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Cost-effectiveness of seasonal inactivated influenza vaccination among pregnant women

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ABSTRACT

Objective: To evaluate the cost-effectiveness of seasonal inactivated influenza vaccination among pregnant women using data from three recent influenza seasons in the United States.
Design, setting, and participants: We developed a decision-analytic model following a cohort of 5.2 million pregnant women and their infants aged <6 months to evaluate the cost-effectiveness of vaccinating women against seasonal influenza during pregnancy from a societal perspective. The main outcome measures were quality-adjusted life-year (QALY) gained and cost-effectiveness ratios. Data sources included surveillance data, epidemiological studies, and published vaccine cost data. Sensitivity analyses were also performed. All costs and outcomes were discounted at 3% annually.
Main outcome measures: Total costs (direct and indirect), effects (QALY gains, averted case numbers), and incremental cost-effectiveness of seasonal inactivated influenza vaccination among pregnant women (cost per QALY gained).
Results: Using a recent benchmark of 52.2% vaccination coverage among pregnant women, we studied a hypothetical cohort of 2,753,015 vaccinated pregnant women. With an estimated vaccine effectiveness of 73% among pregnant women and 63% among infants <6 months, QALY gains for each season were 305 (2010–2011), 123 (2011–2012), and 610 (2012–2013). Compared with no vaccination, seasonal influenza vaccination during pregnancy was cost-saving when using data from the 2010–2011 and 2012–2013 influenza seasons. The cost-effectiveness ratio was greater than $100,000/QALY with the 2011–2012 influenza season data, when CDC reported a low attack rate compared to other recent seasons.
Conclusions: Influenza vaccination for pregnant women can reduce morbidity from influenza in both pregnant women and their infants aged <6 months. Seasonal influenza vaccination during pregnancy is cost-saving during moderate to severe influenza seasons.

1. Introduction

In the United States, pneumonia and influenza is one of the leading causes of morbidity and mortality each year [1]. In 2012–2013, influenza illness was estimated to be responsible for over 300,000 hospitalizations [2]. Pregnant women are at a higher risk of developing influenza-related complications [3]. Additionally, among children, infants aged <6 months have the highest rates of influenza-attributable hospitalization [3]. Seasonal influenza vaccine is the first line of defense to prevent influenza and influenza-associated complications, but current influenza vaccines are not licensed for children <6 months old [4]. Vaccinating women during their pregnancy can provide protection not only for themselves but also for their infants <6 months [5,6]. Since 2004, the Advisory Committee on Immunization Practices (ACIP) and the American College of Obstetricians and Gynecologists have recommended influenza vaccination for all women who are or will be pregnant during the influenza season, regardless of trimester [4]. In the 2013–2014 influenza season, 52.2% of pregnant women received a seasonal inactivated influenza vaccine, similar to the

