

Supporting Materials

Appendix A

Table A1 Descriptive statistics of socioeconomic variables.

Socioeconomic variables	Definitions	Mean	SD	P25	P50	P75
% Older adults	Percentage of persons > 65 years of age	14.61	3.8	11.49	14.58	17.41
% Low education	Percentage of people older than 15 years with education attainment only at primary and below	21.23	7.87	15.83	21.96	27.43
% Low income	Percentage of the working population with monthly income below the poverty line*	3.16	0.88	2.65	3.09	3.46

Notes: All variables were based on Hong Kong census data in 2006 and 2016 (Hong Kong Census and Statistics Department, 2006 and **2016**), and were calculated as the average over the 2 years data for proxies of socioeconomic status level of each large TPU during the study periods.

*The poverty line was HKD\$2000 in 2006 and HKD\$4000 in 2016 according to the poverty indicator of Hong Kong (Hong Kong Census and Statistics Department, 2023).

Table A2 Summary of heatwaves and heatwave-related deaths.

Heatwave (HW)	No. of HWs	No. of HW days	Deaths on HW days
90P_2day	89	617	28367
90P_4day	40	304	14281
92.5P_2day	69	482	22246
92.5P_4day	33	248	11717
95P_2day	46	313	14598
95P_4day	13	95	4692

Notes: HW days indicate days during and immediately following heatwaves (4 days for lagged effects here). Different HW definitions are named following the same format. For example, 90P_2day represents the HW with a daily mean temperature over the 90th percentile lasting at least two consecutive days.

Table A3 Modification effects of urban landscape characteristics on the associations between the mortality of **young people** (0–64 years) and heat waves differing in strength and duration, and *p*-value for the difference in ORs of six heat wave definitions, with 95% confidence intervals.

Urban landscape characteristics	Heat wave definitions	2day	4day	<i>p</i> -value
NDVI	90P	0.89 (0.72, 1.09)	0.97 (0.77, 1.23)	0.548
	92.5P	0.95 (0.77, 1.17)	1.00 (0.78, 1.29)	0.748
	95P	0.96 (0.76, 1.20)	0.78 (0.52, 1.17)	0.388
	<i>p</i> -value	0.620	0.480	0.570
Proximity to water	90P	0.91 (0.78, 1.07)	0.97 (0.81, 1.16)	0.614
	92.5P	1.02 (0.87, 1.20)	0.96 (0.80, 1.17)	0.658
	95P	0.93 (0.78, 1.12)	0.99 (0.75, 1.32)	0.715
	<i>p</i> -value	0.809	0.931	0.614
Building density	90P	1.01 (0.83, 1.23)	0.94 (0.75, 1.18)	0.634
	92.5P	0.97 (0.79, 1.18)	0.94 (0.74, 1.19)	0.853
	95P	0.97 (0.78, 1.21)	1.04 (0.72, 1.49)	0.746
	<i>p</i> -value	0.767	0.699	0.898
Daytime LST*	90P	0.92 (0.77, 1.09)	0.99 (0.81, 1.20)	0.573
	92.5P	1.00 (0.84, 1.19)	1.06 (0.86, 1.31)	0.668
	95P	0.95 (0.79, 1.15)	0.89 (0.66, 1.20)	0.715
	<i>p</i> -value	0.753	0.718	0.862
Nighttime LST*	90P	1.06 (0.88, 1.27)	0.93 (0.76, 1.14)	0.357
	92.5P	1.06 (0.88, 1.28)	0.94 (0.75, 1.17)	0.405
	95P	1.05 (0.86, 1.30)	1.42 (0.98, 2.07)	0.173
	<i>p</i> -value	0.976	0.120	0.166

Notes: *LST is short for Land Surface Temperature.

Table A4 Modification effects of urban landscape characteristics on the associations between mortality of **older adults** (over 65 years) and heat waves differing in strength and duration, and *p*-value for the difference in ORs of six heat wave definitions, with 95% confidence intervals.

