Global Suicide Rates and Climatic Temperature

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ABSTRACT

Global suicide rates vary by country¹, yet the cause of this variability has not yet been explained satisfactorily^{2,3}. In this study, we analyzed averaged suicide rates⁴ and annual mean temperature in the early 21st century for 183 countries worldwide, and our results suggest that suicide rates vary with climatic temperature. The lowest suicide rates were found for countries with annual mean temperatures of approximately 20 °C. The correlation suicide rate and temperature is much stronger at lower temperatures than at higher temperatures. In the countries with higher temperature, high suicide rates appear with its temperature over about 25 °C. We also investigated the variation in suicide rates with climate based on the Köppen–Geiger climate classification⁵, and found suicide rates to be low in countries in dry zones regardless of annual mean temperature. Moreover, there were distinct trends in the suicide rates in island countries. Considering these complicating factors, a clear relationship between suicide rates and temperature is evident, for both hot and cold climate zones, in our dataset. Finally, low suicide rates are typically found in countries with annual mean temperatures within the established human thermal comfort range. This suggests that climatic temperature may affect suicide rates globally by effecting either hot or cold thermal stress on the human body.

KEYWORDS

Suicide rate, Climatic temperature, Human thermal comfort, Köppen–Geiger climate classification

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MAIN TEXT

Suicide rates vary globally but tend to remain temporally stable in each country¹. Although suicide can be considered an individual act, suicide rates have been analyzed in relation to both socio-economic² and meteorological³ factors. However, the dominant factors controlling variations in suicide rates have not yet been constrained. Year-to-year variations in suicide rates within particular regions or countries can be explained, to some extent, by socio-economic factors such as economic crises⁶. However, as Rehkopf & Buka² revealed in a systematic review, the relationship between suicide rates and socio-economic factors is less pronounced in cross-sectional studies than in time-series (longitudinal) studies, and uncertainty in this relationship increases with increasing scale of the region examined. For example, almost all community-level studies undertaken to date have reported inverse relationships with lower rates of suicide in higher socio-economic areas, yet only half of similar country-level studies have demonstrated such a relationship². In cross-sectional analysis at the global level, the high suicide rates in wealthy countries (such as the Nordic states) makes it difficult to explain differences in global suicide rates based on socio-economic factors alone.

Suicide rates have previously been investigated with reference to meteorological conditions³. The seasonal variation in suicide rates has, in particular, been seen as evidence supporting the idea of a relationship between suicide and meteorological factors^{7,8}. Recent studies have reported an increase in the number of suicides occurring on days with high temperatures⁹, which is of interest to researchers as it suggests that climate change could increase the risk of suicide. Conversely, in a cross-sectional analysis of Europe, Fountoulakis et al.¹⁰ reported that countries with lower annual mean temperatures tended to have higher suicide rates and that low temperatures predict suicide rates more accurately than GDP per capita. These seemingly conflicting results may indicate that the effects of temperature on suicide rates depend on the temporal scale of change being considered. More specifically, weather temperature (i.e., daily or seasonal fluctuations in temperature) and climatic temperatures (such as that represented by annual mean temperature) could have different effects on suicide rates.

To clarify the relationship between suicide rates and climatic temperature, we analyzed differences between suicide rates and climate in 183 countries worldwide, focusing primarily on annual mean temperature. Annual mean temperatures were obtained for each country by taking the mean of the period 2000–2009 from Meteonorm¹¹, a global meteorological database. Temperature data from the most populous city in each country, or from another appropriate city were used, the latter when no observations were available for the former. All of the stations selected can be identified using the World Meteorological Organization (WMO) station index number (Extended Data Table 1). We used suicide rate data (per 100,000 people) at the country level, as published by the World Health Organization (WHO)⁴ for the years 2000, 2005, 2010, 2015, and 2016, and the mean values calculated

from these data. The climate and suicide rate data do not cover exactly the same periods; however, we decided to include data from as many years as possible to best capture the average suicide rate. In addition, we used country-level gross domestic product (GDP) per capita for the years 2000–2016, as published by the World Bank¹², as an indicator of the economic characteristics of each country. Additionally, we classified the most populous cities in each country by climate zones following the Köppen–Geiger climate classification for the 50-year period 1951–2000⁵.

