THE IMPACT OF MODERN OBSTETRICS ON THE EVOLUTION OF HUMAN BIRTHWEIGHT

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1) Objective, Design & Method

Objective

- We set out to explore how **medical advancements** have **influenced** the **dynamics of birthweight**.
- Advances in prenatal care, caesarean sections (CS) and neonatal interventions have significantly **improved maternal** and **neonatal outcomes.**
- We hypothesise that this reduction in differential mortality has **relaxed stabilising selection**, leading to **increased birthweights at both extremes**.

Design and Method

- We reviewed literature on the evolutionary maintenance of birthweight, clinical risks associated with extreme birthweights, and population level data on how medical interventions have influenced birth outcomes over time.

Figure A.

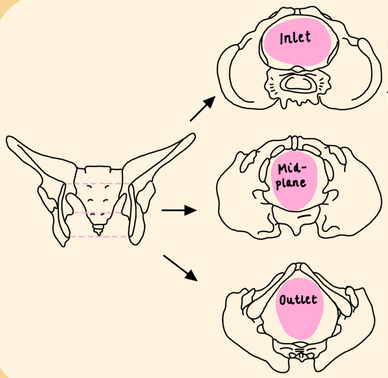

Figure A: Childbirth involves a **complex rotation** of the foetal head and body due to the non-uniform shape of the birth canal, which has its widest dimensions in different directions at the inlet, midplane, and outlet (1). The **tight fit increases the risk of birth complications** without medical intervention. Re-drawn from (1).

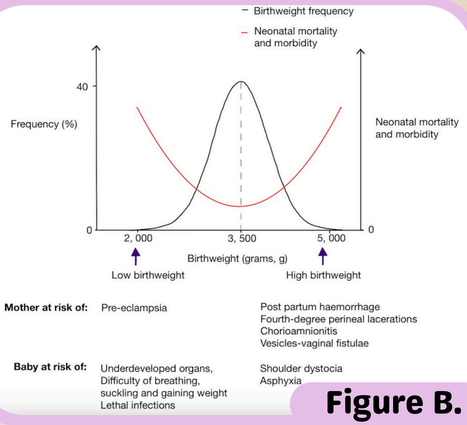

Figure B.

Figure B: The birthweight spectrum in relation to perinatal selection pressures (2).

Figure C: Predicted dynamics of birthweight evolution.

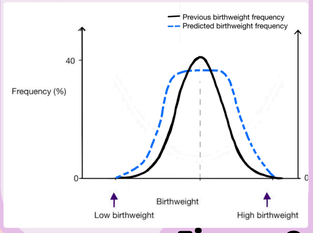

Figure C.

2) Results

- **Birthweight** is a key **determinant** of **perinatal survival** as birthweights at both **extremes** are subject to **intensive selection pressures** (Figure B)**:**
  - **Large** babies face **risks** of **obstructed labour** and **asphyxia**, while their mothers are at risk of **haemorrhage** and **perineal trauma** (2).
  - **Small** babies are at **risk of underdevelopment** and increased susceptibility to **lethal infections,** and the mothers are at increased risk of **pre-eclampsia** (3).

- **Medical advancements have significantly improved outcomes** at both extremes: neonatal intensive care improves survival for small infants, while CS has reduced mortality associated with delivering larger babies.
- As these interventions reduce the mortality risks previously driving selection against birthweight extremes, population data now indicate **emerging trends**, for example:
  - Between 1954 and 1985 in Italy, improved healthcare led to a rapid decline in stabilising selection on birth weight and almost diminished for the majority of newborns (4).
  - This would suggest that there would be an increase in preterm small for gestational age (SGA) and large for gestational age (LGA) babies - a trend that was observed in the United States between 1985 and 1998 (5).
- These findings support the hypothesis that **modern medical practices** are already **altering** the **natural distribution of birthweight**, allowing greater survival at both ends of the spectrum (Figure C).

Figure D.

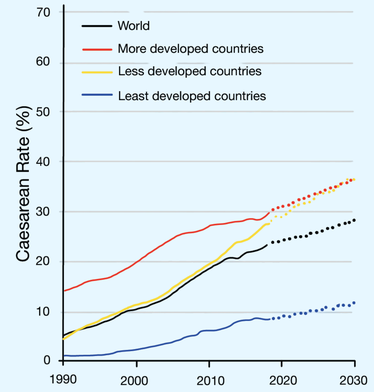

Figure D: Global CS trends (1990-2018) and projections (2030). Re-drawn from (6).

CS rates are projected to reach **30 percent by 2030,** with 38 million births annually (6). CS carries **health risks** and significant **global disparities** exist in **access** to **safe care**.

3) Conclusion

- Medical advancements are **reshaping** the **evolutionary dynamics** of human birthweight by **reducing mortality** across the birthweight spectrum and so relaxing stabilising selection.
- We predict that this may **mean an increased reliance on medical interventions**, e.g. CS and neonatal intensive care, to manage the risks once mitigated by natural selection.
- This necessitates the **need** for **individualised prenatal care** and continued **innovation in obstetric practice**. Persistent genetic traits such as predisposition to macrosomia or cephalopelvic disproportion may further reinforce this dependency.
- These trends also call for research into the long term clinical and evolutionary consequences of an increasingly medicalised model of human reproduction.

4) References

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