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Determinants of maternal immunization in developing countries

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ABSTRACT

Background: Maternal immunization is an effective intervention to protect newborns and young infants from infections when their immune response is immature. Tetanus toxoid vaccination of pregnant women is the most widely implemented maternal vaccine in developing countries where neonatal mortality is the highest. We identified barriers to maternal tetanus vaccination in developing African and Asian countries to identify means of improving maternal immunization platforms in these countries.
Method: We categorized barriers into health system, health care provider and patient barriers to maternal tetanus immunization and conducted a literature review on each category. Due to limited literature from Africa, we conducted a pilot survey of health care providers in Malawi on barriers they experience in immunizing pregnant women.
Results: The major barriers of the health system are due to inadequate financial and human resources which translate to inadequate vaccination services delivery and logistics management. Health care providers are limited by poor attendance of Antenatal Care and inadequate knowledge on vaccinating pregnant women. Patient barriers are due to lack of education and knowledge on pregnancy immunization and socioeconomic factors such as low income and high parity.
Conclusion: There are several factors that affect maternal tetanus immunization. Increasing knowledge in health care providers and patients, increasing antenatal care attendance and outreach activities will aid the uptake of maternal immunization. Health system barriers are more difficult to address requiring an improvement of overall immunization services. Further analyses of maternal immunization specific barriers and the means of addressing them are required to strengthen the existing program and provide a more efficient delivery system for additional maternal vaccines.

1. Introduction

Pregnant women are at a greater risk of complications and mortality from many infectious diseases [1]. This is due to pregnancy-associated immunosuppression leading to decreased responses to infections [1]. Newborns have an immature immune system with inadequate responses to viral and bacterial infections compared to older children [2]. In 2012, about 5 million under-five deaths worldwide (73%) occurred within the first year of life and over 40% of these were during the neonatal period [3,4]. Of these, more than 70% were in sub Saharan Africa (SSA) and Asia with infections being a frequent cause [4]. Although overall under-five mortality is decreasing, neonatal mortality has declined more slowly now contributing to a greater proportion of under-five deaths than in the past: 44% in 2012 compared to 37% in 1990 [5,6].

Effective immunization of neonates and young infants is currently limited due to poor immunogenicity of vaccines in this age group as well as interference from passively transferred maternal antibodies in utero and through breast milk [7]. However, if adequate levels of maternal immunogloulins are transferred across the placenta, infants can be protected during the first six months of life [8].

Vaccinating pregnant women is an intervention with the potential to protect both mothers and newborns from vaccine preventable diseases [9]. The World Health Organization (WHO) recommends vaccination against tetanus and influenza during pregnancy with tetanus toxoid vaccination (TTV), having been introduced in the Expanded Program on Immunization (EPI) in the 1970s [10]. Influenza vaccination is a more recent recommendation following studies of antenatal influenza vaccination showing a significant beneficial effect on pregnant women and their newborns [11]. Although the WHO does not recommend vaccination against pertussis during pregnancy due to a lack of substantial evidence of effectiveness, it is recommended in the USA and the UK

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[12]. Research is currently underway to develop vaccines against Group B Streptococcal disease, Respiratory Syncytial Virus and Cytomegalovirus infections for maternal immunization.

Determining the barriers to existing maternal immunization programs in developing countries will aid program strengthening and facilitate new vaccine introduction to improve maternal and newborn health. TTV is the only maternal vaccine used extensively in developing countries [10]. Focusing on SSA and Asia, we conducted a literature review and a survey of health care providers to identify barriers to the antenatal TTV program.

2. Methods

2.1. Study design: literature review

Barriers to maternal immunization were classified into 3 categories based on S. Kimmel et al. *Addressing immunization barriers, benefits, and risks* [13]. These categories were health system barriers, health care provider barriers and patient barriers which we applied to maternal immunization. Open literature searches using search terms for each category was conducted on PubMed, Google Scholar and WHO, UNICEF and GAVI websites limited to the period January 2000–June 2014.

Search terms included: *health system barriers AND maternal OR tetanus vaccination OR immunization AND developing countries OR Africa OR Asia; health system barriers to tetanus vaccination AND antenatal care.*

(Health care provider determinants of maternal tetanus immunization) OR barriers to maternal tetanus immunization.