Figure 1 illustrates the relationship between suicide rates and annual mean temperatures in countries worldwide. Suicide rates reach a minimum at $\sim 20^{\circ}\text{C}$ and broadly increase as temperatures both increase and decrease from there. A linear correlation between suicide rate and temperature is evident for low temperatures. High suicide rates occur in a number of countries with annual mean temperatures exceeding 25°C , although any correlation between these factors is not very clear. Similar trends were observed in both males and females, although the correlation is stronger for males (Extended Data Fig. 1). Additionally, the overall distribution of global suicide rates cannot be explained by GDP per capita alone (Fig. 1; see also Extended Data Fig. 2).

Fig. 1| Correlation of annual mean temperature and suicide rate for both sexes globally. Countries are categorized based on the Köppen–Geiger classification and denoted by different markers colored according to the average GDP per capita for the years considered. Error bars indicate minimum–maximum range in annual suicide rate for each country. The broken line shows global average suicide rate (9.94 per 100,000 people).

To investigate the relationship between temperature and suicide rate in more detail, we also classified our dataset according to the Köppen–Geiger climate classification⁵. We found a weak correlation between temperature and suicide rate, particularly in dry zone countries (Fig. 1). This could be due to the influence of climatic factors apart from temperature, such as humidity. For example, the correlation between temperature and absolute humidity (water vapor pressure) is very weak in dry zone countries, which is contrary to that for other climatic zones (Extended Data Fig. 3). Moreover, we found that suicide rates in island countries exhibit a different pattern to those in other countries with similar annual mean temperatures, which suggests that it is necessary to consider geographical features unique to those countries. When dry zone countries and island countries are excluded, the correlation between suicide rate and temperature is much stronger for both hot and cold regions (Extended Data Fig. 4).

The range in annual mean temperature at which suicide rates are low coincides with the temperature range that has been established as suitable for human thermal comfort; the WHO¹³ states that 18–24 °C is a comfortable and healthy temperature range for the human body. Ambient temperature and climatic annual mean temperature cannot be considered equivalent owing to the effects of daily or seasonal temperature fluctuations. However, annual mean temperatures can be considered representative of the length of time for which people resident in a given country may be exposed to a comfortable range of temperatures. Therefore, the correspondence between low suicide rates and the temperature range for human thermal comfort suggests that climatic temperature could affect suicide rates by inducing thermal stress in both hot and cold climates.

Of course, climatic temperature alone cannot explain all variations in global suicide rates; investigating other factors create these differences is also important. However, an improved understanding of the relationship between suicide rates and climatic temperature offered by the present study could help with analyzing the effects of other factors. For example, suicide rates in Nordic countries are higher than global average; previously, this has been attributed social issues¹. However, our results demonstrate that these suicide rates are relatively lower than those in other countries with similarly severe cold climates (Fig. 1). The latter could be explained in terms of economic wealth (based on GDP per capita), as wealthier populations can more easily procure necessities to protect them against cold. In order to make better use of these findings, the relationship between suicide rates, socio-economic factors, and climatic temperature should be analyzed in large-scale cross-sectional studies covering a larger region.

There are still several suicide phenomena related to meteorological factors that remain to be understood. For example, suicide seasonality exhibits a pronounced peak during spring or early

summer⁸, and recent previous studies have demonstrated the possibility of a positive relationship between high temperature and high suicide rates⁹. It seems that these phenomena cannot be interpreted as effects of thermal comfort because similar phenomena have also been observed in countries that are generally cold⁷. If the relationship between suicide and temperature were just a matter of thermal comfort, the number of suicides would decrease on warm days or seasons in cold countries. Therefore, we suggest that the effects of temperature on suicide rates may vary depending on the temporal scale of the change being considered and that different causal mechanisms may be responsible at different scales. Moreover, the lack of any clear relationship between suicide rates and temperature in dry zones suggests that other meteorological factors may be important; for example, humidity is known to be important for both thermal comfort and human health in general¹⁴. We posit that the relationship between suicide rate and temperature presented here is likely part of a broader, more complex mechanism that includes the interaction of temperature with other meteorological factors. Furthermore, we acknowledge that suicide is not affected only by climate, but is a complex phenomenon involving geographical, social and other factors, and the contributions of these merit further investigation. Nevertheless, we believe that we have, for the first time, demonstrated the link between climatic temperature and suicide rates on a global scale. Our findings help to better explain the various factors affecting global suicide rates.