Urban landscape characteristics	Heat wave definitions	2day	4day	<i>p</i> -value
NDVI	90P	0.98 (0.91, 1.05)	0.91 (0.84, 0.99)	0.236
	92.5P	0.94 (0.88, 1.02)	0.87 (0.79, 0.95)	0.156
	95P	0.92 (0.85, 1.00)	0.78 (0.68, 0.89)	0.043
	<i>p</i> -value	0.266	0.057	0.004
Proximity to water	90P	1.03 (0.97, 1.09)	1.03 (0.96, 1.10)	0.991
	92.5P	1.04 (0.98, 1.10)	1.04 (0.97, 1.12)	0.954
	95P	1.03 (0.97, 1.10)	1.04 (0.94, 1.15)	0.893
	<i>p</i> -value	0.941	0.822	0.855
Building density	90P	0.99 (0.92, 1.07)	1.06 (0.97, 1.15)	0.272
	92.5P	1.01 (0.94, 1.09)	1.12 (1.02, 1.22)	0.109
	95P	1.04 (0.96, 1.13)	1.18 (1.03, 1.35)	0.135
	<i>p</i> -value	0.381	0.161	0.030
Daytime LST*	90P	0.99 (0.93, 1.04)	1.00 (0.94, 1.06)	0.791
	92.5P	0.98 (0.93, 1.04)	1.01 (0.94, 1.08)	0.540
	95P	0.98 (0.92, 1.05)	1.02 (0.92, 1.12)	0.589
	<i>p</i> -value	0.906	0.780	0.633
Nighttime LST*	90P	1.04 (0.97, 1.10)	1.10 (1.02, 1.18)	0.24
	92.5P	1.08 (1.01, 1.15)	1.13 (1.04, 1.22)	0.423
	95P	1.11 (1.03, 1.19)	1.24 (1.10, 1.40)	0.115
	<i>p</i> -value	0.184	0.123	0.011

Notes: *LST is short for Land Surface Temperature.

Table A5 Modification effects of urban landscape characteristics on the associations between mortality of **males** and heat waves differing in strength and duration, and *p*-value for the difference in ORs of six heat wave definitions, with 95% confidence intervals.

Urban landscape characteristics	Heat wave definitions	2day	4day	<i>p</i> -value
NDVI	90P	0.98 (0.89, 1.07)	0.93 (0.84, 1.04)	0.518
	92.5P	0.95 (0.86, 1.04)	0.88 (0.79, 1.00)	0.364
	95P	0.90 (0.81, 1.01)	0.69 (0.57, 0.84)	0.017
	<i>p</i> -value	0.284	0.016	0.001
Proximity to water	90P	0.98 (0.91, 1.06)	1.01 (0.93, 1.10)	0.637
	92.5P	1.00 (0.93, 1.08)	1.02 (0.93, 1.11)	0.755
	95P	1.00 (0.92, 1.09)	1.06 (0.93, 1.21)	0.484
	<i>p</i> -value	0.749	0.599	0.344
Building density	90P	0.99 (0.90, 1.09)	1.06 (0.95, 1.18)	0.421
	92.5P	1.01 (0.91, 1.11)	1.11 (0.98, 1.25)	0.214
	95P	1.07 (0.96, 1.20)	1.33 (1.10, 1.60)	0.055
	<i>p</i> -value	0.303	0.053	0.007
Daytime LST*	90P	0.94 (0.87, 1.01)	0.95 (0.88, 1.04)	0.795
	92.5P	0.94 (0.87, 1.01)	0.98 (0.90, 1.07)	0.48
	95P	0.94 (0.86, 1.02)	0.96 (0.84, 1.09)	0.793
	<i>p</i> -value	0.942	0.880	0.832
Nighttime LST*	90P	1.01 (0.93, 1.10)	1.03 (0.93, 1.13)	0.775
	92.5P	1.05 (0.97, 1.15)	1.06 (0.95, 1.17)	0.978
	95P	1.09 (0.99, 1.21)	1.34 (1.13, 1.58)	0.041
	<i>p</i> -value	0.200	0.019	0.003

Notes: *LST is short for Land Surface Temperature.

Table A6 Modification effects of urban landscape characteristics on the associations between mortality of **females** and heat waves differing in strength and duration, and *p*-value for the difference in ORs of six heat wave definitions, with 95% confidence intervals.

