

## Association between Non-Optimal Temperature and Excess Mortality in Qatar

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Heat related mortality is estimated to be far higher in the MENA than in any other region of the world. Qatar is a 100% urbanized flat country, and the ambient air and temperature conditions are hot during the summer months of June to October. In this policy brief, we quantify the monthly average total number of all-cause deaths during 2015-2020 and compare these deaths with the corresponding monthly average ambient temperatures to assess excess deaths during the summer and winter months. Our analysis contributes to the understanding of the unfolding association between non-optimal temperature and excess premature mortality. Qatar National Vision 2030 has integrated environmental protection and sustainability into its economic development plans. However, evidence-based climate mitigation and adaptation policies require greater priority.

Extreme heat is a climatic phenomenon of the planet that will increase over the years. Global climatic models predict that heat wave events associated with climate change and global warming will increase in frequency, duration, and intensity<sup>1</sup>. Heat waves and hot weather lasting for several days can have a significant impact on the population, including a rise in heat-related deaths, and are the major cause of environmental and weather-related fatalities.

During heat waves, the number of heat-related deaths tends to increase. People particularly at risk of death due to heat waves or cold conditions are people with preexisting heart and lung conditions. Moreover, populations in lower socioeconomic regions are more vulnerable to the effects of non-optimal temperatures on cardiovascular disease than those in higher socioeconomic regions<sup>2</sup>.

With global warming, extremely hot summer days are becoming more frequent and intense, reaching unprecedented temperatures associated with excess mortality<sup>3</sup>. More than five million people are estimated to die each year globally due to excessively hot or cold conditions<sup>4</sup>. Heat waves are among

the most dangerous natural hazards, but rarely receive adequate attention because their death tolls and destruction are not always immediately obvious. The impact of a long-duration heat wave (more than four days) is 1.5-5 times higher than that of a short duration heat wave<sup>5</sup>. Hot ambient air conditions are also likely to compound physical and mental fatigue, stress, and health losses in addition to productivity losses<sup>6</sup>.

The Middle East and North Africa (MENA) is one of the most vulnerable regions to the negative effects of climate change and heat waves, yet the potential health impacts have been underexplored compared to other regions<sup>7</sup>. The Gulf region is warming twice faster than the global average with temperatures hitting 50°C in the summer months<sup>8</sup>.

According to the Gulf Cooperation Council (GCC) Statistical Center, in the past 21 years the average temperature in the GCC countries has increased by 2.1°C. Heat related mortality is projected to be far higher in the MENA than in any other region of the world. Countries in the Arabian Gulf has already been factoring in summer temperatures that often rise above 50 °C. The MENA region countries of Iran, Iraq, Oman, Palestine, Qatar,

Saudi Arabia, and the UAE are projected to have high future mortality burdens from heat waves<sup>9</sup>.

Qatar is a 100% urbanized flat country, and the ambient air and temperature conditions are hot during the summer months of June to October with maximum temperatures of around 42/43°C. Fossil fuel is used to generate electricity with more than 60% of this electricity used to air-condition buildings. In addition to global warming, the heat waste from air-conditioning heats up the ambient air. This is accentuated in the hot summer months, with more heat being entrapped by the ambient air pollution. From June to October in Qatar, People working continuously in an extremely hot environment are vulnerable to fatal heat strokes. A study among Nepali male migrants in Qatar showed that mortality due to cardiovascular causes peaked during the hot summer months<sup>9</sup>.

In this policy brief, we examine an important aspect of climate mortality impacts, the heatwave or cold wave related excess deaths in Qatar. We quantify monthly average total number of all-cause deaths during 2015-2020 and compare these deaths with the corresponding monthly average ambient temperatures to assess excess deaths during the summer and winter months.

## Data Sources

This analysis is based on the following data sources:

**Planning and Statistics Authority:** Data on deaths were obtained from the annual bulletin of vital statistics on births and deaths for the years 2015 to 2020<sup>10</sup>. Temperature data for the same period were collected from the reports on Qatar's physical and climate features<sup>11</sup>.

**World Bank:** Climate Change Portal Qatar for Development Practitioners and Policy Makers<sup>12</sup>.

## Temperature Variations Associated with Mortality

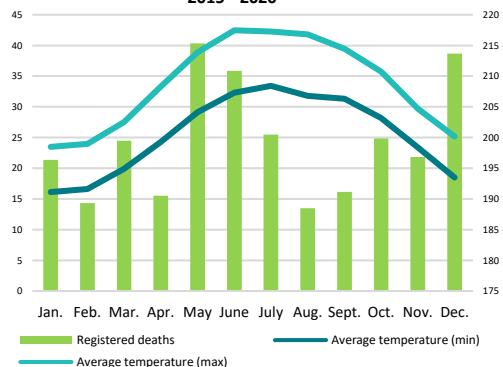
Figures 1, 2, and 3 compare the monthly average temperatures in Celsius and the average number of deaths during 2015–2020 for the total, male, and female populations, respectively, in Qatar. The six-year monthly averages of both temperatures and deaths are useful for understanding the underlying comparative trends of excess mortality associated with hot or cold temperatures. We considered six-year monthly averages to avoid random yearly fluctuations. The hot temperature season lasts for 4.4 months, from May 12 to September 24, with July being the hottest month with an average high of 42°C (Figure 4).

