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The association between migration and smoke-free families: how do migrants from different world regions compare?

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Background: Studies on adolescent secondhand smoke exposure within the family often dichotomously operationalize migration background without paying attention to social and cultural diversity within migrant populations. As a result, little is known about variation within migrant groups in smoke-free family environments (SFFEs). This study analyses the association between SFFEs and parental migration from different world regions. **Methods:** Data from 14- to 16-year-old adolescents ($N = 17\,144$) on SFFEs and parental migration were obtained from cross-sectional repeated SILNE-R surveys. A multivariable multinomial regression was applied, presenting relative risks (RRs) with 95% confidence intervals (CIs) for maternal or paternal tobacco smoking and home smoking bans. Variation in migration background was measured according to parental sex and place of birth. **Results:** Approximately 18% of adolescents are exposed to maternal smoking, and 25% are exposed to paternal smoking. Almost half of the respondents do not live in SFFEs but are subject to permissive (5%) or partial (39%) smoking bans at home. We found that adolescents of Eastern European descent are at a higher risk of being exposed to both paternal and maternal smoking. A sex difference in parental smoking was found among Arabic/Islamic migrants, where mothers are less likely to be smokers. Maternal and paternal African origins are associated with prohibitive smoking bans at home. Eastern European mothers show higher odds of permissiveness and freely allowing smoking at home. **Conclusion:** Notable within-differences according to parental sex and place of birth were found for SFFEs and should be taken into account when implementing equity-sensitive tobacco prevention programs.

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Introduction

According to the Global Youth Tobacco Surveys, conducted in 168 countries, 30% of never-smoking adolescents are exposed to

secondhand smoke (SHS) in their homes.¹ A total smoking ban at home and a fully smoke-free (SF) family environment in advanced tobacco control settings such as Finland is reported by 58%.²

Parental smoking, peer smoking, awareness about smoke harm and permissive attitudes toward smoking rules at home are significantly associated with SHS exposure at home.^{1,2}

While adolescents may be exposed to SHS at home, there is another major risk for adolescents: smoking initiation.^{3,4} Parental modeling and attitudes contribute to intergenerational cycles of nicotine dependence.⁴ In addition, the social gradient in smoking documents inequalities for adolescents in SHS exposure across educational groups.^{2,4,5} Smoking initiation can be transmitted intergenerationally by family structure (e.g. higher odds of adolescent smoking among no-parent or single-parent families)⁶ and parental smoking.^{3,4,7}

Intersections in tobacco and migration studies

There is increasing interest in studying the impact of parental migration background on adolescents' SHS exposure in their homes.^{8,9} A study on US migrants has shown that the main assumptions of the theory of segmented assimilation and the 'healthy migrant effect'¹⁰ hold significance for smoking prevalence among US migrants.¹¹ According to the segmented assimilation theory, migrants neither seem to follow the patterns of their country of origin completely nor do they simply adapt to host standards.¹¹ Findings of Bosdriesz et al. (2013)¹¹ revealed that smoking prevalence among migrants in the US is lower than among US-born and the countries of origin, as migrants also tend to have healthier lifestyles ('healthy migrant'¹⁰) However, another study suggests that intergenerational gaps in smoking behavior within migrant groups are larger among women compared with men.¹²

One strand of migration studies on smoking operationalizes migration dichotomously^{8,13,14} (e.g. domestic vs. one- or two-sided migration). A second strand analyzes, based on citizenship, some country-specific migration groups separately, such as Mexicans in the US¹⁵ or Turks and Russians in Germany.⁸ The impact of migration background on children's SHS exposure in Germany, for instance, is three times higher for Turkish-speaking migrants, two times more likely for so-called 'other migrants', and less likely for Russians in comparison to domestic German adolescents.⁸

However, the intersection of tobacco/nicotine and migration studies on smoking offer no conclusive insights on differences in between and within migrant groups across sex and place of birth. Sex-sensitive differences in SHS exposure are quite often overlooked,^{8,16} but smoking prevalence differs consistently by sex among less acculturated non-Western immigrant groups.¹⁷ Therefore, it remains inconclusive how migrating mothers and fathers of Eastern European, Asian, African, Latin American and Arabic families differ in comparison to domestic counterparts.

Aims and research questions

There is a growing body of US-data-based¹¹ or Chinese migration literature,¹⁸ but little is known about migrants from different world regions and adolescents' experiences in SF family environments (SFFE). To the best of our knowledge, there are no sex- or place-sensitive studies that examine the association between SFFEs and migration status in relation to maternal and paternal cultural-economic background. This is an important and pertinent issue for both the smoking inequalities⁵ research and the practical implementation of youth-focused or school-based prevention programs,¹⁹ as practitioners working in disadvantaged settings might be uninformed about intersectional inequalities in relation to parental migration, sex and smoking. Such knowledge on inequalities within a heterogeneous group should serve to avoid generalized stereotypical views on migrants, could raise awareness about within-inequalities, and educate practitioners about discriminatory structures.

