

# Climate Change

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Climate change poses a great challenge to humanity and significantly affects public health. The World Health Organization (WHO) has called it “the greatest threat to global health in the 21st century.” Climate change may have direct and indirect effects on public health. Direct effects of exposure to extreme temperatures include physiological harm such as sunstroke and dehydration, impaired heart function, neurological and renal damage, an increase in rate of preterm births, cognitive changes, and aggravation of chronic conditions such as cardiovascular and respiratory disease. Extreme climate events such as drought, floods, heat waves, sandstorms, and wildfires can cause physical injury and even death.<sup>1,2</sup>

In addition to their direct effects on human health, environmental changes induced by climate change have indirect impacts including the proliferation of disease transmitting vectors such as the Asian tiger mosquito, which can transmit the Dengue and Chikungunya viruses, and changes in water availability, quantities of food and its nutritional composition, and air quality.<sup>1,2</sup> Changes in the precipitation regime or extreme heat or cold weather events can severely diminish agricultural output (livestock and crops) and increase the risk of food spoilage due to the proliferation of bacteria and mold. Premature flowering of plants and a longer flowering season due to high temperatures may exacerbate the condition of people who suffer from allergies.<sup>3</sup> Finally, changes in weather patterns can impact pollutant formation and transport and increase human exposure to them.

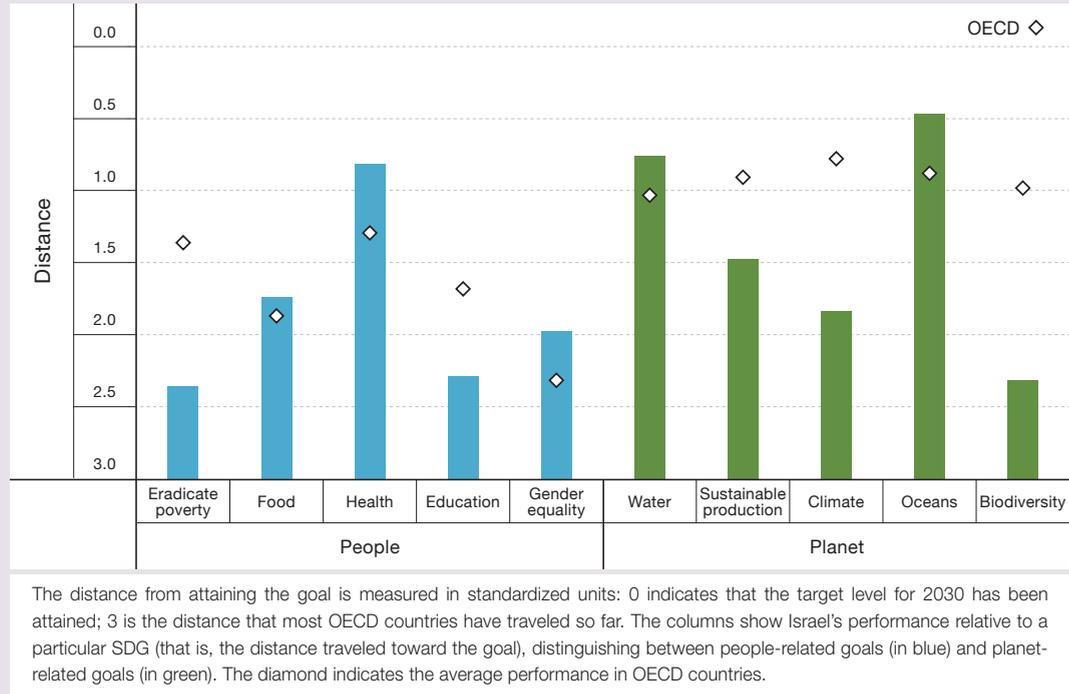
Climate change affects members of the public differentially. Some populations—including children, the elderly, people of low socioeconomic status (SES) and outdoor workers—are more exposed to its dangers than are others. According to the WHO, the effects of climate change are expected to cause an additional 250,000 deaths annually in the years 2030 to 2050.<sup>4</sup> The 2019 issue of *The Lancet Countdown* emphasized the vulnerability of children to climate change: Unless greenhouse gases are substantially reduced, a child born today will live in a world that is at least 4 degrees Celsius hotter than in the pre-Industrial Revolution period, to the detriment of his or her health from infancy through old age.<sup>2</sup>

