Community Risk Factors, Environmental Justice and Health Inequities in Bernalillo County, New Mexico

TECHNICAL REPORT
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Preface

Health is influenced by more than healthcare, and the same is true for health disparities. Inequities in health exist for reasons that transcend access to health care or adequate health insurance coverage. Health is also heavily influenced by health behaviors (e.g., tobacco use), modifiable risk factors (e.g., obesity), and environmental conditions. These conditions are only partly a matter of personal choice. Adopting a healthier diet requires access to supermarkets or farmers’ markets that sell fresh produce. Regular physical activity requires a conducive built environment and access to safe parks, pedestrian routes, and green space for residents to walk, bicycle, or play. Tobacco and alcohol use is influenced by enticing advertising and marketing practices. Exposure to environmental pollutants from unhealthy housing or from nearby factories and smokestacks are not choices made by residents but by society.

In the language of social epidemiology, “downstream” determinants of health—ranging from unhealthy behaviors to living and working conditions—are the byproduct of “upstream” structural determinants (see Figure 1) such as socioeconomic position, race-ethnicity, occupation, and social cohesion. These socioeconomic circumstances are themselves the result of upstream policies that create opportunities for education and employment, income and savings, social equality, and environmental stewardship. Macroeconomic policies create commercial incentives for industries to either promote unhealthy products or more healthful alternatives.
Health also varies sharply by geography—across communities and neighborhoods—because unhealthful downstream conditions are often concentrated in disadvantaged areas. Areas populated by the poor or communities of color typically experience greater exposure to unhealthy conditions and material deprivation, a vicious cycle that is itself shaped by upstream factors. These upstream influences include historical antecedents, such as racial or ethnic discrimination and recurring cycles of poverty that inhibit economic growth and social mobility over generations, but also modern-day decisions about where to position highways and supermarkets and how much resource to invest in public transportation, housing, local development, crime prevention, public schools, job training, and social services. The recognition that “place matters” to health and the need to understand how unwise social policies foment health inequity comes at the recommendation of prestigious commissions sponsored by the World Health Organization, the John D. and Catherine T. MacArthur Foundation, and the Robert Wood Johnson Foundation.
About the Place Matters Project

The Place Matters technical reports were produced by the Virginia Commonwealth University (VCU) Center on Human Needs (CHN) in collaboration with the Joint Center for Political and Economic Studies/Health Policy Institute (HPI) and the Virginia Network for Geospatial Health Research (VANGHR). All maps and geospatial analyses were produced by VANGHR.

The production of the Place Matters technical reports was funded by HPI under a subaward from a parent grant from the National Institutes of Health (grant 5RC2MD004795-02). The goal of the project was to prepare and disseminate a series of locally tailored Community Health Equity reports (CHERs) to assess population health inequities and related social and economic conditions for the following eight communities:

- Alameda County, California  
- Baltimore, Maryland  
- Bernalillo County, New Mexico  
- Orleans Parish, Louisiana  
- Cook County, Illinois  
- San Joaquin Valley, California  
- Boston, Massachusetts  
- South Delta, Mississippi

The VCU Center on Human Needs and VANGHR were contracted by HPI to develop technical reports on which the eight CHERs were based. What follows is the technical report for Bernalillo County, New Mexico. The focus of the report and the research questions it addresses were guided by extensive input from the Place Matters team in Bernalillo County. See the Methods Appendix on the CHN website for more details on analytic methods.

The project was approved by the VCU Institutional Review Board.

For more information about the Place Matters technical reports or collaborating organizations visit the websites listed below:

Center on Human Needs: www.humanneeds.vcu.edu
Health Policy Institute: www.jointcenter.org/institutes/health-policy
Place Matters Initiative: www.jointcenter.org/hpi/pages/place-matters
Virginia Network for Geospatial Health Research: vnghr.org/

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Introduction

The health of Bernalillo County residents is related to many factors, as it is elsewhere. Across the country, disease rates vary dramatically by age, gender, race, and ethnicity as well as with the prevalence of risky health-related behaviors. Place matters in health because characteristics of the areas in which people live affect health choices, behaviors, environmental risks, and access to medical care. Local conditions that may affect health outcomes include levels of stress and environmental toxins, the social and economic characteristics of individuals and families (such as education and income), and the characteristics of the communities in which people live. This report will focus on the characteristics of Bernalillo County and its communities that may affect health outcomes for residents, including socioeconomic and community characteristics and environmental hazards.