Inspired by methodological debates of recent socio-epidemiological approaches to inter- and intra-categorical intersectionality,²⁰ we aim to study suspected unequal outcome

distributions of SFFEs in relation to intersectional migration status.²⁰⁻²² Intersectional aspects of adolescents' migration status will be operationalized based on both parental sex and region of birth.

The following research questions will be answered:

- i. Which adolescents with migrated families are more often exposed to parental smoking and missing home smoking bans than peers without a migration background?
- ii. Do parental smoking and home smoking bans differ across migrated families in relation to parental sex and place of birth?

Methods

Pooled survey data were obtained from the cross-sectional repeated SILNE-R surveys (www.silne-r.ensp.org) from seven cities of the European Union (EU), including 23 888 adolescents and 5439 respondents with a migration background. The study was conducted in two waves (2013 and 2016/17) and consisted of self-reported data on smoking, health and risk behaviors of adolescents.²³ A standard, self-completed questionnaire was carried out during regular school hours in Belgian (Namur), German (Hanover), Dutch (Amersfoort), Finnish (Tampere), Irish (Dublin), Portuguese (Coimbra) and Italian (Latina) medium-sized cities. These medium-sized municipalities were selected because they reflect the respective national average in terms of unemployment rates and demographic factors such as the proportion of migrants.²³ These cities are placed within national policy environments which differ considerably in contextual factors such as SF legislation, locations in which SF legislation is regulated, the prevalence of tobacco consumption in each city, and the implementation of tobacco control policies ([Supplementary file 1](#)). Ethical approval from local or national authorities was obtained in each participating country separately to comply with respective national standards. In Germany and Italy, active parental consent was required. The total response rates in both waves were 86% (2013) and 80% (2016).^{4,23}

Sample

Both waves of the SILNE-R data ($N=23\,888$) included a self-administered questionnaire that was conducted in two grades corresponding to mostly 14- to 16-year-olds in 67 secondary schools. The central target group in tobacco prevention was the group of 14-16 years old,^{4,5} which is why age groups that were unevenly distributed across all cities (respondents aged ≤ 13 or ≥ 17) and students with missing information were excluded. The exclusion of underrepresented age groups and students with missing information on variables used in this study led to a final sample size of $N=17\,144$ adolescents (Belgium/Namur $N=2484$; Germany/Hanover $N=1639$; Netherlands/Amersfoort $N=3147$; Finland/Tampere $N=2669$; Ireland/Dublin $N=1495$; Portugal/Coimbra $N=2467$; and Italy/Latina $N=3243$).

Outcome measures for SFFEs: parental smoking and home smoking bans

Comprehensive SFFEs and no SHS exposure at home can be assumed if adolescents are exposed neither to parental smoking nor to permissive smoking rules in the family.^{2,4} Paternal and maternal smoking status and smoking rules at home were used as two complementary outcomes and indicators of SFFEs. These outcomes are positively correlated ($r=0.4$) indicators of SFFEs and provide information on (i) parental smoking practice of the adolescent's father and mother and (ii) permissive or prohibitive smoking norms within the family context that also hold for other minors and adults in the respective homes.^{2,4}

Parental smoking status was measured in both survey waves with the question 'Does any member of your family smoke cigarettes?' ('yes', 'no' or 'stopped smoking').⁴ The smoking status of

adolescent's mother and father was categorized into three groups: 'never smoker', 'ex-smoker' and 'smoker'.⁵

Information on home smoking policies and permissiveness of smoking rules at home was based on the following question: 'Is smoking permitted at your home?'⁵ Those reporting smoking was not permitted in their home were assumed to have prohibitive smoking bans, while cases reporting to have separate smoking areas or not knowing about smoking rules were treated as partial bans. Respondents being permitted freely to smoke were defined to have permissive smoking rules in their homes.

Independent variable: intersectional migration groups

The operationalization of intersectional migration status by sex and place is based on the questions 'In which country was your mother born?' and 'In which country was your father born?' with the options 'this country' (domestic) or 'another country'. The migration status is commonly operationalized dichotomously (domestic vs. migrant) or defined as one- or two-sided migration.^{5,8,24} Still, this reasonable categorization neglects, even if separated by parental sex, the specific origin and cultural-economic aspects of migration, which is why we decided to amplify and characterize parental migrant groups. Based on the cultural map of the World Values Survey (WVS) studies of Inglehart et al.,²⁵ cultural-economic place of parents' origin was classified. The WVS cultural map has been widely accepted as an indicator for a country's relationship between values, cultural regions of modernization, their economic development, and institutional frameworks or political legacies, such as post-socialist heritage.²⁵ Moreover, cultural-economic world regions, as embodied in the WVS map, are important to migration research in smoking, as economic development and cultural modernization relate to smoking outcomes and the implementation of tobacco control policies.^{26,27}

