Public Health

Partner's Smoking Status and Acute Coronary Syndrome: Population-based Case-control Study in Tirana, Albania

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Aim To assess the association between partners' smoking status and acute coronary syndrome in never smokers in Albania.

Methods This population-based case-control study was conducted in Tirana in the period 2003-2006. It involved 467 consecutive patients with non-fatal acute coronary syndrome and 737 controls. Only married never-smokers (169 patients with acute coronary syndrome and 323 controls) were included in the analysis. Information on socioeconomic status, coronary risk factors, and partners' current smoking status was obtained by a structured questionnaire. Multivariate logistic regression was used to assess the association between partner's smoking status and acute coronary syndrome.

Results Among patients with acute coronary syndrome, 49% of women and 25% of men had a partner who was a current smoker, as opposed to 44% of women and 16% of men in the control group. In age-adjusted models, non-smoking men with smoking partners had a greater acute coronary syndrome risk (odds ratio [OR], 1.76; 95% confidence interval [CI], 0.98-3.18), while no association was found in women with smoking partners (OR, 1.05; 95% CI, 0.48-2.30). After adjustment for socioeconomic characteristics, coronary risk factors, and psychosocial factors, the acute coronary syndrome risk in men was somewhat lower (1.68; 95% CI, 0.81-3.47), while for women it was somewhat greater but still non-significant (1.19; 95% CI, 0.25-5.64). Sex-pooled estimate of the risk was OR 1.64 (95% CI, 0.96-2.83).

Conclusion Partner's current smoking status was positively associated with a greater acute coronary syndrome risk in men but not in women, both before and after adjustment for socioeconomic characteristics and coronary risk factors. Programs aimed at reducing the exposure to passive smoking are need in countries with high prevalence of active smoking.

The association between passive smoking and coronary heart disease is still unclear (1-5). While major reviews have shown that passive smoking increases the risk of coronary heart disease (1-3), some individual studies have failed to demonstrate this (4,5). Furthermore, there are concerns regarding the limitations of epidemiological studies (6,7) and meta-analyses (8,9), which found a 25% greater risk of acute coronary syndrome in people exposed to passive smoking (3).

Data on the prevalence of passive smoking in the post-communist countries of southeast Europe, especially Albania, are sparse (10,11). In Albania, there was an increase in the prevalence of active smoking during the transition from a socialist to market-based economy (12,13). In men it has reached 60%, a level unprecedented in Europe (13), which also made women more exposed to environmental tobacco smoke. Together with the increasing rates of smoking, there was also an increase in cardiovascular disease mortality and morbidity (14,15). Yet, the impact of passive smoking on coronary risk has not been assessed.

In the context of a high prevalence of active smoking, particularly in men, we aimed to assess the association of partner's smoking status, which is a marker of passive smoking, with acute coronary syndrome in non-smoking residents of Tirana. This study is a subgroup analysis of the full sample, described in an earlier report (16). We tested the hypothesis that there was a higher risk of acute coronary syndrome among never smokers exposed to their partners' smoking, independent of socioeconomic characteristics and conventional coronary risk factors.

Methods

Study population

A population-based case-control study of acute coronary syndrome was conducted in Tirana in the period 2003-2006. Study population, sampling procedures, and case definition are described in detail elsewhere (16). Briefly, we recruited 467 consecutive patients with non-fatal acute coronary syndrome, aged 35-74 years, admitted to the University Hospital Center, the only hospital in Tirana (370 men aged 59.1 ± 8.7 years and 97 women aged 63.3 ± 7.1 years; 88% response rate). The diagnosis of acute coronary syndrome was based on a combination of typical symptoms, electrocardiographic and echocardiographic criteria, and elevated cardiac enzymes. The control group comprised a population-based age- and sex-stratified sample of Tirana residents aged 35-74 years (469 men aged 53.1 ± 10.4 years and 268 women aged 54.0 ± 10.9 years), with an overall response rate of 69.2% (737/1065) (16). Female control non-respondents did not differ from respondents, whereas male non-respondents were somewhat older than respondents and were more likely to be retired, but were similar according to religious affiliation and education level (16).

Data collection

Smoking status, socio-economic characteristics, and classical coronary risk factors were obtained in an interview using a structured questionnaire. The examination included standardized measurements of anthropometrics (16).

Participants who reported smoking cigarettes regularly or occasionally were considered to be current smokers. Participants who reported having never smoked cigarettes regularly were considered to be current non-smokers. All participants were asked whether their partners smoked regularly (yes vs no).

