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Living in an urban environment and non-communicable disease risk in Thailand: Does timing matter?

Chaisiri Angkurawaranon [a,b,*], Chawin Lerssrimonkol [b], Nalinee Jakkaew [c], Torranong Philalai [d], Pat Doyle [a], Dorothea Nitsch [a]

[a] Department of Non-communicable Disease Epidemiology, Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London WC1E 7HT, United Kingdom
[b] Department of Family Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand
[c] Fang Hospital, Chiang Mai 50110, Thailand
[d] Wieng Pa Pao Hospital, Chiang Rai 57170, Thailand

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ABSTRACT

Background: This paper uses a life-course approach to explore whether the timing and/or duration of urban (vs rural) exposure was associated with risk factors for NCDs.
Methods: A cross-sectional survey was conducted among health care workers in two hospitals in Thailand. Two measures of urbanicity were considered: early-life urban exposure and the proportion of urban life years. We explored four behavioral NCD risk factors, two physiological risk factors and four biological risk factors.
Results: Both measures of urbanicity were each independently associated with increases in all behavioral and physiological risk factors. For some biological risk factors, people spending their early life in an urban area may be more susceptible to the effect of increasing proportion of urban life years than those growing up in rural areas.
Conclusion: Urbanicity was associated with increases in behavioral and physiological risk factors. However, these associations may not translate directly into increases in biological risk factors. It is likely that these biological risk factors were results of a complex interaction between both long term accumulation of exposure and early life exposures.

1. Introduction

Thailand, like many countries in Southeast Asia and developing regions, faces a growing burden of non-communicable diseases (NCDs) (Dans et al., 2011; Abegunde et al., 2007). One of the main drivers of non-communicable disease is urbanization. Urbanization is thought to be associated with a range of socio-economic, cultural and environmental changes which may contribute to the development of NCDs (World Health Organization, 2005b).

Most research on the link between urbanization and risk factor for NCDs unfortunately does not offer insight into the mechanisms driving the associations (Harpham, 2009). In recent decades, a life course approach to chronic disease epidemiology (Lynch and Smith, 2005) has been suggested as a way forward in the understanding of urbanization and health (Kinra, 2004). A life course approach considers the effect of an exposure (such as urbanization) during different periods of life (from gestation to adult life) on later health-related risks and outcomes. Two main conceptual life-course models exist (Ben-Shlomo and Kuh, 2002). The first is the critical period or sensitive period model. This model emphasizes the importance of the timing of the exposure. It is based on theories that there may be a limited period in which an exposure may affect structural or functional development (the critical period model) or that there is a time period when an effect of an exposure may be stronger than other time periods (the sensitive period model). An example of a critical/sensitive period model is the association between intrauterine growth retardation (IUGR) and low birth weight with many chronic diseases such as coronary heart disease and diabetes (Darnton-Hill et al., 2004). Urbanization is associated with IUGR and low birth weight through many mediating factors such as maternal nutritional

* Corresponding author at: Department of Non-communicable Disease Epidemiology, Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, WC1E 7HT London, United Kingdom.
Tel.: +44 2079272254; fax: +44 2075806897.
E-mail addresses: Chaisiri.angkurawaranon@lshtm.ac.uk, Chaisiri.a@cmu.ac.th (C. Angkurawaranon).

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status and smoking (Ohmi et al., 2001; Kramer, 1987). The second main conceptual life course model is the accumulation of risks model. This model emphasizes the importance of cumulative exposure over time. An example of an accumulation model is where the risk of obesity and diabetes rises with the time spent in urban environments (Sobngwi et al., 2004).

Evidence from life course models can help identify targets for, and timing of, public health interventions. Evidence for critical/sensitive period models would favor interventions during these critical time frames; interventions at others times would be less effective. Evidence for accumulative models would suggest that interventions across the lifespan would be effective (Liu et al., 2010).

In Thailand, recent studies have explored the associations between urbanization and risk factors for NCDs. These studies suggest that urban residence was associated with obesity and high blood pressure, but they did not use a life course approach (Lim et al., 2009; Banwell et al., 2009). Two life-course studies were conducted in a cohort of Thai university students (Sleigh et al., 2008). Using urban residence at two or three different points in time, the studies found that people who had spent more time in an urban area had higher prevalences of smoking, alcohol consumption, obesity (BMI $\geq$ 25) and a higher incidence of self-reported medical diagnosis of hypertension and dyslipidemia than those spending more time in a rural area (Yiengprugsawan et al., 2011; Zhao et al., 2014). However, the authors did not explicitly differentiate between life-course models and did not have actual measurements for blood pressure and laboratory investigations.

