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Paternal smoking is associated with increased risk of child malnutrition among poor urban families in Indonesia

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Abstract

Objective: Paternal smoking is highly prevalent in Asia, and tobacco may account for a large proportion of household expenditures among poor families. We sought to characterise the relationship between paternal smoking, child malnutrition and food expenditures.

Design: Data on smoking, household expenditures and child malnutrition were examined in a stratified multistage cluster sample of households in the Indonesia nutrition surveillance system. Main outcome measures were child wasting (weight-for-height *Z*-score <-2), underweight (weight-for-age *Z*-score <-2) and stunting (height-for-age *Z*-score <-2), and severe wasting, underweight and stunting (defined by respective Z-scores <-3).

Setting: In total, 175 583 households from urban slum areas in Indonesia.

Subjects: Children 0–59 months of age.

Results: The prevalence of paternal smoking was 73.8%. After adjusting for child gender and age, maternal age and education, and weekly per capita household expenditures, paternal smoking was associated with child stunting (odds ratio (OR) = 1.11, 95% confidence interval (CI) 1.08–1.14, $P < 0.0001$), severe wasting (OR = 1.17, 95% CI 1.03–1.33, $P = 0.018$) and severe stunting (OR = 1.09, 95% CI 1.04–1.15, $P < 0.001$). In households where the father was a smoker, tobacco accounted for 22% of weekly per capita household expenditures, with less money spent on food compared with households in which the father was a non-smoker.

Conclusions: Among poor families in urban slum areas of Indonesia, paternal smoking diverts household money from food to tobacco and exacerbates child malnutrition.

Keywords
Food
Malnutrition
Poverty
Smoking
Tobacco

Cigarette smoking causes five million deaths per year worldwide, and it is estimated that the annual death toll from smoking will climb to ten million deaths by 2030, with seven million deaths in developing countries[1,2]. Cigarette smoke damages the lower respiratory tract[3], increases oxidative stress and increases the risk of bronchitis, chronic obstructive lung disease, cancer and death[1]. Tobacco companies have gradually shifted their market from high-income to low-income countries, where many people are poorly informed about the health risks of tobacco use and anti-smoking policy is relatively weak[2]. Although much research has focused on the relationship between smoking and adverse outcomes such as cancer, respiratory and cardiovascular disease, the problem of smoking and its relationship to malnutrition and poverty have not been well characterised[2]. Tobacco use may have adverse consequences for nutrition, health and household budgets, especially among families living in poverty in developing countries.

Smoking exacerbates the effects of poverty, as expenditures for tobacco may divert household income from food, clothing, housing, health and education[4,5]. The amount of money spent on tobacco is especially problematic in low-income countries[4,5]. For example, in Vietnam in 1996, smokers spent an average of $US 49.05 on cigarettes per year, which was 1.5 times that spent on education, five times that spent on health care and about one-third that spent on food per capita in the household each year[4]. In the poorest households in Indonesia, more money was spent on tobacco than on education and health care combined[6]. Indonesia is the fifth largest market for tobacco in the world, with 182 billion sticks consumed per year[7]. The absolute domestic consumption of tobacco

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increased by 159% between 1970 and 1980, coincident with the mechanisation of the cigarette industry in Indonesia in the early 1970s[7]. In the 1990s, an estimated 50% of men and 2.6% of women smoked cigarettes in Indonesia, usually kretek[8], and at present over 62% of Indonesian adult males smoke regularly[7]. The prevalence of smoking is also increasing among adolescents in Indonesia[9].

Although smoking is thought to exacerbate poverty in developing countries, it is not well known whether smoking contributes to malnutrition among children. We hypothesised that among poor urban families in Indonesia in households where the father is a smoker: (1) children are at higher risk of malnutrition, and (2) household income spent on cigarettes is associated with proportionally lower expenditures on food compared with households where the father is a non-smoker. In order to examine these hypotheses, we characterised smoking and malnutrition among poor urban families in Indonesia.

