A binational analysis of health outcomes among stayers and crises-driven diasporas

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Abstract

Our study examines health outcomes among Venezuelan and Colombian nationals in the context of the violence- and crisis-driven migration history of the two nations. The Colombian armed conflict (1960-2010) and the current socioeconomic Venezuelan crisis are the focus of our analysis. We combine censuses and vital registration information to estimate Infant Mortality Rates, Maternal Mortality Ratios, and the prevalence of Low Birth Weight among stayers and migrants in/from both countries. Our preliminary results suggest that although migration is a survival strategy that allows people to escape violence, hunger, and extreme deprivation, it also exposes people to worse health outcomes, especially those with scarce resources socioeconomically speaking. Our study also provides a framework for assessing health dynamics across borders when populations faced adverse conditions, i.e., long-lasting armed conflicts (Colombia) and sudden drastic economic shocks (Venezuela).

Introduction

Venezuela is currently undergoing a profound social and economic crisis with far-reaching demographic consequences. During the last five years, Venezuela's Gross Domestic Product (GDP) halted, and the hyperinflation rate rose to 13,000 percent in 2018 (International Monetary Fund 2007). Health system funding, vaccination campaigns, and patient-to-doctor ratios substantially reduced since 2007 (Roa 2018). In 2017, 61.2% of the population lived in extreme poverty, and 89.4% of household heads declared that their family income was not enough to buy food (LATAM Freedom and Development Foundation 2018). Venezuelan population is facing extreme food and medicine shortages daily (Doocy, Ververs, et al. 2019); increasing infant and maternal mortality, and emerging epidemics of formerly eradicated diseases –such as malaria, measles, and diphtheria (García, Correa, and Rousset 2019). The situation is so dire, that in 2018 during the 23rd General Assembly of the Organization of

American States, the Secretary-General stated, "newborns in Syria have a better chance of survival than those born in Venezuela today."

Migration has become one crucial survival strategy in these socio-economic circumstances (Doocy, Page, et al. 2019). In November 2018, the United Nations High Commissioner for Refugees (UNHCR) reported that more than 3 million Venezuelans had fled the country since 2014, representing more than 10% of the national population. As more and more Venezuelans flee to escape death threats and hunger or to pursue health care, the migrant-receiving countries in Latin America struggle to provide shelter, food, medical care, and employment opportunities to such large numbers of people (Human Rights Watch 2019). Also, the Pan-American Health Organization continues to issue critical warnings about disease outbreaks to the neighboring countries affected by the massive migration.

The increasing pressure on the precarious health services of the neighboring countries has led to their collapse (European Commission 2019). The most affected neighboring country is Colombia, which has received the most significant influx of Venezuelans, approximately 1.3 million as reported in the latest Colombian population census in 2018 (DANE 2019). Colombia and Venezuela share a 1378-miles international border dividing seven Colombian *Departamentos* from five Venezuelan *Estados*. These two countries have historically had an active cross-border population and economic flow (Mejía 2010). Mass migration flowed in the opposite direction until very recently, with more than one million Colombians, mostly rural poor displaced people, going to Venezuela throughout the 70-year undeclared civil war: the Colombian Armed Internal Conflict (Ibáñez 2009; Urdinola 2001).

Formerly displaced Colombians are also migrating back to their home country escaping Venezuelan socio-economic crisis, often with binational families. In total, approximately 4,000 people stream across the Venezuela-Colombia border every day (Arnson 2019). The bordering Colombian *Departamento* North of Santander has seen a sharp rise in the number of cases of Venezuelans seeking medical care, from 182 in 2015 to 5,094 in 2018 (MinSalud 2019). The lack of access to prenatal care in Venezuela has led to more than 8,000 pregnant to enter Colombia in 2018 to give birth. From these women, forty-five experienced serious illness tied to pregnancy or childbirth, and seven died the same year on the Colombian side of the border (MinSalud 2019). Colombian health officials have had to address increasing cases of severe acute malnutrition among Venezuelan children under age five as well, with the number of cases rising from zero in 2015 to 360 in 2018 (Human Rights Watch 2019).

