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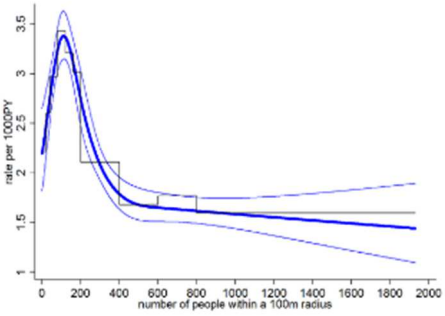
| Title of PhD project / theme | **Understanding urban-rural differences in the risk of dengue fever: the role of population density, entomological parameters and water supply** |
| Supervisory team | Wolf-Peter Schmidt MD PhD – LSHTM<br>Motoi Suzuki MD PhD – NU<br>Professor Lay Myint Yoshida MD PhD – NU<br>Ataru Tsuzuki PhD – NU<br>Professor Mary Cameron PhD - LSHTM |
| Brief description of project / theme | This PhD proposal is based on an earlier successful collaboration between Nagasaki University and LSHTM. By linking hospital cases and census data, we found that the risk of dengue is particularly high in a fairly narrow band of population density typical for rural Khanh Hoa (Vietnam) as opposed to urban areas. Water supply strongly modified this association and reduced dengue fever risk overall.<br>  <br><br>**Figure:** Association between population density (number of residents living around index house) and rate of dengue hospital admission, Khanh Hoa Province 2008-2007.<br>We hypothesised that the ratio of humans to vectors may explain the findings. However the analysis (published in PLoS Medicine[1]) was limited by the lack of entomological data and the reliance on hospital cases which may be biased. There was also concern that the effect of water supply was confounded by socio-economic factors. The proposed PhD will address these three limitations. The research will consist of two parts which each can be modified and extended/downsized to suit the students preferences and skills:<br><br>**1) Analysis of existing data to estimate the effect of *changes* in water supply since 2008 on the risk of dengue fever.** Water supply has improved substantially in Nha Trang (the most urbanised part of Khanh Hoa). Recent re-census data are available for Nha Trang. By linking these updated census data to recent hospital admission data for Nha Trang while using our earlier data as a baseline, the student will conduct a controlled before/ after study. By calculating the difference-in-difference (or "ratio-of-ratios") or using time series analysis we will be able to limit the effect of confounding by socio-economic factors acting at neighbourhood and individual household level.<br><br>**2) Linking entomological and human serological data to estimate the effect of water supply on entomological parameters and risk** |

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| | **of dengue accounting for human population density.**<br>Entomological parameters have been shown to poorly correlate with dengue risk. Our hypothesis is that by accounting for population density, entomological parameters become more predictive for actual dengue transmission. The student will collect entomological and human serological data for example by enrolling 4 types of households: A) tap water + low population density neighbourhood, B) tap water + high population density, C) no tap water + low population density, D) no tap water + high population density. Households could be selected based on census and hospital data.<br>Standard Dengue IgG ELISA could be used to determine past infection with dengue (strain identification is not relevant in this context). The student may focus on standard entomological parameters e.g. pupae index or Breteau *index. Serological data and entomological indices could be analysed for the 4 types of households by using simple or more complex statistical methods such as multi-level or pathway models. The sample size will depend on the available funding and the extent to which the student requires support in the field.*<br><br>***References:***<br>1. Schmidt WP, Suzuki M, Thiem VD, White RG, Tsuzuki A, Yoshida LM, Yanai H, Haque U, Tho le H, Anh DD, Ariyoshi K. Population density, water supply, and the risk of dengue fever in Vietnam: cohort study and spatial analysis.PLoS Med. 2011 Aug;8(8):e1001082. |
| Particular *prior* educational requirements for a student undertaking this project | The PhD is suitable for a student with a degree in medicine, biology or a related field. A master in epidemiology, vector borne diseases or public health or equivalent is essential. The student will need to either have established statistical skills or be familiar with methods of vector sampling. We do not expect a student to have expertise in both fields. Support will be given to complement existing skills. Fluency in Vietnamese is not required. However, a student fluent in Vietnamese may find it easier to conduct field work with limited support and may be able to collect more serological and entomological data with the same resources. |
| Skills we expect a student to develop/acquire whilst pursuing this project | Depending on prior experience skills to be developed may include data management and data collation (e.g. census data, hospital data), epidemiological field methods, vector sampling and identification, and statistics. |