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What Do Toilets Have to Do With It? Health, the Environment, and the Working Poor in Rural South Texas *Colonias*

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Abstract

This paper develops and tests an environmental health ecological framework between the quality of infrastructure, utilities and resident's practices to health problems reported in three Nueces County, Texas *colonias*. Populated by predominantly low-income, minority families, these peri-urban settlements are characterized by substandard housing, lacking traditional sewage systems, potable drinking water and pluvial drainage. It was hypothesized that those without indoor toilets, pluvial drainage and regular garbage collection would be more likely to report health problems. The study found that keeping trash for over a week was statistically related to gastrointestinal illness and eye infections. Having indoor toilets in conjunction with substandard septic tanks was statistically related to gastrointestinal illness, respiratory problems and skin infections. The lack of pluvial drainage was statistically significantly, while not related to a particular disease. The argument is made that flooding problems may have contributed to the sanitation problems. Specifically, drainage problems affect the septic tanks and cause backflow to the indoor toilets. Although a small sample, the findings show that people who live in *colonias* are at risk for disease because structural measures to improve sanitation are not available.

Introduction

As many as 400,000 rural Texans live in *colonias* (Powell 2008¹). *Colonias* are unincorporated communities that often lack the most basic living necessities, such as safe drinking water and sewer systems, electricity, paved roads and safe housing. Recently, the Texas State Office of Rural Community Affairs awarded \$6.7 million to 16 rural communities. Four South Texas counties will receive infrastructure improvements such as first time water or sewer service. The predicament of these communities demonstrates what the Albrechts (2000²) refer to as the extreme and extensive poverty occurring in non-metropolitan areas of the United States related

to structural rather than cultural roots of poverty. It has been suggested that in the *colonias* and other similar areas in the United States poverty significantly impacts lifestyle choices and chances (Fauth et al 2008³; Robert and House, 2000⁴). In addition, numerous studies link poverty to poor living conditions (Link and Phelan 2000⁵), poor working conditions (House et al., 1986⁶; Franzini et al. 2005⁷; Mirowsky et al. 2000⁸; Mulatu and Schooler 2002⁹), higher morbidity rates (Syme and Berkman 2001¹⁰; Mirowsky et al. 2000¹¹), and higher mortality rates (Antonovsky 1967¹²; Williams 1990¹³; Winkleby et al. 1992¹⁴).

According to the *Nueces County Highway Map, Rural Subdivision Map* (Naismith Engineering 1998¹⁵), approximately 176 housing subdivisions (*colonias*) exist in rural Nueces County. The Nueces County *colonias* share many of the traits found along the Texas-Mexico border, though not as severe. The high levels of E-coli and fecal coliform bacteria (water-borne vectors for gastrointestinal illnesses) found in stagnant flood in these areas have been the focus on recent interest.

Prior research has not been conducted in rural Nueces County. It appears that the residents of these *colonias* might share the same problems encountered by the border *colonias*, particularly in terms of a lack of infrastructure and the incidence of illness. Some of these health problems include: gastrointestinal illnesses, respiratory problems, skin and eye infections, cancer, birth defects, neural-tube disorders, and reproductive issues.

Using an Environmental Health Ecological Framework, the purpose of this research is to examine the linkages between incidence of disease and environmental pollution levels. The findings for this research are based on household level interviews in three Nueces County *colonias*. The research questions include:

1. To what extent is household members' access to adequate utilities, such as sanitation and other public services, related to disease incidence?
2. To what extents are household members' daily activities and periodic practices, that bring them in contact with pollutants, related to disease incidence?

Literature Review

Epidemiological Studies

Epidemiological studies have found a relationship between environmental pollution and health problems, particularly in residential areas adjacent to heavy concentrations of industry or agricultural production. Such studies have linked pesticides, herbicides, heavy metals, rubber, paint, industrial solvents, petroleum products, and industrial chemicals to cancers of the brain, liver, breasts, kidney, prostate, esophagus, skin, bone, marrow, and lymph nodes (Steingraber 1997¹⁶; Nurminen et al. 1996¹⁷; Folinsbee 1992¹⁸; The World Bank 1992¹⁹; Murray and Lopez 1996²⁰). Further associations have been found between chemical pollution and infertility, lung disease, brain damage, birth defects (National Research Council 1994²¹), fecal contaminated food and water and cholera and hepatitis A and E (*Morbidity and Mortality Weekly Report* 1997²²) and diarrhea (United Nations 1996²³). Jamison, et al. (1993²⁴) argue that chronic

conditions, such as cardiovascular disease, cancer, and chronic pulmonary disease, are influenced substantially by economic and environmental conditions. However, many of these studies have lacked the robustness to furnish causal relationships.

