Neighborhood Toxic Emissions, Migration, and Mobility

Scott T. Yabiku*

Seung Yong Han

Center for Population Dynamics

Arizona State University

* Direct correspondence to Scott T. Yabiku, Center for Population Dynamics, Arizona State University, Box 3701, Tempe, AZ 85287; syabiku@asu.edu

Neighborhood Toxic Emissions, Migration, and Mobility

Abstract

Prior research has established that immigrants are more likely to be exposed to environmental hazards than non-immigrants, but the literature has not explored the large heterogeneity that exists within immigrants. We generate our hypotheses using frameworks from the residential assimilation and residential instability literatures. Using an innovative new dataset—the Southwest Migration Study—we examine the predictors of neighborhood environmental hazards among Spanish speakers in the Phoenix, Arizona, metropolitan area. We merge these individual-level data with the Environmental Protection Agency's Toxic Release Inventory to create distance-weighted means of neighborhood exposure to chemical hazards. In our largely immigrant sample, we find that nativity is not associated with total exposure, but a measure of residential mobility since age 14 is significantly associated with less exposure to chemical hazards.

Neighborhood Toxic Emissions, Migration, and Mobility

Introduction

The distribution of neighborhood environmental hazards has received much attention in the research literature. Often referred to as "environmental racism," this literature finds that underprivileged groups are more likely to be located in areas with higher levels of environmental hazards: waste sites, air pollution, freeways, and facilities that produce potentially toxic emissions (Downey 1998; Mohai and Saha 2006). The underprivileged groups most often affected include minorities and low income individuals. Given that immigrants tend to be low income and minority, the prior literature has also found that immigrants tend to have higher exposure to environmental hazards (Hunter 2000).

Simply dichotomizing individuals based on immigrant/native designation, however, obscures important heterogeneity within these groups. For example, immigrants are highly varied with respect to time of first arrival in the United States, and the number of different times they have crossed borders: some immigrants enter once and settle, while others make multiple return trips (Saenz and Davila 1992; Lindstrom 1996; Reagan and Olsen 2000). Natives, too, vary in how they have been impacted by the migration experiences of prior generations. The residential assimilation perspective, for example, suggests that compared to their parents, 2nd generation native born individuals may be able to live in better neighborhoods due to the 2nd generation's higher socioeconomic status (Myers and Lee, 1998; White, Biddlecom, and Guo 1993). Likewise, the 3rd generation may have even more socioeconomic resources they can use to avoid environmentally disadvantaged neighborhoods.

In addition to heterogeneity within these groups, the immigrant/native dichotomy is problematic because it tends to obscures potential commonalities across groups with regards to movements other than those that cross international borders. For example, native born individuals are not necessarily less mobile than the foreign born (Rogers and Henning 1999). It is possible for some native born individuals to have levels of internal migration and local residential mobility that rival that of international migrants. In addition, the factors that motivate internal migration and local residential mobility can differ from the factors behind international migration. For example, there could be very different relationships between neighborhood environmental hazards and local residential mobility as compared to the relationship between environmental hazards and international migration.

The distinction between international migration versus residential mobility is important because differing theoretical frameworks predict divergent outcomes. Residential assimilation would suggest that initially, immigrants would be located in neighborhoods of poorer environmental quality because they lack the resources (socioeconomic, linguistic) that would purchase them better neighborhoods. Subsequent generations, however, would be more likely to accrue resources that allow individuals to locate in better neighborhoods. Thus, residential mobility of individuals would be expected to be associated with increasing upward trajectories in terms of neighborhood environmental quality.

In contrast to the residential assimilation framework, the residential instability literature predicts that individuals who are mobile are more likely to experience poorer outcomes and worse neighborhoods (Kirby and Kaneda 2006). In this perspective, often mobility represents the inability to maintain a stable residence, or an involuntary move. For example, South et al. (1998) found that after divorce, if children move, they tend to move to economically worse neighborhoods. Residential instability also has particular relevance for neighborhood hazards. One perspective in the environmental justice literature is that hazards are not necessarily targeted for placement in minority and disadvantaged areas, but rather disadvantaged areas are least prepared to organize against these hazards (Downey 1998). Neighborhoods with high mobility and turnover are less likely to develop social ties (Browning and Cagney 2002), and thus far less able to collectively organize against threats such as the placement of facility that creates environmental hazards.

In this paper, we use data from a new innovative dataset, the Southwest Migration Study (SWMS), to examine correlates of neighborhood environmental quality. We use the Environmental Protection Agency's Toxic Release Inventory (TRI) to characterize the neighborhood environmental quality of Spanish-speaking individuals (both native and foreign born) in the Phoenix metropolitan area. To separate the multiple dimensions of population movement, we predict neighborhood environmental quality with measures of nativity, immigration, and mobility.

