Spatial Analysis of Premature Deaths among African-American Males in Fulton County (Atlanta), Georgia

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Abstract

Approximately half of all the life years lost due to premature deaths in Fulton County, Georgia, occur to African-American males. The Fulton County Department of Health and Wellness analyzed the geographical distribution of premature deaths in the county and used a geographic information system (GIS) application to map the occurrence of these deaths by census tract and by major causes of death. The spatial distribution of premature deaths was then integrated with sociodemographic data from census files to provide a geographic risk profile. Polygon overlays and queries by health center areas were provided to allow prevention interventions to be targeted. Similar polygon overlays by commission districts allow the information to be presented to elected officials and to be related to the budgetary process.

Keywords: African-American males, premature deaths, years of potential life lost (YPLL), mapping in public health

Introduction

The poor health status of African-American males is well known. Although their health status is reflected across many dimensions, it can readily be seen in their disproportionately high mortality rates. Not only do African-American males have 1.7 times the mortality rate of their white counterparts (1), they also have a very high rate of "excess" deaths. Excess deaths are defined as the number of deaths that are greater than would be expected if African-American males had the same age-specific death rates as those of US white males. It has been estimated that up to one-third of the deaths of African-American males in this country may be considered excess deaths (2).

The high death rate, as well as the high number of excess deaths, is due to six main causes: HIV/AIDS, homicides/injuries, cardiovascular/cerebrovascular diseases, diabetes, cirrhosis, and infant mortality (3,4). As pointed out by Hale (2), 70% of the excess deaths occur before age 65 and 40% occur before the age of 45. Needless to say, the life expectancy of the African-American male in this country, currently 65 years, resembles that found in a developing nation more so than in an industrialized one (5). White males in this country can expect to live over seven years longer than African-American males.

In planning health interventions, mapping the geographic variability of premature deaths is a valuable tool in understanding the distributions of the deaths. Geographically based targeting can be used to distribute health resources. However, other characteristics may also be related to the geographic pattern of disease

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prevalence and premature mortality. Much information from the census as well as other databases can be related to the health status of small geographic areas.

Recent studies have focused on the contribution that structural variables play in contributing to premature mortality and excess deaths. It has been found that geographic areas characterized by a high concentration of poverty in conjunction with a high degree of segregation tend to greatly exacerbate poor health status as well as many other social and economic ills characteristic of these neighborhoods. The ill effects caused by the combination of these two conditions have been called "neighborhood" or "concentration" effects (6).

Ecological variables such as income, education, or unemployment have also been found to be important risk factors. Ecological variables are those population characteristics of the census tract as a whole as opposed to those that characterize an individual's behavior or history. Appropriate ecologic variables can be constructed from census information and related to disease patterns. For example, Wells and Horm (7) found that median education of small areas was inversely related to never having had a mammogram. Thus the ecologic characteristics of an area may be helpful in identifying underserved areas or areas with underutilization of services. Ecologic variables may also be useful in constructing estimates of screening behaviors that might be expected to occur in an area.

The purpose of this analysis was to determine the spatial distribution of the premature deaths that occur to African-American males in Fulton County, Georgia. Thus, a geographic information system (GIS) application was used to analyze the geographic patterns of premature deaths. The GIS was further used to relate the pattern of premature deaths to both structural and ecologic characteristics of small areas. In addition to the analysis, there is a practical application of GIS mapping in interacting with the community and political forces needed to turn data into information that can assist in shaping interventions and policy.

Of critical importance to health planning and program development at the local level is the ability to garner political and budgetary support for health interventions. It is necessary to work with numerous community-based organizations and partners in planning health programs geared toward the needs of African-American men. This analysis was designed to facilitate communication with the various stakeholders and partners involved in planning and implementing a preventive health program aimed toward African-American men in Fulton County. Mapping is a powerful tool for helping people visualize the geographic distribution of health problems as well as the structural and ecologic context of these problems. Such presentation makes explicit the rationale for targeting preventive interventions and contributes to the development of community as well as political support for health interventions.

Method

Population Description of Fulton County, Georgia

Fulton County has a population that is 50% African American, 48% white, and 2% composed of other races. African-American males make up approximately 24% of the population, as do white males and white females; African-American females comprise 28% of the population.

