Supplementary Tables & Figure

Supplementary Table S1 – Missing Data Analysis for Birth Interval

Characteristic	Missing Birth Interval (n=354)	Non-missing (n=688)	p-value
Referred from other facility (%)	42.1	28.6	**0.020**
Maternal age (median, IQR)	28 (9)	30 (10)	0.070
Education: primary or less (%)	71.2	68.9	0.450
Parity ≥3 (%)	28.5	26.1	0.400
Neonatal death (%)	0.0	4.7	**<0.001**

Note: Women with missing birth interval data were more likely to be referred and had zero recorded neonatal deaths in the dataset, suggesting that missingness is not random (MNAR). Complete-case analysis for birth interval models may therefore underestimate mortality. Sensitivity analyses are presented in Supplementary Table S2.

Bold values indicate statistically significant p-values.

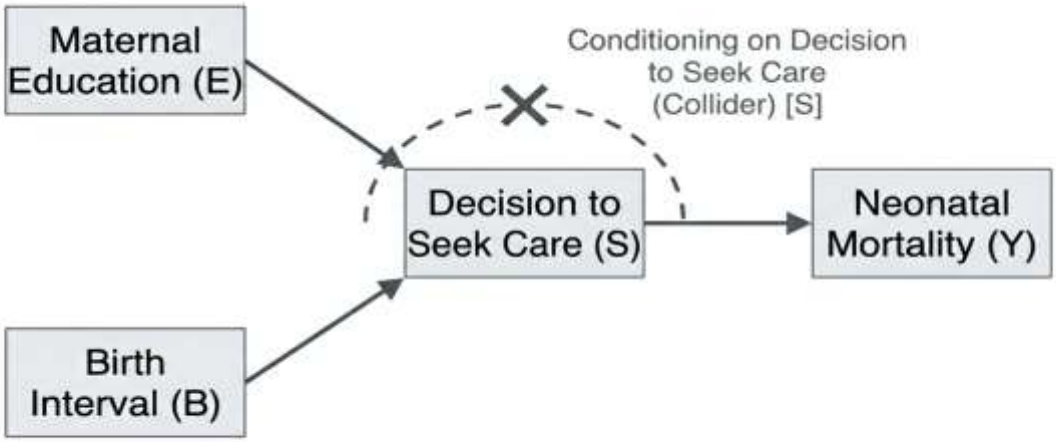
Supplementary Table S2 – Sensitivity Analysis for Birth Interval (n=1042)

Model	aOR (Short vs. Not Short)	95% CI	p-value
Complete-case (n=688)	0.42	0.20–0.85	**0.017**
Best-case (missing = not short)	0.97	0.46–2.06	0.938
Worst-case (missing = short)	0.25	0.12–0.51	**<0.001**

Note: Best and worst case analyses impute all missing birth intervals as “not short” or “short”, respectively. The wide range of estimates highlights the uncertainty due to missing data.

Bold values indicate statistically significant p-values.

Supplementary Figure A1: Directed Acyclic Graph (DAG) Illustrating Selection Bias



Arrows represent proposed causal paths. Conditioning on the collider (Decision to Seek Care) [S] creates a non-causal association between variables leading into it.

The Causal Structure

In this model, we are investigating the relationship between **Maternal Education** (the exposure) and **Neonatal Mortality** (the outcome).

- **Maternal Education (E):** Influences both the health of the neonate and the likelihood of the mother seeking formal healthcare.
- **Birth Interval (B):** An independent risk factor for neonatal health and a predictor of healthcare-seeking behavior (e.g., mothers with short intervals may be flagged as high-risk).
- **Hospital Admission (S):** The **collider**. Both the exposure (Education) and other independent factors (Birth Interval) influence whether a child ends up in the study sample (the hospital).
- **Neonatal Mortality (Y):** The primary outcome of interest.

Why the Bias Occurs

1. **The Collider: Hospital Admission (S)** is a "collider" because arrows from Maternal Education and Birth Interval both point into it.
2. **The Act of Selection:** By conducting a facility-based study, researchers are "conditioning" on the collider. We only see the data for those where S=1.

3. **Spurious Association:** Conditioning on a collider opens a “backdoor path” that did not exist before. Even if Maternal Education and Birth Interval were completely independent in the general population, they become correlated within the hospital.
4. **The Result:** Because Birth Interval also affects Neonatal Mortality (Y), this induced correlation creates a distorted estimate of the effect of Education on Mortality.

   In a hospital-only sample, highly educated mothers might only be present if their child is exceptionally ill (due to other factors like short birth intervals), while low-education mothers might be present for more routine reasons. This selection process makes it appear as though education is less protective - or more harmful - than it actually is in the broader community.