The effects of climate change and their severity depend on a population’s geographic location, demographic composition, SES, and preparedness for various climatic phenomena.<sup>1</sup> Populations in areas heavily affected by climate change may have to migrate to other areas (“climate migration”). Rising temperatures in sub-Saharan Africa in conjunction with inferior health and environmental conditions may lead to refugee migration to Israel. If this occurs, Israel’s healthcare system will need to provide refugees with medical care.<sup>5,6</sup>

In September 2015, the member states of the United Nations, including Israel, adopted the 2030 Agenda for Sustainable Development and its seventeen sustainable development goals (SDGs). In 2019, Israel reiterated its commitment to this agenda in Government Resolution 4631, incorporating the UN development goals and undertaking to improve governance and governmental strategic planning processes.<sup>7</sup> One of the key SDGs is no. 13: “Take urgent action to combat climate change and its impacts.” This goal includes developing national strategies for coping with climate change, raising awareness regarding these changes and promoting mechanisms for dealing with them. In 2019, the Israeli government issued a report on its progress in implementing these goals.<sup>8</sup> The same year the OECD published its own report on this issue and found that Israel falls very short of meeting the UN development goals (Figure 1) and is farther from the SDG targets than the average in OECD countries.<sup>9</sup>

**Distance from Selected UN Development Goals, Israel in Comparison with the Average in OECD Countries**

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Figure 1  
OECD, 2019<sup>9</sup>



The Israeli government’s response to climate change focuses on two topics: reducing greenhouse gas emissions (mitigation) and preparing for climate change (adaptation).

## Reducing Greenhouse Gas Emissions

In the Paris Agreement, signed at the UN Climate Conference in 2015, the Government of Israel declared a national goal of reducing greenhouse gas emissions to 8.8 tons per capita in 2025 and 7.7 tons per capita in 2030. In late 2018, the Minister of Energy presented a plan with goals for the energy sector for 2030, focusing on discontinuing the use of coal for energy generation and transitioning to transportation powered by electricity and natural gas. In response to the Ministry of Energy’s claim that these steps would significantly reduce greenhouse gas emissions and enable Israel to meet its emissions goals, the scientific community in Israel called for a re-evaluation of the expanded use of natural gas and advocated a transition to renewable energy sources.<sup>10, 11</sup> Notably, according to an OECD report published in 2020, emissions have been rising in Israel in recent years and will rise by another 23.6% by 2030 if the current trajectory continues.<sup>12</sup> Some of the measures for reducing emissions provide the co-benefits of mitigating climate change and benefiting public health. They include transitioning to renewable energy and clean transportation and reducing meat consumption. (See the “Planning” chapter for more information on planning issues related to transportation and energy.)

## Preparing for Climate Change

In Government Resolution 4079—Preparedness for Adapting to Climate Change: Implementing Government Recommendations on a National Strategy and Action Plan<sup>13</sup>—approved in 2018, the Israeli government acknowledged the need to prepare for climate change by implementing action plans and policy measures that would mitigate the health, environmental, and economic risks of climate change. The strategy includes three tiers: a) strengthening research and reducing knowledge gaps; b) incorporating climate change considerations into everyday economic activities; (c) pursuing a “no regret” policy.

Pursuant to the government resolution, an Interministerial Administration for Climate Change Adaptation was formed, headed by the Ministry of Environmental Protection (MoEP). The new administrative body is responsible for inter-ministerial coordination, monitoring execution of the national strategy for adaptation, implementing adaptation plans, and updating them from time to time. The thirty-five members of the administration, including representatives of government ministries and other entities, are divided into seven committees that address the key recommendations for a national action plan and strategy for climate change (Figure 2).

