J Immigrant Minority Health (2008) 10:345–351
DOI 10.1007/s10903-007-9087-1

ORIGINAL PAPER

Environmental Risk Factors of Disease in the Cameron Park Colonia, a Hispanic Community Along the Texas–Mexico Border

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Published online: 18 January 2008

Abstract *Objectives* This report summarizes the results of a cross-sectional study in Cameron Park in 2000–2001 to identify disease prevalence and health concerns among colonia residents and to identify environmental exposures to potentially adverse environmental conditions. *Results* Asthma and allergies were among the most prevalent respiratory diseases reported in both adults and children of Cameron Park. Other diseases affecting the community in higher numbers included diabetes and heart disease/high blood pressure. Among children, the most prevalent health conditions were asthma, followed by lung diseases, allergies, and to a lesser degree, skin rashes. *Conclusions* These data can be useful in developing education and intervention programs to address the public health and medical issues impacting residents in the Cameron Park Colonia of Texas.

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Keywords Risk factors of disease · Environment · Cameron Park Colonia · Hispanics · Disease prevalence

Introduction

The United States-Mexico border region comprises an area that stretches 2,000 miles from San Isidro, California to Brownsville, Texas. The border extends some 60 miles on either side of the boundary line, including 10 states in total, and currently has a population of approximately 12 million. The binational US-Mexico Border Health Commission estimates that the number of residents in the region will double by 2025. Some areas along the border such as those in the California, Baja California, El Paso-Ciudad Juarez region, the McAllen-Reynosa region and the Brownsville-Matamorros region are highly populated [1–3]. The US-Mexico border is characterized by poverty and lack of environmental controls. Approximately 80% of the population in the border region is of Mexican origin and Spanish continues to be the predominant language in most US border communities [1–3].

'Colonias' is a Spanish term used to describe unincorporated settlements, neighborhoods or communities along the border of US with Mexico. Colonias lack one or more elements of community infrastructure such as paved roads, sewer system, electricity, gas, clean water and health services [4]. Texas has the largest number of colonias relative to other states along the shared US border with Mexico, with approximately 1,800 *colonias*, and more than 500,000 residents along the US side of the border. About 65% of all *colonia* residents, and 85% of those younger than 18 years, are individuals who were born in the United States. Promotores, a Spanish term for lay community health workers, are community members who typically reside within the

colonia and function almost exclusively to connect healthcare consumers with providers and to promote healthy behaviors among colonia residents [5]. Promotores receive training through a variety of state and federal agency programs to become educators in their own communities.

The Border Industrialization Program initiated in 1965 brought significant population and economic growth to the US-Mexico border [2]. The explosive growth rates experienced during the past 40 years have in many instances surpassed the ability of municipalities to provide basic services to *colonia* residents. The occurrence of health problems in the border is complicated by social, economic, and cultural factors—occupational risks, limited ability to purchase nutritious foods, barriers to affordable medical care, and sometimes, cultural practices and believes about medical care [6]. Another potential factor influencing the health of border residents is the lack of literacy on health-associated issues [7]. Health problems and risks are exacerbated by poor access to health insurance and health care providers by much of the population living in the colonias. In 1997, it was reported that States along the US-Mexico border contained nearly three million people who have no form of health insurance [8].

In light of the above mentioned statistics, it is not surprising that the border region has faced numerous environmental health problems. For instance, the exposure of agricultural workers to pesticides has been identified among the major human environmental health problems along the border [3]. In addition, more than 3,000 factories (Maquiladoras) have been established along the border specializing on the use of solvents and heavy metals in manufacture [2]. Air quality is another serious concern on the border, with industrial emissions and vehicular exhaust in combination with dust from unpaved roads, open burning trash, and smoke from wood-burning stoves have been identified as important contributing factors. Shortages of solid and hazardous waste disposal are also a major problem in the border, as reported by the US General Accounting Office [9]. Water pollution caused by industrial and agricultural contaminants also threatens potable water resources and these problems are expected to continue to increase as the population increases [2].

