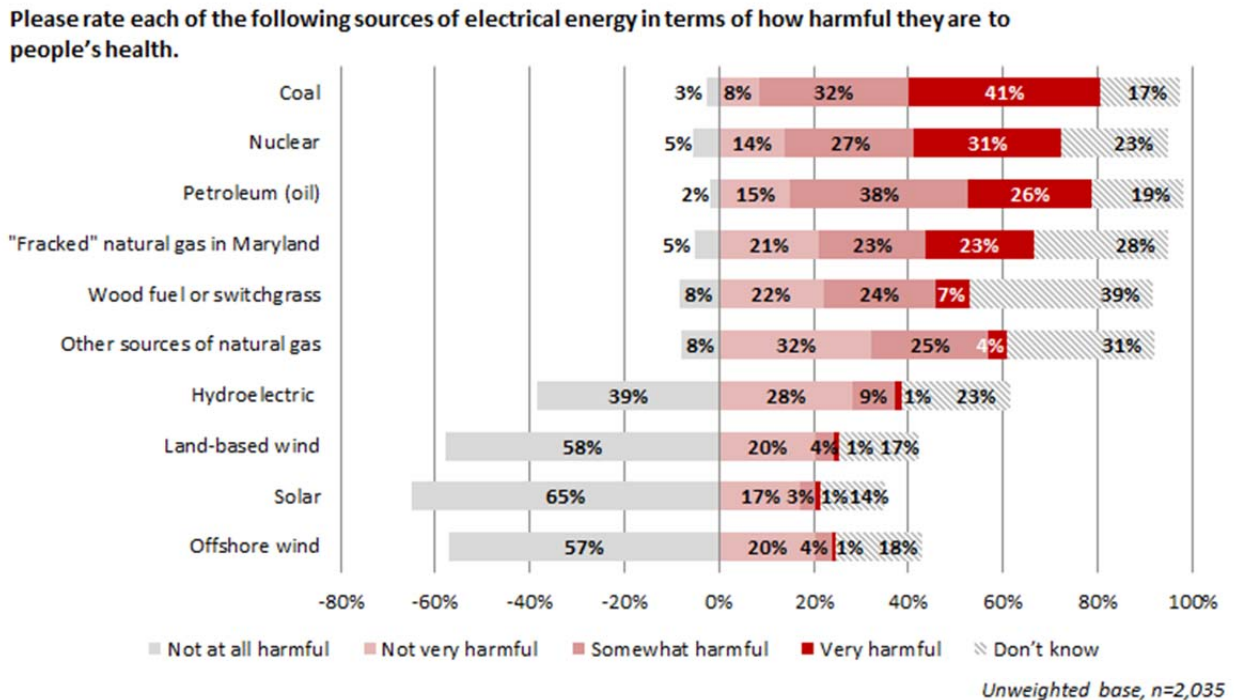


Figure 11 | Majorities say wind and solar are not harmful to public health



6. Study methodology

This study was conducted by George Mason University's Center for Climate Change Communication to explore Marylanders' views on public health, energy and the environment. The survey instrument was developed at George Mason University, partially based on questions used in the Climate Change in the American Mind national surveys run by the Yale Project on Climate Change Communication (<http://environment.yale.edu/climate-communication/>) and George Mason's Center for Climate Change Communication (<http://climatechangecommunication.org/>). The mail survey consisted of 50 questions and took approximately 20 minutes to complete.

For reporting purposes, the data has been broken into four separate documents. Three additional reports focus on Marylanders' climate change attitudes, behaviors and policy preferences regarding sea-level rise and adaptation, energy, and climate.¹³ The unweighted sample margin of error is +/- 2 percentage points at the 95% confidence interval for the state and less than +/- 5 percentage points for each region (see Table 1).

Sampling design; fielding

The survey was mailed to 6,401 households in the state of Maryland, randomly selected from within each of four regions of the state from Survey Sampling International household address databases, based primarily on U.S. Postal Service delivery route information. We sampled at the regional level to ensure the final data was generalizable to these distinctly different geographic and cultural areas of the state, as well as the state as a whole. The sample size for the Central region of the state was higher relative to the other three regions because it accounts for more than half of the state's population (see Table 1). Households that responded to the survey in 2013 were not re-contacted in 2014.

The survey was fielded from March 17 to June 10, 2014. Each household was sent up to four mailings: an announcement letter introducing the survey (March 17), a copy of the survey with a \$2 bill thank you (March 24), a reminder postcard (April 7), and a follow-up survey (April 22). (As a point of comparison, the 2013 survey was fielded from March 28 to June 4. Methodology for the 2013 survey is available within those reports at climatemaryland.org.) In order to achieve randomization of respondents within each household, we requested that the person with the most recent birthday complete the survey. Households that completed and returned the survey were taken off of subsequent mailing lists.

¹³ See the reports at <http://www.climatemaryland.org/survey/>

Weighting

The data tables report percentages for the state and each region. State data were weighted for regional representation, gender, age, and education level based on 3-year American Community Survey data from the U.S. Census Bureau, following the same procedure as in 2013. Each region's data were also weighted for the same demographic variables. Base unweighted sample sizes for each question are reported in addition to the weighted percentages.

Respondents who did not provide regional, gender, age or education level data were dropped from the data set. This lowered the number of respondents by 201 cases. (The overall response rate for the study before those cases were dropped was 38%.) Please see the demographics section of the appendix for more information on the characteristics of the survey sample pre- and post-weighting.

Institutional Review Board

The study was reviewed by the Institutional Review Board for George Mason University (Protocol #8508).

Table 1 | *Regional samples, response rates and margin of error*

Region	Counties	Initial sample	Refusals	Undeliverable addresses	Number of respondents*	Response rate	Margin of error
Western	Allegany, Frederick, Garrett, Washington	1,467	14	107	495	36%	+/- 4.40 % points
Central	Baltimore, Carroll, Cecil, Harford, Howard, Montgomery, Baltimore City	2,000	16	130	629	33%	+/- 3.91 % points
Southern	Anne Arundel, Calvert, Charles, Prince George's, St. Mary's	1,467	11	85	435	31%	+/- 4.70 % points
Eastern	Caroline, Dorchester, Kent, Queen Anne's, Somerset, Talbot, Wicomico, Worcester	1,467	18	190	476	37%	+/- 4.49 % points
State	All counties	6,401	70	512	2,035	35%	+/- 2.2 % points

Investigators:

Karen Akerlof, PhD

Edward W. Maibach, MPH, PhD

George Mason University

Center for Climate Change Communication

4400 University Dr., MS 6A8

Fairfax, VA 22030

kakerlof@gmu.edu, (703) 993-6667

emaibach@gmu.edu, (703) 993-1587

This survey was funded by the Town Creek Foundation of Easton, MD. We thank the Town Creek Foundation and its Executive Director Stuart Clarke for their support.

The project benefitted from the expertise and hard work of many individuals. Members of the Climate Communication Consortium of Maryland (climatemaryland.org) assisted in the development of the survey. Ken Adams and Charles Coats provided invaluable help in coordinating its fielding. They—with additional assistance provided by Mason undergraduate and graduate students Aiya Al-Beyati, Refka Al-Beyati, Natasha S. Taliferro, Rebecca Lloyd, Deanna Kirby, Stacy Nelson, Roxana Kazemi, Claudia Harris, Kelly Hayden, Patrick Greenwalt, Brittany Grutter, Andy Sachs, Vera Solovyeva, Dhara Patel, Elloise L. Lotoc, Danielle Kirby, Suzanne Hewitt, Aileen S. Dierig and Sean Kelley— assembled the mailings over a series of long weekends. Paul Weiss from Emory University provided statistical support for the weights. Any errors are those of the authors.

