

Effect of country-of-origin contextual factors and length of stay on immigrants' substance use in Spain

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Background: Factors explaining disparities in risk of substance use between immigrants and natives and between immigrant subgroups are poorly understood. We aimed to describe such disparities and identify some explanatory factors in Spain. **Methods:** Participants were residents aged 15–64 years from 2005 to 07 nationally representative surveys. Outcomes were prevalences of alcohol, tobacco, sedative-hypnotics, cannabis and other illegal substance use. Immigrants were recent if <5 years of Spanish stay and long term if ≥10 years. Country-of-origin income per capita and population level of substance use were taken from international databases. Adjusted prevalence ratios (aPRs) and percent change from Poisson regression with robust variance were used to estimate risk disparities and effects of immigration variables. **Results:** Most immigrants had lower substance use than natives, although it generally increased with increasing Spanish stay, especially for illegal substances. This lower risk could be partially explained by country-of-origin contextual factors as a lower level of income or substance use and religious or cultural factors such as Islam. By origin, recent immigrant aPRs and convergence–divergence risk patterns were, respectively, as follows: lower aPRs with upward convergence (often incomplete) toward natives' risk in immigrants from Muslim area, Eastern-Europe and Latin-America excluding South-Cone, lower/similar aPRs with upward overtaking or divergent patterns in South-Cone Americans and similar/higher aPRs with stable or upward divergent patterns in Non-Eastern-Europeans. **Conclusion:** Spain is a host context that seems to facilitate increased substance use among immigrants, even those from countries with prevalences close to Spain. However, country-of-origin context is important in explaining disparities in substance use among immigrants.

Introduction

It is often assumed that immigrants show better health than natives upon arrival at the host-country, with subsequent exposure to risk factors (e.g. substance use) and disappearance of the initial advantage over time.¹ Length of stay in the host-country is considered a proxy for acculturation and may unevenly affect some health determinants. Immigrants' substance use upon arrival generally reflects usage in their country-of-origin, with prevalence often lower than in host-country natives.^{2–4} Prevalence then generally rises toward native levels with increasing stay and proficiency in the host language, due to weakening of traditional protective behaviours.^{2,5–10} However, this process may vary by health-related behaviour, host-country, calendar-time and immigrant origin and profile.^{11–17} For example, substance use is often close to that of natives in immigrants from countries with high income¹⁸ or substance use in the population,^{11,19–21} convergence for alcohol use in Muslim immigrants is often lacking^{6,11,13} and divergent trends are found for some substances and immigrant subgroups.¹³ Thus, these aspects should be studied in different host-countries, including Mediterranean Europe, where they have rarely been studied. Assessing effects of country-of-origin contextual factors (predominant religion, population substance use and income) on immigrants' substance use is relevant to identify high-risk groups and learn about the aetiology of substance use. However, these effects, although implicitly hypothesized or assumed,¹¹ have barely been specifically assessed.²² Spain is an interesting country for these studies because immigrants are numerous (5.2 million, 11.6% of residents in 2007), and from varied origins, mainly Andean Region, American South-Cone, North Africa and Eastern-

Europe.^{23–25} This represents a unique opportunity to assess immigrants like South-Cone Americans, who have hardly been studied as a separate group, most of whom have recent European ancestry²⁶ and come from countries with higher levels of income and substance use than other Latin-Americans. Moreover, the Spanish context is characterized by low perceived risks of using legal substances and strong links between substance use among youth, especially alcohol, and socialization with peers in leisure environments.²⁷ The objectives are to assess disparities in substance use risk between immigrants in Spain and natives and the independent effects of country-of-origin contextual factors and length of stay on such risk.

Methods

Participants and variables

Participants were 51 148 people in Spain aged 15–64 years who were included in the 2005 and 2007 national household surveys EDADES. Three-stage random sampling (census sections, households and subject) was used. Samples were stratified by age and region of residence, over-representing people aged 15–34 years and small regions. Response rate was 50.3%. Individual data were collected through self-administered questionnaire (substance use) and face-to-face interview (socio-demographic and other issues). Immigration variables were birthplace and Spanish length of stay. Questions on parental birthplaces were not included, preventing study of its effect. Participants were asked about days of use of tobacco, alcohol, tranquillizers, sleeping pills, cannabis, cocaine-base, cocaine-powder, amphetamines, ecstasy, heroin and

hallucinogens in the previous year and month, days of binge drinking (≥ 5 drinks in approximately a 2-h interval) and quantity-frequency of major alcoholic beverages in the previous month (Supplementary table A1). Some country-of-origin contextual variables were obtained from international databases: predominant religion, gross domestic product per capita (country-of-origin income), monthly prevalences of binge drinking and daily tobacco use, annual prevalence of cannabis use, sum of annual prevalences of cocaine, amphetamine and ecstasy use and daily doses/1000 inhabitants of prescribed anxiolytics and sedative hypnotics (Supplementary table A2).