Data and Methods

The data used to test these hypotheses come from the Southwest Migration Study (SWMS). The aims of the SWMS are to examine the interrelationships between migration, health, and the environment. The SWMS is a joint effort between investigators at Arizona State University and Universidad Autónoma de Sinaloa (UAS), in Culiacán, Mexico. This first set of SWMS data is a small-scale pilot project designed to binationally test data collection procedures in a two-country setting.

In the Phoenix component, Census blocks were sampled from the eight most populous cities in Maricopa County (Phoenix, Tempe, Mesa, Chandler, Glendale, Scottsdale, Peoria, and Gilbert). These eight cities comprised approximately 88% of the entire population of Maricopa County. Blocks were eligible to be sampled if they were at least 25% Hispanic, based on the 2000 Census. Blocks were then sampled, proportionate to size, from all eligible blocks. Interviewers from UAS conducted face to face interviews at housing units in sampled blocks over a 10 day period in March, 2009. Interviewers went door to door, and an individual was eligible for interview if he or she was at least 18 years old and Spanish speaking. If multiple Spanish-speaking adults were in a household, interviewers asked to survey the eligible adult with the most recent birthday. Restricting eligibility to Spanish speakers was necessary because the interviewers from UAS, while bilingual, had fluent proficiency only in Spanish. The benefit of using interviewers from UAS, however, was their very strong rapport with respondents—many of whom would have been less likely to participate in interviews with Anglo interviewers, or even with fluent US-born Mexican-heritage interviewers. The interview protocol consisted of three parts. First was a standard questionnaire that asked a variety of closed-ended questions covering demographic, employment, health, and basic migration history (nativity, parental nativity, year of entry to the US). Second was a yearly life history calendar that measured geographic location, employment status, and family events. Third was a set of biomarker measurements including height, weight, peak lung flow, and dried blood spots that were later assayed for diabetes risk (glycosylated hemoglobin-HbA1c). The response rate of households that were found to an eligible occupant present was 58%. This compares favorably with other studies of immigrant populations, such as the New Immigrant Survey (69% response rate). The sample size for the Phoenix survey was N=418.

Dependent Variable: Weighted Total On-Site Chemical Releases. The individual-level SWMS data were merged with the EPA's Toxic Release Inventory (TRI) data from 2007. These data contain the geographic location of all facilities that fall under specific industry categories (e.g., manufacturing, electrical utilities, hazardous waste sites), employ 10 or more people, and process a specified amount of particular chemicals (Environmental Protection Agency, 2009). The data also contain the amount of more than 600 different types of chemicals and emissions each facility managed. In our preliminary analyses, we do not yet differentiate between the types of chemicals. Although this is a limitation, because the toxicity of these chemicals varies greatly, in our analyses here we simply aim to examine the total amount of regulated emissions. We consider all facilities in the TRI data for Maricopa County, which contains the metropolitan Phoenix area. For each respondent's neighborhood, we create a weighted sum of the total on-site releases of all facilities in the TRI, inversely weighted by the distance from the respondent's neighborhood. Total on-site releases include emissions to the air, discharges to water or land, and disposal in underground injection wells. However, surface water discharging, underground injection, or total on-site land releases by facilities in Maricopa County are almost zero.

Thus, the dependent variable can be considered as an "air emissions" index, though later analyses may focus on specific types of emissions. This is the dependent variable for our analysis.

Nativity. We created a dummy variable to divide the sample into US Born and foreign born. In additional analyses for PAA, we plan to further subdivide the foreign born sample by a proxy measure of acculturation, due to the expected gradient of socioeconomic status that follows acculturation. The data contain a measure of whether the households' language use was Spanish-only or a mix of Spanish and English, or entirely English. This measure will be used to divide the foreign born into two groups: Spanish-only, or at least some English.

Residential Mobility since Age 14. Recall that an important aim of our research is to separately examine the process of immigration from that of mobility. Thus in addition to measures of nativity, we include a measure of residential mobility that is coded 1 if the respondent currently lives in the same metropolitan area that he or she lived in at age 14, and 0 otherwise. This is admittedly a crude measure of mobility, but life history calendar data, which contain complete migration and mobility histories, are currently being transferred from paper to computer format; we expect this data entry to be complete by the end of 2009. Therefore, these data will be available for the final analyses for the PAA meetings in 2010. These additional measures of mobility would indicate the number of prior moves in the metropolitan area and outside the metropolitan area, as well as the timing within the life course of these moves, e.g., how recent was the most prior move.

Controls. Our initial models include some basic controls—gender, age (in categories), educational attainment (categories), marital status, and household income in the prior week. Household income is also measured in categories so that we can designate one category as "missing/refused," and thus not drop those cases from the analysis.