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METHODS

All data sets used for analysis in this paper are publicly available. We collected data from the WHO Global Health Observatory⁴ and the World Bank Open Data¹², and Meteonorm 7.3¹¹. Detailed information for each data set is provided in the paper (Extended Data Table 1).

EXTENDED DATA

All country data used in our study are presented below in Extended Data Table 1. For suicide rates in each year, see the data published by WHO⁴. Some supplementary figures (Extended Data Fig. 1–4) are also provided to help demonstrate the scientific value and authenticity of our results to reviewers.

Extended Data Table 1 | All data used in this study

Country	Averaged suicide rates for 2000, 2005, 2010, 2015 and 2016 (per 100,000 people)			Annual mean temperature for 2000–2009 [°C]	The city at which the weather data we used (*)		GDP per capita [USD]	Köppen–Geiger climate classification	Island country
	Both sexes	Male	Female		City	WMO station index number			
Afghanistan	5.32	8.96	1.38	12.8	Kabul	409480	427	Dsb	
Albania	6.46	8.02	4.88	16.5	Tirana	136150	3272	Csa	
Algeria	3.52	5.06	1.98	17.9	Dar El Beida	603900	3764	Csa	
Angola	6.1	9.22	3.12	25.8	Luanda	661600	2980	BSh	
Antigua and Barbuda	0.96	1.42	0.5	26.9	Coolidge*	788620	13010	Af	Yes
Argentina	9.04	14.78	3.56	18.0	Buenos Aires	875820	8763	Cfa	
Armenia	5.46	9.06	2.24	11.8	Yerevan	377890	2566	Dfa	
Australia	13	19.5	6.52	18.3	Sydney	947680	43438	Cfa	
Austria	16.98	26.08	8.36	11.1	Vienna	110350	41692	Cfb	
Azerbaijan	2.76	4.44	1.12	15.1	Baku	378640	4009	BSk	
Bahamas	1.94	3.32	0.6	26.0	Nassau	780730	29351	Aw	Yes
Bahrain	6.14	8.58	2.42	27.1	Muharraq*	411500	19542	BWh	Yes
Bangladesh	6.28	4.78	7.76	25.2	Dhaka	149170	726	Aw	
Barbados	1.88	2.52	1.26	27.3	Bridgetown	809960	14911	Am	Yes
Belarus	35.78	63.72	11.36	7.6	Minsk	268500	4620	Dfb	
Belgium	21.2	29.32	13.38	11.4	Antwerp	64500	38995	Cfb	
Belize	4.96	8.16	1.82	27.4	Belize City	785830	4178	Am	
Benin	9.72	13.58	5.98	27.5	Cotonou	653440	687	Aw	
Bhutan	11.74	14.32	8.88	None	None	None	1842	Cwb	
Bolivia	14.08	17.72	10.38	25.0	Sant Cruz de la Sierra	852450	1814	Aw	
Bosnia and Herzegovina	9.14	14.72	3.74	10.5	Sarajevo	146540	3817	Cfb	
Botswana	10.9	17.24	4.7	20.7	Gaborone	682400	5777	BSh	
Brazil	5.8	8.94	2.72	20.3	São Paulo	837800	7691	Cfa	
Brunei Darussalam	3.78	5.36	2.08	27.6	Bandar Seri Begawan	963150	30723	Af	Yes
Bulgaria	13.46	20.64	6.62	10.7	Sofia	156140	5411	Cfb	
Burkina Faso	7.74	10.6	4.98	28.8	Quagadougou	655030	490	BSh	
Burundi	8.5	12.06	5.04	24.5	Bujumbura	633900	200	Aw	
Cabo Verde	10.58	15.16	6.12	23.8	Sal Island**	85940	2742	BWh	Yes
Cambodia	5.5	7.88	3.24	28.9	Phnom Penh	489910	708	Am	
Cameroon	12.28	17.02	7.54	26.7	Douala	649100	1152	Am	
Canada	12.84	18.88	6.9	8.9	Toronto	716240	40124	Dfb	
Central African Republic	8.58	12.64	4.6	25.8	Bangui	646500	388	Aw	
Chad	8.58	9.6	7.56	28.7	N'Djamena	647000	678	BSh	
Chile	11.04	18.24	3.94	14.8	Santiago	855740	10248	Csb	
China	11.02	9.72	12.38	17.5	Shanghai	583670	3947	Cfa	

