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Poverty Does Not Limit Tobacco Consumption in Cambodia: Quantitative Estimate of Tobacco Use Under Conditions of No Income and Adult Malnutrition

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Abstract

Current data indicate that under conditions of poverty, tobacco is consumed at the expense of basic needs. In a large national sample from Cambodia, we sought to determine whether tobacco consumption declines under extreme conditions of no income and malnutrition. Our major findings are as follows: (1) Among men, there was no significant difference in the number of cigarettes smoked for no income (425, 95% confidence interval [CI] = 395–456) versus >US\$2 per day (442, 95% CI = 407–477); (2) among women, there was no significant difference in the amount of loose tobacco (ie, betel quid) consumed for no income (539 g, 95% CI = 441–637) versus >US\$2 per day (558 g, 95% CI = 143–973); (3) for the contrast of no income + malnutrition versus >US\$2 per day + no malnutrition in a linear model, there was no significant difference for men who smoked (462 vs 517 cigarettes/month, $P = .82$) or women who chewed (316 vs 404 g tobacco/month, $P = .34$), adjusting for confounders. Among the poorest and malnourished Cambodian adults, lack of resources did not appear to prevent them from obtaining smoked or smokeless tobacco.

Keywords

smoking/tobacco/drug abuse; public health; nutrition/dietetics; population health; population studies; epidemiology

Introduction

Tobacco causes an estimated 5 million deaths annually. If this trend continues, by 2030, 8 million people will die annually as a result of tobacco use.¹ Of these tobacco users, 84% are

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living in developing countries.² Many studies have shown an increased prevalence of tobacco use, particularly smoked tobacco, among those living in poverty. To illustrate, in Australia, 7.7% of individuals in the lowest income quartile use tobacco as compared with 2.4% in the highest income quartile.³ In Bangladesh, the poor are 2 times more likely to smoke than the wealthy.⁴ And in India, 70% of the poor use tobacco in contrast to 40% of the wealthy.⁵ Moreover, John et al⁶ have further computed that when accounting for the household expenditure on tobacco, 15 million more Indians are living below the poverty level.

Some of the hypotheses that have been proposed to explain this disparity include the following: (1) The poor are less educated; therefore, they are less aware of the negative health effects of tobacco^{3,7-9}; (2) smoking is used as a self-medication to control stress and moods and to cope with burdens related to material deprivation^{7,8}; (3) smoking may be used as a replacement reward because poor individuals commonly are unable to do much for themselves; (4) poor individuals perceive that they have “less to lose” in regard to future health complications than someone with a higher income; (5) nicotine dependence is greater among the poor as they predominantly smoke more cigarettes and have a higher intake of nicotine in each cigarette.⁷

The strong link between tobacco and poverty has raised the question as to whether the expenditure on tobacco in the poorest households is detracting from basic household expenditures.² In China, tobacco-spending households have a 24.64% decrease in food expenditure, 39.40% decrease in education expenditure, and 32.30% decrease in medical care expenditure.¹⁰ In Bangladesh,⁴ a country where half the population lives in poverty, an analysis indicated that if a household's tobacco expenditure was reallocated to household basic needs, then there would be a 58.8% increase in food expenditure, 9.5% for housing, and 2.8% for health.

In the present study of adults in Cambodia, we sought to determine whether under the extreme conditions of both no household income (US\$0 per day) and adult malnutrition (assessed by mid-upper-arm circumference [MUAC]), the amount of tobacco consumed by users was significantly lower than among their high-income, better-nourished peers. During 2005-2006, the largest survey of adult (18 years and older) tobacco use ever conducted in Cambodia was completed as part of the NIH-funded Tobacco Control Leadership Training (TCLT) program that partnered Loma Linda University with the National Institute of Statistics (Ministry of Planning, Cambodia), and the WHO Tobacco Free Initiative of Cambodia.¹¹⁻¹³ As part of the TCLT program, a tobacco survey was designed that included not only items on all forms of tobacco use but also on pertinent health, lifestyle, household variables, diet, MUAC, health status, income, and expenditure on tobacco (cash, trade, gift, and grow your own). The resulting data set is a rich source of information on how tobacco use is incorporated into the households, budgets, and lifestyles of the predominantly rural population of Cambodia where most earn less than US\$2 per day.

The specific aims of our study of a national sample of Cambodian adults are the following: (1) to estimate the amount and type of tobacco used under extreme conditions of no household income and malnutrition and (2) to estimate, after adjustment for pertinent

confounders, whether the amount of tobacco used is significantly lower under conditions of extreme poverty (no household income and malnutrition).