### Committees at the Interministerial Administration for Climate Change Adaptation



←  
Figure 2

The Strategic Integration Committee ranked the effects of climate change on various economic sectors based on the gravity of the effects in order to create a basis for prioritizing projects and choosing primary courses of action. Thirty experts in various fields participated in the ranking process, which identified the most critical effects of climate change in Israel: increased frequency of extreme heat waves and droughts, a greater number of hot days in the year, desiccation of riverbeds and moist habitats, desertification, and decreased replenishment of natural water sources. With respect to the effects on human health and safety, increased frequency of wildfires, harm to vulnerable populations and urban heat islands were ranked as most critical.

According to an Israel Meteorological Service (IMS) report from 2020, which included possible scenarios for climate change in Israel, in the severe scenario the average temperature in Israel will rise by 4 degrees Celsius by the end of the current century. According to the moderate scenario, from 2040 to the middle of the century the average temperature will rise by 1.5 degrees Celsius and will then level off.<sup>14</sup>

### Progress since 2017

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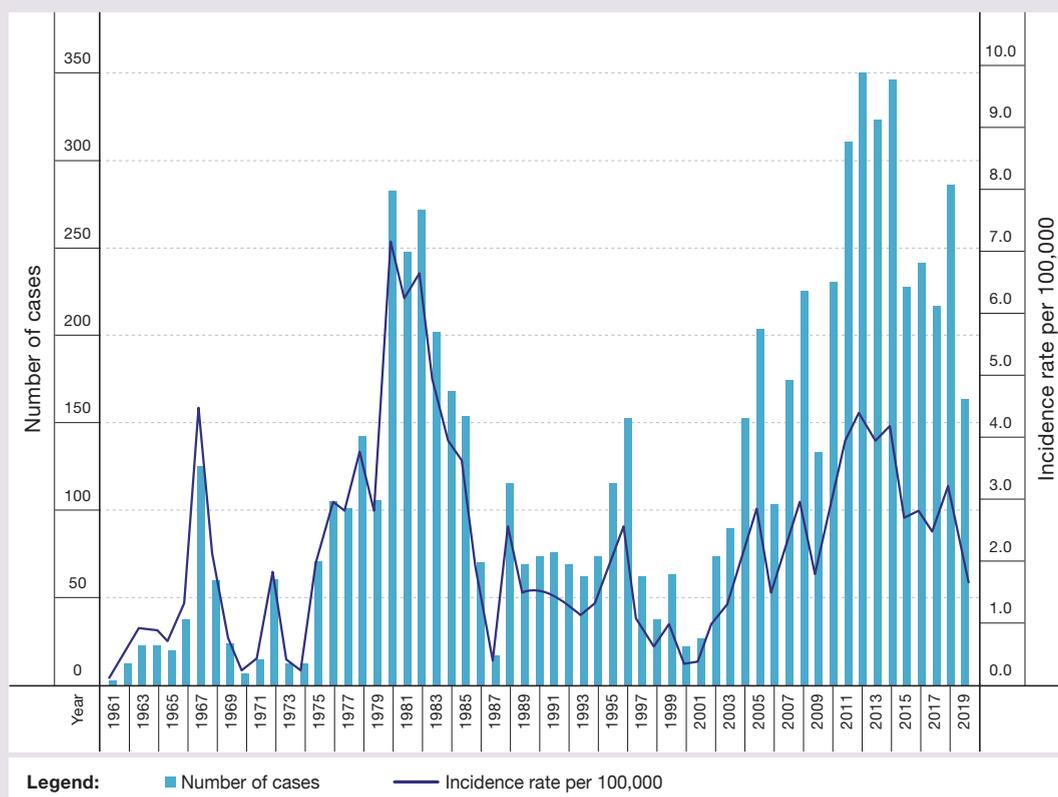
The *Environmental Health in Israel 2017* report defined challenges related to Climate Change. Progress achieved in this area during the past three years is outlined below.

