TEXT S1

Population growth, immigration and emigration, and mortality rates

Population growth rate due to births $\big(b(t)\big)$, the rate at which people leave the population through natural mortality and/or emigration ($\mu(t,a)$), and the immigration rate $\big(m(t,a)\big)$ were parametrized with the following functions, providing a good fit for population growth and demographic age structure of each nationality group in Qatar:

$$b(t) = a_0 e^{-\left(\frac{t-t_0}{b_0}\right)^2}$$

and

$$\mu(t,a) = f(a)\frac{a_1 e^{-\left(\frac{t-t_1}{b_1}\right)^2}}{\left[1+e^{-b_2(a-a_2)}\right]}$$

and

$$b(t) = a_3 e^{-\left(\frac{a-a_4}{b_3}\right)^2} a_5 e^{-\left(\frac{t-t_2}{b_4}\right)^2}$$

Here, the parameters a_0, a_1, a_2, a_3, a_4, a_5, t_0, t_1, t_2, b_0, b_1, b_2, b_3, b_4, and $f(a)$ were obtained by fitting the model to the demographic data for each nationality group obtained from Qatar's Planning and Statistics Authority[1][2]; the Gulf Labour Markets, Migration, and Population Programme[3]; and the Population Division of the United Nations Department of Economic and Social Affairs[4].

ADDITIONAL TABLES

Table S1. Model assumptions in terms of parameter values.

Assumption	Age group	Parameter value (95% CI)		Reference
		Male	**Female**	
Number of age compartments in the model (each for 5 years; a)	-	20	20	-
Relative risk of developing T2DM if obese[∈] (pooled mean and 95% CI; $\left(RR_O\right)$)	All	6.48 (5.17–8.13)	8.38 (5.46–12.85)	5
Relative risk of developing T2DM if current smoker[∈] $\left(RR_S\right)$	All	1.42 (1.34–1.50)	1.33 (1.26–1.41)	6
Relative risk of developing T2DM if physically inactive[∈] $\left(RR_F\right)$	15–69 70–79 ≥80	1.45 (1.37–1.54) 1.32 (1.25–1.40) 1.20 (1.14–1.28)	1.45 (1.37–1.54) 1.32 (1.25–1.40) 1.20 (1.14–1.28)	7
Relative risk of developing T2DM if obese and smoker[∈] $\left(RR_{OS}\right)$	All	9.20 (6.93–12.20)	11.15 (6.88–18.12)	Multiplicative effect calculated based on 5 6
Relative risk of developing T2DM if obese and physically inactive[∈] $\left(RR_{OF}\right)$	15–69 70–79 ≥80	9.40 (7.08–12.52) 8.55 (6.46–11.38) 7.78 (5.89–10.41)	12.15 (7.48–19.79) 11.06 (6.83–18.12) 10.06 (6.22–16.45)	Multiplicative effect calculated based on 5 7
Relative risk of developing T2DM if smoker and physically inactive[∈] $\left(RR_{SF}\right)$	15–69 70–79 ≥80	2.06 (1.84–2.37) 1.87 (1.68–2.17) 1.70 (1.53–1.97)	1.93 (1.73–2.17) 1.76 (1.58–1.99) 1.60 (1.44–1.80)	Multiplicative effect calculated based on 6 7
Relative risk of developing T2DM if obese, smoker, and physically inactive[∈] $\left(RR_{OSF}\right)$	15–69 70–79 ≥80	13.34 (9.49–19.28) 12.15 (8.66–17.65) 11.04 (7.90–16.03)	16.16 (9.43–27.90) 14.71 (8.60–25.55) 13.37 (7.84–23.19)	Multiplicative effect calculated based on 5-7
RR of mortality in T2DM as compared to the general population[¥] $\left(RR_M\right)$	20–29 30–39 40–49 50–59 60–69 70–79+	3.70 3.30 1.95 1.65 1.62 1.40	5.95 5.61 3.41 2.73 2.08 1.78	8 9

T2DM: type 2 diabetes mellitus

[∈]All relative risks are with respect to healthy individuals as the reference group.

[¥]The highest RR_M was for age group 20-29 as other reasons for mortality in that age group are minimal.

