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Tobacco and alcohol use in pregnancy: the role of migrant status.

Tobacco and alcohol use in pregnancy in France: the role of migrant status.

The nationally representative ELFE study.

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Abstract

Introduction

Tobacco and alcohol use in pregnancy are modifiable yet frequent risk factors of poor perinatal outcomes. We examined whether characteristics associated with substance use in pregnancy vary between native and migrant women, who often differ in terms of socio-demographic characteristics.

Methods

Data come from a nationally representative sample of children born in France in 2011 (ELFE study, n=18,014). Maternal substance use in pregnancy (tobacco: ≥ 1 cigarette/day, alcohol: ≥ 1 time, binge drinking: ≥ 3 units of alcohol on one occasion) was assessed using survey methodology by a) trained interviewers and b) self-reports. Migration status was determined based on country of birth (native-born vs. migrant). The sample included 2,330 migrant women, predominantly from North Africa (35.4% - primarily Algeria and Morocco), Sub-Saharan Africa (27.3% - primarily Senegal, Ivory Coast, the Congo and Cameroun), Europe (20.2% - primarily Portugal and Germany) and Asia (10.2% - primarily Turkey). Characteristics potentially associated with substance use included socio-demographics (maternal age, number of children, relationship status, educational attainment, employment status), health (psychological difficulties, incomplete prenatal care) and partner's characteristics (migration status, employment).

Results

Compared to the native-born, migrant women had lower levels of tobacco smoking (8.8 vs. 21.9%) and alcohol use (23.4 vs. 40.7%), but not binge drinking (2.9 vs. 3.3%). Unfavorable socioeconomic circumstances were associated with tobacco smoking in native-born women only. Single parenthood was associated with alcohol use only in migrant women. In migrant women, co-occurring use of another substance and psychological difficulties were more strongly associated with use of tobacco, alcohol or binge drinking than in native-born women.

Conclusions

Migrant women have less favorable socioeconomic characteristics than native women but are generally less likely to use tobacco and alcohol in pregnancy. However those who experience single-

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parenthood need special attention, as they are disproportionately likely to use psychoactive substances which put them and their children at risk of poor health outcomes.

Keywords: pregnancy, tobacco, alcohol, migrants, socioeconomic factors

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Introduction

Tobacco and alcohol use in pregnancy are important modifiable risk factors of poor perinatal outcomes (Andres & Day 2000; Huizink 2013; Lebel et al. 2012; Nykjaer et al. 2014; Saurel-Cubizolles et al. 2013) and children's cognitive and behavioral difficulties (Alvik et al. 2013; Huizink & Mulder 2006; Kelly et al. 2013; Keyes et al. 2013). Despite the existence of primary and secondary prevention strategies (Baha & Le Faou 2009; Inpes 2013), levels of substance use in pregnant women in industrialized countries remain high (Zeitlin et al. 2012). Key associated factors include social and economic hardship (low maternal educational achievement, financial difficulties, unemployment, single motherhood) (Baron et al. 2013), psychological difficulties (symptoms of depression and anxiety) (Orr et al. 2012; Saurel-Cubizolles et al. 2013), as well as patterns of substance use among the women's partner/family/friends (Saurel-Cubizolles et al. 2013; Xu et al. 2013).

In many countries, migrant women experience high levels of socioeconomic and mental health difficulties (Toulemon 2004). Compared to the native-born, migrant women also have less regular prenatal care, a higher number of children, and higher rates of single-motherhood, all of which can contribute to poor pregnancy outcomes (Ekblad et al. 2013; Saurel-Cubizolles et al. 2013). In contrast, migrant women generally have lower substance use levels than native women (Urquia et al. 2012).

