

Housing Environments and Child Health Conditions Among Recent Mexican Immigrant Families: A Population-Based Study

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Abstract The influx of immigrants to urban areas throughout the United States has raised concerns about accessibility of safe, affordable housing and the health consequences of poor-quality housing, particularly among immigrant children. We conducted a population-based study of home environmental conditions among recently immigrated Mexican families (weighted $n = 473$), generally of low socioeconomic status, and the health conditions of their children, in an urban industrial area north of Denver, Colorado. The majority of recent immigrants had low socioeconomic status; virtually all had household

incomes below the Colorado median (\$50,841). Approximately one quarter of homes were overcrowded. Adverse environmental conditions were present across recent immigrant homes. These conditions include dampness or mold (44%), pests (28%), and minimal to no ventilation potential (26%), all of which are associated with asthma and atopic diseases. At least one of these three environmental hazards was found in 67% of homes; multiple hazards were present in 27% of homes. Children of recent immigrant families had active symptoms within the past 12 months suggestive of asthma (4%) and atopic disorders (10%); however, fewer than 2% had been diagnosed with these conditions. The prevalence of asthma and atopic symptoms among Mexican immigrant children, albeit lower than in other low income and minority communities, is partially explained by housing conditions. Many of the conditions identified (e.g., pest infestation, mold resulting from plumbing leaks, and lack of exhaust fans) are amenable to low cost interventions. Solutions to address unhealthy housing conditions among recent immigrants must be multi-faceted and include strategies that target household-level improvements and access to health care.

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Keywords Healthy housing · Urban · Asthma ·
Environment · Immigrant

Background

Despite widespread gains in environmental quality throughout the United States, disparities persist in poor and minority communities and include disparities in sources of, exposures to and adverse health outcomes from environmental hazards. Children are particularly susceptible to the

quality and design of the physical environments, including housing, that produce these hazards [1].

Although the influence of housing on health status is widely recognized, housing conditions are inadequate for immigrants settling in the United States [2–4]. Children of immigrants are the fastest-growing segment of the population, accounting for over 20% (13.5 million) of all US children aged under 18 [5]. National studies suggest that children of immigrants typically live in families with lower income and less education, have at least one parent with limited English skills and face excess exposures to chemical and physical hazards including indoor air pollutants, inadequate housing, and overcrowding [6–8]. Such exposures place these children at increased risk for preventable conditions such as asthma and asthma-related conditions [9–18].

Health and housing conditions among children of recent immigrants are less well understood, particularly, recent Mexican immigrants. From 1990 to 2000, Colorado experienced a 148% increase in children of immigrants, most of whom were either born in Mexico or had at least one parent from Mexico [19]. Little is known about the structural and environmental conditions of the homes in which these children reside. In this paper, we report the findings of a population-based study of recent Mexican immigrant families, which characterizes housing environments and childhood asthma and asthma-related conditions.

Methods

We conducted a population-based descriptive epidemiologic study of environmental hazards and selected child health conditions among recent Mexican immigrant households.

Participants

The target population included all recent immigrant families with children resident in Commerce City, Colorado, an urbanized industrial community in Adams County, located immediately north of Denver, Colorado, consisting of 8,836 households and 27,452 people (52.3% Latino) [20]. The sampling frame was constructed from the US Post Office Delivery Sequence File (DSF) of all addresses within the city's six census tracts. Households were eligible if: (1) at least one parent was foreign-born and immigrated to the US within the past 10 years; (2) children aged under 18 years currently lived in the home; and (3) the primary language spoken in the home was Spanish. We used census block and block group data on ethnicity, age, linguistic isolation, language proficiency, number of children, and year of immigration to identify neighborhoods in which at

least 15–20% of households were expected to be eligible (“Stratum 1”). All 1,615 homes in this stratum were canvassed. We then randomly selected a sample of 1,546 homes (21%) from the 7,221 remaining homes (“Stratum 2”) and canvassed 750 of these homes. Our recruitment goal was 250 households.

Each canvassed home received up to four recruitment visits (morning, afternoon, evening and weekend) between November 2005 and August 2007, during which we screened for eligibility. Respondents were aged 18 years or older and capable of giving consent. We scheduled home visits to collect data in consenting households.