Credits, cover photo:

Photo of a child with asthma using a nebulizer. Longer periods of high temperatures, such as anticipated with climate change, can result in increases in air pollution associated with asthma. Photo from istockphoto.com from Maryland Department of the Environment at climatechange.maryland.gov.

Suggested citation:

Akerlof, K., & Maibach, E. W. (2015). Public health, energy & climate change: A survey of Maryland residents, 2014. Fairfax, VA: Center for Climate Change Communication, George Mason University.

Table of Contents

Executive Summary.....	1
1. Most Marylanders say climate change harms human health	3
Breathing problems are seen as the most likely harm to health; infectious disease less so	3
Marylanders say other people than themselves and future generations are more vulnerable	4
People with medical conditions and the elderly are seen as vulnerable	5
People who are vulnerable due to medical conditions are more likely to understand the risk	6
2. Doctors and public health experts are trusted sources of information on climate change.....	7
3. The perceived risks to health from chemicals and pollution have grown.....	8
Health risks from climate change and flooding are perceived differently across regions.....	8
Many experienced loss of electricity and wind- or storm-related damage in the past year	8
4. Environmental health and health care access are ranked among top state priorities	11
5. Coal, oil, and nuclear power are seen as harmful to health.....	12
Residents say solar and wind are not at all harmful to health	12
6. Study methodology.....	14
Appendices.....	17
Correlation tables	18
Data tables	20
Sample demographics.....	44

Executive Summary

In 2013, George Mason University fielded the first survey of climate change, energy and public health in the state. We repeated some of the questions and added new measures in 2014. This report, focused on public health and climate change, is the last of four released from the 2014 data. Other reports highlight attitudes, behaviors, and policy preferences on sea-level rise and adaptation, energy, and climate change generally.¹ Below we highlight new findings regarding climate change and public health, and some of the most important changes that we found in the state over the past year.

Most Marylanders understand that climate change harms human health

- More than half of Marylanders (55%) say that they expect that people's health in their communities will be affected by climate change in the next several years.
- State residents say breathing and respiratory problems (72%), injuries from extreme weather (61%), and heat stroke (55%) are likely to become more common in the state due to climate change.
- Infectious disease is less likely to be cited as an increasing risk to health due to climate change. Less than half of state residents (42%) say that it will become more common, even though climate change is projected to affect the spread of disease.

Doctors and public health experts are trusted sources of climate change information

- Medical authorities are among the professionals trusted the most for information on climate change. Marylanders trust doctors and public health experts on climate change only slightly less strongly than scientists at Maryland universities (63% vs. 70%).

More Marylanders perceive chemicals and pollution as a risk to health

- More than half of Marylanders (55%) say that exposure to chemicals, including pesticides, in food and other products is a major risk to their personal health. This represents a sizeable shift—up 23 percentage points—since spring 2013.
- Polluted drinking water (52%), air pollution (47%) and second-hand smoke (41%) also showed considerable increases in public perceptions as major risks with 19, 16, and 12 percentage-point gains respectively.
- Sixty-three percent of Marylanders cite climate change as a moderate or major risk to their personal health—an increase of 11 percentage points from spring 2013.

Environmental health and health care access are among Marylanders' top policy priorities

- Three-quarters of Marylanders (74%) say that improving access to health care should be a high or very high priority for the state's General Assembly and governor.

¹ See the reports at <http://www.climatemaryland.org/survey/>

- Health care access ranks after creating jobs (89%) and reducing water pollution (81%) in Marylanders' priorities, and is about the same percentage as growing the middle class and reducing air pollution.

Fossil fuels and nuclear power are seen as harmful to health; solar and wind are not

- Almost three-quarters of Marylanders (72%) say that coal is somewhat or very harmful to people's health. Oil (64%) and nuclear power (58%) also raise health concerns.
- Over the past year, the number of people who say that coal is "very harmful" to health increased by 10 percentage points to 41%.
- Renewable energy sources such as wind and solar continue to be viewed by majorities as non-harmful (solar, 65%; offshore wind, 57%; land-based wind, 58%). In 2014, there was an increase of five percentage points in those people who say that solar has no negative effects on health.

Study methodology

The survey was mailed to 6,401 households in the state of Maryland, randomly selected from within each of four regions of the state.² We sampled at the regional level to ensure the final data was generalizable to these distinctly different geographic and cultural areas as well as to the state as a whole, weighting the data at both the state and regional levels in accordance with U.S. Census population distributions. Households that responded to the survey in 2013 were not re-contacted in 2014. The survey was fielded from March 17 to June 10, 2014 with a response rate of 35%. The unweighted sample margin of error is +/- 2 percentage points at the 95% confidence interval for the state and less than +/- 5 percentage points for each region. (See study methodology, page 14). This report includes survey data from 2013 as a basis for comparison; statistical comparisons between years were assessed for significance. Survey reports from 2013 can be found at climatemaryland.org and include a description of the sample and methodology. Both were consistent across years.

² **Western Region** – Allegany, Frederick, Garrett and Washington counties; **Central Region** – Baltimore, Carroll, Cecil, Harford, Howard, Montgomery counties and Baltimore City; **Southern Region** – Anne Arundel, Calvert, Charles, Prince George's and St. Mary's counties; **Eastern Region** – Caroline, Dorchester, Kent, Queen Anne's, Somerset, Talbot, Wicomico and Worcester counties.

1. Most Marylanders say climate change harms human health

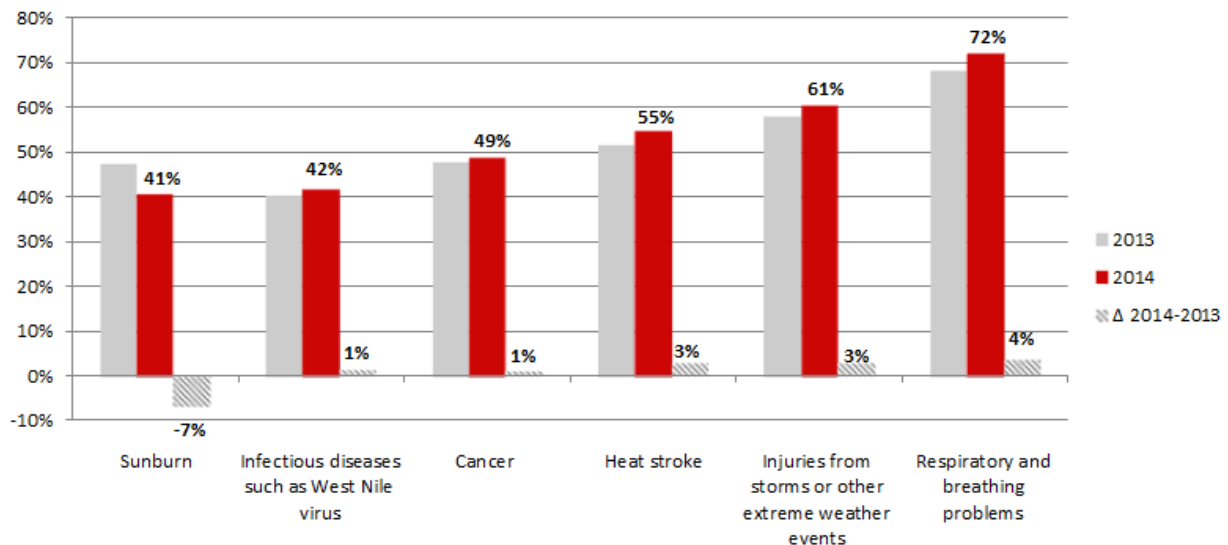
More than half of Marylanders (55%) say that they expect that people’s health in their communities will be affected by climate change in the next several years (see Appendices, Table 1, p. 21). Indeed, many state residents continued in 2014 to see breathing and respiratory problems (72%), injuries from extreme weather (61%), and heat stroke (55%) as likely to become more common in the state due to climate change (see Figure 1). In 2013, they were significantly less likely, however, to think that sunburns would be a consequence, down by seven percentage points to 41%. Climate change has long been confused with ozone depletion,³ which increases the amount of ultraviolet light passing through the atmosphere and the risk of sunburn and skin cancers. (Recently, some studies have suggested that climate change actually might affect UV exposure and related cancers.⁴)

