Racial/ethnic differences in asthma prevalence: The role of housing and neighborhood environments

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Abstract

This paper examines the prevalence of asthma among New York City households with children from ten racial/ethnic groups, and explores whether differential exposure to potentially adverse housing and neighborhood conditions helps to moderate observed disparities. Puerto Rican households exhibit the highest levels of asthma, followed by black and other Hispanic households, and Asian households in general exhibit the lowest levels of asthma. Results from logistic regression models indicate that controlling for household, housing, and neighborhood characteristics reduces the disproportionately high levels of asthma among Puerto Rican and black households, although they remain significantly higher than the level among white households. Housing conditions, particularly the presence of maintenance deficiencies, appear to have the greatest effect among all control variables in moderating these disparities.

Introduction

The persistence of racial/ethnic and socioeconomic disparities in various health outcomes has lead researchers to seek explanations for these inequalities in the contexts within which people live their daily lives. This strategy is embodied in the "population health" perspective, which emphasizes the need to look at social, economic, and physical contexts as causes of health (Dunn 2000; Kindig and Stoddart 2003; Northridge et al. 2003). Housing and neighborhood conditions constitute an important avenue of research in this field (Dunn 2000; Evans and Kantrowitz 2002). Although housing and neighborhood conditions played a prominent role in the public health movement of the nineteenth century, the resulting shift from infectious to chronic diseases as the primary causes of death in the West (House 2001) redirected attention to individual-level factors and behaviors as the root causes of ill health and premature mortality. Yet as these individual-level factors have failed to adequately account for inequalities in health status, researchers have found themselves returning to the broader contexts of peoples' lives in order to provide answers to the question of why some groups of people are sicker or more likely to die than are other groups of people.

The goals of this paper are to document racial/ethnic disparities in the household prevalence of asthma for ten detailed racial/ethnic groups in New York City, and to explore the extent to which inequalities in housing and neighborhood conditions moderate observed disparities. Asthma has been steadily increasing in prevalence since 1980 (Rhodes et al. 2003; Weiss, Gergen, and Wagener 1993) and its greater prevalence among low-income and urban residents has caused it to be termed "the other inner-city health crisis" (relative to HIV/AIDS; Boardman, Finch, and Hummer 2001). The concentration of higher-than-average asthma rates among poor, generally minority, inner-city residents, moreover, has been thought to be linked to the low quality of housing such groups reside in, as well as the concentration of outdoor

pollutants in their neighborhoods (Boardman, Finch, and Hummer 2001; Katz, Kling, and Liebman 2001; Weiss, Gergen, and Crain 1992). Yet, largely because of a lack of data sets combining health indicators and housing quality at the individual level and aspects of conditions prevailing at the neighborhood level, to date there has been little work done to explicitly evaluate the role played by housing and neighborhood conditions in moderating observed disparities in asthma. This paper helps to address this gap in the literature.

Differentials in and correlates of asthma

Rates of self-reported asthma vary across racial/ethnic groups. In 2001, among persons reporting a single race, non-Hispanic blacks were most likely to report having asthma (with 8.5 percent of respondents reporting that they currently suffer from the condition), followed by non-Hispanic whites (at 7.2 percent), other race non-Hispanics (at 5.9 percent), and finally Hispanics (at 5.9 percent) (Rhodes et al. 2003). While the black/white differential has been consistently reported in other sources, including national data sets (Weiss, Gergen, and Wagener 1993), there are indications that the prevalence of asthma varies across individual Hispanic-origin groups (Kinnert et al. 2002). For example, data from the Hispanic Health and Nutrition Survey (HHANES) indicate that Puerto Rican children are more likely to have asthma than do their Cuban-American and Mexican-American counterparts (Mendoza et al. 1991), and a door-to-door survey in the Williamsburg neighborhood of New York City revealed that Puerto Ricans in the area are far more likely than their Dominican and other Latino neighbors to suffer from the condition (Ledogar et al. 2000). The higher prevalence of asthma among Puerto Ricans as indicated by these sources is consistent with the finding that the prevalence of lifetime asthma in 2001 was highest in Puerto Rico relative to the other 53 reporting areas of the Behavioral Risk Factor Surveillance System (BRFSS) (Rhodes et al. 2003). Unfortunately, little is known about the prevalence of asthma among Asians, nor among specific Asian origin groups (Boardman,

Finch, and Hummer 2001).

Several risk factors for asthma have been identified. Among young children, low birth weight has been consistently identified as a powerful predictor of asthma by age 3, while having been breast-fed as an infant appears to play a protective role (Boardman, Finch, and Hummer 2001; Jaakkola and Gissler 2004; Miller 2000; Weitzman, Gortmaker, and Sobol 1990; but see Weiss, Gergen, and Crain 1992; Weiss, Gergen, and Wagener 1993). Exposure to tobacco smoke in the home raises the risk of asthma, as does low socioeconomic status and metropolitan residence (Boardman, Finch, and Hummer 2001; Miller 2000; Weiss, Gergen, and Crain 1992; Weiss, Gergen, and Wagener 1993). Researchers have suggested that at least part of the effect of socioeconomic status is accounted for by the fact that economically disadvantaged families are more likely to occupy inadequate housing (Boardman, Finch, and Hummer 2001) and thus experience greater exposure than do more affluent families to the kinds of asthma triggers – including dust mites, pet dander, cockroach and mice feces, and mold – that are found in substandard housing (Bashir 2002; Evans and Kantrowitz 2002; Kreiger and Higgins 2002; Perez-Pena 2003a; Rauh, Chew, and Garfinkel 2002). Moreover, the finding that metropolitan residence significantly predicts asthma among black but not white children has been argued to reflect the segregation of many black children in deteriorated inner-city neighborhoods (Boardman, Finch, and Hummer 2001) that are home also to many sources of outdoor pollutants, including transfer stations, industrial land uses, and transportation depots (Krieger and Higgins 2001). Such logic can easily be extended to account for the high incidence of asthma among Puerto Ricans, who experience many of the same disadvantaged housing and neighborhood environments (Massey and Denton 1993; Rosenbaum 1996; Rosenbaum, Friedman, Schill, and Buddelmeyer 1999). Persuasive evidence of the influence of housing and neighborhood conditions on asthma comes from the Moving to Opportunity Demonstration Program Boston

site, where children who moved from public housing in high-poverty neighborhoods to higher-quality housing in better neighborhoods experienced a 50 percent drop in asthma attacks (Katz, Kling, and Liebman 2001).