Parents born in the domestic country were treated as 'domestic.' For the intersectional categorization of migrant groups, we altered the WVS categories 'Protestant Europe', 'English-speaking' and 'Western Catholic Europe' (e.g. Italy, France, Spain and Portugal) to 'Western migrants'. The 'Islamic' migrants (including those from Arab North Africa) were coded as 'Arabic/Islamic migrants', and 'Latin American' migrants were coded as 'Latin American migrants.' The migrants from 'Orthodox' (e.g. Russian Federation) and ex-communist 'Protestant' (e.g. Czech Republic) or 'Catholic' countries (e.g. Poland) were recoded as 'Eastern European migrants.' The migrants from 'African' Sub-Saharan countries (excluding Arab North Africa) were classified as 'African migrants', and 'South Asian' and 'Confucian' migrants were classified as 'Asian migrants.' Unfortunately, we must admit that some categories (e.g. Asian, African and Latin American migrants) are not adequately represented in the dataset. Therefore, the categories used are based on relatively wide world regions with still heterogeneous conditions in socioeconomics, culture and tobacco control.^{25,26}

A concise overview of the performed recoding of 246 (former and existing) countries of birth to six intersectional migration categories is provided in [Supplementary file 2](#).

Control variables

Socioeconomic indicators of the family are important factors because they may influence the relationship between parents' intersectional migration status and SFFEs. Parental education as an indicator of parents' socioeconomic status (SES) is strongly associated with adolescent tobacco consumption and parental smoking.^{5,28} Educational background is an essential determinant for the SES of the family and smoking outcomes.²⁹ Paternal and maternal education was assessed by the highest level of schooling parents attained. Paternal and maternal SES was then recoded into 'high', 'medium', 'low' and 'unknown' educational status.⁵

The subjective SES reflects the perceived ranking of economic wealth, cultural capital and the degree of recognition of one's own family within society. The MacArthur Scale is a widely used instrument to measure subjective social position and is furthermore a helpful tool to simplify the intuitive understanding of social inequalities by adolescents through the visualization of a hierarchical ladder.³⁰ The variable corresponds to a scale with the question 'Imagine that this ladder shows how the society is made up. Please tell us where you think your family would be on this ladder'. Adolescents could position their own family from 0 ('the worst off') up to 10 ('the best off'). The variable was recoded into sample-adjusted tertiles that represent high (≥ 8), medium (7) and low (≤ 6) subjective social positions.⁴

Statistical analysis

We applied multinomial regression, presenting relative risks (RRs) with 95% confidence intervals (CIs), to model associations between maternal smoking, paternal smoking and home smoking bans as indicators of SFFEs with respondents' intersectional migration background. Indicators of SES at the family level (parental education, subjective SES) were added to the multivariable multinomial regression analyses as control variables for SFFEs. The statistical analysis followed three steps. First, an explorative descriptive analysis and cross-tabulations were performed. Second, three separate regressions were calculated for parental smoking status stratified by parental sex (Model 1) and home smoking bans (Model 2). The RRs represent the odds of being exposed to a smoking-permissive family by showing risk ratios for smoking or formerly smoking mothers or fathers (ex-smokers) and partial or no smoking rules at home, in comparison to never smokers, and prohibitive home bans as base outcomes. Third, sampling distributions and probabilities were replicated and controlled with average marginal effects (AMEs) in order to ensure a valid interpretation of RRs.³¹ Statistical analyses were performed with STATA 14.0 (StataCorp LLC, College Station, USA).

Results

Descriptive sample information is provided in [table 1](#), revealing that 18% are living with a smoking mother and 25% with a smoking father. [Table 1](#) depicts almost half (44%) of the adolescent respondents living in non-SF homes with permissive (5%) or at least partial (39%) smoking bans at home, whereas 56% report living in a completely SF home.

After adjustment for macro- and socioeconomic control variables, [table 2](#) shows rather small differences between intersectional migration and the domestic population, while the magnitude of individual SES factors of both parents and the subjective socioeconomic perception of the family were found to be consistent predictors for parental smoking status ([table 2](#)) and permissive smoking rules at home ([table 3](#)).

Higher odds for smoking fathers are associated with paternal migration from Eastern European (AME: 9%) countries (RR 1.67, 95% CI 1.21–2.29), whereas a lower risk is reported for African (AME: –8%) paternal migration (RR 0.60, 95% CI 0.44–0.82). The risk of having a smoking father was also increased for Eastern European (AME: 6%) maternal (RR 1.42, 95% CI 1.05–1.92) and Arabic/Islamic (AME: 8%) maternal migration (RR 1.64, 95% CI 1.19–2.24).