Breathing problems are seen as the most likely harm to health; infectious disease less so

On average, 72% of Marylanders say that breathing and respiratory problems will increase with climate change, but those who live in the Southern region of the state, stretching from Anne Arundel to St. Mary’s counties, are 10 percentage points more likely to say so than the more

Figure 1 | Heat stroke, injuries and breathing problems are expected to increase

Which — if any — of the following health problems will become more common in Maryland in the future because of climate change? (Please check ALL THAT APPLY)



Unweighted base: 2013, n=2,126; 2014, n=2,035

³ Read, D., Bostrom, A., Morgan, M. G., Fischhoff, B., & Smuts, T. (1994). What Do People Know About Global Climate Change? 2. Survey Studies of Educated Laypeople. *Risk Analysis*, 14(6), 971–982.

⁴ Hui, Y., Thong, H.-Y., & Maibach, H. I. (2011). Global warming and its dermatologic impact. *Expert Review of Dermatology*, 6(5), 521–523.

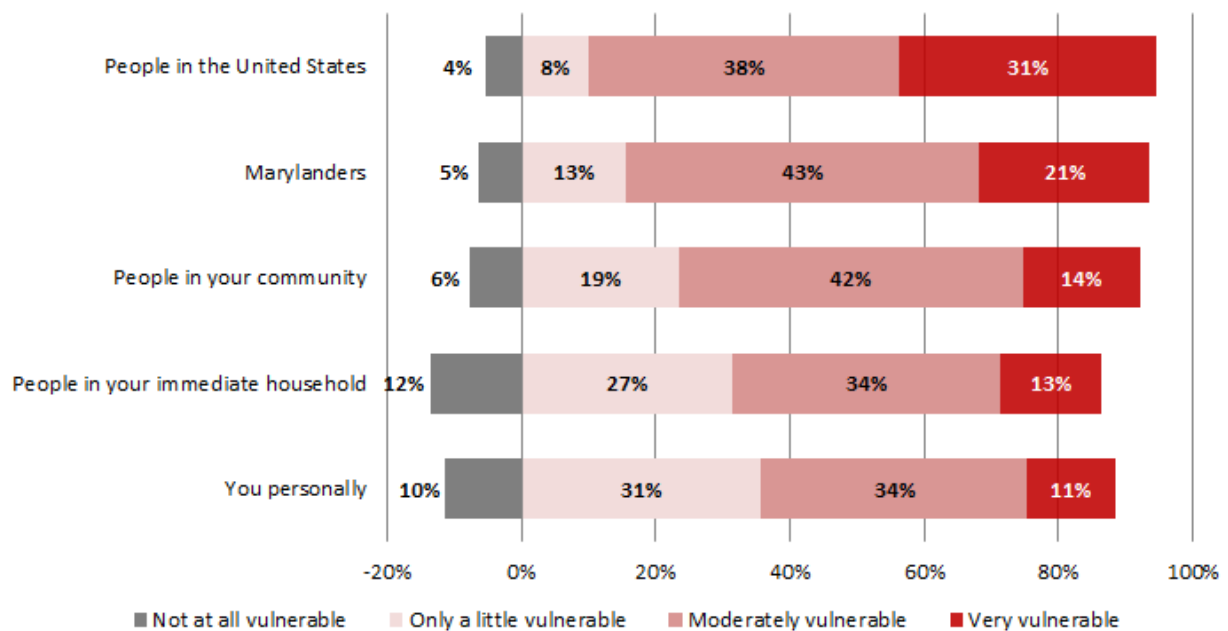
rural Eastern and Western portions of the state (Southern, 76%; Western, 66%; Central, 71%; Eastern, 66%) (see Appendices, Table 2, p. 23). Infectious disease is less likely to be thought of as a health effect from climate change (42%), with little variation from survey respondents across the state’s regions (Western, 40%; Central, 41%; Southern, 44%; Eastern, 43%), even though climate change is projected to affect the spread of disease.⁵

Marylanders say other people than themselves and future generations are more vulnerable

Research has shown that people tend to see climate change as something that happens to people in places far away from them.⁶ In this survey we asked respondents who they believe are most vulnerable to potential health impacts from climate change—themselves, people in their households, people in their communities, Marylanders, or people in the United States—and the degree to which they will be harmed. Consistent with prior research, Marylanders are more likely to say that people in the U.S. generally are “very vulnerable” (31%) or even people in Maryland (21%), than they themselves (11%) or those in their households (13%) (see Figure 2). Of note, few people say that they or people in their household are not at all vulnerable to health threats from climate change (10% and 12% respectively).

Figure 2 | People in the U.S. are seen as more vulnerable than those people close to home

How vulnerable — if at all — are the following people to potential health impacts of climate change?



Unweighted base, n=2,035

⁵ Luber, G., Knowlton, K., Balbus, J., Frumkin, H., Hayden, M., Hess, J., McGeehin, M., Sheats, N., Backer, L., Beard, C. B., Ebi, K. L., Maibach, E., Ostfeld, R. S., Wiedinmyer, C., Zielinski-Gutiérrez, E., & Ziska, L. (2014). *Ch. 9: Human health. Climate change impacts in the United States: The third National Climate Assessment*. U.S. Global Change Research Program, p. 220-256.

⁶ Leiserowitz, A. (2005). American Risk Perceptions: Is Climate Change Dangerous? *Risk Analysis*, 25(6), 1433-1442.