U.S. – Mexico Border: Health and Pollution Problems

Persons living along the U.S.–Mexico border region have suffered numerous and severe health problems. Studies conducted in this region have found relationships among gastrointestinal illnesses, respiratory infections, skin infections, eye infections, cancer, birth defects and neurological problems and pesticides, poor water quality, trans-border air and water pollution, industrial waste, hazardous materials transport and storage and fish contamination (Cech 1992²⁵; Sheilds 1991²⁶; Texas Department of Health 1991²⁷). The Texas-Mexico border area became the focus of environmental health concern when it was found that between 1989 and 1991 the incidence of anencephalic births was four times the national rate (Texas Department of Health 1992²⁸). Some of the literature has attributed these infectious and communicable diseases to the lack of adequate infrastructure and sanitation in developing areas (World Resource Institute 1998²⁹). The *colonias* along the border usually lack potable water, sewage, drainage, electricity and paved roads. As a result, *colonia* residents engage in unsanitary hygienic practices that are exacerbated by exposure to water-borne and vector-borne diseases related to contaminated water.

Health issues in these communities are further jeopardized by exposure to pesticides that are used by agriculture operations in the region (Dutton et al. 2000³⁰; Rogers 1993³¹; Texas Department of Human Services 1988³²). The agriculture is the primary economic engine in the Texas Rio Grande Valley, producing citrus, cotton, and grain. A bi-national study of the Rio Grande/Rio Bravo and its tributaries found that toxic chemicals and fish contamination attributed to pesticides were present in sections of the river downstream from El Paso, Texas/Juarez, Mexico and Laredo, Texas/Nuevo Laredo, Mexico (International Boundary and Water Commission, U.S. Environmental Protection Agency, National Water Commission 1994³³).

At the household-level, only a few studies have been conducted that focus on the impact of the environment on the border community health. In 1991, the Environmental Scoping Study investigated the potential links between local residents' health and environmental pollution in the Lower Rio Grande Valley. After examination of air, soil, and dust, for example, Akland et al. (1997³⁴) found higher levels of certain chemicals (specifically aluminum, calcium chlorine, bromine and silicon) than in other parts of the nation. Higher levels of some pesticides (malathion, permethrins, dieldrin and DDE) were found in the air within the study area than in non-agricultural areas. Water contamination in the well water included coliform bacteria, sulfates, chloride, manganese, and molybdenum, all unsafe for drinking, cooking, brushing teeth and washing dishes. The blood and urine testing of area household members indicated high level of PCBs, low levels of arsenic, small amounts of pesticides, and low levels of bromoform (Akland et al. 1997³⁵). Although the study's small sample did not lend itself to generalizable statistical conclusions, this research introduced a new model for community-based research that integrates public health concerns, exposure reduction, illness prevention, and intergovernmental regulatory activities.

Rios and Valdez (2001³⁶) conducted a bi-national study in Brownsville (Cameron County) Texas and Matamoros (Tamaulipas) Mexico. This ecological, empirical, household level study found that the lack of sanitation facilities, conventional sewage and pluvial drainage were associated with gastrointestinal illnesses.

Conceptual Framework

This study adapts the Rios and Valdez (2001³⁷) framework on infrastructure and incidence of illness in border *colonias*, adding social and other indicators for the Nueces County *colonias*. This conceptual framework is depicted in [Figure 1](#).

Social Indicators

In the present study, social indicators incorporate economic status, housing and ethnicity. Information also includes whether the head of household and spouse (if appropriate) worked for wages, was disabled or retired to establish the economic status of the householder. In addition, the respondent was asked to indicate whether the annual income was above or below \$18,840.00, the poverty line. Each respondent was asked to self-report his/her ethnicity. Housing refers to the respondent's living arrangements, including the number of years lived in the current house, the number of rooms the house has, and the number of adults and children who live in the house.

