

Heat, cold and first hospitalisation after cardiovascular diagnosis in Hong Kong

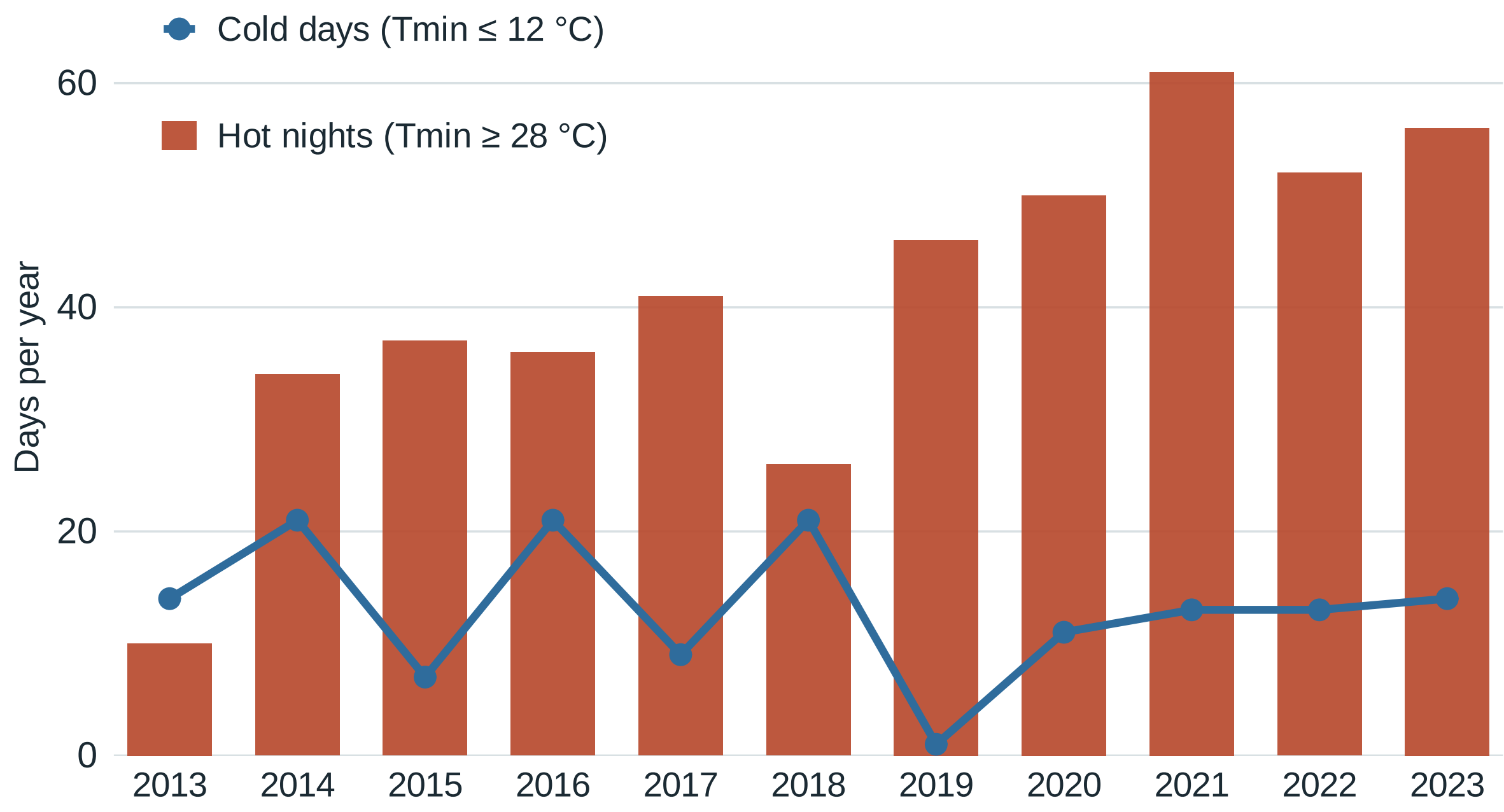
An exploratory monthly study, 2013–2023

Shen Ruililin | Professor David Bishai | School of Public Health, The University of Hong Kong



INTRODUCTION

Hong Kong’s hot nights became more frequent over the past decade: at the Hong Kong Observatory they rose from 10 days in 2013 to a peak of 61 in 2021^[1], while winter cold days have not disappeared. For the growing number of people living with type 2 diabetes or hypertension — a group at high cardiovascular risk — hospital burden^[2,3] complements the better-studied mortality burden^[4,5]. This study examines the monthly association between temperature, extreme-day burdens and first hospitalisation after cardiovascular diagnosis in that group.