Mortality data for this analysis were from data files maintained by the Fulton County Department of Health and Wellness and reflect death certificate data that are recorded for all resident deaths in Fulton County. Mortality data were compiled for the period 1991–1995 by census tract, by sex-race, and by cause of death. In addition to analyzing the total deaths for all causes, selected cause-specific analyses were also included. The specific causes along with their *International Classification of Disease* (ICD) codes (8) are as follows: HIV/AIDS (42.1–44.9), homicide (960–969), all heart disease (390–459), heart attacks (410), hypertension (401–405), cerebrovascular disease (430–438), all cancers (140–208), cancer of the lung (162), and cancer of the prostate (185).

The number of premature deaths, defined as deaths occurring under the age of 75, was determined for all causes as well as for each of the cause-specific deaths. Also, years of potential life lost (YPLL) was calculated by subtracting the age at death from age 75 for all deaths that occurred prematurely and summing these numbers for each sex-race group by census tract.

Thematic maps were constructed using ArcView (ESRI, Redlands, CA), a GIS package that runs on a desktop PC. Maps were developed for both the number of premature deaths and the number of YPLLs by census tract, dividing the census tracts into quintiles and excluding tracts with zero mortality events.

Neighborhood, or concentration, effects were assessed using the percent minority and percent poverty for each census tract. This analysis is ecological in nature in that the population characteristics of the census tract as a whole are used rather than the individual history of decedents. Both the percent poverty and the percent minority data were obtained from summary data by census tracts compiled by the Atlanta Regional Commission (ARC), a ten-county local planning agency. The primary source of the data was the 1990 US Census Summary Tape File 3A (9). Thematic maps were also constructed dividing the census tracts into quintiles based on percent minority and percent poverty of the tracts. Altogether there are 146 census tracts in Fulton County.

The census tract was the main unit of analysis for mapping the number of premature deaths, YPLLs, percent minority, and percent poverty. However, a number of overlays were constructed for use in presenting information to policy makers, community groups, service delivery partners, and other stakeholders. Overlays consisted of commission districts for Fulton County elected commissioners, health center areas for the Department of Health and Wellness, catchment boundaries for other health care providers, boundaries for the Atlanta Empowerment Zone and for other entities as needed. Catchment area boundaries were constructed by aggregation of census tracts and block groups to the appropriate level. Fulton County has two at-large elected commissioners (known as District 1 and District 2 commissioners), and five elected commissioners representing each of five geographic areas (known as commissioners for Districts 3 through 7, respectively).

Results

Due to their small numbers, deaths to races other than African American and white were excluded from this analysis. These deaths constituted less than 1% of the total deaths. A detailed analysis of 1995 data is presented. The number of deaths, number of premature deaths, and YPLLs for each sex-race group are presented in Table 1. During 1995 the number of deaths per year in Fulton County was 6,211. Approximately 30%

Table 1 Number of Total Deaths, Premature Deaths, and Years of Potential Life Lost by Sex-Race Group for Fulton County, Georgia (1995)

	Total Deaths	Premature Deaths (<age 75)	Years of Potential Life Lost
African-American males	1,856	1,495	42,300
African-American females	1,497	863	19,868
White males	1,321	768	16,021
White females	1,537	434	6,763
Total: all sex-race groups	6,211	3,560	84,952

Source: (11,12)

were of African-American males, 24% were African-American females, 21% were white males, and 25% were white females. Of the annual total of 6,211 deaths, 3,560 were premature; that is, they occurred at an age younger than 75 years of age. Overall, 57%, or over half, of the deaths in Fulton County are premature.

Table 2 provides a profile of the population, total number of deaths, number of premature deaths, and YPLLs by sex-race groups in terms of percentages. This profile highlights the disproportionate share of disease burden suffered by African-American men in Fulton County. In 1995, African-American male deaths constituted 42% of all the premature deaths versus 24% for African-American females, 22% for white males, and 12% for white females. Thus, while African-American males make up approximately 24% of the population, they account for 42% of all the premature deaths.