<b>The challenge: Implement the National Plan to Combat Cutaneous Leishmaniasis</b>	
<b>In short:</b> The National Plan to Combat Cutaneous Leishmaniasis began in 2012. At the end of 2018, MoEP allocated an additional NIS 30 million to support the plan.	<b>Challenge for the coming years:</b> Raise public awareness.

Leishmaniasis is caused by the *Leishmania* parasite, which is transmitted to humans by the female sand fly, which can get infected after stinging an infected animal. This vector’s activity may be affected by climate warming because ambient temperatures impact spatiotemporal sand fly activity patterns.<sup>15</sup> Two main parasites are implicated: *Leishmania tropica*, whose host animal in Israel is the hyrax, and *Leishmania major*, hosted by various rodents including several types of gerbils.<sup>16</sup> The Ministry of Health (MoH) data indicate a decrease in incidence rates of leishmaniasis since 2014 (Figure 3), with 432 cases reported to MoH from 2018 through July 2019. Notably, however, there is substantial underreporting and the real scope of morbidity is unknown.<sup>17</sup>

<b>Legend:</b>	<span style="color: green;">■</span> Significant progress	<span style="color: yellow;">■</span> Some progress	<span style="color: red;">■</span> Little or no progress
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## Cutaneous Leishmaniasis in Israel—Cases and Incidence Rates, 1961–2019



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**Figure 3**  
 Israel Ministry of Health

The National Plan to Combat Cutaneous Leishmaniasis was launched in 2012. At the end of 2018, MoEP allocated NIS 30 million in support of the plan (in addition to an earlier allocation of the same sum).<sup>17</sup> The plan offers professional assistance for local governments and funding for research, including a spatiotemporal epidemiological study of the *Leishmania* parasite during the past decade in southern Israel, and development of rapid and accessible molecular diagnosis for various species. The 2020 report of the Israel State Comptroller revealed that MoEP transferred funds to local governments for clearing stones that hyraxes use as habitats. For reasons of medical confidentiality, however, MoEP does not receive precise reports on patients' location (receiving only the names of their localities), making it impossible to precisely target the habitats to destroy. Subsequently, MoH is developing specific procedures for reporting to MoEP.<sup>18</sup>

### The challenge: Develop a national action plan to cope with climate change

**In short:** In July 2018, the Israeli government approved the National Program for Adaptation to Climate Change (without funding its implementation by government ministries).

**Challenge for the coming years:** The National Program for Adaptation to Climate Change defines basic principles for coping with climate change. However, specific operative measures for implementing the program's goals (including health-related goals) have yet to be defined and the program has yet to be funded.

As noted, the government has approved a national action and adaptation program for coping with climate change (Government Resolution 4079, July 2018) and established an Interministerial Administration for Climate Change Adaptation, headed by MoEP.<sup>13</sup> The program aims to mitigate the adverse effects of climate change, including water shortages, droughts and an increase in extreme climatic events. The program includes assessing risks, developing methodological models for prioritizing challenges and actions relevant to Israel, monitoring morbidity and mortality (with an emphasis on vulnerable populations), incorporating climate change adaptation in decision-making processes, and promoting relevant collaborative initiatives.

Importantly, although the government has approved the National Program, it has yet to fund it. Consequently, the various ministries have limited personnel and funding for advancing the strategic program. The Administration for Climate Change Adaptation plays an integrative role but lacks authority vis-à-vis the participating government ministries.

