

# Alcohol Use Behaviors Among Indigenous Migrants: A Transnational Study on Communities of Origin and Destination

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**Abstract** The association between international and domestic migration and alcohol use among indigenous communities is poorly understood. We explored migration-related factors associated with alcohol use behaviors among an indigenous Mayan, binational population. From January to March 2012, 650 indigenous participants from the high-emigration town of Tunkás in the Mexican state of Yucatán ( $n = 650$ ) residing in Mexico and California completed surveys. Multivariate logistic regression identified migration-related factors associated with alcohol use behaviors. US migration of shorter duration ( $<5$  years) was independently associated with at-risk drinking (adjusted odds ratio (AOR) 2.34; 95 % confidence interval (CI) 1.09–5.03), as was longer-duration domestic migration ( $\geq 5$  years) (AOR 2.34; 95 % CI 1.12–4.87). Ability to speak Maya (AOR 0.26; 95 % CI 0.13–0.48) was protective against at-risk drinking. Culturally appropriate alcohol use prevention interventions are needed for domestic and

international indigenous Mexican migrants to address alcohol use behavior in the context of migration.

**Keywords** Alcohol use · Indigenous populations · International migration · Domestic migration · Mexico

## Background

Indigenous Mexican communities comprise a culturally and ethnically diverse segment of Latino migration to the United States that has been increasing since the 1990s [1–3]. Indigenous persons are highly marginalized in both Mexico and in the United States (US) and are often faced with considerable social, cultural, and structural disparities that place them at high vulnerability for poor health outcomes, including mental health problems, chronic diseases, occupational hazards, and barriers to access to care [4–8]. Although indigenous Mexicans are an at-risk and vulnerable population in both their countries of origin and destination, little is known about their alcohol use behaviors and migration-related risk factors that may shape alcohol use, abuse or dependence in the US or in Mexico [5, 8]. Alcohol abuse (also referred to as ‘harmful use’) is one of two primary categories of ‘alcohol use disorders’ that generally indicates recurrent alcohol-related problems (e.g. legal) and maladaptive patterns of drinking and impairment despite knowledge of problems without a physical addiction to alcohol [9]. Alcohol dependence, the more severe category of ‘alcohol use disorder,’ is characterized by maladaptive drinking patterns coupled with a physical dependence (e.g., withdrawal symptoms), physiological tolerance, and impaired control [9].

Studies conducted in Mexico suggest that Mexicans with past US migration experience are at higher risk for

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alcohol dependence than their non-migrant counterparts. [10, 11]. In the US, studies typically find a lower prevalence of alcohol use disorders among foreign-born and recently arrived Mexican (and other Latino) migrants when compared to native-born White and US-born Mexican/Latino populations [12–17]. This situation is typically referred to as the Latino Health Paradox—having better health outcomes than the general US native population despite having lower socioeconomic status, education, income, and greater barriers to access to care [18]. US nativity (i.e. being US-born), younger age of arrival to the US, and longer duration of residency in the US are commonly identified risk factors for increased risk of alcohol use disorders [10, 13, 17–20].

The role of migration in shaping alcohol use behaviors among indigenous populations who migrate domestically within Mexico and/or internationally to the US has rarely been investigated [5, 8]. In the Southern Mexican state of Yucatán, thriving urban tourism industries in large cities such as Cancún and Playa del Carmen have dramatically increased domestic migration to this region [2, 21], including migration of indigenous groups from rural communities. Tourist areas are characterized by social environments that may facilitate or promote excessive alcohol consumption, such as increased anonymity, reduced social controls on behavior and increased access to alcohol and disposable income [22, 23]. Within this context, domestic migrants may experience increased risk of alcohol abuse or alcohol dependence. The impact of domestic migration on shaping alcohol use behaviors is poorly understood—research focusing on migration and substance use has focused almost exclusively on international migration—which warrants further investigation [11, 13, 17, 19, 20].

The objective of this study is to explore factors associated with migration experiences and alcohol use behaviors among a binational sample of indigenous Mayan migrants from Yucatán. We hypothesize that prior international or domestic migration and longer duration of migration will be associated with at-risk drinking behaviors.

## Methods

### Data Collection

From January to March 2012, 650 indigenous Mayan participants from the high-emigrating town of Tunkás in the Southern Mexican state of Yucatán completed structured questionnaires. Our research team traveled to Tunkás in late January to coincide with the town's annual fiesta. This annual fiesta marks a 2-week period of town visitation during which domestic and international (e.g., US) migrants return to Tunkás to partake in local festivities and

visit family members. Hence, this was an optimal data collection time period to interview visiting migrants residing in the US or other parts of Mexico, returned migrants, as well as local residents (i.e., non-migrants). From February to March, cross-sectional data was collected from Tunkás' satellite communities in Anaheim and Inglewood, California.