In France, an estimated 17.0% of pregnant women are daily tobacco smokers, 22.8% drink alcohol (2.5% more than once a month, 3.2% ≥ 3 units of alcohol), and 1.2% use cannabis (Saurel-Cubizolles et al. 2013). Migrants living in France primarily come from Europe (37.0% in 2011 – mainly Southern Europe ex. Portugal and Eastern Europe ex. Romania or Poland), North African countries (Algeria, Morocco, Tunisia, 29.7%), Sub-Saharan Africa (13.3%) and Asia (14.4%)(INSEE 2015), that is a majority comes from countries in which substance use levels are low – particularly in women (WHO 2013). Substance use in migrant women may go undetected for several reasons: lack of regular prenatal care, cultural and language barriers to disclose unfavorable health behaviors, health

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professionals' reluctance to inquire (Moussa et al. 2010). Identifying risk factors associated with substance use in migrant women and comparing them to those most relevant among native women can help refine knowledge of characteristics which physicians should pay attention to in screening for prenatal substance use in their patients.

We examined whether socio-demographic, health and partner's characteristics associated with substance use in pregnancy vary depending on women's migration status, using data come from the nationally representative ELFE cohort study of children born in France in 2011.

Material and Methods

Study population

Data come from the baseline wave of the ELFE (Etude Longitudinale Française depuis l'Enfance) study, a multidisciplinary, nationally representative, birth cohort, which included 18,312 children born in 349 maternity units in France in 2011. Exclusion criteria were stillbirth, birth <33 weeks of gestation and plans to move out of metropolitan France in the following 3 years. Participating mothers and children were recruited in maternity wards (51% participation rate). Data were collected in standardized interviews conducted by trained interviewers and through self-completed questionnaires, which were all first tested in a pilot study. Factors associated with study participation included parental low occupational grade and unemployment, young maternal age and having more than one child. Study weights account for the sampling scheme and factors associated with participation. The ELFE study received approval of bodies overseeing ethical data collection in France (Comité Consultatif sur le Traitement des Informations pour la Recherche en Santé – CCTIRS, Commission National Informatique et Libertés : CNIL).

Measures

Maternal tobacco and alcohol use in pregnancy

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Face-to-face interviews included measures of maternal tobacco and alcohol use, which were identical to those used in the French National Perinatal study in 2010 (Saurel-Cubizolles et al. 2014). Maternal tobacco use was ascertained as follows: 'During pregnancy did you smoke tobacco, even occasionally?', 'Was it also the case in the 3rd trimester of your pregnancy?' 'How many cigarettes, on average, did you smoke per day/week/month?' Based on this information, we identified regular smokers (≥ 1 cigarette/day, yes vs. no) and heavy smokers (≥ 10 cigarettes/day, yes vs. no). Alcohol use was ascertained as follows: 'During pregnancy, how often did you drink alcoholic drinks (beer, cider, wine, heavy liquor)?' In addition, women self-completed a questionnaire which included the following questions: 'How many glasses of alcohol per month did you drink *before* you realized you were pregnant?' 'How many glasses of alcohol per month did you drink *after* you realized you were pregnant?'. Participants who gave a positive answer on any of these three questions on alcohol use (in the face-to-face interview or in the self-completed questionnaire) were considered to have drunk alcohol in pregnancy (yes vs. no). The self-completed questionnaire also included an item on binge drinking 'During pregnancy, how many times did you drink 3 or more alcoholic drinks on one occasion?' – any positive response was considered as indicative of binge drinking (yes vs. no).

Socio-demographic, health and partner's characteristics

Maternal and paternal migration status was ascertained by a) country of birth (France vs. another country) and b) citizenship (French vs. non-French). Both measures were closely related (correlation coefficients 0.74-0.76 for the father and mother), and following other researchers, we defined migrant status using the country of birth. (Moussa et al. 2010) Most migrant women in our study came from North Africa (35.4% - primarily Algeria and Morocco), Sub-Saharan Africa (27.3% - primarily Senegal, Ivory Coast, the Congo and Cameroun), Europe (20.2% - primarily Portugal and Germany) and Asia (10.2% - primarily Turkey). Due to low statistical power, they were combined into a single category, but the role of country of origin with regard to study outcomes was tested in secondary analyses.

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Maternal socio-demographic characteristics studied were: age at the time of pregnancy (25-29, 30-34, ≥ 35 vs. < 25 years), number of children (≥ 1 child vs. 1 child), relationship status (lives with the child's father: yes vs. no), educational attainment (middle school or below; high school vs. above high school), employment status (unemployed/out of labor force vs. employed).