Socioeconomic characteristics included religious affiliation (Muslim vs Christian), educational level, employment status, relative income compared with the Albanian average (lower than average, average, higher than aver-

Table 1. Association of partners' smoking status with acute coronary syndrome in never smokers in Tirana, Albania, in 2003-2006; multivariable-adjusted odds ratios (OR) and 95% confidence intervals (CI) from binary logistic regression

Model	Men			Women			Overall	
	No*	OR (95% CI)	P	No*	OR (95% CI)	P	OR (95% CI)†	P
Model 1‡								
Partner non-smoker	247	1.00 (reference)	–	101	1.00 (reference)	–	1.00 (reference)	–
Partner smoker	61	1.76 (0.98-3.18)	0.06	83	1.05 (0.48-2.30)	0.90	1.48 (0.93-2.34)	0.10
Model 2§								
Partner non-smoker	246	1.00 (reference)	–	101	1.00 (reference)	–	1.00 (reference)	–
Partner smoker	61	1.77 (0.95-3.27)	0.07	83	1.30 (0.52-3.25)	0.57	1.53 (0.94-2.48)	0.09
Model 3‖								
Partner non-smoker	241	1.00 (reference)	–	95	1.00 (reference)	–	1.00 (reference)	–
Partner smoker	60	1.67 (0.83-3.35)	0.15	81	1.25 (0.33-4.74)	0.74	1.60 (0.95-2.70)	0.08
Model 4¶								
Partner non-smoker	239	1.00 (reference)	–	94	1.00 (reference)	–	1.00 (reference)	–
Partner smoker	60	1.68 (0.81-3.47)	0.16	81	1.19 (0.25-5.64)	0.82	1.64 (0.96-2.83)	0.07

*Discrepancies in totals are due to missing covariate values.
†Adjusted also for sex.
‡Model 1 – adjusted for age.
§Model 2 – adjusted also for socioeconomic characteristics: religious affiliation (Muslim vs Christian), educational level (0-8 y, 9-12 y, and >12 y), employment status (employed, unemployed, and retired), self-perceived social position (low, middle, and high), and relative income (low, average, and high) were introduced as dummy variables.
‖Model 3 – adjusted also for conventional acute coronary syndrome risk factors: leisure-time exercise (tertiles of energy expenditure in Kcal/d), hypertension (yes vs no), diabetes (yes vs no), family history of CHD (at least one parent or sibling vs none), body mass index (≤24.9, 25.0-29.9, and ≥30), and waist-to-hip ratio (men: ≤0.95 vs >0.95; women: ≤0.86 vs >0.86).
¶Model 4 – adjusted also for psychosocial factors: financial loss in pyramid schemes (yes vs no), emigration of spouse and/or offspring (no emigrants, emigrants with no financial remittance and emigrants with remittance), and religious observance (totally secular, moderately observant, and observant) introduced as dummy variables.

age), and self-perceived social position (lower, medium, and higher) (17). Coronary risk factors included leisure-time exercise (18), self-reported hypertension, diabetes mellitus, family history of coronary heart disease, body mass index, and waist-to-hip ratio (16). Psychosocial factors included financial loss in pyramid saving schemes, which collapsed in Albania in 1997 (yes vs no) (17), emigration of the spouse and/or an offspring (no emigrants, emigrants with no financial remittance, and emigrants with remittance) (19), and religious observance (totally secular, moderately observant, and observant).

The study was approved by the Albanian Committee of Medical Ethics. Participants gave their written consent after having been informed about the aims and procedures of the study.

Statistical analysis

Sex-specific binary logistic regression was used to assess the association of partner's smoking status with acute coronary syndrome. Age-adjusted odds ratios (OR) with 95% confidence intervals (CI) and *P* values were calculated. Socioeconomic characteristics (religious affili-

ation, education, employment status, relative income, and subjective social position) were added into the models with acute coronary syndrome as the dependent variable (Table 1). Coronary risk factors (leisure-time exercise, hypertension, diabetes, family history of coronary heart disease, body mass index, and waist-to-hip ratio) were also introduced. Psychosocial factors (emigration, financial loss, and religious observance) were added (Table 1). In all analyses, $P \leq 0.05$ was considered as statistically significant.

We repeated the analysis separately for the first and repeated acute coronary syndrome episodes and with exclusion of retired men. The Hosmer-Lemeshow test was used to assess goodness-of-fit; all tests met the criterion. The Statistical Package for the Social Sciences for Windows, version 11.0 (SPSS Chicago, IL, USA) was used to perform the statistical analyses.