Eligible participants were adults aged 18–65 years; born in or had at least one parent/grandparent from Tunkás; and were able to speak Spanish or English and provide informed consent. Potential participants were approached at their place of residence or in a public area (e.g., plazas, community gatherings, car washes, soccer games), and eligible individuals were invited to participate. US-based recruitment relied on a modified “snowball” sample of migrants from Tunkás. US-based potential participants were contacted using information provided on a voluntary basis by family members interviewed in Tunkás. This sampling approach has been used by the investigators in prior research to successfully recruit binational migrant samples [1, 2, 24, 25].

A unique identifier was assigned to each participant to protect confidentiality. Participants completed a 126-item survey using computer-assisted personal interviewing (CAPI) administered by an interviewer from our field research team. Trained bilingual (Spanish/English) and bicultural researchers from the *Instituto Nacional de Antropología e Historia* (INAH) and the University of California, San Diego (UCSD) administered the survey in a private location of the participant's choosing.

The survey covered socio-demographic characteristics (e.g., age, gender, education, income, marital status), language (e.g., ability to speak English, Spanish, and/or Maya), religiosity (e.g., attended a religious service in the past month), migration history (e.g., ever migrated to the United States to live or work, ever migrated to another city in Mexico to live or work, number of trips, duration of longest trip), mental health (e.g., CESD-20 depression scale), and chronic disease risk factors (e.g., food preferences, exercise, history of high blood pressure, BMI). Substance use questions included the World Health Organization (WHO) Alcohol Use Disorders Identification Test (AUDIT) screening instrument [26, 27] and drug use (e.g., types of drugs used and frequency in last 6 months and lifetime).

Our dependent variable, at-risk alcohol use, was measured by the AUDIT questionnaire. This is a 10-item screening instrument that has demonstrated high reliability and predictive validity of hazardous alcohol use experienced in the past year in numerous studies in the US and Mexico [26–31]. This scale utilizes standard points to categorize participants into four categories of drinking risk: low risk (0–7), at-risk (8–15), high-risk (16–19), and severe

risk ( $\geq 20$ ). AUDIT questions refer to general alcohol use behaviors and patterns occurring in the past year. Therefore, it is unlikely that our measure of alcohol risk reflected atypical situations marked with increased alcohol consumption (i.e., celebrations).

Based on AUDIT criteria and criteria for ‘alcohol use disorders’, at-risk drinkers would generally fall under the ‘alcohol abuse’ category and high-risk and severe drinkers would fall under the ‘alcohol dependence’ category. The AUDIT also classifies non-drinkers as ‘low risk’ drinkers. All individuals in our sample completed the AUDIT questionnaire. Due to our small sample of high-risk and severe risk drinkers, we dichotomized our dependent variable (low risk vs. at-risk); participants who scored 8 or above on the AUDIT were categorized as at-risk drinkers for the purposes of our analysis.

Participants were defined as migrants if they indicated ever having left Tunkás for more than 1 month for the purpose of living or working in the US or another part of Mexico. Participants were then characterized into three mutually exclusive migration categories (no migration; any US migration; and domestic migration only). US and domestic migration trips were dichotomized as 1 versus 2 or more trips. Given that previous studies have found behavioral, health risks, and acculturation differences between migrants living  $\geq 5$  years (i.e. “long-term”) or  $< 5$  years (i.e. “recent”) in the US [32], especially in terms of alcohol and substance use [33–38], two mutually exclusive categories were created to assess migration duration. This was determined by the longest trip reported and destination country (US trip  $< 5$  vs.  $\geq 5$  years; domestic trip  $< 5$  vs.  $\geq 5$  years) to assess for recent and long-term migration.

Socio-demographic factors such as age, education, language, gender, marriage, and socioeconomic status (SES) were also considered as covariates. Our SES measure was constructed using educational attainment (dichotomized as  $\geq$  high school education vs. not) and number of household appliances, which are strong indicators for SES [39, 40]. Participants reported whether their household had a TV, stereo, refrigerator, washing machine, car, drinking water, electricity, oven, bathroom, cable/satellite, computer, and internet connection. Using subgroup analysis [41] we empirically characterized participants into 3 mutually exclusive SES groups: (1) low-SES; (2) lower-middle SES; and (3) middle-high SES.