A lower likelihood for maternal smoking (AMEs: –5 to –9%) is found for mothers who migrated from Asian (RR 0.45, 95% CI 0.24–0.84), African (RR 0.68, 95% CI 0.47–0.96) and Arabic/Islamic countries (RR 0.65, 95% CI 0.46–0.94). Lower odds remain for smoking mothers from Africa and Asia associated with African (RR 0.59, 95% CI 0.41–0.84) and Asian (RR 0.52, 95% CI 0.28–0.98) fathers. On the other hand, higher risks are found for Eastern European mothers (AME: 6%) associated with Eastern European fathers (RR 1.51, 95% CI 1.07–2.13).

Table 1 Descriptive sample characteristics

Independent variables	Sample		N = 17,144									
	Age respondents		\bar{x} = 15.0, SD 0.7									
	Dependent indicators/measures		Maternal smoking			Paternal smoking			Smoking rules (bans) at home			
	Labels		Smoker	Ex-smoker	Never	Smoker	Ex-smoker	Never	Permissive	Partial ban	Prohibitive	
	in%		18.4	7.9	73.7	24.8	12.4	62.8	5.2	38.7	56.1	
Total		100.0	N	3146	1354	12 644	4248	2134	10 762	883	6638	9623
Maternal migration	Asian	1.5	252	6.7	5.6	87.7	25.0	13.1	61.9	2.0	13.1	61.9
	African ^a	2.5	432	10.2	6.5	83.3	16.0	11.8	72.2	1.2	28.9	69.9
	Eastern European	3.7	641	29.0	9.1	61.9	39.6	13.6	46.8	11.4	45.9	42.7
	Latin American	0.7	120	16.7	8.3	75.0	21.7	13.3	65.0	5.0	29.2	65.8
	Arabic/Islamic ^b	3.0	505	17.2	4.8	78.0	36.0	11.9	52.1	5.1	44.0	50.9
	Western migrants	3.1	532	18.1	11.5	70.5	22.0	15.8	62.2	4.1	36.5	59.4
	Domestic	85.5	14 662	18.4	7.9	73.7	24.1	12.3	63.6	5.0	38.7	56.3
Paternal migration	Asian	1.3	227	7.5	3.5	89.0	27.8	10.6	61.7	3.1	37.9	59.0
	African ^a	2.6	444	9.5	6.5	84.0	13.7	12.4	73.9	2.9	28.6	68.5
	Eastern European	3.3	566	30.3	9.5	60.1	41.3	13.8	44.9	11.7	46.6	41.7
	Latin American	0.6	106	15.1	11.3	73.6	21.7	11.3	67.0	3.8	31.1	65.1
	Arabic/Islamic ^b	3.6	611	20.0	4.4	75.6	33.9	11.0	55.2	4.9	43.7	51.4
	Western migrants	3.4	584	19.7	13.5	66.8	25.0	16.4	58.6	5.3	35.1	59.6
	Domestic	85.2	14 606	18.2	7.8	73.9	24.1	12.3	63.6	5.0	38.7	56.3
Maternal education	Unknown	13.9	2383	20.1	7.8	72.1	26.5	12.3	61.2	5.4	43.2	51.4
	Low	14.7	2512	25.0	6.9	68.1	31.4	12.4	56.2	8.1	42.3	49.6
	Medium	34.2	5865	22.2	7.9	69.9	28.9	11.9	59.3	6.0	41.8	52.2
	High	37.2	6384	11.6	8.3	80.1	17.9	13.0	69.1	3.1	32.8	64.1
Paternal education	Unknown	15.9	2723	21.5	7.8	70.7	27.9	13.4	58.7	6.2	42.8	51.0
	Low	18.7	3200	23.9	6.9	69.2	35.6	12.9	51.5	7.7	44.1	48.2
	Medium	31.4	5387	20.9	8.2	70.9	28.3	12.6	59.1	5.7	41.6	52.7
	High	34.0	5834	11.5	8.2	80.3	14.2	11.6	74.2	2.8	31.2	66.0
Subjective SES (MacArthur)	Low	37.4	6406	22.6	8.4	69.0	31.1	14.2	54.7	6.5	43.7	49.8
	Medium	28.2	4832	17.9	7.9	74.2	23.2	11.7	65.1	4.9	38.7	56.4
	High	34.5	5906	14.1	7.4	78.5	19.1	11.2	69.7	3.9	33.3	62.8

a: Mostly Sub-Saharan, excluding Arab North Africa.

b: Mostly Middle Eastern, including Arab North Africa.

Interestingly, paternal smoking is associated with maternal migration from Arabic/Islamic regions but not vice versa, which is due to the high amount of smoking Arabic/Islamic fathers (34%) in our sample and the relatively low number of smoking mothers (17%) in this group.

