PREDICTION OF MENINGOCOCCAL MENINGITIS INCIDENCE TREND IN BURKINA FASO FOR YEAR 2014

I. Background

In the case of activities of Burkina National Working Group on Climate and Health (NWGCH), and ongoing joint activities of Burkina Meteorological office, General Department of Health (Burkina Health Ministry), Laboratory of Ocean and Climate Science: Experimentation and Numerical Approach (LOCEAN-France) and African Desk - National Centre for Environmental Prediction (NCEP-United States of America), a prediction of the trend of meningococcal meningitis (mcm) incidence in Burkina Faso for year 2014 and an evaluation of what have been done in 2013 are made. Note that Burkina Faso is between most affected countries by mcm around the world.

This prediction is based on two approaches.

The first one on analyzing epidemiological data and medical information of meningitis surveillance by the expert of General Department of Health (DGS) from Burkina Ministry of Health.

The second one comes from statistical Multidimentional analysis between meningococcal meningitis (MCM) epidemiological data in Burkina Faso (from 1968 to 2014) and reanalysis I from National Centre of Environmental Prediction (NCEP). These data were performed to show the relationships between climate and mcm incidence variability. It was shown that mcm outbreak and upsurge cases are mostly related to an enhancement of Easterly wind (Harmattan).

So, mcm incidence trend prediction models for this country has been elaborated.

These models could be used to be integrated into a system of mcm incidence trend monitoring for early warning. This method should be performed by adding other predictors like socio-demographic, economical, biological and other risk factors. For more information, read the article on the website: http://www.ij-healthgeographics.com/content/7/1/34 .

II. Prediction of meningococcal meningitis incidence trend in Burkina Faso for year 2014

II.1 Prediction based on Meningococcal meningitis time series.

An analysis based on following factors allows deducing the incidence and the risk of MCM epidemic outbreak in Burkina Faso in 2014.

- **II.1.1. Meningococcal meningitis trend of the last decade**
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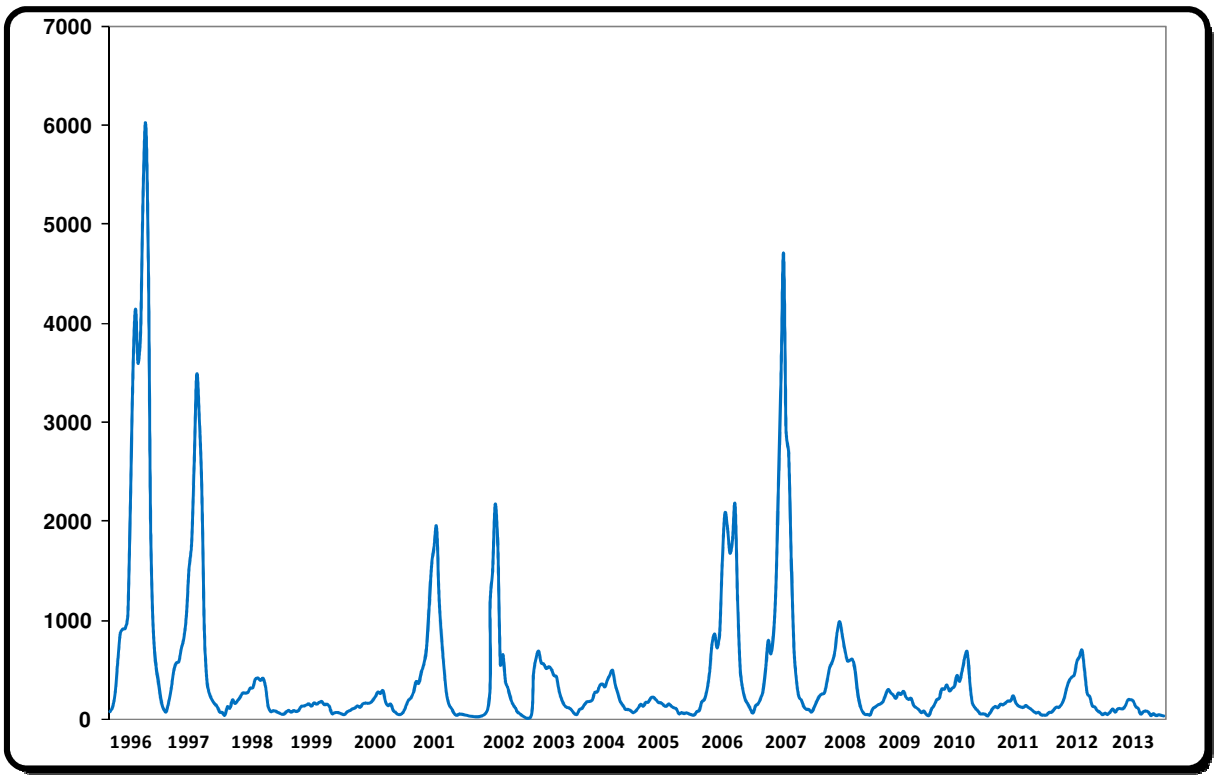