Statistical analyses were conducted using SAS (9.3; Cary, NC) and SPSS (17; Chicago, IL). We generated descriptive statistics for sample characteristics, which were stratified by alcohol use (low and at-risk drinking). Variables were tested for association using the Pearson Chi square (binary variables) and Wilcoxon Rank Sum (continuous variables) tests. Univariate logistic regression models were generated to identify factors associated with our dependent variable (at-risk drinking). Statistically significant variables in univariate analyses were considered

for inclusion in our final multivariate logistic regression model; all variables in our final model were assessed for collinearity. This study was reviewed and approved by the University of California, San Diego Human Research Protection Program and the State of Yucatán, México’s *Sistema para el Desarrollo Integral de la Familia (DIF) del Estado de Yucatán* (System for the Integrated Development of the Family of the State of Yucatán).

## Results

Of 650 participants, 142 were at-risk drinkers (21.9 %) (Table 1). Twenty seven percent of participants ( $n = 176$ ) reported previously migrating to the US; among them 17 % ( $n = 110$ ) reported one US migration trip and 10 % reported two or more US migration trips ( $n = 66$ ).

Among those with domestic migration experience, 28.9 % had only migrated domestically (i.e., never migrated to the US), 29 % ( $n = 191$ ) reported 1 domestic migration trip and 12 % ( $n = 78$ ) reported 2 or more domestic migration trips. Post-hoc analysis conducted to determine whether number of migratory trips and alcohol risk (which could be an indicator of circulatory migration and/or repeated exposure to the receiving community environment) was not significant. Compared to low-risk drinkers, at-risk drinkers were more likely to have ever been a migrant (73.2 vs. 51.2 %), have previous US migration experience (44.4 vs. 22.2 %), younger (mean age: 11.8 vs. 13.8), male (93 vs. 35 %), speak English (47.9 vs. 24.8 %), and report any formal education in the US (16.2 vs. 7.1 %). Further, migrants who reported that their longest migration trip was to the US were more likely to be at-risk drinkers compared to low-risk drinkers, regardless if their trip was  $< 5$  or  $\geq 5$  years; the same was true for those who reported that their longest migration trip was to a domestic destination. Married participants and those who reported the ability to speak Maya were more likely to be low-risk drinkers than at-risk drinkers.

## Factors Associated with At-risk Drinking

In univariate analyses (Table 2), at-risk drinkers were more than twice as likely (odds ratio (OR) 2.61; 95 % Confidence Interval (CI) 1.73–3.93) to have ever been a migrant, more than three times more likely to have any US migration experience (OR 3.63; 95 % CI 2.30–5.76), and almost twice more likely to have only domestic migration experience (OR 1.82; 95 % CI 1.12–2.96) than low-risk drinkers. Migrants who reported that their longest migration trip was to the US were more likely to be at-risk drinkers compared to low-risk drinkers, regardless if their trip was  $< 5$  or  $\geq 5$  years; the same was true for those who

**Table 1** Migration and demographic characteristics among indigenous participants in Yucatán and California by drinking category, 2011 (n = 650)

Variables	Total sample N = 650 N (%)	Low risk 508 (78.2 %) N (%)	At-risk 142 (21.9 %) N (%)	P value
Migration factors				
Ever migrated	364 (56)	260 (51.2)	104 (73.2)	0.001
Type of migration				0.001
No migration	286 (44)	248 (48.8)	38 (26.8)	
Any US migration	176 (27.1)	113 (22.2)	63 (44.4)	
Domestic migration only	188 (28.9)	147 (28.9)	41 (28.9)	
Number of US migration trips <sup>a</sup>				0.241
1 US trip	110 (17)	74 (66)	36 (57)	
2 or more US trips	66 (10)	38 (34)	27 (43)	
Number of domestic migration trips <sup>b</sup>				0.619
1 domestic trip	191 (29)	138 (72)	53 (69)	
2 or more domestic trips	78 (12)	54 (28)	24 (31)	
Longest US migration trip				0.001
<5 years	88 (13.5)	52 (10.2)	36 (25.4)	
≥5 years	88 (13.5)	61 (12)	27 (19)	
Longest domestic migration trip				0.001
<5 years	55 (8.5)	37 (7.3)	18 (12.7)	
5 or more years	218 (33.5)	158 (31.1)	60 (42.3)	
Current resides in US	82 (12.6)	55 (10.8)	27 (19)	0.009
Socio-demographic factors				
Mean age (Std)	39.9 (13.4)	40.7 (13.8)	37.1 (11.8)	0.016
Male	310 (47.7)	178 (35)	132 (93)	0.001
Speaks English	194 (29.8)	126 (24.8)	68 (47.9)	0.001
Speaks Maya	505 (77.7)	410 (80.7)	95 (66.9)	0.001
Ever educated in the US	59 (9.1)	36 (7.1)	23 (16.2)	0.004
SES				0.337
Low	134 (20.6)	111 (21.9)	23 (16.2)	
Low-middle	380 (58.5)	292 (57.5)	88 (67)	
Middle high	136 (20.9)	105 (20.7)	31 (21.8)	
Married/common law	468 (72)	381 (75)	87 (61.3)	0.001
Self-reported alcoholism diagnosis	20 (3.1)	10 (2)	10 (7)	0.002
Self-reported receiving treatment for alcoholism	7 (36.8)	4 (44.4)	3 (30)	0.515