According to table 2, Western migrants (AME: 5%) are more likely to report formerly smoking fathers (RR 1.39, 95% CI 1.10–1.77) compared with domestic parents. Lower risks were found only for formerly smoking mothers associated with Asian (AME: –5%) paternal migration (RR 0.34, 95% CI 0.14–0.82), which corresponds with the relatively low number of female Asian smokers (7%) or ex-smokers (6%) in the sample. Table 3 shows that only children of parents with African origin (mother: RR 0.71, 95% CI 0.56–0.91; father: RR 0.75, 95% CI 0.59–0.95) tend toward a prohibitive home ban on smoking compared with the host population (AME: –6%).

Discussion

This is the first intersectional European study on SFPEs for adolescents across parental sex and place of birth. Adolescents of Eastern European descent have a higher risk of being exposed to both paternal and maternal smoking compared with their domestic peers. We found a lower likelihood for African migrants in terms of parental smoking and permissive smoking rules at home. Western migrants of both sexes were found to be more likely ex-smokers, while Asian women were less likely current or ex-smokers. A sex difference in parental smoking was found for Arabic/Islamic families, pointing to a male gradient in smoking.

Interpretation of central findings

First, we would like to observe that the applied SES proxies were found to be consistent predictors for parental smoking status and permissive smoking rules at home, which is in line with the well-documented social gradient literature on adult and adolescent smoking.^{5,29} The magnitude of the differences according to world regions must be interpreted with some caution, as we found relatively wide CIs only for several groups (African, Asian, Eastern European and Arabic/Islamic migrants). One should avoid generalizations because people with a migration background are generally found to be a heterogeneous group and are not fundamentally sicker or healthier than the majoritarian domestic population.³² However, migration can mediate specific health resources or disease risks, which, among other influencing factors, can have a positive or negative impact on health behaviors.³³

As reported in a Finnish study in 2008 (58%),² our study indicates a similar proportion (56%) of adolescents living in a completely SF home with smoking being fully banned. However, the higher exposure to parental smoking among Eastern European families does not correspond with the findings of a German-based study finding lower risks for Russian migrants.⁸ Our results could be interpreted as an outcome of strong legal (e.g. marketing and promotional activities) and illegal (e.g. tobacco smuggling) efforts of transnational tobacco industries in post-socialist European countries such as in the former Soviet Union.³⁴ Since the 1970s, transnational tobacco companies have particularly influenced decision makers and developed marketing strategies to target youth and women in developing economies.³⁵ Thus, low- and middle-income countries, which are among the top migration countries, have been favored targets

Table 2 RRs and AMEs for maternal and paternal smoking from multivariable multinomial regression

