This World Health Organization (WHO) health and climate change urban profile presents a snapshot of key climate hazards, climate-sensitive health risks and the potential health benefits of climate change adaptation and mitigation. The profile does not provide comprehensive information on all climate hazards, vulnerability factors or health risks but rather provides examples of some immediate risks based on available evidence and reported priorities and initiatives. Outlined in this profile are opportunities to promote policies and projects that protect the climate and environment while having large immediate health benefits at the local level.
Air pollution and climate hazards, such as heatwaves, increase the risk of cardiovascular diseases and respiratory conditions. They pose a particular risk to vulnerable groups, such as older people, children, and those with chronic respiratory conditions or pre-existing medical conditions (4, 7).

166,335 people living below the federal poverty line and were located in a flood zone (4).

In 2019, Indiana ranked 41st in the country for public health funding with only US$ 53 state and federal dollars dedicated per person (5).

In 2018, one in five children in Marion County was affected by chronic asthma. This is double the rate in the state of Indiana and the US average (6).

The Indianapolis metropolitan area had the 2nd highest level of ambient air pollution in the state (13, 16).

The Indianapolis metropolitan area is ranked as the 13th most air polluted US city, based on mean annual particulate matter (PM2.5) (16, 17).

Indianapolis is not part of the BreatheLife global campaign to mobilize cities to address air pollution (18). Indianapolis does adhere to reporting standards set by the US Environmental Protection Agency.

### Health and development indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>166,335 people</strong></td>
<td>From 2012 to 2016, an estimated 166,335 people in Marion County were living below the federal poverty line and were located in a flood zone (4).</td>
</tr>
<tr>
<td><strong>US$ 53 per person</strong></td>
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<tr>
<td><strong>20% of children</strong></td>
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</tr>
<tr>
<td><strong>2nd highest</strong></td>
<td>In 2019, Indianapolis had the 2nd highest level of ambient air pollution in the state (13, 16).</td>
</tr>
<tr>
<td><strong>13th</strong></td>
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</tr>
<tr>
<td><strong>60%</strong></td>
<td>Sixty per cent of the Indianapolis population is especially vulnerable to poor air quality (7).</td>
</tr>
</tbody>
</table>

In 2018, 81% of samples exceeded Indiana’s Water Quality Standards for E.coli (9).

• A reduction in the number of extreme cold days and a lengthening of frost-free seasons are also expected which could reduce health risks associated with extreme cold (3).

Flooding / extreme precipitation
- Indianapolis is expected to see significant precipitation increases during winter (up to 49%) and spring (up to 24%) by mid-century (3). This is likely to result in a greater flood risk that could overwhelm already aging stormwater infrastructure and lead to possible injuries, exposure to waterborne diseases, exposure to mold, and reduced air quality, causing respiratory issues (1, 2).
- Close to 8 billion gallons per year of combined sewage and storm water are dumped into local rivers and streams, primarily after it rains (2). This has been linked to gastrointestinal diseases, including nausea, vomiting and acute diarrhea, as well as increases in pediatric hospital visits (8).
- In 2018, 81% of samples exceeded Indiana’s Water Quality Standards for E.coli (9).

Heatwaves and/or increased temperatures
- Mean annual temperatures in Indianapolis are projected to increase by 3.0 to 7.0 °F (17 to 3.9 °C) from historic values by mid-century (3).
- Historically, Marion County had an average of four days of extreme heat (+95 °F / 35 °C). Extreme heat days are expected to increase to between eight and 11 days by 2050 (3).
- Heat is a leading cause of weather-related mortality and will negatively impact individuals with asthma, respiratory illnesses and mental health issues (10). Noncommunicable diseases such as ischemic heart disease and stroke may also increase. Marion County is already facing higher numbers of these illnesses than state and national averages (11–13).
- A reduction in the number of extreme cold days and a lengthening of frost-free seasons are also expected which could reduce health risks associated with extreme cold (3).

Urban heat island effect
- Parts of the city where there is limited tree coverage and large areas of paved or concrete surfaces are experiencing an urban heat island effect, with air temperatures that can be more than 15 °F (8.4 °C) higher than mean temperatures (2, 10).
- Many heat island hot spots overlap with areas identified as highly socially vulnerable, where people are less able to absorb the increased energy costs for managing indoor air temperature (2, 10).
- Only 36% of the population lives within a 10-minute walk of naturally cooling green spaces, compared with the national average of 55% (14).

