

A Critical Threshold for Global Pediatric Surgical Workforce Density

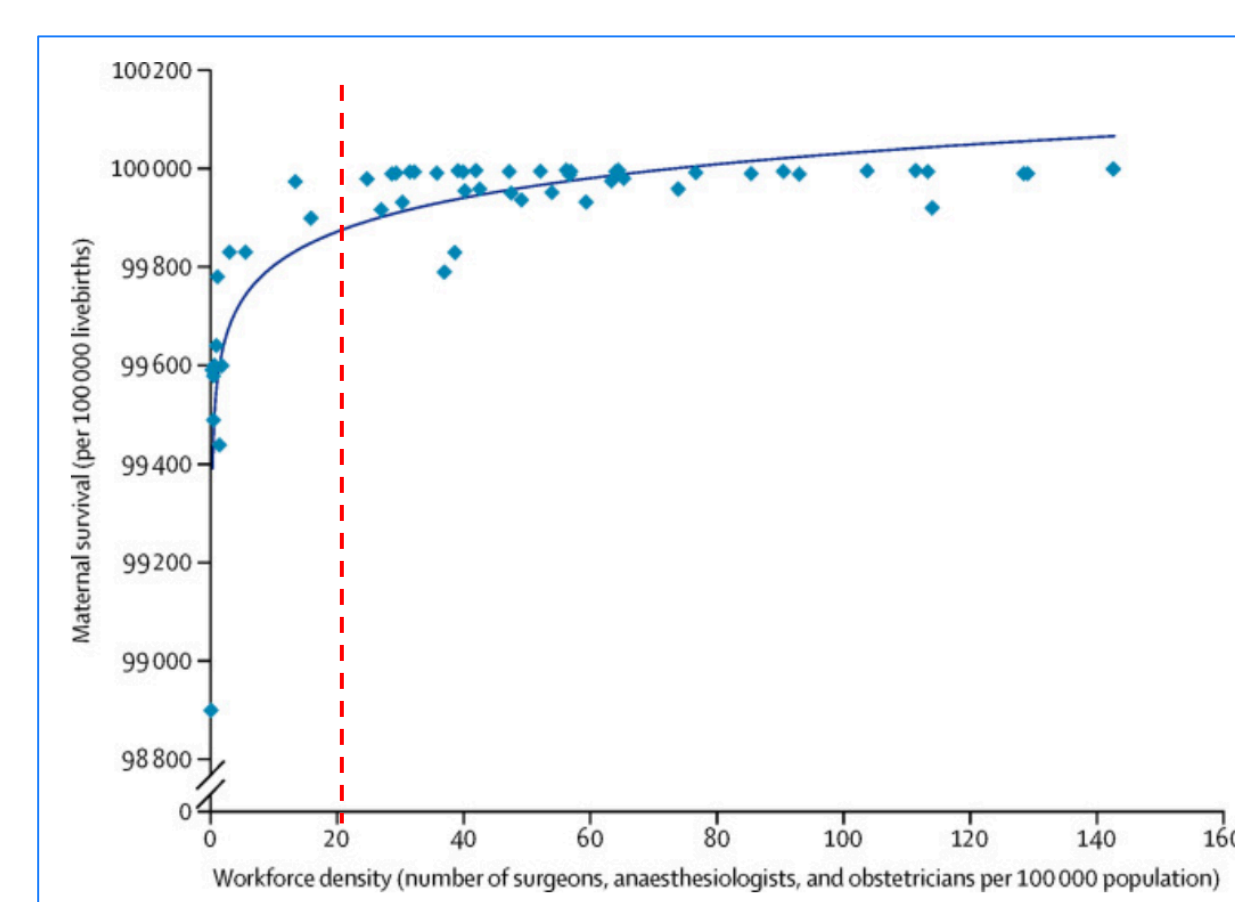
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Background

