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ORIGINAL ARTICLE

Immigration to the USA and risk for mood and anxiety disorders: variation by origin and age at immigration

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Background. Risk for mood and anxiety disorders associated with US-nativity may vary across immigrant groups.

Method. Using data from the National Epidemiological Study of Alcohol and Related Conditions (NESARC), we examined the association of lifetime risk for mood and anxiety disorders with US-nativity and age at immigration across seven subgroups of the US population defined by country or region of ancestral origin: Mexico, Puerto-Rico, Cuba, Central and South America, Western Europe, Eastern Europe, and Africa and the Caribbean. Discrete time survival models were used to compare lifetime risk between the US-born, immigrants who arrived in the USA prior to the age of 13 years and immigrants who arrived in the USA at the age of 13 years or older.

Results. The association of risk for mood and anxiety disorders with US-nativity varies significantly across ancestral origin groups ($p < 0.001$). Among people from Mexico, Eastern Europe, and Africa or the Caribbean, risk for disorders is lower relative to the US-born among immigrants who arrived at the age of 13 years or higher (odds ratios in the range 0.34–0.49) but not among immigrants who arrived prior to the age of 13 years. There is no association between US-nativity and risk for disorder among people from Western Europe and Puerto Rico.

Conclusions. Low risk among immigrants relative to the US-born is limited to groups among whom risk for mood and anxiety disorder is low in immigrants who spent their pre-adolescent years outside of the USA.

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Key words: Anxiety disorders, epidemiology, immigration, mood disorders, United States.

Introduction

Since the early 1980s epidemiological research has found evidence of an 'immigrant paradox' with respect to mental health: immigrants to the USA have lower risk for mood and anxiety disorders compared with the US-born population of the same national origin (Burnam *et al*. 1987; Vega *et al*. 1998; Grant *et al*. 2004; Alegría *et al*. 2008). This apparent intergenerational change within migrating populations suggests that environmental factors are responsible for the elevated risk for these disorders among the US-born (Haenszel, 1970; Rutter, 2005). Particular attention has been given to adversities specific to the process of adaptation to the USA among immigrant groups, such as discrimination, family stressors and detachment from familiar cultural patterns (Rogler *et al*. 1991; Alegria *et al*. 2007*b*). However, recent research suggests that the increase in risk for mood and anxiety disorders associated with US-nativity may be more limited than suggested by previous research. Understanding the pattern of change in risk for mood and anxiety disorders that occurs among immigrant groups as they settle in the USA is important both for identifying etiological factors and for improving services for underserved ethnic minority groups (Rogler, 1994; Escobar & Vega, 2000; Bhugra, 2004).

Evidence suggesting a higher risk of mood and anxiety disorders among US-born individuals than among foreign-born individuals who have immigrated to the USA is limited in two important ways. First, this association is not universal across immigrant

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Table 1. *Epidemiological comparisons of risk for mood and anxiety disorders between immigrants and the US-born*

Group origin	Study name (region)	Citations	Sample size: immigrants, US-born	Languages of interview	Lower risk among immigrants than US-born?
White/Black/ Hispanic	NCSR	Breslau *et al*. (2007*b*)	Immigrants: 299 US-born: 5124	English	Yes
Non-Hispanic Whites	NESARC	Grant *et al*. (2004); Alegria *et al*. (2006)	Immigrants: 1541 US-born: 23262	English, Spanish	Yes
	NLAAS	Alegría *et al*. (2008)	Immigrants: 134 US-born: 4088	English, Spanish	Yes
All Hispanics	NLAAS	Alegria *et al*. (2007*a*)	Immigrants: 1630 US-born: 924	English, Spanish	No
Mexico	ECA (Los Angeles)	Burnam *et al*. (1987); Karno *et al*. (1989)	Immigrants: 706 US-born: 538	English, Spanish	Yes
	NCS	Ortega *et al*. (2000)	Immigrants: 319 US-born: 58	English	Yes
	MAPSS (Fresno, CA)	Vega *et al*. (1998)	Immigrants: 1810 US-born: 1202	English, Spanish	Yes
	NESARC	Grant *et al*. (2004)	Immigrants: 2227 US-born: 2331	English, Spanish	Yes
	NLAAS	Alegría *et al*. (2008)	Immigrants: 488 US-born: 380	English, Spanish	Yes
Puerto Rico[a]	NCS	Ortega *et al*. (2000)	Immigrants: 54 US-born: 16	English	No
	NESARC	Alegria *et al*. (2006)	Immigrants: 434 US-born: 563	English, Spanish	No
	NLAAS	Alegría *et al*. (2008)	Immigrants: 217 US-born: 278	English, Spanish	No
Cuba	NESARC	Alegria *et al*. (2006)	Immigrants: 353 US-born: 97	English, Spanish	No
	NLAAS	Alegría *et al*. (2008)	Immigrants: 501 US-born: 76	English, Spanish	No
Other Hispanic	NCS	Ortega *et al*. (2000)	Immigrants: 68 US-born: 38	English	Yes
Asia	NLAAS	Takeuchi *et al*. (2007*b*)	Immigrants: 1639 US-born: 454	English, Tagalog, Mandarin, Cantonese, Vietnamese	Yes in women, no in men
	NESARC	Breslau & Chang (2006)	Immigrants: 954 US-born: 282	English, Spanish	Yes
China	CAPES	Takeuchi *et al*. (1998); Hwang *et al*. (2005)	Immigrants: 1658 US-born: 86	English, Mandarin, Cantonese	Yes
Caribbean Blacks	NSAL	Williams *et al*. (2007)	Immigrants: 1160 US-born: 440	English	Yes

NCSR, National Comorbidity Survey Replication; NESARC, National Epidemiological Survey of Alcohol and Related Conditions; NLAAS, National Latino and Asian American Survey; ECA, Epidemiological Catchment Area Survey; NCS, National Comorbidity Survey; MAPSS, Mexican-American Prevalence and Services Study; CAPES, Chinese-American Psychiatric Epidemiology Survey; NSAL, National Survey of American Life.

