# The ratio of Surgeons, Anesthesiologists, and Obstetricians around the world: A well-conserved provider ratio that may inform surgical workforce planning

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## Background

- Inadequate access to surgical and anesthesia care is one of the greatest global health crises, affecting over 5 billion people, with 9/10 people in low-income (LIC) and lower-middle income (L-MIC) countries unable to access safe essential and emergency surgery.[1]
- A large contributing factor to this crisis is inadequate workforce, quantified by the Surgeon, Anesthesiologist and Obstetrician (SAO) workforce density (specialist physicians/100,000 population).[1]
- Based on the correlation of SAO density and maternal mortality rate (MMR), the Lancet commission on Global Surgery recommended a minimum of 20 SAO physicians per 100,000 population in LICs.[1]
- A study of anesthesia providers identified that at least 4 (of the 20/100,000) should be physician anesthesiologists to decrease MMR.[2]
- No recommendation for ratio of individual specialist providers:total SAO providers

## Specific Aims

(1) Describe existing ratios of SAO Specialty providers/total SAO providers
(2) Assess relationship of these ratios to World Bank country income group (Low-, Lower Middle-, Upper Middle-, and High-Income Countries)
(3) Assess relationship of these ratios to Fertility rate (FR), Maternal Mortality Rate (MMR) and Infant mortality rate (IMR)

## Methods

- Publicly available Medical Licensing registries use to obtain numbers of practicing Surgeons, Obstetricians and Anesthesiologist physicians in a convenience sample of 20 countries in 2018 or 2019.
  - LIC (n=3): Rwanda, Sierra Leone, Uganda
  - L-MIC (n=3): Kenya, Nigeria, Zimbabwe
  - UMIC (n=7): Colombia, Malaysia, Maldives, Mauritius, Peru, South Africa
  - HIC (n=7): Bahamas, Ireland, Israel, New Zealand, Singapore, Trinidad and Tobago, US Virgin Islands
- World bank data for population, income category, MMR, infant mortality rate (IMR) and Fertility rate (FR) in same year
- Ratios of each specific provider to total SAO provider compared between the 20 countries
- Spearman's correlations were conducted to evaluate the relationship between ratio and MMR, IMR and FR
- Kruskal-Wallis equality of population rank test used to assess relation between ratios and income category