This paper utilized survey data from the Chiang Mai University (CMU) Health Worker Study (Angkurawaranon et al., 2014). The overall aim of the CMU Health Worker Study was to generate evidence on the links, and potential life course mechanisms, between urban environments, NCD risk factors, and development of NCDs. The aim of this paper is to explore the association of urban (vs. rural) residence with risk factors for NCDs in Thailand using two different life course models, the early life critical/sensitive period model and the accumulation of risk model. The study will also explore whether the associations between growing up in urban areas and NCD risk factors are modified by later accumulation of urban exposure.

Table 1
Demographic characteristics and urban exposure in study population.

	Chiang Mai University (CMU) Hospital	Fang Hospital	Total
Number of participants	3204	312	3516
Mean age in years (sd)	40.2 (10.7)	33.1(10.7)	39.6 (10.9)
Female: *N* (%)	2472 (77.1)	235 (75.3)	2707 (77.0)
Highest education: *N* (col%)			
Below Bachelor's degree	1134 (35.5)	143 (46.0)	1277 (36.3)
Bachelor's degree/ equivalent	1690 (52.6)	152 (48.9)	1842 (52.4)
Higher than Bachelor's degree	380 (11.9)	15 (5.1)	396 (11.3)
Monthly household income in baht*: *N* (col%)			
< 20,000	1196 (37.4)	133 (42.8)	1329 (37.8)
20,000–40,000	927 (28.9)	106 (34.1)	1033 (29.4)
40,000–60,000	522 (16.3)	40 (12.9)	562 (16.0)
> 60,000	559 (17.4)	32 (10.2)	591 (16.8)
Early life exposure (Age 0–5)** *N*(col%)			
Rural	1397 (43.7)	272 (87.5)	1669 (47.6)
Urban	1797 (56.3)	39 (12.5)	1836 (52.4)
Proportion of urban life years in percent #: *N* (col%)			
< 25%	245 (7.7)	260 (83.6)	505 (14.4)
25–50%	445 (13.9)	20 (6.4)	465 (13.3)
50–75%	656 (20.5)	15 (4.8)	671 (19.1)
> 75%	1847 (57.9)	16 (5.1)	1863 (53.2)

* 1 US dollar = approximately 32 baht; one missing value from Fang Hospital.
** 11 missing value, 10 from CMU hospital.
# 12 missing value, 11 from CMU hospital.

2. Methods

2.1. Study population

A cross sectional survey of health care workers in two government hospitals in Northern Thailand was conducted between January and June 2013. The first hospital was Chiang Mai University (CMU) Hospital, employing over 5000 workers. The details of the study population, methods, strengths and limitations of the survey conducted in CMU Hospital have been published (Angkurawaranon et al., 2014). The survey utilized a periodic health check up program offered to health care workers. Questionnaires, interviews, physical and laboratory examinations were used to collect data on detailed migration history from birth to current age and information on behavioral, physiological and biological risk factors for NCDs. Using a similar protocol, the survey was extended to a rural hospital in Fang District. The leading investigators of the study trained researchers at both sites to use standard measurement protocols.

2.2. Measurements and variable definitions

2.2.1. Urban exposure

The classification of urban areas in Thailand is defined using government administrative criteria largely driven by population density. In 1970, only three areas were considered 'cities': Bangkok, Thonburi (a suburb of Bangkok) and Chiang Mai (Goldstein and Goldstein, 1978). For our study, all districts in Bangkok and the

Table 2
Relationship between early life urban exposure and proportion of urban life years.

Proportion of urban life years*	Early life Urban exposure (*n*, column%)	Early Life Rural Exposure (*n*, column%)	Total (*n*, column%)
< 25%	6, 0.33	499, 29.9	505, 14.4
25–50%	16, 0.87	449, 26.9	465, 13.3
50–75%	41, 2.23	630, 37.8	671, 19.1
> 75%	1773, 96.6	90, 5.4	1863, 53.2
Total	1836	1668	3504

* 12 missing values in proportion of urban life years.