[a] In the case of Puerto Rico, a commonwealth of the USA, 'immigrant' refers to those born on the island of Puerto Rico and 'US-born' refers to those born in the continental USA.

groups. Table 1 summarizes results of population-based epidemiological studies that have compared lifetime risk for mood and anxiety disorders between immigrants and the US-born and the specific groups in which these comparisons have been made, as defined by ethnicity within the USA and country or region of ancestral origin. In studies that examined all immigrants as a single group (Breslau *et al*. 2007*b*) and

studies that examined immigrants grouped by ethnicity in the USA [i.e. Hispanics (Alegria *et al*. 2007*a*), non-Hispanic Black (Williams *et al*. 2007), non-Hispanic White (Grant *et al*. 2004), Asian-Americans (Breslau & Chang, 2006; Takeuchi *et al*. 2007*b*)] the finding of lower risk among immigrants relative to the US-born is universal. However, studies that have examined groups by country or region of origin have found some important exceptions to this rule: among people of Puerto Rican and Cuban origin, studies have found no difference in risk of mood and anxiety disorders between US-born and foreign-born individuals (Ortega *et al*. 2000; Alegria *et al*. 2006; Alegría *et al*. 2008).

Second, recent evidence suggests that the low risk among immigrants relative to the US-born is limited to immigrants who arrived in the USA as adolescents or adults. For example, Breslau *et al*. reported no differences in risk for psychopathology between all immigrants who arrived in the USA prior to the age of 13 years and the US-born (Breslau *et al*. 2007*b*). Similar findings have been reported among Hispanics (Alegria *et al*. 2007*c*) and Asians (Breslau & Chang, 2006; Takeuchi *et al*. 2007*a*). The implication of these studies is that nativity differences in the risk of psychiatric disorders are driven by factors surrounding the experiences of immigration during early stages of development. However, this hypothesis has not been investigated within particular immigrant groups.

The goal of this paper is to advance our understanding of the etiological factors that might explain the consistent finding of low risk among immigrants to the USA relative to the US-born by examining variation in this pattern across groups with origins in different countries or world regions. Data on 33 601 Hispanics, non-Hispanic Whites and non-Hispanic Blacks from a large national survey of psychiatric disorders in the USA are used to examine these associations in seven groups of different national or regional origin. The seven groups include: four Hispanic groups, those from Mexico, Cuba, Puerto Rico, and Central or South America; two non-Hispanic White groups, those from Western and Eastern Europe; and one non-Hispanic Black group, those from Africa or the Caribbean.

Method

Sample

Data come from the National Epidemiological Survey of Alcohol and Related Conditions (NESARC), a survey ($n = 43\,093$) of the adult (age 18+ years) US household population conducted by the US Bureau of the Census for the National Institute of Alcohol Abuse and Alcoholism (Grant *et al*. 2003*b*). The survey was conducted under the auspices of the US Bureau of the Census. The response rate was 81%. Informed consent procedures were approved by the US Census Bureau and the US Office of Management and Budget. The design and weighting methodology are described in detail elsewhere (Grant *et al*. 2003*b*).

Survey instrument

Diagnoses were based on fully structured face-to-face computer-assisted interviews administered by trained non-clinician interviewers using either the English or Spanish versions of the Alcohol Use Disorder and Associated Disabilities Interview Schedule – DSM-IV version (AUDADIS; Grant *et al*. 2003*a*). In this report, we examine any anxiety disorder (social phobia, specific phobia, agoraphobia/panic disorder or generalized anxiety disorder) and any mood disorders [major depression, dysthymia or bipolar disorder (1 or 2)]. Age of onset was defined as the age at which the first disorder in the category began.

A test–retest reliability study conducted in a subsample of NESARC respondents found fair reliability for lifetime diagnoses of anxiety disorders ($\kappa = 0.42$–0.48) and slightly better reliability for dysthymia ($\kappa = 0.58$) and major depression ($\kappa = 0.65$). Due to low prevalence, reliability for bipolar disorder could not be examined (Grant *et al*. 2003*a*).

Immigrant groups

Information on race/ethnicity and country of origin was used to identify seven groups within which differences by nativity (foreign *versus* US-birth) and age at immigration were compared.

Race/ethnicity

Respondents were asked to self-identify their race/ethnicity in two questions. The first asked whether the respondent was Hispanic. The second asked respondents to identify the racial category or categories to which they belong from the following list, which was presented in a respondent booklet: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Other. Only Hispanics, non-Hispanic Blacks and non-Hispanic Whites were included in this analysis. Respondents who indicated membership in more than one of the above race/ethnic groups were classified into the first of the above groups they indicated.

Origin/descent

Respondents were asked 'What is your origin or descent?' and asked to choose one category from a list of 59 countries and regions presented in a respondent booklet.

Definition of origin groups

Combining information on ethnicity and origin/descent we defined seven groups that share a region or country of origin and US ethnicity: (1) Western European, White or Hispanic; (2) Eastern European, White; (3) Mexican, Hispanic; (4) Cuban, Hispanic; (5) Puerto Rican, Hispanic; (6) Central or South American, Hispanic; (7) African or Caribbean, Black. Note that the Asian-American sample from this survey was examined in a previous paper (Breslau & Chang, 2006) and is not included here. The sample comprised of these seven groups included 33 601 respondents; 28 006 US-born and 5595 immigrants.

Foreign versus *US birth*

Respondents were asked whether they were born in the USA, and, if not, the length of time they have lived in the USA.

