Supplemental material for:

Extreme heat and work injuries in Kuwait's hot summers

Alahmad et al.

Supplemental methods - sensitivity analyses:

(1) <u>Maximum temperature:</u>

In this model, we use the maximum temperature as the exposure of interest instead of the 24-hour average temperature.

$$\log(E[injuries_i]) = intercept + s(\boldsymbol{Tmax}_{l_i}) + s(RH_i) + ns(Time_i, df = 3\ per\ summer) + Day\ of\ the\ Week_i$$

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(2) <u>Heat index (HI):</u>

We applied the U.S. National Weather Service's algorithm to convert ambient temperature and relative humidity to 'heat index' through the open-source R package '*weathermetrics*' by Anderson et al. (2013):

$$\log(E[injuries_i]) = intercept + s(\boldsymbol{HI}_{l_i}) + ns(Time_i, df = 3\ per\ summer) + Day\ of\ the\ Week_i$$

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(3) <u>Case-crossover:</u>

We fitted a three-way interaction between day of the week, month, and year to fit a case crossover analysis instead of the time series and spline control of continuous time. The three-way interaction is a flexible alternative to the conventional conditional logistic regression which usually requires extensive reshaping of the data frame:

$$\log(E[injuries_i]) = intercept + s(T_{l_i}) + s(RH_i) + \boldsymbol{Day\ of\ the\ Week_i * Month_i * Year_i}$$

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(4) <u>Distributed lag non-linear model (DLNM):</u>

We used DLNM (to the temperature-lag-injuries relationship) with the following parameters for the cross-basis matrix:
Lag period: 7 days
Lag modelling: natural spline with two internal knots on the log scale
Temperature modelling: natural spline with 3 degrees of freedom at the 10th, 50th and 90th percentile
Centering: at 37 °C (10th percentile of summer temperatures in Kuwait)

$$\log(E[injuries_i]) = intercept + \boldsymbol{crossbasis\ T} + RH_i + ns(Time_i, df = 3\ per\ summer) + Day\ of\ the\ Week_i$$

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(5) <u>Indicator for June, July and August:</u>

To fit this model, we utilized data for the whole study period from January 2015 to December 2019. An indicator variable was created for the months where the policy was enacted:

$$\log(E[injuries_i]) = intercept + s(T_{l_i}) + s(RH_i) + \boldsymbol{ns(Time_i, df = 7\ per\ year)} + Day\ of\ the\ Week_i + \boldsymbol{ind_i}$$

Where *ind* = 1 if day *i* was in June, July or August, and *ind* = 0 otherwise.