As demonstrated in previous literature, these social indicators are associated with morbidity and mortality rates. It is anticipated that those with lower economic status are predisposed to live in poorer housing and would report higher incidences illness than those with greater economic status. Examination of the social indicators provides a context for understanding the life circumstances of *colonias* residents in South Texas.

Pollution Indicators

For environmental pollution, the daily activities and periodic practices of household members are used both as direct and indirect measures of contact with pollutants. It is anticipated that some of these practices have the potential for environmental contamination and could result in health problems.

Another research question investigates the availability and accessibility of sanitation, utilities and other public services. It is anticipated that the lack of adequate infrastructure has the potential to become an environmental problem, such as poor water quality, air quality (due to the water cycle), soil contamination or a vector for water-borne diseases.

Health Indicators

This study investigates the associations between the absence of traditional infrastructure, utilities, services and practices and gastrointestinal illnesses, respiratory, skin and eye infection. Only those variables reflecting statistical significance and moderate levels of association are used.

Methodology

Research Design

Geographic location was the sample selection criterion for potential interviewees. To obtain samples from numerous sections of Nueces County, we selected one *colonia* from eastern Nueces County and close to Corpus Christi, one in mid-rural Nueces County and in close proximity to Petronilla, and one in western Nueces County abutting Robstown.

It was anticipated that environmental pollution in these areas would be comprised of water and soil mediums and especially compromised water quality. Water pollution is defined in terms of biological agents (sewage) and organic and inorganic chemicals (toxins). Sewage is associated with drainage ditches, septic tanks, and filtration ponds. Toxins are located in landfills, waste sites, chemical waste sites and industrial plants. Secondly, the *colonias* is important as a convenient, accepted, and relatively homogeneous unit of analysis, containing families with common problems, needs, and political jurisdictions. These attributes are most relevant when making policy recommendations based on empirical research findings.

For the Nueces County *colonias*, the researchers anticipated that biological agents would be present due to the lack of infrastructure in these neighborhoods, and that the biological agents might be toxins present because of a lack of public services such as garbage collection and the use in the area of agricultural pesticides.

Site Selection

Based on the framework described above, the following activities were undertaken to select the most appropriate *colonias*.

1. County maps and the most recent engineering study (Naismith Engineering 1998³⁸) on the *colonias* were obtained.
2. The Nueces County Colonia Task Force provided both input as to the problems inherent in numerous *colonias* as well as the possible selection of specific *colonias* to be investigated.
3. The researchers visited and observed each of these *colonias*, recorded the number of houses, construction materials, services on the property, and visual evidence of pollution.

The *colonias* selected are presented in Table 1. Originally the researchers intended to conduct a census of the entire population residing within these *colonias* since U.S. Census data was not available. Time and resource limitations for the study prevented the implementation of a complete census. The sample from each *colonia* represented ten to fifteen percent of the targeted population, acceptable for field research (Babbie 2004³⁹).

Table1. Nueces County Colonia Population and Sample

COLONIA	ESTIMATED POPULATION	SAMPLE SIZE	RESPONSE RATE
Tierra Verde	182	25	13.7%
Tierra Grande	229	23	10.0%
Rose Acres	59	9	15.0%
	N = 470	n = 57	

Tierra Verde is comprised of three separate units. Unit 1 is located at the southwest intersection of County Road 38 and County Road 75 and approximately 2.5 miles southwest of Robstown. Units 2 and 3 are located off of County Road 77 north of County Road 34 and south of County Road 36 about 4 miles southwest of Robstown. The researchers identified 182 dwellings and conducted 25 interviews resulting in a response rate of 13.7 percent. For this *colonia*, 76 percent of residents responded that they had running water in their house. However, researcher observations indicated that approximately half the *colonia* was not connected to a water system. In addition, the majority (80 percent) had septic tanks with a few “holes” (an outdoor hole dug for use as a toilet) used as a means of sanitation. In this *colonia*, 60 percent of the residents did not have pluvial drainage and 40 percent did not have garbage collection services.

Tierra Grande is the most publicized *colonia*, often appearing on the local newscasts for major drainage problems (even though this *colonia* does not lie within a flood plain) and high levels of water-borne bacteria. This *colonia* is located at the northeast intersection of FM 665 and County Road 61 about 12 miles east of Driscoll and northwest of Petronilla. The researchers counted 229 dwellings and conducted 23 interviews, generating a 10 percent response rate. According to the respondents, 87 percent had running water in the house, 87 percent had indoor toilets connected to septic tanks (82.6 percent). In Tierra Grande, almost 96 percent lacked pluvial drainage and 56.5 percent did not have garbage collection services.

