Unauthorized Mexican Immigrants and Business-Generated Environmental Hazards in Southern California

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Recent research suggests that foreign-born residents and lower-income communities are exposed disproportionately to environmental hazards in the United States. Employing 1994 Mexican immigrant legal status survey data, the 1990 PUMS, and 1991-98 Toxic Release Inventory (TRI) data, this paper investigates whether business facilities were more likely to emit toxic releases, and at higher levels, in southern California neighborhoods with higher numbers of unauthorized Mexican immigrant resident workers (UMI) during the 1990s. Controlling for other ethno-racial minority groups and for neighborhood economic conditions, results confirm these two hypotheses, suggesting the need to move beyond simple race and class explanations.

Introduction

Despite efforts by the Immigration and Naturalization Service to slow illegal immigration to the United States during the past decade, unauthorized Mexican immigrant workers (UMI) continue to be an integral component of the US economy (Benson 1999; Cornelius 1998; Griffith 1999; Marcelli 1999, 2001). While this trend is consistent with the finding that the demand for lower-wage workers has risen in the United States since the late 1970s (Bernstein 1999), empirical evidence also suggests that residents without US citizenship, especially unauthorized immigrant workers, face greater environmental, occupational, health and safety risks than legal immigrants and citizens (Simcox 1997). For instance, the Equal Employment Opportunity Commission (EEOC) recently announced a $72,000 settlement with a Minneapolis Holiday Inn Express as a result of complaints about retaliatory firings of unauthorized immigrants resulting from stepped-up union recruitment efforts. The EEOC also attempted to reassure unions that it will back away from labor disputes when such involvement may encourage employers to exploit unauthorized workers (Cleeland 2000). In another recent case, a national contract labor firm pleaded guilty to hiring unauthorized Latino workers to remove carcinogenic asbestos from buildings (Environmental News Service 2000). The fear of losing one's job is only one reason why unauthorized immigrant workers may be less likely to report environmental hazards or mistreatment by an employer. The threat of deportation is arguably at least as dissuasive.

The purpose of this paper is exploratory and straightforward. We investigate the spatial association between the estimated number of UMI residing in southern California (Los Angeles, Riverside, San Bernardino, Orange and Ventura counties) and two proxies for industrial environmental hazards: (1) the number of business facilities having reported releasing toxic chemicals, and (2) the level (pounds) of released toxic chemicals reported by neighborhood. The analysis employs 1991-98 Environmental Protection Agency (EPA) Toxic Release Inventory (TRI) data, data from the 1994 University of Southern California (USC) and El Colegio de la Frontera Norte (COLEF) Foreign-born Mexican Household Survey, and the five percent Public Use Microdata Samples (PUMS) of the 1990 Census.

Recent research has supported the claims of environmental justice advocates that lower-income and certain ethno-racial minority groups are disproportionately exposed to toxic waste or air pollution (Pastor, Sadd and Hipp 2001), and Hunter (2000) finds that foreign-born residents are more likely to live near large-scale hazardous waste generators and proposed Superfund sites. But no study to date has examined whether those who are perhaps most vulnerable to environmentally unsafe toxins in the workplace or neighborhood—namely, immigrants residing in the country illegally—are disproportionately exposed. If it is true that some corporations have intentionally sought out communities less likely to defend themselves against the existence or introduction of toxic chemicals (Bullard 1990), and that unauthorized immigrants are less inclined to resist environmentally hazardous chemicals in the workplace, then it seems reasonable to hypothesize that this may also be the case geographically. But even if a statistically significant spatial association between environmental hazards and members of vulnerable minority groups is the result of residential in-migration rather than the product of intentional location and polluting decisions by businesses, results may inform contemporary environmental and land use policy decision making.

This paper is analytically modest in the sense that the goal is not to establish whether businesses intentionally polluted where disproportionately high numbers of UMI resided in the 1990s. Rather, the task is simply to investigate whether a spatial association existed at the neighborhood level between toxic releases from business facilities (which may have been present before 1990) and the number of UMI. Only when the 2000 Census data become available will it be possible to match them temporally with the EPA's toxic release data in a way that makes the testing of the "move-in" versus "placement" hypothesis possible (Sadd et al. 1999b).

