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The Important Role of Binational Studies for Migration and Health Research: A Review of US-Mexico Binational Studies and Design Considerations for Addressing Critical Issues in Migrant Health

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ABSTRACT

The impact of migration on health is an important and growing concern worldwide. We conducted a literature review of published health literature in PubMed, between January 1999 and February 2015, representing studies including US and Mexico samples and the title word "binational". Fifty-nine studies representing three types of study designs were identified. The health issues examined included chronic conditions, mental health, substance abuse, reproductive health, infectious diseases, environmental health, and use of health-care services. Binational research between the US and Mexico contributes to our understanding of migrant health and offers critical insights into the processes affecting health outcomes in the US and Mexico. Future studies of all designs can pay closer attention to the social determinants of health.

BACKGROUND

The literature on migration and health in the US-Mexican context has grown substantially in recent years, in part, due to efforts from binational University- and community-based programmes such as the US and Mexico-based Health Initiatives of the Americas Program in Migration and Health (HIA) and the University of California Institute for Mexico and United States (UCMEXUS). In border areas, research initiatives have emerged to formalize binational health investigative units (e.g. the California Office of Border and Binational Health (COBBH) and Centers For Disease Control-related border and binational health projects) as well as expanding new priority topics for border health investigations including substance abuse and mental health. (Mier et al., 2008; Strathdee et al., 2008; Deiss et al., 2008; Ojeda et al., 2011; Garcia, 2007; Maxwell et al., 2006; Lopez-Zetina et al., 2010).

For many binational studies, there is an implied conceptual framework that suggests that globalization significantly impacts health outcomes, but there is no consensus on the nature of this influence. There are some studies suggesting that globalization contributes to poor health outcomes among migrants, as evidenced by characterization of a globalized obesity epidemic in both countries and exacerbated by unhealthy diets promoted by globally available cheap non-nutritious

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highly marketed foods (Caballero, 2007). This aligns with a *social determinants* view of migration and health, such as that described by Castañeda et al. (Castañeda et al., 2015), which maintains that *"global patterns of morbidity and mortality follow inequities rooted in conditions produced and reproduced by political economy, such as social structures, policies, and institutions"* (such as employment, housing and living conditions, access to food and social services, regional resource depletion and legal status) and that *"as migration flows increase worldwide, the social determinants of health surround the many individuals who choose to leave or are forced to leave their homelands for survival, work, safety, and in some cases, an new home in another land.*" On the other hand, binational studies have also identified the benefits of maintaining transnational ties, with frameworks suggesting resilience, for example, in the area of dietary resilience (Grieshop, 2006; Handley et al., 2013). Along with this growth in numbers of studies and broadened scope of health issues under investigation, there has also been new types of study design and methodologies in practice that warrants an appraisal of the binational health literature. To date, there have been no formal assessments summarizing the outcomes of this US-Mexico binational research or elaborating on the types of study designs that have been employed to address questions recent migration-related research examines. In order to characterize recent research examining many of the complex factors relevant to the enmeshed relationship between migration and health, we conducted a review of US-Mexico based binational research studies. The goals of this article are to:

(1) Summarize the US-Mexico binational health literature, presented by the types of binational study designs employed to investigate migration and health-related questions;
(2) Discuss the limitations and strengths of each design and potential future directions.

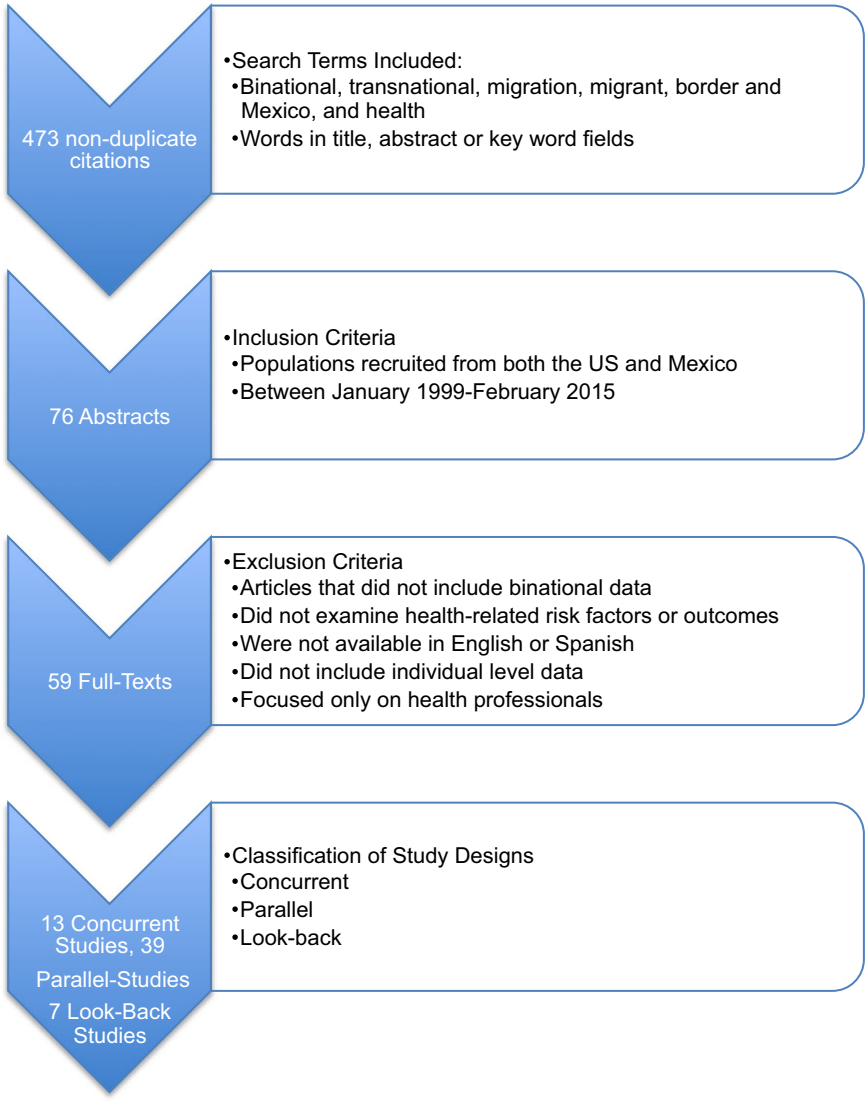
METHODS

A literature search of published research articles was conducted to identify binational studies focusing on the US and Mexico context over a 16-year period between January 1999 and February 2015, coinciding with the recent growth in research related to binational health and migration. The search strategy used the following terms restricted to the title, abstract or keyword fields: binational, transnational, migration, migrant, health, Mexico, Latin America, border. Databases included PubMed and the ISI Web of Knowledge. Studies were included that contained binational health related research findings based on populations recruited from both the US and Mexico. Studies were excluded if they: (1) did not include binational data collection; (2) did not include individual level data; (3) focused only on health professionals; (4) did not examine health-related risk factors or outcomes; or (5) were not available in English or Spanish.

Studies that met eligibility criteria were then categorized into the following binational study designs: (1) parallel studies; (2) concurrent studies; and (3) 'look-back' studies, based on the authors' interpretation of the literature (see Figure 1).

- *Parallel studies* involve primary data collection from two separate populations in the US and Mexico. Data collection is similar in the two samples and these studies focus on comparisons of the prevalence of outcomes and associated risk factors. These studies often use the same methods and measures, focus on descriptive differences between the two samples, and may be cross-sectional or cohort based.
- *Concurrent studies* involve secondary analysis of large data sets collected for population measures in each country, which were then compared. In recent years, such studies have grown in number and often focus on either disentangling factors related to acculturation

FIGURE 1
FLOW DIAGRAM OF LITERATURE REVIEW



processes among Mexican-born immigrants or on reducing selection biases associated with comparing US-born and migrant populations in the US.

- *"Look-back" studies* involve primary data collection for populations in the US and Mexico that have explicit or implicit linkages beyond migration. These studies often start with one migrant community and look-back into their origins prior to migration in order to understand the transnational nature of the connected communities or to understand underlying issues affecting migrant populations, such as regional conflicts, environmental pressures, or marginalization of indigenous populations. A "case-cluster" study is a specific type of "look-back" design in which a case drives the sampling of the cluster.

All studies were further classified as border studies (taking place at the US-Mexico border or within 100 kilometres of the border) or non-border studies (proximity outside of 100 kilometres of the border) (California Office of Binational Border Health, 2015).

