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Meningococcal vaccination for international travellers from Greece visiting developing countries

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Summary *Background:* Meningococcal meningitis is a serious disease. Travel-associated infection for the general traveller is low; however regular epidemics in indigenous population, particularly in sub-Saharan Africa are responsible for significant morbidity and mortality. Our aim was to assess meningococcal vaccination for international travellers from Greece.
Methods: A prospective questionnaire-based study was conducted during 2009–2013.
Results: A total of 5283 travellers were studied (median age: 39.2 years); Meningococcal tetravalent vaccine (A,C,W135,Y) was delivered to 1150 (21.8%) of them. Of those who travelled to the Middle East and sub-Saharan Africa, 73.1% and 21.2% received meningococcal vaccine, respectively. Of those travellers who travelled to sub-Saharan Africa from November to June and from July to October, 22.1% and 20.6% were vaccinated with meningococcal vaccine, respectively. Of all travellers who travelled for $<$1 month and $\geq$1 month, 23.3%, and 20.5%, were vaccinated, respectively. Meningococcal vaccine was administered to 95.3% of pilgrims, 17.4% of those visiting friends and relatives (VFRs), 16.7% of those who travelled for recreation, and 13.8% of those who travelled for work. Of travellers who stayed in urban, in rural, and in urban and rural areas, 32%, 11.6% and 12.7% were vaccinated, respectively. Meningococcal vaccine was delivered to 29.2%, 21.1%, 19.4% and 5.1% of those who stayed in hotels, at local people's home, in camps, and on ships, respectively. The association of meningococcal vaccine administration with the destination, duration and purpose of travel, area of stay and type of accommodation was statistically significant.
Conclusion: There is a need to improve meningococcal vaccine recommendations for travellers

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from Greece, particularly for high risk populations, such as VFRs, business travellers and those visiting sub-Saharan Africa especially during the dry season.

1. Introduction

Neisseria meningitidis, a gram-negative diplococcal bacterium is recognized as the cause of meningococcal disease and a significant public health problem. Neisseria species which usually reside in the nasopharynx of asymptomatic people (4–35% of healthy adults) are easily transmitted to close contacts by respiratory droplets [1]. The incidence of invasive meningococcal disease varies both geographically and with time and in both endemic and epidemic forms is responsible for significant morbidity and mortality worldwide with 5–10% fatality rate [1,2]. Approximately 10–20% of survivors are left with permanent neurological sequelae despite all advances in therapy [1,2]. Meningococcal meningitis epidemics affect more than 400 million people living in the African "meningitis belt" (from Senegal to Ethiopia) annually and during epidemics as many as 1000/100,000 population may be affected [2]. Serogroup A and, less frequently serogroup C, have been responsible for epidemics in the past in Africa and recently, firstly in Saudi Arabia, and later in West Africa, W135 has emerged as a serogroup. Serogroups X and Y are rare, but associated with slowly increasing trends [1]. The risk of acquiring meningococcal disease in general depends on the region, the living conditions and behaviour [1].

International travel and migration may contribute to the importation and rapid spread of meningococcal disease; Africa has been one of the fastest-growing touristic regions of the last decade with 6% more international tourist arrivals recorded in 2013 compared to previous years, equivalent to an increase of three million tourists [3]. The incidence of meningococcal disease in international travellers is low; it is estimated to be 0.4/100,000 travellers/month [4,5]. Risk factors for the acquisition of the disease include destination, duration and season of travel and living in close contact with the local people [6]. Mass gatherings such as the Hajj pilgrimage to Saudi Arabia have been associated with outbreaks of meningococcal disease and it is considered a risk factor [7]. The serogroup A and W135 were responsible for the outbreaks in 1998 and in the years 2000 and 2001, respectively [8]. Vaccination against meningococcal disease is required for Hajj/Umrah pilgrims to Saudi Arabia. Tetravalent polysaccharide and conjugate meningococcal vaccines (A, C, W-135 and Y) are recommended for travellers' to African "meningitis belt". The new conjugate vaccines may help protect travellers and decrease the spread of bacterial carriage and disease [9,10]. The current study was conducted by the Hellenic Center for Disease Control and Prevention in order to evaluate the application of meningococcal vaccine recommendations for international travellers.

2. Methods

In Greece travel medical services are provided predominantly by the 57 Public Health Departments across the country. Travel health providers include physicians, nurses and health visitors specialized in public health. Pre-travel consultation services are provided in accordance with the national guidelines which are similar to World Health Organization, and the Centers for Disease Control and Prevention guidelines [5,11,12]. The meningococcal polysaccharide vaccine is available exclusively in the Public Health Departments. The conjugated (with CRM 197) tetravalent (A,C,W135,Y) meningococcal vaccine has been available on the Greek market since 2011 and it is fully reimbursed for individuals over 11 years of age; this vaccine can be administered by other primary care practitioners as well. Other conjugated (with tetanus toxoid or diphtheria toxoid) tetravalent meningococcal vaccines have not yet been available.

All international travellers who attended all 57 Public Health Departments for pre-travel advice from 1 January, 2009 through December 31, 2013, were asked to participate in a questionnaire-based study. Consent was requested from all participants. The questionnaire (anonymous form) was developed by the researchers and included the following data which were collected prospectively per traveller: age, gender, date of departure, country of destination, duration of stay, type and purpose of travel, visiting areas, type of accommodation, participation in outdoor activities, vaccination and malaria prophylaxis recommendations. Urban accommodation was defined as cities with population of $\geq$5000 people, whereas rural accommodation was defined as villages of $<$5000 population or staying in the countryside. Short-term and long-term travel was defined as a trip of $<$1 month duration and $\geq$1 month, respectively.

Statistical analysis was performed using the STATA 8.0 statistical package. The multivariable logistic regression was applied to investigate the relation between prescription of meningococcal vaccine and travellers' and travel characteristics. χ^2 test was used in each one of the destination areas separately in order to investigate the relation between meningococcal vaccine administration and duration of travel in each destination area. *p*-Values of 0.05 or less were considered statistically significant.

3. Results

During the study period 5283 travellers were studied. The participation rate ranged from 75% to 85% per Health Department. Most participants (40%) were seen in the

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