Part I of this report provides background information about Bernalillo County, including population data, health outcomes, socioeconomic conditions, community characteristics, and a community risk index.

Part II examines the geographic relationship between the community risk index and life expectancy.

Part III looks at environmental hazards in Bernalillo County and examines the geographic relationship between environmental hazards and life expectancy.

Part IV presents conclusions about the role of community risk factors and environmental hazards in understanding disparities in health outcomes in Bernalillo County. Appendix A (available on the CHN website) presents detail about the data and methods that were used in preparing this report.
Part I. Background: Population, Community Characteristics, and Health in Bernalillo County

Population

Bernalillo County, located in central New Mexico, had a population of 642,527 in 2009. It is the most densely populated county in New Mexico, with 477 people per square mile. Bernalillo County is home to the City of Albuquerque, which has a population of 529,219 and a population density of 1,237 people per square mile. The county makes up almost one third of the population of the state. More densely populated census tracts, with more than 6,500 people per square mile, are scattered throughout Albuquerque (Map 1). The densest tracts (more than 12,000 people per square mile) are located in Nob Hill, North-east Heights, Downtown, and Far Northeast Heights.

Map 1: Population Density by Census Tract, Bernalillo County, 2009
In Bernalillo County, the Hispanic population is the majority and makes up a significantly larger percentage of the population than that of the national average (46.7% compared with 15.8% nationally). The majority of the Hispanic population in Bernalillo County was born in the United States. According to the U.S. Census Bureau, the foreign-born population in Bernalillo County is similar to that of the nation (10.4% compared with 12.5% nationally) (Table 1). Figure 2 shows the racial/ethnic composition of Bernalillo County for 2009.²⁰

Table 1: Demographic Characteristics of Bernalillo County, State of New Mexico, and United States

<table>
<thead>
<tr>
<th></th>
<th>Bernalillo</th>
<th>New Mexico</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (2009)(a)</td>
<td>642,527</td>
<td>2,009,671</td>
<td>307,006,556</td>
</tr>
<tr>
<td>Population Density (2000)(b)</td>
<td>477.4</td>
<td>15.0</td>
<td>79.6</td>
</tr>
<tr>
<td>Race/Ethnicity (2009)(a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>46.7%</td>
<td>45.6%</td>
<td>15.8%</td>
</tr>
<tr>
<td>White</td>
<td>42.0%</td>
<td>41.0%</td>
<td>64.9%</td>
</tr>
<tr>
<td>Black</td>
<td>2.7%</td>
<td>1.9%</td>
<td>12.1%</td>
</tr>
<tr>
<td>Other</td>
<td>4.3%</td>
<td>2.9%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Native American</td>
<td>4.2%</td>
<td>8.6%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Foreign Born (2009)(a)</td>
<td>10.4%</td>
<td>9.8%</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

(a) Source: U.S. Census Bureau 2009 American Community Survey.
(b) Source: Geolytics Projections, 2009.

Figure 2: Race/Ethnicity in Bernalillo County, NM

Source: U.S. Census Bureau 2009 American Community Survey
Note: Other includes Two or More Races, Asian, Native Hawaiian and Other, Pacific Islander, Some Other Race. Racial groups include Non-Hispanic population only; Hispanic can include any racial group.
The health of Bernalillo County residents varies by race, ethnicity, and neighborhood. Nationwide, these patterns are shaped by a history of segregation and restrictions in the housing market.\textsuperscript{18,21,22} Bernalillo County does not have a history of racial segregation to the extent experienced in other metropolitan areas across the country; nonetheless, there are notable differences in the ethnic and racial composition of neighborhoods across Bernalillo County.\textsuperscript{a} Map 2 shows the Hispanic composition of each census tract in Bernalillo County. Census tracts with the highest concentrations of Hispanic residents are in South Valley and Southwest Mesa, where Hispanic residents constitute from 75\% to more than 90\% of the population in the majority of census tracts. Downtown has a large percentage of Hispanic residents, but they are not as concentrated as in South Valley or Southwest Mesa. There are a number of census tracts in the Far North Heights/Foothills areas that are more than 75\% White. Northwest Mesa, North Valley, Nob Hill, Southeast Heights, Northeast Heights, and University are fairly diverse areas.