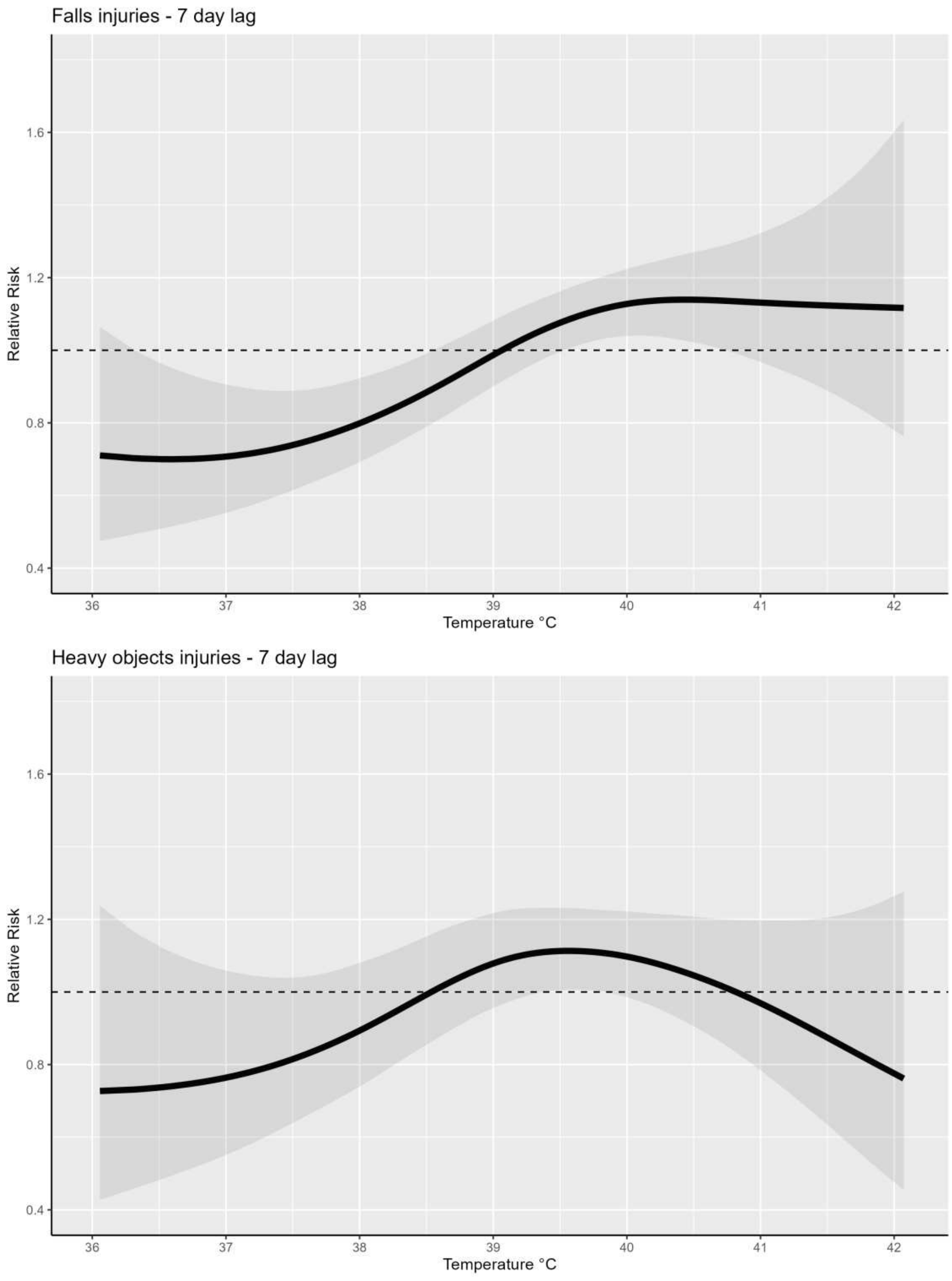

Figure 1S. Exposure-Response curves for 7-day moving average of average summer temperature and relative risks of fall occupational injuries (fall from height and same level) and heavy object occupational injuries (carrying and fall of heavy object) in Kuwait.

