Neighborhood Health Differentials In Warwick, RI: An Analysis of Risk Factors

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THE ABILITY TO DEFINE AND MEASURE THE HEALTH OF RHODE ISLAND'S residents is essential to achieving a common goal of a healthy and prosperous Rhode Island. The **Rhode Island Department of Health** (**HEALTH**) routinely reports on trends in disease and other health status measures. These data inform policies and decisions, help target interventions for neighborhoods with the greatest disparities in health and disease indicators, and address citizens' health concerns about environmental impacts. This report describes HEALTH's on-going efforts to address the concerns of residents who live adjacent to Rhode Island's only major commercial airport, T.F. Green, located in the geographical heart of Warwick, Rhode Island, and the challenges to providing a simple answer to questions about its health impacts.

METHODS

Evaluation of Citizen Concerns of Increased Cancer Rate

Initial analysis. In 2004, staff of the Rhode Island Cancer Registry studied the geographical patterns of cancer incidence in the City of Warwick. Average annual, age-adjusted cancer incidence rates for 1987-2001 were computed by cancer type, census tract, and gender, focusing on lung cancer and other cancers known to be associated with environmental risk factors. Rates were constructed from counts of newly diagnosed cancers reported to the Cancer Registry for Warwick residents (numerators), and parallel population estimates constructed from the US Censuses of Population in 1990 and 2000 (denominators). Relative to cancer incidence rates for all Rhode Island residents, 1987-2001, cancer incidence rates for lung cancer in Warwick census tracts immediately south and east of T.F. Greene Airport were found to be elevated (Figure 1). Some of the elevations were statistically significant. Cancer incidence rates for residents of census tracts immediately north and west of the airport (including residents of census tracts in south Cranston) were not elevated. A report of these findings proposed chance variation in risk factors, tobacco use, exposure to indoor and outdoor air pollutants and/or a combination of these factors as the most likely factors associated with this elevation in lung cancer rates.[1]

Further time-trend analysis. An analysis of the changes in cancer rates over time was conducted to shed light on the likelihood of environmental causes for the observed cancer increase compared to tobacco use. Recent national trends show a decline in male smoking rates at the same time that air traffic at T.F. Green has increased. Extending the cancer incidence data set to include incident cases from 2001 to 2004 allowed a comparison to be conducted between tracts with significant increases in rates to those where none were observed. For men in census tracts with high cancer rates, rates were stable over time, but declined in the rest of Warwick. These time trend data were equivocal with respect to identifying likely sources for the geographical distribution of cancer cases, but supported the need for further study.

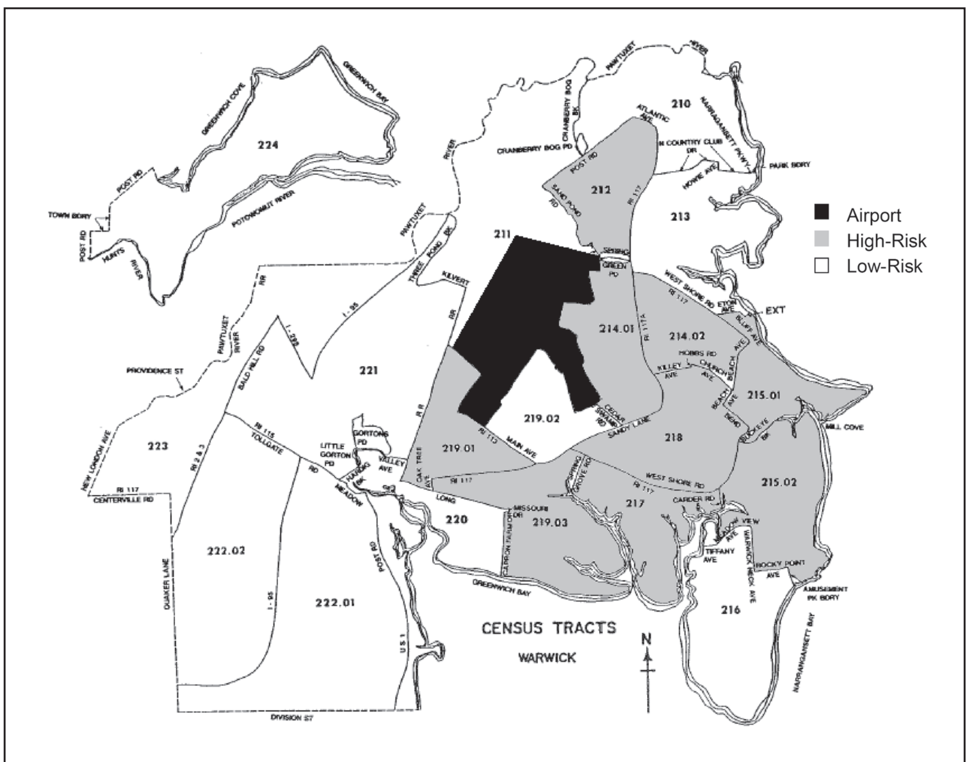

Figure 1. City of Warwick, Rhode Island census tracts with elevated lung cancer incidence rates, covering the period 1987-2000. Source: Fulton, J: Preliminary Cancer Incidence Rates, Warwick, Rhode Island (Memorandum), February 2, 2004.

Surveillance of Other Health Risks and Outcomes. In contrast to lung cancer, acute changes in asthma or other respiratory diseases can occur with daily changes in air quality. Data on these health measures are available from two sources, the **Rhode Island Behavioral Risk Factor Surveillance System (RI-BRFSS)**—part of a national, ongoing telephone survey organized and supported by the Centers for Disease Control and Prevention—and discharge data from Rhode Island's 15 hospitals, reported annually to HEALTH.