Urban landscape characteristics	Heat wave definitions	2day	4day	<i>p</i> -value
NDVI	90P	0.95 (0.87, 1.05)	0.90 (0.81, 1.01)	0.484
	92.5P	0.94 (0.85, 1.04)	0.87 (0.77, 1.00)	0.359
	95P	0.94 (0.84, 1.05)	0.86 (0.72, 1.03)	0.433
	<i>p</i> -value	0.846	0.637	0.345
Proximity to water	90P	1.05 (0.97, 1.14)	1.04 (0.95, 1.13)	0.801
	92.5P	1.08 (0.99, 1.17)	1.05 (0.95, 1.15)	0.640
	95P	1.04 (0.95, 1.14)	1.01 (0.88, 1.16)	0.701
	<i>p</i> -value	0.912	0.825	0.607
Building density	90P	1.00 (0.90, 1.10)	1.03 (0.92, 1.15)	0.682
	92.5P	1.01 (0.91, 1.12)	1.08 (0.95, 1.22)	0.423
	95P	0.99 (0.89, 1.11)	1.02 (0.86, 1.22)	0.773
	<i>p</i> -value	0.969	0.906	0.798
Daytime LST*	90P	1.03 (0.95, 1.11)	1.05 (0.96, 1.15)	0.690
	92.5P	1.03 (0.95, 1.11)	1.05 (0.95, 1.15)	0.770
	95P	1.03 (0.95, 1.13)	1.06 (0.93, 1.22)	0.739
	<i>p</i> -value	0.923	0.938	0.676
Nighttime LST*	90P	1.08 (0.99, 1.17)	1.15 (1.04, 1.27)	0.360
	92.5P	1.11 (1.01, 1.21)	1.16 (1.04, 1.30)	0.502
	95P	1.11 (1.00, 1.23)	1.19 (1.01, 1.40)	0.469
	<i>p</i> -value	0.630	0.688	0.279

Notes: *LST is short for Land Surface Temperature.

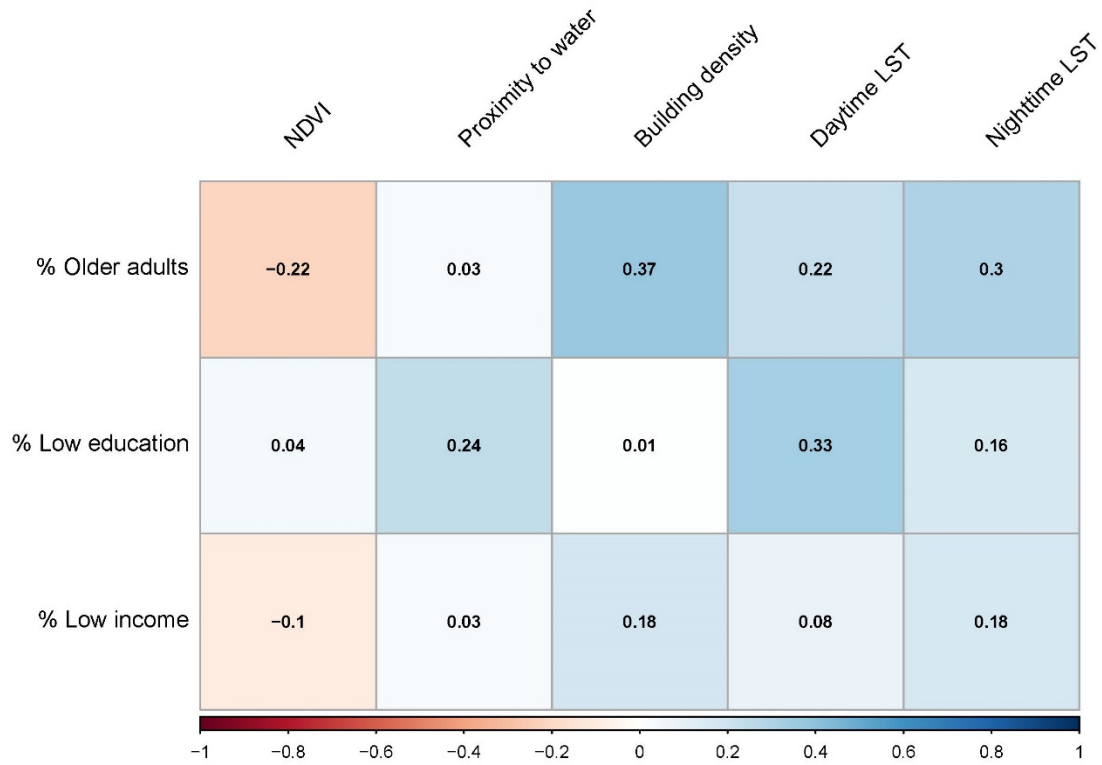


Fig. A1 Results of Pearson's correlation analysis.