The Three Waves of Environmental Concern

Most research by demographers and economists on environmental issues during the past two centuries is located within a much larger literature on population and economic growth within developing nations (Pebley 1998; Torras and Boyce 1998). Before World War II the dominant analytical framework held that changes in demographic behavior (e.g., fertility, migration, mortality) were motivated by socioeconomic structural changes accompanying industrialization (Davis 1945). Subsequently, three waves of concern about population and environment have been identified (Ruttan 1993). The first emanated from Malthusian fears of an "overcharged population" that would outpace food supply (Foster 2000: 92) and arrived in the 1940s and 1950s. The second came in the 1960s and 1970s and focused on environmentally harmful by-products of production and consumption. The third has concentrated attention on global environmental change (e.g., climate, acid rain, ozone) and emerged in the 1980s.

Only very recently, however, has empirical demographic research moved beyond first-wave environmental issues. According to Davis (1991), it is not that most demographers viewed population effects on the environment as unimportant. To the contrary, they have generally accepted that rapid population growth is detrimental to natural resources, but have concentrated their research efforts on investigating mechanisms for reducing fertility in poorer countries. Other demographers have emphasized the importance of considering other mediating feedback effects, such as social institutions (McNicoll 1990), technology (Boserup 1981; Simon 1981), and fertility reduction (Lee 1987, 1997), in addition to population growth. Finally, the challenges of collaborative interdisciplinary research and sparse longitudinal data compete with demographers' *a priori* assumptions concerning the relationship between population growth and the environment as an explanation for the fact that empirical demographic attention to environmental issues is a newer-wave phenomenon (Pebley 1998).

One strand of this newer empirical work, employing census and other local-level data, has begun to investigate whether hazardous waste sites and air pollution are more likely to be found in ethno-racial minority and relatively poor neighborhoods (Anderton et al. 1994; Morello-Frosh, Pastor and Sadd 2001; Pastor, Sadd and Hipp 2001; Sadd et al. 1999a; White and Hunter 1998). This newer strand is also different in its focus on the effects of environmental degradation on population, as opposed to population effects on environment. While grappling with various data and methodological limitations, several of these studies have supported the assertion of environmental justice advocates that low-income and racial minority groups are disproportionately exposed to toxic waste and air pollution because they tend to live near such potential hazards (Boer et al. 1997; Mohai and Bryant 1992; Ringquist 1997; UCC 1987; US GAO 1983).

Other environmental justice researchers are calling for more specificity concerning demographic characteristics and economic factors as they relate to environmental hazards. Blanket classifications of neighborhoods like *minority* and *low-income* do not fully explain the location of environmental hazards. For instance, Baden and Coursey (1997) find little evidence of environmental injustice in Chicago with regard to African American populations, but note that Latinos tend to reside in areas surrounding hazardous sites. And, although Anderton et al. (1994) find no nationally consistent variation in racial or ethnic composition of metropolitan census tracts which contain commercial hazardous waste facilities, they note that in regions with comparatively large percentages of Latino residents, waste facilities are more likely to be found in tracts with Latino groups. Lastly, in a nationwide longitudinal study, Been and Gupta (1997) found that the proportion of Latinos in their study areas had a significant impact on the likelihood of receiving a toxic waste facility when controlling for the percentage of local industrial employees and population density.

Partly because of these findings, some researchers have begun to study the relationship between demography and environmental risk based on factors other than race and class broadly defined. Hunter (2000) recently undertook the first nationwide empirical study of foreign-born residents' exposure to environmental hazards in the United States. Using a county-level nationwide data set reflecting immigrant and environmental risk presence, she suggests that counties with higher percentages of immigrants, particularly those with a high concentration of non-English speaking households, tend to have comparatively large quantities of hazardous waste generators and proposed Superfund sites. Focusing historically on Los Angeles County, Pulido (2000) traces the region's residential and industrial segregation patterns by race. She reports that all ethnic minorities in Los Angeles appear to be disproportionately exposed to environmental pollution to some extent. More important for the present study, Pulido writes, "Latinos' exposure is more a function of their role as low-wage labor within the racialized division of labor and the historic relationship between the barrio and industry…. As a result, Latinos live near industry, since both are concentrated in central LA and industrial corridors, and they are exposed to hazards on the job…. Thus, their exposure is a function of their class and immigrant status, as well as their racial position" (32).

Here we take this question a step further by investigating whether and to what extent a person's legal residency status might further explain the level and severity of environmental hazards she or he is exposed to. We are particularly interested in learning whether UMI were more likely to be exposed to business-generated environmental health hazards than other foreign-born residents who are either legal immigrants or US citizens during the 1990s.

