Parental Smoking as Health-Risk Factors of Indoor Air Pollution

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Abstract

Statistically significant respiratory symptoms effects of smoking had been reported in many studies. The present paper was a partial report of a public health doctoral dissertation base on a cross-sectional environmental health study done in homes of a slum area in Jakarta, capital of Indonesia where ambient air pollution was significantly high. The paper described that among other factors, smoking was the health risk factor related to the development of respiratory symptoms among 263 children under-five in the research area. The children recruited were without any respiratory symptoms at the beginning of the observation, and then were followed for 2 weeks to detect the occurrence of any respiratory symptoms. Factors relating to physical conditions of homes and household activities were also recorded. Analysis of data was done including the control of confounding factors. A cut-off of 70 mg/m^3 indoor PM_{10} concentration as the surrogate for quantitative measure of smoking was seen as the most specific and sensitive level in relation to the occurrence of respiratory symptoms among the children. The study signified that the consumption of cigarettes was significantly related to the increase of indoor PM_{10} concentration. Every single cigarette consumed by the father was related to of indoor PM_{10} increase in the range from 2.6 mg/m^3 to 3.9 mg/m^3. However, the study was not able to prove any influence on the variation of the indoor PM_{10} concentrations by the physical factor of the homes studied. The end conclusion of the study showed that in homes of an overcrowded area, parental smoking was the critical factor for the quality of indoor air, hence the health risk to the respiration system of the occupants.

Keywords: Indoor PM_{10}, parental smoking, respiratory symptoms

Abstrak

Pengaruh dari kebisaan merokok terhdap gejala gangguan pernapasan telah banyak diteliti. Tulisan ini merupakan bagian dari disertasi doktoral berdasarkan studi potong lintang mengenai kesehatan lingkungan di perumahan kumuh di Jakarta, ibukota Indonesia yang dikenal tinggi polusi udaranya. Studi ini menemukan bahwa di samping faktor-faktor lain, merokok adalah faktor risiko kesehatan untuk gangguan pernapasan pada 263 balita di wilayah penelitian. Anak-anak yang direkrut tidak menunjukkan gejala gangguan pernapasan pada awal observasi dan diikuti selama dua minggu untuk mendeteksi kemunculan gangguan pernapasan. Faktor-faktor yang berhubungan dengan kondisi fisik perumahan dan aktifitas rumah tangga juga dicatat. Analisis data dilakukan dengan pengendalian konfounder. Cut-off yang dianggap paling spesifik dan sensitif dalam kaitannya dengan kemunculan gejala pernapasan pada anak konsentrasi PM_{10} dalam ruang sebesar 70 mg/m^3. Studi ini menemukan bahwa konsumsi sigaret secara signifikan berhubungan dengan konsentrasi PM_{10} dalam ruang. Setiap batang rokok yang dihisap oleh ayah berhubungan dengan peningkatan PM_{10} dalam ruang sebesar 2.6 mg/m^3 to 3.9 mg/m^3. Namun studi ini tidak menemukan hubungan antara kondisi fisik rumah dengan PM_{10} dalam ruang. Kesimpulan akhir dari studi ini adalah bahwa di perumahan yang padat, kebiasaan merokok orang tua adalah faktor kritik kualitas udara dalam ruang , dan dengan demikian menjadi fakto risiko kesehatan bagi penghuninya.

Kata kunci : PM_{10} dalam ruang, kebiasaan merokok orang tua, gejala pernapasan

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Air pollution in major cities of Southeast Asia region was classified as the worst in the world. In a 1992 report, out of the twenty main cities made known as having critically polluted of the air, Jakarta was taken in. High ambient concentration of suspended particulate matter was associated to the high rate of respiratory mortality in the city. A range of 181 mg/m^3 to 392 mg/m^3 suspended particulate matters was recorded as enveloping the city from day to day.[1]

To make problem worse, Jakarta was also troubled with slum areas where overcrowding was seen as 10,000 to 30,000 people dwelled in every kilometer square of the city.[2] A total of more than 2 million people inhabited areas of below the environmental standards. In these areas substandard houses had sizes ranged from 19 to 45 meter-square.[3]

It was in this sort of area where the present research was carried out. Pekojan village in the northern part of the city occupied 73 hectares of an area with population of 31,158 in 1996, was one of the densely populated slum area in the very busy region of Jakarta. Alleys of not more that 3/4 meters to 2 meters served as paths across clusters of permanent houses and squatter homes.

Methods

Sample

The present article was based on a Public Health doctoral thesis in the University of Indonesia.[4] Data of the children were collected from mothers and/or other adults in the family by a medical doctor, three cadres of the local Primary Health Care Service and two Family Planning workers.

A sample of 263 children under-five was drawn from a list of 1,165 available records of children under-five in the Village Office of Pekojan, Jakarta. Next, a total of 204 homes were inferred from the sample, known as houses where the 263 children lived. Around 6 to 7 people inhabited the houses that have an average size of 16 meters-square.

Household particulate matter concentrations (in the form of PM_{10} concentration, mg/m^3) were measured in the 204 homes using a portable particulate monitor, the HAZ-Dust Sampler^{TM} 10mm done by a medical doctor who visited the homes door-to-door. The measurement was taken in the morning and in the afternoon from the living room, the kitchen, and the bedroom.

Along with the collection of particulate matter data, a checklist questionnaire of the physical characteristics of the houses was administered. Some physical characteristic of the houses were, types of functional rooms available in each of the houses along with their sizes, dimension of the ventilation, windows and doors, types of floor, types of walls, dampness, and other common characteristics of houses. Also, data of the activities of the occupants indoor were collected such as smoking habits, cooking, socio-economic statuses, type of ventilation used, means of mosquito repelling, types of mattresses used, and other necessary data.