- 1.7 billion children worldwide lack access to surgical care, especially in low- (LIC) and low-middle income (LMIC) countries¹
- Among other indicators, specialist surgical workforce density (specialist surgeons, anesthesiologists, and obstetricians/100,000 population) is one marker of progress in global surgical access
- Surgical workforce density correlates with maternal mortality, with a critical threshold of 20 resulting in significant improvement in maternal survival²



Meara 2015

- Pediatric surgical workforce density (PSWD) of 0.4/100,000 children correlates with improved survival of complex pediatric surgical conditions³
- No studies exist on PSWD and pediatric-specific population mortality rates

Specific Aims

- Compare PSWD with neonatal, infant and <5 childhood mortality rates
- Calculate the critical PSWD threshold associated with mortality reduction

Methods

- Using publicly available registries, a convenience sample of 26 countries were evaluated with 2015-2019 data
- Countries varied in geography and World Bank income classification
- Data obtained:
 - Number of pediatric surgeons
 - Childhood (≤15 years) population
 - Neonatal mortality rate
 - Infant mortality rate
 - Under 5 mortality rate

$$\text{PSWD} = \frac{\text{\# pediatric surgeons}}{\text{100,000 children}}$$

- Survival plotted as a function of PSWD
- Spearman's correlations were conducted to evaluate the relationship between PSWD and neonatal, infant and < 5 mortality