\textsuperscript{a}The diversity index, a measure used by researchers to document racial and ethnic segregation, is not presented for Bernalillo County because of the large percentage of Hispanic residents who describe themselves as “other race” in census surveys. The diversity index is calculated by excluding the “other race” category, resulting in invalid data results.
Foreign-born residents may experience poorer health because of lower levels of health insurance coverage, language and cultural barriers, and challenges accessing health care, quality education, and safe housing. Whereas census data show that 10% of the Bernalillo County population is foreign born, there are census tracts in Northeast Heights, Southeast Heights, the northern part of South Valley, and Downtown in which more than 20% of the population in 2000 was foreign born.

Census population data from 1970 to 2000 was used in Map 3 to highlight census tracts within Bernalillo County in which the percentage of foreign-born residents has been higher than the county average over several decades. As indicated by dark brown shading on the map, foreign-born residents have been more concentrated in central Albuquerque since the 1980s. These areas also have a high degree of ethnic segregation (Map 3).
Socioeconomic Conditions

As is true of other communities, socioeconomic conditions in Bernalillo County exert an important, and often unrecognized, influence on health status. Education, for example, is a pathway to higher income and net worth, which also have strong influences on health status and access to health care. National statistics indicate that adults (age 25 and older) who lack a high school education or equivalent are three times more likely to die before age 65 as are those with a college education. They are also more likely to engage in unhealthy behaviors, such as cigarette smoking.

Educational attainment, the highest level of education completed among adults age 25 and over, was measured by the 2009 American Community Survey. Overall, educational attainment in Bernalillo County, where 86.5% of adults age 25 and over have completed high school, compares favorably with that of New Mexico (82.8%) and the United States (85.3%) (Table 2).

However, educational attainment varies greatly by race and ethnicity (Figure 3). According to 2009 data from the American Community Survey, greater than 25% of the county’s Hispanic adults have not completed high school, and almost 60% have no education beyond high school. Of the foreign-born residents, 32.3% do not have a high school degree, and 54.5% do not have an education beyond high school. Although educational outcomes are slightly better for Native American residents, nearly 40% have no education past high school.

| Table 3: Socioeconomic Characteristics of Bernalillo County, New Mexico, and United States |
|-----------------------------------------|-------------------|-------------------|-----------------|
| **Educational Attainment**             | Bernalillo        | New Mexico        | United States   |
| Less than High School (K-12)           | 13.5%             | 17.2%             | 14.7%           |
| High School Only                       | 24.3%             | 26.4%             | 28.5%           |
| Some College                           | 30.7%             | 31.1%             | 28.9%           |
| Bachelor’s Degree or Higher            | 31.5%             | 25.3%             | 27.9%           |
| **Poverty Rate**                       |                   |                   |                 |
| Below 50% of Poverty Rate              | 7.3%              | 7.5%              | 6.3%            |
| 50–99% of Poverty Rate                 | 8.6%              | 10.5%             | 8.1%            |
| 100–199% of Poverty Rate               | 19.5%             | 22.3%             | 18.4%           |
| 200% and Above of Poverty Rate         | 64.6%             | 59.7%             | 67.3%           |

(a) Source: U.S. Census Bureau 2009 American Community Survey
The percentage of adults in Bernalillo County who have graduated from high school varies greatly by neighborhood. Census tracts in which greater than 40% of the adult population have not completed high school are in Downtown, South Valley, Southeast Heights, North Valley, and outlying areas in the northwest and south (Map 4).
Poverty also has a strong influence on health: Nationally, families living below the federal poverty level are 3.6 times more likely to report fair or poor health than are those with incomes at least twice the poverty level. Experiencing poverty during childhood influences a child’s cognitive, emotional, behavioral, and physical development. Childhood poverty also decreases a child’s likelihood of high school graduation. Poverty rates are highest in outlying communities bordering the western and southern portions of Bernalillo County (Map 5), where greater than 55% of the population had incomes below 150% of the poverty threshold, as well as in a few census tracts in Southeast Heights, Downtown, and northern South Valley.