Racial/ethnic disparities in housing and neighborhood conditions

A long literature has documented the persistence of racial/ethnic disparities in housing and neighborhood conditions that work to the disadvantage of African Americans, Puerto Ricans, and non-white Hispanics more generally. In terms of housing, blacks and Hispanics are less likely than whites to own their homes (Alba and Logan 1992; Rosenbaum 1996). In New York City, blacks and Hispanics are also more likely to occupy housing units that suffer from numerous structural and maintenance deficiencies, such as interior and exterior leaks, chipping paint and broken plaster, holes in the floors or walls, and pest infestation (Rosenbaum 1996; Rosenbaum and Friedman 2004a; Schill, Friedman, and Rosenbaum 1998). Moreover, these housing conditions appear to be more numerous among Puerto Ricans and Dominicans than among Central/South Americans (Schill, Friedman, and Rosenbaum 1998), and are more prevalent among Hispanics reporting black than non-black race (Rosenbaum and Friedman 2004b). These differentials also hold on a national level, regardless of whether the household owns or rents its unit (Friedman and Rosenbaum 2004). In contrast, the housing conditions of white and Asian households appear to be similar on these dimensions (Rosenbaum 1996; Rosenbaum and Friedman 2004a; Schill, Friedman, and Rosenbaum 1998). The kinds of housing problems documented for blacks and Hispanics, moreover, are precisely those that can give rise to asthma attacks (Bashir 2002; Evans and Kantrowitz 2002; Krieger and Higgins 2002; Perez-Pena 2003a; Rauh, Chew, and Garfinkel 2002).

With respect to neighborhood conditions, it has long been recognized that the housing stock and the neighborhood amenities found in minority neighborhoods are of lower quality than

those found in areas where whites predominate (Massey, Condran, and Denton 1987; Massey and Denton 1993; Rosenbaum 1996). Furthermore, studies of the locational attainment process among racial/ethnic groups have demonstrated a general pattern of access to advantaged areas (generally measured by the percent white and the median income of the tract of residence) whereby whites experience the highest levels of access, followed by Asians, Hispanics, and finally blacks (Alba and Logan 1991, 1993; Logan and Alba 1993, 1995; Logan et al. 1996). Blacks and Hispanics, moreover, are more likely than whites to reside in neighborhoods plagued with crime (Alba, Logan, and Bellair 1994), and physical and social disorder, regardless of whether they live in central city or suburban neighborhoods (Friedman and Rosenbaum 2004b).

Racial/ethnic differences in access to advantaged neighborhoods are also found in the New York region, where Asians are relatively successful at acquiring residence in fairly advantaged suburbs (Alba, Logan, and Bellair 1994; Alba, Logan, and Leung 1994; Logan and Alba 1993), and where socioeconomic status is strongly and positively related to decentralization away from the enclave in lower Manhattan (Zhou and Logan 1991). Although controlling for individual-level characteristics increases Hispanics' proximity to whites, Hispanics in the New York area do not fare as well as Asians but do not suffer the same degree of housing disadvantage as do blacks (Logan and Alba 1993). Blacks and Hispanics in the New York area and in New York City *per se* are also more likely than whites to live in neighborhoods with boarded-up buildings (Rosenbaum 1996), and are significantly less likely to gain access to neighborhoods with low crime and teen fertility rates, high-performing schools, and low poverty than are whites in New York City (Rosenbaum et al. 1999; Rosenbaum and Friedman 2004a). Among Hispanics, residence in disadvantaged neighborhood environments is more prevalent among Puerto Ricans and Hispanics reporting black race relative to non-Puerto Ricans and non-black Hispanics (Rosenbaum et al. 1999; Rosenbaum and Friedman 2004b). Once again,

differences between whites and Asians on these measures generally do not attain significance in the presence of relevant controls, highlighting again the more advantaged environments experienced by Asians, relative to blacks and Hispanics (Rosenbaum et al. 1999; Rosenbaum and Friedman 2004b).

Thus, substantial evidence points to the lower-quality housing and neighborhood environments experienced by blacks and particular Hispanic subgroups. Such differentials, by paralleling those in asthma prevalence, suggest strongly that differential exposure to substandard housing and neighborhood conditions may help to explain the variation in asthma rates. Perhaps of equal importance, the fact that racial/ethnic differentials in housing and neighborhood conditions persist in the face of controls for socioeconomic status and other individual-level predictors suggest that the disadvantages experienced by Hispanics, and especially blacks, are largely the result of housing market discrimination (Massey 2001; Turner et al. 2002; Yinger 1995, 2001). Thus, should differential exposure to inadequate housing and neighborhood conditions help to moderate racial/ethnic disparities in asthma, then housing market discrimination can be considered as a contributing cause of such disparities (cf. Cain and Kington 2003).

Data and Methods

Data. The primary source of data is the 2002 panel of the New York City Housing and Vacancy Survey (HVS), a multistage probability sample of approximately 18,000 housing units located throughout the five counties, or boroughs, that make up the city. The HVS is conducted every two or three years by the Census Bureau under contract to the City of New York, in compliance with state and local laws regarding rent control. The 2002 panel is based on a sample drawn from the 2000 Census address list. As an inter-censal survey containing a wealth of information, the HVS is the best source of up-to-date information concerning the city's

population and its housing.

