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Estimating trends in the total fertility rate with uncertainty using imperfect data: Examples from West Africa

By [Leontine Alkema](#), [Adrian E. Raftery](#), [Patrick Gerland](#), [Samuel J. Clark](#), [Francois Pelletier](#)

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Abstract

Background: Estimating the total fertility rate is challenging for many developing countries because of limited data and varying data quality. A standardized, reproducible approach to produce estimates that include an uncertainty assessment is desired.

Methods: We develop a method to estimate and assess uncertainty in the total fertility rate over time, based on multiple imperfect observations from different data sources including surveys and censuses. We take account of measurement error in observations by decomposing it into bias and variance and assess both by linear regression on a variety of data quality covariates. We estimate the total fertility rate using a local smoother, and assess uncertainty using the weighted likelihood bootstrap.

Results: We apply our method to data from seven countries in West Africa and construct estimates and uncertainty intervals for the total fertility rate. Based on cross-validation exercises, we find that accounting for differences in data quality between observations gives better calibrated confidence intervals and reduces bias.

Conclusions: When working with multiple imperfect observations from different data sources to estimate the total fertility rate, or demographic indicators in general, potential biases and differences in error variance have to be taken into account to improve the estimates and their uncertainty assessment.

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