Previous work has highlighted at least three main methodological problems that bear on this study. Two such issues are the determination of appropriate units of demographic analysis (or "aggregation error") and the direction of causality between demographic, economic, and environmental variables (Hunter 2000: 464). Several studies also note a third problem: the proximity of a community to a pollution source cannot, by itself, be considered an adequate measure of environmental health risk (Anderton et al. 1994; Anderton 1996; Been 1994; Boer et al. 1997). For example, in the case of air pollution, weather conditions and other factors may create risks in more distant communities as well as nearby ones. These problems have meant that researchers' conclusions about the extent of exposure to pollution among demographic subgroups are tentative. Indeed, the demand for more rigorous standards of measurement and greater precision reflects to some extent a wider disagreement among researchers whether the evidence available allows us to infer that environmental discrimination is present at all (Anderton et al. 1994; Bowen 1999; Oakes, Anderton and Anderson 1996:125; Szasz and Meuser 1997).

In the context of this debate, a wave of new environmental justice studies have fine-tuned their research methods to try to overcome lingering doubts about the validity of previous studies' findings. These methodological modifications include the geocoding of site locations and the connection of these with US Census tract data to compare visually the location of toxic waste facilities with the demographic characteristics of proximate neighborhoods (Boer et al. 1997); matching new EPA data on toxic releases and models of ambient air exposure with US Census tract data (Morello-Frosch, Pastor and Sadd 2001; Sadd et al. 1999a); longitudinal analysis to identify post-siting effects in host and adjacent census tracts (Oakes, Anderton and Anderson 1996); and accounting for the effects of neighborhood ethnic transitions on the likelihood of receiving toxic facilities, since lower neighborhood social cohesion reduces the possibility of formulating an organized response to siting decisions (Pastor, Sadd and Hipp 2001). Several of the studies noted above have focused on pollution exposure patterns in Los Angeles County. Their focus on one area has helped to overcome problems of aggregation error, better track environmental hazards in the context of regional industrial clusters and a distinct regulatory regime, and examine environmental risks in relation to diverse communities undergoing rapid demographic and socioeconomic change. In general, analysis of geography, demography and pollution data suggests that after controlling for other factors, the geographical association of toxic releases and of minority populations in Los Angeles County is statistically significant.

Only one study (Pastor, Sadd and Hipp 2000) to date, using toxic storage and disposal facilities data rather than EPA toxic release reports from business facilities, has provided evidence that industrial siting is a more important causal factor in this association than minority in-migration. Thus, so far there is little evidence that industrial location decisions are concentrated in minority areas, rather than minorities concentrating in areas with pre-existing polluters. But environmental inequity (e.g., racism) may occur even in the absence of intent. For instance, the presence of white privilege that permits one racial group to purchase homes and to reside in relatively cleaner environments is a result of past individual, industrial and state actions that encouraged decentralization and suburbanization (Pulido 2000).

There are at least two reasons to study whether UMI tend to be disproportionately located in neighborhoods characterized by higher levels of toxic release in the southern California region. First, the region has become the focus of much recent environmental impact research that finds statistically significant correlations between neighborhood ethno-racial composition and environmental hazards (Pastor, Sadd and Hipp 2001). Second, it is home to the largest share of UMI in the nation and the location where one of the leading legal residency status estimation methodologies has been developed (Heer et al. 1992; Marcelli 1999; Marcelli and Heer 1997; Marcelli, Pastor and Joassart 1999).

Estimating the Spatial Association Between Unauthorized Mexican Immigrants and Toxic Releases

The data we employ in this study are the EPA's 1991-98 Toxic Release Inventory (TRI), a database of toxic chemical releases reported by business (mostly manufacturing) facilities in the southern California region; a 1994 Los Angeles County Foreign-born Mexican Household Survey; and the five percent 1990 PUMS. For the purposes of this paper, the southern California region includes the counties of Los Angeles, Orange, Riverside, San Bernadino, and Ventura.

A manufacturing facility is required to report its polluting activities to the EPA if it (1) has ten or more full-time employees; (2) produces or processes more than 25,000 pounds of designated chemicals or uses more than 10,000 pounds of any one designated chemical;[1] or (3) conducts selected manufacturing operations. There were a total of 19,917 such (self-identified) facilities from 1991-98 in southern California, and 16,377 (82 percent) reported having released toxic chemicals.[2] In addition to a large firm size bias, the TRI data are also known to include locational reporting errors and to ignore some hazardous chemicals (Sadd et al. 1999a: 109). Finally, as noted above, a more general limitation is the assumption that proximity to a hazardous release reflects a health risk (Bowen 1999).