RESULTS

A total of 473 non-duplicate abstracts were reviewed for inclusion (see Figure 1). Fifty-nine papers that met the inclusion criteria were identified, representing 45 unique studies at February 12th 2015, and were included. Excluded studies were primarily focused on either a US-only or Mexico-only sample. Most studies were classified as parallel-studies explicitly stating study goals related to comparing differences across binational samples (n=39) (Table 1). Thirteen concurrent studies were included, mostly designed to harness existing independent nationally representative datasets (Table 2) from the US and Mexico. Seven look-back studies were identified, including two case-cluster studies (Table 3). The vast majority of included studies were 'border' studies (Sonora, Chihuaha, Baja California, Tamaulipas, Coahuila de Zaragoza, or Nuevo Leon combined with California, Arizona or Texas).

Fifteen studies related to diabetes, lifestyle factors, nutrition, cardiovascular diseases, or obesity (Handley et al., 2013; Riosmena et al., 2013; Bostean, 2013; Guendelman et al., 2011; Díaz-Apodaca et al., 2010a; Díaz-Apodaca et al., 2010b; Vijayaraghavan et al., 2010; Canela-Soler et al., 2010; Buttenheim et al., 2010; Guendelman et al., 2010; Rosas et al., 2009; Barquera et al., 2008; Ro and Fleischer, 2014;Vera-Becerra et al., 2013; Morales et al., 2014).

Eight studies focused on infectious disease prevalence or risk factors (Garfein, 2012; Barton-Behravesh et al., 2008; Goodman et al., 2005; O'Rourke et al., 2003; Giuliano et al., 2002; Zúñiga et al., 2012; Servin et al., 2012; Centers for Disease Control and Prevention, 2001). Additional inclusions were mental health and substance use studies, (Salgado et al., 2014; Pinedo et al., 2014; Russell et al., 1999; Borges et al., 2012; Leiner et al., 2012; Orozco et al., 2013; Robertson et al., 2014) studies on social support (Guendelman et al., 2010; Guendelman et al., 2001), on lead poisoning, (Villalobos et al., 2009), and on use of health services and health care-related behaviours (Holmes, 2006; Bergmark, Barr and Garcia, 2010; Rivera et al., 2005; Stallones et al., 2009).

PARALLEL STUDIES

Of the 39 binational parallel studies identified in the review (see Table 1), ten focused on cardiovascular disease, diabetes or chronic disease risk factors; seven on reproductive health outcomes; and five on cancer. Other health outcomes studied include mental health, substance use, violence, HIV, and asthma. Thirty-five of these studies (90%) were border studies, focusing on prevalence comparisons of health-related behaviours or health outcomes in border communities, characterizing the unique risks that can occur near the border, or exploring local surveillance and health education strategies for reducing health risks along migration routes.

The majority of parallel studies focused on cardiovascular disease, diabetes or chronic disease risk factors. The US-Mexico Border Diabetes Prevention and Control Project study (2001-2002) was conducted to examine chronic disease-related prevalence, risk factors and prevention opportunities after epidemiological data indicated that inhabitants of the border region were at higher risk of diabetes-related mortality than the general population in the two countries (Díaz-Apodaca et al., 2010a; Díaz-Apodaca et al., 2010b; Lorig, Ritter, and Jacquez, 2005). The investigation focused on diabetes-related factors across a wide-ranging border population, with a view of the border region as a single epidemiologic geographical unit. The survey was conducted in 44 border communities

TABLE 1

BINATIONAL PARALLEL STUDIES, 1999-2014

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Robertson AM, Garfein RS, Wagner KD, et al.	2014	injection drug use behaviors; risk factors; socio-cultural and policy factors (among people who inject drugs - PWID)	Parallel; Border; (Prospective, mixed methods)	Tijuana (n=785) and STAHR in San Diego (n=575); 2012-2014	Assessed attitudes, behaviors, and infectious disease profiles among people who inject drugs in San Diego and Tijuana. Cross-sectional data from the STAHR study indicated that two-thirds of participants had crossed the border from San Diego into Tijuana, and more than a quarter (27%) of this group had injected drugs in Mexico. Injecting in Mexico was associated with injecting heroin, distributive syringe sharing at least half of the time, and transporting drugs. In qualitative interviews, PWID who injected in Mexico reported generally heavier drug use and greater familiarity with the border region. Travel to Tijuana served as an option for some PWID to procure drugs when they were unable to find them in San Diego.
Servin AE, Muñoz FA, Strathdee SA, et al.	2012	HIV (patient-provider relationship)	Parallel; Border	HIV-positive Latinos receiving antiretroviral treatment (ART) from San Diego-Tijuana clinics (n=233); 2009-2010	Compared treatment-related behaviors for HIV-positive patients receiving care in border cities of San Diego and Tijuana. San Diego patients were more likely to make unsupervised changes in ART regimen (59%), but reported better patient-provider relationships and less stigma. San Diego patients were twice as likely to make unsupervised changes in their ART regimen.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Leiner M, Puertas H, Caratachea R, et al.	2012	Children's mental health (in association with poverty and exposure to collective violence)	Parallel; Border (cross-sectional, clinic-based)	Participant information was extracted from electronic record databases maintained in six university-based clinics in the United States and nine clinics of the Secretaria de Salud in Mexico. (El Paso, Texas and Chihuahua, Mexico); 2007-2010. N=466 participants in 2007 (233 in the United States and 233 in Mexico) and 795 (397 in the United States and 398 in Mexico) in 2010.	Exposure to collective violence and poverty appeared to have an additive negative effect on children's mental health. Children exposed to both poverty and collective violence had higher problem scores, than those exposed to poverty alone.
Sarnat SE, Raysoni AU, Li WW, et al.	2012	Asthma (prevalence and association with air pollution)	Parallel; Border	Asthmatic children from two schools in Ciudad Juarez, Chihuahua and two schools in El Paso, Texas (n=58)	Observed small but consistent associations between airway inflammation and numerous pollutant metrics, with estimated increases in airway inflammation ranging from 1% to 3% per interquartile range increase in pollutant concentrations.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Zúñiga ML, Muñoz F, Kozo J, et al.	2012	HIV-ART treatment adherence; predictors	Parallel; Border	Participants in ART treatment programs in San Diego and Tijuana (n=230)	Patient-initiated changes to ART were reported by 43% of participants, and was associated with: being female, having ≥1 sexual partner (past 3 months), ≤6 years since HIV diagnosis. Poor health were associated with increased odds of ART changes (i.e., made small/major changes from the antiretroviral drugs prescribed).
Infante C, Idrovo AJ, Sánchez-Domínguez MS, et al.	2012	Violence-related consequences of migration	Parallel; Border (mixed methods)	Survey participants at shelters (n=1512) and in-depth interviews (n=22); 2006-2007	One-fifth of the total reported having suffered some type of violence in Mexico or the US (20.4%).Results suggest the different types of violence experienced by migrants which include threats, verbal abuse, and arbitrary detention based on ethnicity, as well as assaults, beatings and sexual violence.
Stoddard P, He G, Vijayaraghavan M, et al.	2010	Diabetes (care, smoking rates)	Parallel; Border	US-Mexico Border Diabetes Prevention and Control Project including Mexicans (n=333) and US Hispanics (n=268); 2001-2002	One in five adults with diabetes (20.1%) in the region was a current smoker. Prevalence was higher among Mexicans (26.2%) than U.S. Hispanics (10.1%, p = 0.003); differences were not explained by sociodemographic or healthcare-related characteristics (odds ratio [OR] 3.86, 95% confidence interval [CI] 1.50-9.91.
Díaz-Apodaca BA, de Cosío FG, Canela-Soler J, et al.	2010	Diabetes (care)	Parallel; Border	US-Mexico Border Diabetes Prevention and Control Project (n=4027)	

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Díaz-Apodaca BA, Ebrahim S, McCormack V, et al.	2010	Diabetes (care)	Parallel; Border		Results indicated 42.1% of Hispanics on the U.S. side of the border (95% confidence interval [CI] 35.8%-48.6%) and 37.6% of Hispanics on the Mexican side (95% CI 31.3%-44.3%) had controlled diabetes (defined as glycosylated hemoglobin A1c < 7.0%) of diabetes complications.
Vijayaraghavan M, He G, Stoddard P, et al.	2010	Diabetes (care)	Parallel; Border	US-Mexico Border Diabetes Prevention and Control Project (n=682)	Less than one-third of the sample had controlled blood pressure (< 130/80 mm Hg), almost half had hypertension (≥140/90 mm Hg), and hypertension awareness and treatment were reported inadequate.
Canela-Soler J, Frontini M, Cerqueira MT, et al.	2010	Diabetes (care)	Parallel; Border	US-Mexico Border Diabetes Prevention and Control Project (n=682)	After adjusting for demographics, body mass index, and access to health care, there were no differences in blood pressure control, hypertension, hypertension awareness, or treatment between Mexicans and both U.S. adults and Mexican immigrants. However, compared to Mexicans and Mexican immigrants, U.S.-born Hispanics, particularly younger individuals, had the lowest rates of blood pressure control (17.3%) and the highest rates of coexisting hypertension (54.8%).