Table 2 Percentage of the Population, Premature Deaths, and Years of Potential Life Lost by Sex-Race Group in Fulton County, Georgia (1995)

	Total Population[a] (%)	Total Deaths (%)	Premature Deaths (<age 75) (%)	Years of Potential Life Lost (%)
African-American males	24	30	42	50
African-American females	28	24	24	23
White males	24	21	22	19
White females	24	25	12	8

[a]Source: (9)

YPLL is another way of measuring premature death. This measure captures the impact of the age of death. This measure is higher the younger the individual at the time of death. Overall, there were 84,952 life years lost in Fulton County in 1995. Table 2 shows that deaths of African-American males accounted for 50%, or half, of all the life years lost in Fulton County due to premature deaths. Thus, while African-American males constitute 24% of the population, they account for 30% of all deaths, 42% of the premature deaths, and 50% of the YPLLs. African-American males are disproportionately represented in all three measures of mortality—total deaths, premature deaths, and YPLLs.

As can be seen in Table 3, three-quarters of the premature deaths and two-thirds of YPLLs were due to five major causes: HIV/AIDS, homicide, heart disease, stroke, and cancer.

Table 3 Number of Deaths, Premature Deaths, and Years of Potential Life Lost for All Causes and Selected Cause-Specific Mortality among African-American Males in Fulton County, Georgia (1995)

	African-American Male 1995		
	Total Number of Deaths	**Number of Premature Deaths (<age 75)**	**Years of Potential Life Lost**
All causes	1,856	1,495	42,300
HIV/AIDS	314	313	11,412
Homicides	131	129	5,565
All heart diseases	493	340	6,199
Heart attack	35	35	571
Hypertension	84	84	1,404
Stroke	43	43	795
All cancers	317	244	3,652
Lung cancer	93	76	1,079
Prostate cancer	29	29	254

Source: (12)

Notably, the geographic distribution of deaths for all age groups of African-American males, as well as for premature deaths and YPLLs, are highly correlated. This pattern of mortality reflects the underlying pattern of neighborhood, or concentration, effects characteristic of areas of high poverty and high segregation (reflected in the percent minority population of the census tract). The census tracts with high mortality, high premature mortality, and high numbers of YPLLs among African-American males also tended to be the same census tracts that had a high percentage of minority population as well as high poverty rates.

Maps for number of premature deaths for all causes (Figure 1) as well as for HIV/AIDS (Figure 2) and homicide (Figure 3) are shown to illustrate the geographic variation of premature deaths by census tract for African-American males. Number of premature deaths as opposed to rates were chosen for these maps for health planning purposes because high rates in a small population do not create as many cases as a moderate rate does in a much larger one. Overlays of commission districts illustrate the value of adding boundaries for presentations made to a political stakeholder group.

Discussion

Mapping premature deaths, as was done in this analysis, is a highly effective way of demonstrating the disproportionate disease burden borne by African-American males in Fulton County. Showing the geographic variation and clustering was effective in both demonstrating the problem and in garnering support for preventive health