Age at immigration

Respondents were asked the age at which they arrived in the USA. We divided immigrants into two groups: immigrants who arrived as children (age $\leqslant$13 years) and immigrants who arrived as adolescents or adults (age $>$13 years).

Statistical analysis

Lifetime prevalence of mood and anxiety disorders was estimated as the proportion of respondents in the sample who met criteria for a disorder at any time in their life. Study hypotheses concerning the association of US-nativity and age at immigration with risk for mood and anxiety disorders were assessed using partial logistic regression (Efron, 1988), a discrete time survival analysis model (Allison, 1982). In these models, biographical information collected from respondents is segmented into person-years, beginning at age 5 years and extending to either the year of disorder onset or the year in which the respondent was interviewed. Associations between study covariates and the odds of having a disorder onset are estimated in a logistic regression model controlling for age in each person-year of risk, sex, birth cohort and region of origin. To account for the complex survey design, standard errors were calculated using Taylor series linearization as implemented in the SUDAAN software package (Software for Data Analysis, version 8.1; Research Triangle Institute, Research Triangle, NC, USA). A small number of observations ($n=55$) with missing values on key predictors were excluded from analysis.

Differences between those born outside of the USA (or Puerto Rico) and those born in the USA were assessed using a binary indicator for US-nativity. Heterogeneity of the US-nativity effect across origin groups was then assessed through a test of the statistical interaction between the indicator of US-nativity and the indicators for region of origin. Heterogeneity of risk by age at immigration was assessed separately within each origin group.

Results

Samples for each origin group

The sample sizes for the seven groups range from 450 for Cubans to 16 195 for Western Europeans (Table 2). There are large differences across groups in the proportion of US-born and the proportion of early *versus* late immigrants among the foreign-born. The smallest subgroups are those who arrived in the USA before age 13 years from Eastern Europe ($n=42$) and Cuba ($n=76$). Within origin groups, US-nativity and age at immigration are significantly associated with age at interview in four of the seven groups and with sex in one of the seven groups. Note that the sample sizes within groups defined by US-nativity and age at immigration do not sum to the total for each group because of observations that were dropped due to missing information on age at immigration.

Association between US-nativity and lifetime risk

In the entire sample, the immigrants as a group are less likely to have had a mood [odds ratio (OR) 0.64, 95% confidence interval (CI) 0.58–0.70] or anxiety (OR 0.59, 95% CI 0.52–0.68) disorder compared with the US-born, when age, sex and origin are statistically controlled. The interaction between US-nativity and origin was statistically significant for both mood [$\chi^2(6)=5.70$, $p<0.001$] and anxiety [$\chi^2(6)=6.67$, $p<0.001$] disorders. Subsequent analyses were stratified by origin.

Group-specific associations between generation and risk

Table 3 presents comparisons of lifetime prevalence (%, unadjusted) and lifetime risk (OR, adjusted for age and sex) by US-nativity and age at immigration within each of the seven origin groups.

Table 2. *Sample characteristics*[a]

		Age (%)				Sex (%)	
	Total (*n*)	18–25	26–39	40–54	55+	Male	Female
Hispanics							
Mexico							
Total	4558	45.37	28.16	17.33	9.14	52.01	47.99
US-born	2320	46.63	23.08	18.3	11.99	45.85	54.15
Immigrated age <13 years	440	62.52	23.73	9.49	4.26	50.51	49.49
Immigrated age ⩾13 years	1787	40.71	33.73	18.04	7.52	57.98	42.02
		$\chi^2(10)=31.16$, $p<0.001$				$\chi^2(2)=22.39$, $p<0.001$	
Cuba							
Total	450	19.04	28.97	20.67	31.33	49.91	50.09
US-born	97	38.21	39.31	15.83	6.66	48.35	51.65
Immigrated age <13 years	76	22.33	56.15	19.37	2.14	48.33	51.67
Immigrated age ⩾13 years	277	10.56	16.51	22.95	49.98	51	49
		$\chi^2(10)=18.28$, $p=0.011$				$\chi^2(2)=0.38$, $p=0.826$	
Puerto Rico							
Total	997	32.78	28.3	23.96	14.97	46.06	53.94
US-born	561	43.44	33.7	16.64	6.21	46.43	53.57
Immigrated age <13 years	135	26.45	26.16	35.99	11.4	48.84	51.16
Immigrated age ⩾13 years	299	13.71	18.13	33.42	34.73	44	56
		$\chi^2(10)=11.58$, $p=0.089$				$\chi^2(2)=0.87$, $p=0.648$	
Central and South America							
Total	1038	36.97	30.07	25.92	7.04	47.42	52.58
US-born	139	46.13	29.72	15.99	8.16	46.7	53.3
Immigrated age <13 years	140	73.84	18.11	4.67	3.38	47.08	52.92
Immigrated age ⩾13 years	755	29.41	32.13	30.99	7.48	47.59	52.41
		$\chi^2(10)=12.05$, $p=0.077$				$\chi^2(2)=0.030$, $p=0.984$	
Non-Hispanic Whites							
Western Europe							
Total	16 195	21.3	23.23	28.75	26.71	48.14	51.86
US-born	15 564	21.43	23.11	28.93	26.54	48.24	51.76
Immigrated age <13 years	227	23.61	34.25	24.08	18.06	45.75	54.25
Immigrated age ⩾13 years	387	13.43	22.6	22.74	41.23	44.47	55.53
		$\chi^2(10)=37.01$, $p<0.001$				$\chi^2(2)=1.74$, $p=0.424$	
Eastern Europe							
Total	2037	20.32	25.1	26.14	28.44	51.17	48.83
US-born	1784	19.69	25.53	26.56	28.22	51.98	48.02
Immigrated age <13 years	42	42.54	19.48	17.95	20.03	40.04	59.96
Immigrated age ⩾13 years	209	21.19	22.72	24.33	31.75	46.82	53.18
		$\chi^2(10)=5.59$, $p=0.478$				$\chi^2(2)=1.98$, $p=0.376$	
Non-Hispanic Blacks							
Africa/Caribbean							
Total	8326	30.76	26.43	25.31	17.5	43.96	56.04
US-born	7541	30.7	25.72	25.29	18.29	43.81	56.19
Immigrated age <13 years	153	59.19	26.56	12.44	1.8	43.3	56.7
Immigrated age ⩾13 years	613	24.56	33.25	28.58	13.61	45.52	54.48
		$\chi^2(10)=21.02$, $p=0.005$				$\chi^2(2)=0.45$, $p=0.800$	