Since 1984, the RI-BRFSS has monitored the prevalence of health risks that contribute to the leading causes of disease and death among adults 18 years and older. In some years, data are available for rates of asthma (self-reported prevalence), smoking, exposure to environmental tobacco smoke, and the postal (zip) code. In Warwick, six of nine census tracts with significantly elevated lung cancer rates are located in one zip code—"high-risk zip code"—while two other Warwick zip codes subsume census tracts with lower lung cancer incidence rates, in the main—"low-risk zip codes." The high-risk zip code covers an area generally south and east of T.F. Greene, while the low-risk zip codes cover areas generally north and west of T.F. Greene. Normally, the numbers of RI-BRFSS respondents would be too small to allow geographical comparisons between these high-risk and low-risk areas. However, these areas were over-sampled in the 2008 RI-BRFSS survey, yielding 741 Warwick residents, sufficient to make the desired comparisons.

Hospital discharge data were also used to elucidate differences between the high-risk and low-risk areas of Warwick, so designated on the basis of lung cancer incidence rates. Using ICD-9 codes, discharge diagnoses of "asthma" or "other respiratory diseases" were identified for calendar years 2006 and 2007. Age-adjusted prevalence rates for asthma and other respiratory diseases were constructed using counts of population from the 2000 census. As with RI-BRFSS data, the geographic specificity of hospital discharge data was limited to zip code, with areas designated as either high-risk or low-risk, as described above.

Table 1. Characteristics, risk factors and hospitalization rates for asthma and other respiratory diseases and conditions among residents of Warwick, Rhode Island by geographic area* compared to statewide data

BRFSS (2008)	Warwick High-Risk Zip Code (%)	Warwick Low-Risk Zip Codes (%)	State of RI (%)
Income < $35,000.00	23.5	15.6	28.2
Ages 18-30	20.7	15.4	23.3
Current smoker	22.3	12.5	18.1
Exposure to 2nd hand smoke at home	15.5	12.1	14.2
Exposure to 2nd hand smoke at work	18.6	15.5	15.6
Current asthma diagnosis	12.4	7.5	9.8
Mold in home	18.4	17.9	12.6
Hospital discharge rates (2007-2008)	**(Per 100,000)**	**(Per 100,000)**	**(Per 100,000)**
Asthma	152	104	138
Other respiratory diseases	447	369	430

*Note: areas at high-risk or low-risk of lung cancer
Sources: RI_BRFSS, calendar year 2008, including over-sample of Warwick, Rhode Island, Rhode Island Department of Health; RI Hospital Discharge Data Set, Rhode Island Department of Health.

Results

Compared to respondents residing in low-risk areas, those residing in the high-risk area were significantly more likely ($P < 0.05$) to have incomes less than $35,000 (23.5 percent vs. 15.6 percent), to be current smokers (22.3 percent vs. 12.5 percent), to report mold growth in their homes (18.4 percent vs. 17.9 percent) and to report current exposure to second hand tobacco smoke either at home or at work. (Refer to Table 1.) Compared to respondents residing in low-risk areas, those residing in high-risk areas were more likely to report being diagnosed with asthma by a medical provider (12.4 percent vs. 7.5 percent). The latter differential was corroborated by hospital discharge rates for asthma (152 discharges per 100,000 people per year for patients residing in high-risk areas vs. 104 discharges per 100,000 people per year for patients residing in low risk areas), and hospital discharge rates for other respiratory diseases (447 vs. 369 discharges per 100,000 people per year, respectively).

In addition, hospital discharge data for myocardial infarction and ischemic heart disease revealed significantly higher morbidity in Warwick than in Rhode Island as a whole (627 discharges for myocardial infarction per 100,000 people per year for residents of Warwick vs. 313 discharges per 100,000 people per year for residents of the state as a whole, and 295 discharges for ischemic heart disease per 100,000 people per year for residents of Warwick vs. 250 discharges per 100,000 people per year for residents of the state as a whole. Additionally, significant differences in rates of discharge for myocardial infarction were observed between high-risk and low-risk areas of Warwick (731 vs. 560 discharges per 100,000 people per year).

Discussion

The results of these analyses can be used to support the original (2004) hypothesis that the most likely explanation for the geographical distribution of lung cancer cases was a combination of chance variation in risk factors, tobacco use, and/or exposure to indoor and outdoor air pollutants. The relatively small number of cases used in this evaluation means that chance variation cannot be discounted. The clear and significant difference between high and low risk groups with respect to rates of smoking and exposure to second hand tobacco smoke support tobacco smoke exposure as a likely factor for the differences in the incidence of lung cancer and myocardial infraction and the prevalence of asthma and other respiratory diseases. As well, the higher prevalence of mold in residences located in high-risk areas suggests that indoor air quality unrelated to smoking may also be related to observed morbidity differentials between high-risk and low-risk areas. Finally, outdoor air pollutants, either associated with airport traffic or independent of it, cannot be discounted, nor can the synergistic effects of environmental lung carcinogens and tobacco smoke for the development of lung cancer.

As with many studies, the present analysis raises important questions not anticipated at the start. Why is the rate of heart disease in the City of Warwick so high, compared to the rest of Rhode Island? We know that environmental exposures to elevated levels of particulate matter during smog events are associated with increased cardiovascular morbidity and mortality. We also know that elevated levels of black carbon and ultra-fine particulates in the air are associated with airplane activity. Therefore, airport traffic *might* be related to the differentials observed in cardiovascular morbidity and mortality, but additional study, designed specifically to test this hypothesis, would be necessary to confirm or deny the connection.

References

1. Fulton, JP, and Chiaverini, LC. *A Geographical Analysis of Cancer Incidence in Warwick*, Rhode Island Department of Health, 2004.

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Disclosure of Financial Interests

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