

**GERMANY/HONG KONG JOINT RESEARCH SCHEME**  
**THE PROJECT REPORT**  
*(for Project Completion)*

Project Number: G-HK032/10

**Title**

**Climate change and environmental health – the impact of thermal stress on the mortality and morbidity in urban Hong Kong: Development of a coordinated methodology between multidisciplinary experts from Hong Kong and Germany**

**Particulars**

	Hong Kong team				German team	
Name of Project Co-ordinator (with title)	Chit-Ming Wong (Associate Professor)				Alexander Kraemer (Professor)	
Name of Co-Investigator (if any)	Thuan-Quoc Thach Hak-kan Lai Yuen-kwan Chau Wansu Xu Melissa Hart Poh-chin Lai				Paulo Pinheiro Heiko Jahn Dietrich Penner Lutz Katzschner* Alexandra Scheider#	
Institution or Institutional affiliation	<input type="checkbox"/>	CityU	<input checked="" type="checkbox"/>	HKU	<input checked="" type="checkbox"/>	University of <u>Bielefeld</u>
	<input type="checkbox"/>	CUHK	<input type="checkbox"/>	HKUST	<input type="checkbox"/>	
	<input type="checkbox"/>	HKBU	<input type="checkbox"/>	LU	<input checked="" type="checkbox"/>	Others: *: University of Kassel
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Other project team members (if any)						

**Funding Period**

	1 <sup>st</sup> year	2 <sup>nd</sup> year (if applicable)
Start Date	January 2011	January 2012
Completion Date	December 2011	December 2012

**Objective(s) as per original application**

1. To develop a coordinated methodology and a harmonized data set between the Hong Kong and the German research teams on spatial and temporal characteristics of thermal conditions and population health status;
2. To develop a coordinated methodology between the Hong Kong and the German research teams on the impact of thermal stress on health status;
3. To develop a coordinated methodology between researchers from climatology, urban planning, epidemiology and environmental public health on climate and health mapping;
4. To develop a protocol for assessment of the disease burden due to thermal stress including its interaction with air pollution and identifying subgroups who are more vulnerable;
5. To promote young researchers and to qualify them for international cross-cultural collaboration.

**i) Outline of proposed research and results obtained**

We investigated the following two themes

**1. Spatial associations between thermal stress and mortality in Hong Kong**

We assessed associations between mortality and Physiological Equivalent Temperature (PET) among small geographical areas in Hong Kong. PET has been developed to quantify thermal stress from the environment. Compared to the studies on the associations between PET and health outcomes based on temporal variations, studies based on spatial variations remain scant.

PET values of year 2006 were calculated for 145 Tertiary Planning Units (TPU), which are the smallest geographical demarcations for urban planning, from meteorological and geographical variables. Standardized mortality rate (MR) was computed from mortality and demographic data from Census and Statistics Department in the same year. We assessed spatial correlations between MR and PET by means of bivariate Moran's Index and identified the hot and cold spots for the TPU using Local Indicators of Spatial Association (LISA) analysis. Scatter plots of MR against annual mean PET were produced for three regions: Hong Kong Island (HKI), Kowloon (KL) and New Territory (NT).

The bivariate Moran's Index was 0.25, indicating positive autocorrelation between MR and PET. Using LISA analysis, hot spots (i.e. TPU with high MR are surrounded by TPU with high PET) were identified in areas of high population density. Linear-like patterns exhibited in all regions in that TPU with higher PET tend to have higher MR. In particular, PET in HKI were at the range from 26 to 31.5 °C, while NT (with large green areas) and KL (with the majority of high population density areas) were from 26 to 30 °C and 28 to 31.5 °C, respectively. Furthermore, outliers in the scatter plots with relatively higher MR than expected were mostly found in hot spots.

**2. Measuring the impact of premature mortality on the population of Hong Kong by use of Standard Expected Years of Life Lost**

We determine the Standard Expected Years of Life Lost (SEYLL), an indicator of premature mortality, are increasingly used to estimate the impact of premature mortality on populations at global, national and local level. In contrast to conventional death count statistics, SEYLL take into account the age at death and therefore allow a more accurate view on mortality. This study provides the first comprehensive assessment of SEYLL for Hong Kong in 2010.

For the calculation of SEYLL, life-expectancy at birth was defined according to the first Global Burden of Disease study with 82.5 and 80 years for women and men, respectively. Causes of death data for 2010 were corrected for misclassification of cardiovascular and cancer causes and used for the calculations. SEYLL were calculated by multiplying the number of death cases at a certain age with the remaining life expectancy at age of death. In addition to the baseline estimates, scenario analyses were performed using alternative assumptions about life-expectancy, time-discounting and age-weighting to assess the impact of different social value choices. In addition to the 2010 disease burden estimates, time-series data were used to estimate the disease burden from 2001 to 2010.

In 2010, 524,706.5 years were lost due to premature death in Hong Kong with 58.3% of the SEYLL attributable to male deaths. The three overall leading single causes of SEYLL were "trachea, bronchus and lungs cancers" (52,224.1 SEYLL), "ischemic heart disease" (51,542.2 SEYLL) and "lower respiratory infections" (46,503.2 SEYLL) which together accounted for about 29% of the total SEYLL. Self-inflicted injuries (5.6%; ranked 5<sup>th</sup>) and liver cancer (4.9%; ranked 7<sup>th</sup>), are conditions often occurring in younger ages and were identified as important causes not being adequately captured by classical mortality measures. Scenario analyses indicated that by using a 3% time-discount rate and non-uniform age-weights the SEYLL dropped by 51.6%. Using Hong Kong's standard life-expectancy resulted in an overall SEYLL increase of 10.8% as compared to the baseline SEYLL. Time-series analysis indicated an overall increase of SEYLL by 6.4%. In particular, group I conditions showed highest increases with SEYLL-rates per 100,000 in 2010 being 1.4 times higher than 2001.

**ii) Significance of research results**

**1. Spatial associations between thermal stress and mortality in Hong Kong**

There exist spatial variations in the associations between mortality and PET in Hong Kong. Further studies based on individual characteristics, which are not subject to ecological fallacy, are needed to clarify the spatial associations.

## **2. Measuring the impact of premature mortality on the population of Hong Kong by use of Standard Expected Years of Life Lost**

The study particularly highlights the mortality impact of diseases and injuries that occur in earlier stages of life and thus presents the SEYLL as a more sensitive indicator compared to classical death counts. Compared to conventional death counts, especially self-inflicted injuries rose in priority with rank changes from 9<sup>th</sup> to 6<sup>th</sup> for males and even from 17<sup>th</sup> to 7<sup>th</sup> for women. Using local life-expectancy values resulted in remarkable changes in disease burden and indicated the importance of national and local disease burden assessments. The study further shows that SEYLL can provide important additional information and complements available death statistics.

### **iii) Research output**

We have a submitted one manuscript to BMC Public Health and it is currently under review.

Quantifying the burden of disease due to premature mortality in Hong Kong Special Administrative Region (SAR) using Standard Expected Years of Life Lost. BMC Public Health

A second manuscript is under preparation and it will be soon submitted to a peer-reviewed journal for publication.

### **iv) Potential for or impact on further research collaboration**

This research collaboration between The University of Hong and University of Bielefeld has subsequently resulted in a full GRF funding support 2012-2014 to further the study (Project Number: HKU 780512M). The two Universities are currently collaborating and some interesting results are expected to emerge from this study.