Figures 1 and 2 show the excess deaths for the hot summer months of May to July as well the winter month of December. Excess deaths are observed to be higher among males than females in Qatar. The reasons include higher risk exposure of males than females to the ambient temperature in the hot summer months. Compared to the monthly average number of 198 deaths over 12 months, the monthly average number of deaths observed for the summer months of May–July and the winter month of December was 215, suggesting around 8% excess deaths for these months. For males, the number of deaths ranged up to 155 for these four months compared to a monthly average of 140 deaths across 12 months, suggesting around 10% excess deaths for males in the summer months. For females, no clear pattern of excess deaths was observed.

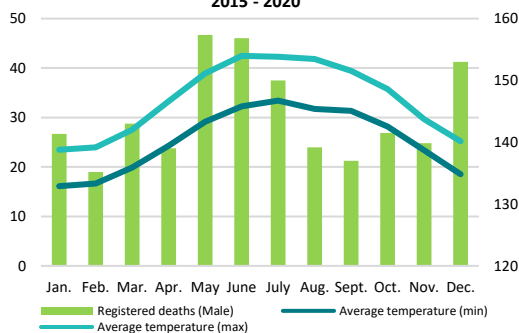
In the absence of detailed mortality data by age, occupation, and nationality, the above pattern provides only preliminary

evidence of heat- or cold-associated excess mortality in Qatar. Zhoë et al. (2021) showed that exposure to both heat or cold is associated with substantial excess mortality but with notable differences across geographical areas and population sub-groups. Around 90 percent of Gulf states population live in urban areas - most of which are located along the coast and often have a high concentration of buildings, roads, infrastructure, and industry, exposing them to climate hazards<sup>10</sup>.

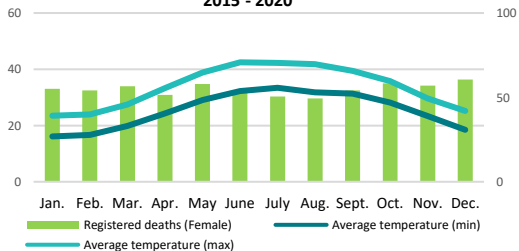
**Figure 1: Average Number of Death Rates and Temperatures by Month in Qatar 2015 - 2020**



**Figure 2: Average Males Death Rates and Temperatures by Month in Qatar 2015 - 2020**



**Figure 3: Average Females Death Rates and Temperatures by Month in Qatar 2015 - 2020**



The overall pattern of excess deaths during the summer months of May–July and the winter months of December–January suggests a non-optimal temperature-associated excess mortality risk in Qatar. Although people living in different climatic regions may acclimatize or adapt to low or high temperatures, populations with preexisting chronic health conditions are likely to be more vulnerable to temperature shocks.

While some studies suggest that seasonality tends to have confounding effects on temperature–mortality associations, others argue that the association between season and mortality need not be wholly mediated through temperature<sup>13</sup>.

Our preliminary analysis of temperature and all-cause mortality data contributes to the understanding of the unfolding association between non-optimal temperature and excess premature mortality. Beyond this preliminary assessment, more in-depth research is needed to assess the associations between climate, health, and mortality in Qatar to inform public policy on climate change, environmental health risks, and mortality impact. Future studies need to consider standardized mortality rates, heat wave durations, seasonality, and preexisting health conditions to uncover the complex association between climate, environmental health risks and the impact on mortality and disability.

In terms of policy inference, Qatar is implementing heat wave mitigation policies and greater adaptation measures and diversification of energy sources. Qatar’s 2021 worker protection regulation prevents workers being in outdoor spaces between 10:00 AM and 3:30 PM from June 1 to September 15. In the last two years, this policy is considered to have contributed to significantly reducing the number of injuries and heatstroke caused by occupational heat stress<sup>14</sup>. A study that aimed to assess the human capacity

exercise in environments at high and very high temperatures in Qatar in 2022 showed specific seasonality of risk based on monthly categorizations and how the seasonality of the highest heat risks may expand later in the century, particularly for higher emission pathways<sup>15</sup>.

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## Policy Recommendations

1. The pattern of non-optimal ambient temperature-associated excess mortality risk is expected to accelerate in the future. This calls for more advanced diagnostic and health system preparedness to prevent heat associated mortality.
2. Qatar has integrated environmental protection and sustainability into their economic development plans, but evidence-based climate mitigation and adaptation policies require greater priority.
3. Addressing higher CO<sub>2</sub> and pollution emission pathways for health promotion require urgent policy efforts.
4. In accordance with COP 28 call for action, the Gulf countries need to raise momentum to further enhance their climate action policy ambitions and implementation.