Results

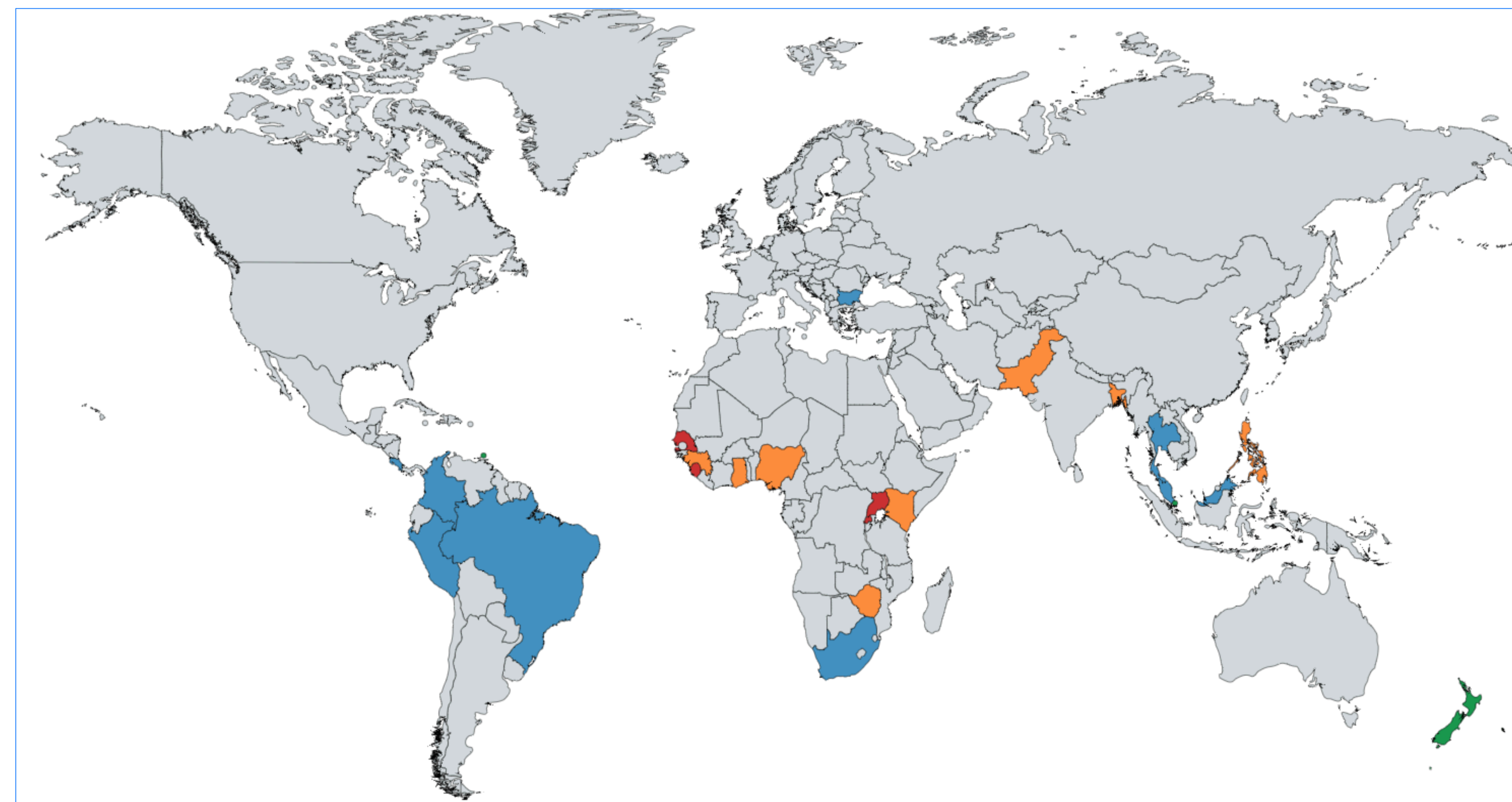


Figure A: Map of income-shaded countries (red = LIC, orange = L-MIC, blue = UMIC, green = HIC) included in analysis.

	LIC	L-MIC	UMIC	HIC
Number of Countries	4	8	10	4
Mean Proportion of <15 population	42.8%	38.2%	21.6%	18.7%
Median PSWD	0.03	0.12	1.34	2.13

	Neonatal	Infant	Child < 5
Spearman Correlation	0.70008 ($p < 0.003$)	0.73878 ($p < 0.001$)	0.74337 ($p < 0.001$)
Critical PSWD Threshold (Per 100,000 children)	0.25	0.25	0.30