Data analysis

Outcomes were monthly prevalences of binge drinking, average excessive drinking (AED) and daily tobacco smoking and annual prevalences of sedative-hypnotics, cannabis and other illegal substance use. AED was average daily alcohol intake ≥ 50 cc in men and ≥ 30 cc in women. Sedative-hypnotics included tranquilizers/sleeping pills with or without medical prescription. Foreign-born people (immigrants) were classified by years of Spanish stay as recent (< 5), medium term (5–9) and long term (≥ 10) and by area of origin, classified into five areas based on birth country (Supplementary table A3). Results were weighted to account for strata oversampling. Missing values for area-of-origin and length of stay were 0.9% and 1.0%, respectively, and for outcomes ranged from 0.2% (cannabis) to 1.3% (AED) in natives and 0.3–1.5% in immigrants, without relevant differences by origin.

To identify immigrant-native disparities in substance use, prevalence of outcomes and 95% confidence intervals (95% CIs) were obtained, together with the adjusted prevalence ratio (aPR) of immigrants versus natives from Poisson regression with robust variance in the framework of generalized linear models.^{28,29} Adjustment variables were calendar-year, age, gender, educational level, current employment, socioeconomic position based on occupation, cohabitation and region of residence. Immigrants' risk was considered lower, higher or equal to natives according to aPR value and its statistical significance. The effect of length of stay on substance use risk was assessed by obtaining percent change (PC) in risk associated with each additional year of stay, holding other covariates constant, from models with only immigrants as $PC = [\exp(\beta) - 1] * 100$, where β is the slope, entering length of stay as continuous and adjusting for covariates listed above plus area-of-origin. According to PC value and its statistical significance, a linear trend in risk was classified as upward, downward or stable. To better characterize convergence-divergence patterns in immigrants' risk with increasing length of stay, taking natives' risk as reference, nine categories were defined according to annual PC in length of stay and aPRs of recent and long-term immigrants. Patterns could be upward, downward or stable. An upward pattern could be completely convergent, incompletely convergent, with overtaking or divergent; downward patterns were classified similarly (table 1). Effect of country-of-origin contextual variables was also assessed in models including only immigrants, adjusted for covariates mentioned above plus the contextual variables. Analyses were performed with SPSS, version 22.

Results

Sample characteristics

The study included 45 618 natives and 5530 immigrants (2562 recent, 1859 medium term and 1109 long term), born in 79 different countries (20 countries with > 50 participants), mainly Latin-America excluding South-Cone (45.9%), Muslim area (15.1%), Eastern-Europe (13.9%), American South-Cone (12.0%) and Non-Eastern-Europe (10.6%). Within areas-of-origin, Romanians predominated in Eastern-Europe, Argentinians in

Table 1 Algorithms for defining patterns of convergence-divergence in risk of substance use behaviours among immigrants during their stay in Spain

Converge-divergence pattern	Immigrants' risk compared to natives		Risk trend as immigrants' length of stay increases
	Recent-immigrants	Long-term-immigrants	
Incomplete upward convergence	Lower	Lower	Upward
Complete upward convergence	Lower	Equal	Upward
Upward overtaking	Lower	Higher	Upward
Upward divergence	Equal/higher	Higher	Upward
Incomplete downward convergence	Higher	Higher	Downward
Complete downward convergence	Higher	Equal	Downward
Downward overtaking	Higher	Lower	Downward
Downward divergence	Lower/equal	Lower	Downward
Stable pattern	Lower/equal / higher	Lower/equal / higher	Stable

Immigrants' risk compared to natives: risk of an immigrant subgroup compared to natives measured by aPR. The model includes natives and immigrants (aPR of natives=1) and was adjusted for socio-demographic factors. Recent-immigrants: risk of immigrants with < 5 years of stay. Long-term immigrants: immigrants with ≥ 10 years of stay. Lower: (aPR < 1 , $P < 0.05$) or aPR < 0.75 . Higher: (aPR > 1 , $P < 0.05$) or aPR > 1.33 . Equal: $0.75 \leq aPR \leq 1.33$, $P \geq 0.05$. Risk trend as immigrants' length of stay increases: the linear trend in risk of substance use by length of stay among immigrants could be upward, downward or stable according to the value and statistical significance of annual PC of such risk. $PC = [\exp(\beta) - 1] * 100$, where β is the slope of length of stay from a Poisson model including only immigrants, entered as a continuous variable and adjusting for socio-demographic factors plus area of origin. Upward: (PC $> 0.0\%$, $P < 0.05$) or $\geq 2.0\%$. Downward: (PC $< 0.0\%$, $P < 0.05$) or $\leq -2\%$. Stable: $-2\% < PC < 2\%$, $P \geq 0.05$.