As part of the adaptation to climate change, MoH was tasked with developing an operative action plan to prepare the healthcare system for potential scenarios stemming from the evolving climate situation. MoH's mandate also includes formulating a strategy for real-time data collection, developing morbidity forecasts in various extreme weather scenarios, and defining work procedures for coping with them. MoH's readiness for climate change focuses on responding to the immediate health impact of extreme climate events such as heat waves, cold waves, and floods. In this context, it has elaborated a program to improve the adaptation of hospitals and medical services as part of emergency preparedness. MoH has also published information on climate change, including recommendations for coping with heat waves and extreme cold, with emphasis on recommendations for the general public and for vulnerable populations such as the elderly and the chronically ill.<sup>19–21</sup>

The Emergency and Health Committee, established under the Interministerial Administration for Climate Change Adaptation, has begun its work and is expected to recommend steps to prepare the healthcare system for climate change in both the short and the long terms. As part of this effort, MoH is conducting a comprehensive review of the health consequences of climate change and actions being taken internationally to address them. The review indicates that the greatest threats to human health from climate change include morbidity due to heat stress, aggravation of chronic diseases, diminished food security, and the spread of vector-borne infectious disease.<sup>22</sup>

### The challenge: Develop specific climate change indicators

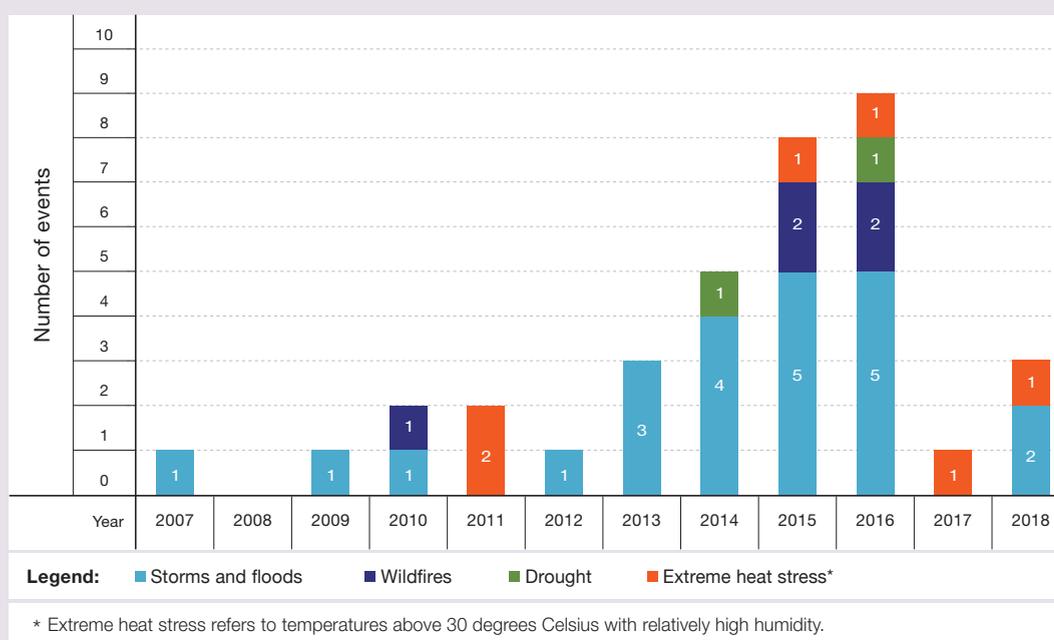
**In short:** An initial list of specific climate change indicators has been compiled.

MoH is in the initial stages of defining health-related climate change indicators, including:

- ♦ emergency room hospitalizations due to respiratory problems and stroke during heat waves;
- ♦ outbreaks of food- and water-borne diseases;
- ♦ outbreaks of vector-borne diseases;
- ♦ physical harm caused by extreme climatic conditions.

According to data published by the Information Center for the Study of Natural Disasters in Israel, the country experienced three extreme climate events in 2018 (Figure 4).<sup>23</sup>

#### Extreme Climate Events in Israel, 2007–2018



←  
**Figure 4**  
Israel Ministry of  
Construction &  
Housing<sup>23</sup>

### The challenge: Strengthen collaboration between the Israel Meteorological Service and the Ministry of Health in order to prepare for extreme climate events

**In short:** In 2019, MoH and IMS held several meetings but did not achieve significant progress in tackling this challenge.