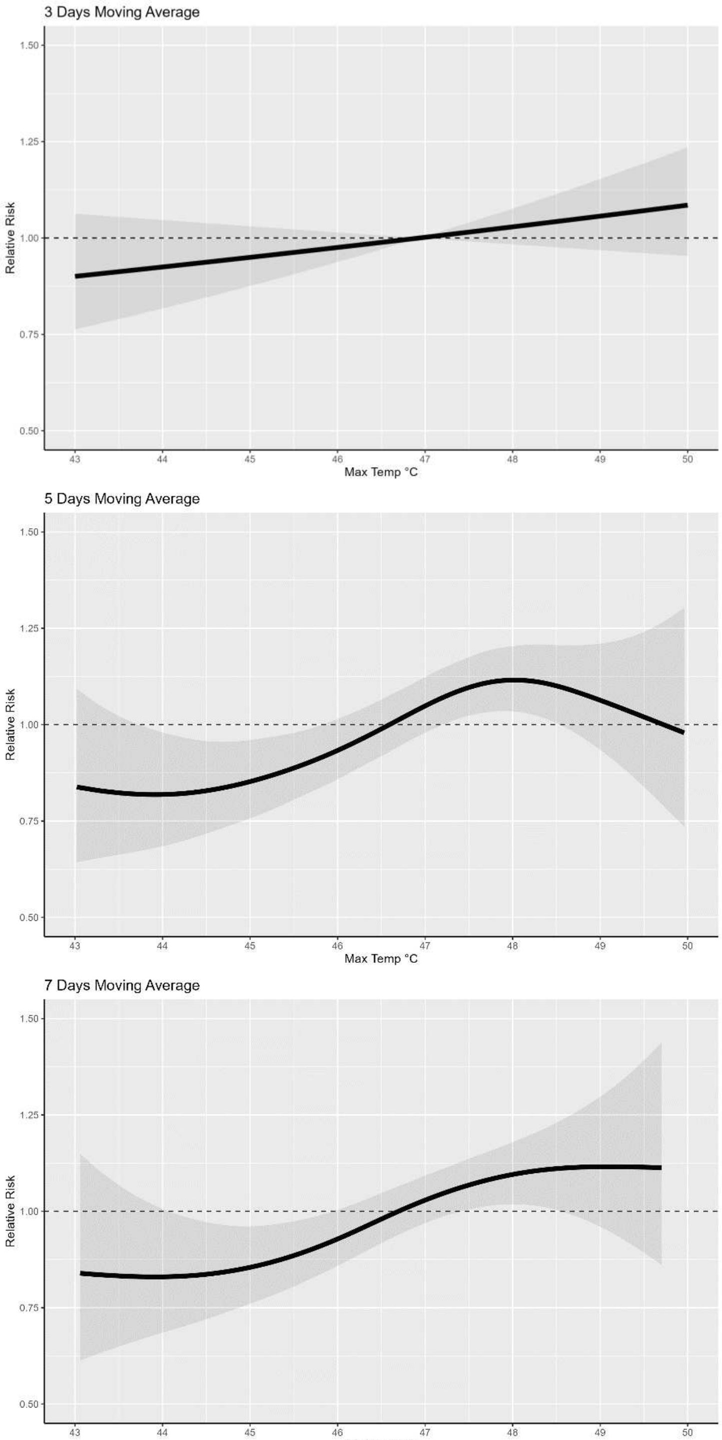

Figure 2S. Exposure-Response curves for 3-, 5- and 7-day moving average of **MAXIMUM** summer temperature and relative risks of occupational injuries in Kuwait.