American South-Cone, Ecuadorians and Colombians in Latin-America excluding South-Cone and Moroccans in Muslim area. Most immigrants had a relatively short Spanish stay (median = 5 years, 90% ≤ 18 years). Recent-immigrants ranged from 22.2% (Non-Eastern-Europeans) to 60.5% (Eastern-Europeans). Compared with natives, recent-immigrants were younger, had less skilled jobs, cohabited less frequently with partner/children and had higher perceived risk of substance use and lower perceived accessibility to substances. The proportion of immigrants cohabiting with partner/children, having skilled employment or originating from Non-Eastern-Europe, Muslim area or countries with high income or substance use level rose with increasing Spanish stay (Supplementary table A3). The perceived risk of cannabis and sedative-hypnotics use decreased significantly, albeit slightly and perceived accessibility to illegal substances other than cannabis increased significantly with increasing Spanish stay. Muslim-origin immigrants less frequently had university studies or skilled employment than other immigrants, whereas the opposite occurred with Non-Eastern-Europeans.

Substance use in immigrants by length of Spanish stay and origin

Compared with natives, the prevalence of all behaviours, except binge drinking, was significantly lower in all-origin recent-immigrants and similar in long-term ones. Between-origin

Table 2 Prevalence of substance use behaviours among people aged 15–64 years living in Spain, by immigration status and origin, 2005–07 (%)

Immigration status and origin	Binge drinking ^a		Average excessive drinking ^b		Tobacco ^c		Sedative-hypnotics ^d		Cannabis ^e		Other illegal drugs ^f	
	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI
Natives	12.2	11.9–12.5	3.6	3.4–3.8	32.4	32.0–32.8	6.9	6.7–7.1	11.0	10.7–11.3	3.7	3.5–3.9
All-origin immigrants												
Long term	11.9	10.0–13.8	2.9	1.9–3.9	29.7	27.0–32.4	8.7	7.0–10.4	11.1	9.2–13.0	4.2	3.0–5.4
Medium term	13.0	11.5–14.5	2.7	2.0–3.4	21.9	20.0–23.8	4.2	3.3–5.1	8.0	6.8–9.2	3.1	2.3–3.9
Recent	14.3*	12.9–15.7	2.5*	1.9–3.1	22.5*	20.8–24.2	3.8*	3.0–4.6	8.3*	7.2–9.4	2.4*	1.8–3.0
Muslim-area												
Long term	6.2	4.6–7.8	0.8	0.0–1.9	27.0	24.0–30.0	4.5	3.1–5.9	11.3	9.2–13.4	1.5	0.7–2.3
Medium term	8.1	6.3–9.9	4.4	2.1–6.7	29.0	25.9–32.1	2.4	1.4–3.4	10.5	8.4–12.6	1.7	0.8–2.6
Recent	5.0	3.5–6.5	1.1	0.0–2.4	23.3	20.4–26.2	0.4*	0.0–0.8	8.8	6.9–10.7	0.8	0.2–1.4
American South-Cone												
Long term	15.7	8.8–22.6	8.3	3.1–13.5	37.0	27.9–46.1	7.4	2.5–12.3	17.6	10.4–24.8	13.9	7.4–20.4
Medium term	14.1	9.3–18.9	5.1	2.0–8.2	42.9	36.0–49.8	8.6	4.7–12.5	18.7	13.3–24.1	12.6	8.0–17.2
Recent	14.7	10.2–17.6	0.9*	0.0–1.9	30.9	27.3–34.5	6.0	3.4–8.6	16.3	12.3–20.3	4.2*	2.6–5.8
Latin-America excluding South-Cone												
Long term	12.0	8.5–15.5	2.2	0.6–3.8	19.2	14.9–23.5	8.2	5.2–11.2	7.2	4.4–10.0	2.5	0.8–4.2
Medium term	13.5	11.3–15.7	1.6	0.8–2.4	10.5	8.5–12.5	3.3	2.2–4.4	4.0	2.8–5.3	1.8	1.0–2.6
Recent	17.8*	15.6–20.0	2.2	1.4–3.0	11.4*	9.6–13.2	4.5	3.3–5.7	5.8	4.5–7.2	2.3	1.4–3.2
Eastern-Europe												
Long term	8.3	0.0–17.2	2.7	0.0–7.9	21.6	8.3–34.9	0.0	—	0.0	—	0.0	—
Medium term	11.4	7.5–15.3	1.6	0.1–3.1	38.6	32.7–44.5	3.4	1.2–5.6	5.0	2.4–7.6	0.4	0.0–1.2
Recent	8.9	6.3–11.5	1.8	0.6–3.0	43.1*	38.6–47.6	1.5	0.4–2.6	4.8	2.8–6.8	0.7	0.0–1.5
Non-Eastern-Europe												
Long term	14.0	10.3–17.7	3.3	1.2–5.4	42.1	36.8–47.4	15.5	11.6–19.4	13.5	9.8–17.2	5.2	2.8–7.6
Medium term	24.8	16.6–33.0	6.5	3.7–9.3	26.4	18.0–34.8	9.3	3.8–14.8	18.9	11.5–26.3	8.4	3.1–13.7
Recent	24.0*	16.5–31.5	8.8*	5.4–12.2	28.0*	20.1–35.9	4.8*	1.1–8.5	20.3	13.2–27.4	8.8	3.8–13.8

a: Having five or more drinks in a 2-h interval at least once in last 30 days.