### Evidence to support

- Many of the drivers of climate change, such as inefficient and polluting forms of energy and transport systems, also contribute to air pollution (4).
- Air pollution in this context refers to fine particulate matter with diameter less than 2.5 microns (PM2.5).
Adaptation and mitigation actions

Transport / clean air
- The Knozone programme aims to reduce ozone and PM2.5 through public outreach and education (1, 16). It encourages residents to be aware of high ozone days, and it motivates them to use sustainable transit and limit their car idling on high ozone days (1, 19).
- The Knozone programme increases accessibility of the Indiana Pacers Bikeshare program and leads efforts to increase multi-modal forms of transportation across Central Indiana (4, 19).
- The Highly Evolved campaign provides public education on the benefits and realities of electric vehicles and debunks common myths about electrification (4).

Benefits to health

Transport / clean air
- Limiting the use of private cars and increasing cycling contributes to reducing greenhouse gas (GHG) emissions and air pollutants while increasing physical activity. Improving air quality levels can lead to direct health benefits, including reduced respiratory diseases, asthma and allergies, cardiovascular diseases, heat stroke and deaths, as well as improved mental health (23-26).
- A study of 53 metropolitan areas in the United States, including Indianapolis, concluded that the electrification of vehicles can reduce air pollution and greenhouse gas emissions (27). A reduction in air pollutants, such as fine particulate matter, is associated with reduced risk of cardiovascular and respiratory diseases and some cancers (28).

Flooding / built environment
- The city is implementing a 20-year, US$ 320 million storm water capital improvement programme to drastically reduce the impacts of neighbourhood flooding and drainage issues (1, 3).
- In addition to annual infrastructure improvement projects, crews clean and repair creek banks, levees, open channels, and detention areas; they also mow levee banks to provide erosion control and maintain and repair floodgates (3).
- Citizens Energy Group owns much of the city’s combined sewer systems and is currently implementing the Digindy Tunnel System, which will collect and store stormwater for treatment during non-flood conditions, thus significantly decreasing the chance of polluted overflow into nearby waterways (20).

Green space
- The Thrive Indianapolis plan set a goal to plant 30 000 additional native trees by 2025 (1, 4). As of 2021, 23 662 trees have been planted toward that goal (14). Furthermore, the Keep Indianapolis Beautiful non-profit organization leads litter cleanups, green space creation and habitat restoration (21).
- The Office of Land Stewardship manages over 1 900 acres of natural area across 37 park properties and over 100 000 square feet of City rain gardens that assist in filtering storm water runoff. Staff has worked to protect green space and preserve critical wildlife habitats by removing invasive species since the 1990s (22).

Emissions

Net zero target – ✔
Indianapolis is committed to being net zero carbon by 2050.

Renewable energy target – ✔
Indianapolis is committed to creating a pathway towards 100% renewable energy use by 2038.

Climate and health commitments

<table>
<thead>
<tr>
<th>Climate change assessments and plans</th>
<th>Completed?</th>
<th>Health included?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate risk and vulnerability assessment</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Adaptation plan</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Mitigation plan</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Climate change and health initiatives
- Global Covenant of Mayors for Climate and Energy
- “America Is All In” signatory
- Winner of the Bloomberg Philanthropies America Cities Climate Challenge
- Climate Mayors

- The implementation of the stormwater collection and treatment system will reduce the risk of flooding during extreme events, the possibility of injury and drowning, the spread of waterborne infections and diseases, and the damage to infrastructure, including health facilities (29).

Green space
- Planting 30 000 trees by 2025 would contribute to lowering temperatures, reducing the urban heat island effect, and improving air quality levels. Green spaces contribute to a reduction in the incidence of cardiovascular diseases, respiratory diseases, heat-related illness and promote mental health (25, 26, 30).
- Green spaces are a fundamental part of an integrated approach to stormwater management, reducing the rate and amount of stormwater entering the sewage system (25, 26, 30).
Implementing benchmarking and transparency will enable cities and their community in advance of a crisis (4).
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LEGEND

Key climate hazards

- Flooding
- Sea-level rise
- Extreme and/or increased precipitation
- Heatwaves and/or increased temperatures
- Drought
- Urban heat island effect
- Air quality degradation

Key health risks

- Heat-related illness and death
- Injury and death from extreme weather events
- Malnutrition and foodborne disease
- Mental and psychosocial health
- Non-communicable diseases
- Respiratory illness
- Vector-borne and infectious diseases
- Water security and waterborne diseases
- Zoonoses
- Effect on health systems, including health care facilities

The key climate hazards listed in this legend may not be a comprehensive list of hazards associated with climate change. Other extreme events including tropical storms or wildfires, if identified as a key hazard, will be presented on page 2.