### The challenge: Create a national database that includes exposure metrics and health indicators related to climate change

**In short:** No progress was made in meeting this challenge.

## Research on Climate Change in Israel

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- ♦ Researchers from the Shamir Research Institute and the University of Haifa, examining how temperature changes affect the activity of *Leishmania tropica* vectors (*Phlebotomus sergenti* and *Phlebotomus arabicus* sand flies), found a positive correlation between air temperature at the beginning of the night and the number of active adult sand flies. As temperature at those hours increased, there were more active adult sand flies, thus increasing the risk of human infection.<sup>15</sup>
- ♦ Researchers from Tel Aviv University, the University of Haifa, and MoH, studying morbidity caused by the *Campylobacter* bacterium (a food-borne bacterium that causes gastrointestinal diseases) in 1999–2010, found that higher temperatures during the year (above 27 degrees Celsius) increase the risk of morbidity in the general population and particularly among young children.<sup>24</sup>
- ♦ Researchers from Tel Aviv University, Ben-Gurion University of the Negev, the University of Haifa, and MoH, studying patterns of morbidity caused by the *Campylobacter* bacterium in Israel, found that the risk of developing *Campylobacter*-infection is higher in the spring than in the winter. They also found, however, that the risk of illness is affected by several variables including population density and temperature. The researchers concluded that there is a spatiotemporal ambient temperature effect on *Campylobacter* morbidity.<sup>25</sup>
- ♦ Researchers from MoH, the Ministry of Agriculture and Rural Development, Clalit Health Services, Ben-Gurion University of the Negev, the Hebrew University of Jerusalem, the Israel Institute for Biological Research, the Israel Nature and Parks Authority, the Israel Defense Forces (IDF), and Mekorot, the national drinking water supplier, analyzed the outbreak of leptospirosis that occurred in August 2018 in the streams of northeastern Israel. The disease is caused by exposure to *Leptospira* bacteria in the urine of infected animals. The researchers reported that the drop in stream levels and reduction in water quality following the drought in 2018 and previous years contributed to the outbreak.<sup>26, 27</sup>
- ♦ Researchers from MoH and Lev Academic Center analyzed patterns of shigellosis morbidity in Israel in 2002–2015. Shigellosis is transmitted through contact with *Shigella* bacteria in food or water or through human contact. The researchers showed that shigellosis morbidity in Israel has significantly declined, especially since 2010. They also found that most incidence of shigellosis occurred during the warm months of the year, implying that climate change and rising temperatures in Israel may spur an increase in shigellosis morbidity.<sup>28</sup>
- ♦ Researchers from MoH, Tel Aviv University, and several medical centers—Assaf Harofeh, Barzilai, Meir, Kaplan, HaEmek, Rambam, Laniado, and Sheba—found an association between the outbreak of West Nile fever in 2015 and extreme heat waves that year.<sup>29</sup>