b: Average daily consumption ≥ 50 cc (men) or 30 cc (women) of pure alcohol in last 30 days.

c: Daily tobacco smoking in last 30 days.

d: Cannabis use at least once in last 12 months.

e: Tranquilizers or sleeping pills use with or without medical prescription at least once in last 12 months.

f: Use of cocaine base, cocaine powder, amphetamines, ecstasy, heroin or hallucinogens at least once in last 12 months. 95% CI: Confidence interval of prevalence at 95%. Calculated assuming a binomial distribution. Natives: Spanish-born. All-origin immigrants: immigrants from all areas shown below plus 139 immigrants from other origins (North America, other Non-European countries), which are not shown separately. Muslim area: countries where Islam is the predominant religion. American South-Cone: Argentina, Chile and Uruguay. Latin-America excluding South-Cone: the rest of Latin-American countries. Eastern-Europe: Albania, Bulgaria, Belarus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Slovakia, Former Yugoslav states and Caucasus states. Non-Eastern-Europe: the rest of European countries. Long-term: foreign-born living in Spain ≥ 10 years. Medium-term: foreign-born living in Spain 5–10 years. Recent: foreign-born living in Spain < 5 years.

*The linear trend by immigrants length of stay in Spain (recent, medium-term, long-term) as measured by chi-square for trends was statistically significant ($P < 0.05$).

differences in prevalence were observed. For example, Muslim-origin recent-immigrants showed a very low prevalence of all behaviours, which remained significantly lower than natives in long-term-immigrants, except for cannabis. However, South-Cone Americans and Non-Eastern-Europeans recent-immigrants generally showed a similar or higher prevalence than natives (table 2).

Data on substance use risk in immigrants versus natives (aPR = 1) after adjusting for socio-demographic factors are listed in table 3. Risks in recent-immigrants from Muslim area, Eastern-Europe and Latin-America excluding South-Cone were lower than natives for all substance-use behaviours, except tobacco (Eastern-Europeans) and binge drinking and sedative-hypnotics (Latin-Americans). APRs ≤ 0.33 were found in Muslim-origin immigrants (all behaviours except tobacco), Eastern-Europeans (sedative-hypnotics and illegal substances) and Latin-Americans excluding South-Cone (tobacco). Risks in long-term-immigrants from such origins were similar to or even lower than natives, especially in Muslim area (five behaviours with lower risk). However, risks in Non-Eastern-Europeans and South-Cone American recent-immigrants were quite similar to natives, except for alcohol in Non-Eastern-Europeans (higher risks) and tobacco and AED in South-Cone Americans (lower risks). Risks higher than natives predominated in long-term-immigrants, both in Non-Eastern-Europeans (five

behaviours, aPR ≥ 2.00 for sedative-hypnotics) and South-Cone Americans (four behaviours, aPR ≥ 2.00 for AED and illegal substances).

Effect of country-of-origin context and length of stay on immigrants' substance use

This was assessed in models with only immigrants, adjusted for length of stay, socio-demographic and country-of-origin contextual factors. Immigrants' substance use risks generally increased with increasing country-of-origin substance use level (all substances except alcohol) and country-of-origin income (alcohol and cannabis). Also, some residual area-of-origin effects remained. For example, compared with Muslim-origin immigrants, there was a significantly increased risk for all substances, except tobacco and cannabis, in those from non-Muslim areas taken together. Substance use risk also generally increased with increasing Spanish stay, although the linear trend was sometimes not statistically significant. The strongest upward trends were found for alcohol and illegal substances (South-Cone Americans) and illegal substances (Muslim-origin immigrants). A downward trend was only found for AED in Non-Eastern-Europeans (table 4). Changes in risk seemed much stronger during the first decade of stay than later,

Table 3 Risk of substance use behaviours among immigrants aged 15–64 years compared to natives by length of stay in Spain and origin area, 2005–07 (aPR and 95% CI)