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Hennessy-Burt TE, Stoecklin-Marois MT, Meneses-González F, et al.	2011	Acculturation and risk behaviors including smoking, alcohol use and number of sexual partners.	Parallel; Non-border	Women in Chavinda, Michoacán (n=102) and Madera, California (n=93)	Mexican residents in the US were less likely than US residents to have consumed at least 12 alcoholic beverages in their lifetimes (8.8% vs. 24.7%, p<0.001). However, models adjusted for age and education comparing Mexican residents to low-acculturated US residents did not statistically differ with regard to alcohol use. Women living in Mexico were less likely to report more than one sexual partner in their lifetimes than US residents (3.9% vs. 15.1%, p<0.001) There were no differences between odds of smoking among Chavinda and Madera women.
Guendelman S, Fernald LCH, Neufeld LM, et al.	2010	Child body weight perceptions among mothers	Parallel; Non-border	Low-income Mexican origin mothers from rural and urban communities in Mexico and California (n=84)	Observed that ideal child body size was considerably lower among Mexican-origin mothers living in California (3.86+/-0.56) than it was among mothers living in Mexico (4.32+/-0.83), and this difference was significant (p=0.001) after adjusting for socio-demographic covariates. Among mothers of overweight children, 82% of mothers in California were dissatisfied with their child's weight compared with 29% of mothers in Mexico (p<0.001).

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Rosas LG, Harley K, Fernald LCH, et al.	2009	Dietary behaviors; Food insecurity	Parallel; Non-border	Participants from US Center for the Health Assessment of Mothers and Children of Salinas study (n=301), Participants from Mexico Proyecto Mariposa study (n=301)	Observed that approximately 39% of California mothers and 75% of Mexico mothers reported low or very low food security in the past 12 months ($p<0.01$). Children in the United States experiencing food insecurity consumed more fat, saturated fat, sweets, and fried snacks than children not experiencing food insecurity. In contrast, in Mexico food insecurity was associated with lower intake of total carbohydrates, dairy, and vitamin B-6.
Stallones L, Acosta MSV, Sample P, et al.	2009	Workplace health and safety; prevention perspectives	Parallel; Non-border (qualitative interviews)	Migrant farmworkers in Colorado (n=10) and farmworkers in Mexico (n=5)	Results identified topics of concern including causes of farm, home and motor vehicle injuries, and treatment preferences for injuries and illnesses. Four main themes emerged: safety and health concerns, personal control and prevention strategies, factors affecting control and prevention strategies, and the importance of family.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Rivera JO, Ortiz M, Cardenas V.	2009	Cross-border medication seeking; Healthcare behaviors	Parallel; Border	Randomly selected adults in El Paso, Texas and Ciudad Juarez, Chihuahua (n=1000)	Observed that one-third of adult residents of El Paso and 5% of those in Ciudad Juarez reported crossing the border to purchase medications ($p < .001$). Lack of health insurance in the United States was associated with crossing the border to purchase medications. Nine percent and 7% of US residents traveled to Mexico seeking dental and medical care, respectively. Mexicans traveling to the United States to purchase medications or health care services were more likely to be uninsured and more-educated men.
Russell AY, Williams MS, Farr PA, et al.	1999	Mental health (prevalence)	Parallel; Border	Random sampling of two populations at US-Mexico border (n=600)	Observed that the young women in both groups reported intense feelings related to emotional distress. The young women in Ciudad Juarez reported somewhat more positive feelings related to recent well-being.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Giuliano AR, Papenfuss M, Abrahamsen M, et al.	2002	Cervical cancer risk factors (Type-specific HPV prevalence, sexual risk factors)	Parallel; Border	Women ages 15-79 years, living in communities on both sides of the United States-Mexico border and attending family planning clinics (n=2246)	In multivariate models, the factors that predict oncogenic infection were young age (p = 0.001), higher number of lifetime male partners (p= 0.001), being single (OR 1.79, 95% CI 1.28–2.51), concurrent Chlamydia trachomatis infection (OR 2.07, 95% CI 1.35–3.16), current use of injectable contraceptives (OR 2.23, 95% CI 1.39–3.57), and ever use of Norplant (OR 2.37, 95% CI 0.94–5.97). In contrast, non-oncogenic HPV infection appeared to be associated with recent sexual activity, suggesting that non-oncogenic infections may be more transient.
Hunter JB, de Zapien JG, Denman CA, et al.	2003	Healthcare behavior (access and underutilization of preventive services)	Parallel; Border	House-hold sampling of woman over age 40 years (n=456)	Mexican participants were more likely to have a regular source of care and to have had a blood sugar test within the past 12 months. U.S. participants more often reported having had a Pap smear and mammogram during the previous year. Factors independently positively associated with having had a routine check-up during the past 12 months included age and having a regular provider or place to go when sick. Only going to the doctor when ill was independently inversely associated with routine check-ups in the past 12 months.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
O'Rourke K, Goodman KJ, Grazioplene M, et al.	2003	*H. pylori* infection (prevalence) among children	Parallel; Border	Participants included 264 children of women from low-income families who were receiving services at health clinics in Juarez, Mexico, or El Paso, Texas, from April 1998 through October 2000. Children of women from low-income families who were receiving services at health clinics (n=264)	Reported that the OR for *H. pylori* prevalence among Mexican children as compared with US children was 3.94 (95% confidence interval: 1.72, 9.06). After adjustment for covariates, the OR decreased to 1.70 (95% CI 0.64, 4.52).
Rivera JO, Chaudhuri K, González-Stuart A, et al.	2005	Herbal products (use, disclosure among patients scheduled for surgery)	Parallel; Border	Adult patients scheduled for surgery (n=227)	Found that 58% of patients in the United States and 49% of patients in Mexico rated the products as "excellent" in treating their conditions. Ninety-two percent of U.S, and 93 per cent of Mexican patients did not inform their physician of their herbal use. Preoperative assessment of patients did not include inquiries about herbal products in either hospital.
Lorig KR, Ritter PL, Jacquez A.	2005	Outcomes from a community-based Chronic Disease Self-management Program for diabetes Spanish-language version (Tomando Control de Su Salud)	Parallel; Border	Adults with diabetes or chronic illness (n=445; two-thirds with diabetes)	Four-month and 1-year outcomes indicated participants had improvements in health behaviors, health status, and self-efficacy. Baseline self-efficacy and 4-month change in self-efficacy were significantly associated with improved 1-year outcomes.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Goodman KJ, O'Rourke K, Day RS, et al.	2005	*H. pylori* infection among children (acquisition, elimination)	Parallel; Border	Children whose mothers were recruited in pregnancy with follow up every 6 months after birth (n=468)	The *H. pylori* incidence rate was 1.7% per month (95% CI 1.4-2.0). Rates were similar in boys and girls and on both sides of the border; evidence suggests, however, that this similarity could be due to selection bias.
Bergmark R, Barr D, Garcia R.	2010	Utilization of health care services (returning to Mexico)	Parallel; Border	Convenience samples of migrants in US (n=35) and returned migrants in Mexico and providers (n=10 providers)	Reported that sixteen of the 35 current and former immigrants (46%) said they or a close friend or relative had returned to Mexico from the U.S. for health-related reasons. Among those 15 had returned to Mexico because they or one of their traveling companions was sick or dying. Participants returned to Mexico for care due to unsuccessful treatment in the U.S., the difficulty of accessing care in the U.S. and preference for Mexican care.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Robles JL, Lewis KL, Folger SG, et al.	2008	Contraception; Unintended pregnancy (behaviors, beliefs)	Parallel; Border (cluster-sampling design, standardized data collection)	Postpartum women in the Brownsville-Matamoros Sister City Project for Women's Health who delivered in hospitals (n=947).	Observed high rates of unintended pregnancy, occurring in 48% of women overall. Among women with unintended pregnancy who did not use contraception, 34.1% of Mexico residents believed they could not become pregnant and 28.4% of US residents reported no reason for nonuse. Significantly fewer Matamoros women (62.1%) than Cameron County women (95.7%) reported ever having had a Pap test. odds of ever having had a Pap test were 7.41 times greater in Cameron County than in Matamoros (95% confidence interval, 4.07-13.48).
Barton-Behravesh C, Mayberry LF, et al.	2008	*taeniasis* tapeworm infection prevalence and risk factors	Parallel; Border	Household interviews in El Paso, Texas and Ciudad Juárez, Chihuahua. Fecal samples from household members were checked for Taenia infection.	Prevalence of *taeniasis* in this border region was found to be 3% Compared with the residents of Juárez, El Paso residents were 8.6-fold more likely to be tapeworm carriers.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Wallace D, Hunter J, Papenfuss M, et al.	2007	Cervical cancer (screening rates, access, utilization, orientation towards prevention)	Parallel; Border (cross-sectional)	Population-based survey (n=456)	Observed that the factors independently positively associated with Pap smear screening were age, clinical breast exam in the last year, doctor recommendation of a Pap test, living in the United States, and checkup in the past year. Having a regular source of health care, as well as a doctor's recommendation for a Pap smear, appears to have a positive effect on women's Pap smear screening rates in U.S.-Mexico border communities.
Banegas MP, Bird Y, Moraros J, et al.	2012	Breast cancer screening and risk factors	Parallel; Border (cross-sectional)	Interviewer-administered questionnaire that obtained information on sociodemographic characteristics, knowledge, attitudes, family history, and screening practices. Survey of Mexicans (n=128) and US-born Latinos (n=137)	U.S. Latinas had significantly increased odds of having ever received a mammogram/breast ultrasound (adjusted OR=2.95) and clinical breast examination (OR=2.67) compared to Mexican participants. A significantly greater proportion of Mexican women had high knowledge levels (54.8%) compared to U.S. Latinas (45.2%, $p<0.05$). Age, education, and insurance status were significantly associated with breast cancer screening use.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Garfein R. Collins K, Munoz F, et al	2012	Directly Observed Therapy (DOT); mobile phone interventions	Parallel; Border	TB patients in San Diego (n=43) and Tijuana (n=9) were included in an intervention using mobile phones and video-V DOT, wherein patients take videos of themselves taking medication to send to providers.	Overall, 90% and 97% of the expected videos were received on-schedule from patients in San Diego and Tijuana respectively. Post-treatment interview responses were similar across cities. Patients and providers easily adopted the technology. Patients required only 3 training sessions on average before being able to perform VDOT independently. Overall, 89% of patients reported never or rarely having problems recording videos, 92% preferred VDOT over in-person DOT, and 81% thought VDOT was more confidential. All patients said they would recommend VDOT to other TB patients.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
McDonald JA, Rishel K, Escobedo MA, et al.	2008	Reproductive health	Parallel; Border (Cluster-sampling design, standardized data collection)	Postpartum women delivering in hospitals (n=947); The Brownsville-Matamoros Sister City Project for Women's Health	Found that the numbers of births per 1,000 women aged 15 to 19 years and 20 to 24 years were similar in the 2 communities (110.6 and 190.2 in Matamoros and 97.5 and 213.1 in Cameron County, respectively). Overall, 38.5% of women experienced cesarean birth. Matamoros women reported fewer prior pregnancies than did Cameron County women and were less likely to receive early prenatal care but more likely to initiate breastfeeding. Few women smoked before pregnancy, but the prevalence of alcohol use in Cameron County was more than double that of Matamoros. In both communities combined, 34.0% of women used contraception at first sexual intercourse.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Castrucci BC, Guzmán AE, Saraiya M, et al.	2008	Reproductive health	Parallel; Border (cluster-sampling design, standardized data collection)	Postpartum women delivering in hospitals (n=947); The Brownsville-Matamoros Sister City Project for Women's Health	Prevalence of attempted breastfeeding before hospital discharge was 81.9% in Matamoros compared with 63.7% in Cameron County. After adjusting for potential confounders, the odds of attempted breastfeeding before hospital discharge were 90% higher in Matamoros than in Cameron County (adjusted OR, 1.93; 95% [CI], 1.31-2.84 for the combined model). In the 2 communities combined, odds of attempted breastfeeding before hospital discharge were higher among women who had a vaginal delivery than among women who had a cesarean delivery (AOR, 1.98; 95% CI, 1.43-2.75) and were lower among women who delivered infants with a low birth weight than among women who delivered infants with a normal birth weight (AOR, 0.26; 95% CI, 0.15-0.44).