Rose Acres was not included in the *Nueces County Comprehensive Colonia Planning Study* (Naismith Engineering 1998⁴⁰). This neighborhood is located west of Corpus Christi off FM 665 and County Road 763 and west of the Corpus Christi Airport. With 59 dwellings in this *colonia*, the researchers interviewed 9 residents, generating a 15 percent response rate. The residents in this *colonia* reported living in the area between 40 to 90 years, and were noted by researchers as been generally older, more elderly than other *colonias*. The respondents indicated that the infrastructure and services lacking municipal sewage connections (all used septic tanks), trash collection (66.7 percent), and pluvial drainage (100%).

Household Interviews

Survey data was collected through face-to-face interviews at the homes of participants. Graduate students were enlisted as field interviewers. Prior to going in the field, the students were trained by lecture on how to establish rapport and maintain professionalism, via role playing and a video on how to avoid bias during the interview. The students were in pairs while in the field. The

interviews were conducted in both English and Spanish. Data collection was conducted October 9 –16, 2004.

Survey Instrument

The questionnaire used was adapted from the empirical research project funded by the Environmental Protection Agency and conducted by Rios and Valdez (1996⁴¹) on the Texas – Mexico border *colonias*. This instrument was used in a previous large study (n = 800) and, thus, provided the necessary validity and reliability for the present study. The changes made to the survey were made to ensure the survey reflected the population and problems specific to Nueces County. Four sections made up the seven-page questionnaire. The first section deal with the respondent household characteristics such as how many people lived in the house, where the adults worked, exposure to pesticides, and availability of utilities. The second section dealt with the proximity of the house to sources of potential contamination. It asked about the number of animals in the household, and practices concerning food and water storage, trash removal, and visits to the border. The next section focused on specific health problems and how they were remedied. The final section concerned recent deaths in the family, the most important problem in the *colonia*, and household income.

Potential Polluting Sources

The survey included *colonias*' infrastructure, utilities and practices as direct and indirect measures of potential polluting sources and related incidence of illness.

Infrastructure and Utilities

In the *colonias*, access to sanitation, utilities and other public services are used as both direct and indirect measures of contact with pollutants. The researchers anticipated that the lack of adequate infrastructure services would have the potential to become an environmental problem, such as poor water quality and contaminated soil. It also was expected that those families with adequate household facilities should be healthier than other families. The variables used in this study for biological agents include the presence or absence of indoor toilets and traditional sewage systems, alternative types of sewage systems such as septic tanks, outside pluvial drainage.

Practices

This study targeted some of the periodic practices or behaviors of the colonia residents that might be associated with environmental health issues. Some practices involved keeping trash on their property for extended periods or burning trash in response to the absence of trash collection services. These variables are classified as organic or inorganic agents or toxins, which can lead to numerous environmental health problems.

Health Indicators

For this study, the incidence of illnesses and disease are measured by the self-reported presence of gastrointestinal illness, such as diarrhea, hepatitis, worms or other parasites. The illnesses for

respiratory infections included prolonged cold, bronchitis, flu, pneumonia, or tuberculosis. Skin infection included chicken pox, rashes, ringworm or scabies. In addition, eye infections reflected conjunctivitis or chronic eye allergies.

Statistical Analysis

Chi-square tests of significance are used to determine the relationships and associations between the infrastructure, utilities, and activities and gastrointestinal diseases, respiratory, skin and eye infections. Bivariate analyses are presented, which indicate the strength of the relationships between the variables. Only those variables indicating at least an acceptable level of association (.20) (Meier and Brudney 2002⁴²) are reported in the results.

Results

The results of 57 householder interviews are presented below. As a vulnerable and marginal population, many *colonia* residents were reluctant to participate in the interviews. Due to a lack of funding and time constraints, prior community awareness campaigns were limited. The Social Indicators for this population are presented in Table 2. Appropriate descriptive statistics are used for each variable. Table 3 depicts the variables for the Pollution Indicators while Table 4 describes the Health Indicators.

