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Epidemiology, clinical presentation, risk factors, intensive care admission and outcomes of invasive meningococcal disease in England, 2010–2015

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ABSTRACT

The epidemiology of invasive meningococcal disease (IMD) is constantly changing as new strains are introduced into a population and older strains are removed through vaccination, population immunity or natural trends. Consequently, the clinical disease associated with circulating strains may also change over time. In England, IMD incidence has declined from 1.8/100,000 in 2010/2011 to 1.1/100,000 in 2013/2014, with a small increase in 2014/2015 to 1.3/100,000. Between 01 January 2011 and 30 June 2015, MenB was responsible for 73.0% (n = 2489) of 3411 laboratory-confirmed IMD cases, followed by MenW (n = 371, 10.9%), MenY (n = 373, 10.9%) and MenC (n = 129, 3.8%); other capsular groups were rare (n = 49, 1.4%). Detailed questionnaires were completed for all 3411 laboratory-confirmed cases. Clinical presentation varied by capsular group and age. Atypical presentations were uncommon (244/3411; 7.2%), increasing from 1.2% (41/3411) in children to 3.5% (120/3411) in older adults. Known IMD risk factors were rare (18/3411; 0.5%) and included complement deficiency (n = 11), asplenia (n = 6) or both (n = 1). Nearly a third of cases required intensive care (1069/3411; 31.3%), with rates highest in adults. The 28-day CFR was 6.9% (n = 237), with the lowest rates in 0–14 year-olds (85/1885, 4.5%) and highest among 85+ year-olds (30/94, 31.9%). These observations provide a useful baseline for the current burden of IMD in a European country with enhanced national surveillance.

1. Introduction

Invasive meningococcal disease (IMD) is one of the most feared infectious diseases in children and adults due to its sudden onset, rapid progression, serious clinical presentations, high case fatality and long-term sequelae among survivors. The fight against meningococcal disease has advanced with the availability of effective vaccines against the major capsular groups responsible for invasive disease worldwide.

In Europe, group B meningococci (MenB) are responsible for the majority of IMD cases and deaths, especially in children, adolescents and young adults [1]. Group C disease (MenC) is rare, especially in countries with established MenC immunisation programmes. Currently, many countries across Europe are experiencing an increase in IMD due to a highly virulent group W meningococcal strain (MenW) belonging to the ST-11 clonal complex [2].

The UK was first country to offer the MenC conjugate vaccine to all children and adults up to 25 years of age. In August 2015, the UK implemented an emergency immunisation programme offering the quadrivalent meningococcal ACWY conjugate vaccine to teenagers in order to control the rapid increase MenW disease across all age groups [3]. In September 2015, the UK also became the first country to introduce a novel, protein-based vaccine against group B meningococci (MenB) into its nationally-funded, infant immunisation programme [4]. This vaccine has the potential to protect infants against other meningococcal capsular groups, including the hypervirulent ST-11 MenW strain [5]. In anticipation of these two national immunisation programmes, Public Health England enhanced national surveillance to collect more detailed data for cases diagnosed since 2011 in order to complement the laboratory surveillance that was already in place.

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Here we present the epidemiology, capsular group distribution, risk factors, clinical presentation and outcomes of all IMD cases in England over a 5-year period, providing a baseline against which the impact of the two new meningococcal vaccine programmes may be measured in future.

2. Methods

2.1. Surveillance of IMD

Public Health England (PHE) conducts enhanced national IMD surveillance and its Meningococcal Reference Unit (MRU) provides a national reference service for IMD confirmation and characterisation of invasive meningococci (both culture and non-culture). The MRU also provides free non-culture PCR confirmation of meningococcal diagnosis (including genogroup and genosubtype analysis) for clinical specimens that are routinely submitted by National Health Service (NHS) hospitals in England [6], a method that has proven high case ascertainment [7]. In 2013, PHE enhanced the laboratory surveillance by collecting clinical data using postal questionnaires to general practitioners (GPs) of laboratory-confirmed IMD cases diagnosed since 01 January 2011. Information collected included comorbidities, risk factors, clinical presentation, intensive care admission (ICU) and outcomes. Incomplete or missing information in the questionnaires was followed-up by telephoning the GP, contacting the patient's hospital clinician or requesting additional information from the local PHE health protection team (HPT), which maintains records of all suspected and confirmed IMD cases for public health management of cases and close contact and for monitoring outbreaks. If needed, additional information was sought from HPZone, a national web-based case management system used by local Health Protection Teams to record public health events and actions, and from electronic death registration records provided to PHE by the Office for National Statistics for public health surveillance purposes and confirmed dates of death using the Personal Demographics Service (PDS) only including deaths within 28 days of receipt of sample.