Results

Fifty-four of 737 control respondents with the evidence of pre-existing acute coronary syndrome were excluded from the analysis, as well

as 152 participants (72 cases, 80 controls; 61 women, 91 men) who reported being single, divorced, or widowed. Of the remaining 998 participants, 942 (94%) provided data on their smoking status, their partners' smoking status, and most covariates (391 cases and 551 controls, 252 women and 690 men). The remaining 56 did not provide data on either smoking variables (n = 8) or physical measurements (n = 48) and were, therefore, excluded from the analysis. Current smokers and/or former regular smokers were also excluded from the analysis, because our analysis was restricted to never smokers (3). The final sample included 492 participants (169 cases and 323 controls; 184 women and 308 men).

As was observed in the full study sample (16), patients with acute coronary syndrome were older than controls (59.2 vs 51.5 years, $P < 0.001$), were more likely to be obese (age-adjusted OR, 1.8; 95% CI, 1.1-3.0), had a higher prevalence of male pattern abdominal obesity (OR, 1.3; 95% CI, 0.8-1.9), self-reported hypertension (OR, 1.2; 95% CI, 0.7-2.0), and diabetes (OR, 1.8; 95% CI, 1.0-3.4), and were more likely to report a family history of coronary heart disease (OR, 3.8; 95% CI, 2.4-5.8).

Among patients with acute coronary syndrome, 49% of women and 25% of men had a partner who was a current smoker, as opposed to 44% of women and 16% of men in the control group. Partner's smoking was inversely associated with self-perceived social position in both patients with acute coronary syndrome and controls and positively associated with financial loss in pyramid schemes and higher scores of religious observance in the control sample. There were no significant associations with conventional coronary risk factors in either group (data not shown).

In age-adjusted models, a greater risk of acute coronary syndrome was found in men with smoking partners (OR, 1.76; 95% CI, 0.98-3.18) than not in women with smoking partners (OR, 1.05; 95% CI, 0.48-2.30; test for sex interaction: $P = 0.340$) (Table 1). After adjustment for socioeconomic characteristics, coronary risk factors, and psychosocial factors, a weak and non-significant association between partners' smoking and acute coronary syndrome risk was found in women (OR, 1.19; 95% CI, 0.25-5.64), whereas in men the association was somewhat decreased (OR, 1.68; 95% CI, 0.81-3.47). Sex-pooled estimate of the risk was OR 1.64 (95% CI, 0.96-2.83; Table 1), but the exclusion of retired men increased the estimate (sex-pooled multivariable-adjusted OR, 2.0; 95% CI, 0.8-4.6; $P = 0.118$).

Restriction of the models only to the first acute coronary syndrome event did not substantially affect the findings in either sex (data not shown).

Discussion

We found that partner's current smoking status, which is a widely used marker of passive smoking in epidemiologic studies (4,5), was positively associated with a greater acute coronary syndrome risk in men but not in women, both before and after adjustment for socioeconomic characteristics and coronary risk factors. There was no formal evidence of a sex interaction. As the association was weak in the modest-sized sample of women (though consistent with effect sizes estimated from meta-analyses) and borderline significant in men, our results should be interpreted with caution.

Association of passive smoking with acute coronary syndrome is subject to substantial confounding by active smoking (4). Therefore, we restricted the analysis to never smokers only, although it was at the cost of a reduced sample size.

Several meta-analyses have found an association between increased coronary heart disease mortality and morbidity and partner's smoking status (1-3). On the other hand, it has

been argued that pooled findings from meta-analyses may be overestimated due to publication bias (4,8,9). Furthermore, several individual studies have questioned the deleterious effect of passive smoking on coronary heart disease (4,5).

The results of our study are prone to selection bias and information bias, which are characteristic limitations of case-control design. The response rate in acute coronary syndrome patients was 88%, whereas in controls it was 69% (16). There was no evidence of selection bias in female controls. In men, control non-respondents were more likely to be retired. Yet, findings were augmented after exclusion of retired people from the analysis. Furthermore, respondents and non-respondents of both sexes were similar with regard to educational level, which has been described as the most important socioeconomic measure in former communist countries of central and Eastern Europe (20). We cannot exclude the possibility that information on partner's smoking may have been affected by case status, although there seems to be no obvious explanation why patients with acute coronary syndrome reported a higher rate of smoking among their partners than controls. However, there was no information on duration and quantity of partner's smoking.

Our findings suggest that non-smoking individuals who are exposed to passive smoking at home may have an increased risk of coronary heart disease. Our results still need to be confirmed by future similar studies in Albania and other transitional countries.