[a] Total sample size (all groups) = 33 601. Fifty-five respondents missing data on nativity were excluded.

Among the four Hispanic groups, statistically significant lower risk among immigrants relative to the US-born is found only among immigrants of Mexican origin who arrived in the USA at the age of 13 years or older [for both mood (OR 0.44) and anxiety disorders (OR 0.49)] and among both groups of immigrants of

Table 3. *Lifetime prevalence and risk for mood and anxiety disorders by US-nativity and age at immigration across seven immigrant groups in the USA*[a]

	Any mood disorder				Any anxiety disorder			
	Lifetime prevalence % (S.E.)		Adjusted OR (95% CI)		Lifetime prevalence % (S.E.)		Adjusted OR (95% CI)	
Hispanics								
Mexico								
US-born	19.11	(1.51)	1		17.07	(1.45)	1	
Immigrated age <13 years	16.64	(2.28)	0.82	(0.58–1.15)	14.62	(2.1)	0.87	(0.59–1.30)
Immigrated age ⩾13 years	8.53	(0.87)	0.44	(0.35–0.56)*	8.49	(1.05)	0.49	(0.37–0.65)*
	$\chi^2(2)=26.83$, $p<0.001$				$\chi^2(2)=18.30$, $p<0.01$			
Cuba								
US-born	20.56	(6.52)	1		15.75	(5.43)	1	
Immigrated age <13 years	28.3	(12.11)	1.72	(0.84–3.51)	10.21	(6.77)	0.58	(0.17–1.93)
Immigrated age ⩾13 years	8.84	(3.18)	0.57	(0.27–1.19)	9.17	(1.87)	0.63	(0.23–1.69)
	$\chi^2(2)=3.24$, $p=0.206$				$\chi^2(2)=1.13$, $p=0.571$			
Puerto Rico								
US-born	23.41	(2.46)	1		18.69	(2.18)	1	
Immigrated age <13 years	24.67	(3.7)	1.05	(0.72–1.52)	21.99	(3.71)	1.19	(0.79–1.80)
Immigrated age ⩾13 years	26.87	(5.27)	1.17	(0.73–1.87)	22.61	(3.45)	1.32	(0.81–2.12)
	$\chi^2(2)=0.37$, $p=0.831$				$\chi^2(2)=0.82$, $p=0.666$			
Central South America								
US-born	18.9	(5.09)	1		24.29	(5.2)	1	
Immigrated age <13 years	16.47	(4.47)	0.84	(0.39–1.87)	10.1	(3)	0.39	(0.17–0.86)*
Immigrated age ⩾13 years	12.1	(1.55)	0.58	(0.31–1.07)	8.77	(1.03)	0.31	(0.19–0.52)*
	$\chi^2(2)=2.33$, $p=0.319$				$\chi^2(2)=8.03$, $p=0.023$			
Non-Hispanic Whites								
Western Europe								
US-born	22.08	(0.48)	1		19.5	(0.53)	1	
Immigrated age <13 years	22.14	(3.2)	0.98	(0.71–1.36)	19.08	(3.05)	0.92	(0.64–1.32)
Immigrated age ⩾13 years	19.66	(2.52)	0.96	(0.71–1.30)	21.02	(2.38)	1.11	(0.86–1.43)
	$\chi^2(2)=0.96$, $p=0.620$				$\chi^2(2)=0.46$, $p=0.796$			
Eastern Europe								
US-born	20.83	(1.16)	1		19.17	(1.15)	1	
Immigrated age <13 years	22.29	(8.03)	0.95	(0.43–2.13)	17.17	(5.81)	0.86	(0.41–1.78)
Immigrated age ⩾13 years	7.9	(1.85)	0.34	(0.21–0.55)*	8.14	(1.98)	0.39	(0.23–0.64)*
	$\chi^2(2)=13.09$, $p=0.003$				$\chi^2(2)=10.67$, $p=0.007$			
Non-Hispanic Blacks								
Africa/Caribbean								
US-born	16.28	(0.62)	1		15.44	(0.68)	1	
Immigrated age <13 years	12.67	(3.07)	0.98	(0.60–1.60)	13.53	(2.59)	0.88	(0.58–1.34)
Immigrated age ⩾13 years	7.72	(1.31)	0.43	(0.31–0.60)*	7.66	(1.37)	0.47	(0.32–0.67)*
	$\chi^2(2)=12.17$, $p=0.004$				$\chi^2(2)=8.74$, $p=0.017$			

S.E., Standard error; OR, odds ratio; CI, confidence interval.

[a] Association of lifetime prevalence with US-nativity and age at immigration tested with design-adjusted χ^2 tests. OR estimated in discrete time survival models controlling for age and sex.

* OR significantly different from 1 at $p=0.05$.

South or Central American origin [for anxiety disorders only (OR 0.31–0.39)].

Among the two non-Hispanic White groups, risk among immigrants is significantly lower than among the US-born only for immigrants from Eastern Europe who arrived in the USA at the age of 13 years or older. This group has significantly lower risk for both mood (OR 0.34) and anxiety disorders (OR 0.39) compared with those born in the USA.