Social Indicators

In this study, 58.9 percent of the *colonia* households are inhabited by two adults with a mode of 3 children (19.3 percent). The findings also reflect that, of the 57 households interviewed, almost 67 percent of the heads of household are employed; 14 percent are retired; and, almost 11 percent are disabled. Within this population, the fewer spouses work (almost 30 percent) than the general population. In addition 11 percent of the spouses had retired from wage-earning employment and about 11 percent of the spouses are disabled. The residents of these *colonias* have lived in their dwelling an average of 7.80 years, with the exception Rose Acres, whose residents had lived there as long as 90 years. The average number of rooms per dwelling is five. The vast majority of the residents are Hispanic (almost 95 percent) and about 58 percent earn less than the poverty rate of \$18,840 as defined by the U.S. Census (2000⁴³).

Table 2. Social Indicators for Environmental Health Ecological Framework

Variable	Description	Average, Mode, and/or Frequency (Percentage)
Economic Status		
JEFWORK	Head of household working	38 (66.7%)
RETIRED	Head of household retired	8 (14.0%)
DISABLED	Head of household disabled	6 (10.5%)
SPOUSEWO	Spouse works for wages	17 (29.8%)
SPRETIRE	Spouse retired	6 (10.5%)
SPDISABL	Spouse disabled	6 (10.5%)
INCOME	Yearly income below poverty (\$18,840)	33 (57.9%)
Housing		
ROOMS	Number of rooms in house	5 (31.6%)
KIDS	Children in household	3 (19.3%)
ADULTS	Adults in household	2 (59.6%)
LONGHOUS	Length of years in house	5 (31.6%)
Ethnicity		
ETHNICITY	Ethnicity of respondent (Hispanic)	54 (94.7%)

The findings reported in the following sections are limited to the aggregated data for the Tierra Verde and Tierra Grande colonias. Based on our observations and judgment, the Rose Acres *colonia* was categorically different from the other two *colonias* in the study. While Rose Acres exhibited some problems, primarily in shared water meters and lack of pluvial drainage, the housing units in the *colonia* appeared to be in much better condition. Notably, the small sample size surveyed in Rose Acres excluded that data from statistical analysis. In addition, the small sample size limited our ability to control for separate social Indicator variables.

Pollution Indicators

Surveyed residents were asked about the presence or absence of selected infrastructure, the sanitary practices and any potentially related health problems. The use of nominal level data (yes/no), limited statistical analysis to frequencies and Chi-square testing of those hypotheses necessary to determine if the variables are independent of each other and the contingency coefficient, necessary to determine the strength of association between the two variables (Norusis 2004⁴⁴). The findings are limited to those variables that generated a statistical significance of $p < .05$.

Infrastructure

The lack of adequate infrastructure, such as water, toilets, sewage, and so on, can be related to health problems. In this section the availability of certain types of utilities and public services are cross-tabulated with the health problems. It is expected that those respondents with infrastructure already in place reported they were healthier.

Table 3. Pollution Indicators for Environmental Health Ecological Framework

Variable	Description	Frequencies and Percentages (n = 48)
WATER	Running water in the house	39 (81.3%)
TOILETS	Indoor toilets	44 (91.7%)
SEWAGE	Connected to city sewage	9 (18.8%)
SETICTAN	Use of septic tank	39 (81.3%)
OOHOUSE	Use of outhouse	6 (12.5%)
HOLE	Use of hole	3 (6.3%)
TRASH	Trash collection services	25 (52.1%)
DRAINAGE	Presence of pluvial drainage	11 (22.9%)
WELL	Well on property for drinking water	14 (29.2%)
WELLFROM	Well from other property for drinking water	2 (4.2%)
WELL2	Well on property for other uses	11 (22.9%)
WELLFR_A	Well from other property for other uses	5 (10.4%)
TRASHY	Keep trash on property over 1 week	16 (33.3%)
BURNTRAS	Burn trash on property	31 (64.8%)

Table 4. Health Indicators for Environmental Health Ecological Framework

Variable	Description	Frequencies and Percentages (n = 48)
GASTRO	Presence of gastrointestinal illnesses	15 (31.3%)
RESPIAT	Presence of respiratory illnesses	13 (27.1%)
SKIN	Presence of skin infections	14 (29.2%)
EYES	Presence of eye infections	15 (31.3%)

According to Table 3, few are connected to the city sewage system (18.8 percent). The majority use a septic tank (81.3 percent) while 12.5 percent have an outhouse and 6.3 percent have a hole. Only about half of the respondents (52.1 percent) have regular trash collection. For the Health Indicators found in Table 4, the presence of gastrointestinal illnesses and eye infections were the predominant maladies (31.3 percent). The respondents also indicated the presence of respiratory illnesses (27.1 percent) and skin infections (29.2 percent).