Each participating family received \$20 and nominally-valued toys for the children. At the completion of the visit, the “health promotora” (lay community health worker), provided a low-literacy educational booklet on environmental health and safety, individualized counseling and a low-cost (average \$10) hazard reduction kit that targeted specific environmental health or safety problems identified during the visit. Kits could include a smoke detector or surge protector, drawer and cabinet locks, outlet covers, anti-mold cleaning supplies (i.e., plastic gloves, bleach, mask, and spray bottle), sealable food containers, or allergy-free pillow or mattress covers. Some households were referred to the Low-Income Home Energy Assistance Program (LIHEAP) and Colorado Energy Saving Partners (providing weatherization for qualified low-income homeowners). Homes found to have elevated carbon monoxide levels were referred immediately to the local natural gas utility company for inspection, testing and repairs. Through our Minor Repairs Program, 25 homes also received repairs averaging \$1,000 each, such as window, door or stove replacements; plumbing, tile and drywall repair; exhaust fan installation; or provision of electric space heaters, stair guards or carbon monoxide detectors.

Data Collection

At each home, promotoras conducted a detailed interview survey in Spanish and took blood lead samples. Inspectors conducted walk-through home inspections and testing, and environmental sampling. We field-tested the visit protocol among eight local Mexican families to evaluate the Spanish translation and the flow of instruments and procedures. Promotoras and inspectors were trained over several weeks using didactics, modeling, practice and feedback. Staff held weekly check-ins to discuss questions that arose in the field, data quality issues, and any housing or health conditions that required further attention. We reviewed county public records to obtain the year study homes were built and, for seven homes where relevant inspection data were missing, the number of rooms.

Measures

The 1-h interview and 30-min inspection instruments were developed from existing questionnaires on asthma and allergies, injury, lead poisoning and home environments as well as other sources [21–32]. We asked about household demographics, housing characteristics, indoor air quality, environmental exposures and risks, safety hazards, and their children's health symptoms and conditions. We inspected homes for infrastructure, minor structural damage, floor coverings, window quantity, heating, cooling and ventilation systems and their use at the time of inspection, dampness and mold, pets, pest infestation, and overall maintenance and cleanliness.

Both interview and inspection data were used to define outcomes. A Ventilation Potential Score (VPS) (0–6) assessed the potential for adequate ventilation, assigning points for having at least one exterior window per room (excluding bathrooms) (1 point), a functional window or working exhaust fan for every bathroom (2 points), working exterior exhaust fans for all stoves (2 points), and additional exterior exhaust fans (1 point). $VPS \leq 2$ was coded as “minimal to none,” $VPS = 3$ as “less than adequate,” and $VPS \geq 4$ as “adequate.” To validate this measure, we examined its relationship with CO_2 time weighted averages (TWA) measured on a subset of study homes, since CO_2 has been shown to correlate with ventilation [33, 34]. Indoor CO_2 TWA less than 1,000 ppm indicate acceptable ventilation [33]. Unlike study homes with $VPS \geq 4$, homes with moderate ($VPS = 3$) and inadequate ($VPS \leq 2$) ventilation potential had indoor CO_2 TWA above acceptable levels (1,232 and 1,329, respectively). Similarly, there was an inverse linear relationship between VPS and the difference between indoor and outdoor CO_2 TWA, ranging from 635 for homes with $VPS \geq 4$ to 949 for homes with $VPS \leq 2$.

Cooling systems included central or window air conditioning units or swamp coolers. “Observed dampness or mold” indicated that the inspector observed damp patches, water stains, mold, or musty/moldy odor. “Any dampness or mold” included inspector-observed dampness or mold or respondent report of having seen damp patches or mold in the last 12 months. Evidence of pests was recorded as present if the respondent reported seeing any type of pests (e.g., rodents, insects) inside the home in the past 12 months or if the inspector observed evidence (e.g., droppings, traps). “Any smoking indoors” was specified if the respondent reported that anyone smoked inside the home or if the inspector found evidence of smoking inside (e.g., tobacco smoke odor, cigarette butts). We calculated occupants per room as the ratio of reported number of household members to observed number of rooms excluding bathrooms [35]. “Overcrowding” was defined as

>1 person per room and “severe overcrowding” as >1.5 persons per room [35].