Methods

The study subjects consisted of households that participated in a major nutritional surveillance system (NSS) in Indonesia that was established by the Ministry of Health, Government of Indonesia and Helen Keller International (HKI) in 1995[10]. The NSS was based upon the conceptual framework on the causes of malnutrition of the United Nations Children's Fund[11], with the underlying principle to monitor public health problems and guide policy decisions[12]. The NSS was based upon stratified multistage cluster sampling of households in sub-districts of administrative divisions of the country and in slum areas of large cities[10]. The NSS in Indonesia involved the collection of data from approximately 40 000 randomly selected slum households every quarter. The NSS involved five major urban slum areas in the cities of Jakarta, Surabaya, Makassar, Semarang and Padang. New households were selected every round. Data were collected by two-person field teams. A structured coded questionnaire was used to record data on children aged 0–59 months, including anthropometric measurements, date of birth and sex. The mother of the child or another adult member of the household was asked to provide information on the household's composition, parental education and weekly household expenditures, along with other socio-economic, environmental sanitation and health indicators. The field teams measured and recorded the weight of each child aged 0–59 months to a precision of 0.1 kg and the length/height to a precision of 0.1 cm. Birth dates of the children were estimated using a calendar of local and national events and converted to the Gregorian calendar. *Z*-scores of weight-for-height (wasting), weight-for-age (underweight) and height-for-age (stunting) were calculated using EpiInfo software (Centers for Disease Control and Prevention), which uses the reference population of the US National Center for Health Statistics. Children with *Z*-scores below −2 standard deviations (SD) from the median for weight-for-height, weight-for-age or height-for-age were considered wasted, underweight or stunted[13]. Severe wasting, underweight and stunting was defined by respective *Z*-score less than −3SD. HKI provided training to new field teams, field supervisors and assistant field officers, and refresher training prior to each new round of data collection. During each round, a monitoring team from HKI visited all field sites to check and calibrate the equipment and supervise data collection. A quality control team from HKI revisited 10% of households without prior warning within two days of data collection by the field teams and re-collected data on selected indicators, including anthropometric measurements. Data collected by these quality control teams were later compared with the data collected by the field teams to check the accuracy of the data collection.

From 1999 to 2003, the NSS included questions on paternal and maternal smoking and weekly expenditures on cigarettes. In each household, data were gathered regarding expenditures the previous week on rice, other staple foods (cassava, sago, etc.), eggs, vegetables and other plant sources of food (bean curd, tempeh), fruits, cooking oil, beef, chicken, fish, sugar, instant noodles, milk, snacks, clothes, housing, education, cigarettes, savings, social activities, medicine, production activities, recreation, transportation, pocket money, water and other (gasoline, electricity, telephone, soap, seasonings, etc.). Expenditure and price variables were collected in Indonesian rupiah. For this analysis, expenditures are presented in $US to control for the fluctuation of the rupiah. Monthly exchange rates from 1999–2003 were established using historic data publicly available through the Bank of Canada[14]. Average exchange rates by data collection round were calculated in Excel® (Microsoft Corporation) based upon the months in which data were collected for each round. Expenditure and price variables in $US per round were created and calculated within SPSS software (SPSS Inc.) using the appropriate exchange rates by round.

The study protocol complied with the principles enunciated in the Helsinki Declaration[15]. The field teams were instructed to explain the purpose of the NSS and data collection to each child's mother or caretaker, and, if present, the father and/or household head; data collection proceeded only after written informed consent. Participation was voluntary and all subjects were free to withdraw at any stage of the interview. The NSS was approved by the Ministry of Health, Government of Indonesia, and the plan for secondary data analysis was approved by the Institutional Review Board of the Johns Hopkins University School of Medicine.

