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Paternal Smoking and Increased Risk of Infant and Under-5 Child Mortality in Indonesia

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We examined the relationship between paternal smoking and child mortality. Among 361 021 rural and urban families in Indonesia, paternal smoking was associated with increased infant mortality (rural, odds ratio [OR]=1.30; 95% confidence interval [CI]=1.24, 1.35; urban, OR=1.10; 95% CI=1.01, 1.20), and under-5 child mortality (rural, OR=1.32; 95% CI=1.26, 1.37; urban, OR=1.14; 95% CI=1.05, 1.23). Paternal smoking diverts money from basic necessities to cigarettes and adversely affects child health; tobacco control should therefore be considered among strategies to improve child survival. (*Am J Public Health.* 2008;98:1824–1826. doi:10.2105/AJPH.2007.119289)

Tobacco companies have gradually shifted their market from high- to low-income countries, where people are less informed about the health risks of tobacco use and antismoking policies are relatively weak.¹ Among poor families in developing countries, smoking diverts money from basic necessities to cigarettes² and increases the risk of child malnutrition.^{3,4} Environmental tobacco smoke increases respiratory disease in children.⁵ The relationship between paternal smoking and child health has not been well characterized in developing countries.¹ We hypothesized that paternal smoking is associated with higher infant and under-5 child mortality among families in Indonesia.

METHODS

The Nutritional and Health Surveillance System, established by the government of Indonesia and Helen Keller International and meant to monitor health and guide policy decisions,⁶ used stratified multistage cluster sampling of households in rural areas and in slum areas of large cities.⁶ Its methods are described in greater detail elsewhere.^{3,6} Demographic, smoking, and health data were collected from December 2000 to September 2003.

Weighting was used to adjust for population size. We used logistic regression models to examine the relationship between paternal smoking and infant and under-5 child mortality. We used population-attributable risk to estimate the proportion of child mortality attributable to paternal smoking.⁷ Data analyses were conducted with SAS version 9.1 (SAS Institute, Cary, NC).

RESULTS

Among 74039 urban families, the prevalence of paternal smoking was 70.8% and of maternal smoking was 0.7%. Among 286982 rural families, the prevalence of paternal smoking was 73.2% and of maternal smoking was 0.5%. We focused our analyses on paternal smoking because of the low prevalence of maternal smoking.

The prevalence of infant mortality among urban and rural families was 6.0% and 8.5%, respectively. Infant mortality was higher in families in which the father was a smoker than in those with a nonsmoking father, in both urban (6.3% vs 5.3%) and rural (9.2% vs 6.4%) areas (in both, $P < .001$). Risk factors associated with infant mortality were similar to those associated with under-5 child mortality. The prevalence of under-5 child mortality in urban and rural families was 7.6% and 10.0%, respectively, and was higher in families in which the father was a smoker than in those with a nonsmoking father in both urban (8.1% vs 6.6%) and rural (10.9% vs 7.6%) areas (in both, $P < .001$; Table 1). In families with under-5 child mortality, mothers were older, both parents had less education, more individuals were sharing a kitchen, and weekly per capita household expenditure was lower than in families with no under-5 child mortality.

After we adjusted for potential confounders, paternal smoking was associated with

TABLE 1—Risk Factors Associated With Under-5 Child Mortality: Nutritional and Health Surveillance System, Indonesia, 2000–2003

	Urban		Rural	
	Families With Under-5 Child Mortality	Families With No Under-5 Child Mortality	Families With Under-5 Child Mortality	Families With No Under-5 Child Mortality
Paternal smoking status, no. (%)				
Yes	4 340 (74.9)	49 451 (70.5)	23 436 (79.7)	191 311 (72.4)
No	1 458 (25.1)	20 708 (29.5)	5 971 (20.3)	72 757 (27.6)
Maternal age, y, no. (%)				
≤24	597 (10.1)	20 313 (28.5)	3 875 (12.9)	91 473 (34.0)
25–28	1 014 (17.2)	18 527 (26.0)	5 444 (18.2)	67 121 (25.0)
29–32	1 363 (23.1)	15 977 (22.4)	7 380 (24.6)	56 653 (21.1)
≥33	2 926 (49.6)	16 408 (23.1)	13 271 (44.3)	53 375 (19.9)
Maternal education, y, no. (%)				
0	754 (12.9)	2 210 (3.1)	4 559 (15.5)	10 657 (4.0)
1–6	3 392 (57.8)	29 843 (42.0)	19 260 (65.7)	142 410 (53.4)
7–9	968 (16.5)	18 158 (25.6)	3 302 (11.3)	58 376 (21.9)
≥10	751 (12.8)	20 806 (29.3)	2 193 (7.5)	55 107 (20.7)
Paternal education, y, no. (%)				
0	294 (5.2)	899 (1.3)	2 826 (10.4)	7 612 (3.0)
1–6	2 702 (47.7)	21 319 (31.0)	16 779 (61.9)	122 208 (47.7)
7–9	1 241 (21.9)	17 541 (25.2)	3 699 (13.7)	51 601 (20.1)
≥10	1 433 (25.3)	29 532 (42.5)	3 787 (14.0)	74 643 (29.2)
No. household members sharing 1 kitchen, no. (%)				
2–4	2 383 (40.4)	41 270 (58.0)	10 498 (35.0)	124 531 (46.4)
>4	4 002 (59.6)	29 904 (42.0)	19 461 (65.0)	143 976 (53.6)
Weekly household expenditure per capita, US \$, no., mean (SEM)	6 364, 4.06 (0.07)	68 752, 4.49 (0.05)	32 553, 2.86 (0.04)	259 782, 3.26 (0.03)

Note. SEM = standard error of the mean. *P* values for each category for urban and rural was less than .001.

an increased risk of infant and under-5 child mortality among both urban and rural families (Table 2). In urban areas, the population-attributable risk from paternal smoking was 11.7% for infant mortality and 13.9% for under-5 child mortality. In rural areas, the population-attributable risk was 23.8% for infant mortality and 24.3% for under-5 child mortality.