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Castrucci BC, Piña Carrizales LE, D'Angelo DV, et al	2008	Reproductive health	Parallel; Border (cluster-sampling design, standardized data collection)	Postpartum women delivering in hospitals (n=947); The Brownsville-Matamoros Sister City Project for Women's Health	Found that significantly fewer Matamoros women (62.1%) than Cameron County women (95.7%) reported ever having had a Pap test. Only 12% of Matamoros women said they received their most recent Pap test during prenatal care, compared with nearly 75% of Cameron County women. After adjusting for potential confounders, the odds of ever having had a Pap test were 7.41 times greater in Cameron County than in Matamoros (95% CI, 4.07-13.48).
Galván-González FG, Mirchandani GG, McDonald JA, et al.	2008	Reproductive health	Parallel; Border (cluster-sampling design)	Postpartum women delivering in hospitals (n=947); The Brownsville-Matamoros Sister City Project for Women's Health	Numbers of births per 1,000 women aged 15 to 19 years and 20 to 24 years were similar in the 2 communities (110.6 and 190.2 in Matamoros and 97.5 and 213.1 in Cameron County, respectively). Matamoros women reported fewer prior pregnancies than did Cameron County women and were less likely to receive early prenatal care but more likely to initiate breastfeeding. Few women smoked before pregnancy, but the prevalence of alcohol use in Cameron County was more than double that of Matamoros.

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Gossman GL, Carillo Garza CA, Johnson CH, et al.	2008	Reproductive health	Parallel; Border (cluster-sampling design)	Postpartum women delivering in hospitals in 2005. Matamoros, Tamaulipas, Mexico (n = 489), or Cameron County, Texas (n = 458). The Brownsville-Matamoros Sister City Project for Women's Health	The prevalence of prenatal HIV testing varied by place of residence–57.6% in Matamoros and 94.8% in Cameron County. Women in Cameron County were significantly more likely than those in Matamoros to be tested. Marital status, education, knowledge of methods to prevent HIV transmission (adult-to-adult), discussion of HIV screening with a health care professional during prenatal care, and previous HIV testing were significantly associated with prenatal HIV testing in Matamoros.
Vera-Becerra LE, Lopez ML, Kaiser LL.	2013	Obesity (prevalence, risk factors)	Parallel; Non-border	Interviewed mothers and weighed children aged 1-6 in US (n=95) and Mexico (n=200) in 2006.	Prevalence of overweight [body mass index z-score (BMIZ) >1.0 and <1.65] and obesity (BMIZ > 1.65) was 21.1 and 28.4% in the US respectively, compared to 11.5 and 12.9% in Mexico ($p < 0.001$). No differences were observed in maternal ability to identify correctly the child's weight status or ever being told the child was overweight. US children ate away from home more often ($p < 0.0001$), had fewer family meals ($p < 0.0001$), and played outdoors less often than Mexican children ($p < 0.0002$).

TABLE 1

(CONTINUED)

Authors	Year Published	Key Topics	Study Design	Data Sources	Findings
Martínez ME, Pond E, Wertheim BC, et al.	2013	Obesity (prevalence)	Parallel; Non-border	Ella National Breast Cancer Study of Mexican-Americans and Mexicans women with breast cancer focusing on women with high parity (n=974). 2009.	Prevalence of obesity ([BMI] ≥ 30 kg/m2) was 38.9%. For Waist Circumference, the multivariate OR for having WC ≥ 35 inches in women with ≥4 pregnancies relative to those with 1–2 pregnancies was 1.59 (95% CI 1.01–2.47). Higher parity (≥4 pregnancies) was non-significantly associated with high BMI (OR = 1.10; 95% CI 0.73–1.67).
Martínez ME.	2010	Reproductive health	Parallel; Non-border	Ella Binational Breast Cancer Study in US (n=364) and Mexico (n=401) in 2009.	Observed that US women had lower parity, breastfeeding rates, higher use of oral conceptives, hormone replacement therapy, and family history of breast cancer compared to Mexican women.
Nodora JN, Gallo L, Cooper R, et al.	2014	Reproductive health	Parallel; Non-border	Ella Binational Breast Cancer Study in US (n=364) and Mexico (n=401) in 2009.	Observed that after adjustment for age and education, compared to women residing in Mexico, Mexican-Americans were significantly more likely to have an earlier age at menarche (<12 years; OR 2.08; 95% CI 1.30–3.34), less likely to have a late age at first birth (≥30 years; OR=0.49; 95% CI, 0.25–0.97), and less likely to ever breastfeed (OR=0.13; 95% CI, 0.08–0.21).