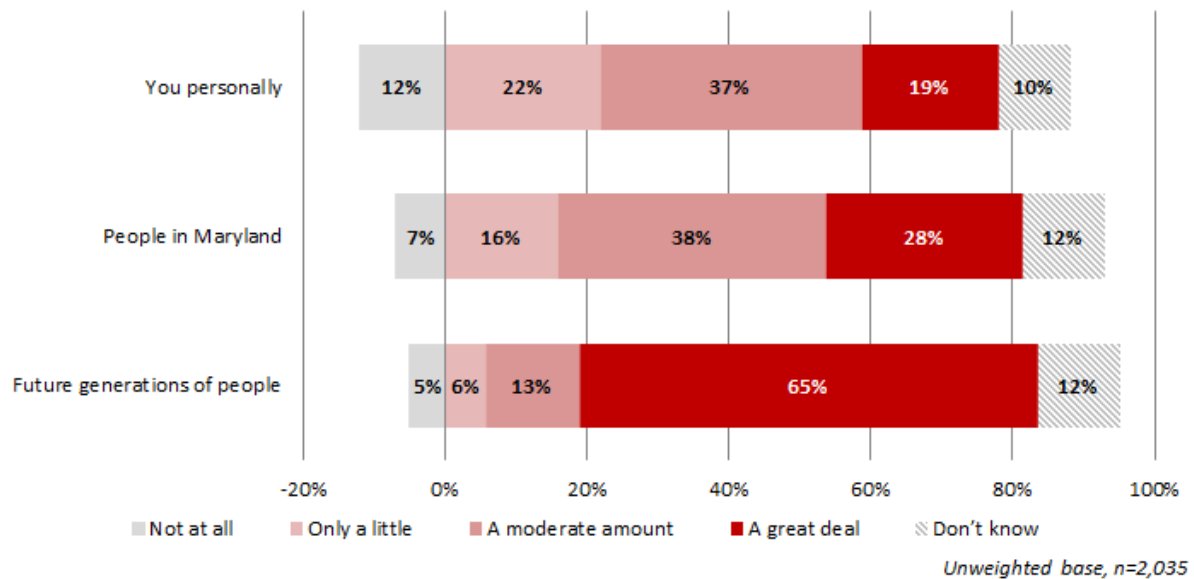
Most Marylanders (65%) believe that future generations of people will be harmed “a great deal,” while only small minorities feel that people in Maryland (28%) or they themselves (19%) will be harmed to the same extent. Conversely, few Marylanders say that they (12%), other Marylanders (7%) and future generations of people (5%) will not be harmed at all by climate change (see Figure 3).

People with medical conditions and the elderly are seen as vulnerable

A majority of Marylanders say that people with medical conditions (59%) and the elderly (55%) are very vulnerable to the potential health impacts of climate change (see Figure 4). They are less likely to identify young children and people on low incomes as very vulnerable (42% and 36%, respectively). In reality, as noted in the key messages of the human health chapter of the National Climate Assessment, “(c)ertain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color.”⁷ Middle-aged individuals are not considered a particularly vulnerable group unless they have other characteristics that put them at risk, such as a medical condition or low income.

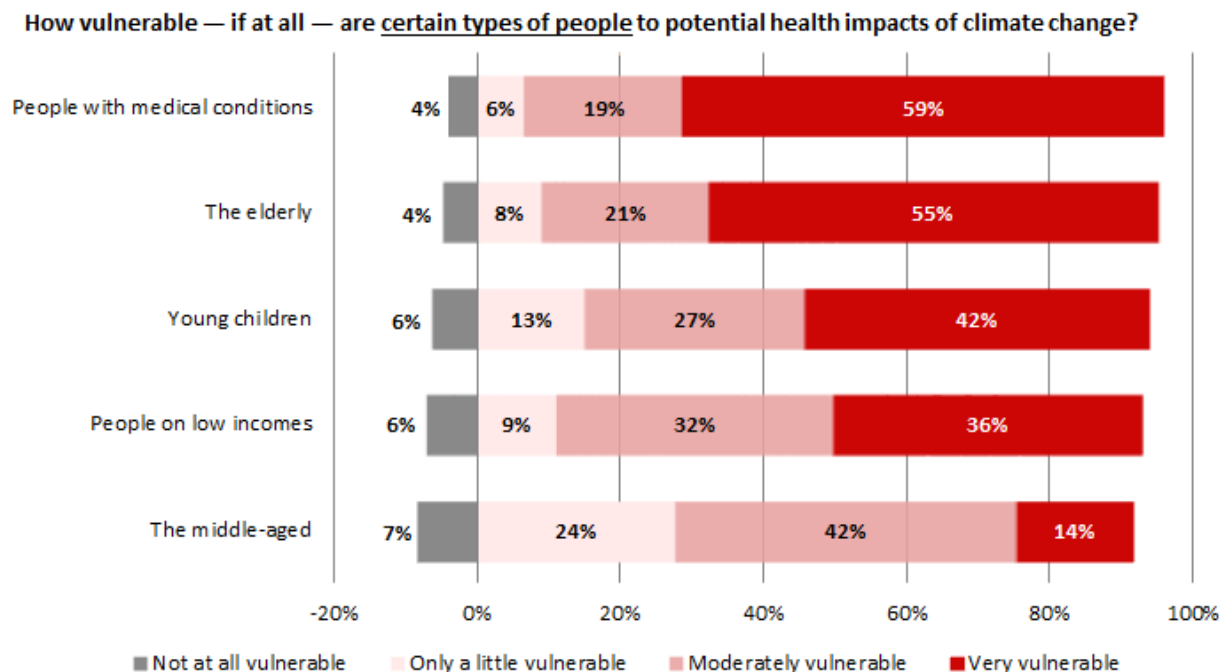
Figure 3 | Climate change is perceived most strongly as a threat to future generations

How much do you think climate change will harm ... ?



⁷ Luber, G., Knowlton, K., Balbus, J., Frumkin, H., Hayden, M., Hess, J., McGeehin, M., Sheats, N., Backer, L., Beard, C. B., Ebi, K. L., Maibach, E., Ostfeld, R. S., Wiedinmyer, C., Zielinski-Gutiérrez, E., & Ziska, L. (2014). *Ch. 9: Human health. Climate change impacts in the United States: The third National Climate Assessment*. U.S. Global Change Research Program, p. 220-256.

Figure 4 | Young children and people on low incomes are less frequently identified as at high risk



Unweighted base, n=2,035

People who are vulnerable due to medical conditions are more likely to understand the risk

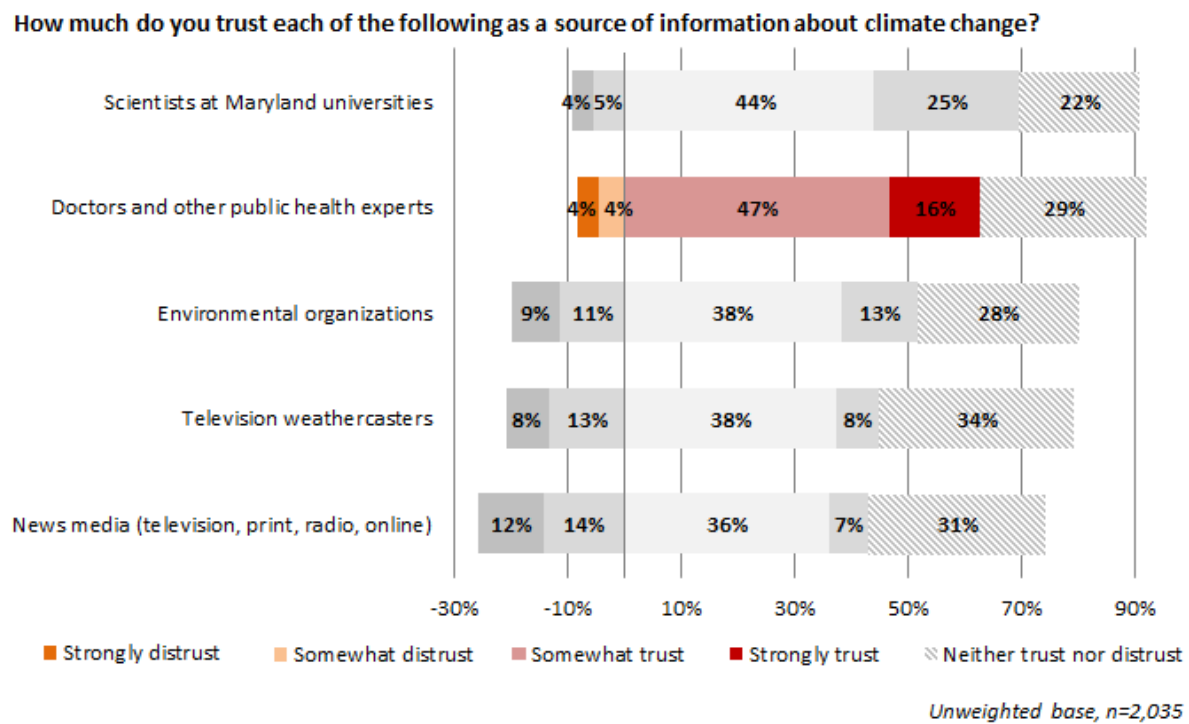
Marylanders who say that they—or members of their household—have not been diagnosed with one or more of five types of medical conditions are less likely to understand that people with medical conditions are more vulnerable to health threats from climate change (see Appendices, Correlation Table 1, p. 18-19).⁸ Indeed, each of the five medical conditions—coronary heart disease, obesity, diabetes, respiratory illness (asthma), a physical or mental disability—are correlated at the personal and/or household level with increased understanding that people with medical conditions are more vulnerable to climate change. The correlations between self-reported diagnoses and recognizing that medical conditions make people more vulnerable to climate change suggest that people who are vulnerable are more likely to realize it, though the effect size is relatively small.