Acknowledgment

References

1 Taylor AE, Johnson DC, Kazemi H. Environmental tobacco smoke and cardiovascular disease. A position paper from the Council on Cardiopulmonary and Critical Care, American Heart Association. Circulation. 1992;86:699-702. Medline:1638735

2 Law MR, Morris JK, Wald NJ. Environmental tobacco smoke exposure and ischaemic heart disease: an evaluation of the evidence. BMJ. 1997;315:973-80. Medline:9365294

3 He J, Vupputuri S, Allen K, Prerost MR, Hughes J, Whelton PK. Passive smoking and the risk of coronary heart disease – a meta-analysis of epidemiologic studies. N Engl J Med. 1999;340:920-6. Medline:10089185 doi:10.1056/NEJM199903253401204

4 Enstrom JE, Kabat GC. Environmental tobacco smoke and tobacco related mortality in a prospective study of Californians, 1960-98. BMJ. 2003;326:1057. Medline:12750205 doi:10.1136/bmj.326.7398.1057

5 Thun M, Henley J, Apicella L. Epidemiologic studies of fatal and nonfatal cardiovascular disease and ETS exposure from spousal smoking. Environ Health Perspect. 1999;107 Suppl 6:841-6. Medline:10592140 doi:10.2307/3434563

6 LeVois ME, Layard MW. Publication bias in the environmental tobacco smoke/coronary heart disease epidemiologic literature. Regul Toxicol Pharmacol. 1995;21:184-91. Medline:7784630 doi:10.1006/rtph.1995.1023

7 LeVois ME, Layard MW. Passive smoking and heart disease. Authors need to analyse the same data. BMJ. 1998;317:344-6. Medline:9685290

8 Bailar JC III. Passive smoking, coronary heart disease, and meta-analysis. N Engl J Med. 1999;340:958-9. Medline:10089192 doi:10.1056/NEJM199903253401211

9 Gori GB, Luik JC. Passive smoke: the EPA's betrayal of science and policy. Vancouver: Fraser Institute; 1999.

10 Rechel B, McKee M. Healing the crisis: a prescription for public health action in South Eastern Europe. New York (NY): Open Society Institute Press; 2003.

11 Nuri B, Tragakes E, editors. Health care systems in transition: Albania. Copenhagen: European Observatory on Health Care Systems; 2002. Available at: *http://www.euro.who.int/document/e80089.pdf*. Accessed: May 1, 2008.

12 Shapo L, Gilmore AB, Coker R, McKee M, Shapo E. Prevalence and determinants of smoking in Tirana city, Albania: a population-based survey. Public Health. 2003;117:228-36. Medline:12966742 doi:10.1016/S0033-3506(03)00084-2

13 Ministry of Health of the Republic of Albania. Public health and health promotion strategy: towards a healthy country with healthy people. Tirana: Ministry of Health of the Republic of Albania; 2004.

14 Institute of Statistics of Albania. Causes of deaths for the year 2000. Tirana: INSTAT; 2001.

15 Institute of Statistics of Albania. Health indicators for years 1994-1998. Tirana: INSTAT; 2001.

16 Burazeri G, Goda A, Sulo G, Stefa J, Roshi E, Kark JD. Conventional risk factors and acute coronary syndrome during a period of socioeconomic transition: population-based case-control study in Tirana, Albania. Croat Med J. 2007;48:225-33. Medline:17436387

17 Burazeri G, Goda A, Sulo G, Stefa J, Kark JD. Financial loss in pyramid savings schemes, downward social mobility and acute coronary syndrome in transitional Albania. J Epidemiol Community Health. 2008;62:620-6. Medline:18559445 doi:10.1136/jech.2007.066001

18 Burazeri G, Goda A, Kark JD. Television viewing, leisure-time exercise and acute coronary syndrome in transitional Albania. Prev Med. 2008;47:112-5. Medline:18313742 doi:10.1016/j.ypmed.2008.01.020

19 Burazeri G, Goda A, Tavanxhi N, Sulo G, Stefa J, Kark JD. The health effects of emigration on those who remain at home. Int J Epidemiol. 2007;36:1265-72.

Medline:17768161 doi:10.1093/ije/dym162

20 Bobak M, Pikhart H, Rose R, Hertzman C, Marmot M. Socioeconomic factors, material inequalities, and perceived control in self-rated health: cross-sectional data from seven post-communist countries. Soc Sci Med. 2000;51:1343-50. Medline:11037221 doi:10.1016/S0277-9536(00)00096-4