TABLE 2

BINATIONAL CONCURRENT STUDIES, 1999-2014

Author	Year	Outcomes	Study design	Data sources	Findings
McDonald JA, Mojarro O, Sutton PD, et al.	2013	Reproductive health (birth rate trends, prevalence of maternal health indicators)	Concurrent; Border and Non-border	Birth certificate data with Hispanic variable in US data Birth used to restrict data analysis (2009-2010)	Observed that among women in the border region, US women had more lifetime births than Mexican women throughout the decade. Birth rates in the group aged 15 to 19 years were high in both the US (73.8/1,000) and Mexican (86.7/1,000) border regions. Late or no prenatal care was nearly twice as prevalent in the border regions as in the non-border regions of border states. Teen pregnancy and inadequate prenatal care were identified as shared problems in US-Mexico border communities.
Orozco R, Borges G, Medina-Mora ME, et al.	2013	Mental health (use of services; prevalence of psychoactive disorders)	Concurrent; Non-border	Merged Mexican National Comorbidity Survey (2001-2002) and US Collaborative Psychiatric Epidemiology Surveys (2001-2003); used Composite International Diagnostic Interview data	Indicated that Mexican-Americans were worse off in terms of psychiatric disorders than Mexicans with no migrants in family. 12-month prevalence of any disorder was more than twice as high among third- and higher generations of Mexican-Americans (21%) than among Mexicans with no migrants in their family (8%).

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Riosmena F, Wong R, Palloni A.	2013	Diabetes, hypertension, smoking, obesity, self-rated health (prevalence); exploration of emigration biases	Concurrent; Non-border	Mexican Health and Aging Study (2001) and US National Health Interview Survey (1997–2007); concurrent design enabled analysis to reduce selection biases from return-migration attrition	Observed an immigrant advantage relative to non-Hispanic whites in hypertension and, to a lesser extent, obesity. Evidence is consistent with emigration selection, and self-rated health among immigrants with less than 15 years of experience in the United States. No evidence identified consistent with sociocultural protection mechanisms.
Herrera DG, Schiefelbein EL, Smith R, et al.	2012	Cancer screening in women (prevalence of cervical cancer screening and predictors)	Concurrent; Border	Mexico National Survey of Health and Nutrition (2006) and US Behavioral Risk Factor Surveillance System in 44 US border countries (n=1724) and 80 Mexican border municipios (n=1454); adjusted prevalence ratios (APR) calculated.	Residence is US was associated with higher cervical cancer screening rates. Sixty-five percent (95% CI 60.3-68.6) of US women and 32% (95% CI 28.7-35.2) of Mexican women had a recent Pap test. Marriage and insurance were associated with a recent Pap test on both sides of the border.
Borges G, Rafful C, Benjet C, et al.	2012	Alcohol use (prevalence and risk factors)	Concurrent; Non-border	Mexican National Comorbidity Survey (2001-2002) (n=2878) and Collaborative Psychiatric Epidemiology Surveys (2001-2003) NCSR (n=66) NLAAS (n=488)	Observed that female immigrants had a lower risk of having opportunities to use alcohol if they immigrated after age of 13, but a higher risk if they immigrated prior to this age; male immigrants showed no difference.

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Bostean G.	2013	Self-rated health; Chronic conditions (prevalence); and the healthy migrant effect and emigration bias hypotheses	Concurrent; Non-border	Mexican Family Life Survey (2002) combined with US National Health Interview Survey (2001-2003) (n=160,265)	Self-rated health patterns revealed that non-migrant Mexicans had lower odds of reporting fair or poor health compared to almost all other groups, with the exception of Mexican return migrants whose odds of poor health were not significantly lower than non-migrant Mexicans (OR = 0.748, ns). Immigrants negatively selected on self-rated health. Established Mexican immigrants, and U.S.-born Mexicans and Whites had significantly higher odds of chronic conditions than non-migrant Mexicans.

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Breslau J, Borges G, Saito N, et al.	2011	Conduct disorder (prevalence in adults related to environmental and genetic influences)	Concurrent; Non-border	Mexican National Comorbidity Survey (MNCS) and National Latino and Asian American Study, National Comorbidity Survey Replication (NCS-R) part of the Collaborative Psychiastric Epidemiology Survey (CPES); used World Mental Health version of the Composite International Diagnostic Interview (n=2663)	Results indicated lower levels of conduct disorder in Mexico population compared to migrants in US or raised in US. Compared with the risk in families of origin of migrants, risk of CD was lower in the general population of Mexico (OR 0.54; 95% CI, 0.19-1.51), higher in children of Mexican-born immigrants who were raised in the United States (OR, 4.12; 95% CI, 1.47-11.52), and higher still in Mexican-American children of US-born parents (OR, 7.64; 95% CI, 3.20-18.27). Prevalence of CD increases dramatically across generations of the Mexican-origin population after migration to the United States.

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Guendelman S, Ritterman-Weintraub ML, Fernald LCH, et al.	2011	Overweight or obesity (prevalence); Perceived weight	Concurrent; Non-border	National Health and Nutrition Examination Survey waves (2001-2006) (n=855) and Mexican National Health and Nutrition Survey (2006) (n=9527)	Observed similar high prevalence of overweight and obesity in both samples. The prevalence of overweight or obese (OO) in Mexican women was 72% and in Mexican-American women was 71%. OO Mexican-American women were more likely than OO Mexican women to label themselves as "overweight" (86% vs. 64%, $p<0.001$). Fewer women in Mexico were screened by health care provider.

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Buttenheim A, Goldman N, Pebley AR, et al.	2010	Smoking, obesity (prevalence across education gradients)	Concurrent; Non-border	National Health Interview Survey (2000–2005) and the Mexican National Health Survey (2000); pooled sample is weighted according to the NHIS sampling scheme (n = 94,595)	Observed that the education-health relationship is weaker among Mexican-origin populations in the US compared to whites, for both men and women. For obesity, it appears that men of all ethnicity/nativity groups have a weak education gradient, while recently-arrived Mexican women have a non-linear relationship that is distinct from the other groups. Results partially support the imported gradients hypothesis and have implications for health education and promotion programs targeted to immigrant populations to reduce racial and ethnic disparities in health in the US.

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Barquera S, Durazo-Arvizu RA, Luke A, et al.	2008	Blood pressure, hypertension (prevalence, patterns of hypertension awareness and treatment)	Concurrent; Non-border	National representative sample of the adult population from Mexico (2000) (n=49,294) and data on Mexican Americans from National Health and Nutrition Examination survey from the United States (1999-2004) (n=8688)	Observed that the prevalence of hypertension (BP > or = 140/90 or treatment) were 33%, 17% and 22%. Hypertension control rates were 3.7%, 32.1% and 37.9%, in the same groups. Awareness and treatment rates were 25% and 13% in Mexico and 54% and 46% among Mexican-Americans in the United States, respectively. Hypertension appears to be more common in Mexico than among Mexican immigrants to the United States.

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Ro A, Fleischer N.	2014	Obesity (prevalence and risk factors)	Concurrent; Non-border	Data from 2000 Mexican National Health Survey (ENSA) (n=36,777), the 2012 Mexican National Health and Nutrition Survey (ENSANUT) (n=32,813) and US National Health Interview Surveys (1999-2000, n= 5073; and 2012, n= 5733)	Observed that US-born Mexican men and women consistently had higher obesity risk compared to recent immigrants across both time points. In the combined sample, we saw significantly higher obesity risk in 2012 than in 2000, mirroring the rising obesity trend. Mexican men who were the least likely to migrate had significantly higher obesity prevalence than recent immigrants. For women, however, there was a clear trend in health selection at both time points. In both 2000 and 2012, Mexican national women had significantly higher obesity prevalence than recent immigrant women.
Morales LS, Flores YN, Leng M, et al.	2014	Cardiovascular disease (prevalence and risk factors)	Concurrent; Non-border	Mexican Health Worker Cohort Study (n= 8379) and US National Health and Nutrition Examination Survey (1999-2006) (n= 2459)	US participants were more likely than Mexican participants to have hypertension, high total cholesterol, diabetes, obesity, and abdominal obesity, and were less likely to have low HDL cholesterol and smoke. Less-educated men and women were more likely to have low HDL cholesterol, obesity, and abdominal obesity.