		Model 1					
		Parental smoking		Maternal smoking		Paternal smoking	
		Total	Smoker ^a RRs (95% CI) AMEs	Ex-smoker ^a RRs (95% CI) AMEs	Smoker ^a RRs (95% CI) AMEs	Ex-smoker ^a RRs (95% CI) AMEs	
Maternal migration	Asian		0.45 (0.24–0.84) –0.09	1.07 (0.54–2.13) 0.01	0.99 (0.64–1.56) –0.02	1.51 (0.89–2.57) 0.05	
	African ^b		0.68 (0.47–0.96) –0.05	0.77 (0.50–1.20) –0.01	0.81 (0.60–1.09) –0.01	0.86 (0.61–1.22) –0.01	
	Eastern European		1.29 (0.93–1.79) 0.04	1.06 (0.65–1.72) 0.00	1.42 (1.05–1.92) 0.06	1.24 (0.83–1.85) 0.01	
	Latin American		1.07 (0.63–1.83) 0.01	0.87 (0.42–1.78) –0.01	1.04 (0.63–1.71) 0.00	1.13 (0.63–2.03) 0.01	
	Arabic/Islamic ^c		0.65 (0.46–0.94) –0.05	0.84 (0.46–1.54) –0.01	1.64 (1.19–2.24) 0.08	1.43 (0.92–2.22) 0.02	
	Western migrants		1.14 (0.90–1.45) 0.015	1.36 (1.03–1.82) 0.023	1.04 (0.83–1.30) –0.00	1.29 (1.00–1.65) 0.03	
	Domestic		1.00	1.00	1.00	1.00	
Paternal migration	Asian		0.52 (0.28–0.98) –0.07	0.34 (0.14–0.82) –0.05	1.08 (0.69–1.70) 0.03	0.60 (0.32–1.09) –0.05	
	African ^b		0.59 (0.41–0.84) –0.06	0.81 (0.53–1.25) –0.01	0.60 (0.44–0.82) –0.08	0.92 (0.66–1.29) 0.00	
	Eastern European		1.51 (1.07–2.13) 0.06	1.36 (0.83–2.25) 0.02	1.67 (1.21–2.29) 0.09	1.24 (0.81–1.90) 0.00	
	Latin American		0.85 (0.47–1.54) –0.03	1.51 (0.78–2.94) 0.04	0.91 (0.54–1.53) –0.01	0.82 (0.42–1.60) –0.02	
	Arabic/Islamic ^c		1.24 (0.91–1.70) 0.04	0.62 (0.35–1.09) –0.03	1.05 (0.78–1.40) 0.02	0.78 (0.51–1.18) –0.03	
	Western migrants		1.28 (1.03–1.60) 0.03	1.82 (1.41–2.36) 0.05	1.22 (0.99–1.50) 0.02	1.39 (1.10–1.77) 0.03	
	Domestic		1.00	1.00	1.00	1.00	
Maternal education	Unknown		1.40 (1.18–1.65) 0.04	1.03 (0.82–1.30) –0.00	1.02 (0.88–1.19) 0.01	0.76 (0.63–0.93) –0.03	
	Low		1.83 (1.60–2.10) 0.09	0.97 (0.78–1.19) –0.01	1.05 (0.92–1.19) 0.01	0.81 (0.69–0.96) –0.02	
	Medium		1.73 (1.55–1.94) 0.08	1.05 (0.91–1.22) –0.00	1.20 (1.08–1.32) 0.04	0.86 (0.76–0.97) –0.02	
	High		1.00	1.00	1.00	1.00	
Paternal education	Unknown		1.65 (1.41–1.94) 0.07	1.04 (0.83–1.30) –0.00	2.20 (1.90–2.56) 0.12	1.62 (1.35–1.95) 0.03	
	Low		1.53 (1.33–1.75) 0.06	0.92 (0.76–1.12) –0.01	2.96 (2.61–3.35) 0.18	1.59 (1.36–1.87) 0.02	
	Medium		1.44 (1.28–1.62) 0.05	1.07 (0.92–1.25) 0.00	2.09 (1.88–2.33) 0.11	1.37 (1.20–1.55) 0.01	
	High		1.00	1.00	1.00	1.00	
Subjective SES (MacArthur)	Low		1.50 (1.35–1.65) 0.05	1.32 (1.15–1.51) 0.01	1.62 (1.48–1.77) 0.07	1.52 (1.36–1.71) 0.03	
	Medium		1.23 (1.10–1.37) 0.03	1.13 (0.97–1.30) 0.01	1.16 (1.05–1.27) 0.03	1.09 (0.96–1.23) 0.00	
	High		1.00	1.00	1.00	1.00	

a: Base outcome = 'never smoker'. 1.00 = reference category.

b: Mostly Sub-Saharan, excluding Arab North Africa.

c: Mostly Middle Eastern, including Arab North Africa.

of the tobacco industry due to still lower smoking rates, such as Eastern Europe in the 1990s. However, these strategies were also applied simultaneously in Western high-income countries or Asia. Western migrants were found to be more likely former smokers and female Asian migrants less likely (ex-)smokers, which could be attributed to the respective stage of Western and Asian countries in the global tobacco epidemic.^{26,27} Migrants tend to be more educated and have on average healthier lifestyles than people in the country of origin,¹⁰ which could explain why our study showed no adverse effects in relation to SFEEs for Asian, Latin American, and African families.

The results revealed, among other studies,¹² relevant sex differences within migrant families from different world regions. Certain path dependencies of modernization and spatial-temporal desynchronization in smoking (e.g. stages in the tobacco epidemic) contribute to global differences in tobacco prevalence.³⁶ Eastern European countries are mostly located in the third stage of the tobacco epidemic,^{26,27} with relatively high prevalence rates (male: 30–50%; female: 20–40%³⁷) and even already high smoking consumption during socialist times.^{26,27} A relevant proportion of Southeast Asian low- and middle-income countries are situated in earlier stages of the tobacco epidemic and observe rather higher male than female prevalence.^{26,37} The observed sex difference in parental smoking for Arabic/Islamic culture points to the well-documented higher male smoking prevalence in Arab countries and to patriarchal rules of cigarette smoking within the dominant culture of Arab societies.^{37,38}

More prohibitive smoking rules at home among African parents might be explained by lower smoking prevalence and possibly more strict-hierarchical and collectivist rules within the family.²⁵ As far as African families are concerned, low exposure to parental smoking and stricter home smoking bans could be attributed to lower smoking prevalence in Sub-Saharan African countries among both sexes

and the fact that African migrants in high-income countries might be higher educated, have healthier lifestyles and are less likely to be smokers.³⁷ The US-based evidence indicates that first-generation immigrants who are people of color are less likely to report being current smokers and that intergenerational increases in smoking are slower among individuals with African origin.¹²

Limitations

Some shortcomings and methodological concerns of this study must be critically discussed. The study design is repeated cross-sectionally, and observed associations should be interpreted with caution. We relied on self-reported data of on average 15-year-old adolescents and pooled two waves from seven EU countries with considerable national variability in tobacco control policies.³⁹ The self-reported data and the repeated cross-sectional study design across seven EU countries with considerable differences in the degree of tobacco control and the composition of migrant groups might have influenced the results.