<sup>a</sup> N = 175, only asked of participants who indicated prior US migration

<sup>b</sup> N = 269, only asked of participant who indicated prior domestic migration

reported that their longest migration trip was to a domestic destination. Currently residing in the US, being male, ability to speak English, and having ever received formal education in the US were associated with at-risk drinking. The ability to speak Maya and being married were protective against at-risk drinking.

In our adjusted multivariate model (Table 3), at-risk drinking was independently associated with having a longest US migration trip of less than 5 years (adjusted odds ratio (AOR) 2.34; 95 % CI 1.09–5.03), having a longest domestic migration trip of more than 5 years (AOR 2.34; 95 % CI

1.12–4.87), and being male (AOR 28.99; 95 % CI 13.91–60.39). Speaking Maya was inversely associated with at-risk drinking (AOR 0.26, 95 % CI 0.13–0.48). According to the pseudo r-square (0.32), our final model explains 32 % of the variability for increased vulnerability to at-risk drinking.

## Discussion

This study yields new information regarding the alcohol-related vulnerabilities of indigenous migrants of Mexican

**Table 2** Univariate logistic regression: Factors associated with at-risk drinking among indigenous participants from Yucatan, 2011 (n = 650)

Variables	Odds ratios	95 % Confidence interval
<b>Migration Factors</b>		
Ever migrated	2.61	1.73–3.93
Type of migration		
No migration	Ref	Ref
Any US migration	3.63	2.30–5.76
Domestic migration	1.82	1.12–2.96
Longest US migration trip		
No migration	Ref	Ref
<5 years	3.46	2.12–5.64
5 or more years	2.21	1.32–3.70
Longest domestic migration trip		
No migration	Ref	Ref
<5 years	2.38	1.27–4.44
5 or more years	1.86	1.24–2.77
Currently resides in US	1.93	1.17–3.20
<b>Socio-demographic factors</b>		
Age	0.98	0.97–1.99
Male	24.47	12.54–47.73
Speaks English	2.79	1.89–4.09
Speaks Maya	0.48	0.32–0.73
Ever educated in the US	2.53	1.44–4.44
Married/common law	0.53	0.36–0.78

Reference group: Low-risk drinkers

origin who migrate within Mexico and to the US. Our findings provide a valuable contribution to the limited evidence base regarding the health impacts of migration on indigenous communities [1–3, 5, 6, 8]. This study suggests the importance of domestic migration in shaping alcohol use behaviors among indigenous populations. Previous studies of Mexican migration and substance use focus almost exclusively on US migration [10–12, 16, 19, 42]. This is the first study, to our knowledge, to investigate the impact of domestic migration within Mexico on alcohol use within an indigenous community. This is especially salient given that indigenous migrants are highly vulnerable to poor health outcomes and are a poorly represented population within the Mexico-US migration and substance use literature.

Consistent with previous research, our findings suggest an association between at-risk drinking and having migrated to the US [11, 19]. Contrary to our hypothesis, we did not find an effect between longer time in the US and hazardous drinking behaviors. However, this may have been due to our small sample of migrants with prolonged experiences (e.g., more than 5 years) in the US. Nonetheless,

**Table 3** Multivariate logistic regression\*: Factors independently associated with at-risk drinking among indigenous participants from Yucatan, 2011 (n = 650)