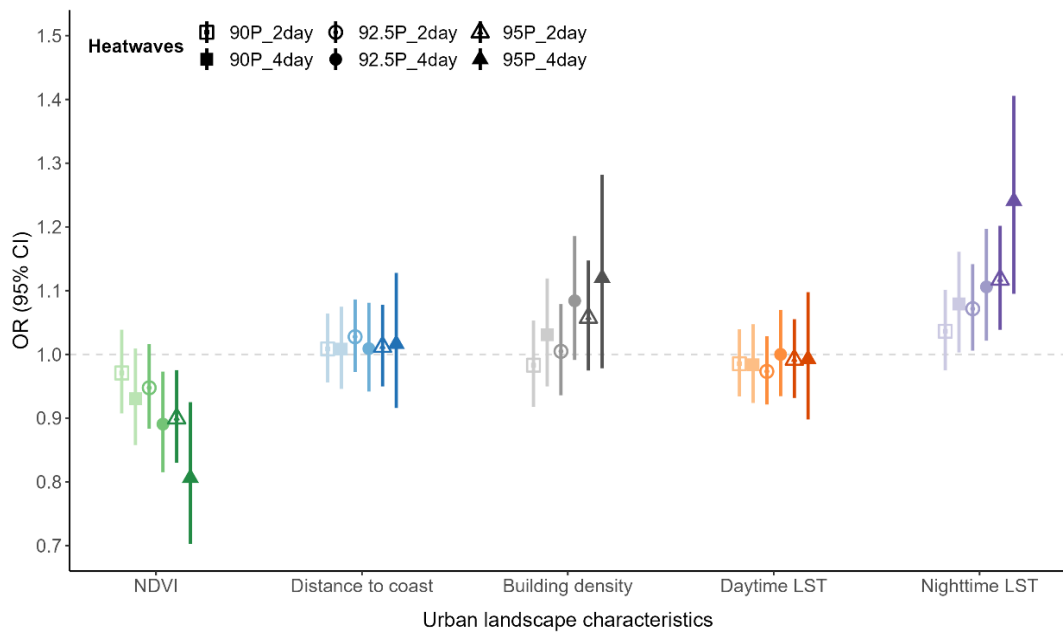


Fig. A2 Effect modifications of urban landscape characteristics on the associations between mortality and heatwaves with different specifications of intensity and duration: results of the sensitivity analysis considering deaths during or 3-days following a heatwave.