Little has been documented about actual environmental risks in colonias along the Texas–Mexico border. In this report, we summarize the major findings of a study conducted to evaluate environmental risk factors of disease in the Cameron Park Colonia. Cameron Park is located in Cameron County, Texas and is geographically situated within the Brownsville metropolitan area. Cameron Park is one of the largest colonias in the Lower Rio Grande Valley, only a stone's throw from the Texas–Mexico border. Its residents share many of the same socio-economic and environmental challenges of other colonias along the border. In 1989, US congressmen introduced measures to provide infrastructure improvements to a number of border colonias such as Cameron Park. In 1990, the population of Cameron Park was 3,802 and that number increased to 5,961 by 2000. By this time, most of the residences in Cameron Park had water facilities and sewer hookups, and more than nine of the community's 11 miles of roads had been paved [10]. In spite of these improvements, Cameron Park remains one of the poorest colonias in Cameron County (US Census, 2000). This ranking is based on the median per capita income for communities of one thousand or more households. The population in the community of Cameron Park colonia is 98.7% Hispanic [11]. To fill existing gaps, the present study was conducted to identify the prevalence of specific diseases among the residents of Cameron Park, to assess environmental risk factors of disease in this *colonia*, and to identify areas in need of specific environmental education and intervention.

Methods

Instrument

A cross-sectional population-based survey instrument was developed for the community of Cameron Park in both English and Spanish [7]. The contents and use of the instrument were approved by the Texas A&M University Institutional Review Board. The survey was divided into four sections including: Demography, Environment, Health and Community perceptions. The total number of questions was 115 and the survey was administered in the language of stated preference. Questions included in the survey focused on demographic characteristics of the cohort, health status and morbidity, and social and economic characteristics. The survey variables included background characteristics of individuals in the randomly selected households, self-reported disease conditions (for example, asthma or asthma symptoms in the past 12 months), accessibility to medical care and immunization, and self-reported exposures to different environmental factors. Disease conditions were assessed using a card of disease codes and reported for a 1-year period. As such, the prevalence of disease and environmental exposures can be estimated. A copy of the survey instrument is included as supplement 1.

Study Population and Setting

The survey was conducted from January 2000 to May 2001. Households were randomly selected from a Cameron Park map developed for sampling purposes in this study.

Eligibility Criteria

Households were defined as the unit of analysis. Interview eligibility required that adult individuals self-identify as heads of household and reside in the Cameron Park Colonia.

Promotores Training for Survey Administration

A training workshop was offered to acquaint promotores with the project and to educate them on survey administration skills, safety and confidentiality policies and general aspects of research methodology.

Data Acquisition

A door-to-door intervention method was used for acquisition of data. Promotores completed 445 face-to-face interviews with a 100% response rate. Appointments were made prior to any visit to improve the probability of willing participation by the residents and to minimize sampling error. After completion of the consent form, Promotores asked the questions and completed the questionnaires. Participants were always offered the opportunity for open response, and all responses were recorded in writing.

Data Analysis

Disease and environmental exposure frequencies were determined using the Intercooled Stata 7.0 statistical analysis package and SAS (SAS Institute Inc. Cary, NC). Environmental risk factors of disease were identified using Fisher's exact test. Logistic regression techniques were used to evaluate the significance of association and to calculate odds ratios and 95% confidence intervals, respectively.

Results

Selected household characteristics among residents of the Cameron Park Colonia are summarized in Table 1. There were 445 households surveyed with an average of 4.5 family members per household. The majority of homes had electricity (97%) and public water supply (97.7%), and the main drinking water source was from either inside tap (72.6%) or bottled water supply (26.7%). About 65% of the residents paid to have garbage removed by a private hauler, while 29.1% regularly self-hauled garbage to either a landfill or a community waste collection station. About 6% of the residents either burned and/or buried their garbage on a regular basis, with one home indicating garbage disposal in the yard behind the home. A considerable number of homes (29.8%) reported living within ¼ mile of junk yard, 21.2% reported living within ¼ mile of crop fields, 17.2% reported living within ¼ mile of dry cleaning business, and 32.6% reported living within ¼ mile of car radiator repair shop. Sorghum, cotton, corn and citrus fruits were the most common crops grown near the Cameron Park community, and 13% of the households reported pesticide exposure, either associated with home proximity to a crop field with known pesticide application via dusting planes, or pesticide use in the home or garden, or in direct contact with pesticides. The majority of Cameron Park residents received primary health care at either a private physician's office (66.3%) or through a health department clinic (23.8%). Further, 74.9% obtained health care for the family solely in the US.