Persistent poverty, defined as when at least 20% of the population reports incomes below the federal poverty level for at least two consecutive census periods, is shown in Map 6. Areas of persistent poverty since the 1970s are shown in dark brown. These include six census tracts in South Valley, Southeast Heights, Downtown, and North Valley. Areas of persistent poverty since the 1980s are shown in lighter brown. These include eight census tracts in Downtown, North Valley, South Valley, and Southeast Heights.

Poverty rates in Bernalillo County are somewhat higher than national rates (Table 2). In 2009, about 7.3% of households in Bernalillo County reported severe poverty: incomes less than half of the federal poverty level ($11,000 or less for a family of 4), compared with 6.3% nationwide. An additional 8.6% of households lived above this level but still below the federal poverty level—15.9% of total households—compared with 14.3% nationwide. Like educational attainment, poverty rates vary by race and ethnicity. Accord-
ing to American Community Survey data for 2009, White residents are least likely to live in poverty as compared with all other groups (10.1%) (Figure 4). Blacks, Native Americans, and foreign-born residents are mostly likely to live in poverty (21.2%, 20.3%, and 23.3%, respectively).

Note: The category of “Persistent Poverty” includes census tracts with a poverty rate of least 20% for at least two consecutive census periods, looking retrospectively from 2009. This concept is based on the United States Department of Agriculture’s research on persistent poverty counties.

Source: U.S. Census Bureau, 2009 American Community Survey.
In Bernalillo County, unemployment and the percentage of households without a vehicle are both lower than the national average and are similar to the state average. Like other measures of socioeconomic status, however, these rates vary significantly across the county.

**Community Conditions**

Health is affected not only by the characteristics of individuals and their families but also by the neighborhoods and environment in which they live. Several important factors include the crime rate, the quality of local schools, the built environment, and neighborhood housing conditions. These factors can affect health regardless of one’s income or education.

Violent crime includes homicide, rape, robbery, and aggravated assault. According to the U.S. Department of Justice, the violent crime rate in Albuquerque was 7.7 crimes per 1,000 persons in 2009. Although this is higher than the national average (4.3 crimes per 1,000 persons), it compares favorably with the average rate for cities that have 500,000 to 999,999 inhabitants (9.6 crimes per 1,000 persons). The Institute for Social Research provided data on the average violent crime rate for 2004 to 2006 by census tract in Bernalillo County. The data revealed that the violent crime rate varied among neighborhoods from about one crime per 1,000 persons to more than 30 crimes per 1,000 persons. Census tracts with violent crime rates greater than 20 crimes per 1,000 persons were located in Downtown, Northeast Heights, the northwest tip of Far Northeast Heights, Southeast Heights, Nob Hill, and Northwest Mesa.

Nonviolent crime includes burglary, larceny-theft, and motor vehicle theft. According to the U.S. Department of Justice, the nonviolent crime rate in Albuquerque was 60.7 crimes per 1,000 persons in 2008. This is higher than the national average (30.4 crimes per 1,000 persons) and somewhat higher than the rate for cities with 500,000 to 999,999 inhabitants (54.9 crimes per 1,000 persons). We used data from the Institute for Social Research to examine the average nonviolent crime rate for 2004 to 2006 by census tract in Bernalillo. The nonviolent crime rate varied among neighborhoods, from approximately three crimes per 1,000 persons to more than 200 crimes per 1,000 persons. Census tracts with nonviolent crime rates greater than 100 crimes per 1,000 persons were located in Northwest Mesa, Northeast Heights, Downtown, the northwest tip of Far Northeast Heights, and Southeast Heights.
Foreclosure rates in 2010 were lower in Albuquerque (1 in 475 housing units) than in the nation (1 in 381 units) but higher than in New Mexico generally (1 in 753 units). To calculate foreclosure rates by census tract, we calculated the average of rates for the years 2006 to 2008 using the number of foreclosures reported by RealtyTrac and the number of households reported by the U.S. Census Bureau in the 2000 decennial census. Foreclosure rates during 2006–2008 were highest in the Downtown area, the northwest tip of Far Northeast Heights, Northeast Heights, and Southwest Mesa.