Among people of African or Caribbean origin, those who arrived in the USA at the age of 13 years or older have lower risk than the US-born for mood (OR = 0.43) and anxiety disorders (OR = 0.47).

Discussion

In this study we used a large national survey to examine patterns of lifetime risk for mood and anxiety disorders associated with US-nativity and age at immigration across a more diverse set of immigrant groups than has been examined in any previous study. While previous studies have suggested that an immigrant paradox exists for mental health in the USA, i.e. that immigrants have lower risk than would be predicted by their socio-economic position, our findings suggest that the immigrant advantage in risk for mood and anxiety disorders is limited in several respects. First, among some groups immigrants are not at lower risk for these disorders than the US-born. Second, among groups in which immigrants have an advantage with respect to the US-born in lifetime risk for mood and anxiety disorders, this advantage is generally limited to those immigrants who arrived in the USA as adolescents or adults, i.e. older than the age of 12 years. Two exceptions to this second pattern are noted below.

Comparison of our results with previous studies summarized in Table 1 shows that our results are consistent with prior studies that have compared immigrants with US-born when those prior studies defined groups as we have done here. Specifically, previous studies of Mexican-Americans (Grant *et al*. 2004) and African-Americans (Williams *et al*. 2007) have found lower risk among immigrants relative to the US-born and studies of Puerto Ricans and Cubans (Alegría *et al*. 2008) have found no differences between the Island-born and mainland born. These consistencies across studies strengthen our confidence in these results. This is the first study to distinguish people of Western European and Eastern European origin, to examine people of Central or South American origin, and to examine age at immigration across this broad range of immigrant groups.

Groups without nativity differences in risk for disorders

We found no evidence of an association of lifetime risk for mood and anxiety disorders with US-nativity and age at immigration among Hispanics from Puerto Rico or non-Hispanic Whites from Western Europe. In both cases, immigrants have equally high levels of risk as the US-born, regardless of the age at which they arrived in the USA. Previous studies of people of Puerto Rican origin in the USA have also found no association between US-nativity and risk for psychiatric disorder (Ortega *et al*. 2000; Alegría *et al*. 2008), and epidemiological evidence from Puerto Rico also suggests that risk for disorder is equally high there as among the US general population (Canino *et al*. 1987).

Previous studies have included people of Western European origin in the broader category of non-Hispanic White (Grant *et al*. 2004; Alegria *et al*. 2006; Breslau *et al*. 2007*b*), which in the USA includes people from Eastern Europe and the Middle East as well as people of European ancestry from other areas of the world. Our results suggest that people of Western European origin are an important exception to the pattern of lower risk among immigrants relative to the US-born that has been reported in those studies. There are no studies of mood and anxiety disorders in samples representative of the sending population of Western Europe. Published data from the European Study of the Epidemiology of Mental Disorders (ESEMeD) study, which included six Western European countries (France, Spain, The Netherlands, Italy, Germany and Belgium) found lower lifetime prevalence of mood (14.0%) and anxiety (13.6%) disorders compared with our findings (Alonso *et al*. 2004). However that study did not include England or Ireland, the two largest sources of immigrants to the USA in Western Europe.

It is important to note that these two groups, Puerto Ricans and Western Europeans, though similar in having high levels of risk regardless of place of birth or age at immigration, are very different with respect to cultural backgrounds, levels of development in country of origin and motivation for immigration.

Groups with lower risks of disorders among immigrants

In three groups from three different world regions – Hispanics from Mexico, non-Hispanic Whites from Eastern Europe, and non-Hispanic Blacks from Africa or the Caribbean – we found a very similar pattern of differences in the risk for mood and anxiety disorders. In each of these groups, there was no difference in lifetime risk between immigrants who arrived in the USA at the age of 13 years or younger and the US-born, but lower risk among immigrants who arrived after the age of 13 years compared with the US-born. This pattern is identical to that found in a previous study of people of Asian origin from this survey (Breslau & Chang, 2006). In all four of these groups, the association between risk for mood and anxiety disorders is due to differences between people who spent their early childhood in the USA and those who spent their early childhood outside of the USA. This

pattern strongly suggests that factors present in early development account for this association (Breslau *et al*. 2007*b*; Takeuchi *et al*. 2007*a*). Of these three groups, comparable studies are available only for Mexico, where studies have found lower lifetime prevalence for mood (9.1%) and anxiety (14.3%) disorders than in the USA (Medina-Mora *et al*. 2003).

Hispanics of Cuban or South or Central American origin follow neither of the above patterns. Among the group of Cuban origin, there were no significant associations between lifetime risk and US-nativity. However, Cubans differed from the Western European and Puerto Rican groups discussed above because there is some evidence that immigrants who arrived in the USA at the age of 13 years or older were at lower risk for mood disorders than immigrants who arrived at the age of 12 years or younger. These differences do not reach statistical significance. Among those from South or Central America, there was no association between US-nativity and risk for mood disorders, but immigrants had lower risk for anxiety disorders than the US-born regardless of the age at which they arrived in the USA.

Potential explanations

Differences between immigrants and the US-born in mental health and general health status might be explained by a number of processes. Immigrants and their US-born descendants also differ on a wide range of behavioral risk factors for adult health problems (Abraido-Lanza *et al*. 2005). Among these behavioral risk factors associated with US-nativity, use of alcohol (Johnson *et al*. 2002), nicotine (Acevedo-Garcia *et al*. 2005) and other drugs (Blake *et al*. 2001) may be factors in subsequent mood and anxiety disorders (Swendsen & Merikangas, 2000). However, the results of this and other studies (Breslau *et al*. 2007*b*) suggest that changes in risk for mood and anxiety disorders occur more rapidly than changes in these behavioral risk factors. There is evidence that immigrants who arrived in the USA as children, who our results suggest have an equally high risk for mood and anxiety disorders as the US-born, are less likely to use substances than the US-born. A recent report by Alegria and colleagues suggests that among Puerto Ricans, those born in Puerto Rico are not at lower risk for mood and anxiety disorders despite lower risk for substance-use disorders compared with those born in mainland USA (Alegría *et al*. 2008).