The proposed intersectional definition of migration status could be criticized for several good reasons. Other intersectional dimensions, such as religion, immigration status or ethnicity, have not been conducted in the survey and should be considered in future studies. Broad 'umbrella categories' such as 'Eastern European' (including Ex-Communist, Catholic and Orthodox countries) or 'African' migrants might conceal different aspects of diversity rather than promoting diversity-sensitive operationalization. Some categories (e.g. Asian and Latin American migrants) are not adequately represented in the sample in terms of N-size and are based on relatively wide world regions with very heterogeneous conditions regarding socioeconomics, culture and tobacco control.^{26,36} Even across low- and middle-income countries and within the same world regions, one can observe large smoking and sex

Table 3 RRs and AMEs for permissive or partial smoking rules at home from multivariable multinomial regression

		Model 2			
		SF homes		Smoking ban at home	
		Total	Permissive ban ^a	Partial ban ^a	
			RRs (95% CI) AMEs	RRs (95% CI) AMEs	
Maternal migration	Asian		0.37 (0.12–1.16) –0.03	0.98 (0.67–1.43)	0.01
	African ^b		0.21 (0.08–0.54) –0.04	0.71 (0.56–0.91)	–0.06
	Eastern European		1.94 (1.16–3.25) 0.04	1.23 (0.93–1.63)	0.03
	Latin American		1.11 (0.45–2.74) 0.01	0.75 (0.49–1.16)	–0.07
	Arabic/Islamic ^c		1.17 (0.62–2.23) 0.01	1.10 (0.83–1.47)	0.02
	Western migrants		0.90 (0.58–1.41) 0.00	1.00 (0.83–1.20)	0.00
	Domestic		1.00	1.00	
Paternal migration	Asian		0.93 (0.34–2.49) 0.00	0.87 (0.58–1.29)	–0.03
	African ^b		0.91 (0.50–1.65) 0.00	0.75 (0.59–0.95)	–0.06
	Eastern European		1.59 (0.92–2.74) 0.02	1.25 (0.93–1.69)	0.04
	Latin American		0.66 (0.22–1.95) –0.01	0.79 (0.50–1.24)	–0.05
	Arabic/Islamic ^c		0.79 (0.43–1.43) –0.01	1.04 (0.80–1.35)	0.01
	Western migrants		1.11 (0.76–1.63) 0.01	0.90 (0.75–1.08)	–0.02
	Domestic		1.00	1.00	
Maternal education	Unknown		1.27 (0.94–1.72) 0.01	1.28 (1.12–1.46)	0.05
	Low		1.94 (1.52–2.47) 0.03	1.16 (1.03–1.30)	0.02
	Medium		1.65 (1.35–2.02) 0.02	1.24 (1.14–1.34)	0.04
	High		1.00	1.00	
Paternal education	Unknown		2.29 (1.72–3.05) 0.03	1.42 (1.25–1.62)	0.09
	Low		2.26 (1.77–2.88) 0.03	1.56 (1.40–1.73)	0.07
	Medium		1.75 (1.41–2.18) 0.02	1.40 (1.28–1.53)	0.08
	High		1.00	1.00	
Subjective SES (MacArthur)	Low		1.57 (1.32–1.87) 0.02	1.45 (1.34–1.57)	0.08
	Medium		1.24 (1.02–1.50) 0.01	1.22 (1.13–1.32)	0.04
	High		1.00	1.00	

a: Base outcome = ‘prohibitive home ban on smoking’. 1.00 = reference category.

b: Mostly Sub-Saharan, excluding Arab North Africa.

c: Mostly Middle Eastern, including Arab North Africa.

variations, as Southeast Asian prevalences from Bangladesh (male 64% vs. 31% female), India (male 54% vs. 18% female) and Vietnam (male 55% vs. 3% female) illustrate.¹⁶ Adequate representation of some migrant groups is a serious concern, especially from an intersectional perspective, as the sample should be at best well balanced with minority and majority groups.²² Moreover, ‘anti-categorical’⁴⁰ intersectional scholars might criticize the approach of identifying certain ‘risky’ migrant groups from the perspective of ‘risk factor epidemiology’,²¹ which might lead to unintended ‘categorical fetishism’ and discriminatory ‘othering’ of Eastern European parents or Arab fathers as ‘risky’ or ‘patriarchal’ families.^{21,22} However, we believe that the definition of migration status is in line with main assumptions of inter- and intra-categorical intersectionality approaches in population health research and informative for public health practice for tackling inequalities.²⁰