A number of new questions were added to the 2002 panel that extend the HVS's reach into the sphere of health. Of importance here is a question that asked whether there is anyone in the household who has been told by a doctor or other health professional that s/he has asthma. This question likely underestimates differences in the prevalence of asthma, given that findings from a collaboration between Harlem Hospital, The Harlem Children's Zone, and Columbia University indicate that a far higher than expected proportion of children under age 13 in central Harlem – 25.5 percent – suffer from asthma, including many who had never received a formal diagnosis of asthma (Perez-Pena 2003b). This first question was followed up with the interviewer asking how many such people live in the household. As a result, the specific individuals with asthma are not identified, and thus it is unclear if those persons are children, adults, or both. I limit the analytical sample to households with children (age 0-18) to indirectly narrow the analysis to the prevalence of childhood asthma. Because more than 75 percent of households with children report no asthmatics, the dependent variable in the analysis is a dichotomy that is coded 1 when there is at least one asthmatic present in the household, and 0 when no asthmatics are present. After eliminating additional cases with missing data on the predictors, the final analytical data set contains 4,089 households with children.

The analysis focuses on three key sets of independent variables: race/ethnicity, housing conditions, and neighborhood conditions. Ten categories of race/ethnicity are used: non-Hispanic white, non-Hispanic black, Puerto Rican, Dominican, Central/South American, Mexican, other Hispanic, Chinese, Asian Indian, and other Asian. The very few households headed by someone reporting more than one race are omitted from the analysis. In the multivariate analysis, non-Hispanic whites are used as the reference group.

With respect to housing conditions, four indicators are used. The first is the number of

maintenance deficiencies in the housing unit, which is a summary index of seven possible deficiencies reported by the respondent for the three months preceding the survey. These deficiencies are: toilet breakdowns; heating breakdowns; the need for additional heat; the presence of rats or mice; leaks from the outside; cracks or holes in the floors, walls, or ceiling; and large areas of broken plaster. Dichotomous variables (coded 1 if the condition is present, 0 otherwise) are used to differentiate housing units with no deficiencies from those with only one or two, and three or more, of these deficiencies. In general, the prevalence of asthma is expected to rise along with the number of maintenance deficiencies.

The second indicator of housing conditions is tenure status (coded 1 for renters, 0 for owners), and the third is a dichotomous indicator of crowding (coded 1 if there is at least one person per room, and 0 otherwise). Crowding is important to control for since it has been associated with poorer physical and mental health (Edwards et al. 1994; Gove et al. 1979), and thus is expected to be positively associated with the prevalence of asthma. Similarly, renter households are expected to exhibit a higher prevalence of asthma than are owners. The final housing condition is a dichotomy differentiating between households in which at least one smoker is present from those free of resident smokers; it is expected that asthma prevalence will be positively associated with the presence of smokers.

A total of six indicators of neighborhood conditions are used. The first is a dichotomy indicating whether there are any boarded-up buildings within 300 feet of the sampled housing unit. This variable derives from an interviewer observation. The second measure taps into the amount of social cohesion in the neighborhood, as reported by the respondent. This variable originally derives from the mean score on responses from two items often used in scales measuring social cohesion: “People in this neighborhood can be trusted,” and “People in this neighborhood are willing to help their neighbors.” Each item has four possible Likert-scaled

responses (ranging from strongly agree to strongly disagree). The variable used in the analysis is a dichotomy, coded 1 for households reporting little or no social cohesion (those with a score of 2.5 or above on the mean of the original two items) and 0 otherwise. While the presence of boarded-up buildings and the physical decay it signals may reflect the presence of asthma triggers in the immediate environment, the effect of these variables is theorized to occur more in terms of how living in such areas affects the behaviors of household members. That is, it may be that the presence of social and physical disorder in the neighborhood increases people's fear for their safety (Cohen et al. 2003; Ross and Mirowsky 2001; Sampson 1990), causing them to spend more time indoors (Robert 1995) and causing parents to exercise protective parenting, keeping their children indoors away from harm (Furstenberg et al. 1999). By spending more time indoors, these household members are increasing their exposure to the asthma triggers inside their homes. As a result, both the proximity of boarded-up buildings and the absence of social cohesion are expected to increase the odds of asthma in the household.

The final indicators of neighborhood conditions are measured for the 55 subareas identified in the HVS. The HVS subareas are geographic units comprised of entire census tracts with a minimum population of 100,000 in accordance with Census Bureau rules on confidentiality. Although larger than what most researchers consider "neighborhoods," subareas are very similar to the 59 community districts in New York, and thus are meaningful geographic units for service delivery and policy making. Two subarea measures, the percent of the population in poverty and the percent white, derive from 2000 census data. The percent white is used to control for the high degree of racial/ethnic segregation in New York City, and was chosen over the percent black because of the emergence of large swaths of predominantly non-white areas composed almost exclusively of blacks and Hispanics (Alba et al. 1995; Lobo, Flores, and Salvo 2002; Rosenbaum and Argeros 2004). Controlling for the percent poor is

called for given the general finding that community-level socioeconomic status influences health (Robert 1995, 1998) and because of the dramatic racial/ethnic disparities in exposure to poor neighborhoods (Massey and Denton 1993). In general, the household-level prevalence of asthma should rise with subarea percent poor, but fall with subarea percent white.

Two additional measures of subarea conditions derive originally from data from the New York City Department of Finance on land use (for 1999). The first measures the number of transportation facilities per 100,000 population, and the second measures the number of (light and heavy) manufacturing facilities per 100,000 (both using 2000 census data as the denominator). The concentration of these kinds of facilities in an area will give rise to high levels of pollutants from idling buses and trucks, high levels of traffic, and other kinds of output from industrial processes; thus, asthma prevalence should be higher in areas with greater exposure to these conditions than in areas where such conditions are less concentrated. All subarea indicators are measured in quintiles based on the original distribution of the 55 subareas. The lowest quintiles of the percent poor and the rates of industrial and transportation facilities are used as reference categories, while the highest quintile of percent white is used as the reference for that variable. *Infoshare*, a unique data base containing public and private sources of data for New York that allows the user to aggregate data up to a number of geographies, including the HVS subarea, provided the data for the subarea indicators.