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Colombia	7.4	11.8	3.06	13.3	Bogota	802220	4999	Cfb	
Comoros	6.36	9.22	3.42	27.2	Moroni	670010	1171	Af	Yes
Congo	7.7	10.74	4.62	25.5	Brazzaville	644500	2064	Aw	
Costa Rica	7.92	13.54	2.28	22.7	San Jose	787620	7117	Am	
Cote d'Ivoire	12.46	17.88	6.86	27.4	Abidjan	655780	none	Am	
Croatia	18.88	28.98	9.44	13.7	Zagreb	142360	11434	Cfb	
Cuba	14.48	22.14	6.8	24.3	Havana	782240	5170	Aw	Yes
Cyprus	4.14	6.14	2.12	19.7	Athalassa	176070	25553	BSh	Yes
Czechia	15.14	25.02	5.66	9.0	Praha	115180	15797	Cfb	
Democratic People's Republic of Korea	11.08	13.66	8.66	11.0	Pyongyang	470580	none	Dwa	
Democratic Republic of the Congo	5.9	8.64	3.18	25.8	Kinshasa	642100	326	Aw	
Denmark	13.92	18.7	9.22	9.1	Copenhagen	61800	51380	Cfb	
Djibouti	6	7.84	4.1	29.9	Djibouti City	631250	2568	BWh	
Dominican Republic	8.98	14.88	3.12	26.4	Santo Domingo	784860	6203	Aw	Yes
Ecuador	8.04	11.6	4.48	25.0	Guayaquil	842030	4067	Aw	
Egypt	3.62	5.72	1.46	22.5	Cairo	623660	2196	BWh	
El Salvador	12.36	20.7	4.86	25.3	San Salvador	786630	2859	Aw	
Equatorial Guinea	15.76	23.4	6.88	None	None	None	12751	Af	
Eritrea	9.4	14.1	4.72	19.6	Asmara	630210	452	BSh	
Estonia	20.78	35.52	7.9	6.3	Tallinn	260380	13417	Dfb	
Eswatini	12.38	18.68	6.48	22.1	Manzini/Matsapa*	683960	3189	Cwb	
Ethiopia	7.52	11.6	3.44	16.7	Addis Ababa	634500	324	Cwb	
Fiji	4.52	6.46	2.5	25.0	Suva	916900	3863	Af	Yes
Finland	18.84	28.1	9.9	6.0	Helsinki	29740	41655	Dfb	
France	19.86	27.1	12.88	12.5	Paris	71560	36258	Cfb	
Gabon	6.82	10.3	3.24	26.5	Libreville	645000	7440	Am	
Gambia	5.54	7.04	4.12	None	None	None	669	Aw	
Georgia	6.84	11.68	2.4	11.0	Tbilisi	375490	2721	Cfa	
Germany	13.88	20.54	7.48	9.8	Berlin	103840	37968	Cfb	
Ghana	4.74	7.5	2.02	27.3	Accra	654720	1112	Aw	
Greece	4	6.6	1.5	18.4	Athens	167160	21883	Csa	
Grenada	1.66	2.38	0.94	27.4	St. George's	789580	7015	Aw	Yes
Guatemala	3.02	4.36	1.72	19.3	Guatemala City	786410	2666	Cwb	
Guinea	6.48	7.74	5.22	27.5	Conakry	618320	575	Am	
Guinea-Bissau	4.3	4.98	3.66	27.2	Bissau	617660	509	Aw	
Guyana	26.58	39.5	13.52	26.8	Georgetown	722547	2504	Af	
Haiti	10.36	15.2	5.62	27.3	Port-au-Prince	784390	608	Aw	Yes
Honduras	2.6	3.84	1.4	22.1	Tegucigalpa	787200	1681	Cwa	
Hungary	24.92	39.6	11.64	11.6	Budapest	128430	11436	Cfb	
Iceland	13.94	21.3	6.54	5.5	Reykjavik	40300	47910	Cfc	Yes
India	16.86	18.04	15.58	24.9	Mumbai	430030	1048	Aw	
Indonesia	3.62	5.06	2.2	25.8	Jakarta	967470	2250	Af	Yes
Iran	7.22	8.76	5.6	18.4	Tehran	407540	4587	Csa	
Iraq	2.82	3.34	2.24	None	None	None	4500	BWh	
Ireland	11.86	18.9	4.88	9.8	Dublin	39690	49260	Cfb	Yes
Israel	6.56	10.1	3.06	20.8	Lod*	401800	27484	Csa	
Italy	7.7	11.46	4.16	15.9	Roma	162390	32040	Csa	
Jamaica	2.1	3.3	0.9	28.0	Kingston	787930	4382	Aw	Yes
Japan	22.38	32.22	12.96	16.6	Tokyo	476620	38732	Cfa	Yes
Jordan	3.02	3.74	2.28	18.0	Amman	402700	3019	BSh	
Kazakhstan	30.7	52.88	10	9.8	Almaty	368700	6991	Dfa	
Kenya	3.54	5.66	1.42	19.3	Nairobi	637400	837	Cfb	
Kiribati	14.2	23.32	5.38	27.3	Tarawa Island	914890	1325	Af	Yes
Kuwait	2.16	2.56	1.66	26.9	Kuwait City	405820	35847	BWh	
Kyrgyzstan	10.24	16.68	3.94	12.1	Bishkek (Frunze)	383530	782	Dfb	
Lao People's Democratic Republic	9.1	12	6.22	25.2	Viang Chan	489400	1044	Aw	
Latvia	25.38	44.78	8.92	7.5	Riga	264220	10585	Dfb	
Lebanon	3.18	4.04	2.34	21.2	Bayrouth	401000	6176	Csa	
Lesotho	19.78	16.44	22.88	None	None	None	918	Cwb	
Liberia	6.46	6.86	6.06	27.4	Harbel*	656600	474	Am	
Libya	5.14	7.74	2.4	21.0	Tripoli	620100	8052	BSh	
Lithuania	39.74	70.14	13.52	7.0	Vilnius	267300	10677	Dfb	
Luxembourg	14.44	20.66	8.26	9.9	Luxembourg	65900	91184	Cfb	
Madagascar	4.28	6.08	2.48	18.7	Antananarivo	670830	406	Cwb	Yes
Malawi	4.36	7	1.8	21.7	Lilongwe	675851	337	Cwa	
Malaysia	5.34	7.58	3.02	27.8	Kuala Lumpur	486470	7568	Af	