For each resident child, we assessed asthma and allergy symptoms (e.g., wheezing, dry cough, itchy rash, sneezing, runny nose) within the past 12 months and lifetime diagnoses of asthma, eczema, or allergic rhinitis. “Current wheezing symptoms” included any wheezing or whistling in the chest in the past 12 months. “Current atopic symptoms” comprised any symptoms of eczema or allergic rhinitis within the past 12 months. We asked questions on asthma and atopic symptoms because of their known association with current housing environmental hazards (e.g., pest infestation, dampness, dust, pets, smoking).

Analysis

All analyses were conducted with sampling weights using SAS v9.1 survey procedures, which use the Taylor expansion technique for calculating complex design-based estimates of variance. Stratum-specific household-level weights were the inverse of the selection probability given the number of eligible households per stratum (see *Sampling Frame*, above). Weights were 1 and 6.09 for Stratum 1 and 2, respectively. The variance of child-level estimates took into account within-household correlation in multi-child households. Prevalence data are presented as frequencies and weighted percentages. Sample size was calculated to provide error margins of ± 1 –4% for a range of population-based prevalence rates.

Although this study was not designed (or powered) to test differences in proportions for asthma and atopic symptoms across environmental housing conditions, we conducted a post hoc exploratory analysis of these relationships, testing them using chi-square tests and presenting odds ratios and 95% confidence intervals.

Human Subjects Protection

The Colorado Multiple Institutional Review Board approved this study.

Results

Research staff visited 2,365 home addresses (1,615 in Stratum 1 and 750 in Stratum 2), of which 1,855 (78%) were determined to be ineligible and 197 (8%) were never contacted. Of 313 (13%) eligible households, 250 (80%) participated, 56 (18%) refused, and 7 (2%) were undecided or could not be reached subsequently to schedule a home visit. Tables 1 and 2 show population-based prevalence estimates of family and household characteristics among

Table 1 Respondent, family and household characteristics

Variable	Unweighted sample (<i>n</i> = 250)	Weighted percent (95% CI) ^a
Respondent country of birth		
Mexico	243	98.7 (97.7, 99.8)
Central America	2	0.4 (0.0, 1.0)
United States ^b	4	0.9 (0.0, 1.7)
Respondent gender		
Female	222	90.5 (85.2, 95.7)
Male	24	9.5 (4.3, 14.8)
Respondent age		
18–19 years old	12	4.7 (1.0, 8.5)
20–24 years old	34	11.6 (6.3, 17.0)
24–29 years old	70	23.7 (16.5, 30.9)
30–39 years old	96	41.3 (32.4, 50.2)
40–49 years old	27	12.3 (6.2, 18.5)
50–59 years old	9	6.3 (1.3, 11.3)
Respondent highest educational level completed		
Did not attend school	3	0.7 (0.0, 1.4)
Elementary or middle school	89	34.7 (26.2, 43.2)
High school	84	33.6 (25.2, 42.1)
Vocational/technical school	57	23.4 (15.7, 31.0)
Some college and higher	15	7.7 (2.5, 12.8)
Occupation of father		
Construction	121	45.3 (36.5, 54.2)
Manufacturing	31	12.0 (6.3, 17.8)
Agriculture/landscape	27	12.3 (6.2, 18.4)
Other	71	30.3 (22.0, 38.7)
Occupation of mother		
Mom/homemaker/stay at home	173	67.3 (58.8, 75.8)
Restaurant/food	30	12.9 (6.8, 19.1)
Cleaning	12	5.8 (1.4, 10.3)
Other	35	14.0 (7.8, 20.2)
Household annual income (in US dollars)		
Less than 10,000	21	13.2 (6.4, 20.0)
10,000 to less than 15,000	37	16.6 (9.7, 23.5)
15,000 to less than 20,000	67	24.1 (16.7, 31.4)
20,000 to less than 25,000	58	18.9 (12.4, 25.3)
25,000 to less than 35,000	48	16.8 (10.4, 23.1)
35,000 to less than 50,000	9	1.9 (0.6, 3.2)
50,000 to less than 75,000	2	0.4 (0.0, 1.0)
Refused	8	8.2 (2.3, 14.2)
Length of stay in current home		
<1 year	100	37.6 (29.0, 46.2)