Origin and length of stay in Spain	Binge drinking ^a		AED ^b		Tobacco ^c		Sedative-hypnotics ^d		Cannabis ^e		Other illegal drugs ^f	
	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI
All-origin immigrants												
Long-term	1.06	0.91–1.24	0.83	0.59–1.15	0.89	0.81–0.97	1.20	0.98–1.46	1.17	0.99–1.39	1.16	0.87–1.55
Medium-term	0.92	0.82–1.04	0.69	0.53–0.91	0.57	0.53–0.63	0.74	0.59–0.92	0.56	0.48–0.65	0.65	0.50–0.83
Recent	0.96	0.87–1.06	0.59	0.46–0.77	0.59	0.55–0.64	0.74	0.60–0.91	0.46	0.40–0.52	0.38	0.29–0.50
Muslim area												
Long term	0.53	0.34–0.84	0.19	0.05–0.76	0.77	0.64–0.93	1.17	0.84–1.63	0.40	0.16–1.01	0.40	0.16–1.01
Medium term	0.44	0.29–0.65	0.81	0.46–1.40	0.72	0.61–0.87	0.53	0.38–0.73	0.23	0.10–0.55	0.23	0.10–0.55
Recent	0.23	0.13–0.39	0.26	0.10–0.69	0.59	0.48–0.73	0.32	0.21–0.49	0.04	0.01–0.28	0.08	0.01–0.59
Non-Muslim area												
Long term	1.25	1.05–1.48	1.06	0.74–1.50	0.94	0.85–1.04	1.45	1.18–1.78	1.18	0.97–1.45	1.45	1.06–1.98
Medium term	1.03	0.91–1.17	0.65	0.47–0.90	0.55	0.49–0.60	0.84	0.67–1.06	0.55	0.46–0.65	0.76	0.58–0.99
Recent	1.10	1.00–1.22	0.60	0.45–0.79	0.60	0.55–0.65	0.80	0.64–0.98	0.48	0.42–0.55	0.44	0.33–0.58
American South-Cone												
Long-term	1.55	1.03–2.31	2.78	1.62–4.78	1.15	0.91–1.46	1.13	0.64–2.00	2.08	1.35–3.22	4.79	3.03–7.55
Medium-term	0.94	0.68–1.31	1.53	0.89–2.63	1.06	0.89–1.26	1.34	0.84–2.14	1.18	0.90–1.53	2.14	1.50–3.06
Recent	1.00	0.78–1.29	0.16	0.04–0.65	0.79	0.67–0.94	0.98	0.63–1.50	0.92	0.73–1.16	0.65	0.39–1.09
Latin-America excluding South-Cone												
Long-term	0.99	0.72–1.36	0.58	0.26–1.28	0.56	0.45–0.71	1.09	0.74–1.57	0.76	0.52–1.16	0.85	0.43–1.69
Medium-term	0.99	0.84–1.17	0.43	0.25–0.73	0.28	0.23–0.33	0.59	0.41–0.84	0.30	0.22–0.41	0.45	0.29–0.71
Recent	1.14	1.01–1.30	0.57	0.39–0.85	0.31	0.26–0.36	0.82	0.63–1.08	0.34	0.27–0.43	0.43	0.30–0.63
Eastern-Europe												
Long-term	0.79	0.30–2.07	0.64	0.09–4.60	0.62	0.35–1.09	-	-	-	-	-	-
Medium-term	0.74	0.51–1.05	0.45	0.17–1.19	0.99	0.84–1.15	0.47	0.21–1.05	0.35	0.21–0.60	0.09	0.01–0.63
Recent	0.60	0.45–0.80	0.41	0.20–0.87	1.07	0.96–1.20	0.32	0.15–0.66	0.28	0.19–0.42	0.08	0.02–0.31
Non-Eastern-Europe												
Long-term	1.22	0.95–1.58	1.07	0.61–1.86	1.29	1.14–1.46	2.04	1.55–2.68	1.39	1.05–1.84	1.35	0.83–2.20
Medium-term	1.43	1.01–2.02	1.57	0.77–3.21	0.76	0.56–1.02	1.66	0.96–2.89	1.22	0.81–1.84	1.67	0.90–3.10
Recent	1.44	1.06–1.97	2.25	1.26–4.02	0.87	0.67–1.13	1.11	0.56–2.19	1.02	0.75–1.40	1.19	0.66–2.13

aPR compared to natives and 95% CI.

aPR: prevalence ratio adjusted for year, age, gender, educational level, regular employment, socioeconomic position, cohabitation and area of residence in Spain. Native aPR = 1; 95% CI: confidence interval at 95% of aPR. Natives: Spanish-born. All-origin immigrants: immigrants from all areas shown plus 139 immigrants from other origins (North America, other Non-European countries), which are not shown separately. Muslim area: countries where Islam is the predominant religion. American South-Cone: Argentina, Chile and Uruguay. Latin-America excluding South-Cone: the rest of Latin-American countries. Eastern-Europe: Albania, Bulgaria, Belarus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Slovakia, Former Yugoslav states and Caucasus states. Non-Eastern-Europe: the rest of European countries. Long-term: foreign-born living in Spain ≥ 10 years. Medium-term: foreign-born living in Spain 5–10 years. Recent: foreign-born living in Spain < 5 years.

a: Having five or more drinks in a 2-h interval at least once in last 30 days.

b: Average daily consumption ≥ 50 cc (men) or 30 cc (women) of pure alcohol in last 30 days.

c: Daily tobacco smoking in last 30 days.

d: Cannabis use at least once in last 12 months.

e: Tranquilizers or sleeping pills use with or without medical prescription at least once in last 12 months.

f: Use of cocaine base, cocaine powder, amphetamines, ecstasy, heroin or hallucinogens at least once in last 12 months. *Statistically different from one.

except for tobacco in non-Muslim areas taken together. Moreover, in Muslim area alcohol use risk seemed to rise sharply in the first decade of stay and decrease afterwards.