The percentage of housing units that were vacant is lower in Bernalillo County than in both the state and nation but varies greatly within the county (Table 3). Census tracts with high rates of vacant housing, greater than 15%, include Southeast Heights, Nob Hill, and the Downtown area.

According to American Community Survey data for 2009, overcrowding—defined as 1 or more persons per room—in Albuquerque (2.6%) was lower than the state and national rates (3.4% and 3.2%, respectively). Overcrowding varies by neighborhood in Bernalillo County, from census tracts with no significant overcrowding to a rate of greater than than 15%. Census tracts with overcrowding rates higher than 9% include Nob Hill, Northeast Heights, South Valley, and Downtown.
Community Risk Index (CRI)

To sum up these socioeconomic and neighborhood risks, we developed an index for comparing the aggregate level of risk in Bernalillo County neighborhoods. We statistically combined a set of measures into a single “community risk” index (CRI) for each census tract (see Appendix A on the CHN website for details). The CRI was calculated according to the following factors: percentage of population with less than a high school education, average standardized test scores, the violent crime rate, the foreclosure rate, the unemployment rate, percentage of houses that were vacant, and percentage of households with no automobile or with overcrowding. The CRI provides a summary value for each census tract that depends on the specific combination of values for these indicators; low values indicate lower risk associated with socioeconomic and community conditions, whereas high values indicate high risk associated with socioeconomic and community conditions. By combining these measures into a single risk index, we can examine the relationship between multiple community-level socioeconomic risks and health outcomes simultaneously.

Figure 5: Community Risk Index Groups
Bernalillo County, NM

Census-tract–level scores on the CRI were divided into quintiles (five equal size groups). Figure 5 illustrates the relationship between the CRI and selected socioeconomic conditions. In the quintile with the lowest CRI values (lowest risk), the unemployment rate is 3%, 7% of the population has an income below 150% of the poverty threshold, and 4% of adults lack a high school diploma. In the quintile with the highest CRI values (highest risk), 13% are unemployed, 48% of the population has an income below 150% of the...
poverty threshold, and 35% of adults lack a high school diploma. Moderate risk refers to those in the third (middle) quintile.

Map 7 examines geographic variation in the CRI, with high-risk areas shaded in dark brown, including Southeast Heights, Downtown, South Valley, and Northeast Heights. These are neighborhoods in which residents may be most vulnerable to poor health outcomes that are influenced by unfavorable socioeconomic conditions and community characteristics, such as high rates of poverty, crime, unemployment, low educational attainment, and poor housing conditions.

**Map 7:**
Community Risk Index by Census Tract, Bernalillo County, 2004–2009

Note: The CRI is a composite index that is based on the following indicators: percentage of population with less than a high school education, average standardized test scores, the violent crime rate, the foreclosure rate, the unemployment rate, percentage of houses that were vacant, and percentage of households with no automobile or with overcrowding. Higher scores represent the highest levels of risk.

In sum, we examined spatial distributions in population demographics, racial and ethnic concentrations, and foreign-born residents. These maps show that the densest census tracts are scattered throughout Albuquerque, whereas more highly segregated census tracts are in South Valley and Southwest Mesa. Central Albuquerque has historically been home to a high percentage of foreign-born residents. Neighborhoods with large (greater than 20%) foreign-born populations in 2000 were Northeast Heights, Southeast Heights, the northern part of South Valley, and Downtown. Certain census tracts have notably higher rates of risk factors on a few indicators, but the CRI also allows us to identify census tracts that are at greatest risk because of a combination of multiple socioeconomic and community risk indicators. Several of the same neighborhoods with large foreign-
born populations appear to have multiple risk factors according to the CRI findings, including parts of South Valley and Downtown.