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Table S2. Characteristics of the expatriate resident population in Qatar based on Qatar's Planning and Statistics Authority[1][2].

| Nationality	Proportion	Proportion of males (%)	Mean age (years)
Bangladeshi	14.0%	96.6%	35
Egyptian	6.9%	66.8%	30
Filipino	9.0%	37.1%	36
Indian	26.9%	81.7%	35
Nepalese	12.2%	96.6%	34
Pakistani	5.6%	76.2%	32
Other nationalities	25.5%	62.4%	32

Table S3. Projected prevalence of type 2 diabetes mellitus by sex and nationality group.

|	Qatari			Bangladeshi			Egyptian			Indian			Nepalese			Pakistani			Filipino			Others		
	T	F	M	T	F	M	T	F	M	T	F	M	T	F	M	T	F	M	T	F	M	T	F	M
2021	17.1	16.7	17.5	4.9	8.6	4.9	12.8	14.2	12.4	6.4	7.7	6.2	1.9	3.4	1.9	6.8	5.6	7.0	4.8	4.1	5.7	7.2	17.8	2.0
2025	18.6	18.3	18.9	5.6	8.8	5.5	13.8	14.6	13.5	7.2	8.1	7.0	2.3	3.8	2.2	7.6	6.4	7.8	5.0	4.4	6.0	7.8	17.4	2.2
2030	20.5	20.3	20.8	6.7	9.2	6.6	15.3	15.2	15.4	8.5	8.9	8.4	2.9	4.3	2.9	8.9	7.9	9.0	5.5	4.9	6.5	8.4	17.1	2.7
2035	22.7	22.5	22.8	8.1	9.6	8.1	17.3	16.2	17.8	10.2	10.0	10.2	3.8	4.9	3.8	10.6	10.0	10.7	6.3	5.7	7.2	9.2	17.1	3.4
2040	24.9	24.9	24.9	10.1	10.2	10.1	19.9	17.7	20.9	12.3	11.4	12.5	5.0	5.4	5.0	12.7	12.8	12.7	7.2	6.7	8.1	10.0	17.6	4.3
2045	27.2	27.3	27.1	12.7	10.8	12.8	23.2	19.7	24.7	15.0	13.1	15.5	6.8	6.0	6.8	15.3	16.7	15.0	8.5	8.1	9.4	11.1	18.4	5.6
2050	29.5	29.8	29.3	15.9	11.4	16.1	27.1	22.2	29.2	18.3	15.0	19.1	9.1	6.5	9.2	18.4	21.6	17.8	10.2	9.8	10.9	12.5	19.5	7.3