After excluding country-of-origin substance use from the model, a significant increase in all-origin immigrants' risk ($PC > 1$, $P < 0.05$) with increasing country-of-origin income was found for all behaviours, as well as a positive effect of country-of-origin level of substance use after excluding income. These effects of country-of-origin context were also found in recent-immigrants, although they were not always statistically significant. After entering in the models, the perceived risk of substance use (all substances), and perceived accessibility (illegal substances), the effect of country-of-origin contextual variables and length of stay remained, although weakened, especially for illegal substances.

Convergence–divergence patterns in risk of immigrants' substance use while in Spain

Convergence–divergence patterns in substance use risk during immigrants' stay in Spain were identified by applying algorithms

in table 1 to data in tables 3 and 4. Upward convergences predominated in Latin-Americans excluding South-Cone (five behaviours, for two incomplete) and Muslim-origin immigrants (four behaviours, for two incomplete), stable or upward divergent patterns in Non-Eastern-Europeans (five behaviours) and upward divergent or overtaking patterns in South-Cone Americans (four behaviours). Patterns in Eastern-Europeans could not be well studied due to lack of statistical power, but stable or incomplete convergent patterns seemed predominant.

Discussion

Disparities in substance use between recent-immigrants and natives

Findings suggest that recent-immigrants in Spain had considerably lower risks of substance use than natives. Those from Latin-America excluding South-Cone, Eastern-Europe and Muslim area had lower risks for 15 of 18 possible combinations of behaviour and origin, with especially low risks in the latter two groups. Similar findings

Table 4 Effects of length of stay in Spain and country-of-origin characteristics on substance use behaviours among immigrants aged 15–64 years, Spain, 2007–09

	Binge drinking ^a		AED ^b		Tobacco ^c		Sedative-hypnotics ^d		Cannabis ^e		Other illegal drugs ^f	
	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI
Effect of length of stay in Spain by area-of-origin (PC) ^g												
All-origin	-0.2	-1.3-0.9	0.1	-2.4-2.6	1.5	0.9-2.0	1.8	0.7-3.0	3.3	2.2-4.5	4.3	2.4-6.2
Muslim area	1.9	-1.3-5.1	-3.7	-9.0-1.9	0.9	-0.4-2.3	2.1	-1.8-6.2	8.6	5.9-11.4	16.8	5.5-29.4
Non-Muslim area	-0.4	-1.6-0.9	0.3	-2.5-3.1	1.6	1.0-2.3	1.9	0.6-3.2	2.4	1.1-3.7	4.2	2.2-6.2
American South-Cone	2.0	-0.5-4.6	10.9	7.1-14.8	1.5	-0.5-1.7	0.3	-2.7-3.5	4.4	2.1-6.7	8.3	5.8-10.9
Latin-America excl. South-Cone	-0.4	-2.5-1.9	-1.3	-8.7-6.7	1.7	0.1-3.3	2.1	0.1-4.1	2.4	-0.4-5.2	4.2	0.2-8.4
Eastern-Europe	1.3	-3.6-6.3	0.8	-7.6-23.9	-1.3	-2.4-0.2	-	-	-	-	-	-
Non-Eastern-Europe	-1.6	-3.5-0.3	-4.7	-9.1-0.0	1.8	0.9-2.7	2.3	-1.0-3.8	1.0	-0.9-3.0	2.5	-1.3-6.4
Effect of country-of-origin contextual factors ^h												
Origin-country substance use level (PC) ⁱ	0.2	-0.9-1.2	-1.4	-1.8-1.1	2.9	2.0-3.8	0.5	0.1-1.0	7.4	3.3-11.7	20.8	5.3-38.6
Origin-country income per capita (PC) ⁱ	2.8	1.8-3.9	3.6	1.7-5.5	0.1	-0.7-1.0	0.8	-0.7-2.3	3.0	1.8-4.3	1.3	-2.2-4.9
Area of origin (aPR)												
Muslim area	1		1		1		1		1		1	
Non-Muslim area	2.79	2.08-3.74	2.77	1.38-5.59	0.75	0.65-0.86	1.76	1.03-3.00	1.04	0.82-1.32	2.00	1.03-3.90
American South-Cone	2.37	1.67-2.35	5.74	1.60-20.65	1.18	0.99-1.41	1.68	0.84-3.37	1.53	1.14-2.07	5.02	2.17-11.58
Latin-America excl. South-Cone	2.98	2.22-4.01	2.31	0.85-6.24	0.55	0.47-0.64	1.92	1.13-3.27	0.86	0.65-1.14	2.25	1.12-4.50
Eastern-Europe	1.53	1.06-2.21	3.95	0.50-15.20	1.16	0.96-1.41	0.94	0.44-2.01	0.71	0.47-1.06	0.44	0.12-1.61
Non-Eastern-Europe	1.24	0.69-2.21	2.76	0.50-15.20	1.03	0.69-1.52	1.59	0.61-4.15	0.38	0.20-0.74	2.09	0.36-12.05

a: Having five or more drinks in a 2-h interval at least once in last 30 days.