Methods

Data Source

The data set used in this study comes from the TCLT survey conducted in Cambodia that has been previously described.^{11,13} The study population consisted of 13 988 adults (ages 18 years and older) who were selected from all provinces of Cambodia using a stratified multistage cluster design that used the Cambodia General Population Census as a sampling frame. The frame was constructed by stratifying the nation into 17 sampling domains that represented either a single province or groups of similar provinces. Within each domain, an average of 26 villages or municipalities were selected for sampling, resulting in 434 final primary sampling units (PSUs). Each PSU (rural, urban) was subdivided into enumeration areas of approximately 110 households. One enumeration area per PSU was randomly selected for surveying. Circular, systematic sampling was used, with a random starting point, to randomly select 15 rural households and 11 urban households from the respective PSU.¹⁴

Survey teams consisted of 4 or 5 interviewers from the National Institute of Statistics (Ministry of Planning) in Phnom Penh, Cambodia, representing each of the 17 sampling domains. The National Institute of Statistics, WHO National Professional officer for Tobacco Control (DY) trained 92 individuals in the administration of the survey as well as the measurement of MUAC. Survey participants included individuals 18 years of age or older who lived in private households, of whom less than 3% declined participation, resulting in 13 988 participants. Institutional households, such as hospitals, prisons, military barracks, or temples, were not included in this survey.

Approval for the survey was granted by the institutional review board of Loma Linda University as well as the National Ethics Committee on Health (Ministry of Health) in Cambodia. Survey teams obtained written informed consent from each participant prior to administering the survey. A monetary incentive of US\$0.50 was offered to participants.

Survey Development

The survey items on all forms of tobacco use were developed by the following methods that have been previously described: (1) conducting focus groups with both rural and urban residents on the issues of tobacco use and health,^{15,16} (2) stakeholders' analyses of local NGOs working in tobacco control; (3) TCLT program sessions where ministry-level personnel reviewed existing national tobacco surveys during epidemiology and health survey research coursework.¹²

Survey items on tobacco use (betel quid, manufactured cigarettes, handrolled cigarettes, and tobacco pipes) were administered together with pictograms to more accurately estimate frequency, amount, and type of tobacco consumed. In this issue of the journal, we have reported validation findings indicating that pictograms enhanced the validity of smoked and smokeless tobacco estimates.¹⁷

Overall, the TCLT survey addressed the topics of demographics, tobacco use (manufactured cigarettes, hand-rolled cigarettes, chewing, and pipe tobacco), age at initiation, reasons for onset and continuation of tobacco use, knowledge concerning tobacco use, attitudes about tobacco use, smoking cessation, lifestyle (anthropometric data, diet, health, access to health care, and women's health), and media exposure.

Malnutrition Assessment

For each study participant, a MUAC measurement was taken after completion of the survey. Survey interviewers had been trained by a nutritionist from the Helen Keller Foundation in a standard MUAC protocol. During interviewer training, an interrater reliability coefficient of 0.9 was found in a substudy to assess the reproducibility of one interviewer's measure of MUAC by another interviewer on the team.

The MUAC has been shown to be a good indicator of chronic energy deficiency in developing nations.^{18,19} Using previous validation findings,^{18,20} an index of malnutrition was then constructed using the following MUAC cutpoints: 0 to 15 cm, extreme wasting; 16 to 18 cm, wasting; 19 to 21 cm, undernutrition; 22 cm or greater, normal.

Statistical Analysis

For the major analyses, we constructed indices of the number of cigarettes, grams of tobacco used, household income, and malnutrition. An index of number of cigarettes smoked per month was computed from survey items as Number of cigarettes smoked per day $\times$ Number days smoked per month. An index of grams of tobacco added to a betel quid was derived from sensitivity analysis done in the validation study described in this issue of the journal.¹⁷ First, betel quid use in times per month was computed as Number of days per month chewing betel quid $\times$ Number of times per day. In this context, a *time per day* is defined as a session where the betel leaf, areca nut, slaked lime, and tobacco are combined into a packet and chewed and/or maintained in the gingival pocket. This index was further modified by a pictogram-derived weighting factor that allowed participants to estimate (using pictures depicting weighed amounts of tobacco) the amount of tobacco that was added to the betel quid. Income was defined by summing the incomes from primary and secondary occupations defined in the Cambodian Socioeconomic Survey.²¹

To account for stratified, multistage cluster sampling, weighting factors and variance inflation factors had to be incorporated into the calculations. The calculation of 95% confidence intervals (CIs) and variances for means, proportions, and the regression coefficients for a linear model were calculated using a Taylor series linearized method. These calculations were done using SUDAAN software release 9.0 (Research Triangle Institute).

