

Vaccination Coverage in India: A Small Area Estimation Approach

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Keywords: National rural health mission; Linear mixed model; Shrinkage estimates; Full immunization; Measles; Vaccination coverage inequality

Abstract

Information on population health indicators in India come from a number of surveys that vary in periodicity, scope and detail. In the case of immunization, the most recent coverage indicators are derived from the first round of Annual Health Survey (AHS-1, 2010-11), but these were conducted only in 9 of 35 states and union territories. The most recent national surveys of immunization coverage were conducted in 2009 (Coverage Evaluation Survey) by UNICEF. Therefore, reliable immunization coverage data for the entire country since 2009 is lacking. We used an established approach of small area estimation to predict coverage rates of several vaccinations for the remaining 26 states (not covered by AHS-1) in 2011. In our method, we considered a linear mixed model that combines data from five cross sectional surveys representing five different time points. Our model encompasses sampling error of the survey estimates, area specific random effects, autocorrelated area by time random effects and hence, borrows strength across areas and time points both. Model-based estimates for 2011 are almost identical to the AHS-1 estimates for the nine states, suggesting that our model provides reliable prediction of vaccination coverage as AHS-1 estimates are highly precise because of their large sample size. Results indicate that coverage inequality between rural and urban areas has been reduced significantly for most states in India. The National Rural Health Mission has had both supply side and demand side effects on the immunization program in rural India. In combination, these effects may have contributed to the reduction of vaccination coverage gaps between urban and rural areas.