2.2. Data

Demographic, clinical questionnaire and microbiological data were entered into a single Microsoft Access Database (Microsoft Corporation, Redmond, Washington) cleaned and de-duplicated before importing into Stata version 13.0 (StataCorp LP, College Station, Texas) for analysis. The final database included all laboratory-confirmed IMD cases in England that were confirmed by the MRU over five epidemiological (July to June) years from 2010/11 to 2014/15. These data were used to calculate national and regional incidence, as well as serogroup distribution of IMD cases. Clinical data are presented for cases diagnosed between January 2011 and July 2015. These data are predominately descriptive and logistic regression analyses were used where appropriate.

3. Results

3.1. IMD incidence

IMD incidence in England declined by 38.9% from 1.8/100,000 (n = 1009) in 2010/11 to 1.1/100,000 (n = 636) in 2013/14, followed by a small increase in 2014/15 at 1.3/100,000 (n = 724) (Fig. 1). The greatest proportional decline was observed in toddlers (10.6/100,000 to 5.8/100,000; 45.3% decrease) and 5–14 year olds (1.8/100,000 to 1.0/100,000; 44.4% decrease), compared to 34.0% in infants (29.1/100,000 to 19.2/100,000). At the same time, IMD incidence increased in older adults, ranging from a 12.5% increase in 65–74 year olds (0.8/100,000 to 0.9/100,000) to 116.7% in 85+ year-olds (1.2/100,000 population to 2.6/100,000 population). Compared to 2013/14, IMD incidence in 2014/15 increased in all age-groups, except infants (21.6/100,000 [n = 151] to 19.2/100,000 [n = 127]) and 25–44 year olds (0.4/100,000 [n = 55] to 0.3/100,000 [n = 48]).

3.2. Capsular group

The incidence of MenB disease nearly halved over the five years, from 1.5/100,000 in 2010/11 (n = 843) to 0.8/100,000 in 2014/15 (n = 418). This decline was observed across all the age-groups and was greatest in toddlers (1–4 years) (10.0/100,000 [n = 278] to 5.0/100,000 [n = 139]; 50% decrease) and infants (27.1/100,000 [n = 195] to 15.2/100,000 [n = 101]; 44% decrease). IMD incidence in 15–24 year-olds also declined by 20% over the same period from 2.0/100,000 (n = 149) to 1.6/100,000 (n = 106).

In contrast, MenW incidence increased from 0.1/100,000 (n = 36; 4% of all IMD cases) in 2010/11 to 0.3/100,000 (n = 176; 24.3% of all IMD cases) in 2014/15. This increase was initially observed in the 15–24 year age group but soon followed across all ages, with the greatest increases seen in infants (0.42 per 100,000 [n = 3] in 2010/11 to 3.01 per 100,000 [n = 21] in 2014/15), such that infants had the highest MenW incidence in 2014/15 compared to any other age group. In 15–24 year olds, MenW incidence increased from 0.08/100,000 (n = 6) in 2010/11 to 0.43/100,000 in 2014/15, when it was responsible for 29.2% (31/106) of all IMD cases in this age group. In older adults, MenW disease was rare but increased rapidly over the five years from 0.04

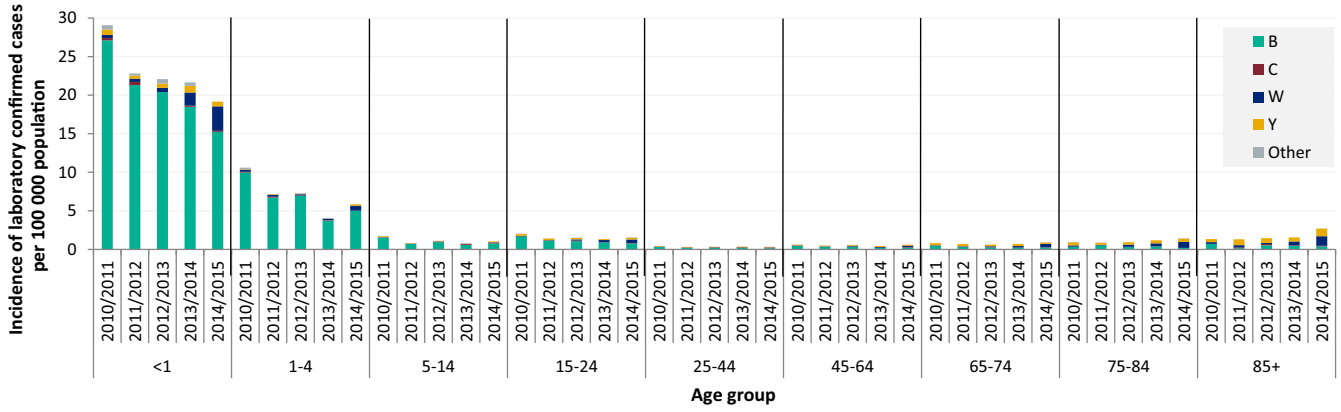

Fig. 1. Incidence by age group stratified by epidemiological year and meningococcal capsular group in England: 2010/11 to 2014/15.

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