TABLE 2

(CONTINUED)

Author	Year	Outcomes	Study design	Data sources	Findings
Breslau J, Aguilar-Gaxiola S, Borges G, et al.	2007	Mental health (prevalence and risk factors)	Concurrent non-border; cross-sectional	National probability samples of Mexican migrants in US (n=76) and Mexican populations (n=2326). Based on nationally representative survey versions of World Health Organization's World Mental Health Survey Initiative.	Observed that preexisting anxiety disorders predicted immigration. Immigration predicted subsequent onset of and mood disorders and persistence of anxiety disorders. Results are inconsistent with the "healthy immigrant" hypothesis (that mentally healthy people immigrate) and partly consistent with the "acculturation stress" hypothesis (i.e., that stresses of living in a foreign culture promote mental disorders).

TABLE 3

BINATIONAL LOOK-BACK STUDY DESIGNS, 1999-2014

Author	Year	Outcome	Study design	Data sources	Findings
de Oca VM, García TR, Sáenz R, et al.	2011	Health and quality of life with aging	Look-back; Non-border	Semi-structured interviews (2009) conducted in US (n=86) and in Mexico for participants who had once lived or sought employment in US (n=38).	Results suggest that different time periods in the previous 60 years of Mexican migration to the US, age at migration, and the conditions under which the migration trajectory developed, have unique impacts on the health and quality of life of elderly, and that a life-course perspective on migrant health is important.
Ramos MM, Mohammed H, Zielinski-Gutierrez E, et al.	2005	Dengue outbreak (clinical and epidemiologic investigation)	look-back Case-cluster; Border	Outbreak investigation (n=1251 cases)	Estimated that the percentage of dengue hemorrhagic fever cases associated with dengue fever outbreaks at the Texas-Tamaulipas border has increased over time.
Villalobos M, Merino-Sánchez C, Hall C, et al.	2009	Lead poisoning (epidemiologic)	look-back Case-cluster; Non-border	Environmental and epidemiologic outbreak investigation of lead poisoning cases from the US that were associated with eating imported foods from sending community	Observed that there were multiple risk factors for lead poisoning in the sending community via: food production and the environment, including significant presence of lead in mine wastes, in specific foodstuffs, and in glazed cookware.
Holmes SM.	2006	Patient-provider relationships with migrant farmworkers; Health care and social contexts	Look-back; Non-border	Ethnographic study with participant observation and interviews on farms and in clinics throughout 15 months of migration with a group of indigenous Triqui Mexicans in the western US and Mexico	Observed structural racism and anti-immigrant practices that contributed to the poor working conditions, living conditions, and health of migrant workers. Subtle racism was described as reducing awareness of this social context for those involved with the workers, including clinicians.

TABLE 3

(CONTINUED)

Author	Year	Outcome	Study design	Data sources	Findings
Pinedo M, Campos Y, Leal D, et al.	2014	Alcohol use	Look-back; Non-border	Population based survey of indigenous participants from Tunkás in Yucatan (n=583) and California (n=67)	Observed vulnerability to alcohol use related to both domestic and international migration. US migration of shorter duration (<5 years) was independently associated with at-risk drinking (adjusted OR 2.34; 95% confidence interval (CI) 1.09–5.03), as was longer-duration domestic migration (≥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.
Salgado H, Haviland I, Hernandez M, et al.	2014	Depression and discrimination	Look-back; Non-border	Population based survey of indigenous participants from Tunkás in Yucatan (n=583) and California (n=67)	Observed relatively low rates of depression (7%). A much higher percentage (41%) of individuals with "any US migration experience" reported perceived discrimination, while 20% of those with only "domestic migration experience" and 13% with "no migration experience" reported being discriminated against. Observed that discrimination factors may effect depression, and observed that religiosity was a protective factor.

TABLE 3

(CONTINUED)

Author	Year	Outcome	Study design	Data sources	Findings
Handley MA, Robles M, Sanford E, et al.	2013	Dietary behaviors; food insecurity; views about food resources	look-back Concurrent; Non-border	Qualitative study using 4 focus groups and 29 in-depth interviews in sending and receiving indigenous communities in Monterey California and Oaxaca Mexico	Themes related to nutrition included: (1) the paradox between participants' experience growing up with food insecurity and fond memories of a healthier diet; (2) mothers' current kitchen struggles as they contend with changes in food preferences and time demands, and the role 'care packages' play in alleviating these challenges; (3) positive views about home-grown versus store-bought vegetables; and (4) the role of commercial nutritional supplements and the support they provide.

(28 in Mexico and 16 in the United States) and focused on comparing Mexican migrants to US whites and Mexican Hispanics who had not migrated. Canela-Soler (2010) found that controlling for demographic characteristics, there were no statistically significant differences in blood pressure control, hypertension, or treatment between Mexicans and US adults and Mexican-immigrants. However, compared with Mexicans, US-born Hispanics had lower odds of controlled blood pressure and greater odds of hypertension and hypertension awareness (Canela-Soler et al., 2010).

Studies focused on the reproductive health of US and Mexican women are also well represented in the included studies using a parallel design. This is in part due to the Brownsville-Matamoros Sister Project, which was developed in response to concerns that maternal and child health services along the Mexico-US border were inadequate, based on high birth rates, poverty, lack of services, and dramatic industrial and population growth, relative to other areas of each country (Robles et al., 2008; Uribe Zúñiga, 2008; Kotelchuck, 2008; McDonald, 2008; McDonald et al., 2008; Galván González et al., 2008; Castrucci et al., 2008a; Castrucci et al., 2008b). The project focused on a locally developed system for reproductive health surveillance in the sister communities of Matamoros, Tamaulipas, Mexico, and Cameron County, Texas, as a model for a localized regional approach that could be applied in other border settings. The investigators sampled hospitalized women in both border settings who delivered live infants in any of 10 larger hospitals (ie. hospitals with a minimum of 100 deliveries per year) in Matamoros, Tamaulipas, and Cameron County, Texas, over a several month period in 2005. In this study, US-residing migrant women and those who lived in Mexico were selected through systematic sampling, stratified by hospital, in one particular geographic area between Texas and Mexico. The studies found that, compared with women living in the US, women in the Mexico side of the border were less likely to report ever having had a Pap test (Castrucci et al., 2008), more likely to attempt breastfeeding before being discharged from the hospital (Castrucci et al., 2008), reported fewer prior pregnancies, less likely to receive early prenatal care (Galván González et al., 2008) or to have prenatal HIV testing (Gossman, 2008), while there were similar numbers of births in the two communities (McDonald, 2008).

Additionally, on-going research in the California-Mexico border cities of San Diego, Tijuana and Ciudad Juarez focuses on the significant risks for HIV and other sexually transmitted infections (STI) among sex workers and clients and among substance abusers, within the context of the high prevalence of drug trafficking in several of these cities on either side of the US-Mexico border region (Strathdee et al., 2008; Deiss et al., 2008; Ojeda et al., 2011). In this work, a series of binational studies have been conducted in the border communities of San Diego, Tijuana and Ciudad Juarez to document the high rates of HIV and STI infection and specific populations identified as being at increased HIV risk, including female sex workers and clients. One study that was excluded from the papers summarized in Table 1, because it was limited to provider attitudes, focused on the border comparing provider perceptions of complementary and alternative medicine in the US vs. Mexico border region as it related to HIV outcomes (Muñoz, 2013). Following these descriptive border studies, this research team subsequently developed a series of behavioural interventions targeted at condom use and other HIV-related preventive behaviors (the Mujer Segura/healthy woman project). These intervention studies targeted HIV prevention content on each side of the border, based on differences in service availability, (particularly related to substance use), and underlying social contexts, such as sex work, in the two different sides of the border.