Method. We use linear regression to predict the total weighted on-site chemical release of the respondent's neighborhood. In our preliminary models, our strategy is to first estimate the total relationship between chemical releases and our two measures of population movement: nativity and residential mobility since age 14. In subsequent models, we introduce basic demographic characteristics to tests if these associations persist in the presence of controls.

Results

Table 1 shows the descriptive statistics for the sample. Recall that the dependent variable, the weighted on-site release, is inversely-weighed by distance from the respondent's neighborhood to each of the 99 facilities in Maricopa County. Although the mean was 60 on this measure, there was substantial variation. The standard deviation was about 30, but the maximum was over 160. This suggests that this measure was skewed, with some respondents on the far right tail of exposure.

(Table 1)

Our two main independent variables are nativity and residential mobility since age 14. Most of the sample was foreign born; only 13% were born in the US. This is likely a result of the survey eligibility rules, which required Spanish proficiency. Most of the sample was also mobile since age 14: 84% were living somewhere else at age 14. In other words, only 16% of the sample were living somewhere in the metropolitan Phoenix area in their early teen years.

The control variables indicate that the sample was 64% female and had an average age of 36 years. The model highest educational level was high school at 31% of the sample, but primary education (29%) and some secondary schooling (28%) were both almost as frequent. Half the sample was currently married, and household income in the past week averaged about $650. As is typical with income questions, there was substantial missing information. Thus in the models, we use categories (with one category as missing) in order to avoid losing these respondents.

(Table 2)

The multivariate models are show in Table 2. The first model includes our two primary variables of interest: nativity and residential mobility. The residential mobility measure has a significant association with weighted total on-site releases. Respondents who were mobile since age 14 are in neighborhoods with significantly less releases. More mobile respondents living in neighborhoods with fewer emissions is supportive of the residential assimilation framework, in which mobility is generally upward mobility. Nativity, however, is not associated with weighted total on-site emissions releases.

In models 2 and 3 we add basic sociodemographic controls to test if these measures account for the differences observed in model 1. Model 2 adds gender and age, while model 3 adds education, marital status, and household income. None of these additional measures, however, reduce the magnitude or the significance of the residential mobility variable. In fact, the coefficient is slightly larger in magnitude in model 3 compared to model 1. In models 2 and 3, older respondents (aged 65+ tended to live in areas with more emissions than younger respondents; and respondents with only primary school education had higher weighted-emissions than high-school graduates (the reference). There were no differences by marital status, but individuals with households earning $600-$1000 per week had higher total weighted emissions than those earning $0-300.

Discussion and Future Directions

The results thus far have illustrated the importance of including a measure of residential mobility in predictors of weighted neighborhood emissions from facilities that have registered with the EPA's toxic release inventory monitoring program. The direction of this coefficient shows that more residentially mobile respondents were in areas with fewer emissions. This finding contrasts with the residential instability literature, which in general has found that residential instability is associated with worse outcomes and poorer neighborhoods. It may be that mobility within this population (Spanish speakers in Phoenix, 87% of whom are foreign born) is upward mobility. More mobile individuals may be moving to better neighborhoods over time as they become more residentially assimilated.

On the other hand, there are several limitations in the analysis thus far that temper our ability to make strong conclusions. First, the residential mobility measure is a crude dichotomy that is based on age 14. There is tremendous heterogeneity within individuals who have moved since age 14 that is not captured by a simple binary indicator. Second, because the sample was overwhelmingly foreign born, it was not possible to observe sufficient variation so that residential assimilation could be tested across multiple generations. We were unable to test if exposure to emissions followed an expected gradient across first, second, and third generation in this sample. Instead, we observed that mobility, regardless of generation, was associated with fewer emissions—and one explanation of this is upward residential mobility.

The next steps of this analysis will be to make better use of the life history calendar data, which will allow us to unpack the residential mobility histories. Rather than being limited to a simple dichotomy of mobility since age 14, we will be able to accumulate the total number of moves, as well as the number of internal versus international moves, and timing within the life course of these moves. Because the sample is so heavily weighted towards the foreign born, we will look to the variation in immigration and mobility histories within the foreign born sample in order to examine the associations between population movement and the exposure to environmental hazards.

References

Browning, Christopher R. and Kathleen A. Cagney. 2002. “Neighborhood Structural Disadvantage, Collective Efficacy, and Self-Rated Physical Health in an Urban Setting.” *Journal of Health and Social Behavior* 43(4): 383-399.

Downey, Liam. 1998. “Environmental Injustice: Is Race or Income a Better Predictor?” *Social Science Quarterly* 79: 766-778.

Environmental Protection Agency. 2009. “The Toxics Release Inventory (TRI) and Factors to Consider When Using TRI Data.” Retrieved from www.epa.gov/tri/triprogram/FactorsToConPDF.pdf

Hunter, Lori M. 2000. “The Spatial Association between U.S. Immigrant Residential Concentration and Environmental Hazards.” *International Migration Review* 34: 460-488.