- ♦ Researchers from the University of Haifa, Rambam Health Care Campus, and the Israel Center for Disease Control analyzed data from the National Stroke Registry to examine the association between high environmental temperatures in the summer and the risk of stroke. They found that while hot summer days may increase the risk of stroke in subsequent days, the risk of stroke decreases as the disparity between daytime and nighttime temperatures widens.<sup>30</sup>
- ♦ Researchers from the Hebrew University of Jerusalem, Ben-Gurion University of the Negev and Soroka University Medical Center studied the association between extreme temperatures and preterm birth among pregnant women in southern Israel. They found that exposure to high temperatures in weeks 32–39 of pregnancy is associated with a higher risk of preterm birth, especially among female fetuses.<sup>31</sup>
- ♦ A group of researchers from Soroka University Medical Center, Ben-Gurion University of the Negev, and Harvard University found that high mean temperatures during the first or third trimester of pregnancy increase the risk of developing preeclampsia. Preeclampsia can occur in high temperatures due to perturbations in maternal heat homeostasis, resulting in reallocation of energy resources and their availability to the fetus.<sup>32</sup>
- ♦ Researchers from the University of Haifa, Meuhedet Health Services, the University of Tulsa and the University of Córdoba compared concentrations of dust particles during a *hamsin* (days of high temperature and low humidity), on hot days (high temperature and high humidity), and on cold days (low temperature) and found the highest concentrations of dust particles in the air during a *hamsin*. Allergy sufferers experience stronger symptoms during a *hamsin* than on other days, and these symptoms may worsen as climate change brings on an increase in the number of *hamsin* days in Israel and the Middle East.<sup>33</sup>
- ♦ Researchers from the University of Haifa and the Hebrew University-Hadassah Braun School of Public Health and Community Medicine are examining urban resilience to extreme climate events in Haifa. The initial findings indicate that while Haifa and its healthcare system are prepared for emergencies such as war or earthquake, they have made no specific preparations for extreme weather.
- ♦ Joint research by Soroka University Medical Center and Harvard University found an association between high temperatures with low humidity and the number of snakebite incidents in Israel in 2008–2015. The researchers also found that heat waves led to a higher frequency of snakebites in both the cold and warm seasons.<sup>34</sup>
- ♦ A study conducted by researchers from Soroka University Medical Center and Harvard University among 2,338 residents of Beer Sheva found an association between a 5 degrees Celsius spike in temperature and suicide attempts during the two subsequent days. The researchers concluded that a steep rise in temperature has a substantial impact on the likelihood of suicidal behavior, especially among patients with a psychiatric diagnosis or with previous attempts at suicide.<sup>35</sup>

## Future Challenges

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In recent years, Israel has made some progress in preparing to adapt to climate change. The Interministerial Administration for Climate Change Adaptation and its committees were established; the Administration worked to rank the criticality of climate change effects as a basis for prioritizing projects and making decisions on primary courses of action. It appears that the main emphasis on health at the Administration for Climate Change Adaptation is on short-term effects such as heat waves, cold waves, and floods.

It is also important to prepare for the long-term effects of climate change on public health—for example, the expected increase in the spread of food pests, mosquitoes, and other vectors. Effective response is needed in case of spread of vector-borne infectious diseases such as leishmaniasis, Zika fever, dengue, West Nile fever, and rabies. Also needed are preparations for unknown viral, bacterial, and parasitic threats potentially related to climate change. In bracing for additional long-term effects of climate change, it is important to ensure that the nutritional value of food is preserved and that the impact of climate change on mental health is addressed.

While climate change may significantly affect public health in Israel, epidemiological research in Israel in this field is still in its very early stages. In particular, there is a lack of interdisciplinary research on the health effects of climate change with emphasis on morbidity and mortality among various populations—for example, examining the association between environmental temperature and hospitalization of chronically ill adults. Also needed is research in the fields of economics, the social sciences, and healthcare system management in the context of climate change. It would be useful, for example, to examine the health effects of climate change using co-benefit models, both in the contexts of mitigation and adaptation. To promote research in this field, relevant data must be systematically collected, and this requires the creation of a digital system capable of gathering the data in real time.

From a broader perspective, legislative action is needed in order to better cope with climate change and its impact on health. MoEP is drafting a “Climate Bill”—a statute that would make Israel’s emission targets binding for the first time.<sup>36</sup> Also, measurements and assessments of climate change should be incorporated into decision-making processes such as those related to planning. Additional partners should be enlisted in the effort to address the health implications of climate change. This includes HMOs and medical centers, which can collect data and raise medical teams’ awareness of the health effects of climate change as well as methods for treatment and prevention; and government ministries, which can advance adaptation plans for heat waves.

Local governments have a central role to play in preparing for climate change. As part of the EU’s Clima-Med program, representatives of forty Israeli local authorities participated in 2019 in a workshop on preparing and coping with the steady increase in consumption of energy resources. The local government committee of the Interministerial Administration for Climate Change Adaptation prepared an adaptation action plan at the local level that would, among other things, identify risks according to climatic regions. One of the challenges in the coming years is to raise involvement of local authorities in mitigation and preparedness for climate change.

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