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Vaccine

Review

Factors associated with incomplete or delayed vaccination across countries: A systematic review

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ABSTRACT

Background: Despite the significant decline in the incidence of vaccine-preventable diseases as a result of increased vaccination coverage worldwide, there are many children with delayed vaccination and a marked heterogeneity in vaccination coverage.

Objective: The aim of this study was to review factors that influence the adherence to childhood immunization schedule in different countries, especially related to socioeconomic conditions and health care system characteristics.

Methods: Pubmed and Web of Science databases were searched systematically for observational studies published in peer-reviewed journals in English, Spanish and Portuguese languages from January 1992 to June 2014. We included original articles that assessed vaccination schedule with at least three diphtheria–tetanus–pertussis, three polio and one measles vaccines in children aged 0–24 months.

Results: 491 articles were identified and 23 met the inclusion criteria and were reviewed. The most cited factors reported by countries with distinct characteristics were higher birth order (9 articles, 39.1%), and low maternal education/socioeconomic status (7 articles each one, 30.4%). Irregular monitoring by the health care services was reported by countries with "mainly private" health care system. Out-of-hospital birth, no reminder(s) about the next follow-up visit, and mother working outside the home were cited by countries with low/medium Human Development Index (HDI). Ethnicity, use of private health care services, and no health insurance were cited by countries with very high HDI. The role of migration on vaccination coverage was reported by three studies conducted in countries with distinct characteristics.

Conclusions: The factors are complex and driven by context. Overall, strengthening the contacts and relationships between the health care services and mothers with several children and families with low educational level/low socioeconomic status appear to be an important action to improve vaccination coverage.

1. Introduction

Immunization is one of the most successful and cost-effective public health intervention for reducing infant and child morbidity and mortality globally [1,2]. The Expanded Program on Immunization (EPI) was launched by the World Health Organization (WHO) in 1974 with the goal of vaccinating children throughout the world. In 1999, the Global Alliance for Vaccines and Immunization (GAVI) was created to increase access to new vaccines for the poorest countries [3]. The first diseases targeted by the EPI were diphtheria, whooping cough, tetanus, measles, poliomyelitis and tuberculosis. Global policies for immunization and the establishment of the goal for providing universal immunization for all children by 1990 were concerted in 1977. This goal was considered an essential element of the WHO strategy to achieve health for all by 2000. In 2010, an estimated 85% of children under one year of age globally had received at least three doses of DTP vaccine (DTP3) against diphtheria, tetanus and whooping cough [4].

Despite the significant decline in the incidence of vaccine-preventable diseases, there is a considerable number of children with delayed vaccination and a marked heterogeneity in vaccination coverage worldwide, which represents a risk to the resurgence of infectious diseases that are under control and to the reintroduction of infectious diseases already eliminated, requiring different vaccination strategies [5,6]. Previous studies suggest that

vaccination status is influenced by factors related to the child, parental attitude or knowledge, social context of the family and health care services [7–9].

Some factors associated with the child involve prematurity and having older siblings. Reasons related to parental attitude or knowledge include lack of knowledge on the role of vaccinations for disease prevention, fear of adverse reaction, belief that vaccination is not beneficial or causes damage, lack of motivation, mistrust of health care system and social or cultural pressure against vaccinations [6,10]. Factors previously associated with the family social context are; education level of caregivers, socioeconomic status, family composition, belonging to a minority ethnic or religious group, single mother and young mother or caregiver. Some reasons related to the health care services include access or distance from vaccination services, missed opportunities to vaccinate, limited availability and knowledge of health workers, costs for vaccinations, inadequate vaccine supply, incorrectly applied contraindications, mothers with limited access to prenatal care and infants born at home [6,10].

However, these factors may be different depending on the context [10]. Therefore, the aim of this study was to review in the literature, studies undertaken in different countries, which investigated factors that influence the adherence to childhood immunization schedule (measured by completeness and/or timeliness) in children aged 0–24 months, especially related to socioeconomic conditions (family features, parents' knowledge and attitudes, the Human Development Index/income) and health care system characteristics.