Maternal health characteristics included psychological difficulties ('During pregnancy, did you experience persistent psychological difficulties?'; yes vs. no) and the adequacy of prenatal care ($<$ vs. ≥ 7 medical visits). Among women who reported psychological difficulties, 31.6% received medical treatment implying symptoms of clinical significance.

Partner's (i.e. the child's father's) characteristics studied were migrant status and employment at the time of birth (unemployed/out of labor force vs. employed) as reported by participating mothers.

Statistical analyses

We studied associations between socio-demographic, psychological and partner's characteristics and tobacco and alcohol use in pregnancy in native-born and in migrant women. First, we calculated weighted estimates of women's characteristics and tobacco and alcohol use. Second, we compared the socio-demographic, health, partner's and substance use characteristics of native-born and migrant women. Third, we studied associations between socio-demographic, psychological and partner's characteristics and tobacco and alcohol use stratifying on migration status, in a logistic regression framework. Fourth, we tested for statistical interactions between each characteristic under study and migration status. Analyses examining the likelihood of tobacco smoking were controlled for alcohol use and vice versa. In additional analyses we a) used maternal and paternal citizenship as an indicator of migration status, b) examined the specificity of associations under study by country/ geographic region of birth.

All analyses were carried out using SAS V9.3 (SAS, Cary, NC).

Results and Discussion

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Results

Descriptive characteristics

As shown in **Table 1**, compared to the native-born, migrant women were somewhat older ($p < 0.0001$), more likely to have more than one child ($p < 0.0001$), less likely to live with a partner ($p < 0.0001$), more likely to have low educational attainment ($p < 0.0001$), less likely to be employed ($p < 0.0001$), more likely to have psychological difficulties ($p = 0.0005$), more likely to have had incomplete prenatal care ($p < 0.0001$), more likely to have a child with a man who is also migrant ($p < 0.0001$) and who is not employed ($p < 0.0001$). Migrant women were less likely than native French women to smoke tobacco ($p < 0.0001$) and use alcohol ($p < 0.0001$), but equally likely to binge drink in pregnancy ($p = 0.32$).

Table 1 – Sociodemographic and substance use characteristics of ELFE study mothers (France, 2011, n=18,014; weighted %; % in native French vs. migrant women, p-value)

	Migration status			Native vs. migrant p-value
	Total (n=18,014) %	Native-born (n=15,413) %	Migrant (n=2,330) %	
<u>SOCIO-DEMOGRAPHIC CHARACTERISTICS</u>				
Age : < 25 years	14.2	12.4	10.3	
25-29 years	31.3	31.9	26.6	<0.0001
30-34 years	33.3	35.3	34.3	
≥ 35 years	21.3	20.5	28.8	
Number of children : 1 child	43.4	46.5	42.0	<0.0001
>=1 child	56.6	53.5	58.1	
Relationship status : Lives with a partner	92.4	95.3	89.6	<0.0001
Does not live with a partner	7.6	4.7	10.5	
Educational attainment : Above high school	52.4	61.7	50.1	<0.0001
High school	38.0	35.2	32.6	
Middle school or below	9.7	3.0	17.4	
Employment status :				
Employed	69.7	83.5	55.8	<0.0001
Unemployed/ out of the labor force	30.2	16.5	44.2	
<u>HEALTH CHARACTERISTICS</u>				
Psychological difficulties :				
No	87.4	87.8	85.2	0.0005
Yes	12.6	12.2	14.8	
Prenatal medical visits : ≥7	87.9	90.3	85.3	<0.0001
<7	12.1	9.7	14.7	

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<u>PARTNER'S CHARACTERISTICS</u>				
Migration status : French	81.4	92.0	43.8	<0.0001
Migrant	18.6	8.0	56.2	
Employment status:				
Employed	88.6	92.8	84.3	<0.0001
Unemployed/ out of the labor force	11.4	7.3	15.7	
<u>SUBSTANCE USE DURING PREGNANCY</u>				
Tobacco smoking: No	78.3	78.1	91.3	<0.0001
Yes	21.7	21.9	8.8	
≥ 10 cigarettes per day				
No	94.9	95.5	98.9	<0.0001
Yes	5.1	4.5	1.1	
Alcohol use:				
Never	65.2	59.3	76.6	<0.0001
At least once	34.8	40.7	23.4	
Binge drinking: Never	96.8	96.7	97.1	0.32
At least once	3.2	3.3	2.9	
Tobacco and/or alcohol use:				
Neither	51.8	46.5	71.3	<0.0001
Tobacco only	13.2	12.7	5.2	
Alcohol only	26.5	31.6	19.9	
Tobacco and alcohol	8.5	9.3	3.6	