Indoor Toilets

Of the various types of infrastructure investigated, the presence of indoor toilets was related to several illnesses. While it would be expected that having indoor toilets would provide a healthier environment, we must also consider that the vast majority of the *colonia* residents have inadequate septic tanks. These tanks may be compromised by the type of soil found in the Coastal Bend that allows a shifting of the amenity, resulting in open holes in the tanks and other damage. Another variable considered is that some septic tanks were found to be self-constructed and insufficient to meet the standard health and construction codes. Finally, the absence of

pluvial drainage exacerbates the problem by flooding the septic tanks and backing up the indoor toilets.

The gastrointestinal illnesses included diarrhea, amoebas, worms or other parasites, salmonella, typhoid and hepatitis, with diarrhea being the most common type of illness. According to the Chi-square analysis (that includes all forms of gastrointestinal illnesses), 12 residents (27.3 percent) suffered from some type of gastrointestinal malady ($\chi^2 = 3.888$; $p = .049$) associated to indoor toilet problems (27 percent).

Table 5. Chi-square and Associations for Environmental Health Ecological Framework in Nueces County, TX

Health Indicators	Pollution Indicators	χ^2	Measures of Association	p-values
Gastrointestinal Illnesses	Indoor toilets	3.888	.274	.049*
Gastrointestinal Illnesses	Week old trash	3.927	.275	.048*
Respiratory Infections	Indoor toilets	5.073	.309	.024*
Skin Infections	Indoor toilets	4.437	.291	.035*
Eye Infections	Week old trash	6.982	.356	.008**
n=48 * p-values indicate significance of Pearson Chi-square <.05 ** p-values indicate significance of Pearson Chi-square <. 01 Contingency Coefficients are used as Measures of Association				

Respiratory infections included prolonged colds, bronchitis, flu, pneumonia, coughing with blood, Tuberculosis. No single type of respiratory infection dominated the results; however, it is noteworthy that almost 11 percent of the respondents had multiple respiratory afflictions. According to the Chi-square analysis, ten residents (about 28 percent) endured respiratory problems ($\chi^2 = 5.073$; $p = .024$) associated with the indoor toilet problems (almost 31 percent).

Slightly more than 28 percent of the residents surveyed suffered from skin infections, including chicken pox, dermatitis, rashes, ringworm, fungus, and scabies. Of these residents, eleven (25 percent) were negatively affected by indoor toilets ($\chi^2 = 4.437$; $p = .035$), indicating a moderate relationship (.291) as reflected by the contingency coefficient. In this category, the interviewers noted that skin infections were visible, but that the respondents often reported no infections.

Behavioral Patterns

To trace other possible sources of contamination for the *colonia* residents, we examined the relationships between the respondent's hygiene practices and health problems.

Garbage

Trash disposal practices are another source of potential environmental contamination. Half of the respondents (50 percent) indicated that they keep trash on their premises for more than a week.

The practice of keeping trash for more than one week is considered to be an organic/inorganic agent or source of environmental pollution that may lead to some environmental health problems. These practices are also a source of compromised air quality. More importantly, engaging in this practice is often associated with the lack of garbage collection in the *colonias*.

Keeping trash on the respondent's property was related to gastrointestinal illnesses and affected eight respondents (50 percent), ($\chi^2 = 3.927$; $p = .048$) and moderately associated as evidenced by the contingency coefficient of .275. Also, the practice of keeping trash for at least a week was related to eye infections. Nine respondents (56.3 percent) experienced eye infections resulting in a strong statistical significance ($\chi^2 = 6.982$; $p = .008$) and the strongest association level of .356.