About 80% of the homes identified the head of household as a male member. The average age of all head of household members was 44.6 years, while spouses were more frequently female (95.1%) with an average age of 41 years. The vast majority of both head of household and spousal members were born in Mexico, 80 and 76.2%,

Table 1 Household characteristics among residents in the Cameron Park Colonia

Household characteristics	%
Electricity	97.0
Public water supply	97.7
Drinking water source	
Inside tap	72.6
Bottled water	26.7
Garbage disposal	
Self-hauled garbage	29.1
Private hauler	64.9
Burned or buried	6.0
Proximity (<¼ mile) to dry cleaner	17.2
Proximity (<¼ mile) to junk yard	29.8
Proximity (<¼ mile) to crop fields	21.2
Proximity (<¼ mile) to car radiator shop	32.6
Any exposure to pesticides	13.0
Healthcare	
Private physician's office	66.3
Health department clinic	23.8
Nation providing health care	
USA	74.9
Mexico	15.6
Both	9.5

*The unit of analysis was defined as households and the total number of heads of household evaluated in this study was 445. The average number of family members per household was 4.5 persons.

respectively, whereas the vast majority of the children living in the community were born in the United States (82.3%). Both spouses and household heads are most frequently Spanish speakers only (69.3 and 71.1%, respectively), and have less than a ninth grade education (63.6 and 62.2%, respectively). Smoking tobacco products was reported by 24.4% of head of household members, while only 8% of the spouses indicated smoking. Smoking tobacco products among child members of the families was reported by 2.5% of the responders. The majority of the surveyed households, i.e. 440 out of 445 households, answered the question on exposures to various chemicals in the home. Among them, 24.6% of the households reported exposures to lighter fluid at home, 97.5% reported exposures to cleaning fluids, 36.4% reported exposures to gasoline, and 17.7% reported exposures to paint thinner at home.

The annual prevalence of specific diseases among adult and child populations of the Cameron Park Colonia is presented in (Table 2). Disease conditions were reported by 21.9% of the Cameron Park community members during the year prior to the survey (1999–2000). The two most prevalent medical conditions of the cohort included asthma (4.3%) and allergies (4.3%). Other diseases affecting the community in higher numbers include lung disease (2.2%), diabetes (3.9%), and heart disease/high blood pressure (3.4%). Other diseases indicated in the survey were found to affect less than 1% of the Cameron Park residents. For purposes of determining disease prevalence within the Cameron Park *colonia*, adult community members were defined as persons 18 years of age or older; with persons less than 18 years of age considered children. The most prevalent medical conditions among the adult population of Cameron Park were diabetes (6.8%) and heart disease/hypertension (5.6%). A total of 4.7% of the adult population was affected by allergies and 3.1% by asthma. Among children, the most prevalent condition in Cameron Park was asthma (5.8%), followed by lung diseases (3.1%), allergies (3.8%), and to a lesser degree, skin rashes (1.5%).

Living in a home located <¼ mile from a junk yard or dry cleaner significantly increased the risk of one or more family members having a respiratory illness (Table 3). It is noteworthy that living within <¼ mile from land used in crop production, with or without known pesticide application, did not significantly increase the risk of respiratory disease among household members (Table 3).

Data analysis was conducted at the household level, i.e., considering whether there is at least one family member in the household reported having a specific disease symptom or clinical sign consistent with that disease. Any pesticide exposure, including home proximity to cropland, households reporting pesticide use in the home or garden, or in direct contact with pesticides, was not significantly associated with increased risk of respiratory diseases (Table 3). In contrast, home proximity of less than 0.25 miles from a dry cleaning business was associated with about twice the risk of respiratory disease (OR: 1.73, 95%CI: 1.03, 2.92) among one or more family members, but was not significantly associated with asthma (OR: 0.94, 95%CI: 0.45, 1.94). A nearly two-fold increased risk of allergy was also associated with home proximity to dry cleaning businesses (OR: 1.96, 95%CI: 1.02, 3.77) (Table 3). Home proximity of less than 0.25 miles from a junk yard was associated with a nearly three-fold increased risk of allergy (OR: 2.88, 95%CI: 1.61, 5.14). Similarly, a significantly increased risk of any respiratory disease (OR: 1.74, 95%CI: 1.12, 2.71) was observed with junkyard proximity to home location, though this reflects, in part, the

Table 2 Prevalence of selected diseases in households of Cameron Park Colonia

Family members	*N*	%
Adult community members	1,138	
All diseases	297	26.1
Asthma	35	3.1
Lung diseases	17	1.5
Allergies	53	4.7
Diabetes	77	6.8
Heart disease/High blood pressure	64	5.6
Bowel/Intestinal problems	15	1.3
Skin rash	8	0.7
Dengue fever	6	0.5
Cancer	5	0.4
Miscarriage	5	0.4
Birth defects	3	0.3
Hepatitis	2	0.2
Infertility	2	0.2
Other	5	0.4
Children (<18 years)	879	
All diseases	144	16.4
Asthma	51	5.8
Lung diseases	27	3.1
Allergies	33	3.8
Diabetes	1	0.1
Heart disease/High blood pressure	4	0.5
Bowel/Intestinal problems	4	0.5
Skin rash	13	1.5
Dengue fever	3	0.3
Cancer	1	0.1
Birth defects	2	0.2
Hepatitis	1	0.1
Other	4	0.5