⁸ No personal medical conditions, Pearson’s correlation, $r = -.109$, $p < .001$; no household medical conditions, $r = -.107$, $p < .001$. For an explanation of correlation, see p. 21.

2. Doctors and public health experts are trusted sources of information on climate change

Among the 11 groups of professionals and organizations assessed in this survey as sources of information about climate change, medical authorities are among the most trusted. Marylanders trust doctors and public health experts as sources of information about climate change only slightly less strongly than scientists at Maryland universities (63% vs. 70%) (see Figure 5). Few residents in the state say that they distrust doctors and public health experts on climate change (8%) or Maryland’s scientists (9%). While environmental organizations, weathercasters and news media are also among the top five most trusted sources of information on climate change, more Marylanders say that they distrust them—about one-fifth to a quarter of the state.

Figure 5 | Marylanders trust doctors and public health experts on climate change



3. Perceived risks from chemicals and pollution have grown

More than half of Marylanders (55%) say that exposure to chemicals, including pesticides, in food and other products is a major risk to their health (see Figure 6). This represents a sizeable shift upward—23 percentage points—since spring 2013. In 2013, obesity was considered the largest personal health risk among Marylanders (major risk, 37%). This year, obesity dropped to fifth after exposure to chemicals in food and products, polluted drinking water (52%), air pollution (47%) and second-hand smoke (41%). Public perceptions of obesity changed little over the past year (major risk, 39%), but beliefs about the personal health risks posed by polluted drinking water, air pollution and second-hand smoke considerably increased with gains of 19, 16, and 12 percentage points respectively.

Climate change ranked eighth as a “major” personal health risk that concerns Marylanders. Sixty-three percent of Marylanders cited climate change as a moderate or major risk to their personal health—an increase of 11 percentage points from spring 2013 (see Figure 7). Almost a quarter—23%—say that it is a major risk to their health, on par with violent storms (23%).

Health risks from flooding and climate change are perceived differently across regions

Marylanders across the state’s four regions generally make similar judgments about personal health risks. Exposure to chemicals in food and other products, and air pollution, are consistently ranked the top moderate or major health risks in all four regions (Western, 82%/74% respectively; Central, 85%/86%; Southern, 81%/81%; Eastern, 80%/75%) (see Appendices, Table 9, p. 33). However, there are differences. Flooding is perceived as less of a concern in the mountainous Western region and more of a concern on the low-lying Eastern Shore (Western, 37%; Central, 51%; Southern, 52%; Eastern, 60%). Climate change is most likely to be listed as a moderate or major personal health risk by those in the urban Central region of the state (67%), where it is ranked 6th of 11 risks, and least likely in the Eastern region (49%), where it is ranked lowest (Southern, 59%, ranked 8th; Western, 52%, ranked 10th).

Many experienced loss of electricity and wind- or storm-related damage in the past year

More than three-quarters of Marylanders (76%) say that they have experienced power outages at least once or more in the last 12 months with almost another two-fifths (39%) saying that they have had wind- or storm-related damage over the same period (see Figure 8). Power outages were reported by large majorities regardless of geographic location (Western, 83%; Central, 74%; Southern, 79%; Eastern, 72%) (see Appendices, Table 10, p. 37). Wind and storm damage afflicted between 37% and 45% of residents across each region of the state (Western, 42%; Central, 38%; Southern, 37%; Eastern, 45%). Other types of storm-related experiences are reported less frequently: 19% lost drinking water, and 9% suffered flood damage. Self-reported flood damages for the previous 12 months overall are low across most of the state, but show a

Figure 6 | Marylanders became more concerned about health risks in the past year

Below is a list of potential risks to people's health. How much of a risk do you feel each of the following poses to your health?