## Figures

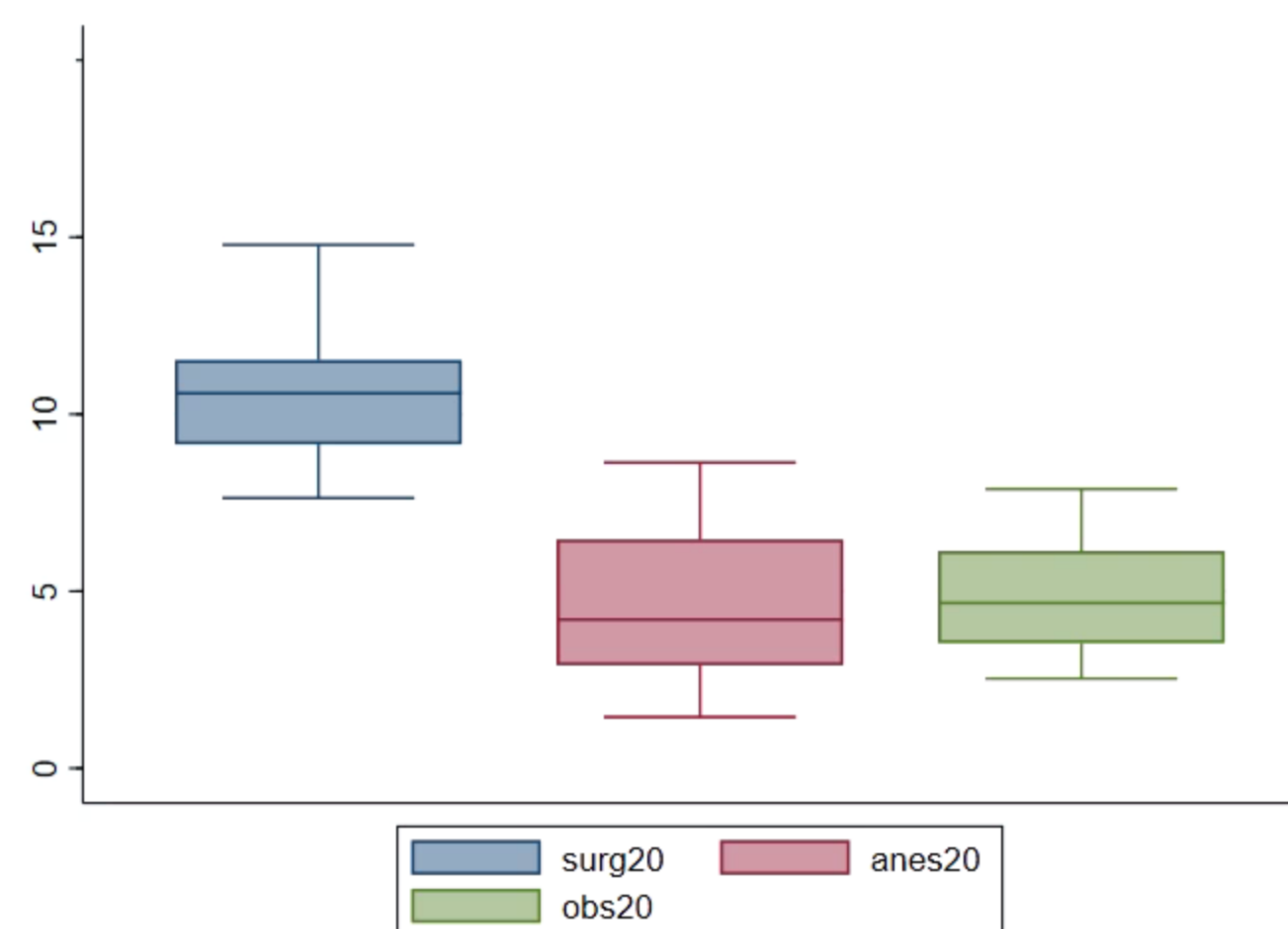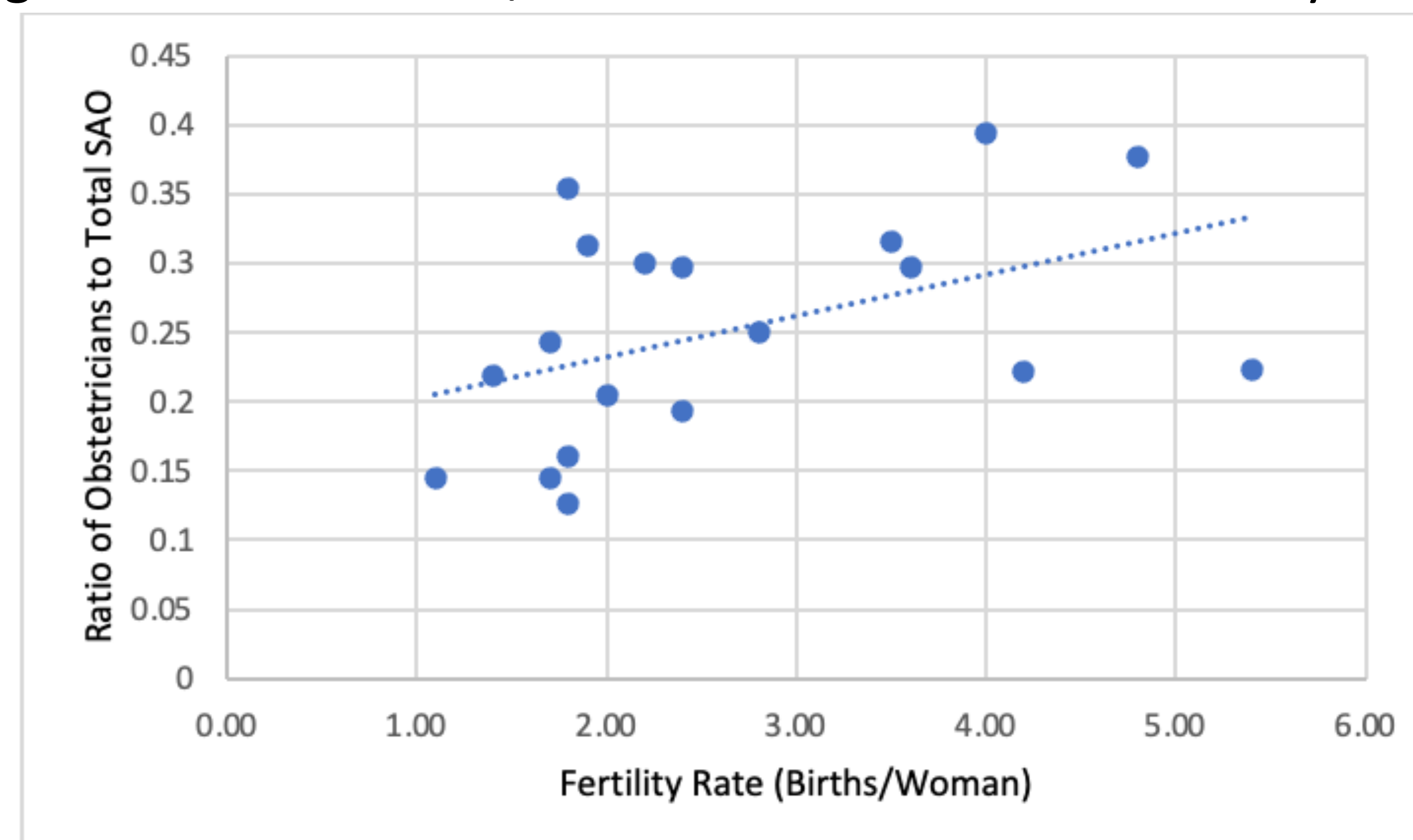Figure 1: Specialist providers normalized to 20 total/100,000