Another potential explanation that is also inconsistent with our findings is that stressors that are specific to the immigration process, i.e. acculturative stress, account for increasing risk for disorder (Alegria *et al*. 2007*b*). Acculturative stresses, resulting from the disconnection from one's culture of origin and struggle to accommodate a strange and potentially hostile environment in the host country (Rogler *et al*. 1991), are more extreme among immigrants who arrived in the USA as adults. Immigrants who are older at arrival have already developed social networks and cultural orientations in their country of origin while immigrants who arrived as children experience their primary socialization in the USA. However, the pattern of risk for mood and anxiety disorders does not follow the pattern that one would predict if acculturative stress were the primary cause of increasing risk; it is the younger immigrants and not the older immigrants who experience higher risk for disorder.

Similarly, our results are not consistent with a protective effect of immigrant cultural practices on risk for mood and anxiety disorders. Cultural practices that change across generations as immigrant groups assimilate to the USA, such as strong extended kinship networks, have been suggested as explanations for relatively good physical health status and low mortality among some immigrant and minority groups (Singh & Miller, 2004; Markides & Eschbach, 2005). If these factors were also protective with respect to mood and anxiety disorders we would predict lower risk among immigrants who arrived as children, who are more likely to live in immigrant communities, compared with the US-born. Our findings do not confirm this prediction.

An alternative hypothesis is that differences associated with US-nativity arise from cross-national differences in disposition to mood and anxiety disorder acquired in childhood. Our results are consistent with this model in two important respects. First, low risk is generally restricted to immigrants who spent their early life outside of the USA. People who spent their early life in the USA appear to have similar levels of risk, regardless of place of birth. Second, the same pattern of risk associated with US-nativity occurs among groups from vastly different ancestral origins (Eastern Europe, Mexico, Africa/Caribbean) and from different ethnic groups in the USA (Hispanic, non-Hispanic Black and non-Hispanic White). The fact that the same pattern was observed in an earlier study of Asian-Americans (Breslau & Chang, 2006) further strengthens this evidence. The fact that immigrants who arrived as children in the USA from these vastly different backgrounds acquire the same high level of risk for mood and anxiety disorder as the US-born population suggests developmental pathways that are common to enculturation of both immigrants and natives rather than a distinct set of pathways characteristic of immigrants (Sam, 2006).

It is important to note the difference between this explanation for differences in risk associated with

US-nativity and the 'healthy migrant hypothesis', which has also been suggested (Grant *et al*. 2004; Alegria *et al*. 2006). Differences between immigrants and the US-born may be due to cross-national differences whether or not immigrants differ in risk from the general populations in their countries of origin. Studies with comparable data collected in both sending and receiving countries are needed to assess the healthy migrant hypothesis.

Methodological limitations

The pattern of variation in risk we found could be due in part to the exclusion from the sample of individuals who could speak neither English nor Spanish. These individuals are most likely to be immigrants who arrived in the USA as adults. If there were higher prevalence of disorder among individuals who spoke neither English nor Spanish, we would underestimate the prevalence of disorder in that group. However, evidence from studies that interviewed respondents in a wider variety of languages, particularly Asian languages, suggests that individuals who are not proficient speakers of English or Spanish have equal lifetime risk for psychiatric disorders as those who are proficient speakers of English or Spanish (Takeuchi *et al*. 2007*b*). These patterns have not been investigated among speakers of European languages (other than Spanish).

The sample sizes are smallest for immigrants who arrived prior to the age of 13 years. It is possible that the finding of no difference in risk between the immigrants who arrived prior to the age of 13 years and the US-born is due to the limited power we have to detect differences between these two groups. We cannot rule out the possibility that a larger study would find significant differences. However, among the groups where differences between the US-born and immigrants were limited to those who arrived at the age of 13 years or older, we found that the two ORs comparing the age at immigration subgroups with the US-born were statistically different from each other (results not shown).

Data in this study were collected at a single point in time and are affected by problems in recall of psychiatric symptoms across the lifespan. Evidence from methodological studies suggests that problems in recall are likely to result in underestimates of lifetime prevalence of disorder because more people fail to recall symptoms than mis-remember symptoms that did not occur. Problems in recall would lead to bias in the current study if they were systematically related to US-nativity, but this possibility has not been examined in methodological studies. In the one longitudinal study that compared retrospective reports of depression with prior assessments, respondents were likely to under-report past symptoms, but associations between depression and risk factors did not differ meaningfully across the two ascertainment methods (Wells & Horwood, 2004).

Psychiatric diagnoses were made by lay interviewers and the chance corrected agreement (κ coefficient) with clinician interviews for some disorders was in the fair to moderate range, as reported above. To examine whether our results may have been affected by low κ we repeated the analysis reported above for major depression, the disorder with the highest κ. We found the same pattern of results for major depression as for the mood disorders as a group (results available on request).

We have offered some comparisons of our results with epidemiological studies of psychiatric disorders conducted in immigrant-sending populations. While suggestive, these comparisons do not adjust for the many factors that might lead to differences between immigrants in the USA and the general population in their country of origin. None of these studies used the same survey instrument, and none of the comparisons adjusted for factors that might predict both immigration and lifetime risk for psychiatric disorder such as age, sex and socio-economic status. Future studies based on samples interviewed with consistent methods in both sending and receiving countries are needed to evaluate the impact of immigration on risk for psychiatric disorders.