Kirby, James B. and Toshiko Kaneda. 2006. “Access to health Care: Does Neighborhood Residential Instability Matter?” *Journal of Health and Social Behaviors* 47(2): 142-155.

Lindstrom, David P. 1996. “Economic Opportunity in Mexico and Return Migration from the United States.” *Demography* 33(3): 357-374.

Mohai, Paul and Robin Saha. 2006. “Reassessing Racial and Socioeconomic Disparities in Environmental Justice Research.” *Demography* 43(2): 383-399.

Myers, Dowell and Seong Woo Lee. 1998. “Immigrant Trajectories into Homeownership: A Temporal Analysis of Residential Assimilation.” *International Migration Review* 32(3): 593-625.

Reagan, Patricia B. and Randall J. Olsen. 2000. “You Can Go Home Again: Evidence from Longitudinal Data.” *Demography* 37(3): 339-350.

Rogers, Andrei and Sabine Henning. 1999. “The Internal Migration Patterns of the Foreign-Born and Native-Born Populations in the United States.” *International Migration Review* 33(2): 403-429.

Saenz, Rogelio and Alberto Davila. 1992. “Chicano Return Migration to the Southwest: An Integrated Human capital Approach.” *International Migration Review* 26(4): 1248-1266.

South, Scott J, Kyle D. Crowder, and Katherine Trent. 1998. "Children's Residential Mobility and Neighborhood Environment following Parental Divorce and Remarriage." *Social Forces* 77(2): 667-693.

White, Michael J., Ann E. Biddlecom, and Shenyang Guo. 1993. "Immigration, Naturalization, and Residential Assimilation among Asian Americans in 1980." *Social Forces* 72(1): 93-117.

<Table 1> Descriptive Statistics of Variables

	N	Mean	Std Dev	Min	Max
Weighted On-site Release	411	60.29	30.75	23.83	166.52
Mobility since age 14	409	0.84	0.37	0	1
US-born	414	0.13	0.34	0	1
Female	418	0.64	0.48	0	1
Age	417	35.70	12.60	18	83
18 ~ 24	417	0.19	0.40	0	1
25 ~ 34	417	0.33	0.47	0	1
35 ~ 55	417	0.25	0.44	0	1
45 ~ 54	417	0.12	0.33	0	1
55 ~ 64	417	0.06	0.24	0	1
65 over	417	0.04	0.19	0	1
Education					
Primary School	417	0.29	0.46	0	1
Secondary School	417	0.28	0.45	0	1
High School	417	0.31	0.46	0	1
College	417	0.12	0.33	0	1
Marital Status					
Currently Married	414	0.50	0.50	0	1
Married Before	414	0.13	0.34	0	1
Never Married	414	0.22	0.42	0	1
Cohabiting	414	0.15	0.36	0	1
Household Income	293	656.52	900.67	0	7,500
$ 0 ~ 300	419	0.18	0.38	0	1
$ 300 ~ 400	419	0.10	0.30	0	1
$ 400 ~ 600	419	0.16	0.36	0	1
$ 600 ~ 1000	419	0.17	0.38	0	1
$ 1000 over	419	0.10	0.29	0	1
Missing	419	0.30	0.46	0	1

<Table 2> OLS Regression Analysis on Weighted Total On-site Releases

	Model 1			Model 2			Model 3		
	B	S.E.		B	S.E.		B	S.E.	
Mobility since age 14	-12.71	4.90	**	-13.45	5.05	**	-15.01	5.24	**
US-born	-2.54	5.48		1.41	5.55		0.47	5.68	
Female				1.50	3.25		1.88	3.41	
Age (ref. Age 35 ~ 44)									
Age 18 ~ 24				-1.35	4.91		-0.08	5.31	
Age 25 ~ 34				-2.68	4.01		-2.50	4.11	
Age 45 ~ 54				-1.94	5.34		-3.39	5.47	
Age 55 ~ 64				-4.18	6.94		-5.81	7.41	
Age 65 over				17.97	8.78	*	17.53	9.11	†
Education (ref. High School)									
Primary School							8.35	4.32	†
Secondary School							2.53	4.22	
College							5.25	5.27	
Marital Status (ref. Currently Married)									
Married Before							-3.97	5.20	
Never Married							-5.04	4.34	
Cohabitate							-3.45	4.57	
Household Income (ref. Income $ 0 ~ 300)									
$ 300 ~ 400							2.91	6.13	
$ 400 ~ 600							5.96	5.34	
$ 600 ~ 1000							10.14	5.41	†
$ 1000 over							6.23	6.37	
Missing							7.71	4.81	
Intercept	70.68	4.76	**	71.49	6.17	**	65.18	7.80	**
R^2	0.03			0.04			0.07		
N	397			397			397		

Note: † $p < .10$; * $p <.05$; ** $p <.01$, two tailed.