Discussion

Numerous policy arenas relate to the peri-urban settlements, such as poverty, housing and infrastructure, and health. Some legislation has been enacted to address the issues in the *colonias*. However, some intractable problems remain. In Texas, water connections and sanitation facilities are traditionally provided by the private sector through the land developer. More importantly, the Texas Constitution bars the counties from providing infrastructure to settlements lying in county's political jurisdiction. In the case of the *colonias*, both on the border as well as in Nueces County, land was sold as undeveloped and lacked these utilities. For the *colonias* situated at the Texas–Mexico border, numerous state-level statutes were enacted beginning in 1995 to halt the sale of undeveloped land; to fund state-level programs for housing, water and drainage; and, to provide authority to county-level government to administer state-level funds for environmental infrastructure.

The *colonias* legislation proved to be successful in the Texas-Mexico border region. Since the enactment of these policies, however, developers purchased nearby property, approximately 150 miles from the international border, and thus contributed to “colonia creep.” The demographic data obtained by the researchers reflect a population popularly known as the “working poor.” It appears that the lack of affordable housing elsewhere and the quest for the “American dream” were the main driving forces for the *colonia* resident's impulse to purchase this undeveloped land. In the absence of infrastructure, the *colonia* residents opted for septic tanks as an alternative means of sewage service. These septic tanks, however, tend to fail regulatory criteria for the type of soil found in this area.

Many comparisons can be drawn between the Texas border *colonias* and the Nueces county *colonias*. Senate Bill 425 was enacted in 2005, targeting counties located within 150 miles from the international border with populations of more than 250,000. The bill allows the affected county the power to regulate the approval of plats in unincorporated areas of the county. Other provisions of this bill include: “(1) to prevent future substandard housing from springing up; (2) to receive the assistance of a *colonia* ombudsman; and (3) to be eligible for economically distressed area (EDAP) funds” (Senate Committee on Intergovernmental Relations 2005⁴⁵).

The legislation provides Nueces County Commissioners the authority to regulate the environmental infrastructure needs for the rural areas in the county. Funding for the projects can be obtained through numerous state-level agencies. However, the County must match these

funds. Although resources have been limited, the County Commissioners approved funds in May 2007 for a wastewater lift station for the Rose Acres *colonia* (Commissioners Court Minutes 2007⁴⁶).

Recent rains in the Coastal Bend area have once again exacerbated the flooding and drainage problems in the *colonias*. In a recent news broadcast, Commissioner Longoria reported that the commissioners have commissioned engineering studies to alleviate the flooding problems. However, the studies have concluded that by relieving the flooding in one area would lead to downstream flooding in other areas. The commissioners are considering a county-wide drainage district that would be funded by taxing rural Nueces County residents. The state has provided \$800,000. However, this infrastructure project is estimated to cost millions of dollars (Carillo 2007⁴⁷).

The lack of county funds, the fragmentation of funding sources and the necessity to navigate through the bureaucracy of numerous state agencies has stymied the volunteer-based *Colonia* Network in their attempts to address area problems. In 2007, State Senator Juan Hinojosa (D, McAllen, representing the Coastal Bend Area) was successful in passing a budget rider to fund a new *colonia* ombudsman for Nueces County to ensure that this area receives the funding they need (www.senate.state.tx.us 2007⁴⁸).

Numerous problems remain. The problematic drainage is at the core of many of the area's problems. For example, health conditions may tend to worsen over time if flooded and contaminated water remains on the surface in the area. Dwellings cannot be upgraded until adequate pluvial drainage is provided in the neighborhoods. The sanitation situation (septic tanks) has not yet been addressed. Again, environmental health problems may soon surface and may be as severe as those found in the Lower Rio Grande Valley (Rios and Valdez 2001⁴⁹).

Conclusion

This research examined the linkages between selected indirect measures of environmental pollution (pollution indicators) and incidence of illnesses (health indicators) in three Nueces County *colonias*: Tierra Verde, Tierra Grande and Rose Acres (which was excluded from the final study). The research questions investigated the daily activities and periodic practices of household members and the access and availability of utilities and other public services in the *colonias* as they related to incidence of disease. The site selection of a geographic location within Nueces County provided an appropriate "picture" of the possible problems for the residents of these neighborhoods throughout Nueces County. The researchers conducted the 57 interviews in October 2004; 48 were used in this study.

Within activities and practices, the practice of keeping trash for over a week on the respondent's property were statistically related to gastrointestinal illnesses and eye infections. These findings reflect organic or inorganic agents or toxins.