DISCUSSION

Our study, to our knowledge, is the first to show that paternal smoking is associated with higher infant and under-5 child mortality in a developing country. Paternal smoking has been shown to divert household income from food to tobacco, putting infants and children at greater risk of chronic malnutrition.^{3,4} Although specific causes of death were not

determined in the surveillance system, the main causes of infant and child deaths in developing countries are diarrheal and respiratory diseases. Malnutrition is estimated to be an underlying factor in about one half of infant and child deaths in developing countries,^{8,9} and environmental tobacco exposure is known to cause higher respiratory disease morbidity among infants and children.^{5,10,11}

Indonesia has the fifth-largest population in the world and serves as a huge market for tobacco, with 182 billion cigarettes consumed per year.¹² There are few restrictions on tobacco industry conduct, advertising, and promotion,¹² and Indonesia is still the only country in southeast Asia that has not signed the World Health Organization Framework Convention on Tobacco Control, which would require implementation of

TABLE 2—Multivariate Models for Paternal Smoking and Other Risk Factors for Infant and Under-5 Child Mortality Among Families: Nutritional and Health Surveillance System, Indonesia, 2000–2003

	Urban				Rural			
	Infant Mortality		Under-5 Child Mortality		Infant Mortality		Under-5 Child Mortality	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Paternal smoking	1.10 (1.01, 1.20)	.046	1.14 (1.05, 1.23)	≤.001	1.30 (1.24, 1.35)	<.001	1.32 (1.26, 1.37)	<.001
Maternal age, y								
≤ 24 (Ref)	1.00		1.00		1.00		1.00	
25–28	1.81 (1.56, 2.09)	<.001	1.91 (1.68, 2.18)	<.001	1.82 (1.71, 1.94)	<.001	1.91 (1.79, 2.03)	<.001
29–32	2.57 (2.23, 2.95)	<.001	2.90 (2.56, 3.28)	<.001	2.83 (2.66, 3.01)	<.001	3.03 (2.87, 3.22)	<.001
≥ 33	4.16 (3.68, 4.71)	<.001	4.93 (4.42, 5.50)	<.001	4.43 (4.18, 4.69)	<.001	5.00 (4.73, 5.28)	<.001
Maternal education, y								
0 (Ref)	1.00		1.00		1.00		1.00	
1–6	0.50 (0.43, 0.56)	<.001	0.47 (0.42, 0.54)	<.001	0.47 (0.44, 0.51)	<.001	0.46 (0.43, 0.49)	<.001
7–9	0.28 (0.25, 0.33)	<.001	0.26 (0.23, 0.31)	<.001	0.24 (0.22, 0.27)	<.001	0.23 (0.21, 0.25)	<.001
≥ 10	0.19 (0.17, 0.22)	<.001	0.17 (0.14, 0.19)	<.001	0.14 (0.13, 0.16)	<.001	0.13 (0.12, 0.15)	<.001
Weekly household expenditure per capita, US\$	0.99 (0.98, 1.00)	.04	0.99 (0.98, 1.00)	.023	0.99 (0.99, 1.00)	.08	0.99 (0.98, 1.00)	.01

Note. OR=odds ratio; CI=confidence interval. Each of the 4 multivariate models was adjusted for all variables in the table and city or province for urban and rural families, respectively.

advertising limitations and the banning of tobacco sales to youths.¹³

The population-attributable risk of excess under-5 child mortality because of smoking ranged from 14% in urban slums to 24% in rural areas. In Indonesia alone, there are an estimated 162 000 under-5 child deaths per year,¹⁴ and paternal smoking, for example, if implicated in one fifth of the deaths, could contribute to 32 400 child deaths annually, or nearly 90 child deaths per day.

Tobacco control has been relatively neglected as an issue related to child health in developing countries. Given the accumulating evidence that smoking is associated with increased risk of child malnutrition^{2–4} and infant and young-child mortality, tobacco control should be integrated with other strategies for promoting child health in developing countries. ■

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Contributors

R.D. Semba originated the study and supervised the data analysis. K. Sun conducted the data analyses. M. Sari was responsible for the original data management in Indonesia. All authors helped to originate ideas, interpret the data, and write the final brief.

Acknowledgments

This study was supported by a Lew R. Wasserman Merit Award from Research to Prevent Blindness to Richard D. Semba.

Human Participant Protection

The Nutrition Surveillance System was conducted in accord with the Helsinki Declaration approved by the ethical review board of the Ministry of Health, Government of Indonesia. Data analysis was approved by the institutional review board of the Johns Hopkins University School of Medicine.

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