The finding in this study regarding differences in risk associated with US-nativity and age at immigration do not imply that migration to the USA is not associated with increases in risk among those who arrived in the USA as adults. There is evidence that longer duration of residence in the USA is associated with higher risk of disorder among immigrants relative to the US-born (Vega *et al*. 1998; Alderete *et al*. 2000; Breslau & Chang, 2006; Alegria *et al*. 2007*c*; Breslau *et al*. 2007*b*; Takeuchi *et al*. 2007*a*). However, variations in the pattern of risk associated with duration of residence across these seven immigrant groups have not been investigated. Studies of the impact of immigration to the USA should focus on those who arrived in the USA as adults. The most valuable studies will be those that can compare immigrants with the populations from which they emigrated, controlling for other predictors of migration and mental health (Breslau *et al*. 2007*a*).

Conclusions

The findings of this study add support to the suggestion that the finding of lower risk for psychiatric disorders among immigrants relative to the US-born of

the same national origin is more circumscribed than previously suggested. Lower risk appears to be largely limited to immigrants who spent their pre-adolescent years outside of the USA and only applies to groups with low risk for mood and anxiety disorder. The groups in which lower risk occur are not homogeneous with respect to region of origin or ethnicity in the USA. This pattern is consistent with a disposition towards mood and anxiety disorders that is acquired early in life by immigrants who spent their childhoods in the USA and the US-born.

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Declaration of Interest

None.

References

Abraido-Lanza AF, Chao MT, Florez KR (2005). Do healthy behaviors decline with greater acculturation? Implications for the Latino mortality paradox. *Social Science and Medicine* **61**, 1243–1255.

Acevedo-Garcia D, Pan J, Jun HJ, Osypuk TL, Emmons KM (2005). The effect of immigrant generation on smoking. *Social Science and Medicine* **61**, 1223–1242.

Alderete E, Vega WA, Kolody B, Aguilar-Gaxiola S (2000). Effects of time in the United States and Indian ethnicity on DSM-III-R psychiatric disorders among Mexican-Americans in California. *Journal of Nervous and Mental Disease* **188**, 90–100.

Alegria M, Canino G, Stinson FS, Grant BF (2006). Nativity and DSM-IV psychiatric disorders among Puerto Ricans, Cuban Americans, and non-Latino Whites in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Journal of Clinical Psychiatry* **67**, 56–65.

Alegria M, Mulvaney-Day N, Torres M, Polo A, Cao Z, Canino G (2007*a*). Prevalence of psychiatric disorders across Latino subgroups in the United States. *American Journal of Public Health* **97**, 68–75.

Alegria M, Shrout PE, Woo M, Guarnaccia P, Sribney W, Vila D, Polo A, Cao Z, Mulvaney-Day N, Torres M, Canino G (2007*b*). Understanding differences in past year psychiatric disorders for Latinos living in the US. *Social Science and Medicine* **65**, 214–230.

Alegria M, Sribney W, Woo M, Torres M, Guarnaccia P (2007*c*). Looking beyond nativity: the relation of age of immigration, length of residence, and birth cohorts to the risk of onset of psychiatric disorders among Latinos. *Research in Human Development* **4**, 19–47.

Alegría M, Canino G, Shrout P, Woo M, Duan N, Vila D, Torres M, Chen C, Meng X (2008). Prevalence of mental illness in immigrant and non-immigrant U.S. Latino groups. *American Journal of Psychiatry* **165**, 359–369.

Allison PD (1982). Discrete-time methods for the analysis of event histories. *Sociological Methodology* **13**, 61–98.

Alonso J, Angermeyer M, Bernert S, Bruffaerts R, Brugha T, Bryson H, de Girolamo G, Graaf R, Demyttenaere K, Gasquet I, Haro J, Katz S, Kessler R, Kovess V, Lépine J, Ormel J, Polidori G, Russo L, Vilagut G, Almansa J, Arbabzadeh-Bouchez S, Autonell J, Bernal M, Buist-Bouwman M, Codony M, Domingo-Salvany A, Ferrer M, Joo S, Martínez-Alonso M, Matschinger H, Mazzi F, Morgan Z, Morosini P, Palacín C, Romera B, Taub N, Vollebergh W; ESEMeD/MHEDEA 2000 Investigators, European Study of the Epidemiology of Mental Disorders (ESEMeD) Project (2004). Prevalence of mental disorders in Europe: results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. *Acta Psychiatrica Scandinavica Supplementum* **109** (Suppl. 420), 21–27.

Bhugra D (2004). Migration and mental health. *Acta Psychiatrica Scandinavica* **109**, 243–258.

Blake SM, Ledsky R, Goodenow C, O'Donnell L (2001). Recency of immigration, substance use, and sexual behavior among Massachusetts adolescents. *American Journal of Public Health* **91**, 794–798.

Breslau J, Aguilar-Gaxiola S, Borges G, Castilla-Puentes RC, Kendler KS, Medina-Mora ME, Su M, Kessler RC (2007*a*). Mental disorders among English-speaking Mexican immigrants to the US compared to a national sample of Mexicans. *Psychiatry Research* **151**, 115–122.

Breslau J, Aguilar-Gaxiola S, Borges G, Kendler KS, Su M, Kessler RC (2007*b*). Risk for psychiatric disorder among immigrants and their US-born descendants: evidence from the National Comorbidity Survey Replication. *Journal of Nervous and Mental Disease* **195**, 189–195.

Breslau J, Chang DF (2006). Psychiatric disorders among foreign-born and US-born Asian-Americans in a US national survey. *Social Psychiatry and Psychiatric Epidemiology* **41**, 943–950.