Annual prevalence of specific diseases among adult and child populations of the Cameron Park Colonia in Cameron County, Texas, 2000

Table 3 Odds ratios (OR) and 95% confidence intervals (CI) for selected environmental exposures associated with households reporting one or more family members with any respiratory disease, allergies, asthma

Disease	OR	95% CI
Environmental factor		
Any respiratory disease		
Pesticide exposure		
No	1	Ref.
Yes	0.82	(0.52, 1.31)
Home <¼ miles from junk yard		
No	1	Ref.
Yes	1.74	(1.12, 2.71)
Home <¼ miles from dry cleaner		
No	1	Ref.
Yes	1.73	(1.03, 2.92)
Allergies		
Pesticide exposure		
No	1	Ref.
Yes	0.65	(0.35, 1.19)
Home <¼ miles from junk yard		
No	1	Ref.
Yes	2.88	(1.61, 5.14)
Home <¼ miles from dry cleaner		
No	1	Ref.
Yes	1.96	(1.02, 3.77)
Asthma		
Pesticide exposure		
No	1	Ref.
Yes	0.75	(0.42, 1.35)
Home <¼ miles from junk yard		
No	1	Ref.
Yes	1.01	(0.57, 1.78)
Home <¼ miles from dry cleaner		
No	1	Ref.
Yes	0.94	(0.45, 1.94)

association with allergy and home proximity to junkyards. Asthma reported among household family members was not significantly associated with junkyard proximity. Further more, repeat study was done in full once with the reproducible findings.

Discussion

Little is known about disease prevalence in colonias along the Texas–Mexico border and this is certainly the case for the Cameron Park Colonia. Cameron Park was chosen for our study due to its population size with approximately 5,961 residents, 98.7% of Hispanic origin. Because of its proximity to Brownsville, Texas, the anencephaly cluster heavily publicized in the early 1990s, the community of Cameron Park has consistently expressed concerns about birth defects, neurological deficits, cancer, cardiovascular morbidity, and respiratory problems.

The prevalence of diseases in Cameron Park and other colonias along the US-Mexico border has been identified as a public health issue of concern, especially in terms of environment-related disease conditions. Cameron Park is a typical colonia along the border and as such likely faces many of the same socio-economic and environmental challenges of other colonias along the border. The results of our cross-sectional study indicate that diseases of environmental etiology, such as asthma, allergies, lung disease, diabetes, heart disease, and to a lesser extent skin's rashes in children, are prevalent in the colonia of Cameron Park. However, when compared to disease prevalence data reported in national surveys, such as the National Health and Nutrition Examination Survey [12], or the National Health Interview Survey [13], overall disease prevalence in Cameron Park Colonia was similar to rates for the US population in general. This finding suggests that public health improvements and interventions in the past decade have had a positive influence on the Cameron Park Colonia. Of note was the finding that Cameron Park possessed a better developed infrastructure, as evidenced by the availability of electricity and public water supply in the majority of homes, and that the main source of drinking water from an inside tap or bottled water, than younger colonias. The prevalence of disease conditions found in our study may reflect regular practices in the community, such as self hauling of garbage to a landfill or community waste collection sites and burning and burying of garbage.

Two of the most prevalent conditions identified in Cameron Park were asthma and allergies. Other diseases affecting the adult community in higher numbers included lung disease, diabetes, and heart disease/high blood pressure. Of importance was the finding that living in a home located near a junk yard or dry cleaner significantly increased the risk of one or more family members having respiratory illness. These relationships may be explained by significant changes in metabolic activity of phagocytes, alpha 2-macroglobulin, C3 and C4 complement component, salivary secretion of IgA due to exposure to dry cleaning solvents [14], and the biological effects of chemicals and metals in junk yards, such as lead [15]. Home proximity to a dry cleaning business or junkyard was associated with twice the risk of allergy among one or more family members. The relationship between proximity to junkyard/dry cleaner and respiratory disease may in part reflect the association of proximity to junkyard/dry cleaner with allergies. Asthma, however, was not significantly associated with either junkyard or dry cleaning exposure.

However, households reporting exposures to pesticides, including home proximity to cropland, use of pesticides in the home or garden, or direct contact with pesticides, was not statistically significantly associated with risks of all reported respiratory diseases (asthma, allergies, and lung disease). Among children, the most prevalent condition in Cameron Park was asthma, followed by lung diseases, allergies, and to a lesser degree, skin rashes. In terms of health outcomes it is important to note that the majority of Cameron Park residents received primary health care from a private physician's office or a health department clinic solely in the US.