Overarching goal and hypotheses

Our overarching goal is to assess how binational migration flows in the time of crises can, on the one hand, allow people to escape hunger, death and extreme deprivation; on the other, expose people to worst health outcomes, especially women and their children. In other words, we want to assess the health cost (or benefit) of forced/crisis-driven migration.

Because binational migration flows between Colombia and Venezuela have a very long history, this assessment requires the reconstruction of time-series of health outcomes as further back in the past as possible for each country and for nationals who migrated (Venezuelan diaspora in Colombia, and Colombian diaspora in Venezuela). We plan to analyze three health outcomes: Infant Mortality Rate (IMR), Maternal Mortality Ratio (MMR), and Low Birth Weight (LBW). These three outcomes provide a holistic picture of how national health systems operate as they account for the health of children (IMR), mothers (MMR), and the connection between these two (LBW).

Also, these three outcomes are likely to be affected by migration, primarily when it occurs in the context of forced displacement. For example, migrant women may face barriers for accessing health care services at destination which can further translate in higher risk of dying for them and their children. Likewise, migration- and violence-related stress and adverse conditions during migration may affect fetuses' health, translating into a higher prevalence of low birth weight (Torche 2011; Torche and Kleinhaus 2012; Torche and Villarreal 2014). However, migration does not necessarily have to be detrimental to health. In time of crisis, migration can be the only survival strategy, and when families sufficiently anticipate the crisis, they may benefit from moving out before the worst consequences hit their households. Due to this potential positive and negative association crisis-driven migration and health, one would expect more considerable variation in health outcomes among national diasporas compared to stayers. This heterogeneity should be more significant in years of acute crisis, e.g., the bloodiest years of the Colombian Armed conflict (80s and 90s), and the last decade of Venezuela's history.

Due to differences in data sources, our temporal coverage and precision vary by country and across the three health outcomes. This variation is one additional reason to analyze three instead of only one outcome. We will be more confident to conclude on the role of migration if we found consistent patterns across many outcomes.

Our hypotheses are 1) health outcomes trends of migrant mothers and their children respond to country-of-origin shocks, 2) As survival strategy, migration can have protective or worsening effects on migrants' health which will necessarily translate into a higher variability of health outcomes among diasporas. If forced/crisis-driven migration is mostly pursued by vulnerable groups socioeconomically speaking, the overall effect of migration on health will be negative; if migrants are positively selected in terms of socioeconomic status, the effect of migration on health would instead be positive.

Data and methods

We combine data from censuses and vital registration systems from both countries. We estimate infant mortality rates (IMR) for both national populations and their *diasporas* in each country, using a combination of Summary Birth History (SBH) from Population Censuses, and birth and death counts coming from civil registries. Registered death counts will also be used to calculate Maternal Mortality Rates (MMR) and registered birth counts to analyze the prevalence of low birth weight. Population counts on their side will come from census data. We use Venezuelan censuses collected in 1971, 1981, 1990, 2001 and 2011 and Colombian censuses from 1993 and 2005, as well as, civil registry data from Colombia during the years 1979 to 2018, and Venezuelan from 1961 to 2011.

Colombia and Venezuela have very distinct vital registration systems. This difference affects the quality and availability of information. Venezuela has good quality and coverage since the seventies, with more than 90% of all deaths with medical certification, and 90% coverage (Bay and Orellana 2007; Jaspers-Faijer and Orellana 1994; PAHO 2018). Instead, Colombia has one of the highest proportions of under-registration of births and deaths in the region. Only in recent years, the quality of Colombian registration systems has improved. Completeness of birth certification improved from around 77% in the early 2000s to 95 percent in 2015. Still, the coverage of death certification was about 86% in 2015 (CRVS 2018). Concerning availability, Colombian vital statistics system reduced its time lag delivery to one year and has made all its micro-data available online. On the contrary, in Venezuela a strict secrecy policy has ruled public institutions, especially since 2013, and data sources are no longer updated nor publicly available (The Lancet 2018).