Burnam MA, Hough RL, Karno M, Escobar JI, Telles CA (1987). Acculturation and lifetime prevalence of psychiatric disorders among Mexican-Americans in Los Angeles. *Journal of Health and Social Behavior* **28**, 89–102.

Canino GJ, Bird HR, Shrout PE, Rubio-Stipec M, Bravo M, Martinez R, Sesman M, Guevara LM (1987). The prevalence of specific psychiatric disorders in Puerto Rico. *Archives of General Psychiatry* **44**, 727–735.

Efron B (1988). Logistic regression, survival analysis and the Kaplan–Meier curve. *Journal of the American Statistical Association* **83**, 414–425.

Escobar JI, Vega WA (2000). Mental health and immigration's AAAs: where are we and where do we go from here? *Journal of Nervous and Mental Disease* **188**, 736–740.

Grant B, Dawson D, Stinson F, Chou P, Kay W, Pickering R (2003*a*). The Alcohol Use Disorder and Associated

Disabilities Interview Schedule-IV (AUDADIS-IV): reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. *Drug and Alcohol Dependence* **71**, 7–16.

Grant BF, Kaplan K, Shepard J, Moore T (2003*b*). *Source and Accuracy Statement for Wave 1 of the 2001–2002 National Epidemiologic Survey of Alcohol and Related Conditions*. National Institute on Alcohol Abuse and Alcoholism: Bethesda, MD.

Grant BF, Stinson FS, Hasin DS, Dawson DA, Chou SP, Anderson K (2004). Immigration and lifetime prevalence of DSM-IV psychiatric disorders among Mexican Americans and non-Hispanic whites in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry* **61**, 1226–1233.

Haenszel W (1970). Studies of migrant populations. *Journal of Chronic Disease* **23**, 289–291.

Hwang W-C, Chun C-A, Takeuchi DT, Myers HF, Siddarth P (2005). Age of first onset major depression in Chinese Americans. *Cultural Diversity and Ethnic Minority Psychology* **11**, 16–27.

Johnson TP, VanGeest JB, Cho YI (2002). Migration and substance use: evidence from the US. National Health Interview Survey. *Substance Use and Misuse* **37**, 941–972.

Karno M, Golding JM, Burnam MA, Hough RL, Escobar JI, Wells KM, Boyer R (1989). Anxiety disorders among Mexican Americans and non-Hispanic Whites in Los Angeles. *Journal of Nervous and Mental Disease* **177**, 202–209.

Markides K, Eschbach K (2005). Aging, migration, and mortality: current status of research on the Hispanic paradox. *Journal of Gerontology Series B: Psychological Sciences Social Sciences* **60**, S68–S75.

Medina-Mora ME, Borges G, Lara C, Benjet C, Blanco J, Fleiz C, Villatoro J, Rojas E, Zambrano J, Casanova L, Aguilar-Gaxiola S (2003). Prevalence of mental disorders and use of services: results from the Mexican National Survey of Psychiatric Epidemiology. *Salud Mental* **26**, 61–72.

Ortega AN, Rosenheck R, Alegria M, Desai RA (2000). Acculturation and the lifetime risk of psychiatric and substance use disorders among Hispanics. *Journal of Nervous and Mental Disease* **188**, 728–735.

Rogler LH (1994). International migrations. A framework for directing research. *American Psychologist* **49**, 701–708.

Rogler LH, Cortes DE, Malgady RG (1991). Acculturation and mental status among Hispanics: convergence and new directions for research. *American Psychologist* **46**, 585–597.

Rutter M (2005). Natural experiments, causal inferences, and policy development. In *Ethnicity and Causal Mechanisms* (ed. M. Rutter and M. Tienda), pp. 1–20. Cambridge University Press: New York.

Sam DL (2006). Adaptation of children and adolescents with immigrant backgrounds: acculturation or development. In *Acculturation and Parent-child Relationships: Measurement and Development* (ed. M. H. Bornstein and L. R. Cote), pp. 97–111. Lawrence Erlbaum Associates Inc. Publishers: Mahwah, NJ.

Singh G, Miller B (2004). Health, life expectancy, and mortality patterns among immigrant populations in the United States. *Canadian Journal of Public Health* **95**, I14–I21.

Swendsen J, Merikangas K (2000). The comorbidity of depression and substance use disorders. *Clinical Psychology Review* **20**, 173–189.

Takeuchi D, Hong S, Gile K, Alegria M (2007*a*). Developmental contexts and mental disorders among Asian-Americans. *Research in Human Development* **4**, 49–69.

Takeuchi DT, Chung RC-Y, Lin K-M, Shen H, Kurasaki K, Chun C-A, Sue S (1998). Lifetime and twelve-month prevalence rates of major depressive episodes and dysthymia among Chinese Americans in Los Angeles. *American Journal of Psychiatry* **155**, 1407–1414.

Takeuchi DT, Zane N, Hong S, Chae DH, Gong F, Gee GC, Walton E, Sue S, Alegria M (2007*b*). Immigration-related factors and mental disorders among Asian Americans. *American Journal of Public Health* **97**, 84–90.

Vega WA, Kolody B, Aguilar-Gaxiola S, Alderete E, Catalano R, Caraveo-Anduaga J (1998). Lifetime prevalence of DSM-III-R psychiatric disorders among urban and rural Mexican Americans in California. *Archives of General Psychiatry* **55**, 771–778.

Wells JE, Horwood LJ (2004). How accurate is recall of key symptoms of depression? A comparison of recall and longitudinal reports. *Psychological Medicine* **34**, 1001–1011.

Williams DR, Haile R, Gonzalez HM, Neighbors H, Baser R, Jackson JS (2007). The mental health of Black Caribbean immigrants: results from the National Survey of American Life. *American Journal of Public Health* **97**, 52–59.