T: Total population; **F:** Female population; **M:** Male population
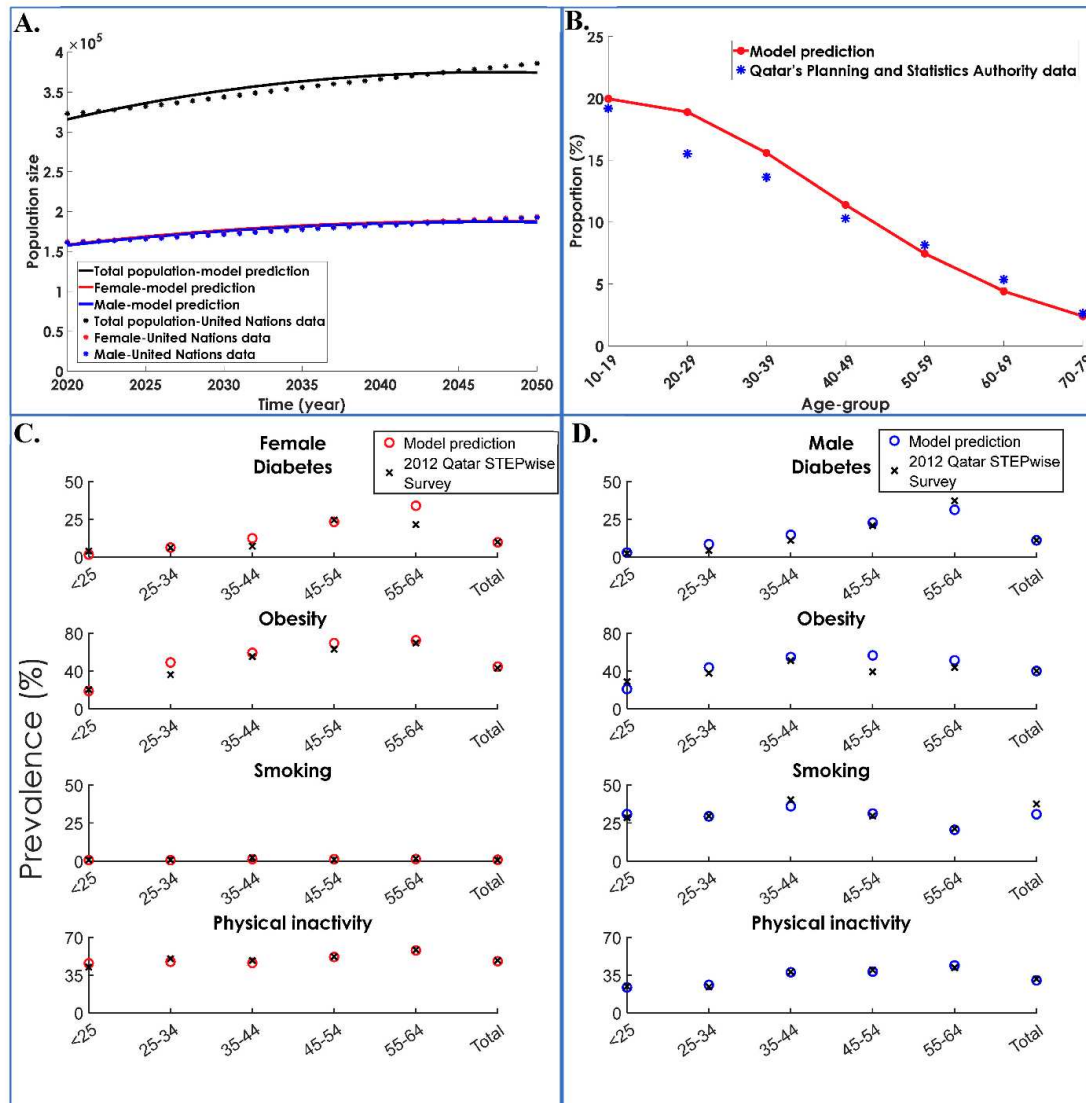
ADDITIONAL FIGURES