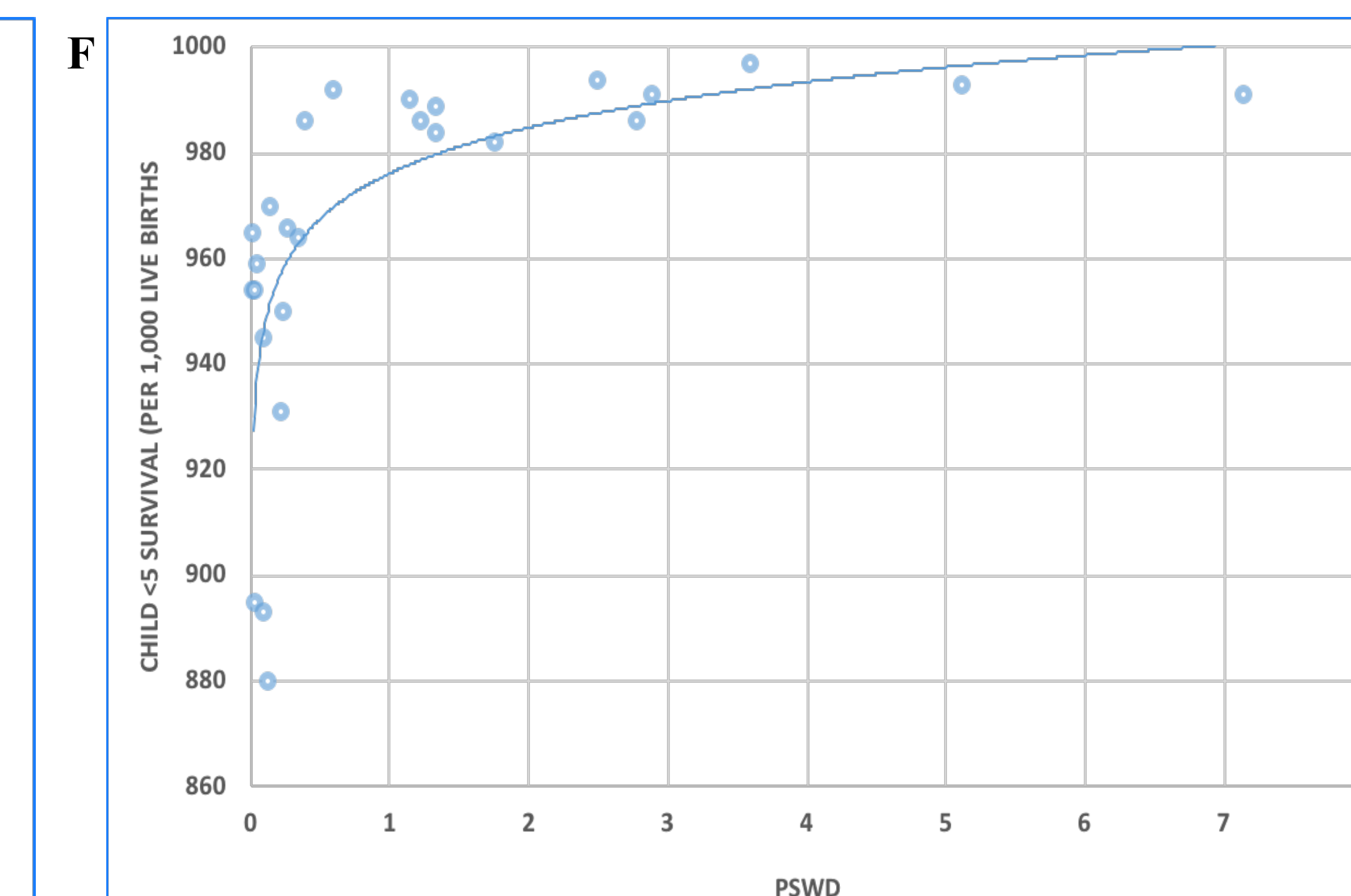
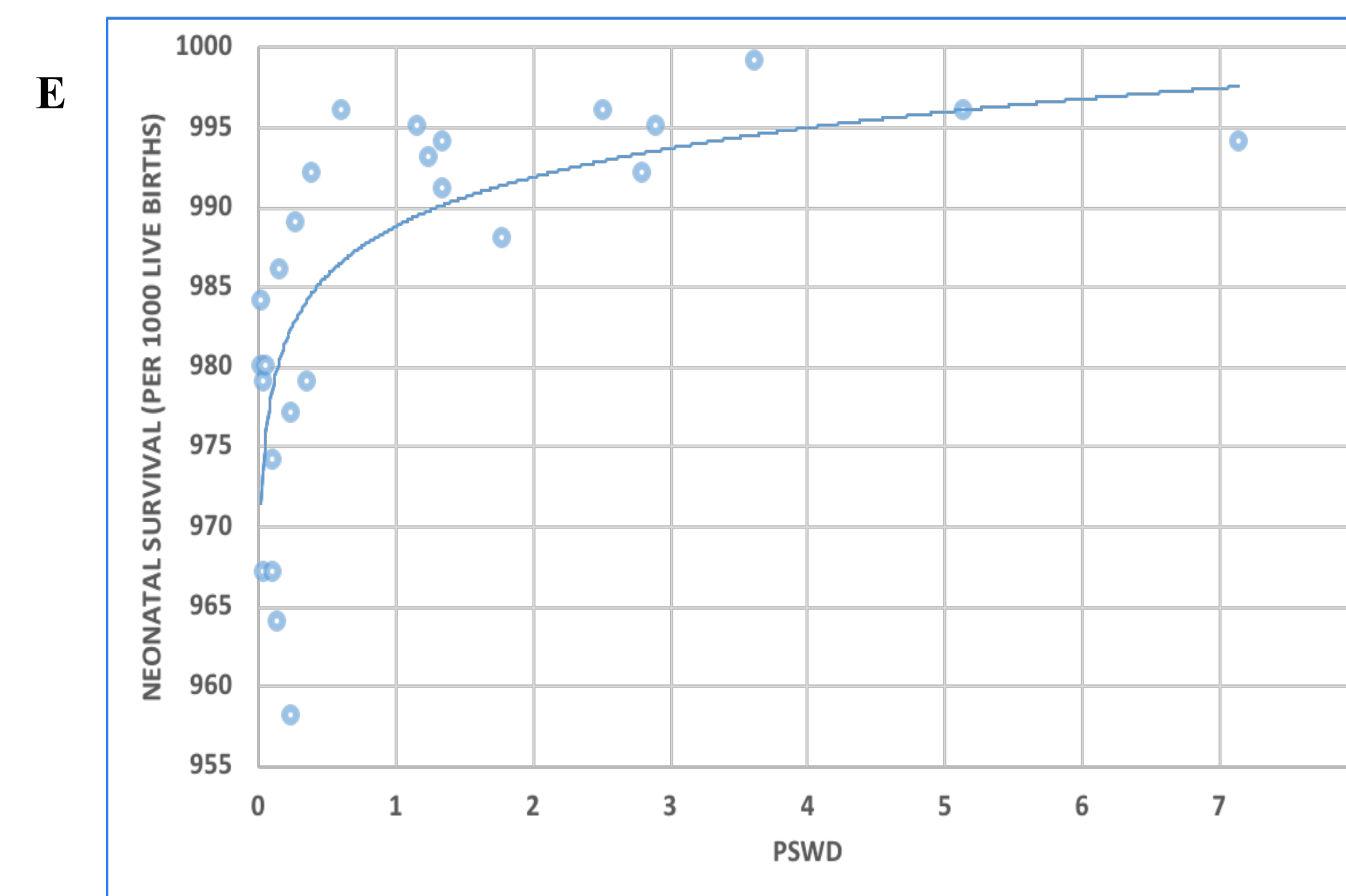
