Recent patterns of meningococcal meningitis risk in sub-Saharan Africa

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Meningococcal meningitis has long been linked to an arid climate, with the majority of cases on the African continent occurring within the semi-arid 'meningitis belt' between 300 mm and 1100 mm isohyets, and a marked increase in incidence during the October to May dry season in even the more humid climates south of the belt. Whether dry, dusty conditions directly impact rates of carriage of meningococcal disease (Cheesbrough, et. al., 1995) or affect occurrence only indirectly, by contributing to a higher incidence of crowding and the barricading of shelters during dust storms, hence increasing risk of direct transmission, as well as increased risk of upper respiratory infection, is unclear. With currently available polysaccharide vaccines conferring limited immunity, reactive vaccination has been adopted as the main strategy for meningitis control in the region, with reactive vaccination triggered when the weekly incidence at the district level crosses the 10/100,000 population threshold. The WHO Department of Global Alert and Response, Health Security, and Environment is seeking any information that will allow more effective and more timely deployment of reactive vaccines. This first-time analysis of recent WHO epidemiological data on meningitis for countries deemed at high epidemic risk allows for the identification of meningitis hotspots and assessment of the current spatial and temporal pattern of spread of the disease. Data at the scale of the belt is available only through WHO weekly epidemiological reports, which list districts in alert status (5-10 cases/100,000 inhabitants) and epidemic status (>10 cases/100,000 inhabitants) for 13 countries within and surrounding the belt from 2003 to 2011, as well as number of cases per week at country level and the number of districts in alert and epidemic annually.

Preliminary analysis of the available data indicate an average 30% level of discrepancy between cumulative numbers of districts affected based on weekly real-time reports and cumulative numbers published at the end of the year, pointing to delays in actual reporting. Epidemic frequency analysis at the district level identifies hotspots, or districts that enter alert and/or epidemic status multiple times during the nine year period, with highlights clustered in Burkina Faso and in southern Niger, corresponding to the area of the classical meningitis belt. While these data conform to previous studies of meningitis in the belt, an unexpected high incidence of meningococcal disease in the Democratic Republic of Congo, apparent even from limited reporting years when compared to other countries included in WHO epidemiological reports, indicates that high levels of absolute humidity may have less of a modulating effect on carriage rates than previous work suggests. Analysis of the timing of epidemic outbreaks shows that 90 % of affected districts have a median week of entrance into epidemic status before week 16 (mid to late April), indicating a steep decline in epidemic risk after this week. The limited number of years of data included

necessarily limit the scope of conclusions; as an exploratory study, however, this work provides preliminary analysis of recent trends in meningococcal disease and identifies questions suitable for future research on the link between climate and meningitis.