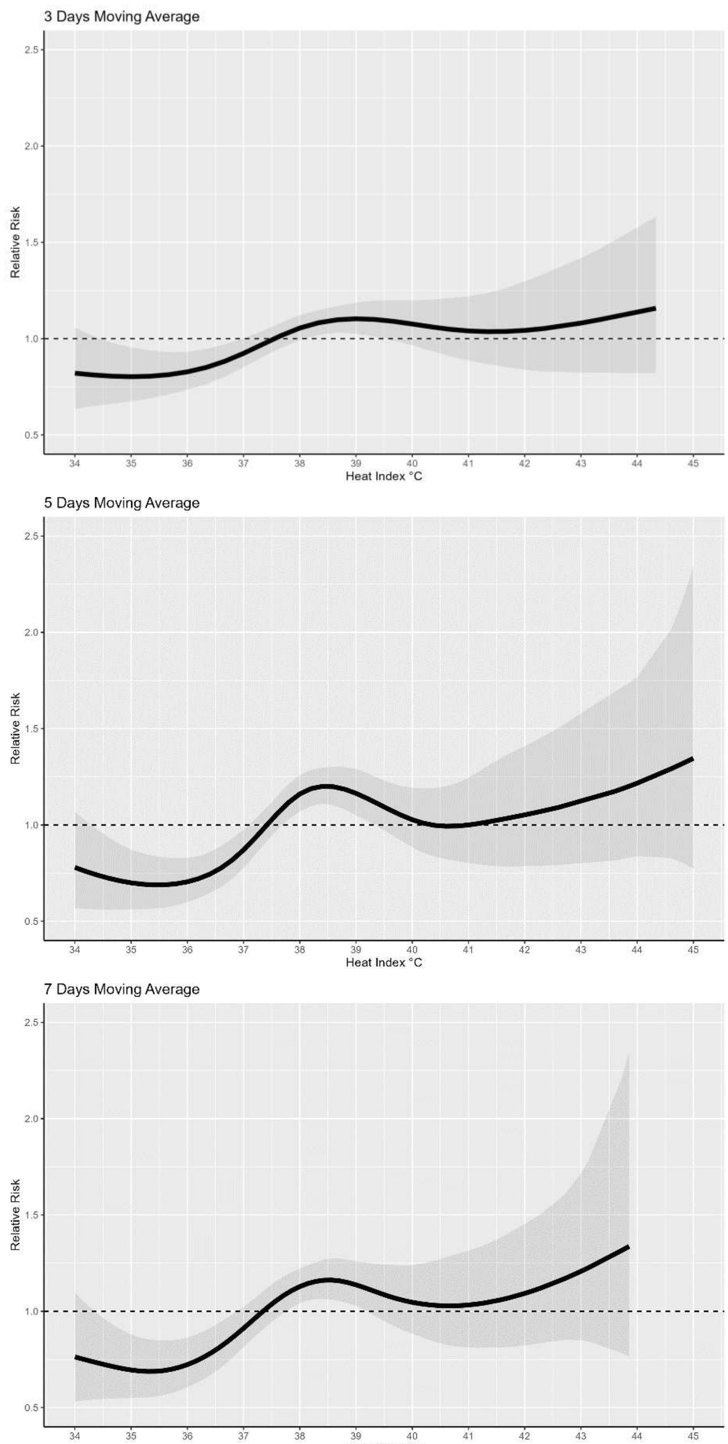

Figure 3S. Exposure-Response curves for 3-, 5- and 7-day moving average of **HEAT INDEX** and relative risks of occupational injuries in Kuwait.

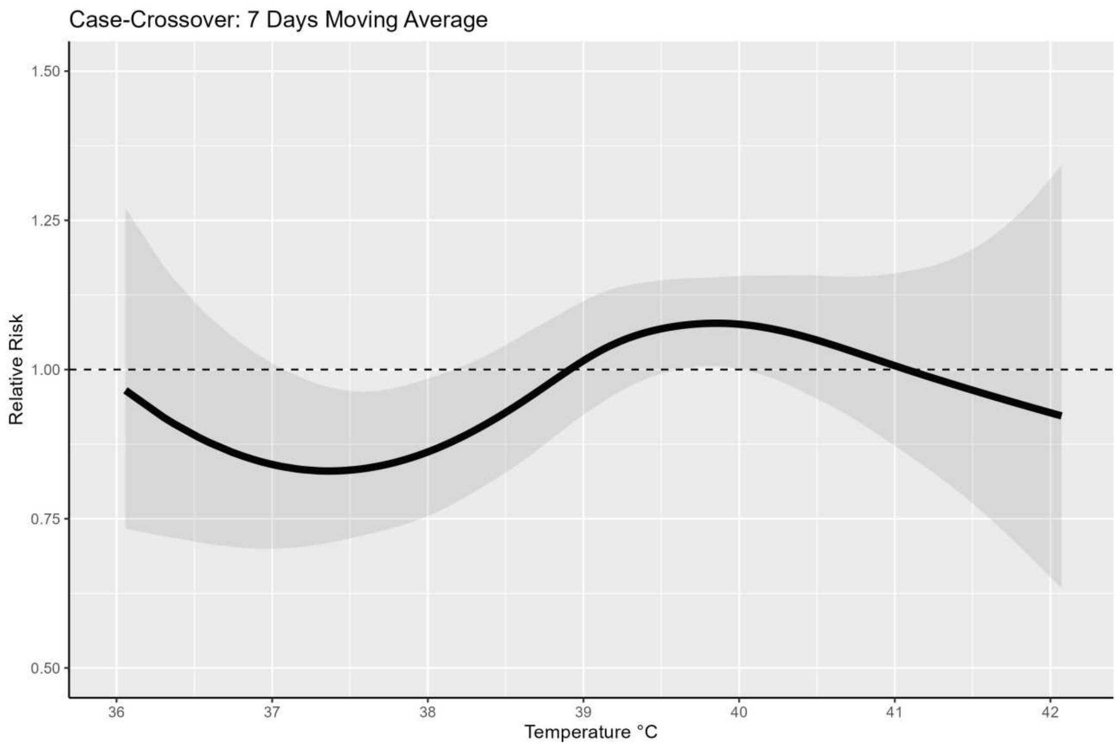

Figure 4S. Exposure-Response curves for 7-day moving average of summer temperature and relative risks of occupational injuries in Kuwait using a **case-crossover model**