Table 1 continued

Variable	Unweighted sample (<i>n</i> = 250)	Weighted percent (95% CI) ^a
1–5 years	133	47.9 (39.0, 56.8)
>5 years	17	14.5 (7.1, 21.9)
Housing tenure		
Renter occupied	162	57.3 (48.3, 66.4)
Owner occupied	88	42.7 (33.7, 51.7)
Multi-family households		
No	175	78.2 (71.2, 85.3)
Yes	64	21.8 (14.8, 28.8)
Crowding		
≤1.0 person/room	187	73.5 (65.6, 81.5)
>1.0 person/room but ≤1.5 persons/room	53	23.2 (15.5, 31.0)
>1.5 persons/room	10	3.2 (0.4, 6.0)

^a Weighted estimates: 250 sampled households weighted to represent 473 households in Commerce City; weighted analyses exclude missing data

^b Non-responding parent was foreign-born and primary language spoken in the home was Spanish

recent, primarily Mexican, immigrants. Unweighted frequencies are also provided (*n* = 250 surveyed households).

Socio-Demographic Characteristics

Among recent Mexican immigrant householders, 35.4% of the population had not completed high school while only 7.7% attained at least some college education. Primary paternal occupations include construction (45%), manufacturing (12%), and agriculture and landscaping (12%). More than half of households (54%) earned less than \$20,000 per year whereas <1% earned \$50,000 or more. Only 15% had lived in their dwellings more than 5 years. Fewer than half (43%) were homeowners.

The number of occupants averaged 5.2 (range 2–17), with multiple families living in 22% of households. Households averaged 1.2 children under 6 years and 2.6 total children per home. The mean number of occupants per room was 0.98. More than 25% of homes were overcrowded, with 3% severely overcrowded.

Housing Characteristics

Most homes occupied by immigrant families were built before 1970, mainly between 1950 and 1969 (Table 2). The most common housing types were single family detached houses and duplexes and other attached houses. Twelve percent of homes needed substantial maintenance or major repairs (e.g., broken gutters, leaking pipes,

Table 2 Housing characteristics

Variable	Unweighted sample (<i>n</i> = 250)	Weighted percent ^a (95% CI)
Year housing structure built		
Before 1950	34	9.4 (5.2, 13.7)
1950–1969	130	58.1 (49.5, 66.8)
1970 or later	68	25.4 (17.7, 33.0)
Missing	18	7.1 (2.5, 11.7)
Housing type		
Single family detached	90	48.5 (39.5, 57.5)
Duplex/row house/townhouse	75	21.4 (15.1, 27.8)
Low or high rise apartment	45	16.1 (9.8, 22.4)
Manufactured homes	40	14.0 (8.1, 19.8)
Category of road on which housing structure is located		
Major arterial	4	0.9 (0.0, 1.7)
Primary or secondary arterial	12	2.6 (1.1, 4.1)
Collector road	17	5.9 (2.0, 9.8)
Local traffic street	217	90.8 (86.6, 95.0)
Overall maintenance		
Very well maintained	80	47.9 (38.7, 57.1)
Moderately well maintained	132	40.3 (31.8, 48.8)
In need of maintenance or repair	28	11.8 (5.9, 17.7)
Overall cleanliness		
Very clean	60	39.6 (30.3, 49.0)
Moderately clean	151	47.2 (38.3, 56.2)
In Need of cleaning	30	13.2 (6.9, 19.4)
Ventilation potential		
None to minimal	47	26.3 (17.9, 34.8)
Less than adequate	125	46.2 (37.3, 55.1)
Adequate	78	27.5 (19.8, 35.2)
Cooling system present		
No	53	11.8 (8.3, 15.3)
Yes	188	88.2 (84.7, 91.7)
Observed dampness or mold		
No	115	55.9 (47.0, 64.7)
Yes	127	44.1 (35.3, 53.0)
Any dampness or mold		
No	95	43.6 (34.6, 52.7)
Yes	149	56.4 (47.3, 65.4)
Evidence of pests		
No	145	72.3 (65.2, 79.5)
Yes	95	27.7 (20.5, 34.9)
Any household pets		
No	185	72.0 (63.9, 80.2)
Yes	65	28.0 (19.8, 36.2)
Any smoking indoors		
No	214	84.5 (77.6, 91.5)
Yes	31	15.5 (8.6, 22.4)
Basement used as living, play or sleeping space		
No	142	60.8 (52.2, 69.4)
Yes	36	19.7 (12.0, 27.4)
N/A	71	19.5 (13.6, 25.5)