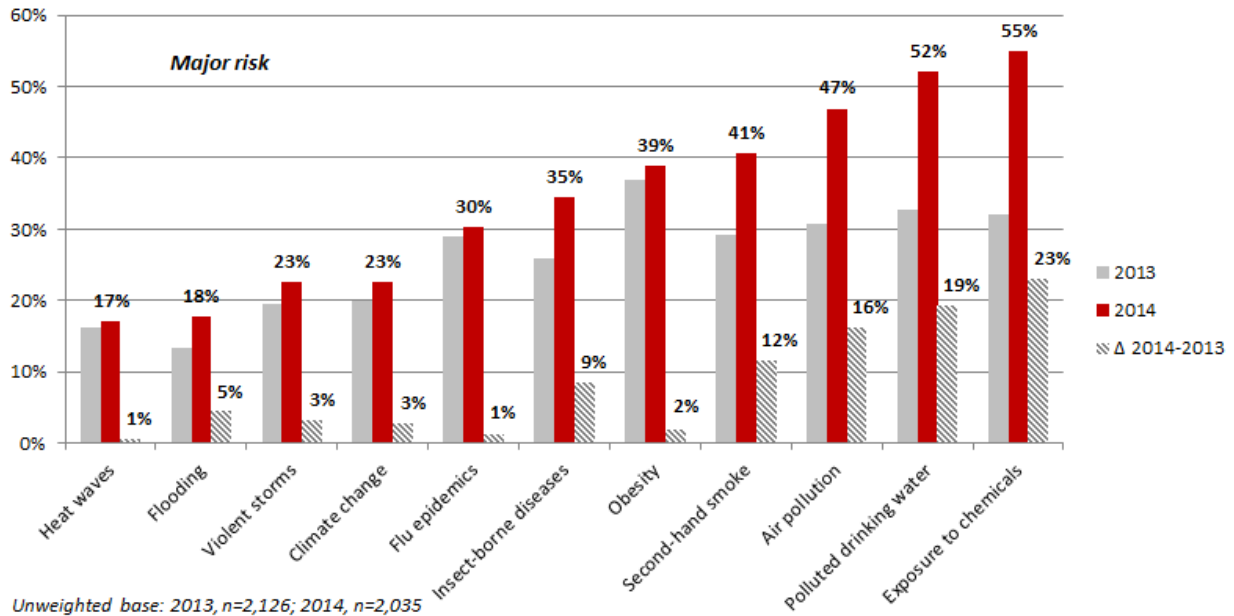
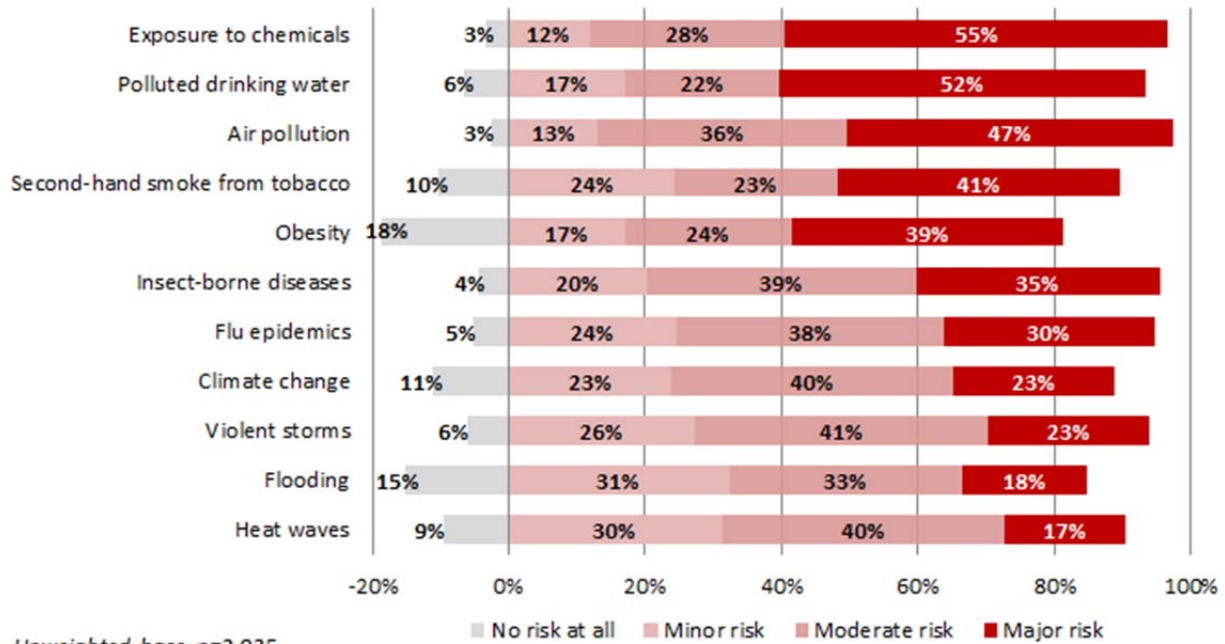


Figure 7 | Chemicals, polluted water and air pollution are perceived as major health threats

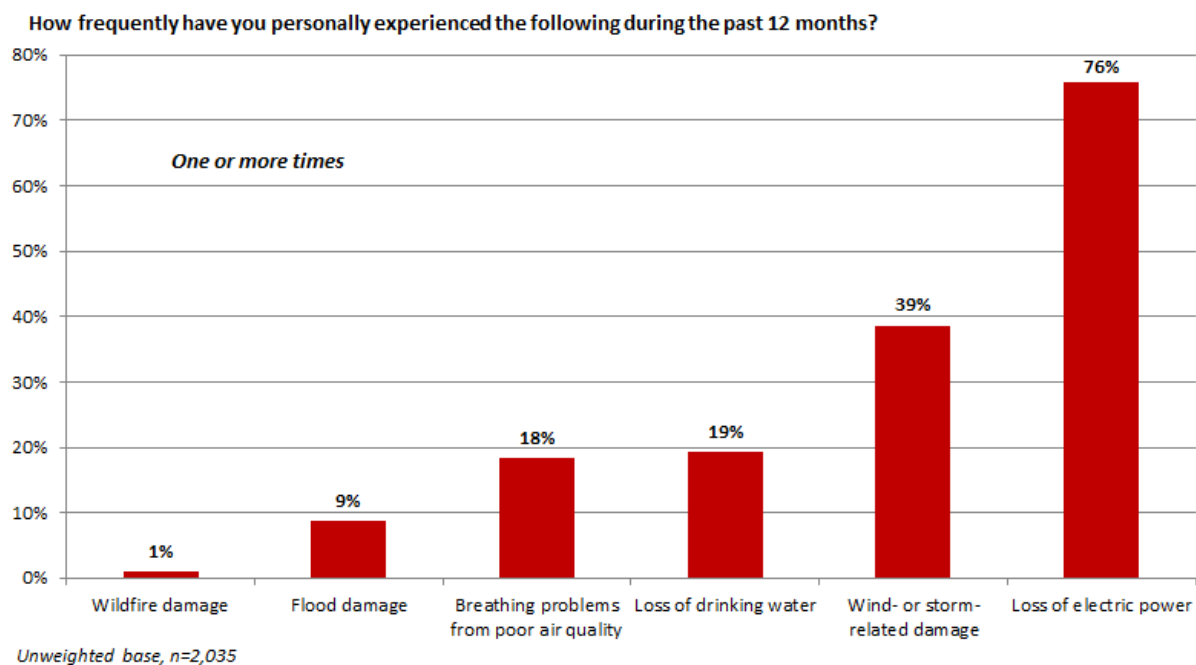
Below is a list of potential risks to people's health. How much of a risk do you feel each of the following poses to your health?



similar pattern as the regional perceptions of flood risks reported above with 18% of residents from the low-lying Eastern Shore reporting damages, but just 5% of the Western region (Central, 9%; Southern, 9%). Very few Marylanders say that they have experienced wildfire damage (1%).

Personally experiencing harm or loss can influence the way in which people weigh future risks, and motivate them to take protective actions.⁹ Having experienced difficulty breathing due to air pollution during the 12 months prior to the survey is associated with perceiving 11 potential health threats—from second-hand smoke to flu epidemics, obesity, and climate change—as more significant personal risks,¹⁰ and is most strongly correlated with believing oneself to be at risk from air pollution and heat waves,¹¹ although the correlations are relatively weak (see Appendices, Correlation Table 2, p. 18-19). Incidents of recent flood damage are also associated—though not strongly—with higher risk perceptions regarding seven types of health threats, but particularly flooding.¹² Believing oneself to be being personally at risk from the health impacts of climate change is also weakly correlated with previous experiences of flood and wind- or storm-related damage.

Figure 8 | Large majority of Marylanders experienced electric power disruption in the past year



⁹ Whitmarsh, L. (2008). Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *Journal of Risk Research*, 11(3), 351–374.

¹⁰ Pearson’s correlation, $r=.147$, $p<.001$. For an explanation of correlation, see p. 21.