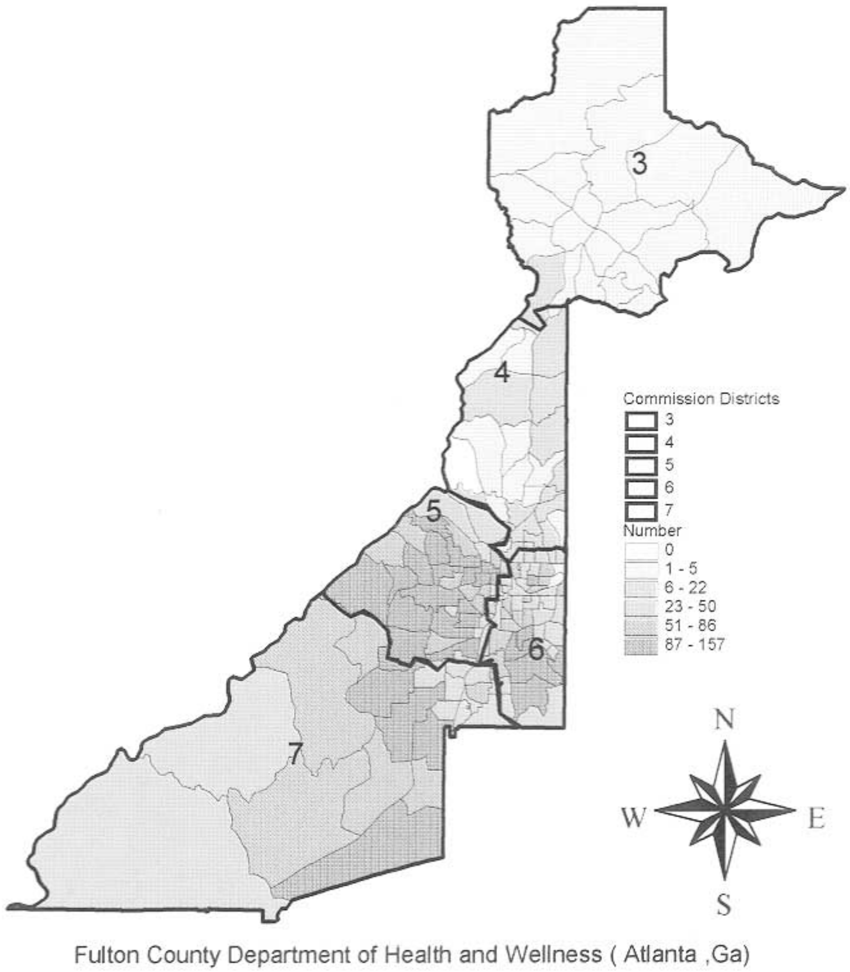

Figure 1 Number of premature deaths (age <75 years) for African-American males, all causes, 1991–1995.

programs. Relating the premature deaths to census variables allows health status to be understood in terms of its neighborhood context.

Both the spatial distribution of mortality among African-American males and the neighborhood, or concentration, effects in Fulton County are highly correlated. As found in other research, such structural variables as high poverty in conjunction with high segregation are powerful risk factors for poor health for a wide range of conditions. While public health has often focused its attention on individual health behavior and risk factors, neighborhood and environmental risk factors appear to be just as important, if not more important. In fact, some researchers have even suggested that neighborhood effects are as great as, if not greater than, such major individual risk factors as smoking (10). Clearly both individual and structural variables of neighborhoods are important and interventions are needed that target both. Preventive clinical services such as immunizations and disease screening programs have clearly been found to be

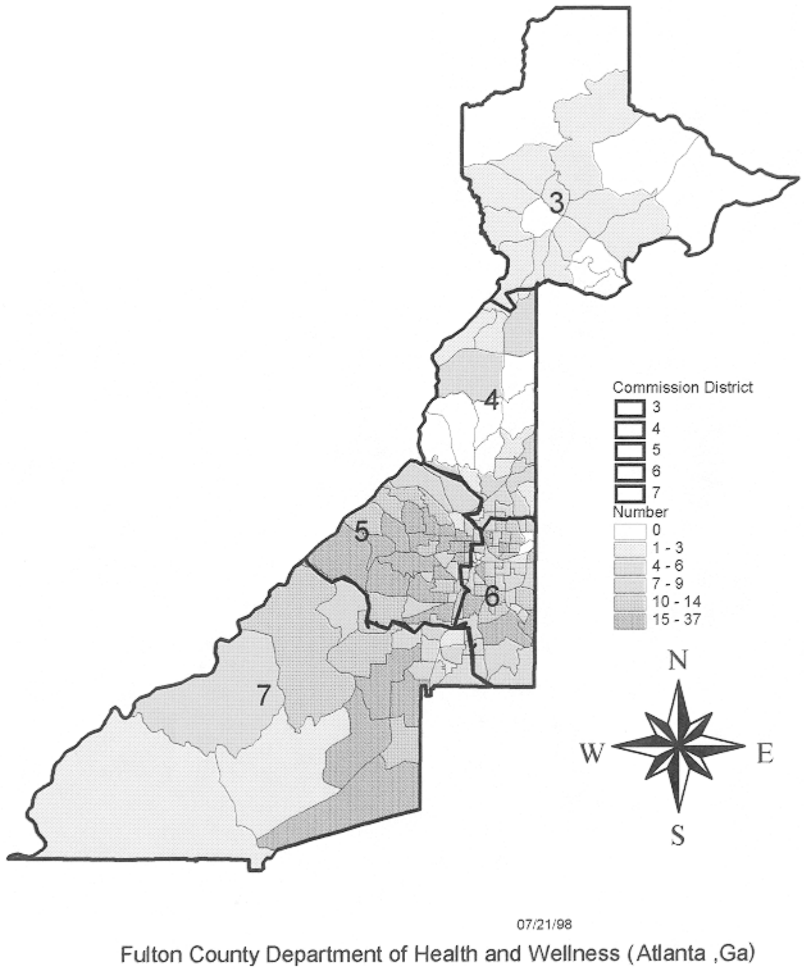

Figure 2 Number of premature deaths (age <75 years) for African-American males, HIV/AIDS, 1991–1995.

effective. So too have been strategies that focus on target groups of individuals exhibiting risk factors for various health conditions.