Parallel non-border studies included in this review focused on obesity (Ro and Fleischer, 2014) and breast cancer (Martínez, 2010; Martínez et al., 2013; Nodora et al., 2014; Banegas et al., 2002).US women had lower parity, breastfeeding rates, higher use of oral contraceptives, hormone replacement therapy, and family history of breast cancer compared to Mexican women (Martínez, 2010). Additionally, US women had higher prevalence of overweight and obesity compared to women in Mexico (Ro and Fleischer, 2014). Overall, these parallel study designs typically focused on border communities, which allowed comparisons of two populations in similar proximity, but did not lead to interpretation of the findings beyond these unique settings.

CONCURRENT STUDIES

A total of 13 concurrent design studies were identified with most published since 2010 (see Table 2). The topics of study were similar to the studies with parallel designs. However, some of these concurrent designs focused on examining the Hispanic Health Paradox and the Immigrant Health Advantage, as described below (Riosmena, Wong and Palloni, 2013) or included samples with measures not previously included in binational studies (Guendelman et al., 2011). These studies included samples of Mexican immigrants living in the US, US-born Latinos, Mexicans living in Mexico, and Mexican populations in Mexico who had been identified as having migration history.

Investigation of the Hispanic Health Paradox and the Immigrant Health Advantage

Explicit in many of the chronic disease focused studies in particular, are attempts either to avoid or to investigate a potential bias in self-selection among Mexicans to migrate to the US. In previous studies, Mexican migrants to the US often appeared to be healthier than US-born Latinos but there was often an attenuation over time of the health benefits of migration, posited to relate to an accumulation of stressors in the US environment.

The formation of concurrent designs and merged large-scale data sets enables a different type of comparison that includes the populations of non-migrants. As described by Ro and Fleisher (2014), previous research had focused only on immigrants and US-born and did not examine non-Migrants living in Mexico. Studies that addressed this topic include those by Riosmena et al. (2013), Bostean (2013), Buttenheim (2010), and Ro and Fleisher (2014). An excellent example of this type of study is that by Riosmena et al. (2013). This study included men ages over 50 from the Mexican Health and Aging Study in 2001 and the US National Health Interview Study (NHIS) between 1997–2007. The authors examined six indicators: self-reported hypertension, diabetes, obesity, current smoking, fair/poor self-rated health, and height. Findings from the NHIS for whether or not Mexican immigrants are healthier suggest that Mexican immigrants with less than 15 years of US experience have no clear advantage in indicators except for hypertension, for which immigrants have 68 per cent lower odds than non-Hispanic whites ($p < .001$). Although the data suggest a mild advantage for immigrants regarding diabetes and obesity, these studies suggest that it is important to take into account the initial conditions under which the migration trajectory occurred, rather than focus only on cross-sectional comparisons. The authors did not find any evidence consistent with sociocultural protective mechanisms in their study sample and propose that emigration and return selection mechanisms may be more relevant for explaining the immigrant health advantage.

Examination of Chronic Disease Risk with Inclusion of Externally Measured Indicators

In a study focused on women, Guendelman et al. (2011) examined the NHIS 2001-2006 data and the Mexican National Health and Nutrition Study from 2006 to explore both overweight and perceptions of overweight among Mexican-American women and Mexican women. A strength of this study was that actual weight was assessed by health technicians using BMI measurements. Weight misperceptions were common in both populations but more prevalent in the sample from Mexico. The prevalence of overweight or obesity (OO) in Mexican women was 72 per cent and in Mexican-American women it was 71 per cent. OO Mexican-American women were more likely than OO Mexican women to label themselves as "overweight" (86% vs. 64%, $p < 0.001$), and this difference was significant while controlling for socio-demographic and weight-related variables.

In general, the included concurrent studies focus on country-level differences that might provide insights into determining modifiable factors that may come with migration or that may

disproportionately affect the populations who do not migrate. These studies could be further enhanced by exploring regional variations that are likely to impact OO outcomes. A significant gap in these studies, however, relates to a lack of focus on the social determinants of heath. In the case of obesity, for example, programmes and policies aimed at reducing obesity among children of Mexican origin in the US as well as in Mexico would benefit from a better understanding of the underlying social and economic factors that contribute to obesity on both sides of the border.

LOOK-BACK STUDIES

We identified seven studies that were characterized by this design, which emphasizes primary data collection among populations in the US and Mexico that have explicit or implicit linkages through migration (see Table 3). One of the seven studies focused on a border setting (Ramos et al., 2008), which coincided with an outbreak of dengue fever. Studies classified as look-back studies involved several types of data collection including: ethnographic field work and participant observation (Villalobos et al., 2009; Holmes, 2006); qualitative interviews (Grieshop, 2006); and semi-structured interviews (Guendelman et al., 2001). The included studies focuses on a variety of health topics and several incorporated social determinants frameworks. Examples include: descriptions of health and aging; risk factors for dengue fever; risk factors for lead poisoning among indigenous migrants; risk factors for alcohol abuse, depression, discrimination; and description of the social context of migrant farm workers and its relationship to health and health care.

Examination of risk, vulnerability and social context among population of Indigenous Migrants

Five of the studies focused on indigenous Mexican populations, involving three different populations from Mexican states of Oaxaca, with distinct languages (Triqui and Zapotecan); (Handley et al., 2013; Villalobos et al., 2009; Holmes, 2006) and Yucatan (Tunkás) (Salgado et al., 2014; Pinedo et al., 2014). This focus on indigenous populations in recent studies may reflect a surge in migration pressures within indigenous populations, for whom migration to the US has increased dramatically since the 1990s as a consequence of regional conflicts and environmental pressures (Pinedo et al., 2014). Currently, in the US there are approximately 57 different ethnic indigenous migrant groups from Mexico and there is a strong awareness that indigenous persons are highly marginalized in both Mexico and in the United States. Migrants and sending communities often face 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, which are reflected in several of the look-back studies (Pinedo et al., 2014).

For example, the studies by Pinedo et al. (2014) and Salgado et al. (2014) focus on improving an understanding of the risk behaviours and determinants of vulnerability among an indigenous population in both the US and Mexico, particularly around the issues of alcohol abuse, depression, discrimination and religiosity which have rarely been studied among migrants. The investigators selected a sending community with high rates of both domestic migration and international migration, to explore both of these factors in more detail. Salgado et al. reported that migration experience and current US residence were associated with high levels of perceived discrimination, which in turn were associated with a higher risk for depressive symptoms. However, religiosity was associated with lower perceived discrimination among women. Pinedo et al. reported that 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 (≥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.

In the case-cluster outbreak investigative work by Handley et al. (2007) and Villalobos et al. (2009) there was a targeted investigation into sources of lead poisoning affecting a specific transnational indigenous community from Oaxaca. In this investigation the original lead poisoning problem was identified in Seaside, California (Monterey County) among Zapotecan Oaxacan migrants to California who received and consumed home-prepared foods from their families back home, transported through community "envios" (delivery) companies, which operate like mom-and-pop package express businesses. Although many Oaxacan immigrants to the different cities included in the study received such packages, only those who were originally from the Zimatlan district of Oaxaca (including the towns of Zimatlan de Alvarez, Santa Inez Yatziche, and San Pablo Huixtepec) had elevated lead levels, leading the investigators to explore what was going on in the Zimatlan community that was resulting in so much lead contamination in the foods eaten in California. The investigation was then focused on the home community in Zimatlan, but only through involving the California-based community to gain trust for conducting the home-based sampling that was needed to determine the sources. Through the assistance of Oaxacan community members living in California, a 'look-back' design was selected, working with the extended family members of Oaxacan-born migrants in Seaside who had lead poisoning, to contact their family members in Oaxaca to consent to participate in a study of their home and community environment, including sampling their foods (both home grown and store bought), cooking practices (before and after testing), and water and soil samples in their community wells and gardens. Lead sources were identified, as related primarily to locally produced pottery that released more lead upon cooking than other forms of pottery and to mining contamination of soils used to grow foods (Villalobos et al., 2009).

In the ethnographic work by Holmes (2006) the topics of working conditions, living conditions, and health of migrant workers were examined in relation to structural racism, anti-immigrant practices, ethnicity and citizenship. Through working with a migrant population on farms and in clinics throughout 15 months of migration in the western US and Mexico, Holmes found that there were several factors at play, including internal hierarchies amongst the workers, and racism and anti-immigrant practices that together determined the poor working conditions, living conditions, and health of migrant workers. More subtle forms of racism also served to reduce awareness of the social context for all involved, including clinicians.