The 1994 USC-COLEF Los Angeles County Foreign-born Mexican Household Survey is a probability sample of County census tracts in which twenty-five percent or more of the total population was born in Mexico, according to the 1990 Census. Adults from 271 households in which at least one person was born in Mexico were asked a series of questions pertaining to legal status and other demographic characteristics. In addition to ensuring potential respondents that their answers would be anonymous, the surveyors informed them that this was a joint project between one Mexican and one US university, and only Mexican-origin interviewers administered the surveys.[3] From these data we generate immigrant legal status predictors by logistically regressing reported legal residency status (LS) on AGE, SEX (female), TIME (time residing in the US since first arrival), and EDUC (highest level of education attained). Legal status is correctly predicted eighty-five percent of the time with these four demographic variables (see Equation 1). While AGE, TIME, and EDUC are negatively related to the probability of having been an unauthorized Mexican immigrant, females are more likely to have been unauthorized.

$$LS = f(AGE, SEX, TIME, EDUC) \quad [1]$$

We apply these four immigrant legal status predictors to each foreign-born, non-US citizen, Mexican adult enumerated in the 1990 five percent PUMS to compute a probability that he or she was a UMI. Aggregate-level estimates produced by this survey-based methodology are very similar to those generated by those obtained from the use of composite or components-of-change estimating methodologies (Heer and Passel 1987, Marcelli 1999).

After separating unauthorized and legal Mexican immigrant adults, and creating other demographic and economic variables from the 1990 PUMS that will be used in our analysis, the last step in our data preparation was to merge TRI and the modified PUMS data at the Public Use Microdata Area (PUMA) level.[4] Because the TRI data has zip code and city but not PUMA-level variables, we mapped zip codes to PUMAs and used PUMAs as the unit of analysis.[5] There are 92 PUMAs in the five-county area.

We first examine the relationship between the number of facilities that reported emitting toxic chemicals (FACILITY), the amount of toxic release (TR) in pounds, and the percentage distribution of UMI, using simple descriptive statistics. In the final stage of our empirical analysis, we control for other minority and economic factors using ordinary least squares regression. We regress FACILITY (and TR) on UMI; the number of other foreign-born persons (OFB), Latinos (LAT), non-Latino Asians (ASN), and non-Latino African Americans (BLK); median total income (MEDINC); the number of poor persons (POOR), where the poverty threshold is set at 150 percent of the US Census poverty threshold; and whether the PUMA is located inside Los Angeles County (LA=1) (see Equation 2).

$$\textit{FACILITY or TR} = f\ (\textit{UMI, OFB, LAT, ASN, BLK, POOR, MEDINC, LA}) \qquad [2]$$

While both dependent variables (FACILITY and TR) represent reported environmentally hazardous activities of mostly manufacturing facilities from 1991 to 1998, all independent variables are taken from the 1990 PUMS (except for UMI, which requires the use of both the 1990 PUMS and the 1994 USC-COLEF data). Furthermore, all variables are aggregated to the PUMA level. Thus, we are able to test directly whether the presence of UMI and the propensity of facilities to pollute were spatially correlated during the 1990s in southern California by controlling for other ethno-racial group characteristics and neighborhood economic conditions.

Results of Analysis

The number of business facilities reporting to the EPA's Toxic Release Inventory declined during the 1990s. While 2,867 (eighty-three percent) of 3,450 facilities reported having emitted a toxic chemical in 1991, as of 1998, 1,735 (eighty-five percent) of 2,049 did. During the entire period, there were 16,327 facilities (eighty-two percent of all those reporting) that reported toxic emissions. Similarly, the level (pounds) of toxic materials released fell during the 1990s (see Figure 1, facing page). Only in 1998 is there a slight rise in the number of facilities reporting and the level of toxic releases reported. Slightly over fifty million pounds (or 11,000 tons) of toxic chemicals were reported in 1991, approximately twenty-three million pounds (or 25,000 tons) in 1997, and about twenty-eight million pounds (or 14,000 tons) in 1998. Given that the average level of toxic release by facility fluctuated only slightly during the 1990s (between 14,816 and 17,623 pounds), the decline in emissions is directly related to the reduced number of facilities reporting having released any toxic material during this period.