The remaining independent variables include dichotomies indicating borough location and indicators of household composition and socioeconomic status (age of householder, educational attainment of householder, householder gender, total household income, and household receipt of Temporary Assistance to Needy Families [TANF]) that help to predict where people live. Because of the relative racial/ethnic homogeneity of Staten Island, and the relatively small number of cases in this borough, these cases had to be combined with those from

another borough. Thus, location in the Bronx, Brooklyn, and Queens/Staten Island is compared in the multivariate models to location in Manhattan. The household characteristics are used mainly as statistical controls. Additional controls include nativity status of the householder (coded 1 for foreign-born householders and householders born on the island of Puerto Rico,[1] 0 otherwise), given the importance of immigration in New York City and the likelihood of a "healthy immigrant" effect (cf. Kinnert et al. 2002; Landale, Oropesa, and Gorman 1999, 2000; Rumbaut 1999). The final control variable used is a measure of the length of time households have occupied their housing units. This latter variable is a dichotomy coded 1 for households who have lived in their units for five or more years, and 0 otherwise.

Methods. Because the dependent variable is a dichotomy, logistic regression is used to predict the prevalence of asthma among households with children. The basic model is contextual, in that the prevalence of asthma in the household is regressed on household, housing, neighborhood, and subarea characteristics. All analyses are weighted with scaled-down sampling weights to reflect unweighted cell sizes.

Results

Descriptive analysis. Table 1 shows the percent of households with children with at least one asthmatic, by race/ethnicity. The data reveal a huge range in the experience of asthma; Puerto Rican households are the most likely, and Chinese households the least likely, to contain at least one asthmatic, with just under 45 percent and 11 percent, respectively, falling into this category. All other Hispanic households report lower levels of asthma relative to Puerto Rican households, a finding consistent with other studies suggesting that Puerto Ricans suffer from asthma at higher rates than do other Hispanics (Kinnert et al. 2002; Ledogar et al. 2000;

[1] Although island-born Puerto Ricans are not immigrants, research has noted differences in health favoring Puerto Ricans born on the island relative to those born on the mainland (e.g., Landale, Oropesa, and Gorman 2000).

Mendoza et al. 1991). Moreover, apart from Mexican households, all non-Puerto Rican Hispanic households report a higher level of asthma prevalence than do non-Hispanic white households, as do black households, while the prevalence of asthma reported by Asian households generally falls below that reported by white households. The relatively low level of asthma prevalence among Mexican households is additional evidence of the "epidemiological paradox" characterizing this group, namely, fairly robust health conditions in the face of low socioeconomic status (Boardman, Finch, and Hummer 2001; Kinnert et al. 2002).

[Table 1 about here]

To what degree does the variation in asthma prevalence derive from differential exposure to potentially adverse housing and neighborhood conditions? To lend insight into the answer to this question, Table 2 presents descriptive statistics for the housing, neighborhood, and subarea conditions for each racial/ethnic group (household characteristics can be found in Appendix Table 1). Starting with the housing characteristics, crowding is most extreme among Mexican, Central/South American, and Asian Indian households, a finding undoubtedly related to the fact that the vast majority of these households are headed by immigrants (Appendix Table 1). Indeed, the relatively moderate levels of crowding among white, black, and Puerto Rican households parallels the smaller shares of foreign- and island-born householders evident among these groups. The presence of smokers in the household is highest among Puerto Ricans, other Hispanics, and other Asians, and all Hispanic (apart from Central/South American) and black households are most likely to live in units plagued by three or more maintenance deficiencies. Finally, white and Chinese households are least likely to be renters, while home ownership is extremely rare among Mexican and Dominican households.

[Table 2 about here]

Turning to the neighborhood characteristics, Puerto Ricans are most likely to report little

or no social cohesion in their neighborhoods, with just under 40 percent doing so, followed by other Hispanics and African Americans at just over 35 and 28 percent respectively. African Americans are most likely to live nearby boarded-up buildings, followed by Mexicans and Puerto Ricans. In contrast, whites live in neighborhoods with the highest levels of social cohesion (as reported by the respondent), and along with all Asian and Central/South American households, they also live in neighborhoods with the fewest signs of physical decay.

Given the persistence of extremely high levels of white/black segregation in New York City (Rosenbaum and Argeros 2004), it is hardly surprising that the percent of black (white) households plummets (rises) as the percent white at the subarea level rises. The distribution of Puerto Ricans households across the quintiles of subarea percent white is basically similar to that of black households, although a plurality is located in the second, rather than the first quintile. A similar finding is evident for all non-Puerto Rican Hispanic households and for all Asian households, although in general, relatively fewer Asian than Hispanic households are found in the subareas with the fewest whites. Such findings are consistent with the lower levels of white/Asian than white/Hispanic or white/black segregation in New York City (Rosenbaum and Argeros 2004).

In general, as the poverty level of the subarea rises, the percent of white and Asian households declines, while the opposite is true for Puerto Rican and Dominican households, among whom over 40 percent reside in the poorest subareas. In contrast, black, Central/South American, and Mexican households are most likely to be found in the middle quintile of subarea percent poor, while other Hispanic households are most likely to be found in poorer subareas, specifically, those in the fourth quintile. While the generally less-advantaged socioeconomic profiles of Puerto Ricans and Dominicans versus whites and Asians (Appendix Table 1) can help to explain parallel differences in exposure to subarea-level poverty, Puerto Ricans are doing at

least as well as – if not better than – Mexicans and other Hispanics, but exhibit a far more disadvantaged subarea poverty profile than either group.

Black households are the most favorably distributed across the quintiles of exposure to transportation and manufacturing facilities, with the lowest proportions residing in the highest-exposure subareas (less than 10 percent in each). In contrast, whites are most likely of all groups to be found in subareas with the greatest exposure to transportation facilities, followed by Puerto Ricans. Although Puerto Ricans are the most likely to live in subareas with the highest levels of exposure to manufacturing facilities, the degree of exposure experienced by Puerto Ricans is not substantially different from that evident among the remaining racial/ethnic groups.