A linear model was used to predict the amount of tobacco (number of cigarettes, grams of tobacco) where the exposure was defined using 7 indicator variables ($x_1 \dots x_7$) for 4 categories of income (US\$0 per day, US\$1 per day, US\$1-US\$2 per day, >US\$2) by 2 categories of malnutrition (<22 cm MUAC, $\geq$ 22 cm MUAC) relative to the highest income

and no malnutrition. Then, k pertinent confounders ($p_1 \dots p_k$) were added for a final model as follows:

$$f(y) = \beta_{US\$0 \text{ per day, malnutrition}} x_1 + \beta_{US\$1 \text{ per day, malnutrition}} x_2 + \beta_{US\$1-US\$2 \text{ per day, malnutrition}} x_3 + \beta_{>US\$2 \text{ per day, malnutrition}} x_4 +$$

+To account for skews in y , transformations (ie, log) were performed and did not substantially change results from the model. Nonparametric regression was also tested and also did not alter results. It follows, for the contrast of greatest interest, that the predicted amount of tobacco (without) for no income and malnutrition was given by

$$f(y) = \beta_{US\$0 \text{ per day, malnutrition}} x_1 + \sum_{i=1}^k \beta_i \bar{c}_i + \alpha \quad (2)$$

and for high income and no malnutrition by

$$f(y) = \sum_{i=1}^k \beta_i \bar{c}_i + \alpha. \quad (3)$$

Results

The descriptive statistics of this study population (as a sample, stratified by use of tobacco) and prevalence of tobacco use have been previously reported.¹¹ Briefly, the national sample was predominantly Khmer, Buddhist, earned less than US\$1 per day, had completed 6 years or less of schooling, and were farmers or laborers by occupation.¹¹ Tobacco use (smoked and smokeless) was more common in adults who had low income, were less educated, and were engaged in farming. A very strong gender-related trend was evident, where smoked tobacco was a habit of men, and smokeless tobacco (in the form of a betel quid) was a habit of women after about the second decade of life.²² Also, 91.3% of male smokers and 95.7% of female chewers lived in rural areas.

Population-Based Estimates

We found that a large proportion of the national sample reported no household income (40.8%, no income; 31.0%, <US\$1 per day; 14.8%, US\$1-US\$2 per day; and 13.4%, > US\$2 per day). The question follows as to whether having no income substantially limited their consumption of tobacco. We answered this question by examining the 2 most common gender norms for tobacco use: cigarette smoking in men and smokeless tobacco use in women. In Table 1, we provide for men the mean number of cigarettes (95%CI) (1) by income and (2) by income and malnutrition. First, we note that the mean number of cigarettes smoked per month for no income (425 cigarettes, 95% CI = 395-455) and >US\$2 per day (442 cigarettes 95% CI = 407-477) was virtually the same. The contrast between no income and malnutrition (459.9 cigarettes, 95% CI = 276-644) and >US\$2 per day and no malnutrition (445 cigarettes, 95% CI = 410-490) also revealed little difference, although confidence limits for the extreme poverty condition were wide. One prominent difference in Table 1 was the substantially lower (almost 25% of the population average for male

smokers) number of cigarettes in the malnutrition and >US\$2 per day category (mean of 122.5 cigarettes per month). We note that the category “malnutrition and >US\$2 per day” is somewhat contradictory, and in interpreting our findings, further note that malnutrition was assessed not by food intake but rather by MUAC. One possibility is that these are individuals who are in a wasting state as a result of sickness and have reduced their smoking.

In Table 2, we provide for women, the mean grams of loose tobacco consumed (95% CI) (1) by income and (2) by income and malnutrition. We found very little difference in mean grams of loose tobacco consumed per month for no income (539 g, 95% CI = 441-637) and >US\$2 per day (558 g, 95% CI = 143-973). It did seem that consumption for >US\$2 per day and no malnutrition was higher than for no income and malnutrition (571 vs 371 g). The confidence limits for these estimates were, however, quite wide. Given the strong age-related trend toward smokeless tobacco use by older women, some adjustment of these contrasts for age and other confounders is needed for clearer interpretation.