Variables	Adjusted odds ratio	95 % Confidence interval
<b>Migration factors</b>		
Longest US migration trip		
No migration	Ref	Ref
<5 years	2.34	1.09–5.03
5 or more years	1.14	0.42–3.13
Longest domestic migration trip		
No migration	Ref	Ref
<5 years	2.14	0.85–5.35
5 or more years	2.34	1.12–4.87
Currently resides in the US	2.07	0.78–5.48
<b>Socio-demographic Factors</b>		
Age	0.99	0.97–1.01
Male	28.99	13.91–60.39
Speaks English	1.36	0.74–2.38
Speaks Maya	0.26	0.13–0.48
Ever educated in the US	1.57	0.74–3.36
Married/common law	0.80	0.47–1.37
<b>SES</b>		
Low	Ref	Ref
Low-middle	1.48	0.80–2.74
Middle high	0.60	0.02–0.21

Reference group: Low-risk drinkers

\* Model goodness of fit indicators: Log likelihood: 221.53 ( $df = 14$ ;  $p < 0.001$ ); Pseudo  $R^2$ : 0.32; Model intercept:  $-2.724$ ,  $p < 0.001$ 

participants in our study with US migration experience were more susceptible to at-risk drinking behaviors during the initial 5 years spent in the US. This may suggest that the initial years of migration to the US may be particularly difficult in terms of adapting to a foreign environment and as a result may increase susceptibility to harmful drinking behaviors [38]. The disruption hypothesis provides theoretical justification for these findings, indicating that initial experiences and exposures upon arrival in a new setting are associated with stressful and disruptive effects which can lead to short-term adverse health impacts [43].

Putting our findings in context, the environment of the destinations where domestic migrants travel (especially for work) may play an important role in shaping alcohol use. The primary domestic migration destinations of our study population were to large urban tourism cities on the eastern shore of the Yucatán peninsula (e.g., Cancún, Playa del Carmen, etc.). These cities have a long history as international tourist destinations, attracting particularly large proportions of US tourists. The flourishing tourism industry in this region has been a significant pull factor that has increased domestic migration, especially among southern

indigenous communities [2, 21]. This type of migration to large tourist centers poses unique risks when compared with broader rural-to-urban migration patterns. For example, high tourism areas are often associated with behaviors that may increase health risks (e.g., substance use, commercial sex), and foment significant increases in access to and availability of alcohol and drugs [22, 23]. Prolonged exposure to an environment conducive to hazardous alcohol use likely plays a role in influencing alcohol use behaviors. Though this topic has not been previously investigated in the context of domestic indigenous migration, our finding that increased time spent on a domestic trip parallels past findings that have focused on US migration, which indicate that prolonged time spent away from one's community of origin is associated with increased risk for alcohol and substance use disorders [12, 16, 42]. The topic of domestic migration in the eastern Yucatán peninsula as it relates to alcohol and substance use warrants greater research attention.

Participants who spoke Maya were considerably less likely to engage in hazardous drinking. Past studies have suggested that retaining traditional Mexican indigenous culture following migration to the US is associated with decreased adverse health-related behaviors, and may serve as a protective factor for poor health outcomes [44, 45]. Hence, retention of the Maya language in our sample population may be a marker for maintenance of traditional roles and identities specific to Mayan culture, which may ultimately serve as a protective factor against hazardous alcohol use [45]. Important to note, however, is that other studies have shown that integration of indigenous persons into mainstream society in Mexico and other parts of Latin America has been linked to poor health outcomes, including increased consumption of alcohol and adverse social consequences, as a result of the adoption of health-damaging behaviors [46].

Previous studies with Mexican migrants in the US have found an association between one's ability to speak English (typically used as a proxy for acculturation) with alcohol and drug use patterns [47–49]. Though ability to speak English was positively associated with at-risk drinking in univariate analyses, this relationship was not significant after adjusting for other factors. This may be explained by the high levels out-emigration to tourist destinations among our sample. Tourist destinations in Southern Mexico (e.g., Cancún) cater to English-speaking populations, and one's ability to speak English is often essential to find work; indeed, previous studies have found that most Mexicans working in the tourism sector speak English [50]. In our study, ability to speak English was not mutually exclusive with US migration.

The majority of participants who reported at-risk drinking were males, thus explaining the strong association

we found between male gender and at-risk drinking. Consequently, our findings may not be generalizable to migrant or indigenous women. A larger sample of women who report risky consumption of alcohol would have allowed for improved exploration of the impact of migration, especially as drinking patterns and factors associated with hazardous drinking behaviors may differ between Mexican migrant males and females [51, 52]. Alcohol use among migrant Mexican males has been well documented [33, 35, 45, 52], especially in the context of Mexico-US migration, since Mexican migration has been historically male dominated [53]. The impact of migration on alcohol use behaviors among migrant Mexican and indigenous women remains an important area of research inquiry as mobility among women increases. Future studies focused on substance use patterns among female migrants merits future exploration to better understand the impact of migration on this population.

