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Costs of Sequelae Associated with Invasive Meningococcal Disease: Findings from a US Managed Care Population

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ABSTRACT

OBJECTIVES: To assess health care utilization and costs among patients experiencing invasive meningococcal disease (IMD)-related sequelae compared with IMD patients without sequelae.

STUDY DESIGN: A retrospective cohort analysis of an administrative claims database for years 1997-2009. Patients with IMD-related inpatient admissions and continuous health plan enrollment were selected and categorized by the presence (complicated IMD) or absence (uncomplicated IMD) of IMD-related sequelae during the 12-month follow-up period. Univariate and multivariable analyses assessed differences in health care utilization and related costs between the 2 patient groups.

RESULTS: We identified 343 patients; 117 (34%) had a diagnosis claim for at least one IMD-related sequela during the follow-up period. Multivariable analyses showed significantly higher total health care costs for complicated IMD cases (mean: $96,826; 95% confidence interval: $88,659-$104,993) compared with uncomplicated IMD cases (mean: $32,414; 95% confidence interval: $30,825-$34,003). Risk of rehospitalization after initial IMD admission was higher for patients with complicated IMD (hazard ratio = 1.7; 95% confidence interval: 1.0-2.7; $P = .034$) compared with patients with uncomplicated IMD.

CONCLUSION(S): Predicted health care costs among patients with complicated IMD were 3 times higher compared with patients with uncomplicated IMD. These costs should be considered when economic evaluations of meningococcal vaccination programs are made.

KEYWORDS: Economic burden; Health care utilization; Invasive meningococcal disease

In the US, there are typically between 1400 and 2800 cases of invasive meningococcal disease (IMD) reported annually, which accounts for an annual incidence rate of 0.5 to 1.0 per 100,000 population.[1-3] In the last 40 years, the incidence of IMD has typically fluctuated in 10- to 15-year cycles, peaking at 1.7

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per 100,000 population in the 1990s and declining to approximately 0.35 and 0.34 per 100,000 population in 2007 and 2008, respectively.[4-6]

Worldwide, 13 *Neisseria meningitidis* serogroups have been identified, 5 of which (A, B, C, W-135, and Y) account for the majority of disease in humans.[2,4] There also has been a recent emergence of serogroup X in the African meningitis belt.[7,8] In the US, most of the reported IMD cases are due to the *N. meningitidis* serogroups B, C, and Y.[6] The Active Bacterial Core surveillance program serves as a population-based surveillance system for invasive bacterial pathogens, including *N. meningitidis*. The program reports that, of all IMD cases reported in 2008, 31% were due to serogroup B, 28% were due to serogroup C, and 23% were due to serogroup Y.[5] The incidence of IMD also varies significantly by age. A disproportionately higher incidence of IMD was reported among infants <1 year of age (7.6 per 100,000 population), during the period 1997-2007.[2] In 2008, a majority (approximately 79%) of IMD cases reported among infants <1 year of age were due to serogroup B.[5]

The availability of vaccines for the bacterial organisms *Haemophilus influenzae* type B and *Streptococcus pneumoniae* has helped lower the incidence of these infections.[9-11] However, invasive infections due to *N. meningitidis* still remain a serious public concern in the US. Currently, 3 meningococcal conjugate vaccines are commercially available in the US. These include meningococcal polysaccharide (serogroups A, C, Y, and W-135) diphtheria toxoid conjugate vaccine; quadrivalent meningococcal conjugate vaccine for serogroups A, C, Y, and W-135; and meningococcal polysaccharide vaccine for serogroups A, C, Y, and W-135 combined.[12] Based on guidelines set forth by the Advisory Committee on Immunization Practices of the American Academy of Pediatrics, the meningococcal polysaccharide diphtheria toxoid conjugate vaccine is the preferred choice of vaccine among children (2-10 years of age), and the quadrivalent meningococcal conjugate vaccine or the meningococcal polysaccharide combined vaccine may be used among persons aged 11-55 years.[12,13] At the present time, the meningococcal polysaccharide diphtheria toxoid conjugate vaccine is not licensed in the US for individuals over 55 years of age, so the meningococcal polysaccharide combined vaccine is preferred for adults over the age of 55 years.[12,13] Although routine vaccination among 12-year-olds has been shown to have potential in reducing the incidence of invasive disease by 39% and vaccine-preventable cases by 62%,[14] the low vaccination rates among adolescents in the US remains a concern (11.7% in 2006 and 32.4% in 2007 for all adolescents; 38%-45% in 2008, depending on adolescent age).[6,15]

Individuals experiencing invasive infections due to *N. meningitidis* have a high risk of death, with a case fatality rate of approximately 10%.[16] In addition, life-long debilitating sequelae, including hearing loss, stroke, limb amputation, brain and nervous system damage, and seizure among IMD survivors[14,17-20] have been reported. In the last decade, the death rate due to IMD in the US has varied from 7% to 16%. Several studies have previously assessed the prevalence of sequelae among IMD survivors.[18,19,21,22] However, the additional economic burden from IMD-related sequelae in US managed care settings has not been documented.

The objective of this study, therefore, was to compare health care utilization and associated costs in IMD patients with and without related sequelae, which will facilitate a better understanding of the incremental economic burden these sequelae represent. This additional burden should be considered when economic evaluations of meningococcal vaccination strategies are made.

METHODS

Data Source

This study used data from the Ingenix Impact (formerly the Integrated Health Care Information Services) database for the years 1997-2009, which contains administrative insurance claims from a national sample of over 40 managed care health plans covering approximately 50 million lives. Individuals from all