In the next section, we examine health outcomes in Bernalillo County and evidence of important geographic disparities in health. We then examine the relationship between the CRI and geographic health disparities.

### Health Outcomes

Overall indicators of the health status of Bernalillo County are mixed. According to the County Health Rankings released in 2011 by the Robert Wood Johnson Foundation, Bernalillo County ranked the 7th highest in health status among the 33 counties in New Mexico.\(^3\) On the basis of health outcome data from the Bernalillo County Department of Health for years 2001 to 2005, the average life expectancy in Bernalillo County (80.3 years) is slightly higher than that of the state of New Mexico (77.3) or the United States (77.9). Similarly, the all-cause mortality rate in Bernalillo County (783.6 deaths per 100,000 population) is somewhat higher than that of the state of New Mexico (761.2) and lower than that of the United States (803.6). Infants in Bernalillo County have health outcomes similar to New Mexico and the United States with respect to low birth weight and infant mortality (Table 4).

<table>
<thead>
<tr>
<th></th>
<th>Bernalillo((a))</th>
<th>New Mexico((b))</th>
<th>United States((b))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life Expectancy in years</td>
<td>80.3</td>
<td>77.3((b))</td>
<td>77.9((b))</td>
</tr>
<tr>
<td>Death rate/ 100,000 population</td>
<td>783.6</td>
<td>761.2((b))</td>
<td>803.6((b))</td>
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<tr>
<td>Births</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent Low Birth Weight Births</td>
<td>8.4</td>
<td>8.5((b))</td>
<td>8.2((b))</td>
</tr>
<tr>
<td>Infant Mortality/1,000 births</td>
<td>6.3</td>
<td>6.1((e))</td>
<td>6.8((e))</td>
</tr>
</tbody>
</table>

\(\text{(a) Source: Bernalillo Department of Health, Seer Stat, 2001-2005.}\)
\(\text{(b) Source: Centers for Disease Control and Prevention, National Center for Health Statistics, 2005.}\)

In the previous section, we examined geographic variations in population, socioeconomic conditions, and community risk factors. Given these marked geographic disparities in community risk factors that may affect health in Bernalillo County, it follows that health outcomes—including life expectancy—might vary sharply by neighborhood as well.

Life expectancy—how long a person born today can expect to live—varies by several decades across Bernalillo County neighborhoods. According to vital statistics data from the Bernalillo County Department of Health for years 2001 to 2005, the life expectancy for the county as a whole is 80.3 years. However, in some census tracts in Downtown and
Northeast Heights a person born today can expect to live only 70 or fewer years. Some census tracts have a shorter life expectancy than do the countries of North Korea, Pakistan, Mongolia, and Timor-Leste. In other places in Bernalillo County, a person born today might expect to live into their 90s. This variation is illustrated in Map 8, in which census tracts with the lowest life expectancies are denoted in dark brown and census tracts with the highest life expectancies are denoted by light yellow.

Low birth weight (defined as a weight of less than 2500 grams, or about 5.5 pounds at birth) also varies sharply by neighborhood. According to data from the Bernalillo Department of Health for years 2001 to 2005, low birth weight occurred in 8.5% of births in Bernalillo County. Geographic patterns for low birth weight are shown in Map 9. Darker brown areas on the map represent areas of high rates of low birth weight, with rates in excess of 12% located in Northeast Heights and the University region.
Figure 6 shows that the incidence of low birth weight is nearly identical for Hispanics and Whites, the two largest racial/ethnic groups in Bernalillo County. Thus, variability in low birth weight incidence in Bernalillo County is likely to have less to do with racial/ethnic composition of neighborhoods than with other community and individual risks.

Note: Racial groups include non-Hispanic population only. Hispanic can include any racial group.
Community Risk and Health Outcomes

There is a geographic relationship in Bernalillo County between life expectancy and community risk: Census tracts with the highest level of community risk have lower average life expectancy (Figure 7). This association points to possible explanations but does not provide evidence for a causal relationship between community risk and life expectancy. A variety of factors may affect life expectancy, including social, environmental, and behavioral factors—some of which are themselves associated with the indicators measured by the CRI. To some degree, the observed association between our index and life expectancy may represent the influence of these confounding variables and not a causal role of the measured indicators themselves.