The terms ‘parent’ or ‘family’ in our study are moreover limited and must be treated with some caution. We conducted migration information of ‘biological’ parents and needed to exclude information on smoking step-parents from the analysis. We must assume that adolescents answered mostly on migration of biological parents even if they had ‘social’ parents, as they could not give explicit information on migration of step-parents in the questionnaire (Supplementary file 3). We know that, due to serial monogamy in high-income countries, a relevant proportion of adolescents do not live in a traditional core family home. Last, time and date of parental migration were not assessed in the survey, which could have also affected unobserved heterogeneity of the data such as represented in the healthy migrant effect or processes of acculturation.^{10,17}

Conclusions

Notable within-differences by migration background across parental sex and place of birth were found in relation to SFFEs and should be taken into account when implementing equity-sensitive tobacco prevention programs. Practitioners such as school staff or social workers should be educated and critically informed about intersectional dimensions (e.g. sex/gender, place, class/SES) of smoking and other youth-relevant behaviors.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- This is the first study on smoke-free family environments for European adolescents with diverse parental migration backgrounds.
- Adolescents of Eastern European descent are exposed to both paternal and maternal smoking.
- We found lower risks for African migrants in terms of parental smoking and permissive smoking rules at home.
- A gender gap in parental smoking was found for Arabic/ Islamic families.
- Public health practice should reflect intersectional migration aspects in relation to smoking and tobacco prevention programs.

List of ethical approval

Belgium: REF 2012/09OCT/461 N° enregistrement belge B403201215182 – Comité d'éthique Hospitalo-Facultaire des Cliniques Universitaires Saint-Luc. Germany: Ethical approval MLU Halle-Wittenberg: 2016-90 hm-bü. Supervisory school authority Hanover: H 1 R b—81402—55—2016. Supervisory school authority Lüneburg (Celle): LG 1 R.22—503000. Portugal: General Directorate for education, approval number 0338600002 on 26 July 2016. The Netherlands: Medical Research Involving Human Subjects Act (WMO): reference number W16_252 # 16.297, 11 August 2016. Ireland: Research Ethics Committee – Dublin Institute of Technology: Ethical Clearance Ref 15—105, 16 June 2016. Finland: Ethics Committee of the Tampere Region, Statement 29/2016. Italy: Ethical Committee 'Lazio 2', protocol number 0068451/2016.

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The influence of marital status and partner concordance on participation in colorectal cancer screening

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Background: Colorectal cancer screening program using a fecal immunochemical test aims to reduce morbidity and mortality through early detection. Although screening participation is free-of-charge, almost 40% of the invited individuals choose not to participate. To bring new insight into how non-participation can be identified and targeted, we examined the association between marital status and screening participation; with a focus on partner concordance in participation and sex differences. **Methods:** This nationwide cross-sectional study included all Danish citizens aged 50–74 years, who were invited to colorectal cancer screening between 2014 and 2017. Logistic regression analysis was used to estimate odds ratio (OR) of participation while adjusting for sociodemographic variables. **Results:** A total of 1 909 662 individuals were included in the analysis of which 62.7% participated in the screening program. Participation was highest among women. Stratified by marital status, screening participation was markedly lower in widowed (61.5%), divorced (54.8%) and single (47.3%), while participation reached 68.4% in married individuals. This corresponded to ORs of 0.59 (95% CI 0.58–0.59) for widowed, 0.56 (95% CI 0.55–0.56) for divorced and 0.47 (95% CI 0.47–0.48) for single, compared to married individuals. Individuals married to a participating partner were five times more likely to participate than married individuals with a non-participating partner, regardless of gender. **Conclusions:** Marital status was strongly associated with participation in colorectal cancer screening, and participation was even higher in married individuals with a participating partner. Future efforts to increase participation in colorectal cancer screening could potentially benefit from considering the role of partner concordance.

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Introduction

Globally, colorectal cancer is the third most frequent cancer type and the second most common cause of cancer death with an estimated 1.8 million incident cases and around 860 000 deaths worldwide in 2018.¹ The incidence rate of colorectal cancer is higher in men than in women.¹ Population-based screening for colorectal cancer has shown to reduce the morbidity and mortality of colorectal cancer by enabling the removal of premalignant lesions and by

detecting disease at an early stage.^{2,3} However, even in settings where screening is free-of-charge, ~40% of the eligible population choose not to participate.^{4–6} The identification of groups of citizens with low participation in colorectal cancer screening is needed in the planning of targeted interventions to increase the overall participation. Studies have identified a range of predictors for non-participation, which suggests that screening participation is impacted by gender, age, immigration status, income, education, the region of residence and marital status.^{4,5} Married people are