Finally, there is a substantial amount of racial/ethnic variation in terms of borough residence, reflecting patterns of group dominance in particular areas. For example, Brooklyn has been home to the largest concentration of blacks since the 1920s and is the home to the city's largest concentration of West Indians. In contrast, Asian Indians and other Asians are concentrated in Queens, while the distribution of Chinese households reflects at once the long-standing enclave in lower Manhattan and the newer enclaves that have emerged in both Brooklyn (especially Sunset Park) and Queens (particularly in Flushing). The concentration of Dominicans in Manhattan reflects the dominance of this group in Washington Heights in the northern end of the borough, while Puerto Ricans are most likely to be found in the Bronx and Brooklyn. Central/South Americans are most likely to be found in Queens, Mexicans are fairly well distributed outside of Manhattan, and about one third of other Hispanics are found in the Bronx and Queens each.

In summary, the descriptive analysis indicates preliminary support for the notion that housing and neighborhood conditions may moderate racial/ethnic disparities in asthma prevalence, in that the groups most afflicted by asthma tend to live in less-desirable

circumstances than do the groups least affected by the illness. This is particularly the case for a juxtaposition of Puerto Ricans again Asian households, with the former exhibiting the most extreme levels of asthma while often living in the worst conditions, and the latter groups exhibiting the lowest asthma rates while residing in housing units relatively free of maintenance deficiencies, in neighborhoods that are physically sound and featuring high levels of social cohesion, and in relatively prosperous (and white) subareas. However, to fully determine the extent to which housing and neighborhood conditions account for observed racial/ethnic variation in asthma, we must turn to the multivariate analysis.

Multivariate analysis. Table 3 presents the results of two logistic regression models predicting the prevalence of asthma among households with children. The only variables entered in Model I are the race/ethnicity dummies, while Model II contains the full set of predictors. Additional models entered individual blocks of variables, alone and in combinations leading up to the full model, shown here as Model II. The results of these other analyses are discussed when appropriate but are not shown in the interests of space. (These additional models are available upon request.)

[Table 3 about here]

The results of Model I demonstrate that the higher levels of asthma among blacks, Puerto Ricans, Dominicans, and other Hispanics, relative to whites, that were evident in Table 1 achieve statistical significance. Similarly, the lower levels of asthma reported by Chinese and Asian Indian, relative to white, households are also statistically significant. Entering the variable reflecting foreign birth among householders (not shown) resulted in increasing the magnitude of the coefficients for black and all Hispanic households, causing the effect for Dominican and Central/South American households to achieve significance at the p # .001 level, and causing the effect for other Hispanic households to become significant at p # .05. Such findings indicate a

"healthy immigrant" effect for these groups, although no such effect is evident for Mexicans. Controlling for foreign birth among householders (and no other variables apart from race/ethnicity) also increased the size of the coefficients for all three Asian groups, and eliminated the significance of the advantage exhibited by Chinese and Asian Indian households. The generally beneficial effect of having a foreign-born householder is further evident in the significantly negative effect in Model II, which suggests that the odds of asthma are 39 percent lower among foreign- than native-born households.

The results of Model II demonstrate the significant effects of housing conditions. Although renting (versus owning) and crowding do not significantly affect the prevalence of asthma, living in the same household as at least one smoker significantly raises the odds of someone having asthma by approximately 18 percent. In addition, living in a housing unit with one or two maintenance deficiencies significantly raises the odds of asthma by 45 percent, while living in a more seriously deficient housing unit more than doubles the odds of asthma. Moreover, longer exposure to adverse housing conditions also appears to be important in predicting asthma. That is, households who have lived in their units for at least five years are more likely to contain asthmatics than are those who have more recently moved in.

Among the household characteristics, female headship and receiving TANF both raise the odds of asthma, reflecting the tendency for less-advantaged households to be more often afflicted with the condition relative to their more affluent counterparts (Boardman, Finch, and Hummer 2001; Miller 2001; Weiss, Gergen, and Crain 1992; Weiss, Gergen, and Wagener 1993). The finding that indicators of low SES and of deteriorated housing conditions both significantly affect the odds of asthma in the household indicates that low SES has an effect independent of its association with a disadvantageous position in the housing market. This effect may reflect the stresses of living in poverty or of having access to limited social networks, which can interfere in

families' abilities to manage chronic illnesses like asthma (Weiss, Gergen, and Crain 1993).

Turning to the effects of neighborhood conditions, living nearby boarded-up buildings significantly raises the odds of asthma in the household by 30 percent. This finding suggests support for the notion that households may remain indoors to avoid the uncertainties arising from the physical and social disorder that often accompanies physical decay (Skogan 1990). Although perceiving little or no social cohesion in the neighborhood also tends to raise the odds of asthma, this effect does not achieve statistical significance at conventional levels.

With respect to the subarea characteristics, only exposure to manufacturing facilities emerges as significant in the presence of all other controls, with residence in the second and fourth quintiles (relative to the first) raising the odds of someone in the household having asthma. However, in a model containing all predictors except for borough, residence in the second and fourth (relative to the first) quintiles of exposure to transportation facilities also significantly increased the odds of asthma in the household. The combination of these results supports the notion that the various consequences of manufacturing activities and the concentration of exhaust fumes emanating from the high traffic and frequent idling of transportation vehicles creates an unhealthy outdoor environment that exacerbates the predisposition towards respiratory illness. However, once borough location is entered into the model, the significance of exposure to transportation facilities vanishes, while residence in the Bronx, versus Manhattan, is associated with a 71 percent increase in the odds of asthma in the household. This finding suggests that there is something unique about the Bronx that is harmful to residents' health. Such an effect may reflect the concentration of other facilities – such as waste disposal plants, transfer stations, sewage plants, and incinerators – that are disproportionately sited in the South Bronx, and that have long been a cause of protest among community groups (Almeida 1995; Nossiter 1995). Despite recent city-wide declines in the

child hospitalization rate for asthma, the rate remains highest in the Bronx (Perez-Pena 2004).

Finally, turning to the effects of race/ethnicity in the full model, the significant advantage (relative to whites) exhibited by Chinese and Asian Indian households disappears, as does the significant disadvantage exhibited by other Hispanic households. In contrast, a significant disadvantage is apparent for Central/South American households; the fact that significance is evident only in the presence of the control for householder nativity status suggests that the Central/South American disadvantage is largely a result of the "healthy immigrant" effect mentioned above.