Despite our best efforts to develop rapport and long-term relationships with Tunkaseños residing in the US, our US-based sample was limited in size and length of time spent in the US. Therefore our study may be biased towards recent US migrants. Challenges to recruiting a broader population of US residents may include factors that make it more difficult to reach and recruit this population including fear of deportation or job-related pressures (i.e. inability to take time off from work to participate in the study). Our limited sample of US-residing migrants ( $n = 82$ ) may also explain why we did not observe an association between longer-term residence in the US (e.g.,  $\geq 5$  years) and at-risk drinking.

Lastly, causality between migration and drinking cannot be inferred due to our cross-sectional design and the fact that our survey did not assess for pre-migration alcohol use behaviors. Future studies should use a longitudinal design to allow for improved measures of pre- and post-migration alcohol use over time and how this relates to features of migration destinations and contexts. Our reliance on the AUDIT scale was limited in this extent, given that it only provides assessments of alcohol use behaviors in the past year. However, the AUDIT scale is one of the best available measures for alcohol use, with strong demonstrated reliability in detecting hazardous alcohol use in diverse populations, including Latino migrants and Mexicans [26–31]. Though our data collection occurred at a time period that may be characterized by increased alcohol use (i.e., the town's 'fiesta'), we are confident that the AUDIT scale was an adequate measure of past-year hazardous alcohol use.

Although migration to the US has decreased in recent years [54], the US and Mexico share a substantial binational population that is linked through personal travel, family and social networks. Understanding migration and its impact on health in a binational context is imperative,

especially among indigenous populations, about whom far less is known. This study offers an important binational perspective to improve our understanding of the health of risky alcohol use among a population of domestic and international indigenous migrants, a perspective that to date has been missing from the literature. Our findings suggest the need for culturally tailored alcohol abuse prevention interventions to reduce health disparities among indigenous migrants in Mexico and the US. Findings from this study also have the potential to inform policies and public health decisions pertaining to migrants on both sides of the border, and suggest the need to develop evidence-based binational and regional policies and collaborations aimed at reducing risky alcohol consumption and related adverse health and social outcomes.

**Acknowledgments** The authors of this paper would like to acknowledge the Tunkás community members for their valuable support and participation; the *Instituto Nacional de Antropología e Historia* and the Mexican Migration Field Research Program at the University of California, San Diego. Research reported in this publication was supported by the *Programa de Investigación en Migración y Salud* (Research Program on Migration and Health); the National Institutes of Health—National Institute on Drug Abuse grant R37DA019829-S1; and the Fogarty International Center of the National Institutes of Health under Award Number D43TW008633. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