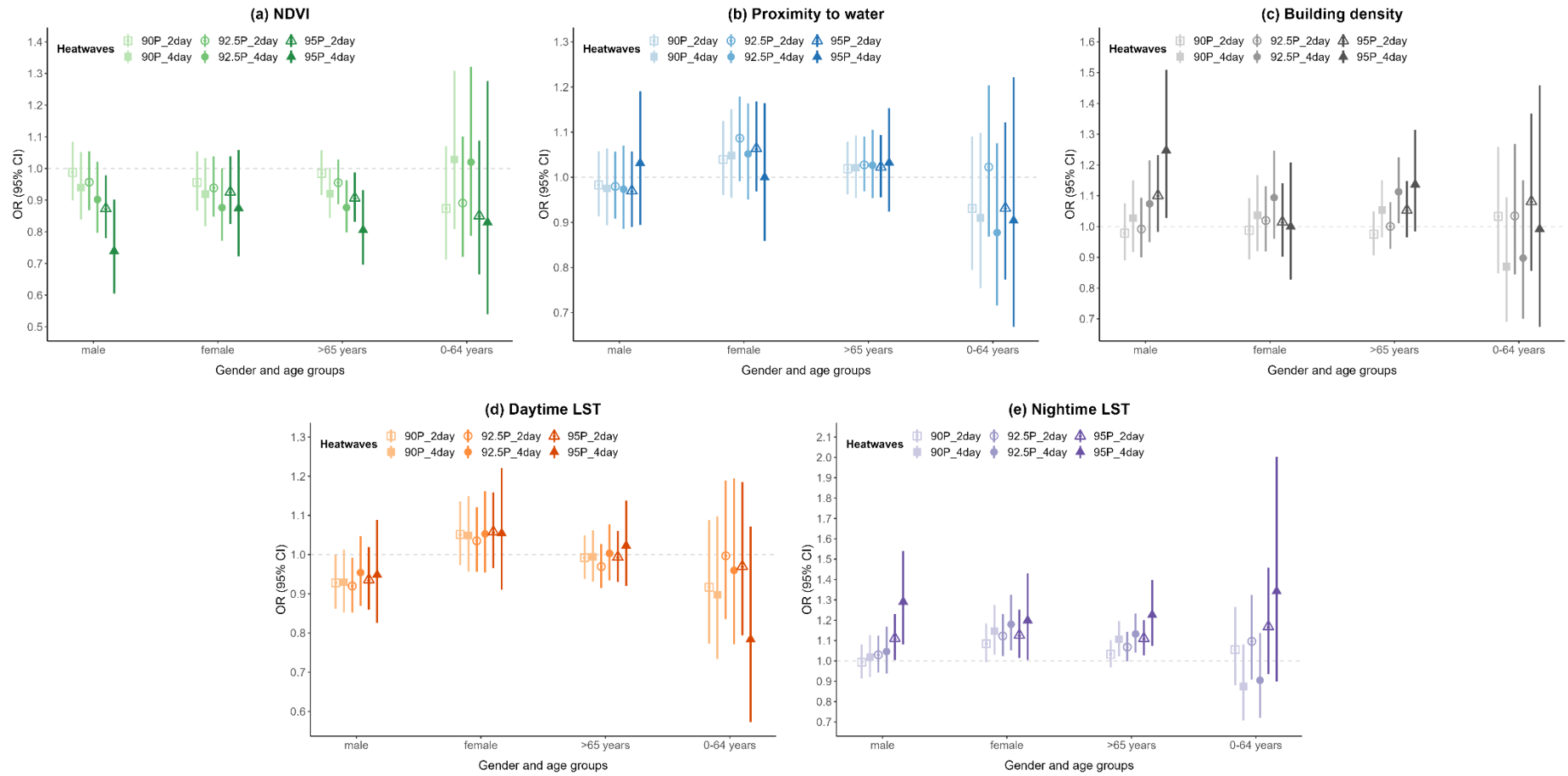


Fig. A3 Relative odds of dying during or **3-days** following a heat wave versus dying on other days during hot season for people who live at the top quantile, compared with those living at the bottom quantile of **(a)** NDVI; **(b)** Proximity to water; **(c)** Building density; **(d)** Daytime Land Surface Temperature (LST); **(e)** Nighttime LST.