^a Weighted estimates: 250 sampled households weighted to represent 473 households in Commerce City; weighted percentages exclude missing data

sagging floors) and 13% needed major cleaning (e.g., visible dust, cobwebs, clutter).

Environmental Conditions

Only 28% of houses had adequate ventilation potential (Table 2). Dampness or mold and pests were evident in 44% and 28% of dwellings, respectively. Smoking inside was recorded in 16% of homes; 23% of these homes were identified by inspection only, with no indoor smoking having been reported by the occupants. The basement was used for living, play or sleeping in 20% of households. Most homes (40%, 95% CI: 31.5, 49.0) contained only one major environmental problem, i.e., dampness or mold, pests or minimal to no ventilation potential. Two major problems occurred in 24% (95% CI: 16.4, 30.8) of the homes including: 13% (95% CI: 8.01, 17.2) with pests and dampness or mold; 9% (95% CI: 3.1, 14.2) with minimal to no ventilation potential and dampness or mold; and 2% (95% CI: 0.0, 5.1) with pests and minimal to no ventilation potential. Only 3% (95% CI: 0.2, 5.8) of homes had three major environmental problems, that is, dampness or mold, pests and minimal to no ventilation potential.

Child Health Status

Table 3 shows unweighted frequencies ($n = 574$ children) and population-based prevalence estimates of environmentally related health conditions among children of recent Mexican immigrants. About one-third of the children were foreign-born. Average age was 6.5 years. The prevalence of current atopy was 9.7% (95% CI: 6.5, 12.9) and that of current wheezing symptoms was 3.9% (95% CI: 1.7, 6.1). The prevalence of having atopy ever or currently was 11.7% (95% CI: 8.2, 15.2); that of having asthma ever or wheezing symptoms currently was 4.8% (95% CI: 2.5, 7.2). None of these four health outcomes was significantly associated with income or education.

Exploratory Analyses: Housing Conditions in Relation to Symptoms of Asthma and Atopy

The prevalence of current wheezing symptoms increased significantly with decreased VPS ($P = 0.02$); the highest prevalence (8.5%) was reported for children living in homes with minimal or no ventilation potential. Current atopy symptoms were also reported most often (15.5%) for children from homes with minimal to no ventilation potential, although the relationship between current atopy and VPS was not significant ($P = 0.13$).

Table 3 Child health characteristics

Variable	Unweighted sample ($n = 574$)	Weighted percent ^a (95% CI)
<i>Child born in the US</i>		
No	207	30.6 (25.4, 35.8)
Yes	355	69.3 (64.1, 74.5)
Refused	1	0.1 (0.0, 0.3)
<i>Current symptoms of asthma and atopy (within the past 12 months)</i>		
<i>Asthma symptoms (i.e., wheezing or whistling in chest)</i>		
No	546	95.9 (93.7, 98.2)
Yes	23	3.9 (1.7, 6.1)
Don't know	2	0.2 (0.0, 0.4)
<i>Any atopic symptoms (e.g., wheezing/itchy rash/sneezing)</i>		
No	502	90.3 (87.1, 93.5)
Yes	67	9.7 (6.5, 12.9)
<i>Ever had lifetime asthma and atopy</i>		
<i>Ever had asthma</i>		
No	539	98.3 (97.5, 99.1)
Yes	19	1.8 (1.0, 2.6)
<i>Ever had hay fever</i>		
No	558	99.3 (98.8, 99.8)
Yes	8	0.7 (0.2, 1.2)
Don't know	5	0.5 (0.1, 0.8)
<i>Ever had eczema</i>		
No	538	96.8 (95.3, 98.2)
Yes	13	1.6 (0.4, 2.9)
Don't know	18	1.6 (0.9, 2.4)
<i>Current symptoms and ever had asthma and atopy combined</i>		
<i>Asthma symptoms in past 12 months or ever had asthma</i>		
No	521	95.0 (92.6, 97.4)
Yes	32	4.8 (2.5, 7.2)
Don't know	2	0.2 (0.0, 0.4)
<i>Atopic symptoms (e.g., wheezing/itchy rash/sneezing) in past 12 months or ever had atopy</i>		
No	473	88.3 (84.8, 91.8)
Yes	81	11.7 (8.2, 15.2)