Official Hong Kong Observatory extremes at Headquarters. Hot nights rose about fivefold over the decade; cold days recurred every winter — the exposure setting for this study.

RESULTS

Model 1: twelve thermal fits, specified after the outcome series was available — two residual signals, with unequal robustness.

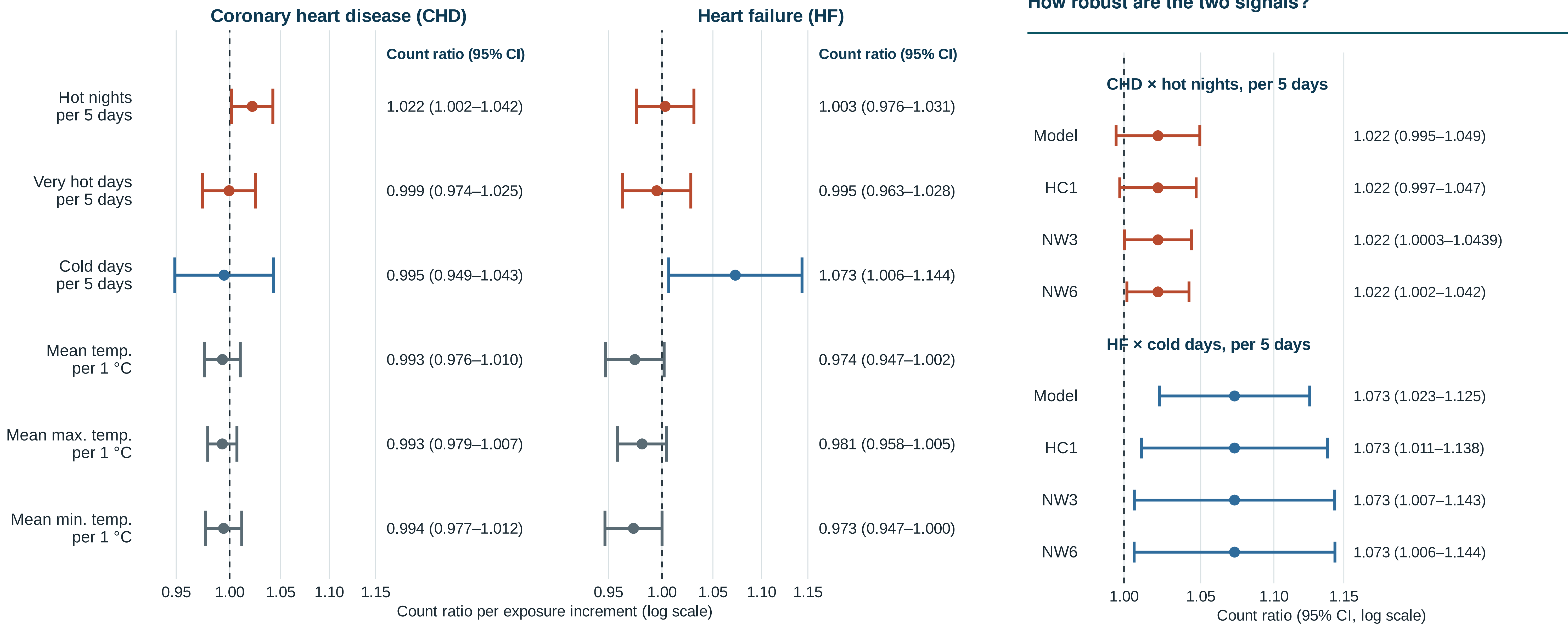
1.022

CHD series × hot nights, per 5 days
Full window (NW6): 1.002–1.042 $p = 0.032$ $q = 0.192$
2013–2019: 1.011 (0.991–1.032) — includes 1