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Maldives	3.16	4.06	2.06	28.7	Male	435550	5842	Am	Yes
Mali	4.96	7.16	2.8	27.7	Bamako	612910	603	Aw	
Malta	7.12	11.28	2.94	18.9	Luga/Qrendi*	165970	18950	Csa	Yes
Mauritania	3.9	5.84	1.92	25.5	Nouakchott	614420	995	BWh	
Mauritius	8.86	14.02	3.76	24.1	Plaisance	619900	7065	Am	Yes
Mexico	4.64	7.48	1.84	16.8	Mexico City	766793	8916	Cwb	
Micronesia	11.26	15.48	6.92	27.9	Pohnpei	913480	2626	Af	Yes
Mongolia	15.54	26.08	5.14	-0.8	Ulan Bator	442920	2217	BSk	
Montenegro	10.5	15.24	5.9	15.8	Podgorica	134620	5216	Cfa	
Morocco	4.34	3.46	5.22	18.4	Casablanca	601550	2418	Csa	
Mozambique	6.18	9.2	3.34	23.7	Maputo	673410	477	Aw	
Myanmar	7.54	5.38	9.56	27.6	Yangon	480970	664	Am	
Namibia	9.88	16.04	4.04	20.4	Windhoek	681100	4138	BSh	
Nepal	11.26	12.04	10.48	19.0	Kathmandu	444540	487	Cwa	
Netherlands	10.96	14.56	7.38	10.9	Amsterdam	62400	44610	Cfb	
New Zealand	12.68	19.06	6.56	15.3	Auckland	931190	30371	Cfb	Yes
Nicaragua	13.7	21.18	6.42	27.6	Managua	787410	1448	Aw	
Niger	4.74	5.94	3.48	29.8	Niamey	610520	301	BSh	
Nigeria	9.78	9.42	10.14	27.5	Lagos	652010	1843	Aw	
Norway	12.64	16.8	8.42	7.1	Oslo	14920	74417	Dfb	
Oman	3.88	5.78	0.9	28.2	Muscat	412560	15325	BWh	
Pakistan	3.16	2.84	3.52	27.0	Karachi	417800	916	BWh	
Panama	5.12	8.72	1.48	27.3	Tocumen*	787920	7829	Am	
Papua New Guinea	6.06	8.52	3.52	26.9	Port Moresby	920350	1617	Af	Yes
Paraguay	9.78	12.96	6.5	23.3	Asuncion	862180	3526	Cfa	
Peru	4.82	7	2.68	19.1	Lima	846280	4220	BWh	
Philippines	2.96	4.14	1.8	27.2	Maynila*	984300	1853	Af	Yes
Poland	17.04	30.16	4.78	9.0	Warszawa	123750	10215	Cfb	
Portugal	11.98	18.98	5.54	16.8	Lisboa	85350	19316	Csa	
Qatar	5.16	6.72	0.92	28.2	Doha	411700	59123	BWh	
Republic of Korea	26.18	35.88	16.42	12.9	Seoul	471080	20374	Dwa	
Republic of Moldova	17.76	31.32	5.22	10.8	Kishinev	338150	1487	Dfb	
Romania	12.34	21.02	4.16	11.9	Bucharest	154200	6675	Cfa	
Russian Federation	41.46	74.28	12.86	6.3	Moscow	276120	8441	Dfb	
Rwanda	9.5	12.62	6.5	None	None	None	472	Aw	
Saint Lucia	6.22	10.98	1.62	27.6	Vieux Fort*	789480	7221	Af	Yes
Saint Vincent and the Grenadines	4.92	8.5	1.26	None	None	None	5711	Af	Yes
Samoa	5.74	8.78	2.44	26.7	Apia	917590	3044	Af	Yes
Sao Tome and Principe	2.08	2.76	1.4	26.8	Sao Tome	619310	none	As	Yes
Saudi Arabia	3.12	4.5	1.34	27.3	Riyadh	404380	16900	BWh	
Senegal	6.98	10.54	3.58	24.6	Dakar	616410	1110	BSh	
Serbia	17.26	25.26	9.62	13.1	Beograd	132740	4782	Cfa	
Seychelles	9.18	15.92	2.48	27.3	Anse des Genets*	639800	11333	Af	Yes
Sierra Leone	9.94	11.76	8.2	27.3	Freetown	618560	404	Am	
Singapore	10.58	14.16	7.1	27.8	Singapore	486980	40278	Af	Yes
Slovakia	13.54	23.64	3.98	11.2	Bratislava	118160	13849	Cfb	
Slovenia	23.96	37.72	10.6	11.2	Ljubljana	140150	19985	Cfb	
Solomon Islands	6.84	9.32	4.24	27.0	Honiara	915201	1317	Af	Yes
Somalia	4.64	6.2	3.1	31.3	Berbera*	631600	296	BWh	
South Africa	11.8	18.56	5.24	16.0	Johannesburg	683680	5447	Cwb	
South Sudan	4.18	5.48	2.86	25.3	Juba	629410	1433	Aw	
Spain	8.1	12.26	4.1	14.5	Madrid	82210	26434	Csa	
Sri Lanka	20.08	31.88	8.74	27.3	Colombo	434660	2210	Af	Yes
Sudan	8.08	12.18	3.98	30.5	Khartoum	627210	1266	BWh	
Suriname	24.72	38.08	11.26	26.3	Paramaribo	8120016	5834	Af	
Sweden	15.56	20.62	10.5	7.8	Stockholm	24640	47460	Dfb	
Switzerland	18.62	24.36	13.02	9.9	Zurich	66600	65779	Cfb	
Syrian Arab Republic	1.72	2.68	0.76	18.0	Aleppo	400070	1464	Csa	
Tajikistan	2.68	3.9	1.42	15.9	Dushanbe	388360	598	Dsb	
Thailand	14.44	22.64	6.56	29.1	Bangkok	484550	4130	Aw	
Republic of North Macedonia	7.3	10.62	3.96	12.4	Skopje	135860	3853	Cfb	
Timor-Leste	6	8.14	3.8	27.4	Dili	973900	2663	Aw	Yes
Togo	9.6	12.86	6.38	27.3	Lome	653870	482	Aw	
Tonga	3.52	4.14	2.88	24.2	Tongatapu	917920	3193	Af	Yes
Trinidad and Tobago	13.78	22.44	5.3	26.9	Piarco*	789700	14587	Am	Yes
Tunisia	3.5	4.78	2.24	19.5	Tunis	607150	3535	Csa	
Turkey	7.56	11.92	3.32	11.3	Ankara	171300	8646	Csb	