Malnutrition in children was defined using criteria of the World Health Organization (WHO) for stunting, underweight and wasting[13]. In analyses where child

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malnutrition was the outcome and there was more than one child in the household, the youngest child in the household was used as the index of child malnutrition for that particular household (i.e. households were not counted more than once). Maternal and paternal age was divided into quartiles. Maternal and paternal education was categorised as 0, 1–6 (primary), 7–9 (junior high) and ≥10 years (high school or greater). The proportion of mothers and fathers who had achieved >12 years (high school graduate) was small and thus included in the category ≥10 years. Weighting was used to adjust for urban population size, and all results are weighted. Univariate and multivariate logistic regression models were used to examine the relationship between paternal smoking and the risk of wasting, underweight and stunting in the youngest 0–59-month-old child in the household. $P < 0.05$ was considered significant.

Results

From 1999 to 2003 there were 179 370 households surveyed, of which there were 175 859 households (98.0%) with information collected on paternal smoking. The prevalence of paternal smoking was 73.8%. The characteristics of households in which the father was a smoker were compared with those of households in which the father was not a smoker (Table 1). In households where the father was a smoker, children were younger, the level of both paternal and maternal education was lower, the proportion of households with >4 individuals eating from the same kitchen was higher, and the mean weekly per capita expenditure was higher than in households where the father was a non-smoker.

The prevalence of child wasting was 10.0%. The prevalence of wasting within categories of specific household-related risk factors was compared (Table 2A). Risk factors associated with child wasting included child's age in the 12–23 month age category, male gender, lower maternal and paternal education, maternal and paternal non-smoking, and lower weekly mean household expenditure per capita.

Maternal age and the number of individuals in the household sharing the same kitchen were not significantly associated with wasting. In a univariate model (model 1) and a multivariate model adjusting for child gender and child age (model 2), and in a final model adjusting for child gender, child age, maternal age, maternal education and weekly per capita household expenditure (model 3), paternal smoking was associated with a lower risk of child wasting (Table 3).

The prevalence of underweight children was 34.1%. The prevalence of underweight within categories of specific household-related risk factors was compared (Table 2B). Risk factors that were associated with the child being underweight included older child age, female gender, older maternal age, lower maternal and paternal

Table 1 Characteristics of households where the father is a smoker or a non-smoker among poor urban families in Indonesia

	Smoker		Non-smoker		
Characteristic	*N*	%	*N*	%	*P*-value
Maternal age (years)					
≤ 24	34 271	74.0	12 049	26.0	0.0001
25–28	32 766	72.6	12 361	27.4	
29–32	28 525	73.0	10 564	27.0	
33+	34 032	75.7	10 916	24.3	
Maternal education level (years)					
0	5 449	79.4	1 414	20.6	0.0001
1–6	59 687	76.2	18 647	23.8	
7–9	30 748	73.3	11 177	26.7	
≥ 10	33 610	69.8	14 568	30.2	
Paternal education level (years)					
0	2 392	79.6	613	20.4	0.0001
1–6	47 373	78.0	13 348	22.0	
7–9	33 147	75.8	10 585	24.2	
≥ 10	45 672	68.9	20 574	31.1	
Child's age (months)					
0–5	15 581	75.0	5 180	25.0	0.0001
6–11	22 216	74.7	7 527	25.3	
12–23	36 923	74.1	12 897	25.9	
24–35	26 321	72.7	9 890	27.3	
36–47	17 764	73.2	6 509	26.8	
48–59	10 912	73.9	3 863	26.1	
Number of household members eating from same kitchen					
1–4	67 695	72.2	26 040	27.8	0.0001
> 4	61 930	75.8	19 806	24.2	
Weekly household expenditure per capita ($US)	95 254	3.56 (0.01)*	34 934	3.39 (0.02)*	0.0001

* Mean (standard error of the mean).