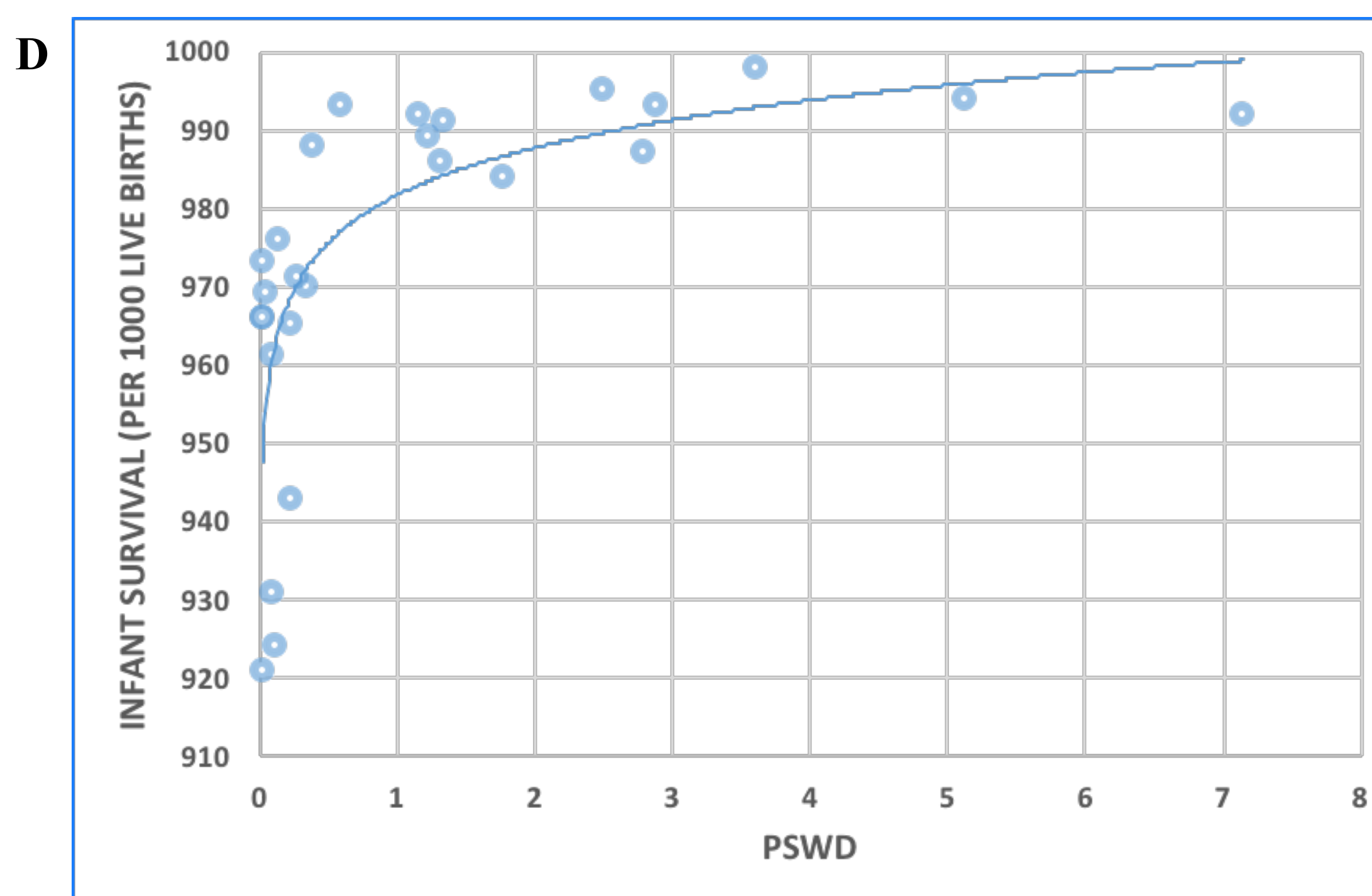