Predictions From a Linear Model

For men who smoked tobacco, we constructed a linear model with the number of cigarettes as the dependent variable. We added exposure terms for 4 categories of income by 2 categories of malnutrition and used the highest income/no malnutrition category as a referent; confounders added to the model included age, education, rural residence, and occupation. The contrast for no income/ malnutrition (462 cigarettes/month predicted from adjusted model) versus >US\$2 per day/no malnutrition (517 cigarettes/month predicted from the adjusted model) did not attain significance ($P = .82$) and is depicted in Figure 1.

For women who used smokeless tobacco in the form of a betel quid, we constructed the same linear model for the independent variables but used grams of loose tobacco consumed per month as the dependent variable. The contrast for no income/malnutrition (316 g/month predicted from adjusted model) versus >US\$2 per day/no malnutrition (404 g/month predicted from adjusted model) did not attain significance ($P = .34$) and is depicted in Figure 2.

Discussion

Our analysis of a nationally representative sample of adults from Cambodia sought to determine whether under extreme conditions of no income (40.8% of the nation in this category) and malnutrition, users reduced their consumption of smoked and smokeless tobacco. Our major findings are as follows: (1) Among men who smoked cigarettes, there was no significant difference in the mean number of cigarettes smoked per month between those with no income (425 cigarettes) and those earning >US\$2 per day (442 cigarettes); (2) among women who used smokeless tobacco in the form of a betel quid, there was no significant difference in the mean grams of tobacco consumed per month between those with no income (539 g) and those earning >US\$2 per day (558 g); and (3) in linear models that adjusted for age, education, rural dwelling, and occupation, there was no significant difference between no income + malnutrition versus >US\$2 per day + no malnutrition for

men who smoked cigarettes (462 vs 517 cigarettes/month) or women who consumed loose tobacco in their betel quid (404 vs 316 g/month).

Among the poorest and malnourished Cambodian adults in a large national sample, we found that lack of resources does not appear to prevent them from obtaining smoked or smokeless tobacco. Our findings add to an emerging picture of how tobacco use interacts with poverty in Cambodia. From large-scale prevalence surveys of adult tobacco use in 2006 (the sample we studied) and 2011, we know that (1) of the 1.9 million tobacco users in the nation, approximately 1.3 to 1.4 million are men smoking tobacco, and more than 500 000 are women who use smokeless tobacco in the form of a betel quid^{11,23}; (2) use of smoked and smokeless tobacco is highest in those earning less than US\$2^{11,23}; (3) of the US\$99 million spent on cigarettes by Cambodians in 2011, 42 million was spent by those earning US\$2 per day or less²³; and (4) the average price of a pack of manufactured cigarettes in Cambodia is US\$0.20 and out competes hand-rolled cigarettes in rural areas to the point that, of every 21 cigarettes smoked in Cambodia, 18 are from packs of manufactured cigarettes.

Tobacco Use Under Conditions of Extreme Poverty: Cambodia

Under conditions of extreme poverty, what drives Cambodians to smoke and chew tobacco? In this issue of the journal,²⁴ we have reported a pattern of alcohol and tobacco use in men that may be linked to the burden of posttraumatic stress disorder and other mental health conditions caused by the genocide and mass violence events that occurred in Cambodia during 1975-1979. The similar aggregation of habitual smokeless tobacco and alcohol use in older Cambodian women may also be from similar pathology.²⁴ It is also relevant that among the poorest Cambodians who will tend to use more traditional medicine, smokeless tobacco in the form of a betel quid represents a traditional medicine remedy for morning sickness and many infectious diseases.

Finally, in some of the poorest communities on the Laos-Cambodia border (Mondol Kiri, Rotanak Kiri), tobacco pipes are commonly used. We have previously reported that more than 70% of the tobacco pipe smokers in Cambodia indicate that they smoke tobacco in this form to decrease appetite.¹¹ The lifestyle choice of reaching for tobacco to quell appetite rather than using resources to acquire food needs further study. Also relevant are further investigations into how the expenditure on tobacco affects the diet of the household. In India, for example, John²⁵ has reported a “crowding out” effect, where tobacco expenditures tend to specifically subtract from the household budget for milk—an effect that targets children of the household.