**Conflict of interest** None.

## References

- Cornelius WA. *Migration from the Mexican Mixteca: a transnational community in Oaxaca and California*. La Jolla, CA: Center for Comparative Immigration Studies, University of California, San Diego; 2009.
- Cornelius WA, Fitzgerald DS, Fischer PL, editors. *Mayan Journeys: The new migration from Yucatán to the United States*. La Jolla, CA: Center for Comparative Immigration Studies; 2007.
- Fox J, Rivera-Salgado G, editors. *Indigenous Mexican Migrants in the United States*. La Jolla, CA: Center for Comparative Immigration Studies, University of California-San Diego; 2004.
- La población indígena Mexicana. Mexico: Instituto Nacional de las Mujeres, 2006. [http://cedoc.inmujeres.gob.mx/documentos\\_download/100782.pdf](http://cedoc.inmujeres.gob.mx/documentos_download/100782.pdf).
- Mines R, Nickol S, Runsten D. California's indigenous farmworkers: final report of the indigenous farmworker study. January 2010. [http://www.indigenousfarmworkers.org/es/IFSFULLReport\\_Jan2010.pdf](http://www.indigenousfarmworkers.org/es/IFSFULLReport_Jan2010.pdf). Accessed 14 April 2012.
- Navarrete-Linares F. Los pueblos indígenas de México. Comisión Nacional para el Desarrollo de los Pueblos Indígenas (CDI), 2008:141. <http://www.cdi.gob.mx>.
- Stevens G, et al. Characterizing the epidemiological transition in Mexico: national and subnational burden of diseases, injuries, and risk factors. *PLoS Med*. 2008;5(6):e125.
- Villarejo D, et al. The health of California's immigrant hired farmworkers. *Am J Ind Med*. 2010;53(4):387–97.
- Hasin D. Classification of alcohol use disorders. *Alcohol Res Health*. 2003;27(1):5–17.
- Borges G, et al. A cross-national study on Mexico-US migration, substance use and substance use disorders. *Drug Alcohol Depend*. 2011;117(1):16–23.
- Borges G, et al. The effect of migration to the United States on substance use disorders among returned Mexican migrants and families of migrants. *Am J Public Health*. 2007;97(10):1847–51.
- Alegria M, et al. Prevalence of mental illness in immigrant and non-immigrant U.S. Latino groups. *Am J Psychiatry*. 2008;165(3):359–69.
- Breslau J, et al. Migration from Mexico to the United States and conduct disorder: a cross-national study. *Arch Gen Psychiatry*. 2011;68(12):1284–93.
- Grant BF, Stinson FS, Deborah S. Immigration and lifetime prevalence of DSM-IV psychiatric disorders among Mexican Americans and Non-Hispanic Whites in the United States. *Arch Gen Psychiatry*. 2004;61:1226–33.
- Caetano R, Ramisetty-Mikler S, Rodriguez LA. The Hispanic Americans Baseline Alcohol Survey (HABLAS): rates and predictors of alcohol abuse and dependence across Hispanic national groups. *J Stud Alcohol Drugs*. 2008;69(3):441–8.
- Vega WA, et al. 12-month prevalence of DSM-III-R psychiatric disorders among Mexican Americans: nativity, social assimilation, and age determinants. *J Nerv Ment Dis*. 2004;192(8):532–41.
- Warner TD, Fishbein DH, Krebs CP. The risk of assimilating? Alcohol use among immigrant and U.S.-born Mexican youth. *Soc Sci Res*. 2010;39(1):176–86.
- Vega WA, Sribney WM. Understanding the Hispanic Health Paradox through a multi-generation lens: a focus on behavior disorders. *Nebr Symp Motiv*. 2011;57:151–68.
- Borges G, et al. The Mexican migration to the United States and substance use in northern Mexico. *Addiction*. 2009;104(4):603–11.
- Vega WA, et al. Illicit drug use among Mexicans and Mexican Americans in California: the effects of gender and acculturation. *Addiction*. 1998;93(12):1839–50.
- Carte L, McWatters M, Daley E, Torres R. Experiencing agricultural failure: Internal migrations, tourism and local perceptions of regional change in Yucatan. *Geoforum*. 2009;41:704–8.
- Padilla MB, et al. HIV/AIDS and tourism in the Caribbean: an ecological systems perspective. *Am J Public Health*. 2010;100(1):70–7.
- Padilla MB, Guilamo-Ramos V, Godbole R. A syndemic analysis of alcohol use and sexual risk behavior among tourism employees in Sosua, Dominican Republic. *Qual Health Res*. 2012;22(1):89–102.
- Cornelius WA et al. *Four generations of norteños: new research from the cradle of Mexican migration*. La Jolla, CA: Center For Comparative Immigration Studies, University of California, San Diego; 2009.
- Cornelius WA, Lewis JM. *Impacts of border enforcement on Mexican migration: the view from sending communities*. CCIS anthologies2007, La Jolla, CA: Center for Comparative Immigration Studies. 175 p.
- Johnson JA et al. Use of AUDIT-based measures to identify unhealthy alcohol use and alcohol dependence in primary care: a validation study. *Alcohol Clin Exp Res*. 2012.
- Facundo FRG, et al. Alcohol consumption disorder (AUDIT) for marginal adolescents and youth from juvenile gangs of Mexico. *Escola Anna Nery*. 2007;11(4):611–8.
- Luchters S, et al. Use of AUDIT, and measures of drinking frequency and patterns to detect associations between alcohol and sexual behaviour in male sex workers in Kenya. *BMC Public Health*. 2011;11:384.
- Kallmen H, et al. Alcohol habits in Sweden during 1997–2009 with particular focus on 2005 and 2009, assessed with the