Figure S1. Proportion of the total population that are Qatari nationals. Data were obtained from the Gulf Labour Markets, Migration, and Population Programme[3] and Qatar's Planning and Statistics Authority[1 2].
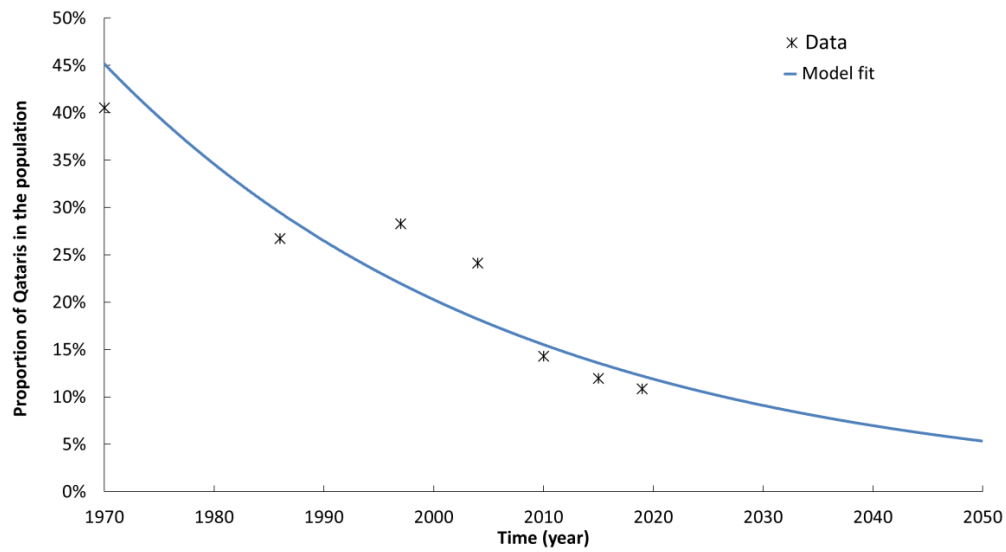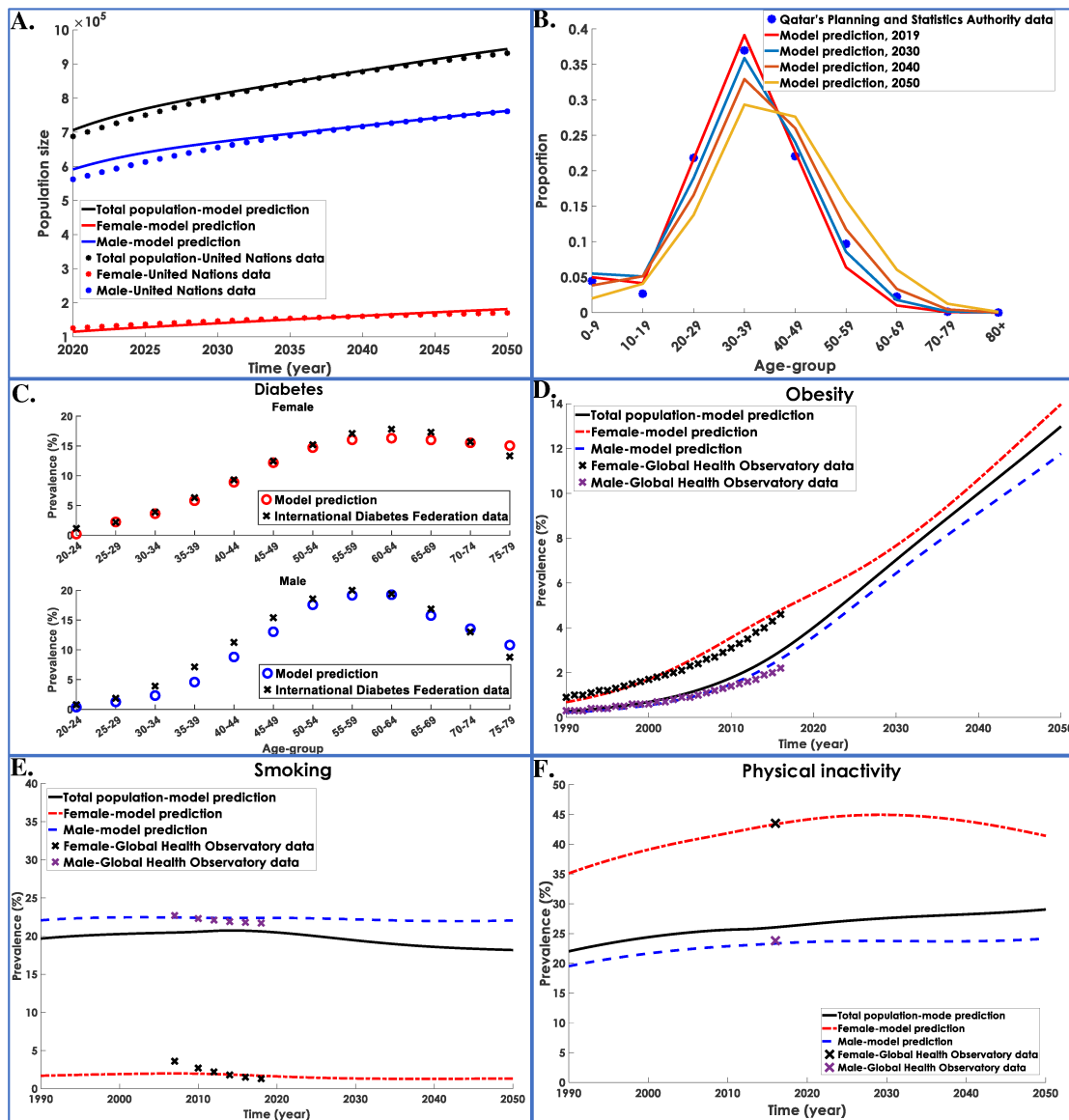
Figure S2. Model predictions for the population age-distribution of each nationality group in Qatar. Data were obtained from Qatar's Planning and Statistics Authority[1][2].
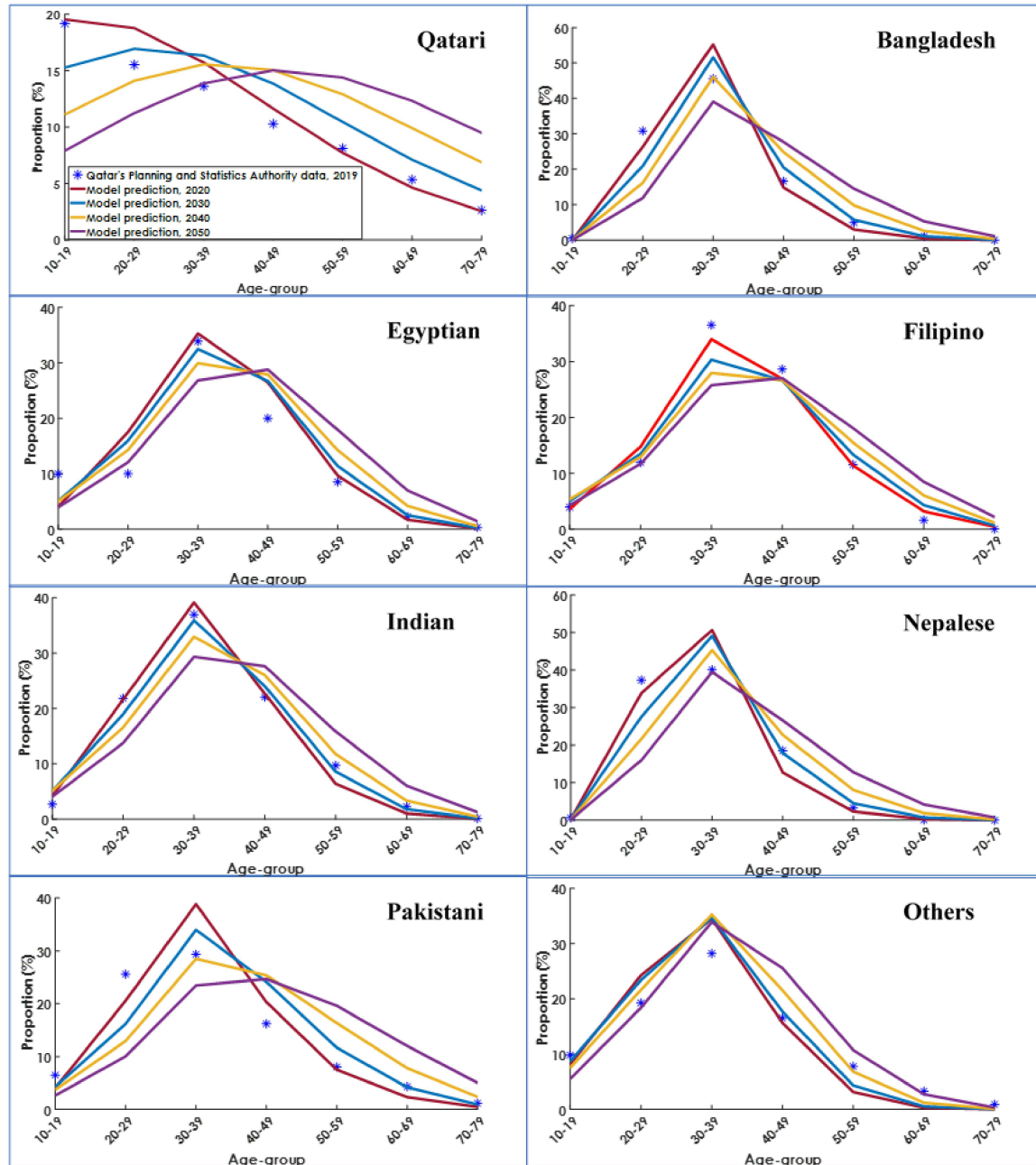
Figure S3. Model fitting for data on Qataris. **A)** The population size; **B)** the proportion of the population in each age-group in 2019; **C)** age-specific prevalence of diabetes, obesity, smoking, and physical inactivity in females in 2012; and **D)** age-specific prevalence of diabetes, obesity, smoking, and physical inactivity in males in 2012. Model predictions were compared to estimates from the Population Division of the United Nations Department of Economic and Social Affairs[4], Qatar's Planning and Statistics Authority[1 2], and the 2012 Qatar STEPwise Survey[10 11].