Applying our previously generated immigrant legal status predictors to the non-US citizen, Mexican-

Figure 1
Pounds of Toxic Chemicals Released, Per Year, 1991-98
Five-County Southern California Area
Source: EPA Toxic Release Inventory

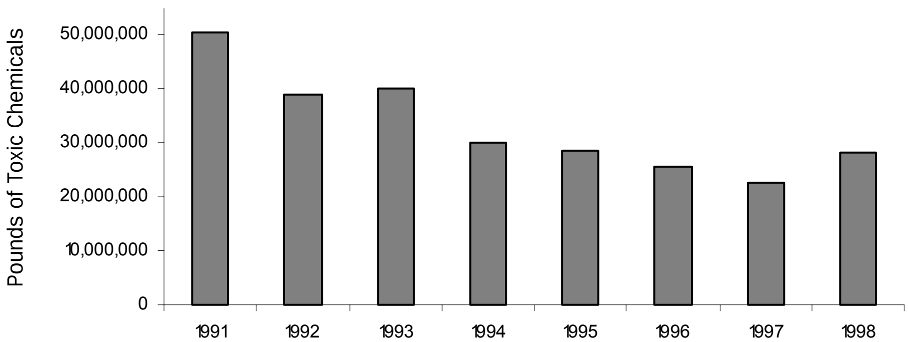
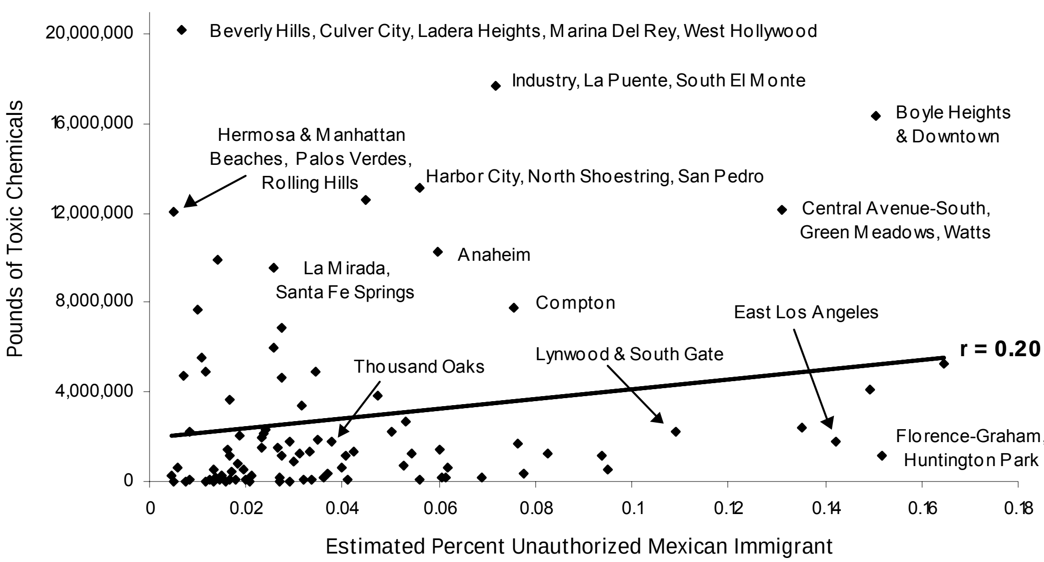


Figure 2
Pounds of Toxic Release and Estimated Percent of Unauthorized Mexican Immigrant Workers by Public Use Microdata Area
Totals for 1991-98, By PUMA, Five-County Southern California Area
Sources: EPA Toxic Release Inventory; authors' estimates



born adult population enumerated in the 1990 PUMS and residing in the southern California region results in an estimated 272,237 unauthorized Mexican immigrants in the five-county region.[6] Merging UMI and Toxic Release Inventory data at the PUMA level reveals a positive association between UMI and both the number of facilities having reported that they released toxic chemicals (FACILITY) and the level (pounds) released (TR). The correlation between the percent UMI and FACILITY is 0.34 and between percent UMI and TR is 0.20. Figure 2 (previous page) shows a scatterplot for percent UMI and pounds of pollutants released.