We adjust under-coverage using the national inter-census life tables calculated by the Latin American Mortality Database (LAMBdA) for both countries. The LAMBdA produces

adjusted inter-census life tables of all Latin American countries based on reported deaths and population census (University of Wisconsin 2018). Their death counts come from the civil registry system, and they are published by the World Health Organization (WHO). LAMBdA adjusts death count by eliminating under-coverage and age miss-declaration errors. These adjusted estimates are considered to create a yearly correction factor applied to national and Diasporas rates coming from inter/extrapolation of the inter-census ratio, obtained by dividing LAMBdA's rates to our rates at national level.

We assume that under-coverage in Diasporas registered births and deaths, as well as their census omission follow the same pattern that national populations. Adjusting Diasporas rates by these ratios allow both: 1) maintaining annual variation in the rates, which is crucial due to the high sensitivity of IMR and MMR to the socio-economic crises (Romero 1999), and 2) adjusting the changing levels of under-coverage due to improvements in the data sources.

We estimate Colombian and Venezuelan national IMR, and their Diasporas' IMR by using direct and indirect methods. Direct estimates are the ratios of under-one year registered death to registered live birth. For the indirect estimation, we gather information on children born alive and children still alive for both national and Diasporas women coming from SBHs. We apply Trussell's variant of Brass method. The SBHs do not provide information on the timing of births and deaths. The lack of information is overcome through fertility and mortality model age patterns; likewise, the proportions of children ever born, and currently dead to women are converted into a standard life table function (IUSSP 2014). The proportion of dead children is the ratio of children ever born (CEB) and still alive (CSA) from women in age group x to $x+5$:

$$D_{(x\ to\ x+5)} = \frac{CEB\ (x\ to\ x+5) - CSA(f\ x\ to\ x+5)}{CEB\ (x\ to\ x+5))}$$

The underlying logic is that the oldest child has more years of exposure than younger ones, and the difference in the number of CEBs between groups of women indicates an above-average date of birth. Thus, parity ratios P are estimated by contrasting the proportion of women age x to $x+5$ and age $x+5$ to $x+10$ with children ever born (CEB):

$$P_{(x\ to\ x+5)}/P_{(x+5\ to\ x+10)} = \left(\frac{CEB\ (x\ to\ x+5)}{women\ (x\ to\ x+5)} / \frac{CEB\ (x+5\ to\ x+10)}{women\ (x+5\ to\ x+10)} \right)$$

Thereby, it is possible to estimate from the SBH data infant mortality levels for about 15 years before data collection. Because this method overestimates IMRs (Verhulst 2016), we use these indirect estimations to build a proportional factor of Diasporas IMR concerning the

national population. Equally, these estimates are adjusted in comparison with LAMBdA inter-census life tables.

Because the period of reference for the indirect census estimates does not necessarily cover the same years for national and Diasporas IMR, between-group gaps are estimated via linear regression. In order to obtain a yearly Diasporas proportional factor (DPF) for each country, (*c*), two independent models are produced for each country, i.e., national and Diasporas *D*.

$$DPF_{(c,t)} = \frac{n\hat{q}_{1\,(D,t)}}{n\hat{q}_{1\,(c,t)}}$$

IMR of Colombian diaspora living in Venezuela and national IMRs of both countries are calculated using indirect method on SBH data. Colombian diaspora's IMR could only be estimated using indirect methods because Venezuelan citizenship is acquired by birth, and deceased children's nationality is the only variable found in the dead certificated, regardless of the mother's legal status. On the contrary, Colombia citizenship depends on parents' legal status in the country, which makes it possible to identify by the nationality the Venezuelan Diaspora through the registered birth and death counts.

In order to estimate maternal mortality for national populations and Diasporas in both countries, instead of using mortality rates, we estimate a maternal mortality ratio (MMR). MMR is the number of maternal deaths per 100,000 live births. We choose this indicator over maternal mortality rate (maternal deaths to women in reproductive age ratio) because 1) it directly shows the impact of health care services, while the maternal mortality rates expresses a set of aspects of the reproductive health of the country, such as fertility according to age, family planning among other aspects; 2) being maternal death a rare event, its event-exposure ratio is better to capture when analyzing small subpopulations such as Diasporas, and 3) In the context of forced/crisis-driven migration, having accurate estimates of migration flows (person-year exposed to risk) turns out a technical challenge that may easily lead to miss-calculations. In this sense, we apply a proportional ratio of cause of death identified as *pregnancy, childbirth and the puerperium* (ICD10: O00-O9A) to adjusted age-specific death rates.