![Figure 7: Life Expectancy in Bernalillo County by Community Risk Groups](image)


Map 10 shows the geographic relationship between socioeconomic and community risk factors (as measured with the CRI) and life expectancy in Bernalillo County. Areas with high CRI and low life expectancy are shown in dark colors. The map, which focuses on the urban areas of Bernalillo County, illustrates that census tracts in Southeast Heights, Downtown, Four Hills, South Valley, and portions of Northwest Mesa and Northeast Heights have a co-occurrence of high CRI and low life expectancy.

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*This section presents data on life expectancy alone and not birth weight because our data did not reveal any significant relationships between the low birth weight rates in census tracts and corresponding community or household-level characteristics.*
Environmental Hazards

As noted above, social determinants of health are not restricted to the characteristics of individuals and families; communities in which people are exposed to environmental hazards may also face higher than expected levels of adverse health outcomes. Environmental hazards may induce disease and injuries by exposing the population to contaminated air, water, and food or to hazards associated with workplace conditions, transportation, pests, vectors, noise, toxic spills, and climate change.

Although a broad array of environmental risks are considered to have health effects, the 2003 Albuquerque/Bernalillo County Comprehensive plan, produced by the City of Albuquerque Planning Department, identified the following primary sources of air pollutants: vehicular emissions, residential wood burning, dust from unpaved roads and construction sites, and to a lesser degree, industrial operations. Primary sources of water pollutants included septic tanks, agricultural activities, petroleum handling facilities, solid waste disposal sites, illegal discharges, dumping, and leaking underground storage tanks for petroleum products and hazardous materials. In addition, three Superfund sites are located in Bernalillo County; according to the Environmental Protection Agency, “a Superfund site is an uncontrolled or abandoned place where hazardous waste is located, possibly affecting local ecosystems or people.”

The AT&SF Superfund site is located in South Valley. The facility operated as a wood pressure treatment plant from March 1908 to January 1972, and primarily used creosote and oil mixtures for the manufacture of pressure treated wood products. Downtown Albuquerque contains the Fruit Avenue Plume site, with an aquifer containing TCE, a chlorinated solvent and known carcinogen. The Grants Mineral Belt reaches across several New Mexico counties, including western Bernalillo County. This was a site of uranium extraction from the 1950s until the late 20th century. A fourth site, the Rinchem Company site, which involved industrial solvents, was removed from the list of proposed Superfund sites in 1999.
Exposure to environmental hazards is not always uniform across geographic areas. Studies document that proximity to hazardous sites and heightened exposure to pollution is more common in neighborhoods with larger populations of people of color and the socio-economically disadvantaged.\textsuperscript{33-40} Cross-sectional studies in various locations document that proximity to environmental hazards is heightened among communities with large minority populations.\textsuperscript{41} The trend persists across multiple racial and ethnic groups and is intensified in areas of clustered environmental hazards.\textsuperscript{38} Some longitudinal studies suggest that toxic facilities are deliberately sited in minority communities,\textsuperscript{42} possibly because such neighborhoods are socially isolated and hold limited political power to resist undesirable land-use decisions by governments and corporations.\textsuperscript{43}

As demonstrated in Map 11, environmental hazards are most prevalent in downtown Albuquerque and the Northeast Heights close to interstate 25. Although one census tract in Four Hills has elevated risk as measured with this index, the high risk score is primarily a result of land that is zoned for industrial or commercial use. Land use in this zoning classification does not necessarily result in exposure to environmental hazards.