b: Average daily consumption ≥ 50 cc (men) or 30 cc (women) of pure alcohol in last 30 days.

c: Daily tobacco smoking in last 30 days.

d: Cannabis use at least once in last 12 months.

e: Tranquilizers or sleeping pills use with or without medical prescription at least once in last 12 months.

f: Use of cocaine base, cocaine powder, amphetamines, ecstasy, heroin or hallucinogens at least once in last 12 months.

g: Models including only immigrants adjusted for year, age, gender, educational level, regular employment, socioeconomic position, cohabitation, area of residence in Spain and in all-origin immigrants and non-Muslim area by area-of-origin.

h: Models including only immigrants adjusted for covariates mentioned above plus country-of-origin contextual covariates (country-of-origin level of substance use and income per capita and area-of-origin).

i: PC: percent change of covariates entered in the models as continuous variables (length of stay in Spain, country-of-origin level of substance use and income per capita). $PC = [\exp(\beta) - 1] * 100$, where β is the Poisson slope. Native aPR = 1; 95% CI: confidence interval at 95%. All-origin immigrants: immigrants from all areas shown plus 139 immigrants from other origins (North America, other Non-European countries), which are not shown separately. Muslim area: countries where Islam is the predominant religion. American South-Cone: Argentina, Chile and Uruguay. Latin-America excl. South-Cone: the rest of Latin-American countries. Eastern-Europe: Albania, Bulgaria, Belarus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Slovakia, Former Yugoslav states and Caucasus states. Non-Eastern-Europe: the rest of European countries.

have been reported for people emigrating from poorer to wealthier countries.^{3-8,11,13,15,16,30,31} South-Cone Americans had risks closer to natives than other Latin-Americans, suggesting that Hispanic immigrants are heterogeneous.^{5,15,32,33} Non-Eastern-Europeans had similar or higher risks than natives, which is consistent with previous findings among immigrants from wealthy countries.^{7,11,16,30} In addition to country-of-origin factors discussed below, the healthy immigrant bias (less likelihood of substance users settling in the host-country because of selective arrivals or returns) has been hypothesized to explain the lower substance use among recent-immigrants.^{2,22,34} However, we have not found evidence of this bias. Thus, the age-standardized prevalences of daily tobacco smoking in the 580 immigrants from 18 countries with <2 years of stay and country-of-origin populations (pooled weighted prevalence) were quite similar (19.5% vs. 21.6%, respectively). Also, prevalences in recent-immigrants for alcohol and cannabis use (Argentina, Colombia, Bolivia and Romania) seemed similar or higher than in their age-counterparts in the country-of-origin (Data not shown. See sources in Supplementary table A2). Furthermore, although recent-immigrants from poorer countries may have lower risk than their country-of-origin peers, some evidence suggests that this could be attributed mainly to rapid suppression of substance use (lower initiation and higher cessation) in

the host-country due to low availability of money and time, high sensitivity to punitive policies or social sanctions and low substance accessibility (illegal substances).^{22,35,36}

Changes in risk of substance use while immigrants are in Spain

In general, risk of substance use was considerably higher in long term than recent-immigrants, which could be due to increasing risk within birth cohorts as stay increases (period effect) or higher risk in cohorts born earlier and who came earlier to Spain (cohort effect). These two effects cannot be formally separated in this cross-sectional study. There is evidence that the cohort effect may be relevant in explaining some time trends in tobacco and alcohol use.³⁷⁻³⁹ Therefore, we cannot rule out a possible contribution of this effect in explaining some substance use increases with increasing Spanish stay, especially for tobacco, for which a downward trend in level of use in most countries-of-origin has been described since 1990 (data not shown. See data sources in Supplementary table A2). However, increases in substance use in the initial period after arrival (<10 years) are more likely the result of within-cohort changes in risk after exposure to the host context. This could be explained by progressive weakening of cultural protective factors

linked to country-of-origin or the action of host-country factors promoting substance use, such as progressively increased substance accessibility¹⁷ or affordability, decreased sensitivity to punitive policies or social sanctions, etc.^{22,35,36} Here, the effect of length of stay remains, although slightly weakened, after adjusting for perceived risk of substance use (all substances) and substance accessibility (illegal substances).

