

## SUPPLEMENTARY MATERIAL

### Admission Arterial Partial Pressure of Carbon Dioxide (PaCO<sub>2</sub>) and Outcomes After Out-of-Hospital Cardiac Arrest: A Single-Centre Retrospective Cohort Study

**Table S1. Sensitivity analyses - association of PaCO<sub>2</sub> with one-month mortality using alternative categorisations**

| PaCO <sub>2</sub> specification         | Adjusted OR (95% CI)* | p      |
|-----------------------------------------|-----------------------|--------|
| Data-driven groups (ref ≤ 50 mmHg)      |                       |        |
| > 50-70 mmHg (n=286)                    | 2.75 (1.73-4.38)      | <0.001 |
| > 70 mmHg (n=140)                       | 4.45 (2.18-9.09)      | <0.001 |
| Clinical cutoffs (ref ≤ 45 mmHg, n=136) |                       |        |
| 46-60 mmHg (n=205)                      | 1.76 (1.04-2.98)      | 0.035  |
| > 60 mmHg (n=276)                       | 3.45 (1.94-6.12)      | <0.001 |
| Tertiles (ref T1, 18-51.5 mmHg)         |                       |        |
| T2 (51.6-64.5 mmHg)                     | 3.31 (2.00-5.48)      | <0.001 |
| T3 (64.6-101.6 mmHg)                    | 3.87 (2.17-6.92)      | <0.001 |
| Continuous, per 10 mmHg                 | 1.45 (1.24-1.70)      | <0.001 |

\*Adjusted for age, sex, witnessed arrest, bystander CPR, call-to-arrival time, shockable rhythm, prehospital ROSC and etiology. Reference categories indicated in parentheses. The graded association is preserved across all cut-point schemes and in the continuous model, indicating results are not an artefact of a particular categorisation.

**Table S2. Effect of adjustment for concurrent metabolic acidosis on the PaCO<sub>2</sub>-mortality association (per 10 mmHg)**

| Model                                                     | Adjusted OR (95% CI) | p      |
|-----------------------------------------------------------|----------------------|--------|
| Clinical model*                                           | 1.45 (1.24-1.70)     | <0.001 |
| Clinical model + lactate, base excess, PaO <sub>2</sub> † | 0.80 (0.64-1.01)     | 0.063  |

\*Clinical model: age, sex, witnessed arrest, bystander CPR, call-to-arrival time, shockable rhythm, prehospital ROSC, etiology. †Additional adjustment for lactate, base excess and PaO<sub>2</sub>. PaCO<sub>2</sub> was strongly collinear with these acid-base variables (Pearson r with pH -0.88; base excess -0.73; lactate 0.52; variance-inflation factors for pH and base excess > 20). Because lactate and base excess are largely downstream of the same global hypoperfusion, this model likely over-adjusts for mediators and is presented as a conservative test of independence rather than as the primary estimate.

**Table S3. Neurological outcome analyses (PaCO<sub>2</sub> per 10 mmHg)**

| Analysis                                    | Unadjusted OR (95% CI) | p      | Adjusted OR (95% CI)* | p      |
|---------------------------------------------|------------------------|--------|-----------------------|--------|
| Ordinal CPC (1-5), common OR                | 1.93 (1.68-2.23)       | <0.001 | 1.53 (1.31-1.79)      | <0.001 |
| Unfavourable neurological outcome (CPC 3-5) | -                      | -      | 1.59 (1.34-1.88)      | <0.001 |
| Unfavourable CPC among survivors (3-4)      | -                      | -      | 1.91 (1.25-2.91)      | 0.003  |

\*\*Adjusted for age, sex, witnessed arrest, bystander CPR, shockable rhythm, prehospital ROSC, and etiology (call-to-arrival time additionally included for mortality/unfavorable outcome models). Ordinal CPC analyzed by proportional-odds regression. The survivor-only analysis (CPC 3-4 among one-month survivors, n = 163) was analyzed using Firth's penalized logistic regression due to the low number of events (n=17), demonstrating that the association is not solely attributable to competing mortality.\*

**Table S4. Subgroup analysis by arrest etiology (PaCO<sub>2</sub> per 10 mmHg, one-month mortality)**

| Etiology subgroup               | Adjusted OR (95% CI)* | p      |
|---------------------------------|-----------------------|--------|
| Cardiac (n=395; 260 deaths)     | 1.51 (1.25-1.84)      | <0.001 |
| Non-cardiac (n=222; 194 deaths) | 1.32 (0.97-1.80)      | 0.074  |

\*Adjusted for age, sex, witnessed arrest, bystander CPR, call-to-arrival time, shockable rhythm and prehospital ROSC. Test for PaCO<sub>2</sub> × etiology interaction: p = 0.371. The confidence intervals overlap substantially and the interaction is not significant; a differential effect by etiology cannot be claimed. Only cardiac and non-cardiac categories were available in the dataset.

**Table S5. Discrimination for one-month mortality (area under the ROC curve)**

| Model                              | AUC (95% CI)        |
|------------------------------------|---------------------|
| Admission PaCO <sub>2</sub> alone  | 0.740 (0.695-0.782) |
| Clinical model*                    | 0.794 (0.750-0.834) |
| Clinical model + PaCO <sub>2</sub> | 0.816 (0.775-0.854) |

\*Clinical model: age, sex, witnessed arrest, bystander CPR, call-to-arrival time, shockable rhythm, prehospital ROSC, etiology. Adding admission PaCO<sub>2</sub> to the clinical model improved discrimination by ΔAUC 0.022 (0.002-0.043), a minimal improvement of uncertain clinical utility.

**Table S6. Comparison of included patients (n=617) versus patients excluded due to missing admission ABG or one-month outcome data**

| Characteristic   | Included (n=617) | Excluded (n=84) | P value |
|------------------|------------------|-----------------|---------|
| Age,years        | 67(57–76)        | 66(55–74)       | 0.38    |
| Male sex         | 367(59.5%)       | 44(52.4%)       | 0.21    |
| Witnessed arrest | 253(41.0%)       | 32(38.1%)       | 0.62    |
| Shockable rhythm | 143(23.2%)       | 17(20.2%)       | 0.55    |
| Prehospital ROSC | 78(12.6%)        | 8(9.5%)         | 0.42    |
| Cardiac etiology | 395(64.0%)       | 51(60.7%)       | 0.55    |

Data are median (IQR) or n (%). Comparisons: Mann-Whitney U (continuous) or  $\chi^2$  (categorical). No statistically significant differences were observed between included and excluded patients, suggesting that complete-case analysis did not introduce substantial selection bias on measured characteristics.

**Supplementary Note. Variable availability**

All analyses were performed on the complete de-identified dataset (N = 617). The following variables were available and analyzed: age, sex, witnessed arrest, bystander CPR, shockable initial rhythm, prehospital ROSC, call-to-arrival time, arrest etiology (cardiac vs non-cardiac), admission PaCO<sub>2</sub>, PaO<sub>2</sub>, pH, lactate, base excess, one-month mortality, and one-month CPC. Variables often recommended for OHCA prognostica-

tion but not present in this dataset—including detailed comorbidity, airway-management type, shock on admission, no-flow/low-flow intervals, targeted temperature management, and ventilator settings,could not be included and are acknowledged as limitations. As noted in the main manuscript, the absence of no-flow/low-flow intervals, ventilator settings, and ROSC-to-ABG time is a major limitation that precludes disentangling the prognostic signal of PaCO<sub>2</sub> from resuscitative treatment effects.