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Turkmenistan	8.46	13.2	3.86	17.6	Ashgabat	388800	3786	BSk	
Uganda	10.38	10.7	10.1	21.9	Kampala	636800	474	Af	
Ukraine	28.8	51.82	8.9	9.0	Kiev	333450	2363	Dfb	
United Arab Emirates	2.98	3.86	0.84	28.4	Dubai	411940	37801	BWh	
United Kingdom of Great Britain and Northern Ireland	8.54	12.84	4.42	12.4	London	37790	40276	Cfb	Yes
United Republic of Tanzania	5.7	8.14	3.3	26.1	Dar es Salaam	638940	667	Aw	
United States of America	13.34	20.76	6.1	13.2	New York City	725030	47022	Cfa	
Uruguay	17.42	28.1	7.42	16.4	Paso de Carrasco*	865800	9876	Cfa	
Uzbekistan	6.84	9.68	4	16.1	Tashkent	384570	1308	Csa	
Vanuatu	5.42	7.88	2.88	24.7	Port Vila	915570	2383	Af	Yes
Venezuela	5.14	8.68	1.62	27.7	Caracas	804150	8760	Aw	
Viet Nam	6.98	10.46	3.62	27.4	Ho Chi Minh	489000	1163	Aw	
Yemen	8.16	10.94	5.26	19.7	Sanaa	414040	1078	BWk	
Zambia	6.62	9.52	3.8	20.8	Lusaka	676650	1100	Cwa	
Zimbabwe	12	18.32	6	19.1	Harare	677750	837	Cwb	