¹¹ Air pollution, $r=.220$, $p<.001$; heat waves, $r=.195$, $p<.001$

¹² $r=.154$, $p<.001$

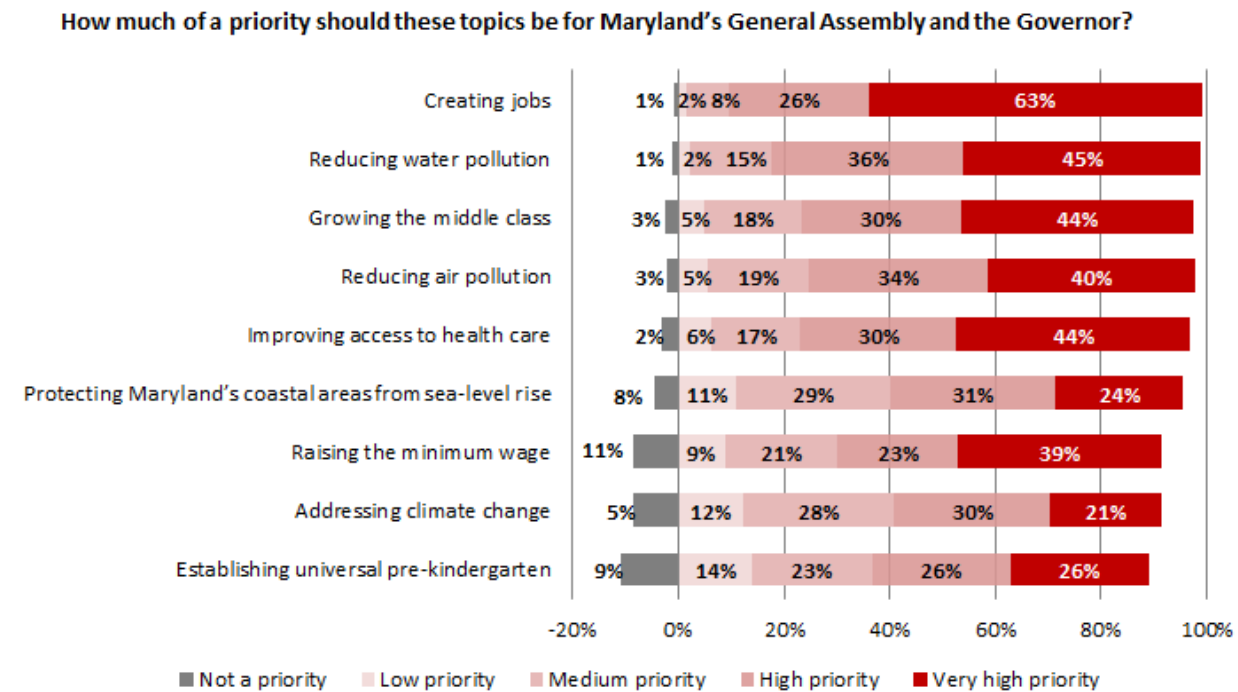
4. Environmental health and health care access are ranked among top state priorities

Maryland residents rank health care access and environmental health along with jobs and growing the middle class at the top of their list for state policymakers to address.

Three-quarters of Marylanders (74%) say that improving access to health care should be a high or very high priority, about the same percentage as growing the middle class and reducing air pollution. These three priorities fall just after creating jobs (89%) and reducing water pollution (81%) (see Figure 9). The Central and Southern regions of the state—the corridor stretching from Cecil County to the Washington, D.C. suburbs and St. Mary’s County—are most likely to cite access to health care as a high or very high priority issue (Western region, 59%; Central, 75%; Southern, 79%; Eastern, 58%) (see Appendices, Table 11, p. 38).

Reducing environmental threats such as water pollution (81%), air pollution (73%), and climate change (51%) also provides direct public health benefits. Climate change ranks toward the bottom of the list of nine issues that Marylanders were asked to prioritize, but even so, half of the state (51%) describes it as a high or very high priority for policymakers.

Figure 9 | Health concerns are among top priorities for the General Assembly and Governor



5. Coal, oil, and nuclear power are seen as harmful to health

A majority of Marylanders say that the fossil fuels coal and oil, and nuclear power, are somewhat or very harmful to people's health. Almost three-quarters of Marylanders (72%) say that coal is somewhat or very harmful, followed by oil (64%) and nuclear power (58%) (see Figure 10). Over the past year, the number of people who say that coal is "very harmful" to health increased by 10 percentage points to 41%. Oil and natural gas extracted from hydraulic fracturing also became more strongly viewed as a health hazard in the last year with increases of six percentage points of those who say they are very harmful (respectively, 26% and 23%). Of note, substantial percentages of Marylanders—14% to 39%—report that they do not know whether or not each of 10 named sources of electrical energy in the survey are potentially harmful to people's health. Wood fuel or switchgrass are the least-well known by the public; 39% don't know whether they are harmful or not to health.

Coal and nuclear are ranked as "very harmful" sources of energy by approximately one-third of residents in three of the state's regions, and there are generally only slight regional differences (Western, nuclear/35%, coal/32%; Southern, coal/39%, nuclear/33%; Eastern, 38%/nuclear, 33%/coal) (see Appendices, Table 12, p. 40). In the Central region of the state, however, there is a 16 percentage point difference between those who say that coal is very harmful to health (45%) and those who say nuclear is (29%). More than a quarter (26%) of Central Maryland's residents also say that they don't know what the health implications of nuclear power are. This compares to 19% in Western and Eastern Maryland, and 17% in the Southern region. Calvert Cliffs, the state's only nuclear power plant, is located 40 miles south of Annapolis in the Southern region.

Marylanders say solar and wind are not at all harmful to health

Renewable energy sources such as wind and solar continue to be viewed as non-harmful to people's health. Large majorities say solar (65%) and wind (land-based, 58%; offshore, 57%) are not at all harmful. In 2014, there was an increase of five percentage points—up to 65% from 60% the previous year—in those people who say that solar has no negative effects on health (see Figure 11).