Graph n°1 : Meningococcal meningitis fluctuation in Burkina Faso from 1996 to 2013.

Reference: Epidemiological surveillance database, Ministry of Health, Disease Control Direction, Burkina Faso

Year to year, most cases of mcm are noticed from week 1 to week 21 with peaks from week 9 to weak 16.

MCM cases fluctuation from 1996 to 2013 show that high epidemics occurred two consecutive years followed by three years without / with low epidemics. So, after high mcm epidemics in 2006 and 2007, came low epidemics from 2008 to 2010. Following this trend, high epidemic was expected in 2011.

However, after preventive vaccination campaign against mcm serogroup A with MenAfriVac® in 2010, a change is noticed in mcm epidemics trend characterized by a decrease of mcm incidence and epidemics peaks.

II.1.2. Meningococcal serogroups epidemiological profile

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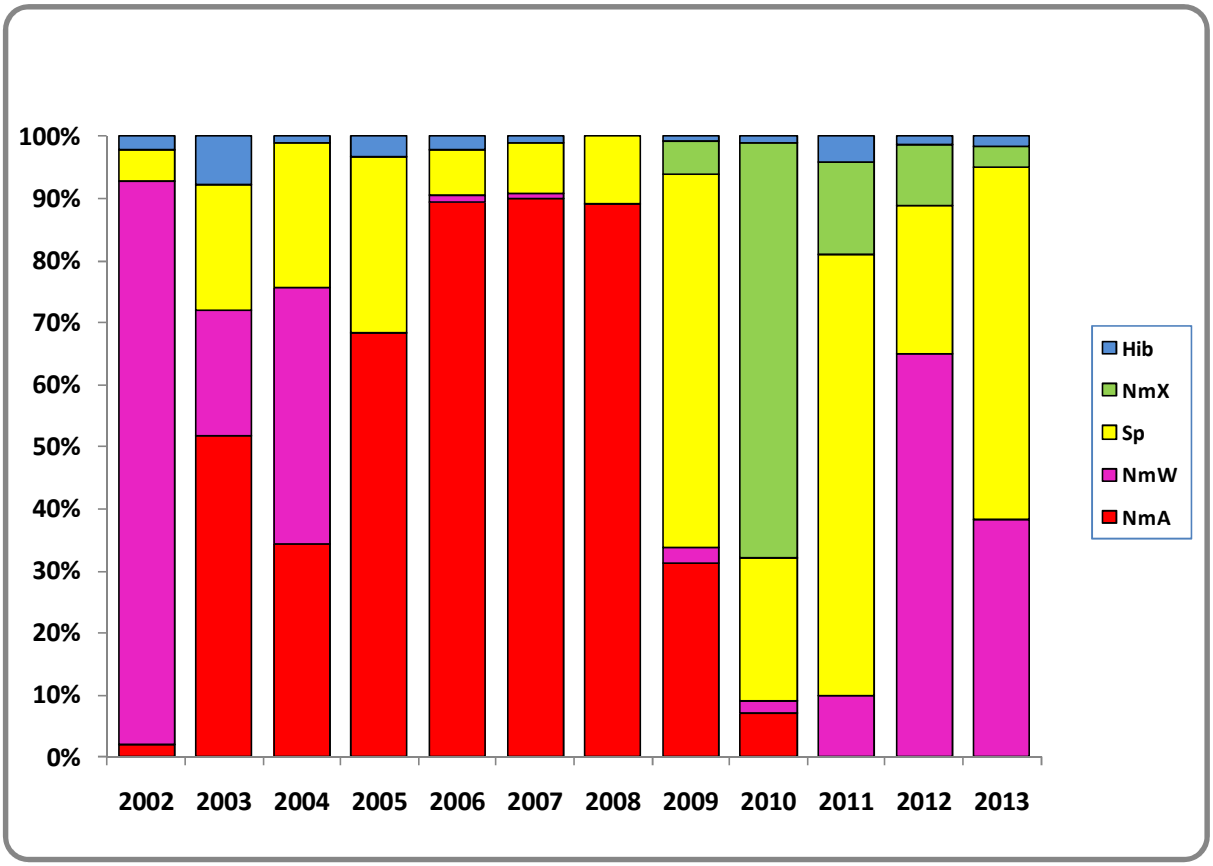