Even in the presence of the full set of controls, the odds of asthma remain significantly higher for black and Puerto Rican households, relative to white households, although the magnitude of these differences has been reduced. That is, the full complement of control variables reduces the difference in odds between blacks and whites from 86 to 51 percent (for a reduction of almost 19 percent), and reduces the difference in odds between Puerto Ricans and whites from nearly three fold to just over two fold (for a reduction of just over 23 percent).[2]

To what degree does the moderation of racial/ethnic differences arise from housing and neighborhood conditions? When the blocks of household, housing, neighborhood, and subarea characteristics are entered individually (and apart from any other predictors, save race/ethnicity), the block of housing conditions has the greatest effect on the pseudo R^2s, and reduces the magnitude of the coefficients for black and Puerto Rican households to a far greater extent than does any other block of characteristics. Such findings suggest not only that housing conditions may be the most potent of these predictors, but that housing quality plays a larger role in accounting for the higher prevalence of asthma among blacks and Puerto Ricans, the two most

[2] Because of the enhancing effect of immigrant status, the reductions are larger when compared to the model containing only this variable along with race/ethnicity. In this case, the difference in odds between blacks and whites declines by just over 23 percent, while the difference in odds between Puerto Ricans and whites declines by just over 29 percent.

seriously affected groups.

The effects of the individual housing characteristics, though, sometimes work in opposing ways. Specifically, controlling only for the presence of smokers reduces slightly the odds ratio for Puerto Ricans, while increasing it for blacks. These findings suggest that the lower overall level of smoking in black versus white households serves to keep the observed racial disparity in asthma smaller than it would otherwise be, while the higher overall level of smoking among Puerto Rican households helps to widen what would otherwise be a smaller difference. In contrast, controlling only for the presence of maintenance deficiencies has the most pronounced effect, of all the housing characteristics, in narrowing the black/white and Puerto Rican/white differentials in asthma prevalence. Thus, it appears that exposure to deficiencies that can give rise to the presence of asthma triggers has the greatest overall impact in explaining the higher levels of asthma among Puerto Rican and black households.

In contrast to the findings for Puerto Ricans and blacks, controlling only for household characteristics helps to narrow the advantage in terms of asthma prevalence that Chinese and Asian Indian households display relative to their white counterparts, while controlling only for the block of housing characteristics *enhances* this advantage. Once again, the individual housing characteristics display different effects. It appears that the overall higher level of smoking among white households explains part of the advantage displayed by Chinese and Asian Indian households at the bivariate level. Yet controlling only for the presence of maintenance deficiencies results in a greater overall advantage for Chinese and Asian Indian households. Thus, the greater tendency for Chinese and Asian Indian than white households to live in housing with at least one maintenance deficiency helps to understate the true advantage, in terms of respiratory ailments, that these groups maintain. As was the case with Puerto Ricans and blacks, controlling only for maintenance deficiencies has the most pronounced effect, of all the housing

characteristics, on the coefficients, underscoring the importance of this aspect of housing conditions in explaining racial/ethnic differences in respiratory health.

In summary, the analysis demonstrates that neighborhood and especially housing characteristics exhibit expected relationships with the prevalence of asthma when measured at the household level. In general, households with children living in deteriorated housing units, with at least one smoker, and in physically decaying areas are more likely than other households to contain at least one asthmatic. Similarly, households with children who live in areas with relatively high concentrations of manufacturing activities, and those who live in the Bronx, are also more likely to contain an asthmatic. These housing and neighborhood effects, moreover, are independent of the significant influence of low socioeconomic status. However, even in the presence of this full range of controls, black and especially Puerto Rican households remain far more likely to contain asthmatics than do white households, although the magnitude of the differentials is greatly reduced, with housing conditions apparently accounting for most of this reduction. Thus, whereas the analysis demonstrates that housing and neighborhood conditions are effective moderators of the differences in asthma prevalence between racial/ethnic groups in New York City, blacks and Puerto Ricans in particular remain significantly more seriously affected by this aspect of ill health.

Discussion

The goal of this paper was twofold. The first was to document differentials in the prevalence of asthma for households with children from ten specific racial/ethnic groups. While other studies have examined differences between blacks and whites (e.g., Boardman, Finch, and Hummer 2001; Miller 2001) and there has been some investigation of difference among Hispanic groups (Kinnert et al. 2002; Ledogar et al. 2000; Mendoza et al. 1991), little research has been done to date that includes Asians. Using data for New York City, I find significant

variations in the prevalence of asthma, with Puerto Rican households most likely, and Chinese households least likely, to contain at least one asthmatic. The relatively advantaged position occupied by Chinese households is shared by Asian Indian households who also exhibit very low levels of asthma. Controlling for the nativity status of the householder indicated that immigrant households in general tend to be more healthy than their native-born counterparts.

The second goal was to establish if differential exposure to potentially adverse housing and neighborhood conditions helped to explain at least part of the observed racial/ethnic disparities in asthma prevalence. Logistic regression models demonstrated that many of the housing and neighborhood conditions significantly predicted the presence of at least one asthmatic in the household. As expected, the odds of asthma prevalence rose with the number of maintenance deficiencies reported by householders, and were higher for households living nearby boarded-up buildings than for those living in areas free of physical decay. While the former effect is consistent with findings of epidemiological studies that document the relationship of asthma to the presence of triggers (including mold, dust mites, and pest infestation), the latter effect suggests that households may increase their exposure to adverse housing conditions by staying indoors to avoid the perils they may perceive in their neighborhoods. Providing indirect support for this idea is the finding that households who have lived in their units for longer periods also exhibit higher levels of asthma prevalence.

The findings regarding the influence of housing conditions, and especially the role played by maintenance deficiencies, point to the importance of strengthening laws regarding the correction of housing code violations, and of programs aimed at helping landlords to make structural improvements in the face of high costs. Also indicated by these findings is that interventions, such as those embodied in "Healthy Homes" programs and pursued by the Harlem Children's Zone, that help families to reduce the level of asthma triggers in the home can also

can help to reduce the severity of asthma (Krieger and Higgins 2002; Perez-Pena 2003a, 2003b). Such programs also work with landlords to make necessary repairs to leaks or drafts or other conditions that can exacerbate a predisposition to respiratory illness.

