Vaccine xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Review

Vaccination of special populations: Protecting the vulnerable

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ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Special group
Pregnancy
Preterm
Immunocompromised
Adolescent
Older adults

ABSTRACT

One of the strategic objectives of the 2011–2020 Global Vaccine Action Plan is for the benefits of immunisation to be equitably extended to all people. This approach encompasses special groups at increased risk of vaccine-preventable diseases, such as preterm infants and pregnant women, as well as those with chronic and immune-compromising medical conditions or at increased risk of disease due to immunosenescence. Despite demonstrations of effectiveness and safety, vaccine uptake in these special groups is frequently lower than expected, even in developed countries with vaccination strategies in place. For example, uptake of the influenza vaccine in pregnancy rarely exceeds 50% in developed countries and, although data are scarce, it appears that only half of preterm infants are up-to-date with routine paediatric vaccinations. Many people with chronic medical conditions or who are immunocompromised due to disease or aging are also under-vaccinated. In the US, coverage among people aged 65 years or older was 67% for the influenza vaccine in the 2014–2015 season and 55–60% for tetanus and pneumococcal vaccines in 2013, while the coverage rate for herpes zoster vaccination among those aged 60 years or older was only 24%. In most other countries, rates are far lower. Reasons for under-vaccination of special groups include fear of adverse outcomes or illness caused by the vaccine, the inconvenience (and in some settings, cost) of vaccination and lack of awareness of the need for vaccination or national recommendations. There is also evidence that healthcare providers' attitudes towards vaccination are among the most important influences on the decision to vaccinate. It is clear that physicians' adherence to recommendations needs to be improved, particularly where patients receive care from multiple subspecialists and receive little or no care from primary care providers.

Contents

Abbreviations: ACIP, Advisory Committee on Immunisation Practices; CDC, Centers for Disease Control and Prevention; GVAP, Global Vaccine Action Plan; Hib, *Haemophilus influenzae* type b; HIV, human immunodeficiency virus; HPV, human papillomavirus; NICU, neonatal intensive care unit; PCV, pneumococcal conjugate vaccine; Td, tetanus-diphtheria vaccine; Tdap, Td-acellular pertussis vaccine; WHO, World Health Organization.

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http://dx.doi.org/10.1016/j.vaccine.2016.11.015
0264-410X/

1. Introduction

One of the strategic objectives of the 2011–2020 Global Vaccine Action Plan (GVAP) is for the benefits of immunisation to be equitably extended to all people [1]. This approach encompasses special groups at increased risk of vaccine-preventable disease, such as preterm infants and pregnant women, as well as those with chronic and immune-compromising medical conditions. The increased risk of disease due to immunosenescence with advancing age must also be taken into consideration in the development of vaccination strategies that cover all ages and health conditions.

Special populations are often under-vaccinated for various reasons, including lack of awareness of vaccine-preventable diseases and uncertainty or misconceptions about the safety and efficacy of vaccination among patients, parents and healthcare providers, as well as cost and the inability of healthcare systems to ensure such patients receive recommended vaccines. In this review, we discuss vaccination strategies in the context of special situations or conditions that increase vulnerability to disease, focusing mainly on recommendations of the World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunisation Practices (ACIP). Rationales that support recommended vaccination strategies, as well as barriers to the immunisation of special populations, are also considered.

2. Vaccination in pregnancy

The physiological changes associated with pregnancy can lead to an elevated risk for severe disease [2] (Box 1). Influenza infection during pregnancy also has risks for the foetus, including premature birth, reduced birth weight and an elevated risk of death [3]. The 2009 influenza pandemic was a timely reminder of the risks: surveillance data from the US estimated that influenza infection during pregnancy was associated with a sevenfold increased risk of hospitalisation and fourfold increased risk of admission to intensive care units or death when compared to infected non-pregnant women [4]. During the winter of 2009 in Australia and New Zealand, the proportion of patients with influenza who were pregnant and admitted to an intensive care unit was nine times higher than the corresponding proportion in the general population [5]. Advisory groups throughout the world have therefore recommended influenza vaccination for pregnant women, with the WHO identifying them as a priority group [6,7]. The positive impact of maternal influenza vaccination is not limited to developed countries [7]. For example, a randomised controlled trial with trivalent inactivated influenza vaccine in Bangladesh suggested maternal vaccination had effectiveness of 63% against confirmed influenza in infants, with reduction of influenza-like illness in infants and mothers by 29% and 36%, respectively [8]. Other study data suggest influenza vaccination was associated with a significant decline in the risk of infants being small for gestational age [9]. However, for countries with very constrained health budgets, influenza prevention is rarely a priority [10].

Vaccination against tetanus and pertussis is also widely recommended (Table 1). Neonatal tetanus has a very high case fatality rate and although improved hygiene during birth reduces the risk of maternal and neonatal tetanus, maternal vaccination has been critical in reducing the incidence, especially where good quality perinatal care is not available and home births are frequent [11]. Effectiveness trials demonstrated reductions in neonatal tetanus of 80%, with declines in mortality of up to 98% after maternal receipt of two or three vaccine doses [12]. Between 1988 and 2013, the estimated number of deaths due to tetanus among neonates fell from 787,000 to 49,000 globally, which was attributed mostly to maternal tetanus vaccination [13]. A key component of this was the establishment of supplementary immunisation activities, which ensured that as many pregnant women as possible had access to the vaccine [11].

Pertussis (whooping cough) remains endemic in much of the world. Infants are especially vulnerable in the early months of life before vaccination, once protective maternal antibody levels have waned [14]. Since vaccination of the family to prevent pertussis transmission ('cocooning') has shown little evidence of effectiveness, health authorities now increasingly advise against the

Box 1
Vaccination in pregnancy.

Population	• Pregnant women
Reasons for increased risk of disease	• Altered state of immune responsiveness due to adaptive immune responses by mother to tolerate foetus and by foetus to tolerate mother
Diseases most commonly targeted by vaccination	• Influenza • Tetanus • Pertussis
Reported vaccine uptake rates[a]	• Influenza vaccine uptake ~50% or less
Common barriers to vaccination	• Failure of healthcare provider to recommend vaccination • Lack of knowledge of vaccine safety and effectiveness; fear of adverse pregnancy outcomes • Perceived susceptibility to disease • Lack of awareness of national recommendations • Inconvenience
Unmet vaccination needs	• Vaccination against other leading causes of infection during early infancy • Group B Streptococcus • Respiratory syncytial virus

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Please cite this article in press as: Doherty M et al. Vaccination of special populations: Protecting the vulnerable. Vaccine (2016), http://dx.doi.org/10.1016/j.vaccine.2016.11.015