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Figure S4. Model fitting for Indians residing in Qatar. **A)** The population size; **B)** the proportion
of the population in each age-group in 2019, 2030, 2040, and 2050; **C)** age-specific prevalence
of type 2 diabetes mellitus in females and males in 2019; **D)** prevalence of obesity between
1990–2050; **E)** prevalence of smoking between 1990–2050; and **F)** prevalence of physical
inactivity between 1990–2050. Model predictions were compared to estimates from the
Population Division of the United Nations Department of Economic and Social Affairs[4], Qatar's
Planning and Statistics Authority[1 2], the International Diabetes Federation data, and the Global
Health Observatory data repository[12-14].

Figure S5. Model prediction for the mean age of each nationality group in Qatar.
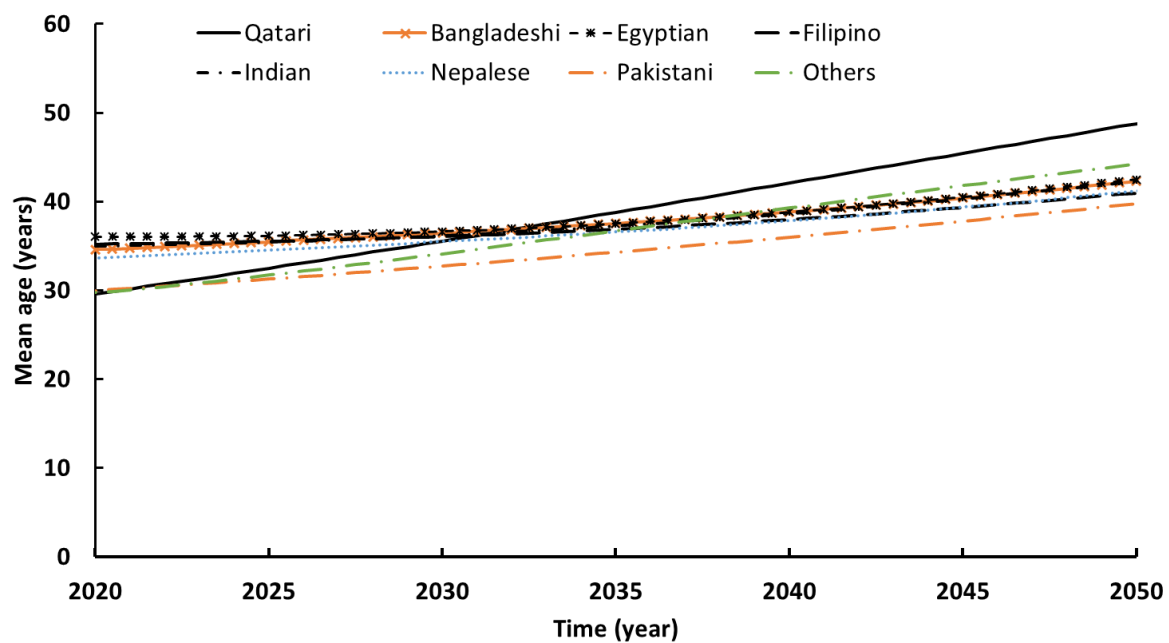
Figure S6. Two sensitivity analyses to investigate the impact of population aging on T2DM burden. **A**) T2DM prevalence in the two sensitivity analyses compared to the base-case scenario. First sensitivity analysis assumes that T2DM incidence rate after 2020 is independent of age to control the effect of aging. The second sensitivity analysis assumes a stable constant obesity prevalence to control the effect of obesity (obesity prevalence is shown in Panel **B**).
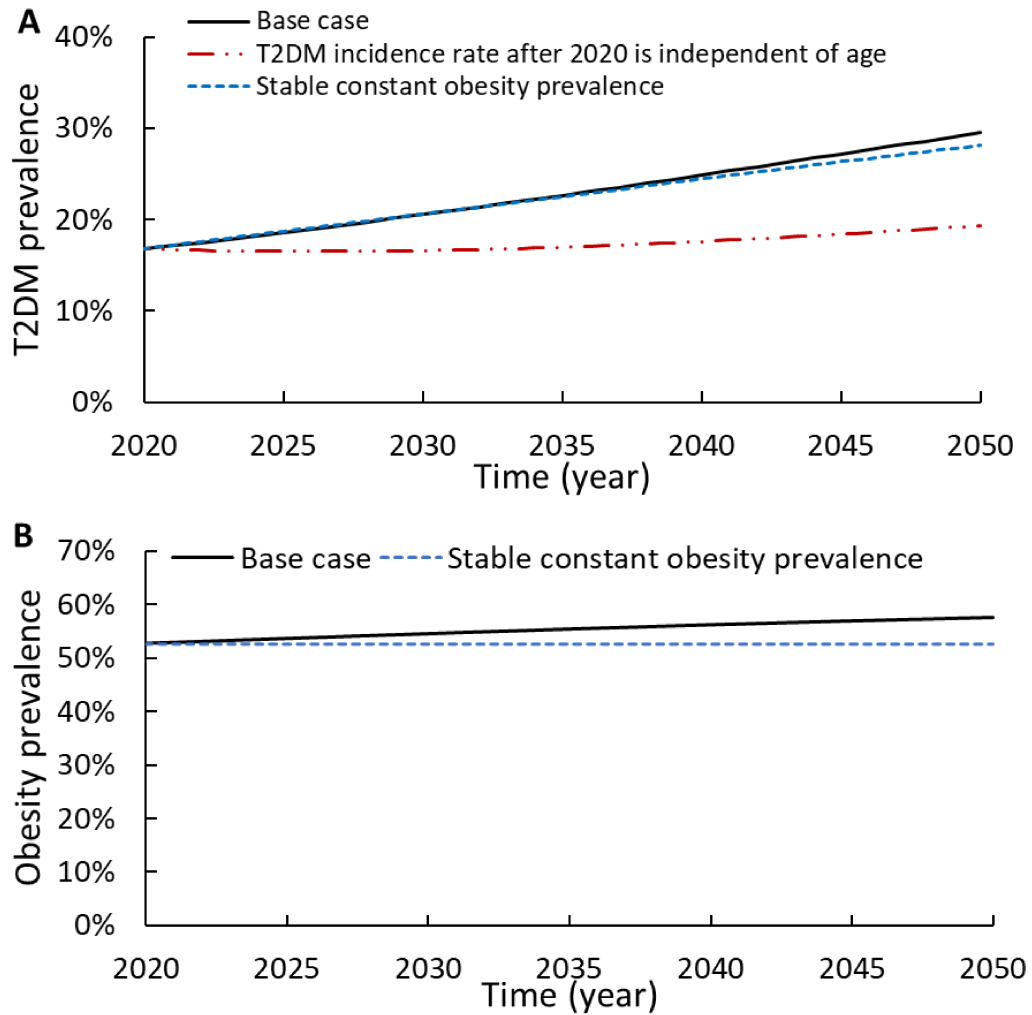
Figure S7. Uncertainty analysis for the prevalence of type 2 diabetes mellitus (T2DM) in Qatar between 2020-2050. The solid line represents the mean, while the dashed lines bracket the 95% uncertainty interval.
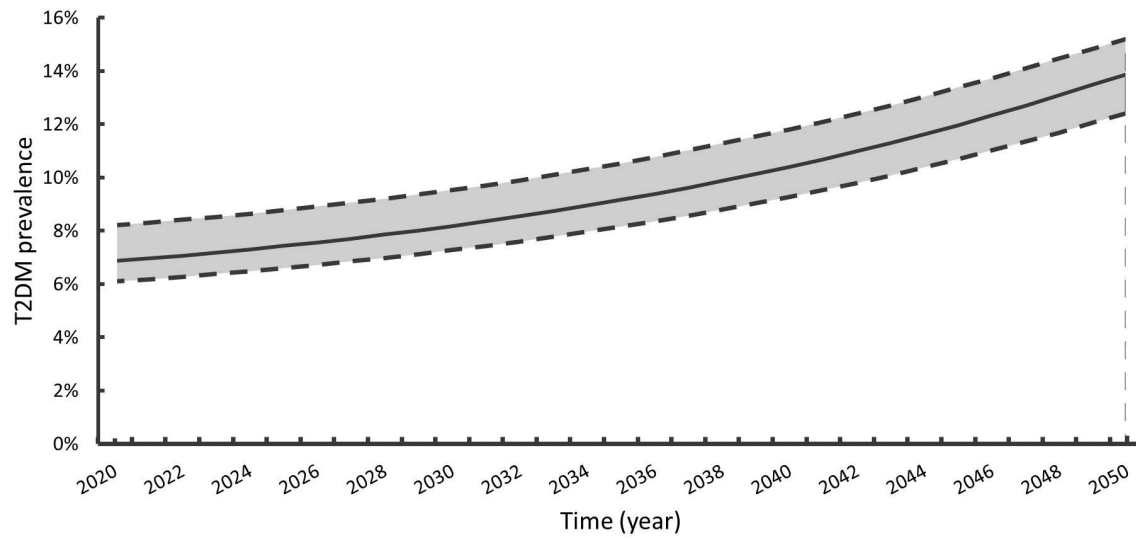
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