Table 1: Test for association between Ratio and Income Bracket

|  | $\chi^2$ | P-value |
|---|---|---|
| S/SAO | 2.107 | 0.55 |
| A/SAO | 2.050 | 0.56 |
| O/SAO | 5.079 | 0.16 |

Figure 2: Obstetricians/Total SAO Increases with Fertility Rate



## Results/Discussion

- Ratio of 10.5 Surgeons: 4.5 Anesthesiologists: 5 Obstetricians per 100,000 population seen across countries sampled
- Positive correlation between fertility rate and fraction of Obstetricians (Spearman's Rho = 0.56, P-value = 0.01), other providers types, MMR and IMR not significantly related.
- No relationship between S:A:O provider ratio and World Bank income bracket;
- While unclear whether this ratio is ideal or natural, it is interesting that while SAO density (total SAO/100,000) varies with Income group[3], the ratio of providers does not
- When assessing local deficiencies/needs the S:A:O ratio could be helpful to compare to local ratios, to guide for national planning when creating NSOAPs, or for funding post-graduate training
- Increased proportion of Obstetricians in countries with higher fertility rates should be considered in national workforce planning

## Limitations

- Limited sample of 20 countries
- Ideal ratio to provide adequate access is not known, nor is proportion of subspecialty providers
- Unable to determine if providers practice full time in country or how they are distributed throughout the country
- Cannot quantify non-specialist providers who provide surgical care

## Next Steps

- Increase sample size using Lancet Commission data
- Evaluate change over time
- Correlation with surgical volume and outcome measurements
- Include non-specialist providers
- Implement into NSOAPs
- Study specific outliers for cause

## References

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[2]Davies JI, Vreede E, Onajin-Obembe B, Morriss WW. What is the minimum number of specialist anaesthetists needed in low-income and middle-income countries? BMJ Glob Health. 2018 Dec 1;3(6):e001005. PMID: 30588342.
[3]Bouchard, ME., et al. "Cross-sectional analysis tracking workforce density in surgery, anesthesia, and obstetrics as an indicator of progress toward improved global surgical access." IJS Global Health 3.6 (2020): e26.