Tobacco smoking in pregnancy

In multivariate regression models (**Table 2**), characteristics associated with tobacco smoking in both native French and migrant women were: age < 25, single parenthood and incomplete prenatal care.

In native-born women, tobacco smoking was associated with low educational attainment (high school: OR: 3.09, 95% CI 2.81-3.40; middle school or below: OR: 5.11, 95% CI 4.07-6.42; interaction with migration status: $p < 0.0001$) and unemployment (OR: 1.45, 95% CI 1.30-1.62, interaction with migration status: $p < 0.0001$). In migrant women, these characteristics showed weaker (low educational level) or inverse associations (unemployment). In migrant women, tobacco smoking was specifically associated with psychological difficulties (OR: 1.95, 95% CI 1.32-2.88; interaction with migration status: $p = 0.02$), alcohol use (OR: 1.92, 95% CI 1.35-2.75; interaction with migration status: $p < 0.0001$) and the partner being a migrant (OR: 0.33, 95% CI 0.23-0.48; interaction with migration status: $p < 0.0001$).

Table 2 – Family sociodemographic characteristics and maternal tobacco use during pregnancy in the ELFE study (France, 2011; n=18,014, multivariate ORs, 95% CI)

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	Native-born <i>n smokers:</i> 3,356/15,321 21.9%	Migrant <i>n smokers:</i> 202/2,309 8.8%	p-value of interaction term
<u>SOCIO-DEMOGRAPHIC CHARACTERISTICS</u>			
Age : < 25 years	1	1	
25-29 years	0.90 (0.79-1.04)	0.50 (0.28-0.91)	
30-34 years	0.79 (0.68-0.91)	0.68 (0.38-1.20)	0.60
≥ 35 years	0.75 (0.63-0.88)	0.58 (0.31-1.05)	
Number of children : 1 child	1	1	
>= 1 child	1.03 (0.94-1.13)	0.92 (0.65-1.31)	0.07
Relationship status : Lives with a partner	1	1	
Does not live with a partner	1.64 (1.32-2.03)	1.74 (0.98-3.07)	0.15
Educational attainment : Above high school	1	1	
High school	3.09 (2.81-3.40)	1.86 (1.27-2.74)	<0.0001
Middle school or below	5.11 (4.07-6.42)	1.05 (0.58-1.91)	
Employment status:			
Employed	1	1	
Unemployed/ out of the labor force	1.45 (1.30-1.62)	0.68 (0.47-0.99)	<0.0001
<u>HEALTH CHARACTERISTICS</u>			
Psychological difficulties: No	1	1	
Yes	1.32 (1.17-1.49)	1.95 (1.32-2.88)	0.02
Prenatal visits : ≥7	1	1	
< 7	1.21 (1.05-1.38)	1.23 (0.77-1.96)	0.18
<u>OTHER SUBSTANCE USE ING PREGNANCY</u>			
Alcohol use : No	1	1	
Yes	1.49 (1.37-1.63)	1.92 (1.35-2.75)	<0.0001
<u>PARTNER'S CHARACTERISTICS</u>			
Migration status : Native-born	1	1	
Migrant	0.82 (0.70-0.96)	0.33 (0.23-0.48)	<0.0001
Employment status:			
Employed	1	1	
Unemployed/ out of the labor force	1.30 (1.12-1.52)	1.35 (0.84-2.16)	0.02

Alcohol use in pregnancy

In multivariate regression models (**Table 3**), characteristics associated with alcohol use in both native-born and migrant women were: age ≥ 25 years, having 1 child, educational attainment >high school, employment, tobacco use, the partner being native-born or employed. In migrant women, the likelihood of alcohol use was also elevated in participants who did not live with a partner (OR: 2.12, 95% 1.38-3.25; interaction with migration status: p=0.0006) or had psychological difficulties (OR: 1.46, 95% CI 1.08-1.95; interaction with migration status: p=0.06).