Figure B Average proportion of < 15-year-old population and median PSWD by income. Figure C: Correlation of PSWD with mortality rate. Critical PSWD threshold that correlates with improved survival. Figures D-F: Survival plotted as a function of PSWD for neonatal (D), infant (E) and under < 5 (F) mortality rates.

Discussion

- PSWD correlates with pediatric population-level mortality rates
- Critical threshold of PSWD ~0.3 per 100,000 children correlates with significant increase in survival
 - This mirrors PSWD 0.4 for survival from pediatric surgical conditions³
 - Can serve as benchmark in tracking progress in pediatric surgical access and national health planning
- 42.3% of countries sampled (LIC/LMICs) had PSWDs below 0.25 → 270 million children in the countries sampled have inadequate access to pediatric surgical care
 - If not addressed in LMICs, where a large proportion of the population is <15, many children will continue to die from preventable deaths each year
- PSWD is likely an indirect representation of a system with comprehensive resources for pediatric care, though pediatric surgeons remain an essential component of functional health systems
- Further efforts are needed to increase the training and retention of pediatric surgical specialists to meet UN Sustainable Goal 3.2 for infant and child mortality by 2030

Limitations

- Limited sample of 26 countries
- Recognize global infant and child mortality have multiple causes other than surgical conditions
- Unable to determine if providers practice year-round in country or how they are distributed throughout the country
- Cannot quantify non-specialist providers who provide surgical care

Next Steps

- Increase sample size
- Evaluate correlation with specialist anesthesia density
- Assess relationship between PSWD and surgical volume/outcomes
- Examine the impact of increased PSWD in future childhood survival rates

References

- Mullapudi et al. Bulletin WHO 2019
- Meara et al. Lancet 2015.
- Hamad et al. JPS 2020.