^a Weighted estimates: the sample of 574 children weighted to represent 1121 children in Commerce City; weighted percentages exclude missing data

Children living in homes with evidence of pests were significantly more likely to have current wheezing symptoms than children in homes without such evidence (8.1% vs. 2.3%; $P = 0.02$). Similarly, children living in homes with evidence of pests were twice as likely to have current atopy relative to children in homes without such evidence (14.9% vs. 7.9%; $P = .05$). No other housing characteristics were significantly associated with current wheezing or atopic symptoms.

Discussion

This study presents population-based estimates of housing and health conditions among recent Mexican immigrant families in an urban environment. The majority of recent immigrants have low socioeconomic status as measured by educational attainment, occupation and income; virtually all have household incomes below the median household income in Colorado (\$50,841) [36]. We found that 54% of recent immigrants had annual household incomes less than \$20,000, compared to 14% of residents of Adams County as a whole. The percentage of owner-occupied homes was also low among recent immigrants, at 43%, compared to the general population in Commerce City, Adams County, Colorado and the Western region of the US (60%, 71%, 67%, and 62%, respectively) [20]. Among recent immigrants, 58% of houses occupied were built between 1950 and 1969. In Adams County as a whole, 31% of occupied houses were built in that time period. In contrast, 25% of recent immigrants occupied homes built after 1970, compared to 65% of the general population in Adams County.

Only 49% of recent Mexican immigrant households in Commerce City live in single-family detached homes while 14% live in mobile homes, compared to 66% and 8%, respectively, among all householders in Commerce City. Early and others found that 58–70% of migrant workers in North Carolina occupied mobile homes whereas Crain and others found that 29% of households in the Inner City Asthma Study lived in detached homes, 57% occupied apartment buildings and 2% occupied mobile homes/trailers [11, 37, 38]. Residential stability patterns among recent Mexican immigrants in Commerce City are similar to survey findings by Early and others among recently immigrated farmworker families in North Carolina [11], in which the proportions of families living in their current homes for less than 1 year ranged from 28% to 37% across survey sites, whereas 6.9% to 27.5% of families had lived in their home for more than 5 years.

Average household size was greater among recent immigrants (5.2 occupants) than the general Commerce City population (3.1 occupants). Moreover, households tend to be slightly more crowded among recent immigrants, with 23% having 1.01–1.5 occupants per room, compared to 8.5% and 3.9%, respectively, among all households in Commerce City and Adams County as a whole.

Adverse environmental conditions are widely present in recent immigrant homes. Conditions include dampness and mold (44%), pests (28%), minimal to no ventilation potential (26%) and indoor smoking (16%), all of which predict respiratory disease and cause wheezing [37–41]. Crain et al., in a multi-city study of home and asthma conditions among children, found dampness or water leaks

in 45% of participant homes consistent with our findings. Unlike our study, Crain et al. focused on homes with asthmatic children where, as expected, hazards were typically more prevalent and included cockroaches (58%), pets (28%), and smoking (32%) [37]. Consistent with Crain et al., smoking was observed in 4% of our homes where the householder did not report smoking [37].