Much more emphasis, however, is needed on targeting interventions at the neighborhood level as opposed to focusing just on the individual level. Research has shown that behaviors are culturally or socially mediated. For example, if it is considered "cool" or "grownup" to smoke within a social group, individuals are at much greater risk of taking up the habit. Strategies such as policy development and community empowerment through partnership development and coalition building can be effective interventions at the neighborhood level.

Of course, both cultural factors and the cultural context are important for messages that seek to build individual healthful behaviors. Considerably more ethnographic research is needed in this area. This approach seeks to ameliorate, on the individual level, the high-risk circumstances of neighborhood structural variables.

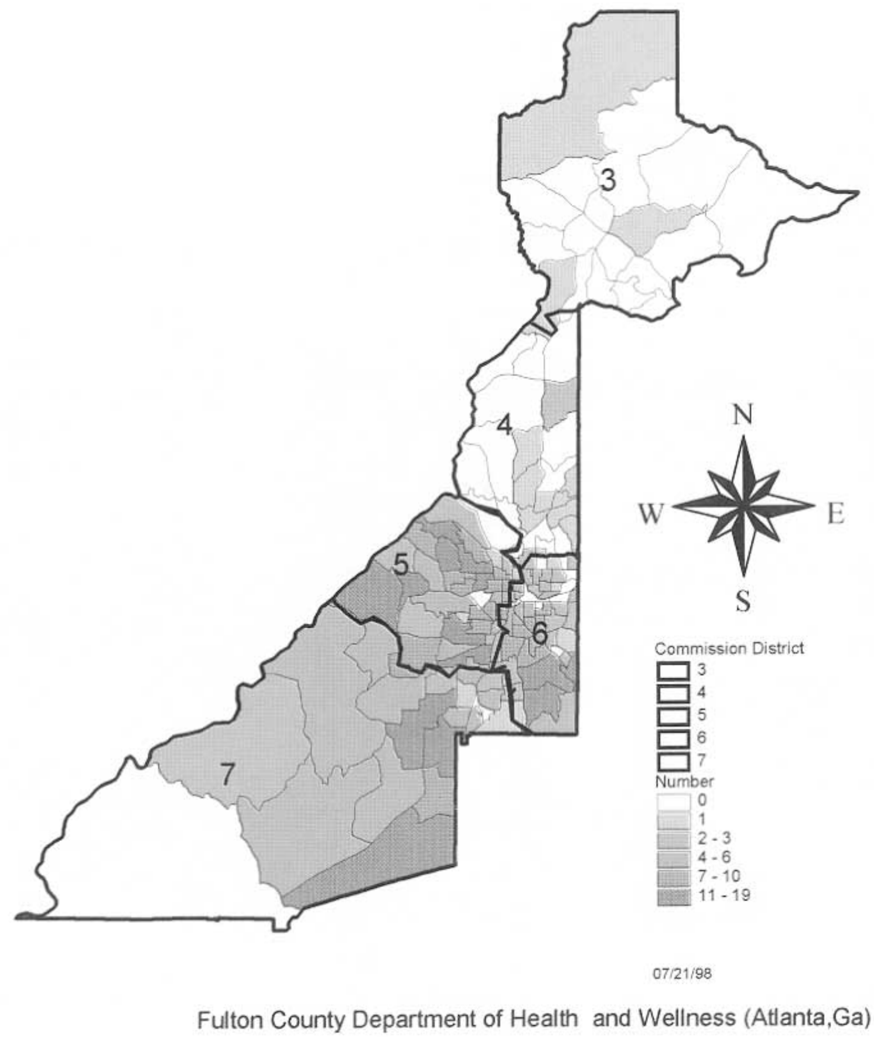

Figure 3 Number of premature deaths (age <75 years) for African-American males, homicide, 1991–1995.