To be more precise about the correlation, it is necessary to control for other mediating factors that may influence whether business facilities pollute in a given neighborhood (and at what level), and where UMI reside. Table 1 (facing page) reports descriptive statistics for all variables used in subsequent regression analyses by low, intermediate, and high level of toxic release. PUMAs falling into the bottom third of the total toxic release value distribution (which range from zero to slightly more than twenty million pounds for the 1991-98 period) had both a smaller number of facilities that reported a toxic release (120) and a lower per-facility release (11,449 pounds) than PUMAs falling into either the middle or top third of the distribution. Further, whereas the percentage of UMI, OFB, LAT, ASN, and POOR, and the proportion of PUMAs within LA County (LA) were higher in PUMAs with relatively high levels of reported toxic release; the percentage BLK as well as MEDINC and RENT were lower.[7]

After controlling for these other demographic and economic variables by PUMA, and for the clustering effects produced from aggregating at the PUMA level, we find that only two variables (UMI and ASN) remain positively related to FACILITY and TR (see overleaf, Table 2). However, the significance of the positive relationship between UMI and FACILITY/TR must be viewed with some caution. Because the number of UMI is itself an estimated independent variable, the standard deviation for UMI is underestimated, leading to a possible overestimate of statistical significance.[8]

The number of non-UMI foreign-born persons (OFB), on the other hand, was inversely correlated with whether facilities reported toxic releases and the levels reported. Specifically, Table 2 reports the coefficients resulting from regressing FACILITY (Column 1) and TR (Column 2) on all demographic and economic variables. Overall our model explains variation in the number of facilities that reported having released toxic materials ($R^2 = 0.22$) better than the level of releases reported ($R^2 = 0.10$) across PUMAs. Given the relatively small number of observations (n=92), this relatively low level of explained variance is unsurprising. Indeed, while it may be tempting to dismiss the models' results simply because of unsatisfactory levels of explained variance, such levels are common among some of the most recent and most sophisticated empirical environmental justice impact studies (Boer et al. 1997; Pastor, Sadd and Hipp 2001; Sadd et al. 1999a). If factors other than those representing the two dominant hypotheses in the literature to date (e.g., neighborhood ethno-racial

Table 1

Descriptive Statistics for Low, Intermediate, and High Levels of Toxic Release By PUMA, Five-County Southern California Area, 1991-98

	Level of Reported Toxic Release		
	Low	Intermediate	High
Number of PUMAs	79	10	3
Facilities reporting toxic release (FACILITY)	120	465	732
Total toxic release in pounds (mean)	1,373,926	10,204,684	18,058,595
Average toxic release in pounds (by facility)	11,449	21,946	24,670
Unauthorized Mexican immigrants (UMI)	4.10%	4.49%	7.63%
Other foreign-born residents (OFB)	28.94%	25.65%	40.50%
Latino residents (LAT)	29.95%	29.41%	53.59%
Asian American residents (ASN)	9.06%	7.54%	11.67%
African American residents (BLK)	6.89%	13.86%	2.42%
Poor residents (POOR)	12.34%	13.43%	18.33%
Median household income (MEDINC)	$21,632	$21,186	$18,333
Within-PUMA mean of household median rent	$682	$624	$596
PUMA in Los Angeles (LA)	63.29%	50.00%	100%

Note: "Low" PUMAs had less than 6.6 million pounds of toxic release reported between 1991 and 1998. "Intermediate" PUMAs had between 6.6 and 13.3 million pounds reported, and "High" PUMAs had more than 13.3 million pounds reported.

Sources: 1990 Public Use Microdata Sample (PUMS) 5 percent sample; 1991-98 EPA Toxic Release Inventory data; authors' estimates of UMI.

characteristics and socioeconomic status) are found to be statistically related to environmental hazardous activity, then perhaps they warrant immediate public policy and future scholarly attention.

Focusing on the impact of UMI on FACILITY first, we see that a within-PUMA increase of 2,931 unauthorized Mexican immigrant workers (one standard deviation) is associated with an additional 158 facilities having reporting toxic releases.[9] Further, a one standard deviation increase in the number of Asian-origin persons (5,326) was also positively related to the number of facilities having reported affirmatively, but this impact is substantially smaller (69 additional facilities). In contrast, a one standard deviation rise in the number of non-UMI foreign-born persons (12,221) was associated with a decrease of 147 facilities reporting toxic releases. The comparison group for each of these results is US-born, non-Latino Whites. Also, facilities in LA County were more likely to have reported emitting toxic releases.