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Table 2A Risk factors, including paternal smoking, for child wasting (weight-for-height *Z*-score <−2) among poor urban families in Indonesia

	Wasted		Not wasted		
Characteristic	*N*	%	N	%	*P*-value
Age of child (months)					
0–5	383	1.9	19 921	98.1	0.0001
6–11	2 042	6.8	27 770	93.2	
12–23	9 264	18.5	40 908	81.5	
24–35	3 343	9.1	33 449	90.9	
36–47	1 726	7.0	22 885	93.0	
48–59	912	6.1	14 058	93.9	
Gender					
Male	9 915	10.8	81 884	89.2	0.0001
Female	7 779	9.1	77 339	90.9	
Maternal age (years)					
≤ 24	4 646	10.0	41 885	90.0	0.85
25–28	4 530	10.0	40 797	90.0	
29–32	3 884	9.9	35 339	90.1	
33+	4 584	10.1	40 867	89.9	
Maternal education (years)					
0	788	11.3	6 204	88.7	0.0001
1–6	8 276	10.5	70 723	89.5	
7–9	4 193	10.0	37 915	90.0	
≥ 10	4 382	9.1	43 886	90.9	
Paternal education (years)					
0	302	10.2	2 671	89.8	0.19
1–6	6 131	10.2	54 132	89.8	
7–9	4 316	9.9	39 139	90.1	
≥ 10	6 443	9.8	59 218	90.2	
Father's smoking status					
Smoker	12 602	9.8	115 599	90.2	0.0001
Non-smoker	4 732	10.5	40 532	89.5	
Mother's smoking status					
Smoker	167	7.4	2 076	92.6	0.0001
Non-smoker	17 526	10.0	157 103	90.0	
Total weekly household expenditure per capita ($US)	13 331	3.42 (0.01)*	117 649	3.52 (0.01)*	0.0001
Number of household members eating from same kitchen					
1–4	9 280	9.9	84 531	90.1	0.056
> 4	8 371	10.1	74 341	89.9	

* Mean (standard error of the mean).

education, lower per capita weekly household expenditure and >4 individuals sharing the same kitchen. In a univariate model (model 1) and in multivariate models adjusting for child gender and child age (model 2), and a final model adjusting for child gender, child age, maternal age, maternal education and weekly per capita household expenditure (model 3), paternal smoking was not associated with the child being underweight (Table 3).

The prevalence of child stunting was 28.1%. The prevalence of stunting within categories of specific household-related risk factors was compared (Table 2C). Risk factors that were associated with child stunting included older child age, older maternal age, lower maternal and paternal education, paternal and maternal smoking, lower per capita weekly household expenditure and >4 individuals sharing the same kitchen. In a univariate model (model 1), a multivariate model adjusting for child gender and child age (model 2), and a final model adjusting for child gender, child age, maternal age, maternal education and weekly per capita household expenditure (model 3), paternal smoking was significantly related to increased risk of child stunting (Table 3).

The relationship between paternal smoking and severe malnutrition was also characterised. The prevalence of severe wasting (weight-for-height *Z*-score <−3), severe underweight (weight-for-age *Z*-score <−3) and severe stunting (height-for-age *Z*-score <−3) was 1.0, 6.3 and 7.0%, respectively. Using a similar approach for wasting, underweight and stunting as above, in multivariate models adjusting for child gender, child age, maternal age, maternal education and weekly per capita household expenditure, paternal smoking was associated with an increased risk of severe wasting (odds ratio (OR) = 1.17, 95% confidence interval (CI) 1.03–1.33, $P = 0.018$) and severe stunting (OR = 1.09, 95% CI 1.04–1.15, $P < 0.001$).

The proportions of weekly per capita household expenditures on food, cigarettes and other items in households in which the father was a smoker versus households in which the father was not a smoker are shown in Fig. 1. In households where the father was a smoker, 22% of weekly expenditures per capita were spent on cigarettes (Fig. 1A), and a smaller proportion was spent on foods such as animal foods, vegetables and fruits, rice and other staples, snacks and baby food, sugar and oil,

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Table 2B Risk factors, including paternal smoking, for child underweight (weight-for-age *Z*-score <−2) among poor urban families in Indonesia