Graph n°2 : Fluctuations of the rate of identified serogroups in medical laboratory from 2002 to 2013 in Burkina Faso.

Reference: Epidemiological surveillance database, Ministry of Health, Disease Control Direction, Burkina Faso

Until 2010, in Burkina Faso, mcm epidemics were caused essentially by the serogroup A..

After the vaccination campaign against serogroup A done in 2010, we remark an absence of mcm epidemic due to this serogroup. Nevertheless, we noticed the fresh outbreaks of others serogroups with a predominance of the germs pneumocoque and serogroup W135.

II.1.3 Migrations and population mobility;

Some border areas of Burkina are densely populated with high level mobility of population due to trading, mining, agricultural, pastoral activities. Those areas, in spite of MenAfriVac® campaign vaccination, could be affected by localized meningitis epidemics. These risks are high due to the presence of refugees coming from Mali and living in northern, central, southern parts of Burkina Faso in precariousness situation with unknown vaccine statue.

II.1.4. People social economical conditions

Livestock breeding, agriculture and mining are people main activities during dry season, exposing them to dust and harmattan wind.

Some socio-cultural activities, as funerals, wedding and celebrations occur mainly after harvesting period from October to December. These situations could allow high transmission of mcm germs.

Conclusion

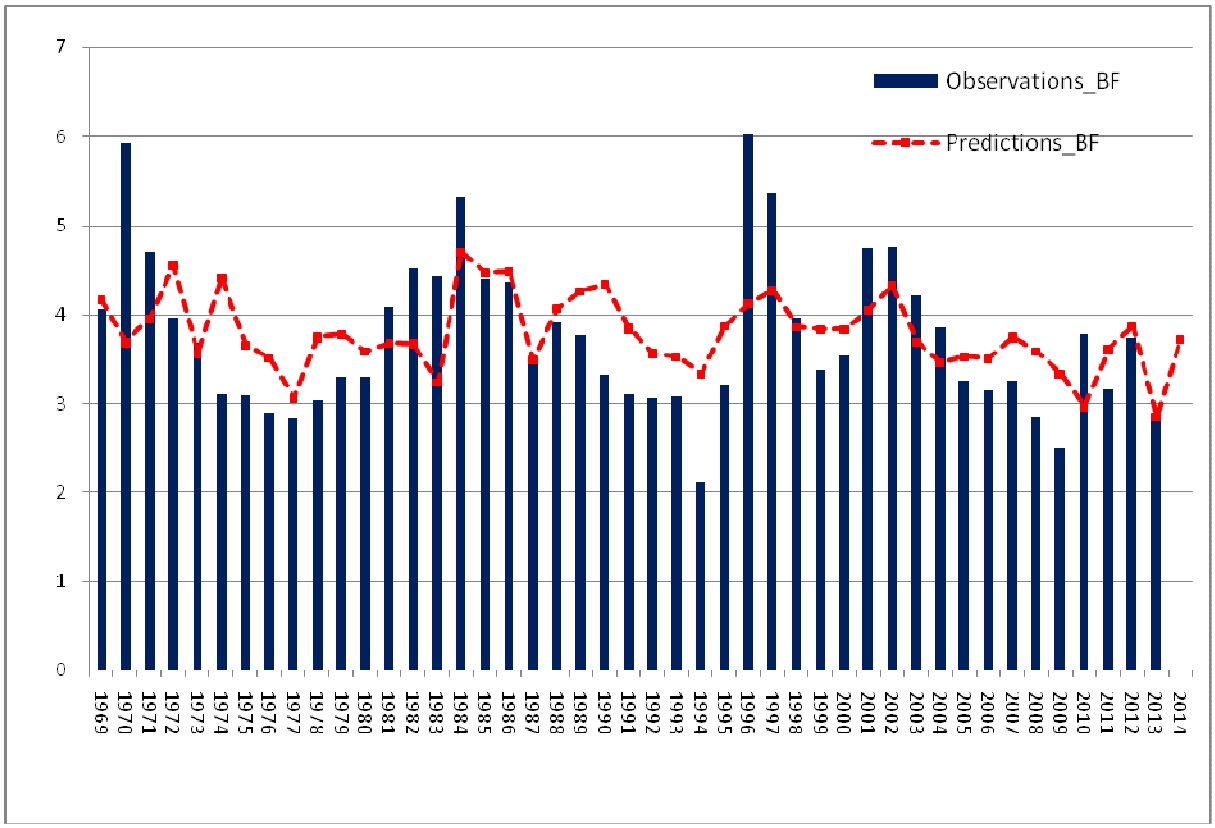
Finally, , the probability of meningococcal meningitis high epidemic outbreak due to serogroup A in 2014 in Burkina Faso is low, taking into account the period of immunity giving by the vaccination campaign that is 10 years.

In case of outbreak of meningococcal meningitis due to serogroup W135, the extent could be lesser, due to the impact of conjugate vaccine A that decrease the portage level.

In addition, inclusion of vaccine against the pneumocoque germ in October 2013 in national program of mass vaccination, could contribute to reduce the incidence of meningitis due to the pneumocoque in 2014.

II.2. Prediction based on climatic factors.

In 2014, by analyzing forcing of climate factors (essentially meridional wind component) on meningococcal meningitis (MCM) yearly incidence in Burkina Faso***, the amplitude (peak) of mcm epidemic should be intermediate*** (that means intermediate to high and low meningitis epidemics amplitude frequently observed over forty passed years). Also, the epidemic amplitude (peak) could be higher than what has been observed last year, in 2013 (see graph n°3).



Graph n°3: Meningococcal meningitis incidence rate predicted and observed in Burkina Faso from 1969 to 2014.