From Column 2 we can see similar effects, but on a different scale, given that we are estimating the association of UMI and other demographic characteristics with pounds of toxic release (rather than number of reporting facilities). A one standard deviation increase in the number of UMI (ASN) was related to an additional 2.1 (1.2) million pounds of reported toxic release. Alternatively, a rise of one standard deviation in the number of OFB was associated with a reduction of 2.9 million pounds of reported toxic release. To our surprise, neither the number of African American nor Latino residents appears to have been related to either of the two dependent variables. Similarly, neither of our neighborhood economic variables is statistically significant.[10] Facilities located in an LA County PUMA, however, were more likely to have reported higher levels of toxic release.[11]

Discussion

Only recently has environmental equity research begun to look beyond simple race and class categories in an effort to understand the spatial diffusion of environmentally hazardous activities in the United States. This paper builds on Hunter (2000), who found that although the presence of foreign-born persons by county throughout the United States was not significantly related to toxic air releases, it was positively related to large-scale hazardous waste generators and Superfund sites. Our findings, obtained from data cut across a smaller geographic level within southern California, suggest otherwise. A higher number of UMI was positively associated with a higher number of business facilities reporting toxic releases and higher levels being reported by PUMA in southern California, even after controlling for other neighborhood demographic and economic factors. A higher number of other foreign-born residents had the opposite effect. Except for Asians, the presence of other minority ethno-racial groups was not statistically related to the number of reporting facilities or the level of toxic releases reported, and none of our neighborhood economic contextual variables (level of poverty, median income, and mean rental price) was statistically significant.

Table 2

Spatial Association Between Unauthorized Mexican Immigrant Residents and (a) Facilities Reporting Toxic Releases, (b) Pounds of Toxic Release[1]

By PUMA, Five-County Southern California Area, 1991-98

	(a) Number of facilities (FACILITY)	(b) Pounds of toxic release (TR)
Unauthorized Mexican immigrants (UMI)[2]	0.054 ***	727.55 **
	(0.017)	(360.15)
Other foreign-born residents (OFB)	-0.012 ***	-241.27 ***
	(0.005)	(94.28)
Latino residents (LAT)	-0.000	-25.87
	(0.004)	(100.09)
Asian residents (ASN)	0.013 *	247.21 *
	(0.007)	(142.00)
African American residents (BLK)	-0.001	-34.59
	(0.003)	(60.76)
Poor residents (POOR)	0.006	154.18
	(0.007)	(153.48)
Median household income (MEDINC)	0.005	-15.03
	(0.008)	(164.58)
PUMA in City of Los Angeles (LA)	101.421 *	1,764,752 #
	(56.382)	(1,215,794)
Intercept	-29.745	2,643,943
	(205.752)	(4,520,551)
N	92	92
R^2	0.22	0.10

Legend: *** = p<.01; ** = p<.05; * = p<.10; # = p<.20.

Note: Standard errors reported in parentheses.

[1]Results of ordinary least squares regressions of FACILITY and TR on independent variables in left-hand column. See text for further explanation.

[2]Estimated by the authors based on parameters from a logistic regression using 1994 USC-COLEF data, as applied to PUMS data. See equation 1 and previous discussion.

Sources: 1994 USC-COLEF Los Angeles County Foreign-born Mexican Household Survey; 1990 Public Use Microdata Sample (PUMS) 5 percent sample; 1991-98 EPA Toxic Release Inventory data; authors' estimates of UMI.

The finding that the presence of UMI was independently and positively associated with the number of reporting facilities and the reported level of toxic release crystallizes conceptually what is hinted at by previous research on racially-based environmental inequity (Morello-Frosh, Pastor and Sadd 2001; Pastor, Sadd and Hipp 2001; Pulido 2000; Sadd et al. 1999a). Our results suggest that in addition to more traditional race and class variables, immigrant legal status may also be an important factor because those residing in the United States illegally may be less likely to report environmentally hazardous toxins for fear of being detected and possibly deported. In this sense our results are consistent with (1) Bullard's (1990) claim that businesses may intentionally seek locations with relatively compliant populations; (2) evidence suggesting that UMI are more likely to be exploited in the workplace (Cleeland 2000; Environmental News Service 2000); (3) the claim that those on the short side of power relations in the United States receive the larger slice of the pollution pie (Boyce 1994; Boyce et al. 1999), and (4) recent empirical work that shows, using more sophisticated econometric techniques, that lower-income and ethno-racial minority minorities (Morello-Frosh, Pastor and Sadd 2001; Pastor, Sadd and Hipp 2001)—and more recently foreign-born residents (Hunter 2000)—are more likely to reside in geographical areas populated with higher concentrations of toxic storage and disposal facilities, polluting business facilities, and toxic releases.

