Socioeconomic factors associated with full childhood vaccination in Bangladesh, 2014

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A B S T R A C T

Objectives: Childhood vaccination in Bangladesh has improved, but there is room for improvement. This study estimated full immunization coverage in Bangladeshi children and characterized risk factors for incomplete immunization.
Methods: Using the 2014 Bangladesh Demographic and Health Survey (DHS), full vaccination of children aged 12 to 24 months was examined; this was defined as the receipt of one dose of bacillus Calmette–Guérin (BCG), three doses of pentavalent vaccine, three doses of oral polio vaccine (OPV), and one dose of measles-containing vaccine (MCV). Associations between full vaccination and selected risk factors were assessed by logistic regression.
Results: Overall, 83% of children were fully vaccinated. BCG had the highest completion (97%), followed by OPV (92%), pentavalent vaccine (91%), and MCV (85%). Full vaccination coverage ranged from 64.4% in Sylhet to 90.0% in Rangpur and was lowest among non-locals of all regions (78.4%). Children who were in the lowest wealth quintile, who had mothers without antenatal care visits, or who had mothers without autonomy in healthcare decision-making were less likely to be fully vaccinated.
Conclusions: Overall, full vaccination of children is high, but varies by vaccine type. Disparities still exist by wealth and by region. Maternal access to care and autonomy in healthcare decision-making are associated with higher vaccination coverage.

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Introduction

A strong national commitment to childhood vaccination has contributed substantially to Bangladesh's success in reaching Millennium Development Goal 4 to reduce childhood mortality. The death rate in Bangladeshi children under the age of 5 years declined from 133 per 1000 live births in 1993 to 46 per 1000 in 2014 (MOHFW, 2015). Implementation of the World Health Organization (WHO) Expanded Programme on Immunization (EPI) in Bangladesh occurred in 1979, but had minimal impact until the government made a public commitment to improve childhood vaccine coverage in 1985 (Expanded Programme on Immunization (EPI), 2015). Bangladesh has recently experienced robust economic growth, with the 20th highest average increase (6.3%) in gross domestic product (GDP) of any country globally

since 2008 (Obiols, 2017); its GDP is projected to be the 41st largest by 2020 (International Monetary Fund, 2016). This prolonged period of economic growth has correlated with improvements in childhood health outcomes, despite a poor perception of the public health system by its citizens (Ahmed et al., 2015).

Bangladesh has expended considerable public health effort targeting reductions in childhood vaccine-preventable diseases. Sustained high polio vaccination coverage has rapidly decreased incident polio, with the last reported case in 2006 (WHO, 2016). Three nationwide supplementary immunization activities (SIAs) from 2000 to 2016 immunized approximately 108.9 million children with measles-containing vaccine (MCV) (Khanal et al., 2017), leading to a subsequent decline in measles from 14 745 incident cases in 2010 to 972 in 2016 (Khanal et al., 2017). In 2014, the Bangladeshi government set a goal to eliminate measles by 2018, aligning with the WHO South East Asia Regional goal of realizing measles elimination by 2020 (Khanal et al., 2017). Despite these successes, Bangladesh, which continues to be one of the most densely populated countries in the world with over 162 million residents (NIPORT et al., 2016; Anon, 2017), experienced 119 000 deaths among children under 5 years of age in 2015 (UNICEF,

2015a), placing them among the top 10 countries with the highest childhood mortality globally.

While Bangladesh has made significant gains in childhood vaccination coverage, greater focus on series completion of all recommended EPI vaccines (Table 1) is needed to achieve further gains in decreasing childhood morbidity and mortality (WHO Bangladesh, 2016). Sustainable Development Goal 3 (United Nations Sustainable Development Goals (SDGs)) addresses the goal of universal health coverage (target 3.8), with a recommended indicator metric of attaining and sustaining 90% national vaccine coverage and 80% in every district with all vaccines in national programs (World Health Organization, 2013).

The United Nations Children's Fund (UNICEF) and the WHO estimated that individual vaccine coverage in Bangladesh in 2015 was 98% for bacillus Calmette–Guérin (BCG), 94% for three doses of pentavalent vaccine (diphtheria–tetanus–pertussis, *Haemophilus influenzae* type b, and hepatitis B virus; DTP–Hib–Hep B), 94% for three doses of oral polio virus vaccine (OPV), and 88% for the first dose of measles-containing vaccine (MCV) (UNICEF, 2015b). These composite estimates were based on administrative coverage data aggregated from health service providers, estimated coverage data from national authorities, coverage from population-based household surveys, and relevant research reported in the published and grey literature (WHO/UNICEF, 2017). The administrative estimates are often unreliable due to incomplete or inaccurate primary recording of vaccinations. Therefore, it is important to bolster administrative surveys with more accurate examination of vaccination coverage using national surveys. The Demographic and Health Survey (DHS) is a nationally representative, standardized survey used globally, containing validated questions. It provides more robust data and allows factors associated with vaccination coverage to be studied (Cutts et al., 2016). The Bangladesh DHS in 2014 is the most recent publicly available, nationally representative survey of vaccination coverage in Bangladesh.