- AUDIT: a repeated cross-sectional study. *Eur Addict Res.* 2011; 17(2):90–6.
30. Villamil Salcedo V. Validation of the alcohol use disorders identification test (AUDIT) in Mexican patients with schizophrenia. *Rev Panam Salud Publica.* 2009;26(4):283–9.
  31. Medina-Mora E, Carreno S, De la Fuente JR. Experience with the alcohol use disorders identification test (AUDIT) in Mexico. *Recent Dev Alcohol.* 1998;14:383–96.
  32. Guendelman S, English PB. Effect of United States residence on birth outcomes among Mexican immigrants: an exploratory study. *Am J Epidemiol.* 1995;142(Supplement 9):S30–8.
  33. Gfroerer JC, Tan LL. Substance use among foreign-born youths in the United States: does the length of residence matter? *Am J Public Health.* 2003;93(11):1892.
  34. Cherpitel CJ, Borges G. A comparison of substance use and injury among Mexican American emergency room patients in the United States and Mexicans in Mexico. *Alcoh Clin Exp Res.* 2001;25(8):1174–80.
  35. Vega WA, Sribney WM, Achara-Abrahams I. Co-occurring alcohol, drug, and other psychiatric disorders among Mexican-origin people in the United States. *Am J Public Health.* 2003;93(7):1057–64.
  36. Schwartz SJ et al. Substance use and sexual behavior among recent Hispanic immigrant adolescents: Effects of parent–adolescent differential acculturation and communication. *Drug Alcohol Depend.* 2012.
  37. Sanchez MA, et al. The effect of migration on HIV high-risk behaviors among Mexican migrants. *J Acquir Immune Defic Syndr.* 2012;61(5):610–7.
  38. Caetano R, Mora MEM. Acculturation and drinking among people of Mexican descent in Mexico and the United States. *J Stud Alcohol Drugs.* 1988;49(05):462.
  39. Braveman PA, et al. Socioeconomic status in health research: one size does not fit all. *JAMA.* 2005;294(22):2879–88.
  40. Barquera S, et al. Obesity and central adiposity in Mexican adults: results from the Mexican National Health and Nutrition Survey 2006. *Salud pública de México.* 2009;51:S595–603.
  41. Lanza ST, et al. PROC LCA: A SAS Procedure for Latent Class Analysis. *Struct Equ Modeling.* 2007;14(4):671–94.
  42. Breslau J, et al. Risk for psychiatric disorder among immigrants and their US-born descendants: evidence from the National Comorbidity Survey Replication. *J Nerv Ment Dis.* 2007;195(3):189–95.
  43. Kessler K, Quezada L. Contraceptive use, unmet need for contraception, and unintended pregnancy in a context of Mexico-US migration field actions. *Sci Reports.* 2010;S2:1–6.
  44. Morales LS, et al. Socioeconomic, cultural, and behavioral factors affecting Hispanic health outcomes. *J Health Care Poor Underserved.* 2002;13(4):477–503.
  45. Ozer EJ, Fernald LC. Alcohol and tobacco use among rural Mexican adolescents: individual, familial, and community level factors. *J Adolesc Health.* 2008;43(5):498–505.
  46. Montenegro RA, Stephens C. Indigenous health in Latin America and the Caribbean. *Lancet.* 2006;367(9525):1859–69.
  47. Alderete E, et al. Lifetime prevalence of and risk factors for psychiatric disorders among Mexican migrant farmworkers in California. *Am J Public Health.* 2000;90(4):608–14.
  48. Marsiglia FF, et al. The influence of linguistic acculturation and gender on the initiation of substance use among Mexican heritage preadolescents in the borderlands. *J Early Adolesc.* 2011;31(2):271–99.
  49. Epstein JA, Botvin GJ, Diaz T. Linguistic acculturation associated with higher marijuana and polydrug use among Hispanic adolescents. *Subst Use Misuse.* 2001;36(4):477–99.
  50. Castellanos MB. *A return to servitude: Maya migration and the tourist trade in Cancún 2010*: U of Minnesota Press.
  51. Vega WA, Sribney WM, Achara-Abrahams I. Co-occurring alcohol, drug, and other psychiatric disorders among Mexican-origin people in the United States. *Am J Public Health.* 2003;93(7):1057–64.
  52. Borges G, et al. Mexican immigration to the US and alcohol and drug use opportunities: does it make a difference in alcohol and/or drug use? *Drug Alcohol Depend.* 2012;125(Suppl 1):S4–11.
  53. Durand Jorge, Massey Douglas S. Mexican migration to the United States: a critical review. *Latin Am Res Rev.* 1992;27(2):3–42.
  54. Pew Hispanic Research Center, 2011. As Deportations Rise to Record Levels, Most Latinos Oppose Obama's Policy. <http://www.pewhispanic.org/2011/12/28/as-deportations-rise-to-record-levels-most-latinos-oppose-obamas-policy>. Accessed 22 Oct 2012.