Growing concern about disproportionate or inequitable distributions of toxic materials by race, ethnicity, income, and legal status is also related to the recent policy efforts of President George W. Bush and Governor Gray Davis that may favor the utility industry over disadvantaged community interests. Bush-appointed EPA administrator Christie Whitman revoked former President Clinton's higher arsenic standards for drinking water in March 2001 (Shogren 2001a); more recently, the current administration suspended environmental cleanup regulations relating to use of publicly owned land, regulations imposed on the mining industry by former President Clinton on his last day in office (Shogren 2001b). Meanwhile, at the state level and in the midst of an energy crisis, California's governor recently negotiated a deal with twenty generators to supply $43 billion worth of electrical power during the next decade (Morain 2001). Little is known about the environmental risk this plan will ultimately impose on vulnerable communities. But given that the state has supposedly promised to pay for some of the industry's pollution credits (at about $45 per pound) when their pollution exceeds allowable limits strongly suggests that considerations of social cost (e.g., environmental hazards) have taken a back seat to issues of market cost (e.g., the dollar price of electricity). At least this is the case when it comes to polluting at home. Davis has simultaneously signed three environmental agreements with Mexico's President Vicente Fox to tackle pollution problems emanating in Tijuana but spilling over into southern California (Smith and Bustillo 2001). If recent empirical evidence is accurate, ignoring the need for policy changes in California is likely to increase the adverse environmental impacts in those communities already experiencing higher levels of pollution.

This study's analysis, while exploratory and limited by data constraints, provides additional support to concerns of environmental justice and immigrant rights advocates. Unfortunately, the Toxic Release Inventory data simply do not permit a causal evaluation of health risks associated with business-generated toxic releases at this time, given their restricted chemical and locational coverage, firm-size bias, and inability to weight toxic releases for real or perceived health risks. Furthermore, we are unable to speak to the which-came-first debate—that is, do polluting businesses intentionally seek vulnerable neighborhoods or workers to exploit (the "placement" hypothesis) or are UMI and other minorities more likely to move into areas and accept jobs that have higher business-generated toxicity levels (the "move-in" hypothesis). The only study of southern California that approaches this question in an empirically credible manner (Pastor, Sadd and Hipp 2001) provides stronger support for the placement hypothesis.

Still, "uncertainty about causality does not imply a lack of policy lessons or needs" (Sadd et al. 1999b: 137). Even if firms do not intentionally locate in neighborhoods with higher concentrations of UMI (or other lower-income or ethno-racial minorities), this does not imply that nothing can be done to offset the probable disproportionate health risks generated by proximate toxic releases in one's community. The finding that UMI are concentrated in neighborhoods with higher levels of business-generated toxic release suggests that in addition to income and skin color, legal status may influence where and at what level businesses pollute. In the meantime, Sadd et al.'s (1999a) call for more fairness in the siting of future polluting facilities, and a wider distribution of information about areas currently experiencing relatively high levels of environmental risk, regardless of the concentration of unauthorized immigrant residents, seem two modest steps in the right direction.

Endnotes

[1] There were 350 designated chemicals from 1987 through 1994, and 643 thereafter.

[2] Statewide, 35,149 facilities reported. Of these, 28,574 (81.3 percent) reported having released environmentally hazardous materials. Thus, all facilities that reported (as well as those that reported toxic releases) in southern California represented fifty-seven percent of the state total.

[3] These data and the survey methodology have been more fully explained in previous published studies. We direct the interested reader to Marcelli (1999), Marcelli and Heer (1997) and Marcelli, Pastor and Joassart (1999).

[4] In the southern California region, PUMAs have a mean population of about 150,000 people and 75,000 workers.

[5] We used land area to match overlapping zip codes and PUMAs because we do not have population information by zip code. There were very few zip codes that crossed PUMA boundaries.

[6] The mean number of UMI by PUMA is 2,959 and the standard deviation is 2,931.

[7] RENT is computed from the 5-percent 1990 PUMS as the within-PUMA mean of household median rents. This variable was not part of our original model and does not appear in the regression results reported in Table 2, because it was not statistically significant and its inclusion did not affect the impact of other variables in the model. RENT is highly correlated with MEDINC, another control variable in our model that was also not statistically significant. We report the mean value of RENT by level of toxic release in Table 1.

[8] See Pagan (1984) for a discussion of estimation problems associated with generated regressors.

[9] This figure is computed by multiplying an assumed one standard deviation change in UMI (2,931) by the parameter coefficient (0.054). All subsequent conversions are accomplished similarly.

[10] We included RENT in subsequent regression runs of both models but this had a very minor impact on results reported here. Interested readers may contact Marcelli to obtain detailed results.

[11] Using STATA functions, we ran a full set of statistical diagnostic tests. No multicollinearity or other statistical problems were detected. Results available upon request from Marcelli.

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