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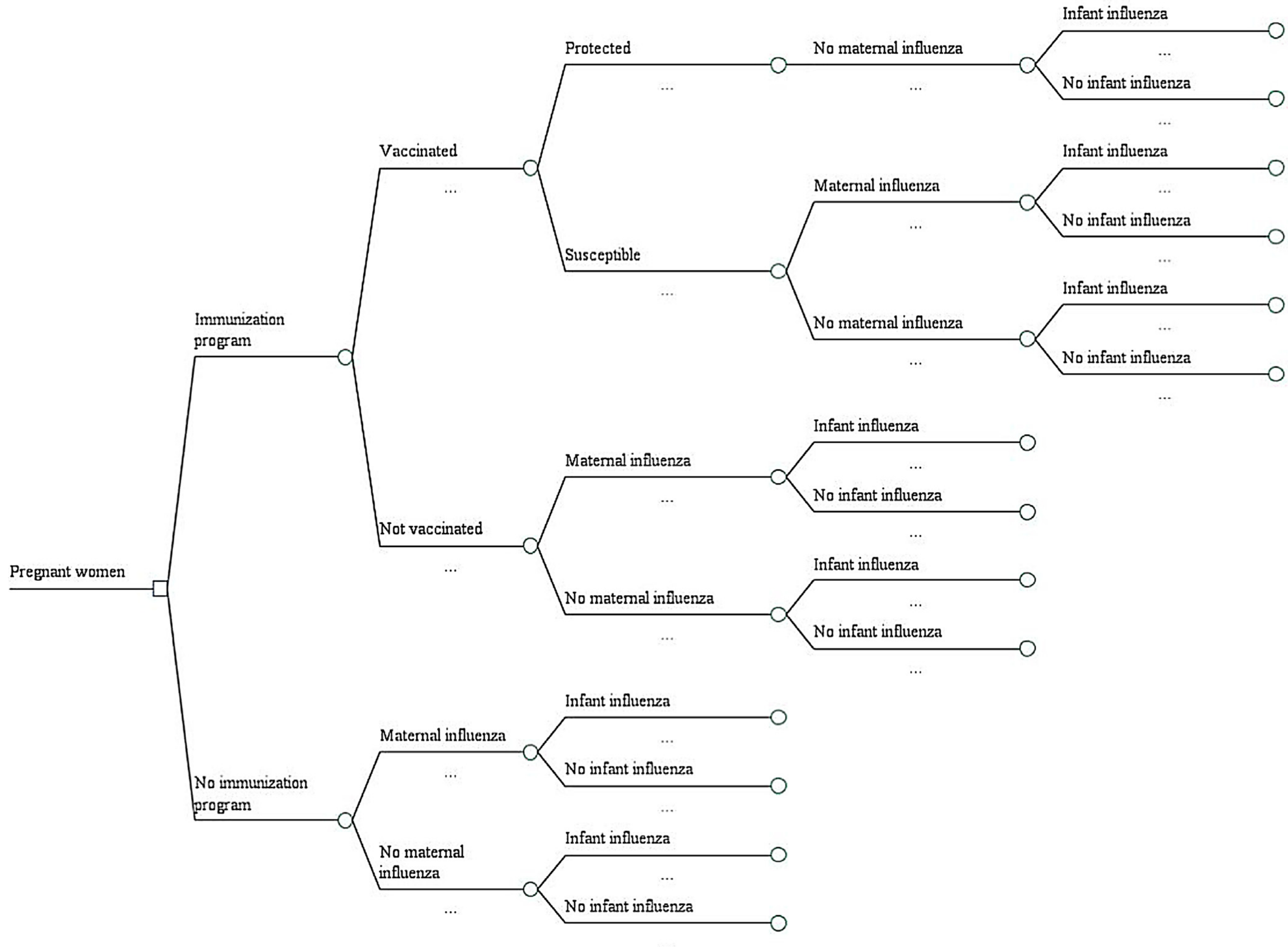

Fig. 1. Simplified decision tree.

coverage in the preceding season [7]. However, the coverage is still well below the Healthy People 2020 target of 80% influenza vaccination among pregnant women [8].

The costs of medical care and productivity losses associated with influenza are substantial [9]. Consideration of these costs in relation to vaccination costs can provide valuable information to immunization programs and policy makers in order to make recommendations for seasonal influenza vaccination. Several studies have analyzed the cost-effectiveness of influenza vaccination for pregnant women and they reached different conclusions [10–12]. All previous studies suggested that the cost-effectiveness ratio (CER) was heavily dependent on the influenza incidence rate, although one study also suggested the impact of timing of vaccination relative to gestational age on cost-effectiveness estimates [12]. These studies used influenza incidence data collected during or before the 2009 H1N1 pandemic. Since the 2009 influenza season, the influenza landscape in the US has greatly changed. Influenza morbidity per case has likely declined due to the increased use of antiviral therapy [13,14]. Influenza case ascertainment and, therefore, surveillance data, may have improved due to availability of more sensitive diagnostic techniques [15]. These recent developments make our study, especially because of the inclusion of post-2009 pandemic data, a timely addition to the literature on the cost-effectiveness of influenza vaccination. In this study, we estimated the cost-effectiveness of seasonal inactivated influenza vaccination among pregnant women using data from three recent influenza seasons.

2. Methods

2.1. Decision analysis model

We developed a cohort decision analysis to estimate the cost-effectiveness of vaccinating women during pregnancy against seasonal influenza from a societal perspective (Fig. 1). As the at-risk population and probability of birth are conditional on calendar week and gestational age, we used the Markov state-transition model in Excel software to track weekly changes in delivery patterns and disease incidence. Our model estimated the averted direct medical costs and indirect productivity loss due to influenza-associated illness, quality-adjusted life year (QALY) gains for both mother and their infants aged <6 months due to vaccination, and overall cost-effectiveness of vaccination.

We assumed that sub-types of influenza across seasons are different and there is no cross protection between different sub-types. Based on 2011–2012 National Centers for Health Statistics (NCHS) data, we constructed two hypothetical populations: pregnant women and infants [16]. A hypothetical cohort of 5.2 million pregnant women who experienced defined influenza season during their pregnancy was targeted for influenza vaccination. Following a live birth, we assumed an infant was protected for 6 months [5,6]. Hence, infants aged <6 months were also included in the analysis, as they receive passive immunity through transplacental transfer of antibodies following maternal immunization [17]. We simulated the two interrelated populations from July 1 to June 30