Regarding the prevalence of low birth weight, we follow a standard definition that classifies as low weight, newborns below 2,500 grams. This information is made available by the Colombian National Office of Statistics (DANE) for all registered births from 1992 to 2017. These micro-level data include socioeconomic and demographic information about the mother

including educational attainment, place of residence, and municipality of the delivery. For Venezuela, we will rely on yearly Health Reports where the prevalence of low birth weight is included at the national level. We are not sure we will be able to have micro-level information about LBW for the Colombian diaspora in Venezuela.

In any case, we will estimate (or used already computed) prevalence of LBW by educational attainment of the mother (a proxy for socioeconomic conditions) along with a two- or three-categories variable for the location of the delivery. This category variable will separate Colombian (and Venezuelan if information is available) municipalities (counties) according to their distance to the border. The assumption here is that areas that are closer to the border are more likely to be affected by the crisis than areas that are far. Also, vulnerable migrants are more likely to migrate to areas close to the border.

Preliminary Results

Figure 1 displays IMR trends for Colombia (top panel) and Venezuela (bottom panel) from 1960 to 2017 according to different sources: countries' civil registry and the United Nations. We include a series that adjust civil registration estimates according to LAMBDA life tables. Because IMR is declining in both countries, we prefer to use adjusted civil registration data. As seen in Figure 1, these data are better able to capture year-specific shocks (typically smoothed out in the UN series). For example, in Colombia, increased IMR has been associated with the Colombian Armed Internal conflict (Urdinola 2004), which had two of its bloodiest decades during the 1990s and 2000s (Salas 2010). After the 2010 peace agreement, conflict-related violence declined and so did the IMR.

Infant mortality is lower in Venezuela than Colombia until the mid-1990s, where both IMR converge around levels of 20 deaths per thousand live births. After this period, IMR in Venezuela continues declining with some bumps around 2002, year in which, a failed *coup d'etait* and a national strike involving the National oil company (PDVSA) led to increasing violence and food and fuels shortage that impacted most of the population. The declining trend stalled in 2007 and reverses in the following years due to social and economic crisis described above.