Implications for WHO Framework Convention on Tobacco Control (FCTC) Implementation in Cambodia

Our findings in this report and reported previously indicate that in Cambodia tobacco addiction is an affliction of the poor, and that among the poorest adults, tobacco use is not curtailed by limited income or food (Figures 1-2). Cessation of tobacco use in Cambodia tends to occur in a very small proportion of adult users, and they tend to be older adults who are quitting after the onset of illness.^{26,27} In Table 1, the significant decrease in the number

of cigarettes smoked among higher-income adults (>US\$2 per day) with an arm circumference (<22 cm) indicating at least some wasting is likely evidence of this form of cessation.

The WHO has recently reported that Cambodia has one of the lowest rates of taxation of manufactured cigarettes (20% domestic brand; 25% foreign brands) among the ASEAN countries and one of the lowest average prices per pack (US\$0.20).²³ Under these conditions, increasing the price of manufactured cigarettes does provide one means of making tobacco less accessible to the poorest adults. In Bangladesh, Nonnemaker and Sur²⁸ looked at the relation between tobacco pricing for a household and growth stunting in the children of that household and found that higher prices tended to promote child growth—presumably because of more resources for food. In Cambodia and other parts of the Western Pacific Region, however, the prevalence of other forms of loose tobacco among the poor (hand-rolled cigarettes, betel quid, and tobacco pipe) is a concern because it provides an alternative that is more difficult to regulate. Further studies to examine how households with no reported income obtain their tobacco are needed.

Limitations

The aims of this analysis required accurate measures of tobacco, income, and malnutrition. Our measures of tobacco use (smoked and smokeless) were validated against salivary cotinine. Our income measures used the same methodology as the census, socioeconomic survey, and demographic and health survey of Cambodia, and our estimates agreed with the most recent census estimates. Our malnutrition assessment used a field measure of arm circumference, and some people labeled as having “malnutrition” may have in fact been simply sick or very old. Error in the measured arm circumference should be noted, although the interviewers were evaluated during the pretest, and interrater reliability was found to be high ($\kappa > 0.80$).

Conclusions

In a large national sample of Cambodian adults, we found that conditions of extreme poverty (no reported income and MUAC < 22 cm) did not appear to influence tobacco users to decrease their use of smoked or smokeless tobacco.

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Figure 1.

Number of cigarettes smoked per month is estimated for categories of malnutrition and income (no income, US\$0 per day; >US\$0 to US\$1 per day; >US\$1 to US\$2 per day; >US\$2 per day) in a linear regression model with confounders for age, rural dwelling, and occupation.^a *High income is defined as >US\$2 per day and malnutrition by arm circumference <22 cm.

Figure 2.

Amount of smokeless tobacco (grams) used per month by women is estimated for categories of malnutrition and income (no income, US\$0 per day; >US\$0 to US\$1 per day; >US\$1 to US\$2 per day; >US\$2 per day) in a linear regression model with confounders for age, rural dwelling, and occupation.^a ^a*High income is defined as >US\$2 per day and malnutrition by arm circumference <22 cm.

Table 1

Mean Number of Cigarettes Smoked Per Month Among Cambodian Men^a (n = 2975) in the TCLT Survey of Cambodia.

	No Income, US\$0 Per Day	>US\$0 to US\$1 Per Day	>US\$0 to US\$1 Per Day	>US\$2 Per Day
All	425 [395, 456]	399 [379, 418]	441 [416, 466]	442 [407, 477]
Malnutrition ^b	460 [276, 643]	455 [328, 582]	515 [388, 641]	123 [98, 148]
No malnutrition	424 [395, 454]	397 [377, 418]	440 [415, 466]	445 [410, 480]

Abbreviation: TCLT, Tobacco Control Leadership Training.

^a Age 18 years and older (mean [95% CI]).

^b Assessed by arm circumference <22 cm.

Table 2

Mean Grams of Smokeless Tobacco (Added to a Betel Quid) Used Per Month Among Cambodian Women^a (n = 1012) of the TCLT Survey of Cambodia.

	No Income, US\$0 Per Day	>US\$0 to US\$1 Per Day	>US\$1 to US\$2 Per Day	>US\$2 Per Day
All	539 [441, 637]	481 [389, 574]	461 [301, 620]	558 [143, 973]
Malnutrition ^b	371 [268, 474]	346 [256, 437]	579 [220, 937]	309 [248, 370]
No Malnutrition	556 [450, 662]	505 [399, 610]	450 [281, 620]	571 [135, 1006]

Abbreviation: TCLT, Tobacco Control Leadership Training.

^a Age 18 years and older (mean [95% CI]).

^b Assessed by arm circumference <22 cm.