2. Methods

This systematic review was written in accordance with the PRISMA guidelines [11]. The search strategy was designed to retrieve observational studies looking at the factors that influence the adherence to childhood immunization schedule in children aged 0–24 months, published from January 1, 1992 to June 31, 2014. The Pubmed and Web of Science databases were searched for relevant articles between July 17 and July 21, 2014, using the key words "vaccination" AND ("delay" OR "timeliness" OR "completeness" OR "age-appropriate") AND ("factors" OR "predictors"). All databases in the Web of Science website were selected. Articles in English, Spanish and Portuguese were eligible for inclusion. Two authors (MCT and APSS) conducted the database search and data extraction independently. Duplicated articles obtained from different databases were excluded. Manual searching was used in reference lists of the obtained articles.

Due to the different vaccination schedules across countries, we included original articles that assessed vaccination schedule with at least three diphtheria–tetanus–pertussis (DTP3), three polio and one measles vaccine in children aged 0–24 months. We also included articles that reported factors independently associated with complete/incomplete or timely/delayed vaccination using Cox or logistic regression analysis. Literature reviews and articles that reported only associated factors with a specific vaccine were excluded.

Completeness was defined as receiving the basic series of vaccines recommended by the National Immunization Program [12]. Timeliness was based on minimum ages at which doses are considered valid and minimum acceptable intervals between doses [13]. The factors were classified into three categories [6]:

1. Family features: socioeconomic status (including community unemployment rate, interaction between literacy and wealth index, families with dependent children receiving aid), mother

working outside the home, birth order (including parity and family size, more than one child in the house), maternal education, ethnicity, living in a rural area, migrant family (including recent and settled migrants, rural–urban and international migration), age and marital status of the mother.
2. Parents' knowledge and attitudes: premature child, lack of information about vaccination, and vaccination delay at three months of age.
3. Health care services: type of health care service (public/private), access to health services (including distance from the health unit, additional visit to a doctor), irregular monitoring by the health care services (including antenatal care visits), multiple vaccination providers, health insurance, out-of-hospital birth, no reminder(s) about the next follow-up visit, being vaccinated by a family doctor (not a pediatrician), and delay in being seen in the last vaccination.

Information about Human Development Index (HDI)/income, countries health care system and vaccination strategies and coverage were selected from articles, manuals and official sites. The HDI is a summary measure that includes the following indicators: life expectancy at birth, mean years of schooling and gross domestic product per capita. According to the 2013 HDI, countries with less than 0.550 are considered with low human development; between 0.550 and 0.700, medium human development; between 0.700 and 0.800, high human development; and with 0.800 or more, very high human development [14]. The health care system was categorized as "mainly public", "mainly private" and "mixed" (nearly half public and private). Additionally, we verified if the country receives investments of the GAVI, whether the country's vaccination was free of charge (at least for the vaccines included in this review – DTP, polio and measles vaccines), how many immunogens were offered to children aged 0–24 months and about the DTP3 coverage.

3. Results

Four hundred ninety-one papers were identified as fulfilling the initial search criteria (Fig. 1). After removing duplicate papers (104 articles) and those that did not meet the inclusion and exclusion criteria (345 articles), 91.4% (449 articles) of the studies were discarded. Forty-two articles had full text screening and another 13 articles were further included after searching the references of the pre-selected articles. Among the 55 articles, 58.2% (32 manuscripts) were excluded due to: lack of report of associated factors related to all vaccines included (DTP, polio and measles) (21.9%); inclusion of broader age group than 0–24 months (34.4%); inaccessibility of the manuscript (9.4%); language – one article was in French (3.1%); and lack of information about all the vaccines included (31.2%). A total of 23 articles were selected for this review. Of these, 19 (82.6%) were cross-sectional studies, two (8.7%) were retrospective cohort studies and two (8.7%) were case–control studies.

Table 1 describes the HDI/income, the health care system characteristics and the vaccination program of the countries with manuscripts included. The 23 selected studies were done in 13 different countries. Seven countries (53.8%) have "mainly public" health care system, three (23.1%) "mainly private" health care system and three (23.1%) have "mixed" health care system. In the United States of America (USA), very high HDI, where the health care system is "mainly private", the vaccination is not free of charge for the majority of the population.

The number of immunogens applied to children aged 0–24 months ranges from seven in India to 16 in Brazil. Countries with lower HDI such as, Mozambique, Uganda and Kenya, have lower vaccination coverage for DTP3 than the countries with higher HDI