	Underweight		Not underweight		
Characteristic	*N*	%	*N*	%	*P*-value
Age of child (months)					
0–5	426	2.1	20 083	97.9	0.0001
6–11	5 215	17.4	24 674	82.6	
12–23	22 118	44.0	28 195	56.0	
24–35	16 862	45.8	19 962	54.2	
36–47	9 905	40.1	14 768	59.9	
48–59	5 861	39.0	9 156	61.0	
Gender					
Male	30 951	33.6	61 061	66.4	0.0001
Female	29 466	34.6	55 794	65.4	
Maternal age (years)					
≤ 24	15 343	33.0	31 295	67.0	0.0001
25–28	14 846	32.7	30 506	67.3	
29–32	13 490	34.3	25 825	65.7	
33+	16 562	36.4	28 934	63.6	
Maternal education (years)					
0	2 951	42.3	4 020	57.7	0.0001
1–6	29 753	37.6	49 405	62.4	
7–9	13 925	33.0	28 220	67.0	
≥ 10	13 573	28.0	34 863	72.0	
Paternal education (years)					
0	1 185	39.7	1 797	60.3	0.0001
1–6	22 771	37.7	37 553	62.3	
7–9	14 729	33.8	28 844	66.2	
≥ 10	19 881	30.2	45 920	69.8	
Father's smoking status					
Smoker	43 633	34.0	84 813	66.0	0.42
Non-smoker	15 384	33.9	29 969	66.1	
Mother's smoking status					
Smoker	776	34.7	1 463	65.3	0.29
Non-smoker	59 630	34.1	115 356	65.9	
Total weekly household expenditure per capita ($US)	45 845	3.45 (0.01)*	85 460	3.54 (0.01)*	0.0001
Number of household members eating from same kitchen					
1–4 people	31 728	33.8	62 256	66.2	0.001
> 4	28 574	34.5	54 315	65.5	

* Mean (standard error of the mean).

and instant noodles, than in households in which the father was not a smoker (Fig. 1B).

Discussion

The present study shows that, in poor urban households in Indonesia, paternal smoking was associated with an increased risk of stunting in children. Paternal smoking was also associated with an increased risk of severe malnutrition among young children, notably severe wasting and severe stunting. Paternal smoking was most strongly associated with stunting but not risk of underweight among children, and this may be due to the more chronic effect of a lower-quality diet in households where the father was a smoker. The proportion of weekly per capita household expenditures on quality foods such as eggs, fish, fruits and vegetables was reduced in households where the father was a smoker. The slightly protective effect of paternal smoking and wasting (weight-for-age *Z*-score <−2) may be a chance finding, as paternal smoking was associated with a significantly increased risk of severe wasting (weight-for-age *Z*-score <−3).

These findings suggest that the adverse effects of tobacco use include increasing the risk of malnutrition among young children of the household, as a large proportion of household income is diverted towards cigarettes with a lesser proportion spent on food. The present study is consistent with observations from Bangladesh that in poor families in which the father smoked, a large proportion of weekly income was spent on tobacco, diverting money that might be spent on food[5]. These findings also corroborate findings from the National Family Health Survey II in India of 92 486 households in which household tobacco use increased the risk of malnutrition among children[16].

The per capita expenditure on tobacco in the lowest-income households may be increasing in Indonesia, from 9% of total expenditures in 1981 to 15% of total expenditures in 1996[17]. In the present study, cigarettes accounted for an average of 22% of weekly per capita household expenditures in poor urban households where the father was a smoker. The mean weekly per capita household expenditure in poor urban households was $US 3.56, thus an estimated $US 0.78 of weekly per capita

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Table 2C Risk factors, including paternal smoking, for child stunting (height-for-age *Z*-score <−2) among poor urban families in Indonesia