Analysis

To determine the cut-off value of 70 mg/m^3 PM_{10} concentration (the most predictive value) an analysis of the curve Receiver Operating Characteristics was run. The effect of the measured level of PM_{10} on the development of respiratory symptoms among children under-five was estimated by logistic regression. The analysis was done by controlling for the effects of children's characteristics, house dampness, respiratory infection of the other inhabitants, type of walls, mosquito spray, kerosene, and physical factors of the houses. For number of cigarette consumed by father (continuously distributed variable) multiple linear regression analysis was used to determine the contribution of a single cigarette to indoor PM_{10} concentration.

Results

Living Condition

Distribution of floor dimension of homes was in the range from less than 16 meter-square to more than 54 meter-square. Less than 16 meter-square floor dimension was found in 24.0 percent of the houses. Homes with floor dimension more than 54 meter-square were also inhabited by 24.0 percent of the respondents. To cover the need for space, most of the houses (76.4 percent) were built in 2 or 3 storey construction. Yet, a total of 13.7 percent of the houses were without any bedroom and the whole family occupied a single room together. Household daily activities like sleeping, cooking, and other family activities were done in that same room. More than half (55.9 percent) of the respondents lived together with other family in the same house.

Since the area was frequently flooded, dampness was also a problem for houses in that place. Up to 67.3 percent of the children under-five lived in damp houses while 67.3 percent lived in home with walls made of bricks. A total of 24.7 percent of the children under-five lived in residences with sizes of less than 2.5 meter-square for each person.

Indoor air pollution in the area primarily came from the use of mosquito spray, kerosene for cooking, cigarette consumption by father and other member of the family. More figures of household characteristic were presented in table 1.

During the two-week observation, 52.9 percent of the children under-five developed respiratory symptoms. They were distributed among 106 children under-five who lived in homes that contained more than 70 mg/m^3 and 157 children under-five who lived in homes that con-

Table 1. *Proportion of Household Characteristics*

	N	263	100.0
Floor dimension of houses			
< $16m^2$		63	24.0
16—32 m^2		73	27.8
33—54 m^2		64	24.3
> $54m^2$		63	24.0
Two to three storey houses		201	76.4
Number of bed-rooms			
No bed-room		36	13.7
1—2 bed-rooms		107	40.7
> 2 bed-rooms		120	45.6
House inhabited by more than one family		147	55.9
Damp House		178	67.7
Wall made of concrete-brick		177	67.3
House dimension/person ratio			
<$2.5m^2$/person		65	24.7
2.6 – $5.0m^2$/person		79	30.0
5.1 – $8.0m^2$/person		54	20.5
> $8.0m^2$/person		65	24.7
Mosquito spray use		139	52.9
Use of kerosene for cooking		204	77.8
Parental smoking (mostly father)		184	70.0
Other family members smoking		117	44.5

Table 2. *Increases of PM_{10} concentrations by Cigarette*

Place of measurement	Increase of PM_{10} concentration/cigarette (mg/m^3)	
	Afternoon	Morning
Living room	3.5	3.9
Kitchen	2.6	3.2
Bedroom	2.9	3.0

tained not more than 70 mg/m^3 PM_{10} concentration. Respiratory symptoms among children under-five were found among 58.5 percent of those who lived in homes that contained more than 70 mg/m^3 PM_{10} concentrations while those who lived in homes that contained up to 70 mg/m^3 of PM_{10} showed a figure of 24.2 percent only.

Further analysis showed that controlled for physical characteristics of the houses, besides house dampness, cigarette smoking by the fathers increases the risk up to 2.08 (1.19 – 3.63; 95 % confidence interval) for children under-five to develop respiratory symptoms.

Cigarettes Consumption and PM_{10} Concentration

Of the various sources of indoor pollution, statistical analysis revealed that only number of cigarettes consumed by the father was strongly related to the increase of PM_{10} concentration in parts of the houses. Measurement of PM_{10} concentration in the living room in the afternoon and in the morning showed that every single cigarette contributed to increases of 3.5 mg/m^3 and 3.9 mg/m^3 PM_{10} concentration consecutively. In the kitchen a single cigarette smoking contributed to increases of PM_{10} concentrations from 2.6 mg/m^3 in the afternoon and 3.2 mg/m^3 in the morning. In the bedroom increases were recorded as 2.9 mg/m^3 in the afternoon and 3.0 mg/m^3 in the morning. Altogether, increases of PM_{10} concentrations by every single cigarette consumed by the father ranges from 2.6 mg/m^3 to 3.9 $mg/m.^3$

Discussion

Of the three primary sources of indoor air pollution namely, mosquito spray, kerosene for cooking, and cigarette smoking, smoking was found statistically related to PM_{10} concentration. This household smoking by the father was one type of a passive exposure to cigarette smoke for other inhabitants of the house. In this research, children under-five were selected for reason of their intensive exposure to cigarette smoke due to their

length of stay in the house. Although not directly related, cigarette smoking contributed to the relationship between PM_{10} concentration and respiratory symptoms development among children under-five. Nevertheless, it should be borne in mind that no criteria of causality were met between health effects and PM_{10} concentration.[5]

This study was not able to describe the relationships between physical factors of the houses and respiratory symptoms due to topographical condition of the slum area. The area was so densely populated and rooms between houses were very limited in that the area could be considered as a very big living area where houses act as compartments within. Therefore, instead of the physical status of the houses, household activity (cigarette smoking) was statistically related to the raised concentration of particulate matter.

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