Fig. 1 – Infant mortality rate in Colombia and Venezuela, 1960 - 2017

COLOMBIA
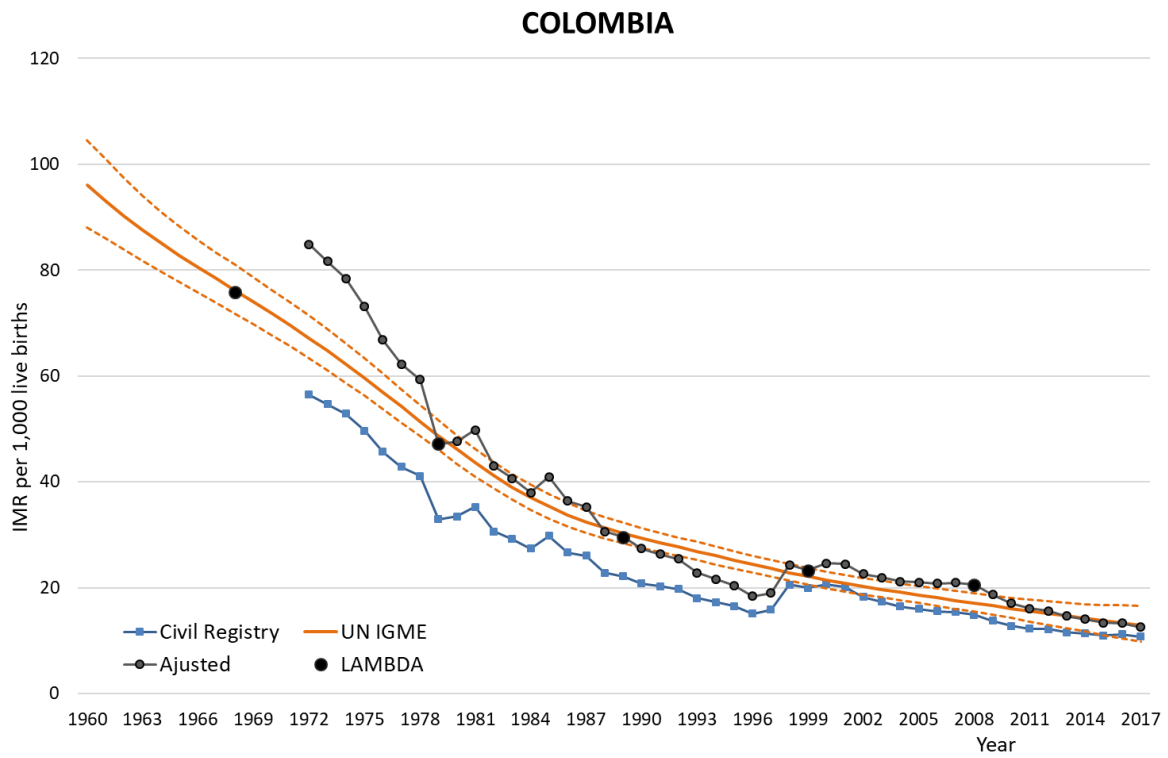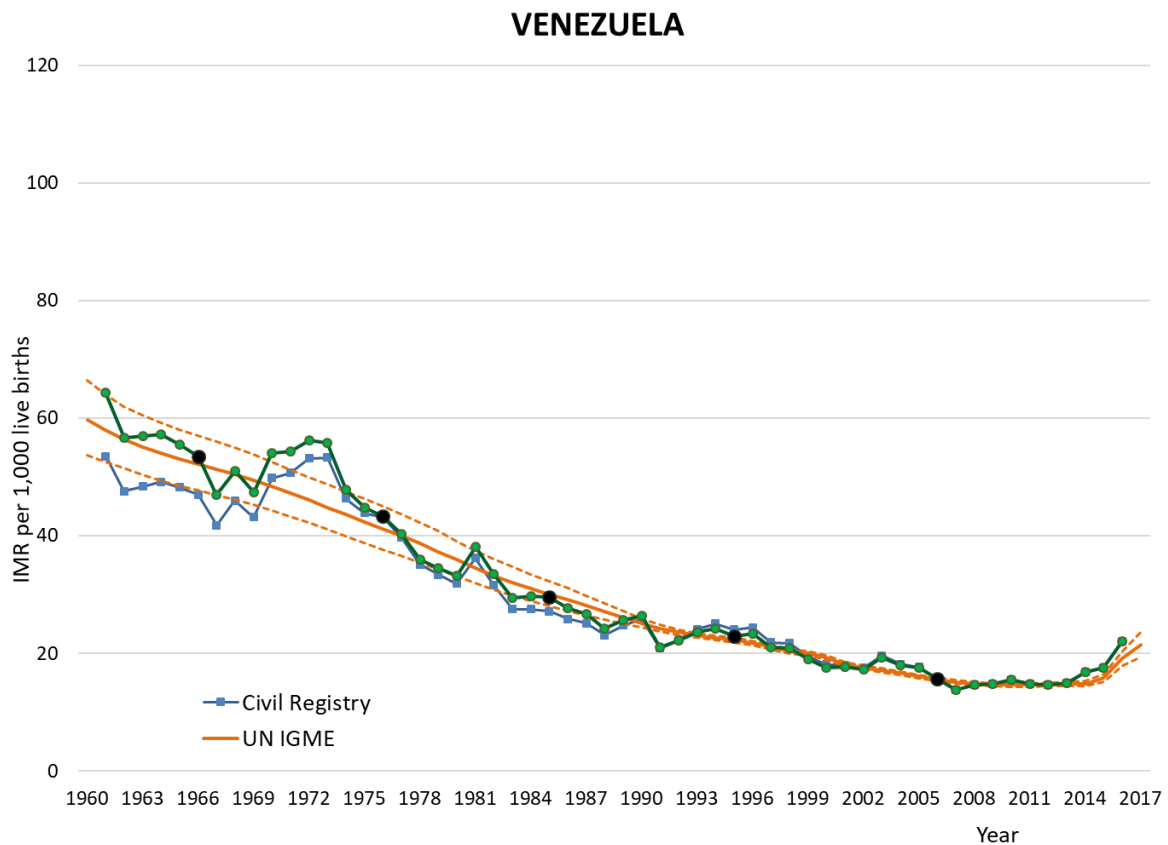
VENEZUELA