	Stunted		Not stunted		
Characteristic	*N*	%	*N*	%	*P*-value
Age of child (months)					
0–5	879	4.3	19 586	95.7	0.0001
6–11	3 303	11.2	26 207	88.8	
12–23	16 375	32.8	33 514	67.2	
24–35	13 099	35.7	23 572	64.3	
35–47	9 626	39.1	15 004	60.9	
48–59	6 244	41.4	8 853	58.6	
Gender					
Male	25 623	28.0	65 900	72.0	0.15
Female	23 922	28.2	60 852	71.8	
Maternal age (years)					
≤ 24 years	12 437	26.8	33 994	73.2	0.0001
25–28	11 856	26.3	33 303	73.7	
29–32	11 017	28.1	28 147	71.9	
33+	14 154	31.3	31 008	68.7	
Maternal education (years)					
0	2 652	38.3	4 277	61.7	0.0001
1–6	25 264	32.1	53 321	67.9	
7–9	11 298	26.9	30 697	73.1	
≥ 10	10 119	21.0	38 118	79.0	
Paternal education (years)					
0–6	18 921	42.8	25 266	57.2	0.0001
7–9	10 795	36.6	28 028	63.4	
≥ 10	13 146	29.8	31 010	70.2	
Father's smoking status					
Smoker	36 340	28.5	91 321	71.5	0.0001
Non-smoker	11 998	26.6	33 183	73.4	
Mother's smoking status					
Smoker	813	36.6	1 409	63.4	0.0001
Non-smoker	48 721	28.0	125 308	72.0	
Total weekly household expenditure per capita ($US)	37 320	3.39 (0.01)*	93 304	3.56 (0.01)*	0.0001
Number of household members eating from same kitchen					
1–4	25 546	27.3	68 080	72.7	0.0001
> 4	23 896	29.0	58 383	71.0	

* Mean (standard error of the mean).

household expenditure was spent on cigarettes that could have been spent on food. These data are consistent with a study of poor families in Bangladesh which showed if money were not spent on cigarettes and were used for food and other necessities, over 50% more money would be available to purchase food for the household[5].

Among poor urban households in Indonesia, nearly three-quarters of fathers were smokers. The high prevalence of smoking among men in this study is comparable to the high prevalence of smoking among men in many countries in southeast Asia, including Vietnam (72.8%)[4], Bangladesh (70.3%)[5], Cambodia (65% in urban areas)[18], Malaysia (49.2%)[19] and the Philippines (54.0%)[19]. The overall male smoking prevalence in this region is 62.3% – the highest in the world[20]. In contrast, only 1% of women in the present study reported that they smoked cigarettes, which is also consistent with a relatively low prevalence of smoking among women in other countries in southeast Asia, such as Vietnam (4.3%)[4], Bangladesh (3.3%)[5], Malaysia (4.0%)[19] and the Philippines (12.6%)[19].

The strengths of this study are the detailed data collection on demographic factors, anthropometry and household expenditures on cigarettes, types of food and other items in a large number of households. The inferences from this study are limited to the urban poor in Indonesia, as rural households were not included, and the proportion of household expenditures may be different in wealthier households. Further work is needed to characterise the relationship between paternal smoking and child nutritional status in rural households and to corroborate these findings in other settings in southeast Asia.

The results from the present study support the growing belief that tobacco control, poverty alleviation and child health promotion should not be looked upon as mutually exclusive efforts[5,16]. The WHO has presented three main ways by which tobacco exacerbates poverty on the household level: first, expenditure of tobacco takes over money that could otherwise be spent on basic necessities; second, smoking leads to increased health care needs, lost productivity and premature death of wage earners; and third, those employed in tobacco-related work experience particularly low wages and high health risks[21]. In the hand-rolled kretek sector employment has remained relatively stable, but the work is labour-intensive and

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Table 3 Multivariate models for paternal smoking and other risk factors for child malnutrition among poor urban families in Indonesia