The predominant convergence–divergence pattern in Latin-Americans excluding South-Cone and Muslim-origin immigrants was upward convergence, often incomplete, which has also been found elsewhere.^{2–8,10,11,13,15,16,30–33} The persistence of lower risks compared with natives in long-term immigrants, or even in their host-country-born descendants (incomplete convergence), has been described mainly in Muslims immigrants for alcohol or tobacco,^{6,11,13} and less frequently in other groups for tobacco.^{8,22} The lower alcohol use among Muslims can be explained by religious rules, but in this and other groups, other long-lasting country-of-origin contextual factors probably act, which could cushion the alleged impact of host-country exposure. In non-Eastern-Europeans, and especially in South-Cone Americans, upward overtaking or divergent patterns were often found with increasing stay, with risks in long-term-immigrants significantly exceeding those of natives. This could be explained by the special ability of these immigrants (most South-Cone Americans have European ancestry from migrations in XIX and XX centuries²⁶) to integrate in the Spanish lifestyle and by access to substances in an environment with high availability. However, since many long-term South-Cone Americans arrived to Spain in the short period 1975–85 as a consequence of military dictatorships, a cohort effect cannot be ruled out. Upward divergent or overtaking patterns, although infrequent, have been found elsewhere, mainly in immigrants from wealthy countries.^{11,13,14} Changes in risk seemed stronger in the first decade of stay than later, both in Muslim-origin and non-Muslim-origin immigrants, except for tobacco in the latter. A greater increase in tobacco use after 10–15 years of immigrant stay has been also found in the USA.⁷ In Muslim-origin immigrants, reduced alcohol use was found in the second decade of stay, after a significant prior increase, which is surprising and explains the absence of convergence of these indicators.

Effect of country-of-origin context on immigrant substance use

Our findings suggest that substance use risk in immigrants significantly increases with increasing income or substance use in the country-of-origin population; the first contextual indicator having direct effects for alcohol use, indirect effects —mediated by the second—on use of tobacco, sedative-hypnotics and illegal drugs other than cannabis and both effects for cannabis. These effects had been previously hypothesized^{11,22,34} and may help explain immigrant-native disparities in substance use and the much higher risk in immigrants from wealthier than poorer countries found in Spain or elsewhere.^{6,7,11,33,40} Other country-of-origin contextual factors, probably religious or cultural, also condition immigrants' substance use. Thus, a much lower risk in Muslim-origin compared with other immigrants was found for all substances, except tobacco and cannabis, which had already been reported elsewhere for alcohol.^{6,11,13}

Strengths and limitations

The main study strengths are assessment of independent effects of country-of-origin contextual factors previously poorly studied, systematic classification of convergence–divergence patterns in risk with increasing immigrant stay and focus on a host-country (Spain), origin subgroups (e.g. South-Cone Americans or Eastern-Europeans) and outcomes (illegal substances, sedative-hypnotics) with little information available. Limitations include the cross-

sectional design, low statistical power to assess outcomes by origin, possible heterogeneity of some effects by country-of-origin within areas and self-reporting, which may have caused immigrant group-specific bias if the non-response, recall or sincerity was differential. However, the proportion of missing values in outcomes was low, without relevant differences by origin. Also, immigration history (e.g. parental birthplaces) was not recorded, preventing assessment of the effect of generation and being a descendent of a mixed-couple (one native and one immigrant). Finally, between-group disparities were only assessed with relative measures (risk ratios); so one must consider outcome prevalences when interpreting the public health relevance of the findings.

Recommendations for policy and further research

The findings suggest that Spain is a host context that could facilitate increased substance use among immigrants, even those from countries with prevalences close to those of Spain, prevailing upward patterns, either convergent toward natives' risk (e.g. Muslim-origin, Latin-Americans excluding South-Cone) or divergent or with overtaking (South-Cone Americans and Non-Eastern-Europeans). Thus, preventive policies should target all immigrants in Spain, especially during the first decade after arrival, to mitigate the unwanted effects of acculturation. Efforts should focus on all substances, including those most widespread in the population (alcohol, tobacco), but also those with the largest relative risk increases (illegal drugs, sedative-hypnotics). Some immigrants (e.g. Muslims) seem quite protected against substance use by country-of-origin contextual factors, probably religious or cultural, whose effect seems long lasting. Consequently, they could be valuable allies for community action programs. These studies should be replicated in specific countries, as it is generally not appropriate to extrapolate findings from elsewhere. Future research should better assess effects of length of stay in the host-country as well as host-country contextual factors in substance use risk, using samples with sufficient heterogeneity and statistical power, and, if possible, longitudinal studies.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Key points

- Most immigrants in Spain had lower substance use than natives.

- Lower country-of-origin income and substance use partially explain this lower risk.
- Muslim-country origin is also protective against substance use.
- The risk often increased with Spanish stay, even if country-of-origin risk was high.
- Preventive actions should reach all immigrants during the first decade of stay.

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