* in “the city at which the weather data we used” means that the city is not the most populous one.

a. Male

b. Female

Extended Data Fig. 1| Correlation between annual mean temperature and global suicide rate for males and females. Countries have been categorized according to the Köppen–Geiger classification, denoted by markers colored according to the average GDP per capita in the years considered. Error bars indicate the minimum–maximum range in annual suicide rate for each country. The broken line shows global average suicide rate (14.8 and 5.23 per 100,000 males and females, respectively).

Extended Data Fig. 2| Correlation between average GDP per capita and global suicide rate for both sexes. Countries have been categorized according to the Köppen–Geiger classification, denoted by markers colored according to average GDP per capita in the years considered. Error bars indicate the minimum–maximum range in annual suicide rate for each country. The broken line shows average global suicide rate (9.94 per 100,000 people).

Extended Data Fig. 3| Correlation between annual mean temperature and vapor pressure worldwide. Countries have been categorized according to the Köppen–Geiger classification, denoted by markers colored according to the suicide rate for both sexes.

a. Male

b. Female

Extended Data Fig. 4| Correlation between annual mean temperature and suicide rate for males and females globally, excluding countries in dry zones and island countries. Countries have been categorized according to the Köppen–Geiger classification, denoted by markers colored according to average GDP per capita in the years considered. Error bars indicate minimum–maximum range in annual suicide rate for each country.