The study also provided evidence of the relationship between both indoor and outdoor pollutants and asthma prevalence. Specifically, living with at least one smoker – and the consequent exposure to environmental tobacco smoke – raises the odds of asthma in the household, as does living in area with relatively high levels of exposure to manufacturing facilities. While the latter finding does not identify the presence of particular pollutants, it is likely that it reflects a combination of factors, including diesel exhaust from trucks delivering to and taking products from manufacturing plants as well as particulates released as a consequence of manufacturing processes. Equally important, prior to controlling for borough location, exposure to concentration of transportation facilities also increased the odds of asthma prevalence. However, once borough location was entered into the model, households living in the Bronx were found to be at an especially pronounced risk of having asthma. This effect likely reflects the concentration in the borough of other kinds processes emitting noxious fumes and pollutants into the air, including incinerators and waste disposal plants.

Perhaps most significantly, the study revealed that controlling for the full range of predictors reduced the disadvantage experienced by black and especially Puerto Rican households by almost one quarter. In particular, I found evidence that the block of housing conditions was the most successful at moderating the persistently high levels of asthma among these households. Because the disproportionate exposure of black and Puerto Rican households to deleterious housing and neighborhood conditions stems not from low socioeconomic status but apparently from external constraints on their housing choices (Rosenbaum 1996; Rosenbaum and Friedman 2004a, 2004b; Schill, Friedman, and Rosenbaum 1998), discrimination in the

housing market can be said to contribute to these groups' lower levels of health. Such a finding adds to the growing literature documenting a connection between racism and health (e.g., Williams and Collins 1995), and points to the need to strengthen fair housing laws to, for once and for all, make access to safe and desirable housing available to all households.

However, what is of at least equal importance is the finding that even in the presence of all controls, black and especially Puerto Rican households remain at a far greater risk of asthma than do their white counterparts. At least part of these persistent differentials stems from the absence of information in the data set on health behaviors and other factors relating to a predisposition to respiratory ailments. It is also possible that the unique circumstances of New York City, with its persistently high levels of segregation (Lewis Mumford Center 2001) and its extremely high levels of asthma (Weiss, Gergen, and Crain 1993) contribute to the findings. Thus, to fully understand the nature of the disproportionate asthma risks faced by Puerto Ricans and blacks, it is essential that data sets containing all potentially relevant predictors be collected for a variety of different areas. Without this kind of information, fully effective interventions to reduce these disparities will remain elusive.

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Table 1: Percent of New York City households with children that contain at least one asthmatic by race/ethnicity of householder, 2002

Race/ethnicity	Percent
Non-Hispanic white	16.96
Non-Hispanic black	27.54
Puerto Rican	44.94
Dominican	21.21
Central/South American	20.33
Mexican	15.62
Other Hispanic[a]	26.28
Chinese	10.74
Asian Indian	11.14
Other Asian[b]	15.26

a Category includes Cubans and "other" Hispanics.
b Category includes Koreans, Japanese, Filipinos, Vietnamese, other Pacific Islanders, and "other" Asians.

Table 2: Selected descriptive characteristics of New York City households with children, by race/ethnicity of householder, 2002

Characteristic	White	Black	Puerto Rican	Dominican	Central/South American	Mexican	Other Hispanic
Housing characteristics							
Crowded	33.18	41.85	46.31	56.53	63.07	85.91	37.55
At least one smoker	28.83	25.62	36.98	10.84	15.42	12.36	31.92
Number of maintenance deficiencies							
None	64.17	40.93	40.34	32.69	47.81	35.85	28.61
One or two	29.40	37.61	38.53	41.91	34.90	40.66	45.87
Three or more	6.43	21.46	21.13	25.39	17.29	23.49	25.52
Renter	47.54	70.23	84.56	92.57	80.84	97.68	74.68
Neighborhood characteristics							
Little or no social cohesion	7.61	28.52	39.40	24.50	25.78	19.42	35.11
Boarded-up buildings nearby	4.00	15.00	13.00	10.00	4.00	14.00	11.00
Subarea characteristics							
Percent white quintiles							
First	2.35	49.76	23.48	28.18	13.09	12.88	18.87
Second	5.87	26.61	37.45	48.44	26.58	29.02	30.50
Third	16.95	13.97	15.89	10.97	36.21	29.53	12.82
Fourth	31.25	7.65	15.25	8.67	15.24	11.10	20.97
Fifth	43.58	2.01	7.93	3.74	8.88	17.47	16.85
Poverty quintiles							
First	34.26	10.49	7.71	2.96	8.65	6.55	18.84
Second	31.48	11.86	14.51	8.19	26.13	19.80	20.80
Third	15.22	29.68	12.06	13.91	35.72	26.70	13.11
Fourth	13.14	21.22	23.23	32.77	12.18	20.74	24.98
Fifth	5.91	26.75	42.49	42.17	17.33	26.21	22.26
Transportation facs/100,000 quintiles							
First	23.70	37.04	36.40	32.85	26.16	38.97	38.64
Second	5.43	24.90	8.26	13.59	8.76	7.92	12.86
Third	20.85	16.86	13.86	27.99	23.39	18.27	20.87
Fourth	21.13	11.46	18.67	14.81	32.20	23.06	15.75
Fifth	28.89	9.74	22.81	10.76	9.50	11.79	11.88
Manufacturing facs./100,000 quintiles							
First	24.48	8.93	9.67	29.10	8.47	12.16	23.88
Second	27.99	20.36	16.64	18.24	10.39	15.32	22.19
Third	15.37	23.53	17.71	15.13	32.96	19.92	6.43
Fourth	9.70	37.57	26.34	15.34	15.54	20.68	23.14
Fifth	21.81	9.29	28.77	21.50	27.92	27.13	22.21
Borough							
Manhattan	15.68	9.12	11.80	26.84	4.03	9.84	17.07
Bronx	6.37	21.40	42.21	41.03	19.97	23.92	30.52
Brooklyn	35.23	44.88	29.66	17.62	16.13	31.60	19.87
Queens/Staten Island	42.72	24.60	16.33	14.51	59.87	34.64	32.54
N	1,085	1,191	478	376	316	87	64