How do trends among diasporas compare to national levels? Figure 2 presents preliminary estimates of IMR for Colombians in Venezuela (top panel) and Venezuelans in Colombia (bottom). We divide diasporas according to time since arrival into Recent arrivals (less than five years) and diaspora (more than five years). The IMR among the recent Colombian diaspora is much higher than that of Venezuelan and Colombians non-migrants until the late 1990s. After 1999 both diasporas display lower IMR compared to Colombians who did not migrate. This reversal suggests migration could have changed from being harmful before 2000 to be protective during the first decade of this century. The intensification of the Colombia Armed conflict may have played a role in depressing health outcomes among non-migrants.

The IMR of Venezuelans in Colombia can be traced back to 1998. Although it starts below the IMR of Venezuelans and Colombian non-migrants, the IMR of the Venezuelan diaspora in Colombia has a positive slope over time, and it is very erratic. The years 2011 and 2014 display IMRs above 60 per thousand for the Venezuelan diaspora in Colombia. These two figures are about four times the IMR of non-migrants Venezuelans and Colombians. This reversed relationship between the IMR of migrants and non-migrants also shows how migration can be both protective (before 2008) and harmful (after 2009). The positive or

negative effect of migration on overall health outcomes may be associated with the socioeconomic characteristics of the migrants (probably more negatively selected during times of violence and crisis) and the context of reception (i.e., differential access to health services at destination).

We also explore trends in low birth weight among births that occur in Colombia to mothers whose permanent residence was in Venezuela. Not surprisingly, the number of births to mothers with these characteristics increased substantially in recent years, potentially due to the Venezuelan crisis. The number of births to Venezuelan mothers in Colombia was 1,086 which is more than ten times the number of births registered in previous years (see Figure 3).

