Health Implications of a Changing Climate

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For the past five years, staff from the Minnesota Department of Health's Minnesota Climate and Health Program have been studying climate data and the potential health effects of climate change in the state. This year they released the “Minnesota Climate and Health Profile Report 2015,” which presents a synthesis of their research. This article summarizes key points from that report.

In February, the Minnesota Department of Health’s (MDH) Minnesota Climate and Health Program released “Minnesota Climate and Health Profile Report 2015.” The 100-page report provides a comprehensive review of the evidence for climate change and identifies health concerns relating to it and populations at high risk for these problems.

The health department's work on climate change began in 2010 when it received funding from the Centers for Disease Control and Prevention (CDC). That funding was used to create and support the Minnesota Climate and Health Program. Currently, the CDC provides funding for 16 state and two municipal health departments to develop and test methods for adapting to present and future changes in climate.

For the past five years, Minnesota Climate and Health Program staff have been analyzing and synthesizing research and data to identify the effects of climate change on health and the populations likely to be most affected and developing adaptation strategies. In addition to releasing its 2015 report, the program has published the “Minnesota Climate Change Vulnerability Assessment 2014”; developed the Minnesota Extreme Heat Toolkit, which provides information on how to prepare for heat waves in order to prevent heat-related illnesses and deaths; formulated a strategic plan for adapting to climate change; and produced six training modules on climate change and its effect on health as well as a film, Health and Climate, with Twin Cities Public Televisi

sion. Program staff also have helped plan and sponsor conferences; given presentations on climate change and health; and provided technical assistance to cities and counties related to climate change and mapping at-risk populations.

The scientific evidence regarding climate change and its effects on health has grown since 2010, and the “Minnesota Climate and Health Profile Report 2015” reflects this new knowledge. This article summarizes some of the key points in the report.

Evidence of Climate Change in Minnesota

Temperature

Data from the first recorded temperatures in Minnesota in 1895 to the present show that Minnesota’s weather is becoming warmer. In the early 1900s, the annual average air temperature was 39.2°F. Today the average is 41.6°F.1 The pace of warming has increased especially fast in the last few decades. From 1895 to 1959, annual average air temperatures increased at a rate of about 0.2°F per decade.1 From 1970 to 2013, the rate of increase between 1960 and 2013 was 0.5°F per decade.1 From 1970 to 2013, the rate of increase in annual average temperature has accelerated to 0.6°F per decade, tying Minnesota with Maine and Massachusetts as the eighth fastest-warming state in the continental United States.2 Data from 1895 to 2013 show that nine of the 10 warmest years have occurred after 1980.1

Not only are annual average temperatures higher, in recent years, we have seen new record highs. On July 19, 2011, Moorhead, Minnesota, set a new all-time state record with a dew point temperature of 88°F. That produced a heat index of 134°F, which also was the highest ever recorded in Minnesota.3 Climate change projections suggest that temperatures will continue to rise, leading to more frequent and intense heat waves.4

Minimum or overnight low temperatures have been rising faster than the maximum temperatures.5 In the early 1900s, the average annual minimum air temperature was 28.2°F. The average minimum temperature is now 31.3°F.1

The greatest changes are occurring during certain seasons. Winter temperatures have been rising much faster than annual average temperatures. The average annual winter air temperature in the early 1900s was 8.6°F. Now the average winter air temperature is 13.7°F.1 In addition, the pace of warming is increasing. Average annual winter temperatures, as measured from December through February, increased at a rate of 0.3°F per decade between 1895 and 1959, then at a rate of 1.1°F per decade between 1960 and 2013.1

Warmer temperatures have predictably led to an earlier start of spring and a longer growing season. In the Midwest, there was a nine-day increase in number of days between the date of the last spring freeze and the date of the first fall frost from 1991 to 2011 as compared with the period from 1901 to 1960.6 Comparing the 1990 U.S. Department of Agriculture Plant Hardiness Zone Map with the 2012 map, we can see that Minnesota’s plant
hardiness zones have shifted—from most of the state being primarily in Zone 3 or 4 to more of it being in Zone 4 and some parts of southern Minnesota being in Zone 5. Each zone represents a 10-degree F span of average annual minimum winter temperatures, so a higher zone number reflects a higher average annual minimum winter temperature. In Zone 4, average annual minimum temperatures are between -30°F and -20°F. Because of these changes, plants that previously could not survive in Minnesota may now survive and thrive.

