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Editorial Article

Air Pollution and Asthma

Urban environments contain sources of air pollutants which may be emitted, released or give rise to secondary pollutants like ozone and aldehydes. Pollutants in the urban environment may include aldehydes, acetic acid, carbon monoxide, formaldehyde, lead, microorganisms, nitrogen oxides, ozone, particulates, phenols, polycyclic aromatic hydrocarbons, radon, sulfur oxides, sulfuric acid, and volatile organic hydrocarbons.

Particulates, ozone, sulfur and nitrogen dioxides and volatile organic compounds have effects on asthma. Sulfur dioxides and particles, separately and together, result in pollution due to their chemical reduction effects. This reducing pollution is the oldest and most basic form of industrial air pollution. Secondly, photochemical pollution results from the reaction of chemicals such as hydrocarbons and nitric acid with sunlight producing dangerous byproducts like ozone, nitrogen dioxide and aldehydes. Point source pollutants like lead from a smelting operation add to these two already serious types of air pollution[1].

The bad news is that all three of these types of air pollution need better control in Thailand and asthma is an increasing problem because of them. The good news is that despite the fact that genetics plays a part in the asthma equation, the environmental contribution is arguably greater. So, even though asthma is increasing, an understanding of and actions to counter environmental air pollution could have a substantial positive effect. While a number of measures have been proposed as possible ways to prevent asthma, the study and understanding of the indoor and outdoor pollutants contributing to the development and exacerbation of asthma are important goals for respiratory medicine[2].

Particulate matter in the air is associated with an elevated risk of mortality and morbidity (including cough and bronchitis), especially among populations such as asthmatics and the elderly. The main sources of this type of air pollutant are fireplaces, wood and coal stoves, tobacco smoke, diesel and automotive exhaust, and other sources of combustion. In developed countries, tobacco smoke is the primary contributor to respirable particles indoors[1]. Although the ambient standard of total suspended particles (TSP) is 265 ug/m^3 ac-

cording to the US Environmental Protection Agency (EPA) and 330 ug/m^3 by the Thai Nataional Primary Ambient Air Quality Standard (NPAAQS), there is no standard for indoor air[3,4]

There have recently been great concerns about health effects from extremely small particulates, especially in urban air pollution. Particulate matter of 10 um and smaller (PM_{10}), corresponding to the respirable range, consists mostly of carbon-containing material from combustion, whereas $PM_{2.5}$ (2.5 um and below) contains a proportionately larger amount of water and acid-forming chemicals such as sulfate and nitrate, as well as trace metals. Particles below 10 um enter the airways with greatest efficiency and may be deposited in the alveoli, or airspaces, that are the deepest structures of the lungs. The effect of particulates on the body reflects the efficiency with which they penetrate all the way to and within the lung and their chemical reactivity and toxicity[1].

The Thai standard of PM_{10} is 50 um/m^3(per year). In 1996, the annual average of PM_{10} in Bangkok and its surrounding areas was 103-238 um/m^3, considerably exceeding the standard[5]. Air pollution data in Bangkok indicate that problems related to particulates are probably the most serious among detected air pollutants. A 1995 study by Vichayanon concluded that the incidence of asthma in children over a 10 year-period had increased 4 times due to air pollution[6]. Particulates result in more respiratory symptoms in asthmatic than in normal children[7].

Indoor air pollution is usually generated from chemicals from burning fuels, tobacco smoke and other sources in buildings. The most important indoor air contaminants in developed countries are tobacco smoke, formaldehyde, asbestos fibers, combustion products (such as NO_x, SO_x, CO, CO_2 and polycyclic aromatic hydrocarbons)[1]. Indoor air pollution contributes to acute respiratory infections in young children, exacerbation of asthma, chronic lung disease and cancer in adults, and adverse pregnancy outcomes for women exposed during pregnancy[1].

The effect of passive, sidestream or environmental tobacco smoke (ETS) has been an issue of great concern in all societies. When inhaling tobacco smoke, non-smokers involuntarily breathe in up to 4,000 chemicals, many of which are carcinogens. The concentrations of toxic chemicals in sidestream smoke are several times higher than those in mainstream smoke. For example, the carcinogenic dimethyl nitrosamine in sidestream smoke is 52 times that of mainstream smoke[6].

Previous studies have reported great effects from passive smoke, especially on young children. Rantakallio et al. reported that the rate of hospital admission due to lung infections in children is associated with the number of cigarettes per day their mother smoked. Another study found that children under 5 years of age living in a family with at least one smoker have a 2.5 times greater risk of lower respiratory infections than those living in a family of no smokers[9]. Evidence shows that passive smoking exacerbates asthmatic symptoms, i.e. increases the chance of hospital admissions 2-3 times[10]

Following further indoor and large, whole environment studies of contributing factors, additional control measures will be necessary. Government policies and supportive legislation in areas

like the further discouragement of smoking and in controls on environmental air pollutants are likely to make important contributions to reducing the toll from asthma.

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