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## Review

## Coverage and determinants of childhood immunization in Nigeria: A systematic review and meta-analysis

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## ABSTRACT

**Introduction:** The proportion of fully immunized children in Nigeria is reportedly low. There are concerns over national immunization data quality, with this possibly limiting country-wide response. We reviewed publicly available evidence on routine immunization across Nigeria to estimate national and zonal coverage of childhood immunization and associated determinants.

**Methods:** A systematic search of Medline, EMBASE, Global Health and African Journals Online (AJOL) was conducted. We included population-based studies on childhood immunization in Nigeria. A random effects meta-analysis was conducted on extracted crude rates to arrive at national and zonal pooled estimates for the country.

**Results:** Our search returned 646 hits. 21 studies covering 25 sites and 26,960 children were selected. The estimated proportion of fully immunized children in Nigeria was 34.4% (95% confidence interval [CI]: 27.0–41.9), with South-south zone having the highest at 51.5% (95% CI: 20.5–82.6), and North-west the lowest at 9.5% (95% CI: 4.6–14.4). Mother's social engagements (OR = 4.0, 95% CI: 1.9–8.1) and vaccines unavailability (OR = 3.9, 95% CI: 1.2–12.3) were mostly reported for low coverage. Other leading determinants were vaccine safety concerns (OR = 3.0, 95% CI: 0.9–9.4), mother's low education (OR = 2.5, 95% CI: 1.8–3.6) and poor information (OR = 2.0, 95% CI: 0.8–4.7).

**Conclusion:** Our study suggests a low coverage of childhood immunization in Nigeria. Due to the paucity of data in the Northern states, we are still uncertain of the quality of evidence presented. It is hoped that this study will prompt the needed research, public health and policy changes toward increased even-spread coverage of childhood immunization in the country.

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Abbreviations: AJOL, African Journals Online; DHS, Demography and Health Surveys; EPI, Expanded Programme on Immunization; MeSH, Medical Subject Headings; sSA, sub Saharan Africa; VPDs, vaccine preventable diseases.

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## 1. Introduction

Routine immunization is currently one of the key components of primary health care services in several countries [1]. It is widely regarded as a cost-effective and proven public health tool to address the burden of infectious diseases in children [2]. The Expanded Programme on Immunization (EPI) was established in 1974 by the World Health Organization (WHO) as a public health strategy to enhance and strengthen routine immunization coverage across member countries, toward reducing infectious and vaccine preventable diseases (VPDs) among children [3,4]. Six traditional vaccines targeting tuberculosis, polio, diphtheria, pertussis, tetanus, and measles, were initially introduced. Over the years, newer vaccines for other deadly diseases have emerged, including yellow fever, hepatitis B, *Haemophilus influenzae* type b (Hib), and pneumococcal conjugate [1,3]. Despite a remarkable progress across WHO member states, it is estimated that about 23 million immunization coverage deficits among children in their first year of life occurred globally in 2012 [5]. Moreover, over 6 million children under 5 years reportedly died from infectious and neonatal causes worldwide in 2013, with several deaths attributable to VPDs, particularly in sub-Saharan Africa (sSA) [6,7].

In Nigeria, nearly 40% of under-five mortality, accounting for about 15% of global child deaths, have been attributed to VPDs [2,8]. Over the years, vital steps have been taken to address rising rates of child mortality in Nigeria, especially through interventions targeting increased coverage of routine immunization across many rural communities [6]. Following the introduction of EPI in Nigeria in 1979, childhood immunization coverage rates were relatively high, with DPT and measles coverage both estimated at about 60% between 1980 and 1990 [9]. However, the country has reportedly experienced progressive decline in immunization coverage in recent years [10]. The WHO reported that more than half of all incompletely vaccinated children reside in Indonesia (7%), Nigeria (14%), and India (32%) [11]. Nigeria, being a part of the Global Vaccine Action Plan (GVAP) that facilitates equitable access to existing vaccines [12], has deployed several strategies to address the low immunization coverage in the country, including but not limited to, routine immunization intensification, supplemental immunization activities, global positioning system (GPS) tracker, emergency vaccination centres, and several community level interventions [13,14]. Despite these interventions, available reports still show that over one million Nigerian children die annually before the age of five [15]. In fact, under-five mortality in the country increased from 138 to 158 per 1000 live births between 2007 and 2011, in contrast to a global decline over the same period [2]. Experts in the country have linked this to several logistic, polit-

ical and contextual factors [6,16] (see Section 4), notably the fact that local governments (lowest hierarchy of governance in Nigeria), have been given the responsibility, albeit with poor funding and operational capacity, for the delivery of primary health care services (including routine immunization) at the community levels; this is due to a presumed declining capacity of the better-financed state governments that have the resources to equitably respond to local and grass root health needs [16,17].

Recently, there have been concerns that the reported immunization coverage in Nigeria may not be representative of the actual national and regional rates [10,18]. Indeed, most reports on immunization coverage in the country have been based on estimates provided by the WHO and United Nations Children Fund (UNICEF). Although, these widely reported international estimates were actually collated from Demography and Health Surveys (DHS) in Nigeria [19], and reports collated from relevant country-based health offices, experts have opined that the crude data sometimes do not cover several settings in the country, and often, may have been politically directed [20]. As reported by Ophori and colleagues [10], the understanding of the underlying determinants and factors responsible for the reported low coverage still remain poor, especially in rural settings. The authors further highlighted the lack of comprehensive evidence-based report on immunization in the country [10]. Hence, these prevailing challenges, coupled with issues on data quality and completeness, demonstrate the need to conduct a systematic and comprehensive review of publicly available evidence on routine immunization across Nigeria. This review seeks to provide an estimate of national and zonal coverage of childhood immunization and associated determinants, with the hope that this may prompt better evidence-based public health and policy response.

## 2. Methods

This study was conducted in strict compliance with the MOOSE guidelines of systematic reviews and meta-analysis of observational studies [21].

### 2.1. Search strategy

On identifying relevant Medical Subject Headings (MeSH) terms on childhood immunization in Nigeria, a final search strategy was developed. Searches were conducted on 01 September 2016 on four databases—Medline, EMBASE, Global Health and African Journals Online (AJOL)—with search dates set from 1990 to current (Table 1). Unpublished documents were sourced from Google

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