Precipitation
Minnesota’s precipitation patterns are changing. From 1895 to 1959, the state saw a slight decrease in average annual precipitation (about -1.5 inches per century). From 1960 to 2013, average annual precipitation has been increasing at a rate of 3.5 inches per century.1

In addition to changes in average annual precipitation are changes in the character of Minnesota’s precipitation events. From 1958 through 2007, the number of very heavy events (defined as the heaviest 1% of all daily events) increased by 31% in the Midwest.2 Another study found a 71% increase in the number of storms discharging at least 3 inches of precipitation between 2001 and 2010 as compared with the number between 1961 and 1990.3 Since 2000, there have been five “super storm” events in Minnesota that have produced 7 or more inches of rainfall within 48 hours.4

Precipitation delivered in heavier, localized storms leads to flooding and, conversely, longer dry spells between events. In 2012, 75 Minnesota counties were declared primary or continuous disaster areas for drought, and 15 counties and three tribal reservations were declared disaster areas for flooding. Eight counties received disaster declarations for both.5,6

In summary, Minnesota is seeing summers with more extreme heat, warmer winters (on average), increased localized and heavy precipitation, and longer dry spells.

The Impact of Climate Change on Health
More heat events may lead to more cases of heat-related illnesses. Heat waves directly affect health by causing heat exhaustion, heat stroke and even death. During the summer of 2011, the heat index in the Twin Cities reached 105°F or greater on six days. That same summer there were 1,255 emergency department visits and three deaths directly related to the heat.7,8 Heat also can exacerbate symptoms related to cardiovascular disease, respiratory diseases, diabetes and other conditions.9 One study demonstrated an association between short-term increases in cardiovascular-related hospital admissions and elevated air temperatures.10 With more heat waves predicted in the future, Minnesota can expect more visits to emergency departments for heat-related illnesses and illnesses exacerbated by heat.

Warmer weather also may lead to more cases of tick-borne diseases. Although many factors influence a person’s risk of developing a vector-borne disease, climate is an important variable.11 Higher temperatures have been linked to the earlier emergence of blacklegged ticks and their spread to new geographical areas.12 Blacklegged ticks carry the pathogens that cause Lyme disease, human anaplasmosis and babesiosis.

Lyme disease is the No. 1 vector-borne disease in Minnesota. The number of cases has been steadily increasing since 1982, when the state began collecting information on people diagnosed with the condition.13 The median number of 1,065 Lyme disease cases reported annually from 2005 through 2013 is considerably higher than the median number of 463 cases reported annually from 1996 through 2004.14 In 2013, there were more than 1,400 confirmed cases of Lyme disease in Minnesota.15 Given Minnesota’s changing climate, it is likely that the incidence of tick-borne diseases will continue to increase.

A longer growing season corresponds with a lengthening pollen season. From 1995 to 2013, Minneapolis experienced a 21-day increase in the length of the ragweed season.16 Consequently, those with allergies may be affected for a longer period of time than in the past.17 Some suggest a link between increases in air temperature and carbon dioxide in the atmosphere and increased pollen production. Thus, in addition to a longer pollen-production season, certain trees and plants may produce larger quantities of pollen than they do now.18

Increased precipitation may lead to more flooding, which can affect health both directly and indirectly. From 1996 to 2013, flash floods caused 13 deaths.19 Flooding also can lead to respiratory problems arising from exposure to mold in wet basements; mental health problems arising from injuries or property loss; and disease outbreaks related to contaminated drinking water.

Final Thoughts
The evidence is clear. Climate change is already occurring and has implications for health.

Across the country, physicians are already noticing changing health trends. In a survey by the American Thoracic Society,10 77% of respondents said they had seen an increase in chronic disease severity related to air pollution; 58% said they had seen an increase in the number of allergic reactions resulting from exposure to plants or mold; and 57% said they had seen an increase in the number of injuries related to severe weather.21

In the coming years, physicians likely will see more patients with heat-related illnesses, vector-borne diseases, allergies and flood-related illnesses. They may see changes in the types of illnesses and injuries patients present with, and their patient load may increase. Awareness that our climate is changing and that there will be corresponding health implications is the first step toward preparing for them. Physicians can play a key role in ensuring that clinics, emergency rooms and hospitals are preparing for and responding to the
effects of these changes. The Minnesota Department of Health will continue working to ensure that the medical and public health communities are well-equipped to face the new realities.

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REFERENCES