Table 3– Family sociodemographic characteristics and maternal alcohol use during pregnancy in the ELFE study (France, n=18,014, 2011, 18-48 years of age, multivariate ORs, 95% CI)

	Alcohol use		p-value of interaction term	Binge drinking		p-value of interaction term
	Native-born <i>n</i> drinkers: 6,245/15,334 40.7%	Migrant <i>n</i> drinkers: 540/2,312 23.4%		Native-born <i>n</i> binge drinkers: 490/ 15,023 3.3%	Migrant <i>n</i> binge drinkers: 64/ 2,236 2.9%	
<u>SOCIO-DEMOGRAPHIC CHARACTERISTICS</u>						
Age : < 25 years	1	1		1	1	
25-29 years	1.46 (1.27-1.67)	1.35 (0.81-2.25)	0.68	1.13 (0.79-1.62)	0.89 (0.33-2.41)	0.18
30-34 years	2.04 (1.77-2.36)	1.93 (1.17-3.20)		1.32 (0.91-1.91)	1.00 (0.37-2.66)	
≥ 35 years	2.56 (2.20-2.98)	1.76 (1.04-2.96)		1.89 (1.28-2.78)	1.11 (0.40-3.09)	
Number of children : 1 child	1	1		1	1	
>=1 child	0.86 (0.79-0.92)	0.85 (0.67-1.08)	0.36	1.10 (0.89-1.35)	0.72 (0.40-1.29)	0.07
Relationship status :						
Lives with a partner	1	1		1	1	
Does not live with a partner	0.96 (0.76-1.20)	2.12 (1.38-3.25)	0.0006	0.77 (0.42-1.39)	2.78 (1.25-6.18)	0.008
Educational attainment :						
Above high school	1	1		1	1	
High school	0.58 (0.53-0.63)	0.43 (0.33-0.57)	0.05	1.32 (1.06-1.64)	1.18 (0.63-2.21)	0.98
Middle school or below	0.41 (0.31-0.53)	0.33 (0.22-0.50)		1.68 (0.99-2.84)	0.93 (0.38-2.29)	
Own employment status:						
Employed	1	1		1	1	
Unemployed/ out of the labor force	0.75 (0.67-0.84)	0.70 (0.55-0.89)	0.68	0.90 (0.68-1.19)	1.00 (0.56-1.79)	0.68
<u>HEALTH CHARACTERISTICS</u>						
Psychological difficulties : No	1	1		1	1	
Yes	1.14 (1.02-1.26)	1.46 (1.08-1.95)	0.06	1.14 (0.87-1.50)	0.98 (0.47-2.05)	0.85
Prenatal visits : ≥7	1	1		1	1	
< 7	0.97 (0.86-1.10)	1.13 (0.80-1.57)	0.34	1.23 (0.91-1.66)	0.85 (0.37-1.94)	0.60
<u>OTHER SUBSTANCE USE IN PREGNANCY</u>						
Tobacco use : No	1	1		1	1	
Yes	1.50 (1.37-1.64)	1.91 (1.34-2.71)	0.13	2.04 (1.65-2.51)	4.05 (2.15-7.65)	0.04
<u>PARTNER'S CHARACTERISTICS</u>						
Immigration status : Native-born	1	1		1	1	
Migrant	0.46 (0.39-0.53)	0.51 (0.40-0.64)	0.46	0.56 (0.36-0.87)	0.88 (0.50-1.56)	0.32
Employment status:						
Employed	1	1		1	1	
Unemployed/ out of the labor force	0.78 (0.67-0.90)	0.79 (0.55-1.14)	0.55	0.81 (0.54-1.21)	0.64 (0.27-1.52)	0.91

Binge drinking in pregnancy

In multivariate regression models, in both native-born and migrant women levels of binge drinking were elevated in those whose partner was native-born. In native-born women, levels of binge drinking were specifically associated with age ≥ 35 years (OR: 1.89, 95% CI 1.28-2.78) and educational

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attainment \leq high school (OR associated with high school degree: 1.32, 1.06-1.64; OR associated with middle school or below: 1.68, 95% CI 0.99-2.84). In migrant women, binge drinking was associated neither with maternal age nor with educational attainment. In migrant women, the likelihood of binge drinking was elevated in those who did not live with a partner (OR: 2.78, 95% CI 1.25-6.18; interaction with migration status: $p < 0.008$) and smoked tobacco (OR: 4.05, 95% CI 2.15-7.65; interaction with migration status: $p = 0.04$).