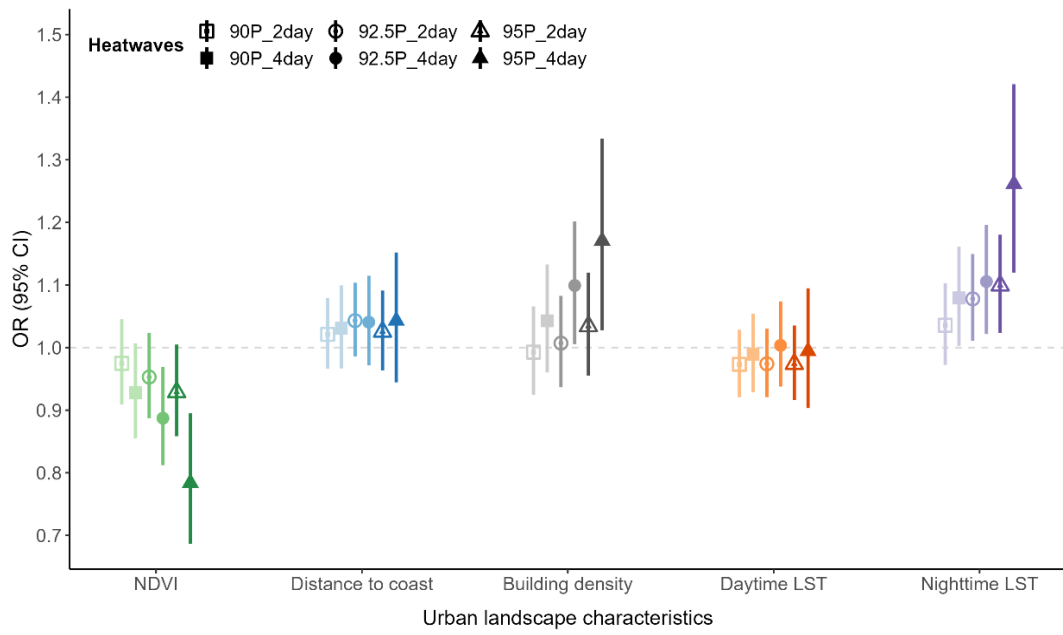


Fig. A4 Effect modifications of urban landscape characteristics on the associations between mortality and heatwaves with different specifications of intensity and duration: results of the sensitivity analysis **with the control of relative humidity**.

