DEVELOPMENT OF RESEARCH AND INNOVATIVE POLICIES SPECIFIC TO THE WATER-RELATED IMPACTS OF CLIMATE CHANGE ON HEALTH IN CAMBODIA

Chan Vibol*, Lachlan McIver, Steven Iddings*, Masahiro Hashizume***, Chisato Imai*** Prak Piseth Raingsey****, Kol Hero****

World Health Organization, Cambodia*, Australian National University**, Nagasaki University, Japan***, Preventive Medicine Department, Ministry of Health, Cambodia****

Background

Cambodia is among the most vulnerable countries in south-East Asia to the impacts of climate change, which will doubtless include detrimental impacts on human health, especially on water quality, water security and water-related diseases (WRDs).

Cambodia already suffers from a significant burden of WRDs, including various types of illnesses manifesting as diarrhea, and number of serious WRDs which are present in Cambodia. The Developing Research and innovative Policies Specific to the Water-related impacts of Climate Change on Health Project (DRIP_SWICCH) explored the relationship between climate, socio-economic, demographic and other factors (particularly those related to water, sanitation and hygiene) and the incidence of WRDs, principally diarrhea diseases, and considered the likely impacts of climate change and strategies to reduce the current and future burden of WRDs in Cambodia.

Methodology

Statistical analysis of the relationship between diarrhoeal disease notifications and socioeconomic, demographic and water/sanitation/hygiene factors was carried out for all 24 provinces of Cambodia over the study period 1997-2012. In addition, Time series regression analysis was conducted to investigate associations between climate variables and diarrhoeal disease in 11 provinces with complete data. A Poisson regression model was used to model the relationship between weather parameters and diarrhoeal controlling for seasonal and other time trends. The analyses were performed with R version 2.15.3.

The Time series regression models used were:

1 Models for temperature and rainfall

$$Log[E(YI)] = NS(temperature) + NS(rain) + NS(time)$$

2. Models for river level

$$Log[E(Yi)] = NS(river) + NS(time)$$

Yi is denoted the monthly case counts on month i, E(Yi) is the expected monthly counts, “temperature”, “rain” and “river” indicate temperature, rainfall and river level. NS indicates a natural cubic spline function. Seasonal patterns and long-term trends not modeled by measured explanatory variables were controlled by incorporating natural cubic splines of time.

Results

The main risk factor related to the use of unimproved water sources (tube wells and surface water) and poor sanitation facilities (lack of latrine and sewerage infrastructure), while the analysis provided strong evidence of a protective effect of education and literacy, particularly for women and girls, against diarrhoeal disease. Population size and density and factors related to employment were also significantly correlated with diarrhoeal disease incidence.

The relationship between monthly temperature, rainfall and diarrhoeal disease incidence across Cambodia’s province heterogeneous, with provinces differing with respect to the direction and magnitude of these associations. It was observed that the associations between monthly temperature, rainfall, and diarrhoeal disease cases vary in terms of both their direction (positive or negative) and magnitude (Figure 1, 2). It was also observed that six provinces are also affected by river height such as Kampong Cham, Kampong Chhnang, Kratie, Pursat, Stung Treng, and Phnom Penh.

Figure 1: The associations between temperature and diarrhoeal disease in provinces of Cambodia

Figure 2: The associations between rainfall and diarrhoeal disease in provinces of Cambodia

Conclusion

It is clear that such climatic factors play a role in the epidemiology of diarrhoeal disease in Cambodia, and it is highly likely that the impacts of climate change including, inter alia, increasing temperatures, altered rainfall patterns and increasing frequency and severity of extreme weather events such as droughts and floods, will further influence the burden of diarrhoeal disease in Cambodia, and the net effect of this is likely to be negative. Urgent, informed action should be taken to address the social and environmental determinants of these illnesses, and strategies are implemented to improve the capacity of communities and the health sector to minimize these risks.

Reference

1. Akerlof, K., Debono, R., Berry, P., Leiserowitz, A., Roser-Renouf, C., Clarke, K.-L., … Maibach, E. W. (2010). Public perceptions of climate change as a human health risk: surveys of the United States, Canada and Malta. International Journal of Environmental Research and Public Health, 7(6), 2559–606.

2. Amano, A., Sakuma, T., Kazama, S., & Gunawardhana, L. (2013). Evaluation of diarrhea disease risk attributed to inundation water use on a local scale in Cambodia using hydrological model simulations. River Systems, 20(3), 185–196.

3. Berlioz-Arthaud, A., Kiedrzynski, T., Singh, N., Yvon, J.-F., Roualen, G., Coudert, C., & Uluiviti, V. (2007). Multicentre survey of incidence and public health impact of leptospirosis in the Western Pacific. Transactions of the Royal Society of Tropical Medicine and Hygiene, 101(7), 714–21.

4. Hashizume, M., Armstrong, B., Hajat, S., Wagatsuma, Y., Faruque, A. S. G., Hayashi, T., & Sack, D. a. (2007). Association between climate variability and hospital visits for non-cholera diarrhoea in Bangladesh: effects and vulnerable groups. International Journal of Epidemiology, 36(5),

5. Inglis, T. J. J., Levy, A., Merritt, A. J., Hodge, M., McDonald, R., & Woods, D. E. (2009). Melioidosis risk in a tropical industrial environment. The American Journal of Tropical Medicine and Hygiene, 80(1), 78–84.

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Any correspondences should be addressed to

Dr Lachlan McIver: lachlan.mciver@gmail.com