Due to low socioeconomic status and other barriers, children of recent immigrants may be less likely to access medical care and therefore be diagnosed with asthma or atopy. Yeatts and others reported that compared to whites, Mexican-Americans were significantly more likely to have frequent wheezing with no known asthma diagnosis [42]. To address the possibility of under-diagnosis of asthma due to healthcare disparities, we estimated the prevalence of asthma and atopic conditions by asking parents about current symptoms indicating wheezing and atopy as well as known asthma and allergic disease [21, 22]. Even using these measures, we found the combined prevalence of lifetime asthma or current wheezing symptoms among children of immigrants to be only 5%. A ‘healthy immigrant’ effect might help explain this low prevalence, since virtually all parents and nearly one-third of children in our study were foreign-born. Numerous studies in the United States and elsewhere have found the prevalence of asthma or wheezing symptoms to be about half as high among children who are foreign-born, or whose parents are foreign-born, compared to native-born children and parents [43–50]. For example, Brim et al., in a national US sample, reported an asthma prevalence of 7.3% among foreign-born children compared to 13.6% among US-born children [47]. Subramanian et al. recently reported a significantly reduced risk of lifetime reported asthma among the children of foreign-born mothers, but only for children of immigrant Mexicans, the same population we studied [50]. These investigators suggested that potential interactions between genetic susceptibilities and environmental factors in both the native and host countries may be important contributors to asthma occurrence [50]. In addition, differences in perception or reporting of symptoms based on different culture and language may influence prevalence, given that reports on asthma prevalence are typically based on parent report. Although the prevalence of wheezing and atopic symptoms are low among children of recent Mexican immigrants, they are nevertheless at least partly explained by housing and indoor environmental conditions, as has been reported in other populations [15, 17, 37, 51]. While these analyses are limited by the small sample size we had for our post hoc analysis, our data suggest that further investigation of immigrant housing conditions and child health conditions are warranted.

Study Limitations

Although the uncertain legal status of study participants might have biased our findings, the use of health promoters who were first generation Mexicans, spoke fluent Spanish, and were members of the community, for data collection is likely to have attenuated this potential bias. Our 80% participation rate suggests that our recruitment and data collection strategies were effective. Moreover, along with self-reported housing conditions, we incorporated objective measures of housing conditions, collected by trained housing assessors through direct observation, to improve the reliability of our findings.

Another limitation of our study is that the two sampling strata differed in terms of the season in which the data were collected from them. This potentially confounding effect of season and stratum limits the generalizability of these data. Other limitations of this study include our reliance on self-reported health information, which may affect our estimates of asthma and atopic disease prevalence. However, given issues related to access to health care, educational attainment, and linguistic isolation, self-reported health and housing information may provide a more realistic picture of child health conditions and home environments among recent immigrants [43].

Conclusions

Environmental risk factors for asthma are prevalent across immigrant housing. Common hazardous conditions included dampness or mold, pests, and minimal to no ventilation potential, all of which are amenable to intervention. We also found a higher prevalence of overcrowded and multi-family households, which may raise issues beyond risk for asthma and atopic disorders (e.g., psychological distress, respiratory infections, and tuberculosis activation) [3]. Solutions to address unhealthy housing conditions among recent immigrants must be multi-faceted and include strategies that target household-level improvements and access to health care. Partnerships with local housing authorities and public health organizations and clinics are necessary to raise awareness of housing and child health needs and to develop healthy housing policies and comprehensive approaches to home remediation that address the range of hazards present in substandard housing [52, 53].

Acknowledgements The authors gratefully acknowledge Fernando Pineda, Diana Pineda-Ford, Laura Diaz, Maribel Olivas, Joe Campe, Peter Scaramella, and Tina Irwin (promotoras and inspectors), Ken Scott (research assistant), Dr. John Kittelson (statistical consultant), Dr. Analice Hoffenberg (development and pilot testing of data collection instruments), and (posthumously) Alyssa Heberton (data

management). We are also grateful for support and guidance from Cristie Jophlin, ED, Commerce City Community Enterprise; Wendy Hawthorne, through a contract with Northeast Denver Housing Center; Jaime DiPaulo, Community Relations, City of Commerce City; and Tri-County Health Department. The US Department of Housing and Urban Development funded this project (No. COL-HH0123-04). This report does not necessarily reflect the views of the aforementioned agencies and organizations.

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