	Wasting		Underweight		Stunting	
Characteristic	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Model 1						
Father smokes	0.93 (0.90–0.97)	0.0001	1.00 (0.97–1.03)	0.85	1.10 (1.07–1.23)	0.0001
Model 2						
Father smokes	0.93 (0.90–0.97)	0.0001	1.03 (1.00–1.51)	0.03	1.13 (1.11–1.16)	0.0001
Male gender	1.21 (1.17–1.25)	0.0001	0.97 (0.95–0.99)	0.006	1.00 (0.98–1.03)	0.66
Child's age (months)						
0–5	0.29 (0.26–0.33)	0.0001	0.03 (0.03–0.04)	0.0001	0.06 (0.06–0.07)	0.0001
6–11	1.12 (1.04–1.22)	0.005	0.33 (0.32–0.35)	0.0001	0.18 (0.17–0.19)	0.0001
12–23	3.46 (3.22–3.71)	0.0001	1.22 (1.18–1.27)	0.0001	0.70 (0.67–0.73)	0.0001
24–35	1.51 (1.40–1.63)	0.0001	1.31 (1.26–1.36)	0.0001	0.79 (0.76–0.82)	0.0001
36–47	1.16 (1.07–1.26)	0.0001	1.05 (1.01–1.09)	0.03	0.92 (0.89–0.96)	0.0001
48–59	1.00 (ref)	–	1.00 (ref)	–	1.00 (ref)	–
Model 3						
Father smokes	0.95 (0.96–0.99)	0.02	1.01 (0.98–1.04)	0.52	1.11 (1.08–1.14)	0.0001
Male gender	1.21 (1.16–1.25)	0.0001	1.00 (0.98–1.02)	0.98	1.03 (1.01–1.06)	0.01
Child's age (months)						
0–5	0.29 (0.25–0.33)	0.0001	0.033 (0.029–0.037)	0.0001	0.06 (0.059–0.071)	0.0001
6–11	1.08 (0.98–1.19)	0.12	0.32 (0.30–0.34)	0.0001	0.18 (0.169–0.191)	0.0001
12–23	3.35 (3.09–3.64)	0.0001	1.18 (1.13–1.24)	0.0001	0.69 (0.66–0.72)	0.0001
24–35	1.50 (1.38–1.64)	0.0001	1.28 (1.22–1.34)	0.0001	0.79 (0.76–0.83)	0.0001
36–47	1.09 (0.99–1.21)	0.07	1.03 (0.98–1.08)	0.29	0.92 (0.88–0.97)	0.001
48–59	1.00 (ref)	–	1.00 (ref)		1.00 (ref)	–
Maternal age (years)						
≤ 24	0.92 (0.87–0.97)	0.001	1.06 (1.02–1.08)	0.002	1.09 (1.05–1.13)	0.0001
25–28	0.94 (0.89–0.99)	0.014	0.93 (0.89–0.96)	0.0001	0.92 (0.89–0.96)	0.0001
29–32	0.96 (0.91–1.02)	0.17	0.99 (0.96–1.03)	0.68	0.99 (0.95–1.02)	0.48
33+	1.00 (ref)	–	1.00 (ref)	–	1.00 (ref)	–
Maternal education (years)						
0	1.15 (1.04–1.27)	0.006	1.72 (1.61–1.82)	0.0001	2.20 (2.06–2.35)	0.0001
1–6	1.12 (1.07–1.18)	0.001	1.43 (1.39–1.47)	0.0001	1.67 (1.61–1.72)	0.0001
7–9	1.08 (1.02–1.14)	0.005	1.23 (1.19–1.28)	0.0001	1.35 (1.30–1.40)	0.0001
≥ 10	1.00 (ref)	–	1.00 (ref)	–	1.00 (ref)	–
Total weekly household expenditure per capita ($US)	0.992 (0.985–1.003)	0.007	0.981 (0.977–0.985)	0.0001	0.971 (0.967–0.975)	0.0001

OR – odds ratio; CI – confidence interval; ref – reference category.

wages are only 63% of average manufacturing-sector wages[7]. While previous studies have inferred that household health is linked to household smoking expenditure and would improve if the money spent on cigarettes were instead spent on food[5,22,23], the present study corroborates and extends these arguments by showing that paternal smoking is associated with increased child malnutrition.