1.073

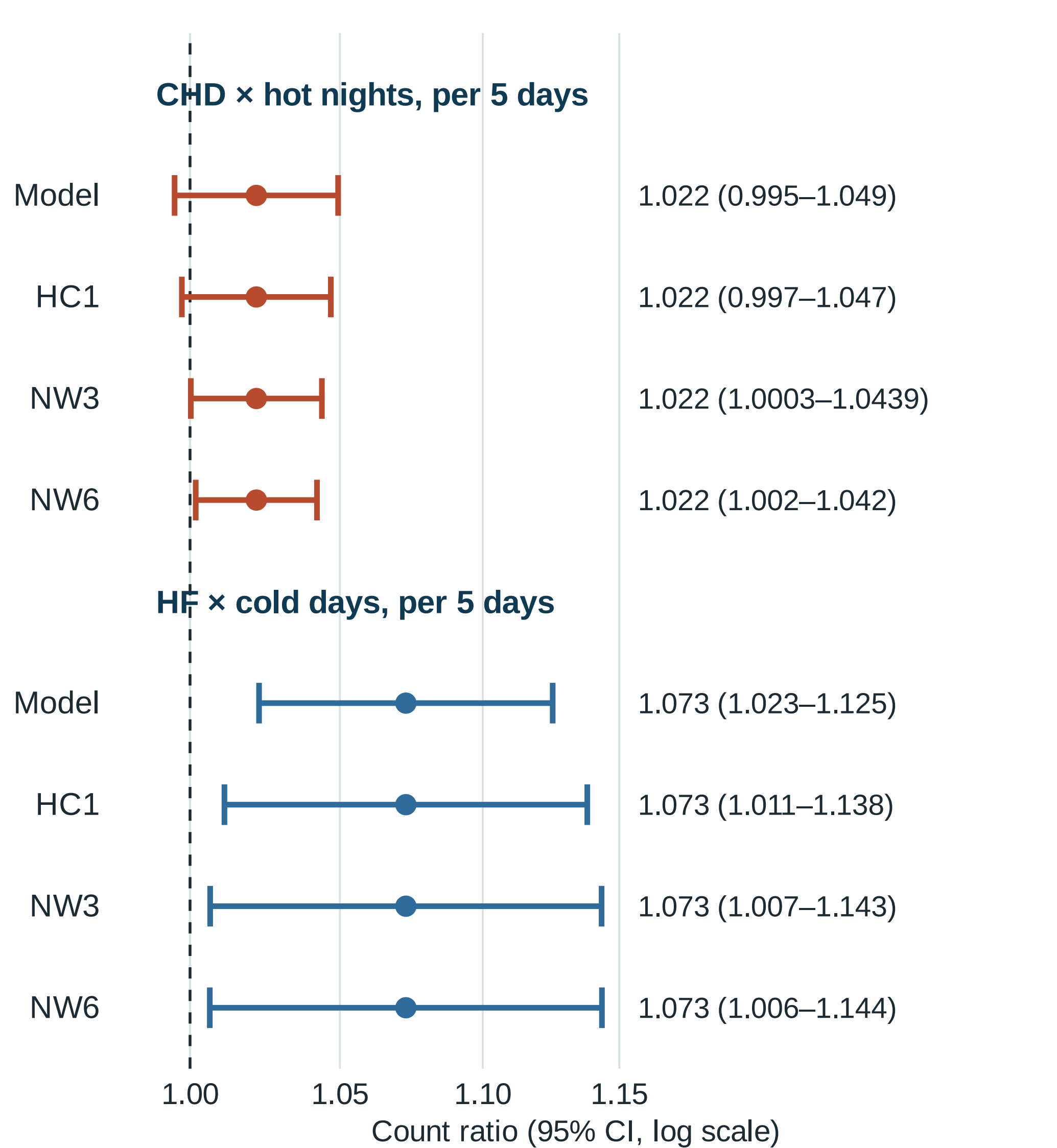
HF series × cold days, per 5 days
Full window (NW6): 1.006–1.144 $p = 0.031$ $q = 0.192$
2013–2019: 1.113 (1.053–1.176) — excludes 1

- **Unequal coherence:** the HF cold-day interval excludes 1 under all four standard-error methods and before 2020; the CHD hot-night interval includes 1 under two methods and in 2013–2019.
- The other ten contrasts sit near 1. **All 12 Benjamini–Hochberg q -values exceed 0.19:** after correction for 12 comparisons, both signals remain exploratory.



The twelve Model 1 thermal fits: count ratios from single-exposure negative-binomial models (days-in-month offset); 95% intervals with Newey–West lag-6 standard errors. Values right of 1 mean more first hospitalisations following recorded diagnosis in months with higher exposure. All 12 Benjamini–Hochberg $q > 0.19$. Models 2 and 3 are specified, not shown.

How robust are the two signals?



The two leading contrasts under four standard-error methods. For CHD × hot nights: Model and HC1 intervals include 1; NW3 excludes it only on the unrounded scale (1.0003–1.0439); NW6 excludes it. The HF cold-day interval excludes 1 under all four. The main display uses NW6; methods were not chosen by interval position.