Continued

Table 2: Selected descriptive characteristics of New York City households with children, by race/ethnicity of householder, 2002 (continued)

Characteristic	Chinese	Asian Indian	Other Asian
Housing characteristics			
Crowded	56.85	63.00	53.24
At least one smoker	20.45	15.67	31.32
Number of maintenance deficiencies			
None	60.41	52.69	56.14
One or two	29.07	36.27	33.19
Three or more	10.51	11.04	10.68
Renter	51.41	62.72	60.22
Neighborhood characteristics			
Little or no social cohesion	16.06	12.76	15.20
Boarded-up buildings nearby	3.00	2.00	6.00
Subarea characteristics			
Percent white quintiles			
First	0.66	11.27	6.76
Second	7.43	12.64	11.12
Third	39.39	44.05	34.97
Fourth	39.44	22.97	32.27
Fifth	13.08	9.06	14.88
Poverty quintiles			
First	20.24	23.76	26.14
Second	28.07	29.48	38.17
Third	19.19	32.66	19.83
Fourth	30.72	10.53	11.91
Fifth	1.78	3.56	3.96
Transportation facs/100,000 quintiles			
First	25.15	42.34	22.45
Second	3.42	13.03	8.00
Third	18.62	8.00	31.23
Fourth	36.07	29.59	28.09
Fifth	16.75	7.05	10.23
Manufacturing facs./100,000 quintiles			
First	31.18	18.14	29.47
Second	25.81	16.03	9.64
Third	12.85	21.05	14.98
Fourth	4.18	13.93	9.56
Fifth	24.47	27.91	27.92
Borough			
Manhattan	21.52	3.84	7.76
Bronx	2.36	9.32	6.09
Brooklyn	33.28	15.68	18.14
Queens/Staten Island	42.84	71.16	68.01
N	174	187	131

Table 3: Results of logistic regression models predicting the prevalence of asthma in New York City households with children, 2002 (odds ratios)

Predictor	Model I	Model II
Race/ethnicity (vs. white)		
Black	1.861***	1.514**
Puerto Rican	3.997***	3.064***
Dominican	1.319†	1.291
Central/South American	1.250	1.396†
Mexican	0.907	1.060
Other Hispanic	1.746†	1.457
Chinese	0.589*	0.869
Asian Indian	0.614*	0.793
Other Asian	0.882	1.114
Household characteristics		
Householder is foreign born[a]		0.610***
Mean age of householder		0.992*
Householder education (vs. at least some college)		
Less than high school		0.930
High school diploma		0.888
Headed by female		1.207*
Household income/10,000		0.996
Receives TANF		1.438*
Lived in unit 5+ years		1.206*
Housing characteristics		
Crowded		1.130
At least one smoker		1.184†
Number of maintenance deficiencies (vs. none)		
One or two		1.450***
Three or more		2.053***
Renter		1.152
Neighborhood characteristics		
Little or no social cohesion		1.084
Boarded-up buildings nearby		1.302†
Subarea characteristics		
Percent white quintiles (vs. fifth)		
First		0.800
Second		0.956
Third		0.883
Fourth		0.872
Poverty quintiles (vs. first)		
Second		0.909
Third		0.911
Fourth		0.920
Fifth		0.765
Transportation facs/100,000 quintiles (vs. first)		
Second		1.199
Third		0.975
Fourth		1.177
Fifth		1.233
Manufacturing facs./100,000 quintiles (vs. first)		
Second		1.309†
Third		1.248
Fourth		1.592**
Fifth		1.294
Borough (vs. Manhattan)		
Bronx		1.713**
Brooklyn		0.865
Queens/Staten Island		1.232
constant	1.969	0.840
Cox and Snell pseudo R^2	.046	.094
Nagelkerke pseudo R^2	.069	.141

a Includes householders born on the island of Puerto Rico. † p # .10; * p # .05; ** p # .01; *** p # .001.

Appendix Table 1: Selected descriptive characteristics of New York City households with children, by race/ethnicity of householder, 2002

Characteristic	White	Black	Puerto Rican	Dominican	Central/South American	Mexican	Other Hispanic
Household characteristics							
Householder is foreign born[a]	33.50	43.03	45.42	93.31	94.80	96.71	68.05
Mean age of householder	40.84	41.48	39.66	39.61	39.56	32.34	39.45
Householder education							
Less than high school	7.12	18.78	33.52	43.38	34.19	62.21	27.41
High school diploma	27.70	30.57	30.91	25.05	30.29	31.86	28.45
At least some college	65.18	50.65	35.56	31.57	35.53	5.93	44.14
Headed by female	14.05	51.70	52.85	55.61	33.14	13.68	40.61
Median household income	$69,051.55	$38,000.00	$27,383.41	$24,000.00	$37,000.00	$27,532.88	$28,527.00
Receives TANF	1.00	7.00	11.00	11.00	3.00	6.00	7.00
Lived in unit 5+ years	61.85	63.63	57.54	62.11	48.04	41.84	57.41
N	1,085	1,191	478	376	316	87	64

Continued

Appendix Table 1: Selected descriptive characteristics of New York City households with children, by race/ethnicity of householder, 2002 (continued)

Characteristic	Chinese	Asian Indian	Other Asian
Household characteristics			
Householder is foreign born[a]	93.65	98.67	89.61
Mean age of householder	43.40	40.27	42.23
Householder education			
Less than high school	39.93	14.11	15.03
High school diploma	29.01	32.56	25.75
At least some college	31.06	53.33	59.22
Headed by female	8.32	6.76	12.00
Median household income	$38,231.39	$39,191.02	$50,663.76
Receives TANF	0.00	0.00	1.00
Lived in unit 5+ years	55.82	54.61	52.69
N	174	187	131

a Includes householders born on the island of Puerto Rico.