Abscissa : years
Ordinate : logarithm of mcm annual incidence rate
Histogram : Observed MCM logarithm incidence rate from 1969 to 2013.
Curved line: Predicted MCM logarithm incidence rate from 1969 to 2014

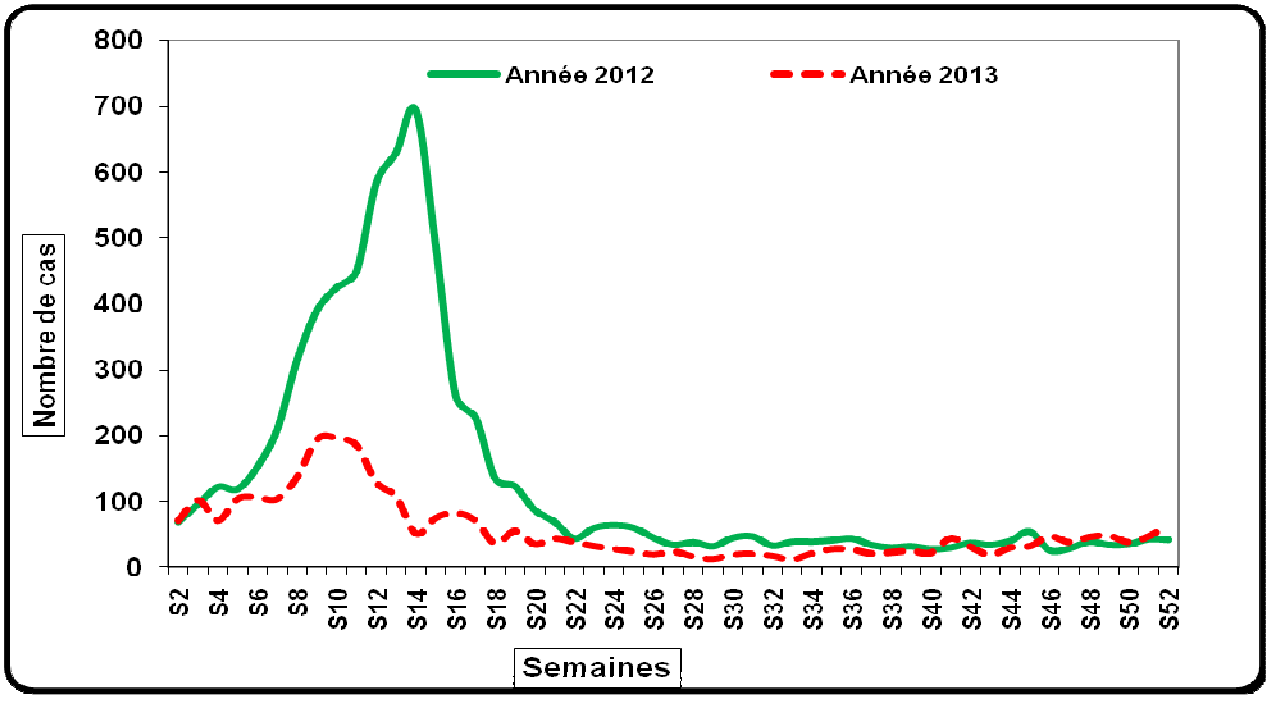
III. Evaluation of Prediction of meningococcal meningitis incidence trend in Burkina Faso for year 2013

In the graph above (graph n°3), we remark that the mcm predicted and observed incidences rates (ir) in 2013, are located in the median threshold, that means between the threshold of separation of mcm low incidence rate (rates below (log (mcm ir) = 3) and those of mcm high incidence rate (log (mcm ir) = 5).

That significantly confirms the prediction made in the beginning of 2013, of a MCM epidemic with intermediate amplitude (peak) in 2013. Also, in 2013, MCM incidence rate predicted and observed was quiet precise (see the rates in graph n°3).

Mention that the prediction of the mcm **epidemic amplitude (peak) in 2013 lower than what has been observed in 2012 is also confirmed.**

In fact, in 2013, 2919 cases of meningitis have been registered by Burkina Health Services, comparing to 7022 cases in 2012. See on the graph below (graph°4), on weekly case of mcm in 2012 and 2013.



Graph n°4 : Meningococcal meningitis cases by week in 2012 and 2013 in Burkina Faso

Reference: Epidemiological surveillance database, Ministry of Health, Disease Control Direction, Burkina Faso