Our results were stable but had lower statistical significance when women's migration status was measured using citizenship rather than country of birth (not shown). Among migrant women, single-parenthood was most strongly associated with tobacco or alcohol use in those who were born in North Africa; the relationship between psychological difficulties and tobacco use was strongest in women born in North Africa or in Europe; the relationship between psychological difficulties and alcohol use was strongest in women born in Sub-Saharan Africa (not shown).

Discussion

Main findings

Our study, conducted in a nationally representative sample, confirms high levels of tobacco (21.7%) and alcohol use (34.8%) among pregnant women in France. The novel aspect of our study is that we examined trends and risk factors of tobacco and alcohol use in pregnancy separately among native and migrant women. Native women have higher levels of tobacco and alcohol use than migrant women, but levels of binge drinking are comparable in both groups. Low socioeconomic position is associated with elevated levels of tobacco use and alcohol abuse in native women, while in migrant women the association is reverse. Migrant women who do not live with a partner are especially likely to use alcohol and binge drink. Co-occurring psychological difficulties and the use of another substance are associated with tobacco and alcohol use in both native and migrant women, but associations are stronger in migrants. Overall, tobacco and alcohol use in pregnancy have social determinants which vary with women's migration status.

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Tobacco use

In our study, 21.7% of women reported daily smoking in pregnancy, which is roughly consistent with recent estimates in France (Blondel et al. 2012) and similar to levels observed in the United Kingdom, Spain and Denmark, but higher than in other European countries and in the United States (2012; Tong et al. 2013). Overall, migrant women are approximately two times less likely to smoke (8.8%) than native French women (21.9%), which is similar to findings of prior studies-particularly those that studied migrant women of non-European origin-and probably reflects lower pre-pregnancy levels of smoking (Bansal et al. 2014; Moussa et al. 2010; Nykjaer et al. 2014).

Age below 25 years, single parenthood and incomplete prenatal care were similarly associated with tobacco use in native and in migrant women (Baron et al. 2013; Beijers et al. 2014a; Beijers et al. 2014b; Ekblad et al. 2013). Yet while in native French women, the likelihood of smoking in pregnancy was increased in those who had low socioeconomic position, in migrant women, lack of employment was associated with a decreased likelihood of smoking. Moreover, associations between psychological difficulties and concurrent alcohol and tobacco use were stronger in migrant than in native French women. While in native pregnant women, as in the general population of France, tobacco smoking follows a socioeconomic gradient (Peretti-Watel et al. 2009; Redonnet et al. 2012), this is not the case in migrant women, possibly reflecting a less advanced stage of the tobacco epidemic in their country of origin and more traditional gender roles (Moussa et al. 2010). In native French women tobacco smoking is widespread (over 30% of women of reproductive age are daily smokers) (Beck et al. 2011), but this is not the case of migrant women, particularly if they come from North or Sub-Saharan Africa.

Alcohol use

Levels of alcohol use and binge drinking in pregnancy in our study (34.8% and 3.2%) are consistent with other research in France (Saurel-Cubizolles et al. 2013) but difficult to compare to data from other countries due to differences in populations and measures. Native French women were more

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likely than migrant women to report any use of alcohol, but rates of binge drinking were similar in both groups.