Figure 10 | Coal, oil and nuclear power are perceived as harmful to health

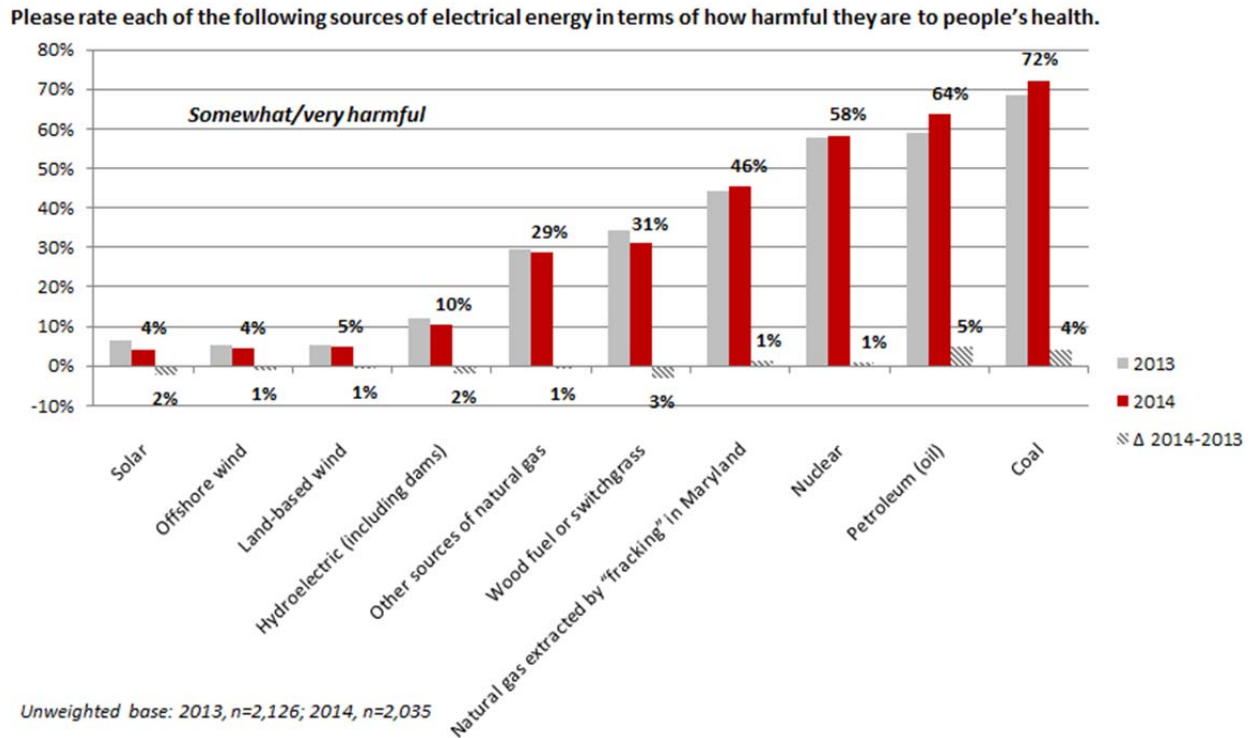
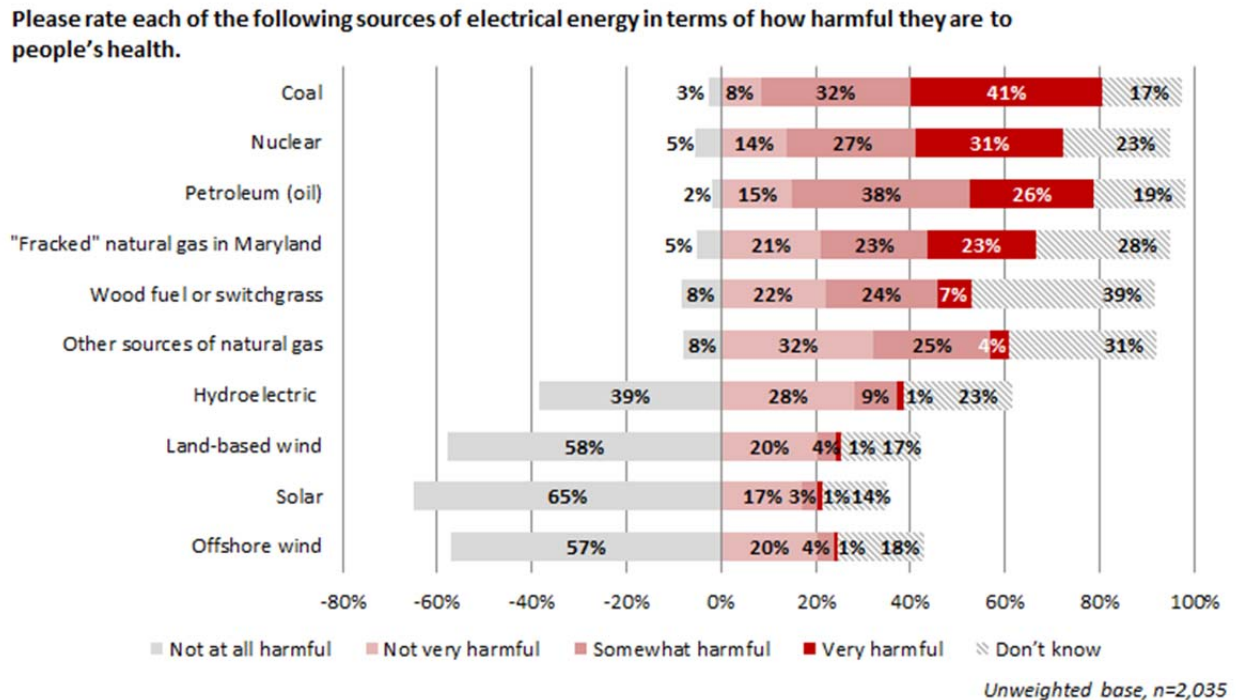


Figure 11 | Majorities say wind and solar are not harmful to public health



6. Study methodology

This study was conducted by George Mason University's Center for Climate Change Communication to explore Marylanders' views on public health, energy and the environment. The survey instrument was developed at George Mason University, partially based on questions used in the Climate Change in the American Mind national surveys run by the Yale Project on Climate Change Communication (<http://environment.yale.edu/climate-communication/>) and George Mason's Center for Climate Change Communication (<http://climatechangecommunication.org/>). The mail survey consisted of 50 questions and took approximately 20 minutes to complete.

For reporting purposes, the data has been broken into four separate documents. Three additional reports focus on Marylanders' climate change attitudes, behaviors and policy preferences regarding sea-level rise and adaptation, energy, and climate.¹³ The unweighted sample margin of error is +/- 2 percentage points at the 95% confidence interval for the state and less than +/- 5 percentage points for each region (see Table 1).

Sampling design; fielding

The survey was mailed to 6,401 households in the state of Maryland, randomly selected from within each of four regions of the state from Survey Sampling International household address databases, based primarily on U.S. Postal Service delivery route information. We sampled at the regional level to ensure the final data was generalizable to these distinctly different geographic and cultural areas of the state, as well as the state as a whole. The sample size for the Central region of the state was higher relative to the other three regions because it accounts for more than half of the state's population (see Table 1). Households that responded to the survey in 2013 were not re-contacted in 2014.

The survey was fielded from March 17 to June 10, 2014. Each household was sent up to four mailings: an announcement letter introducing the survey (March 17), a copy of the survey with a \$2 bill thank you (March 24), a reminder postcard (April 7), and a follow-up survey (April 22). (As a point of comparison, the 2013 survey was fielded from March 28 to June 4. Methodology for the 2013 survey is available within those reports at climatemaryland.org.) In order to achieve randomization of respondents within each household, we requested that the person with the most recent birthday complete the survey. Households that completed and returned the survey were taken off of subsequent mailing lists.

¹³ See the reports at <http://www.climatemaryland.org/survey/>

Weighting

The data tables report percentages for the state and each region. State data were weighted for regional representation, gender, age, and education level based on 3-year American Community Survey data from the U.S. Census Bureau, following the same procedure as in 2013. Each region's data were also weighted for the same demographic variables. Base unweighted sample sizes for each question are reported in addition to the weighted percentages.

Respondents who did not provide regional, gender, age or education level data were dropped from the data set. This lowered the number of respondents by 201 cases. (The overall response rate for the study before those cases were dropped was 38%.) Please see the demographics section of the appendix for more information on the characteristics of the survey sample pre- and post-weighting.

Institutional Review Board

The study was reviewed by the Institutional Review Board for George Mason University (Protocol #8508).

Table 1 | *Regional samples, response rates and margin of error*

Region	Counties	Initial sample	Refusals	Undeliverable addresses	Number of respondents*	Response rate	Margin of error
Western	Allegany, Frederick, Garrett, Washington	1,467	14	107	495	36%	+/- 4.40 % points
Central	Baltimore, Carroll, Cecil, Harford, Howard, Montgomery, Baltimore City	2,000	16	130	629	33%	+/- 3.91 % points
Southern	Anne Arundel, Calvert, Charles, Prince George's, St. Mary's	1,467	11	85	435	31%	+/- 4.70 % points
Eastern	Caroline, Dorchester, Kent, Queen Anne's, Somerset, Talbot, Wicomico, Worcester	1,467	18	190	476	37%	+/- 4.49 % points
State	All counties	6,401	70	512	2,035	35%	+/- 2.2 % points