Fig. 2 – Infant mortality for the Colombian and Venezuelan binational diasporas

IMR Colombian Diaspora living in Venezuela
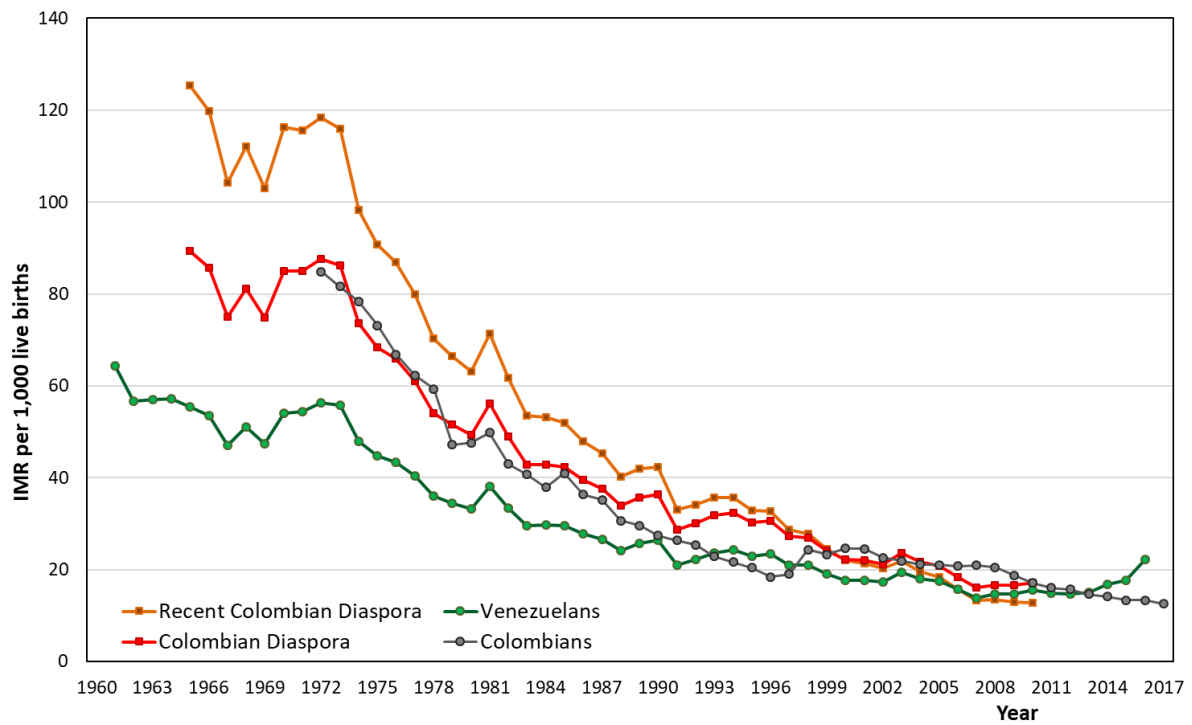
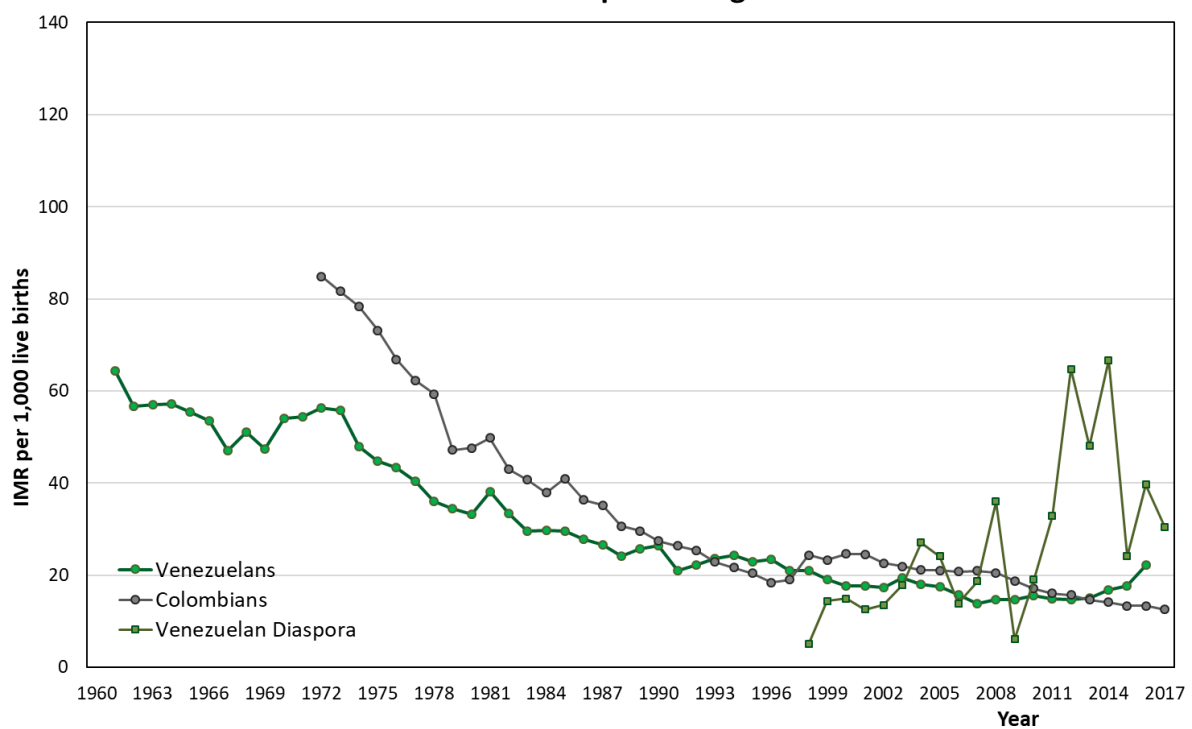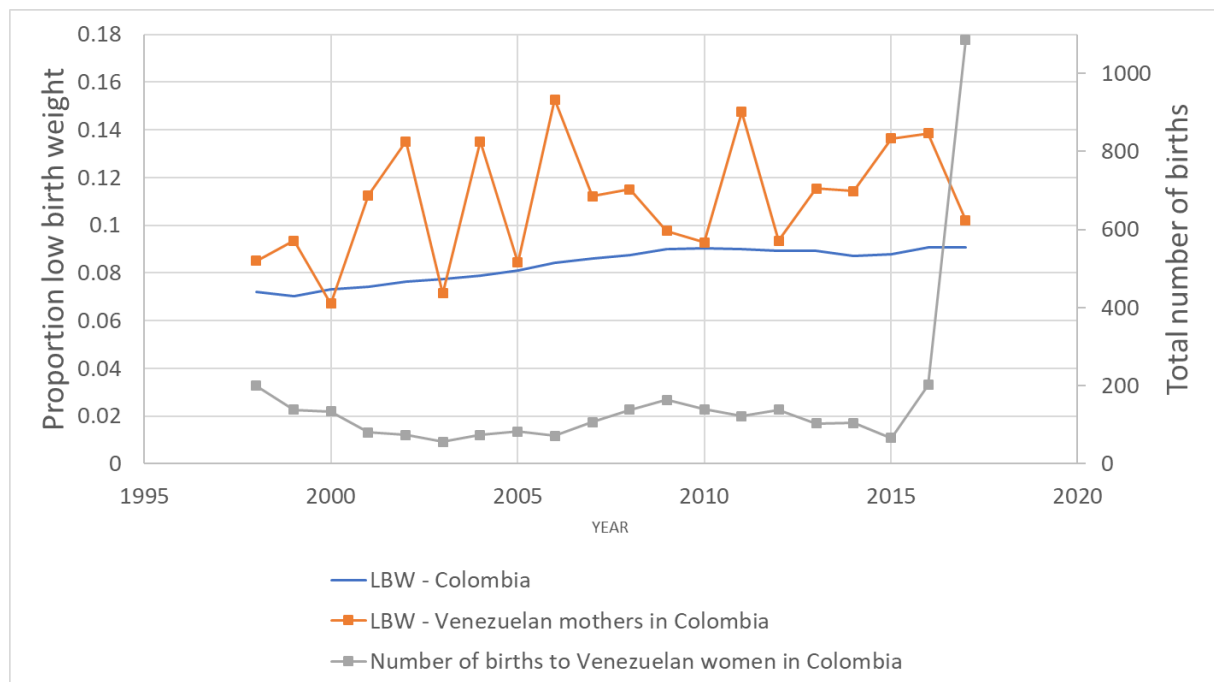## IMR Venezuelan Diaspora living in Colombia

Figure 3 – Proportion of births below 3,500g (Low birth weight, LBW), and the total number of births in Colombia to women with residence in Venezuela

Trends for the prevalence of LBW suggest migration may be detrimental for babies' health as the probability of low birth weight is always higher among babies whose mother lives in Venezuela but gave birth in Colombia. We need further analysis to locate these births within Colombian municipalities and better understand the potential context of each delivery. Also, we need to construct series of LBW for Colombian mothers giving birth in Venezuela, and for Venezuelan mothers who did not migrate. Similarly, we need to construct the four series for the Maternal Mortality Ratio.

Discussion

This study might be the only academic attempt to estimate comparatively the relationship between migration and health outcomes among diasporas in two neighboring countries. Besides providing yearly-national-level measures of health outcomes for these populations, this study aims to shed light on how populations react to societal pressure such as violence and acute economic crisis. We believe migration is a survival strategy, but because families and individuals have incomplete information and differential socioeconomic resources, the consequence of migrating may be both positive or negative for their health.

This research will provide a framework for understanding population dynamics beyond national borders, or for that matter, at the very border between nations. We believe this is a promising approach for understanding migration flows in areas with historical and cultural connections, such as the Colombian-Venezuelan border, but also many other binational borders.

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