CONCLUSIONS AND RECOMMENDATIONS

This review identified 59 articles using binational data to address important questions affecting the health of communities in the US and in Mexico. These studies provide important insights into migration and health in the US-Mexico context. Also, important recent shifts in the binational literature are evidenced by the following:

- A wider range of health-related topics under study than in previous years (e.g. technology use, health service utilization disparities, mental health);
- An increase in studies that explore connections between transnational or binational communities (providing insights into the origins of potential 'carried' risk or resilience and level of connectedness to communities of origin);
- More detailed examination of health care-related behaviours;
- Exploration of chronic disease risk factors); and
- Investigations into the migration experience itself.

As these articles describe, the health problems of migrants from Mexico to the United States are often complex and binational studies provide essential information about health concerns affecting migrant populations, both in terms of geographies of migration, such as borders, and geographies of experience. Taken as a whole these findings suggest that not only is there a diverse literature regarding binational populations and their health, but that there are underlying socio-economic, political and historical processes that affect health and migration (such as poverty, globalization, national and regional politics and health related policies), that have been partially examined only in some of the more recent studies. This expansion of research questions and accompanying designs is evident in some of the reviewed articles and reflects a shift from a generally more disease prevalence focused orientation to a risk factor and socio-ecological framework approach that addresses the structural determinants of health more directly. However, the majority of studies were observational and few described interventions in binational settings, a weakness that hopefully future research will address.

There are a number of strengths and limitations in each type of binational design, and the decision to choose a design should be guided by the research question. For example, strengths in a parallel design include the participation of two study teams, from conception to data collection, to interpretation of data, and a strong ability to compare differences and similarities for the two populations, as a consequence of migration. Researchers are able to introduce the same measures, methods, and data collection protocols, at approximately the same time. Limitations to a parallel design can include challenges in obtaining representative population-based samples and obtaining large sample sizes. Clinic-based samples are common as well as cross-sectional data because it is difficult to develop and implement two-sample concurrent or cohort methodologies. Therefore, to date, the majority of parallel studies have focused on the border areas, which often involve interdependent populations in terms of health services and financial and economic relationships, which is important to factor into the decision-making for these types of studies. However, there are important questions which could be answered in future studies that go beyond comparisons of the border regions and instead look more broadly at health conditions, risk factors and outcomes among groups in different communities. For example, what are the differences in health outcomes and preventive behaviours, between Mexicans living in rural versus urban communities in the US after migration compared with rural and urban residents in communities in Mexico? or to what extent are factors associated with different living conditions, or social and economic factors within these communities, impacting health outcomes?

Concurrent study designs, on the other hand, are typically generalizable to larger populations, typically use existing datasets, and therefore, perhaps are more cost-effective for research questions well-addressed with this design. For example, concurrent designs can be chosen in instances in which researchers investigate migration-related selection biases (such as the healthy migrant effect/Hispanic Health Paradox, or the 'salmon' bias, which refers to selective return migration to the country of origin), or examine the prevalence and impact of acculturation-related health risks. However, because secondary analyses of existing data are often used for these studies, it is oftentimes difficult to link samples in the same year, link populations, measures, and data collection systems, or explore important social, political and economic factors through the quantitative cross-sectional survey designs most often employed. Moreover, there may be inconsistent definitions and measures used, based on how questions were asked in different surveys or how questions are understood based on different cultural understandings of health behaviours or outcomes. Additionally, these studies have not generally focused on examination of regional differences, or on the unique 'risk environments' of border settings – both areas of study that are critical to developing interventions targeting migrants as they come into contact with these risk environments. Data collection strategies in future studies may be more able to include geographic measures associated with different regions and examine more stratifications of results, and could potentially add questions that may enable a broader understanding of the socio-economic context of the experiences of individuals included in the sampling.

Finally, look-back studies are particularly useful for deeper exploration of populations with strong connections, for which the connections may be part of the line of research inquiry undertaken. This type of design explicitly links populations but is used less often because it often requires close contact and resource-intensive data collection strategies, and as such tends to be smaller in scale and less generalizable to other populations. Moving forward, it is important to continue these look-back studies and to develop ways to expand their focus to include intervention studies that may work directly with transnational communities.

In the last decade or so, a widely held view in public health, that Mexican migrants often have better health than their US-born counterparts, has been challenged by concerns that there is no longer an overall "healthy migrant" effect or related "Hispanic Health Paradox" (as well as awareness of the inherent selection biases in these earlier studies), and that we now have a "globalization of risk factors". This shift in perspective on US-Mexican migrant health, however, does not go far enough and future research must explore the social and economic factors that shape migration (Castañeda et al., 2015) and how these factors play out in changing migration experiences (such as during, immediately after, and much later after migration occurs as well as whether or not there is regular return migration). Through collecting more comprehensive data and by working more closely with binational communities, we can move a research agenda forward to prioritize a better understanding of the complex array of chronic and historically mediated social determinants of health that may be exacerbated or relieved by migration.

With the emergence of large publicly available datasets and efforts to augment the types of data that are collected, we can begin to compare binational populations from the US and Mexico in new ways. For example, one could study migrant health topics through combining risk factors measured at the individual level, such as consumption of sugar-sweetened beverages, food insecurity, or limited use of health care with an examination of these risks in broader socio-ecological terms, as with measures of the availability low quality foods in migrant communities, poverty rates and measures of discrimination experiences in healthcare. We also must explore underlying social determinants of health that also migrate with migrating populations, and examine assumptions that risk gets 'equalized' after crossing borders, by understanding what are the lasting effects of chronic poverty and resource deprivation in sending communities on the quality of health among new migrants.

We propose that future studies take these newer lines of inquiry even further by also addressing the policy context for service delivery that affects migrant populations, the financial pressures related specifically to health care expenses and to what factors affect health care sensitive behaviours so as to inform interventions and regional and national insurance programs. Additionally, although there are many US-Mexico border studies that collect primary data on in-depth topics, there are far fewer studies that are conducted outside of the border areas, and these studies would be critical to understanding a broader range of migration experiences. The advent of large datasets from both countries in recent years has allowed for some important national and regional comparisons, but are not able to answer other important questions about the social and structural factors affecting health or for more targeted populations of migrants from sending and receiving communities. While the look-back studies have grown over time, there are very few of them to date. Also, the focus among these look-back studies on indigenous communities suggests there are important factors affecting the health and well-being of these populations that have warranted in-depth assessments. The small number of studies using this design for non-indigenous sending and receiving communities suggests that there are more studies to be done to examine to what extent the findings from the existing literature would be relevant to a more diverse range of sending communities.

There are number of considerations when choosing the type of binational research design to undertake from the design phase, measures and data collection activities, analysis, and interpretation of the data. In the design phase, identifying who is involved, including collaborators and funders, is important. In the data collection phase, it is important to understand how to sample populations and what measures are appropriate for both populations. For example, weight or self-rated health

may be understood differently across contexts. Finally, in the analysis phase, considerations include how to link data, who analyses the data, and who are the important stakeholders to involve. Ultimately, the study design should be guided by the research question.

This literature review is limited in that it only includes studies which collected data in both the US and Mexico. It does not include studies that ask migrant questions about transnational practices or cross-national ties. However, these studies may also contribute to the understanding of binational populations, practices, and influences, and provide insights into how migrants influence and are influenced by their communities of origin. For example, studies focused only on migrants find that over half of Latinos in the US remit money, 40 per cent make weekly phone calls, and 20 per cent travelled to their sending countries in the past year (Soehl and Waldinger, 2010). Among adolescents, 72 per cent participate in transnational communication through the use of instant messaging, text messages, and online social network sites (Lam et al., 2009). Other studies have identified specific activities through which migrants are connected to their communities of origin, including financial, social, and political ties, and how this influences migrants' mental health outcomes (Murphy and Mahalingam, 2004). New sources of data to address these communication-focused questions are likely to appear as social media and technology continues to grow and play an important part in transnational communication. These new sources may result in additional ways to understand migration and to provide seamless forms of intervention delivery across borders. As well, the broader environmental shifts in technology and communication may allow for public-private initiatives related to binational health topics to be leveraged, ideally to inform strategies for improving public health initiatives and be translated into local and national policy contexts. Because binational studies are indicative of how governments and institutions may work more closely together in order to achieve common public health goals, more work in this policy arena is also a priority (Silver, 2014).

Each of the binational designs described contributes to our understanding of migrant health and offers critical insights into the processes affecting health outcomes in the US and Mexico. In future work it will be important to focus on developing interventions that can address migration-exacerbated health disparities and that are responsive to local and national policy contexts that affect health and healthcare that migrants encounter.

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