Ongoing assessment of childhood vaccination through the DHS program is key to providing the essential information needed to inform and guide future program development through the identification of gaps in coverage, including differences based on residence or socio-demographic group. This study used the most recently available data from the 2014 DHS to calculate full immunization coverage in Bangladeshi children and to characterize risk factors for incomplete immunization, such as socioeconomic status and decision-making autonomy.

Methods

Study population

The DHS is an internationally recognized program that has conducted nationally representative surveys in over 90 developing countries. It includes population, health, and nutrition indicators. Seven DHS were conducted in Bangladesh between 1993 and 2014. At the time of the 2014 DHS, Bangladesh was divided into seven administrative regions: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet. After completion of the 2014 DHS, an eighth region, Mymensingh, was divided from the Dhaka administrative region in 2015. Complete details of the DHS survey have been reported elsewhere (NIPORT et al., 2016).

Briefly, the DHS survey enrolled individuals from all seven administrative regions of Bangladesh using a two-stage stratified sample of households. First, 600 enumeration areas were selected based on probability proportional to size. Then, within each enumeration area, a systematic sample of 30 households on average was selected, resulting in a total of 17 989 residential households. The data were collected by 20 interview teams

Table 1
Bangladesh immunization schedule, 2015.

Vaccine	Age at administration
BCG	At birth
Pentavalent[a]	6 weeks, 10 weeks, 14 weeks
OPV	6 weeks, 10 weeks, 14 weeks, 38 weeks
PCV	6 weeks, 10 weeks, 14 weeks
IPV[b]	14 weeks
MR[c]	38 weeks
Measles	15 months

BCG, bacillus Calmette–Guérin; OPV, oral polio vaccine; PCV, pneumococcal conjugate vaccine ; IPV, injectable polio vaccine; MR, measles–rubella vaccine.
[a] Pentavalent includes DTP–Hib–Hep B (diphtheria–tetanus–pertussis, *Haemophilus influenzae* type b, and hepatitis B virus).
[b] Introduced into the Expanded Programme on Immunization in 2015. Used in conjunction with OPV.
[c] MR introduced into the Expanded Programme on Immunization in 2012.

consisting of five female interviewers during a 4-month period in 2014. The Women's Questionnaire module of the DHS collected information from ever-married women aged 15–49 years, including background characteristics, reproductive behavior, perinatal care, children's health, aspects of women's empowerment, husband's background, and other topics. From the selected households, 17 683 ever-married women were interviewed, resulting in data on a total of 43 772 children of all ages.

Measures

The main outcome for this study was full vaccination of children 12–24 months of age. Full vaccination was defined as having received all eight EPI-recommended vaccine doses (one dose of BCG, three doses of pentavalent vaccine, three doses of OPV, and one dose of MCV), in accordance with the WHO definition of full vaccination coverage (World Health Organization, 2018a).

Demographic, socioeconomic, and clinical data were abstracted from the DHS. Individuals who were not de jure residents at the location where they were interviewed were considered to be 'non-locals'. A variable was derived to represent a respondent having autonomy in her own care; this variable was created by combining the categories of 'respondent alone' and 'respondent and husband/partner' for the question "Who is the person who usually decides on the respondent's healthcare?"

Statistical analysis

The distributions of various demographic, socioeconomic, and clinical factors were examined using descriptive statistics. The associations between these factors and full vaccination were assessed using logistic regression with output estimates of odds ratios (OR) and 95% confidence intervals (CI) for under-vaccinated compared to fully vaccinated children. All descriptive and analytical statistics followed standard survey procedures, employing the individual weight from the Women's Questionnaire. Additionally, the analysis included cluster and sample strata statements, based on the study design, to estimate standard errors. Significance was assessed at an α level of 0.05, and all analyses were conducted in SAS version 9.4 (SAS Institute, Cary, NC, USA).

Ethical approval

This study was limited to previously collected, publically available, secondary data, and therefore was not under the purview of the institutional review board at the University of Michigan.