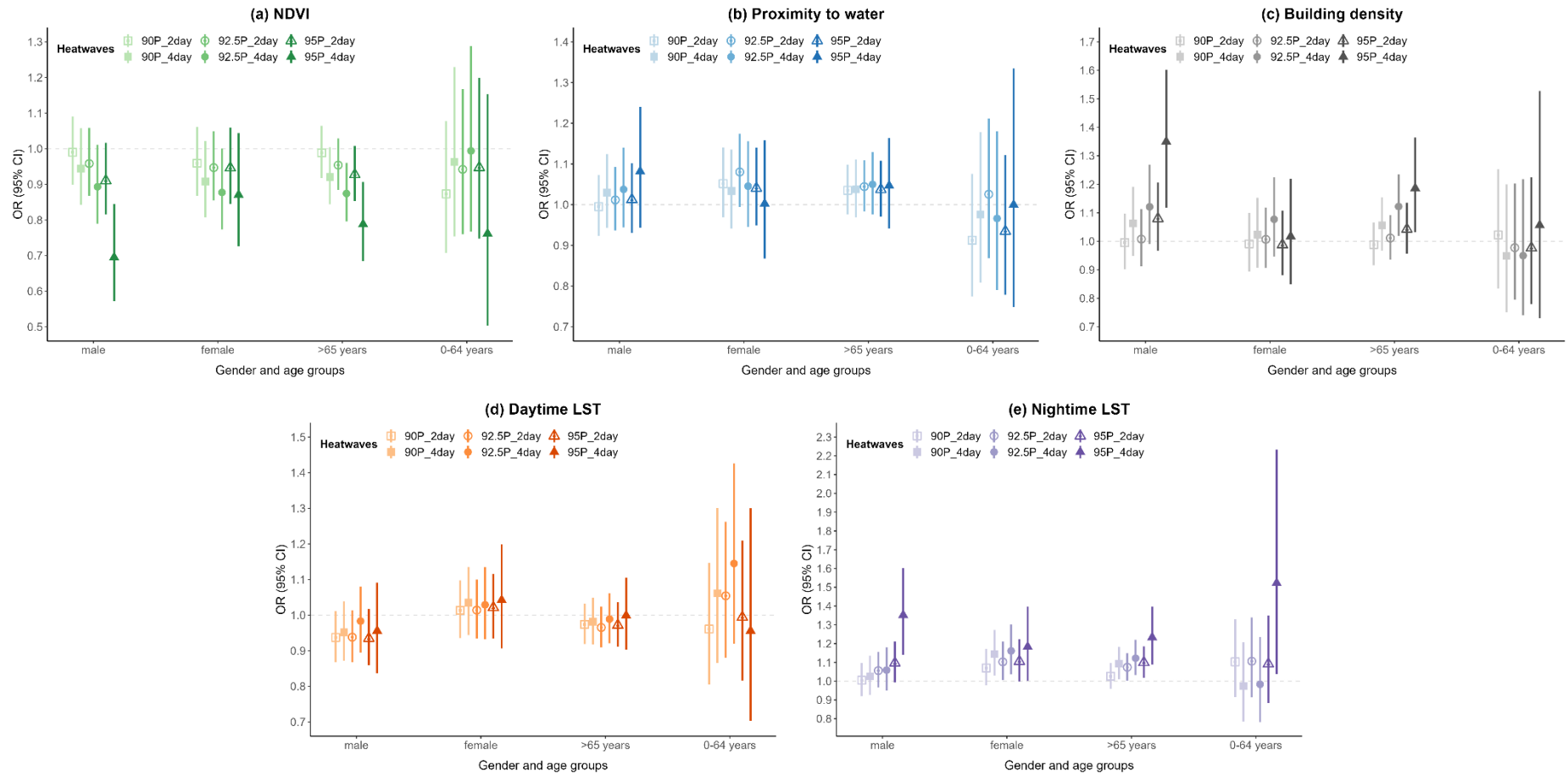


Fig. A5 Relative odds (with the control of relative humidity) of dying during or 4-days following a heat wave versus dying on other days during hot season for people who live at the top quantile, compared with those living at the bottom quantile of (a) NDVI; (b) Proximity to water; (c) Building density; (d) Daytime Land Surface Temperature (LST); (e) Nighttime LST.

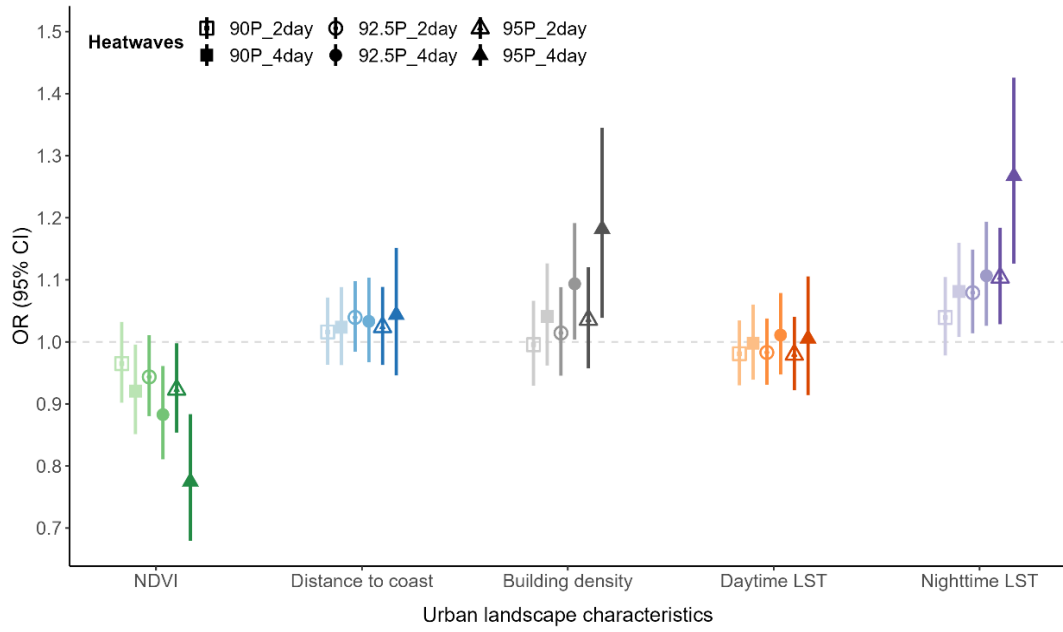


Fig. A6 Effect modifications of urban landscape characteristics on the associations between mortality and heatwaves with different specifications of intensity and duration: results of the sensitivity analysis with the control of air pollution by including O₃ and PM₁₀ at lag0–1.