In Indonesia, kretek cigarettes, which contain about two-thirds tobacco, one-third cloves and various additives and flavours, account for nearly 90% of the cigarettes consumed[24]. Kretek cigarettes are available for purchase individually or in small, less expensive packs, and they are particularly accessible to the poor[25]. Indonesian and multinational tobacco companies advertise heavily on billboards, television, cinemas and at sporting events, with tobacco ranked among the largest advertising spending categories in the country[25]. There are few restrictions on the tobacco industry's conduct, advertising and promotion in Indonesia[7], and Indonesia is the only country in southeast Asia that has not signed the WHO Framework Convention on Tobacco Control[26], which would require implementation of advertising limitations and the banning of tobacco sales to youths[27]. In addition, relatively weak tobacco control legislation passed in 1999 was further weakened with an amendment in 2003 to drop sanctions against the tobacco industry for violation of tobacco control regulations, such as not including health warnings[7]. The heavy advertising and marketing of cigarettes in Indonesia may be a contributing factor to the high prevalence of smoking among Indonesian men.

Child growth is internationally recognised as the best global indicator of physical well-being in children, as children with wasting, underweight or stunting are at higher risk of deficient or delayed mental development and increased infectious disease morbidity and mortality[13]. Long-term consequences of child malnutrition include poor school performance, diminished intellectual achievement, reduced adult size and reduced work capacity[13]. Among poor urban families in Indonesia, children may be needlessly going hungry because money that could be spent on necessities like food is being diverted to cigarettes. Smoking is potentiating malnutrition among children in the family, exacerbating poverty[17], and

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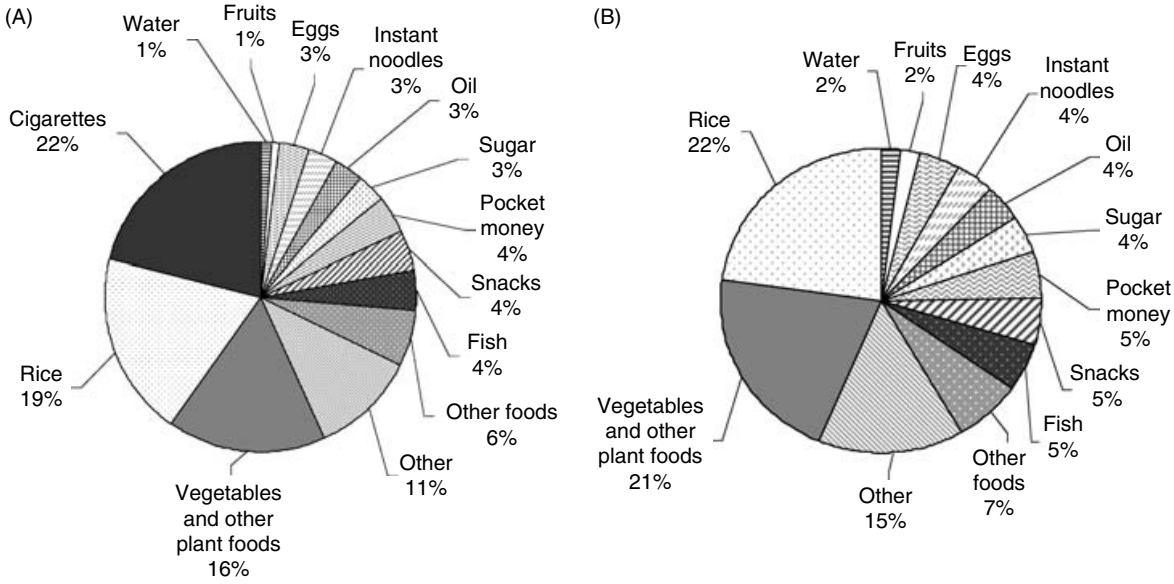

Fig. 1 Weekly per capita expenditures for households with a smoking father (A) and a non-smoking father (B). Proportion of expenditures spent on major food types and other commodities. 'Other foods' was defined as ready-to-eat foods and foods not produced in the household. 'Snacks' were defined as commercially packaged products made in a factory. The category 'Other' consisted of electricity, gasoline, telephone, soap, seasonings, etc.

may have long-term implications for the health of future generations of children in Indonesia and other countries with poverty and widespread tobacco use.

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