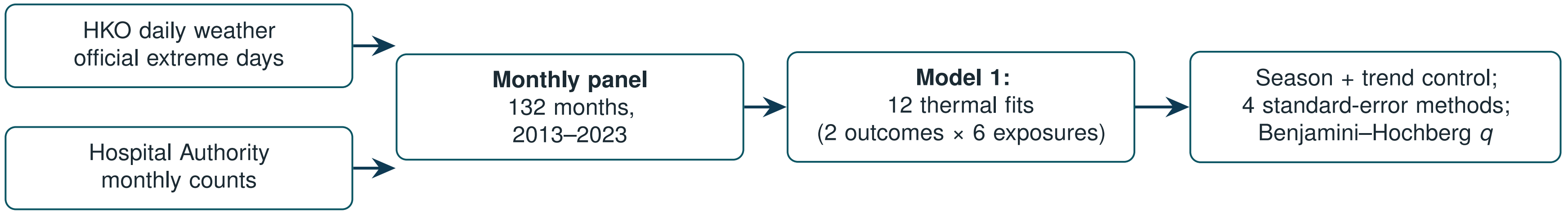
INTERPRETATION / LIMITATIONS

- All 12 q -values exceed 0.19 — these are **exploratory signals**, not confirmed effects.
- The CHD hot-night estimate is **window-dependent and uncertainty-sensitive**; the HF cold-day estimate is more coherent across methods and before 2020, but not confirmed.
- Monthly, territory-level data with no recorded admission cause support **no causal or principal-diagnosis claim**^[6].

OBJECTIVE

Are monthly temperature and extreme-day burdens associated with **first hospitalisation after a recorded coronary heart disease (CHD) or heart failure (HF) diagnosis** in a high-risk Hong Kong cohort?

METHODS



- **Window and weather:** 132 territory-months, Jan 2013 – Dec 2023; daily records and official extreme-day definitions from the Hong Kong Observatory.
 - **Outcomes:** Hospital Authority monthly counts of *first hospitalisation after a first recorded CHD or HF diagnosis* in people with type 2 diabetes and/or hypertension — 156,156 CHD and 29,681 HF events. Delivered columns are labelled inpatient; admission cause is not recorded, and final event semantics require data-provider confirmation.
 - **Model 1 (shown):** 2 outcomes × 6 thermal exposures = 12 negative-binomial regressions with calendar-month indicators, a trend spline, and a days-in-month offset, specified after the outcome series was available. **Model 2** adds monthly humidity and rainfall; **Model 3** counts days above or below the historical same-calendar-day mean. Models 2 and 3 are specified, not shown.
 - **Uncertainty:** four standard-error methods per contrast; Benjamini–Hochberg q across all 12 comparisons.
- Definitions.** Hot night: minimum 28 °C or higher; very hot day: maximum 33 °C or higher; cold day: minimum 12 °C or lower (HKO definitions)^[1]. Estimates are count ratios per 5 extreme days or per 1 °C.

CONCLUSION

Monthly data suggest **different thermal patterns** in the CHD and HF series — hot nights for CHD, cold days for HF — but the evidence is **exploratory, not confirmatory**: no Model 1 contrast survived correction for twelve comparisons. Models 2–3 are specified, not shown. The project leaves a **reproducible monthly framework** and a clear next requirement: **daily or cohort data with recorded admission cause**.

What would strengthen this: linked daily weather and admission records with cause of admission, so the monthly burden patterns seen here can be tested at the resolution at which heat and cold act.

REFERENCES

1. Hong Kong Observatory. The Year’s Weather — 2013 and 2021. hko.gov.hk/en/wxinfo/pastwx

2. Goggins WB, Chan EYY, Yang C-Y. Int J Cardiol 2013;168:243–9. doi:10.1016/j.ijcard.2012.09.087

3. Goggins WB, Chan EYY. Int J Cardiol 2017;228:537–42. doi:10.1016/j.ijcard.2016.11.106

4. Liu J, Hansen A, Varghese B, et al. Sustain Cities Soc 2020;57:102131. doi:10.1016/j.scs.2020.102131

5. Liu Z, Ren C, Liu J, Kawasaki Y, Bishai DM. medRxiv preprint 2026. doi:10.64898/2026.03.05.26347683

6. Greenland S, Morgenstern H. Int J Epidemiol 1989;18:269–74. doi:10.1093/ije/18.1.269