Policy can also be an effective intervention as has been seen with the reductions in both mortality and serious injuries that occurred when speed limits were lowered to 55 mph. Local neighborhoods have also been successful in using zoning laws and business licensing regulations to limited the number of liquor stores that can be opened in a given neighborhood. Thus, both individual interventions and public policy, especially when combined with community empowerment, can be potent strategies for building the health of a population at the neighborhood level.

The true value of technology is in its application to the real world. Science must serve humanity to achieve its true mission. Advances in the application of geographical information mapping to focus on issues of the public's health provide us with a powerful example of that principle. In that regard, the power of GIS lies in its ability to be used as a tool in the process of examining, evaluating, and improving the health status of communities. In this instance, we have placed GIS technology in the practical context of assisting the shaping of public policy and directing the decision-making process of local political leadership.

The value and uses of GIS technology can be illustrated in several ways. This project highlights many of them. Specifically, the practical applications of GIS technology include the following:

- As a tool in the development of stakeholder support
- Assisting in the determination of the siting of fixed resources
- Assisting in the process of targeting intervention and prevention strategies
- As a tool in providing support for budget allocation requests
- Providing a geographical focus for the development of public health advocacy groups
- Providing a framework for the building of coalitions with non-public health partners

The policy-makers at the county level depend on department heads to provide them with the data necessary to develop public policy. Frequently, their time demands and their perspective on public need are such that the presentations must be powerful, illustrative, and clear. GIS mapping fits all of these criteria.

Using color-coded GIS maps focusing on the health status of African-American men in Fulton County, we were immediately able to demonstrate to our local policy-makers where the most dramatic needs were. This will allow us to target our resources and programming to the specific areas represented on the GIS map. Progress can then be measured and its representation illustrated for the benefit of the local board of commissioners.

Much as this technique can be used with policy-makers, it is equally valuable to illustrate health issues to any segment of the population that is not oriented to "hard" epidemiological data. This includes the affected populations, other stakeholders, budget committees, and potential collaborative partners from all segments of society.

GIS mapping relates information on public health data in a clear, concise, yet dramatic manner that is consumer-friendly and almost self-explanatory. It will continue to be a mainstay in the way in which we communicate public health issues to our colleagues.

References

1. National Center for Health Statistics (NCHS). 1998. Health, United States, 1998 with socioeconomic status and health chartbook. Hyattsville, MD: NCHS.
2. Hale, CB. 1992. A demographic profile of African Americans. In: *Health issues in the black community.* Ed. RL Braithwaite, SE Taylor. San Francisco: Jossey-Bass. 6–19.
3. US Department of Health and Human Services. 1985. *Report of the Secretary's Task Force on Black and Minority Health (vol.1, executive summary).* Washington, DC: US Government Printing Office.
4. Braithwaite RL, Taylor SE, Eds. 1992. *Health issues in the black community.* San Francisco: Jossey-Bass.

5. McCord C, Freeman HP. 1990. Excess mortality in Harlem. *New England Journal of Medicine* 322:173–7.
6. Polednak, AP. 1977. *Segregation, poverty and mortality in urban African Americans.* New York: Oxford University Press.
7. Wells BL, Horm JW. 1998. Targeting the underserved for breast and cervical cancer screening: The utility of ecological analysis using the national health interview survey. *American Journal of Public Health* 88:1484–9.
8. US Department of Health and Human Services. 1989. *International Classification of Diseases, Ninth Revision.* DHHS Publication No. (PHS) 89-1260. US Department of Health and Human Services, Public Health Service, Health Care Financing Administration.
9. US Census Bureau. *1990 decennial census of population and housing, summary tape file 3A (STF3A).* Washington, DC: US Census Bureau.
10. Kaplan GA, Lynch JW. 1997. Wither studies on the socioeconomic foundations of population health. Editorial. *American Journal of Public Health* 87:1405–11.
11. Fulton County Department of Health and Wellness. 1995. Fulton County birth certificates. Atlanta: Fulton County Department of Health and Wellness.
12. Fulton County Department of Health and Wellness. 1995. Fulton County death certificates. Atlanta: Fulton County Department of Health and Wellness.