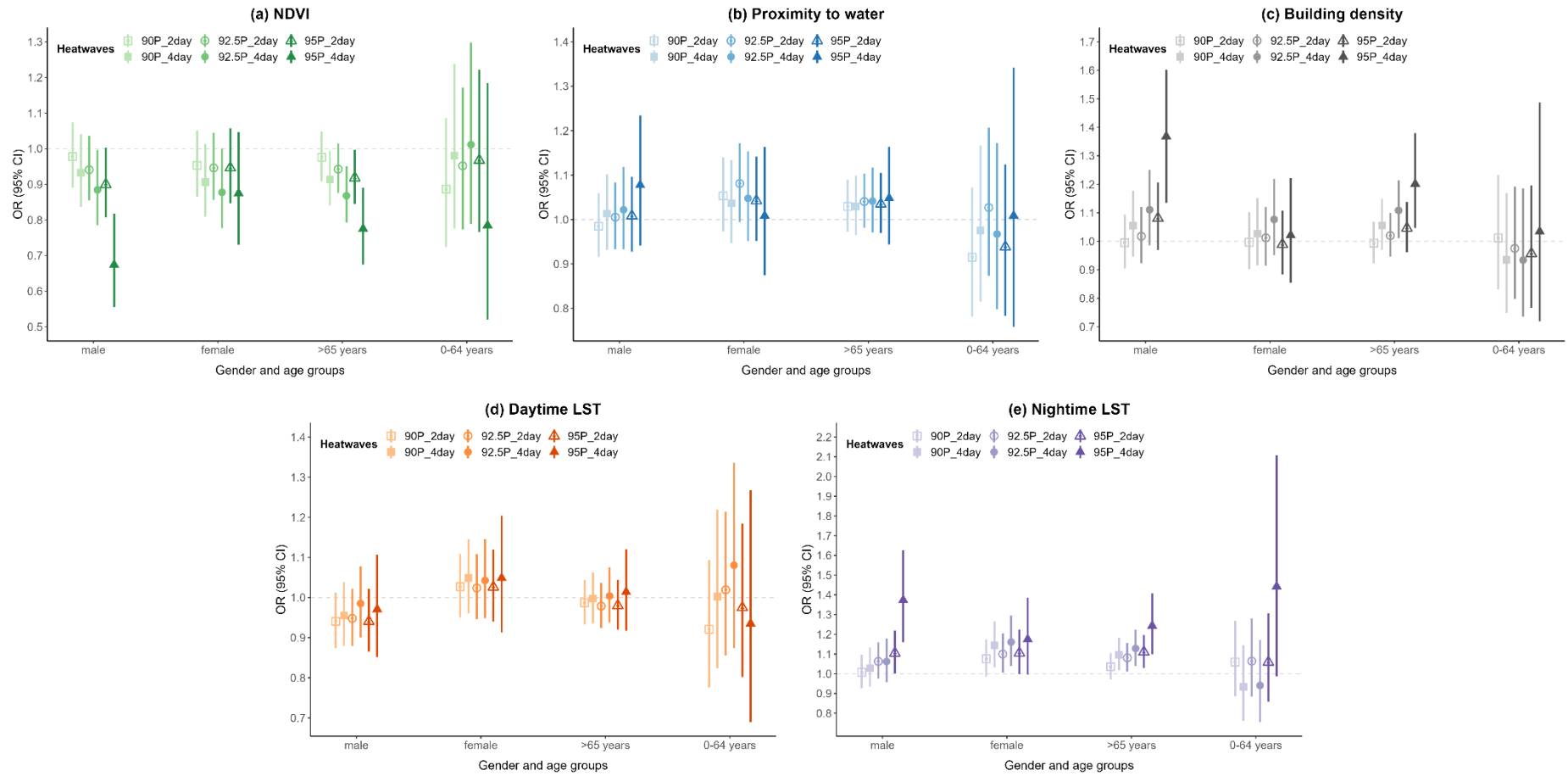


Fig. A7 Relative odds (with the control of air pollutions by including O_3 and PM_{10} at lag0–1) of dying during or 4-days following a heat wave versus dying on other days during hot season for people who live at the top quantile, compared with those living at the bottom quantile of (a) NDVI; (b) Proximity to water; (c) Building density; (d) Daytime Land Surface Temperature (LST); (e) Nighttime LST.

References

Hong Kong Census and Statistics Department (2006). Hong Kong Census Data in 2006. Hong Kong, China: Hong Kong Census and Statistics Department

Hong Kong Census and Statistics Department (2016). Hong Kong Census Data in 2016. Hong Kong, China: Hong Kong Census and Statistics Department

Hong Kong Census and Statistics Department (2023). Statistics: Population and Households. Hong Kong, China: Hong Kong Census and Statistics Department