Of interest was the finding that up to 66.3% of the residents received medical care from private physicians. Although the reasons accounting for this finding are unclear, it is plausible that colonia residents prefer to utilize private services because of immigration issues that preclude them from seeking government-sponsored medical care. While direct measures of migrant stability were not obtained, the high percentage of residents who sought private medical care suggests that the community is in fact stable. Other indicators of stability included the stability of promotores residing and working in the community for at least 2 years and the employment histories of workers.

Asthma and allergies have been identified as the most adverse diseases in both adults and children at the Cameron Park colonia. The prevalence of asthma at Cameron Park colonia is similar to a childhood asthma study of two counties on the California/Baja California border [16]. In that study, high rates of childhood asthma were partially related to poverty and air quality conditions. Ozone and particulate matter (less than 10 microns in diameter) were examined as two major pollutants which can aggravate asthma, suggesting that future studies should define environmental factors associated with junk yards and dry cleaners in Cameron Park.

Clearly, the above statistics are specific to the Cameron Park Colonia and therefore attempts to extrapolate these findings to other colonias on either side of the border must be made with caution since the inherent characteristics of each colonia may directly impact the nature of findings. Colonias on the US side are unincorporated settlements with substandard housing conditions. They often exist in floodplains and industrial areas, or on land with little agricultural value. Colonia residents in Texas sometimes own their plots, as developers have sold unimproved land to low-income families. However, given their limited property tax base, cities are reluctant to annex colonias. On the Mexican side of the border, colonias often have less government assistance than those in the US For instance, Juarez, a city of about 800,000, has no sewage treatment facilities; approximately 55 million gallons of raw sewage pour daily into open canals, which cut through the colonias as they carry the sewage to the Rio Grande River. There is not sufficient data on incomes in Mexican colonias, but some unofficial statistics suggest that Mexicans who participated in the survey earn 1/10th to 1/5th of the hourly wages of a US worker earning minimum wage [17]. Residents on both sides of the border work in similar fields: seasonal farm work, construction, factory labor, and independent enterprises such as food vendors and product peddlers [17]. On the Mexican side, residents of colonias work as trash collectors, or sorters and resellers of trash. Houses are sometimes built with recycled shipping pallets and cable spools. While these living conditions in many ways are worse than those encountered in Cameron Park, Colonia residents on both sides of the border often struggle with similar problems that affect their quality of life. These include poverty, higher-than-average unemployment rates, illiteracy, insufficient public transportation, lack of health benefits coverage, and unfamiliarity with government services. Although investments in environmental infrastructure on both sides in the past decade have led to improvements, shortages such as drinking water, wastewater treatment, and solid waste disposal remain at crisis levels [2]. These challenges may contribute to a host of diseases including gastrointestinal infections, asthma, tuberculosis, multiple myeloma, systemic lupus erythematosus, hepatitis A, neural tube defects, and lead poisoning [2]. These interpretations are consistent with previous reports summarizing health and environmental conditions in Texas Border Counties and Colonias [18, 19].

Community and individual education programs are central to addressing many of the problems faced by residents along the Texas–Mexico border. Reaching out to these communities poses unique challenges that require unique approaches. In order to promote sustainable environmental health in rural Texas–Mexico border communities, a project was developed in the Cameron Park *colonia*, using a 'train-the-trainer' model of environmental education. This model of environmental education is now commonplace in community outreach and education programs [3]. The present study affords several strengths and weaknesses over other studies carried out in colonias along the Texas–Mexico border. Of most relevance is the availability of data on disease prevalence within a Hispanic population on the Texas–Mexico border region. Because disease prevalence was estimated based on self-reported data, a weakness of the study is the lack of exact measurements of disease conditions. Further studies are warranted to investigate possible environmental factors associated with junk yards and dry cleaners and to classify the relationship between respiratory diseases and toxicant exposures. On the basis of our findings it is recommended that future environmental health interventions in the colonias include special community education programs

targeted toward asthma treatment, control, and prevention, especially for children and parents of children with asthma in Cameron Park. Specifically for adult populations, health education programs should address prevention and control of cardiovascular diseases and diabetes.

Acknowledgements This work was supported by the National Institute of Environmental Health Sciences (NIEHS), NIH grant numbers P30 ES09106 and 5-T32 ES07262–12. We acknowledge the technical assistance of Ms. Teresa Serna during the data collection phases of this project.

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