Patient Barriers OR Patient determinants of maternal vaccination OR immunization OR antenatal care.

Relevant papers from SSA and Asia were then selected following review of the titles and abstracts.

2.2. Search outcome

The literature search on health system specific barriers to maternal immunization in developing countries had very limited results. Papers found referred to maternal and reproductive health barriers which mostly addressed issues surrounding obstetric care and antenatal care utilization. Two systematic reviews on utilization of antenatal care in developing countries were reviewed as background research and to support the discussion. Searches for GAVI publications produced country specific comprehensive multiyear plans (cMYP) which address problems in the overall national immunization plans which were exclusively used to assess health system barriers to maternal immunization. Multiyear plans provide country-focused summaries of key data and indicators of interest on immunization planning and financing for the immunization program over the next five years. Priorities are set based on country needs and the global and regional goals for child survival with routine immunization programming being the basis for achievement of the cMYP objectives [14]. cMYP are generated by conducting a situational analysis from a wide variety of sources such as routine health information data and reports, the last cMYP and the annual workplan, WHO/UNICEF annual joint reporting forms and post-introduction evaluations (PIE) for new vaccines [14]. The situational analysis is summarized in the final section consisting of the strengths and weaknesses of the immunization program. Four cMYP were reviewed for the purpose of this work to identify immunization barriers which are also applicable to maternal tetanus immunization. These were plans of two African countries (Angola, Ethiopia) and two Asian countries (Cambodia, Pakistan). The rationale for these choices was that these countries are yet to eliminate tetanus and are based in the two regions of interest. Although these countries may not be representative of all other countries in their regions, cMYP are developed based on guidelines set by WHO and UNICEF following similar formats, thus comparable to needs in other GAVI eligible countries. Important common barriers to all four countries were identified and compiled into an integrated format as shown in Table 1.

The literature search for patient barriers to TTV in SSA or Asia retrieved six relevant papers from which four were chosen for this review. All four studies used multivariable logistic regression analysis to identify determinants of maternal tetanus vaccination. Studies from Turkey and Bangladesh were excluded as Turkey is not part of the Asian and SSA region, whilst the Bangladeshi study conducted a univariate logistic regression analysis alone and hence the results were not comparable to the others.

There was limited literature on health care provider barriers to maternal TTV with only two Asian studies identified and none from an African setting. To add to this data, a small survey of health care providers in Malawi was designed to serve as a pilot survey.

2.3. Health care provider survey

Malawi was chosen due to convenience as the author has past experience of the health system, access to health care providers and due to resource constraints available to conduct the survey. The questionnaire consisted of 13 questions based on provider knowledge of maternal immunization and barriers which are faced in vaccinating pregnant women. Guidance to develop the questions was based on surveys of health care providers in the USA by Vinay Vijayan et al. on immunizing pregnant women against influenza and pertussis and adapted to the Malawian context [15]. The questions were posed in the following format:

Example. What is the main reason for women not receiving TTV? (a) Low antenatal care attendance, (b) not returning for boosters, (c) inadequate immunization record and (d) other (describe)

Out of 20 district hospitals which were invited to participate through email, six consented. The questionnaires were administered by telephone interview following verbal consent from 1st to 15th August 2014. Respondents included district health officers (DHOs) and maternal and child health coordinators (MCHCs) from each of the six districts. The DHO is responsible for management and technical support of the health service delivery system at secondary level which includes the district hospital and primary level health facilities. They oversee referrals to tertiary level facilities (central hospitals), integration of service delivery, procurement and financial management. The MCHC is responsible for the day-to-day running of the EPI services in the district, coordinating immunization activities and compiling data. Each DHO of the six districts responded whilst five MCHCs out of six from each district responded. Responses are impressions and experiences of the health care providers from their day to day practice. Ethical approval for the survey was obtained from the Ethical Committee of the National Health Sciences Research Committee of Malawi.[1]

3. Results

Substantial progress has been made in reducing maternal and neonatal tetanus mortality and morbidity through a global maternal tetanus vaccination program. However in 2014, more than 25 years after the declaration of the Maternal and Neonatal Tetanus Elimination Initiative, 24 countries still have not achieved tetanus

[1] The literature review and the surveys conducted were performed as part of the requirements for a Masters in Vaccinology degree for JP from the University of Siena.

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