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DTP1–3 and MCV1 vaccination coverage in the Democratic Republic of the Congo: mapping zero-dose and under-vaccinated children

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Introduction

Vaccination coverage rates in the Democratic Republic of the Congo (DRC) have improved over recent decades, but they are still lower than national and global targets. As a result, measles epidemics have occurred frequently over recent years, with over 300,000 measles cases and nearly 6000 deaths recorded in 2023 in the country. Médecins Sans Frontières (MSF) provided vaccination to over 1.6 million children and treatment to over 46,000 patients in 2023. Existing data on vaccination coverage, usually obtained from household surveys, often lack the spatial granularity needed to effectively target vaccination campaigns and other interventions. In this study, we used geospatial modelling approaches to estimate vaccination coverage rates for diphtheria-tetanus-pertussis-containing vaccine (DTP1–3) and measles-containing vaccine (MCV1) at a range of spatial scales.

Methods

Using geolocated data from the 2023 national vaccination coverage survey (Enquête de Couverture Vaccinale; ECV), conducted by the Kinshasa School of Public Health, and a suite of geospatial covariate datasets, we developed and fitted a bespoke Bayesian geostatistical model to estimate DTP1–3 and MCV1 coverage at 1×1 km resolution, along with quantified uncertainties. The resulting estimates were also aggregated to the health area (HA), health zone (HZ), and province levels, and integrated with gridded population data to produce estimates of numbers of zero-dose and under-vaccinated children. Zero-dose children were those who did not receive their first dose of DTP vaccine. Under-vaccinated children were defined as those who had received DTP1 but not DTP3.

Ethics

This study was approved by the University Ethics Committee of the University of Southampton, UK (application ID 95116).

Results

We estimated that the coverage rates of DTP3 only attained 80% in 75 (14.5%) of the 519 HZs and in 815 (15.0%) of 5426 HAs with complete boundaries located in 14 provinces. For MCV1, coverage rates of 80% were only attained in 37 (7.1%) HZs and 450 (8.3%) of HAs, with maximum coverage rates of 91.6% at the HZ level and 93.3% at the HA level. Estimates of the median numbers of zero-dose children aged under 1 year in 2024 were 896 (IQR 1582) and 64 (IQR 116) at the HZ and HA levels. At the national level, 775,023 and 1,969,969 children had not received DTP1 and MCV1, respectively, whereas 870,537 children were under-vaccinated.

Conclusion

Our study has uncovered substantial heterogeneities in vaccination coverage across the DRC, highlighting the potential for the persistence of disease circulation and outbreaks. Our estimates of coverage and corresponding numbers of zero-dose and under-vaccinated children can guide the planning and implementation of appropriate interventions to reach all missed and under-served communities by MSF and other partners.

Conflicts of interest

All authors declare no competing interests.