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Health effects of respirable particulate matter in Bangkok schoolchildren

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Abstract. The chronic effects of air pollution to Bangkok children were investigated. The lung function and respiratory symptoms of 570 children aged 10 to 15 years were examined during May–August 2004. Three study areas based on the level of PM_{10} obtained from the Pollution Control Department (PCD) ambient monitoring stations were selected as High-polluted area (H), Moderate-polluted area (M) and low-polluted area as a Control (C). Effects of residential area were estimated by the multiple logistic regression analysis. The prevalence of respiratory symptoms increased significantly [odds ratios (95% CI) in H and M are: 3.92 (2.02–7.59) and 2.36 (1.12–5.01), respectively]. There was no significant difference between impaired lung function among H, M and C. Residential location of subjects was associated with the prevalence of respiratory symptoms statistically significant. The other factors such as ATS-DLD responder, gender, age, parental smoking habits, use of air conditioners and possession of domestic pets were not associated with the respiratory symptoms. The prevalence of respiratory symptoms was higher among children living in areas with high- and moderate-pollution than those in an area with low-pollution statistically significant.

Keywords: Air pollution; Bangkok; Children; Lung function; Respiratory symptoms

1. Introduction

The high concentration of particulate matters in ambient air is one of the serious environmental problems in Bangkok, particularly in the traffic-congested area. In

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2004, the 24-h average concentrations of roadside total suspended particulate matter, TSP and particulate matter with diameter less than 10 μm, the PM_{10} were about 0.18 mg/m^3 and 78.5 μg/m^3, respectively. Frequently, the level of particulate matters exceeded the National Ambient Air Quality Standard [1] by approximately 8% days. PM_{10} in Bangkok has been associated with serious health effects, such as the increase in hospital admission and mortality [2]. There were some reports on the association of air pollution and respiratory health among traffic policemen [3–6] and their wives in Bangkok [7]. However, those studies have mainly been conducted in healthy adults groups. It is not clear to what extent such associations would be revealed in children who might be more susceptible to air pollution than adults. However, the chronic health effects in children remain uncertain, particularly in Bangkok children.

2. Material and methods

2.1. Study site and population

Based on the level of PM_{10} obtained from the ambient monitoring stations, site characteristic, traffic volume, season, and wind direction, three areas with elementary and junior high schools were chosen in Bangkok. The annual average of PM_{10} levels in 2003 at Nonsi Withaya School Station located in high-polluted area (H) was 62.5 μg/m^3, at Thonburi Substation Station located in moderate-polluted area (M) it was 53.9 μg/m^3, and at Khlong Chan Housing Community Station located in low-polluted area as a Control (C) it was 45.8 μg/m^3. Schoolchildren aged 10–12 years and 13–15 years from each area were recruited for the study. Total study subjects were 666 schoolchildren determined with 10% precision levels of sampling size [8].

2.2. Respiratory questionnaires

The prevalence of chronic respiratory symptoms (Non-Specific Respiratory Disease: NSRD, Persistent Cough and Phlegm: PCP) were assessed by ATS-DLD-78-C [9] questionnaires (Thai version).

2.3. Lung function test

Lung function was measured by automated spirometer (Pony Graphic 3.3, Cosmed, Italy) using Spiro Thai 2.0 Program according to predicted lung function parameters from reference values in the Thai population [10]. Lung function was measured during May–August 2004 (H=225, M=226, C=215 cases) according to the Standardization of Spirometry method [11].

2.4. Statistical analysis

Differences of the health-related parameters among the areas of H, M and C groups were compared using Yates' Chi-square test [12]. Logistic regression techniques were used to assess the dependency between prevalence of respiratory symptoms, lung function and independent variables such as responder, gender, age, parental smoking habits, use of air conditioners and possession of domestic pets. We used the factor of residential areas as categorical covariate and the control area as reference category. The