In native French as well as in migrant women, the use of alcohol increased with older age, and decreased in women with more than one child, low educational attainment, lack of employment, tobacco use and the partner being migrant or unemployed. Among migrant women, not living with a partner or having psychological difficulties were associated with more frequent alcohol use. Hence, in native women alcohol use could reflect a low perception of associated risks (Meschke et al. 2013), while in migrant women it may be associated with social or psychological vulnerability. Importantly, binge drinking, which presents higher risks in terms of perinatal and child outcomes (Saurel-Cubizolles et al. 2013), was most frequent in the oldest age group in native French but not in migrant women. Moreover, in contrast to what we observed with regard to any alcohol use, native French women with low education were more likely to report binge drinking than those with higher education. Thus, similar to tobacco use, alcohol abuse in native pregnant women follows a socioeconomic gradient (Berg et al. 2013). In migrant women, levels of binge drinking were elevated in case of single-parenthood, which was not the case in native French women. Occasional intensive alcohol use is probably perceived as more risky than occasional low-level alcohol use, and therefore mainly characterizes women who experience hardship - socioeconomic among the native and social and psychological in migrants.

Limitations

Our study has several limitations. First, women reported their substance use at the time of their child's birth and by definition those who chose not to carry on with a pregnancy or who miscarried were not included. Substance use tends to decrease during pregnancy and would have been higher had we investigated the early stages of gestation (Skagerstrom et al. 2013; Tong et al. 2013). Assessment could be subject to information and social desirability biases. However, pregnant women's substance use is not systematically recorded in medical records and low or occasional levels

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of use are currently difficult to assess using biological measures (Gilligan et al. 2010; Rice et al. 2007), therefore self-reports are the best available method of measurement. To limit bias to the best of our ability, we included the period when women were not aware of being pregnant in our measurement. Nevertheless, we acknowledge that levels of substance use - particularly binge drinking - may be higher and associations with women's characteristics stronger than we report. Second, the ELFE study did not collect information on women's substance use prior to pregnancy or among partners (Bakhireva et al. 2011; Skagerstrom et al. 2013; Xu et al. 2013) and future research should integrate pre-pregnancy habits and characteristics of the family environment. Third, our measure of maternal psychological distress is broad and future studies should ascertain maternal depression and anxiety using validated measures. Fourth, although the ELFE sample included over 18,000 women, the number of migrants was too limited to distinguish specific regions of origin. Additionally, we lacked information on participants' degree of acculturation (duration of residence in France, the language spoken at home) (Lert et al. 2007) and were not able to identify second-generation migrants born in France. We had information on participants' country of origin and citizenship, which can potentially help identify the degree of migrants' acculturation, but in our study turned out to be highly correlated. More detailed information on participants' geographical and cultural origins was collected in later waves of the ELFE study and we plan to study links between acculturation and substance use in future investigations.

Study implications

Our findings have several implications. First, vulnerable women may be less sensitive to prevention messages alerting to the negative consequences of smoking and high alcohol use during pregnancy (Tong et al. 2013). Second, these women may also have greater difficulty decreasing pre-pregnancy levels of substance use. Third, psychological difficulties such as anxiety and depression, which may be heightened during pregnancy, could further impede efforts to quit smoking and limit alcohol intake – particularly in migrant women who simultaneously experience other problems (Dupre et al. 2013;

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Massey & Compton 2013). Fourth, the negative association between lack of employment and tobacco smoking in migrant women suggests that tobacco smoking in this subgroup depends on living circumstances in France but even more so on the stage of the tobacco epidemic and women's status in the country of origin (Moussa et al. 2010; WHO 2013). The role of the partner's migrant status indicates that women's psychoactive substance use also depends on their degree of acculturation, that is the degree to which they embrace traditional gender roles or more modern gender roles generally promoted in France (Lert et al. 2007). This relationship between women's acculturation and their levels of psychoactive substance use should be examined in further detail in future studies.

Conclusions

Despite decades of prevention efforts, tobacco and alcohol use in pregnant women remain frequent in many countries. In France, migrant women are generally less likely to use psychoactive substances than the native-born, however, those who are socially isolated, have psychological difficulties or use one substance may be especially vulnerable to addictive behaviors. This is the case even for women who come from geographical regions where rates of psychoactive substance use are low (North or Sub-Saharan Africa) and whose tobacco and alcohol use may therefore go undetected by health professionals. Our results call for greater efforts to address the burden of tobacco and alcohol use in pregnancy, taking into consideration risk factors specific to diverse sub-groups of the population.

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