Map 11: Environmental Risk by Census Tract, Bernalillo County, 1974–2010

Note: The density of environmental hazards was generated from an aggregation of the following types of hazards per square mile:

- Tier II reporting facilities
- Discharge permit points
- Dumping locations
- Hazmat locations
- Hospitals
- Railroad depots
- New Mexico Environmental Department discharge permit locations
- National Pollutant Discharge Elimination System permit locations
- New Mexico Environmental Department petroleum storage tank bureau leak sites
- Stationary air [pollution] sources
- Superfund sites
- Industrial/manufacturing land use
Community Characteristics and Environmental Exposure

In Bernalillo County, particular community characteristics are common in areas that have high exposure to environmental hazards. Our findings suggest that areas with high levels of environmental exposure are significantly more likely to contain low-income, Hispanic, and recent immigrant populations (Figure 8). In the quintile with the highest levels of environmental risk exposure, 32% of households have an income below 150% of the federal poverty level, and 53% are Hispanic (Figure 8). In addition, areas with the highest exposure to environmental hazards have, on average, 5% more foreign-born residents than do areas with the lowest exposure. Communities with the lowest levels of environmental risk exposure tend to report higher incomes—only 20% are below 150% of the federal poverty level—and to have a majority White population (53%).

Map 12 illustrates the areas with persistent poverty and elevated levels of exposure to environmental hazards. Census tracts in Downtown, South Valley, and North Valley have experienced high rates of poverty over several decades and also have a high density of environmental hazards. There are, however, census tracts in the South Valley that have experienced persistent poverty but relatively low environmental hazards.
In sum, our findings indicate that exposure to environmental hazards is more likely in Bernalillo County communities in which a higher percentage of the population is poor and Hispanic. Conversely, environmental risk appears to be lower in communities that have lower concentrations of poverty and a larger White population.

**Environmental Risks and Health**

Exposure to environmental agents was measured at the census-tract level by calculating the density of environmental hazards per square mile on the basis of data supplied by the Bernalillo County Department of Geographic Information Systems. Environmental hazards were defined as traffic corridors, railroads, industrial zones, Brownfield sites, Superfund sites, Resource Conservation and Recovery Act (RCRA) sites, and hazardous air pollutants. The density of all of these risks was examined in relationship to life expectancy (Map 13). Patterns emerged when comparing the spatial distributions of environmental hazard density and life expectancy. We noted that areas with low life expectancy existed in the following census tracts with high environmental hazard exposure: Downtown, South Valley, and the Far Northeast Heights. To further examine this relationship, we used a simple linear regression to examine the effects of environmental hazards and CRI on life expectancy. Both CRI and environmental hazards were inversely related to life expectancy (P < 0.0001, P = 0.0009 respectively).
The inverse relationship between the density of environmental hazards and life expectancy for census tracts in Bernalillo County is illustrated in Fig. 9. Census-tract–level environmental hazard density was divided into quintiles (five equal size groups). Life expectancy in the tracts in the highest quintile (with the most environmental hazards) was on average 5.2 years shorter than for census tracts with the lowest density environmental hazards (lowest quintile). Although these factors appear to be related, a wide variety of factors are known to affect health outcomes, including (but not limited to) genetics, social factors, individual health behaviors, and access to quality health care. These variables are deeply interrelated in a complex causal web and can be misleading when their effects are examined as independent relationships.
Conclusion: Environmental Risks, Community Characteristics, and Health Outcomes

The degree to which environmental injustice contributes to higher rates of disease in disadvantaged communities, apart from other confounding variables, is less clear from the literature because of complex methodological challenges. Some studies have shown an association—for example, Morello-Frosch et al. found that heightened racial exposure to air pollution helped explain cancer risk distributions in Southern California, even after controlling for other socioeconomic and demographic indicators—but further empirical data are needed. Even without definitive evidence of adverse health consequences, disproportionate exposure of a population to environmental hazards is considered problematic as a matter of social justice.

In Bernalillo County, individuals living in areas with a high density of environmental hazards have a lower life expectancy. Areas with low life expectancy appear to have a higher density of environmental hazards. As noted above, these census tracts are more likely to be home to vulnerable populations. These findings clearly show that vulnerable populations in Bernalillo County are more likely to be exposed to multiple risk factors: physical, socioeconomic, and environmental. Census tracts with elevated social and environmental risks consistently have poorer health outcomes.


31. County Health Rankings. 2010 health outcomes map; 2010.