Within the infrastructure variables, having indoor toilets (in conjunction with substandard septic tanks) were statistically related to gastrointestinal illness, respiratory problems and skin infections. The lack of pluvial drainage was statistically significant, while not related to a

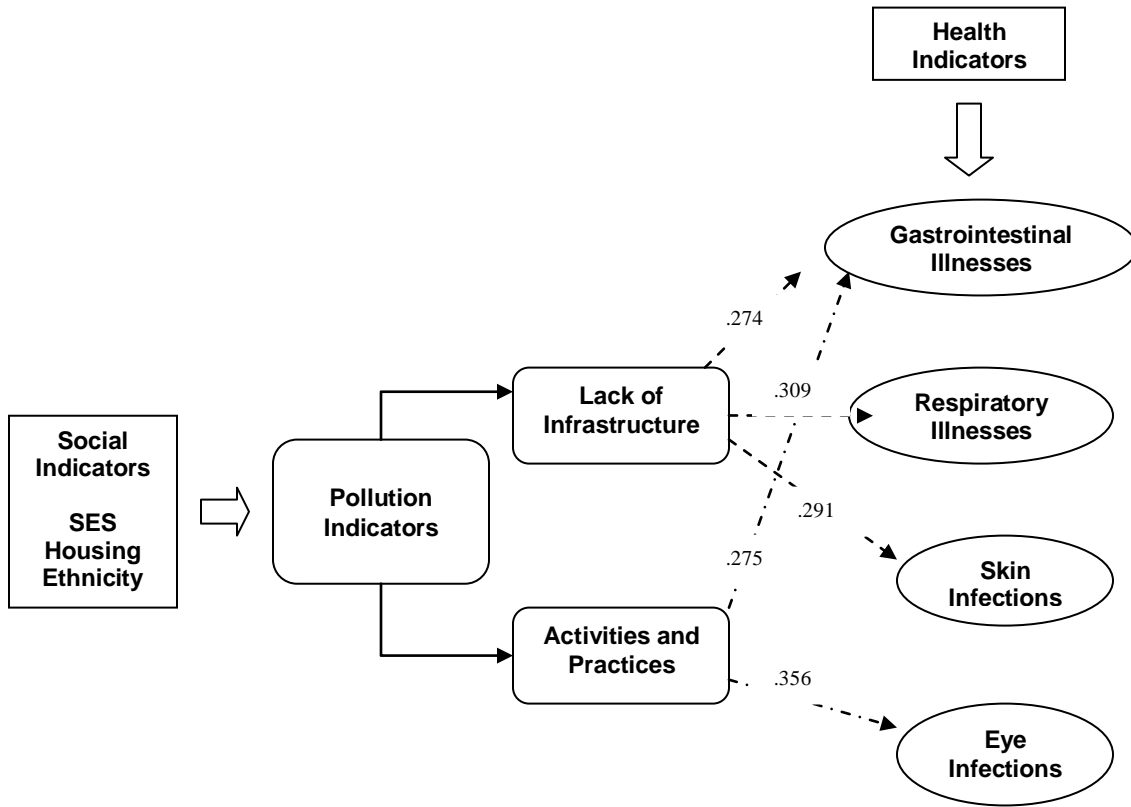
particular disease. However, the researchers assert that the flooding problems may have contributed to the sanitation problems. Specifically, the drainage problems in these areas affect the septic tanks and cause backflow to the indoor toilets. These findings are associated with biological agents of environmental pollutants.

The small sample size did not allow us to fully investigate the social indicators. However, it appears that the problems in these *colonias* are related to poverty, especially a lack of affordable housing. People who live in *colonias* are at risk for disease because structural measures to improve sanitation are not available to them. Mirowsky, et al., concluded that “Improvements in status and resources produce the largest health payoff among relatively disadvantaged groups, for whom such improvements are least common” (2000 p.59⁵⁰). With this in mind, efforts to improve the living conditions of the poor serve not only those individuals, but also the community at large.

This sample size for this research was relatively small due to a lack of funding, time constraints, and the lack of cooperation among *colonia* residents. More definitive conclusions could be made from a larger study that would include the social indicators and a census of the entire *colonia* population in Nueces County.

Appendix

Figure 1. Environmental Health Ecological Framework [\[back to top\]](#)



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