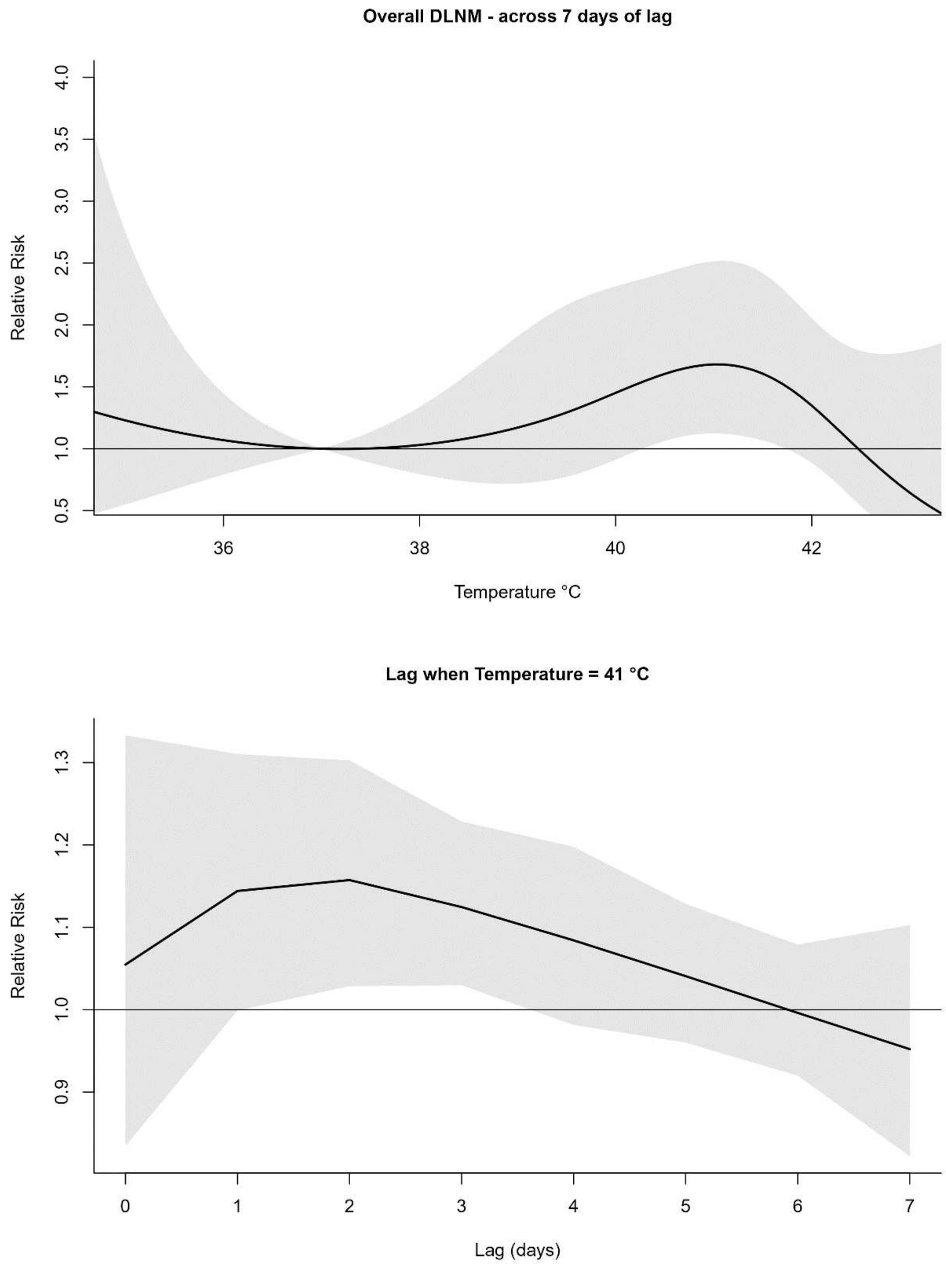

Figure 5S. Distributed lag non-linear model outputs showing the overall relationship between summer temperatures and occupational injuries across all lags (top panel) and the lag effect at 41 C temperature (bottom panel)

Table 1S. Number and percentage of summer injuries (June to August, 2015-2019) by cause of injury

Cause of Injury, N (%)	**3710 (100%)**
Body movement	323 (8.7%)
Carry Heavy Object	70 (1.9%)
Caught in/between	161 (4.3%)
Collision	249 (6.7%)
Contact with an electric current	11 (0.3%)
Cut with a sharp object	375 (10.1%)
Disease	131 (3.5%)
Entering a foreign body	36 (1.0%)
Explosion	4 (0.1%)
Exposure to high or low pressure	3 (0.1%)
Exposure to loud noise	4 (0.1%)
Fall from Height	678 (18.3%)
Fall from Same Level	617 (16.6%)
Fall of Heavy Object	545 (14.7%)
Friction	2 (0.1%)
High or low heat contact	68 (1.8%)
Rad/Chem/Toxic Exposure	13 (0.4%)
Road Injury	384 (10.4%)
Shock	24 (0.6%)
Trespass / assault / hit	10 (0.3%)
Missing	2 (0.1%)