

Premature Mortality in North Carolina: Progress, Regress, and Disparities by County and Race, 2000–2010

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BACKGROUND This study examined trends in premature mortality—defined as years of potential life lost before age 75 years—in North Carolina during the period 2000–2010.

METHOD Premature mortality at the county level was calculated and compared for two 5-year periods (1996–2000 and 2006–2010) for the entire population, among whites, and among nonwhites. This study also examined and compared leading causes of death that contributed to premature mortality among whites and nonwhites in each county and in the state as a whole.

RESULTS Premature mortality in North Carolina was reduced 13.3% for the population as a whole, 26.6% for nonwhites, and 7.2% for whites. However, premature mortality actually increased for the population as a whole in 20 counties, among whites in 35 counties, and among nonwhites in 8 counties. Among whites, chronic obstructive pulmonary disease, suicide, injuries, and motor vehicle crashes each contributed an above-average share of premature mortality. Among nonwhites, stroke, diabetes, homicide, and heart disease each contributed an above-average share of premature mortality.

LIMITATIONS We were unable to calculate reliable rates of premature mortality for Hispanics, Asians, American Indians, and other nonwhite ethnic groups because the numbers at the county level were too small.

CONCLUSIONS Public health professionals should focus attention on counties in which premature mortality is increasing or remaining constant and should address the specific underlying causes of such deaths. In counties in which premature mortality among whites is increasing, community health efforts should focus on prevention of smoking, suicide, and injury. In counties with large nonwhite populations, programs should focus on prevention of stroke, heart disease, diabetes, homicide, and kidney disease.

The average life span for people in the United States increased by almost 30 years during the 20th century—an average of 3 years per decade [1]. In the first decade of the 21st century, however, only 1.7 years were added to the average life span [2], and that progress was unevenly distributed across population groups and geographic regions. This paper examines longevity using a measure called *premature mortality* to examine progress and changes in disparities in North Carolina over a recent decade.

Premature mortality is defined here as years of potential life lost (YPLL) before age 75 years, expressed as a rate per 10,000 population (YPLL-75/10K). During the first decade of the 21st century, the premature mortality rate for North Carolina improved substantially, and North Carolina's rank among the states improved modestly. Specifically, the state's premature mortality rate was 843.3 YPLL-75/10K in 2000 but decreased to 735.0 YPLL-75/10K by 2009, which is a 13% improvement [3]. We were interested to see how the degree of improvement varied among North Carolina counties and between nonwhites and whites.

Premature mortality is a well-accepted indicator of population health because, unlike mortality, it places extra emphasis on early deaths, which presumably might have been prevented [4–10]. It is a main health indicator for the University of Wisconsin, County Health Rankings of the Robert Wood Johnson Foundation [11], and the United Health Foundation's America's Health Rankings [12]. Healthy

People 2020 also uses premature mortality for monitoring general health status [13]. Premature mortality has been described as “the best single proxy for reflecting differences in the health status of states' populations as measured by both the Healthy People 2000 indicators and the ReliaStar Index” [14]. The Centers for Disease Control and Prevention provides YPLL-75/10K data through its Web-based Injury Statistics Query and Reporting System (WISQARS) [2].

In this paper, we pay particular attention to differences between whites and nonwhites in county-level premature mortality rates. In addition, we examine the causes of premature mortality, both to identify particular diseases that are responsible for premature mortality in a county and to identify counties in which particular causes contribute a disproportionate share of premature mortality.

Methods

We calculated the YPLL for individuals who died before age 75 years. Although some studies and surveillance systems use other conceptions of premature mortality and other

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age limits to define and calculate it [15-18], our method is the one most commonly used for monitoring population health. YPLL with a cutoff at age 75 years is consistent with rankings now commonly used [11-13], and age 75 years approximates the normal life expectancy in North Carolina (which was 78.1 years in 2010-2012) [19]. Thus, a death prior to age 75 years may be considered an early death. The total YPLL for those who died prior to age 75 years were summed and expressed as a rate per 10,000 population (YPLL-75/10K). The rates were then age-adjusted using the 2000 US standard million population so that counties with different age structures could be compared. Thus measured, premature mortality is a straightforward outcome indicator for overall health and health disparities [8, 20] that can be compared across countries, counties, and states [21]. Our interest was to compare populations and counties in North Carolina.

We calculated YPLL due to premature mortality for each North Carolina county for two 5-year periods: 1996-2000 and 2006-2010 [22]. We calculated YPLL for all individuals, for white individuals, and for nonwhite individuals in each North Carolina county. We then compared the county-level change in the premature mortality rate between the 2 periods (1996-2000 versus 2006-2010). We did not analyze the intervening years. We used 5 years of data rather than smaller time periods because the larger data set provides a more stable estimate of premature mortality at the county level, particularly for small counties.

Vital statistics data from the North Carolina State Center for Health Statistics were downloaded from the Dataverse Web site of the Odum Institute at the University of North Carolina at Chapel Hill [22]. We analyzed the data using 2 racial categories: white and nonwhite. Vital statistics data for North Carolina are classified into the following racial groups: white, black, American Indian, Chinese, Japanese, Hawaiian, Filipino, other Asian, and other nonwhite. We were interested in disaggregating premature mortality by race, but we were limited in how narrowly we could specify the racial categories because we also wanted to analyze the data by county. At the county level, there are often only a small number of individuals in racial groups other than white. Overall, African Americans make up 21% of the state's population [23], but there is great variation at the county level, and many counties have very small numbers of African Americans, particularly in the western part of the state. For 22 North Carolina counties, African Americans make up less than 5% of the population. For other racial groups, the number is often quite a bit smaller. Robeson County is an exception, as American Indians make up 39% of the population there; for most counties, however, this group makes up less than 1% of the population. Orange County is the only county in which Asians make up more than 5% of the population; in most counties, this group makes up less than 1% of the population. Given the small numbers for individual racial groups, we chose to combine the groups into a single category (nonwhite) so that we could conduct the county-level analysis.

We also chose not to analyze these data in terms of ethnicity. Vital statistics data for North Carolina classify individuals by race, and then separately classify them by Hispanic origin: Cuban, Mexican, non-Hispanic, other Hispanic, Puerto Rican, Central/South American, or unknown. An individual may be white Hispanic, black Hispanic, white non-Hispanic, black non-Hispanic, or any of the many other possible combinations of race and Hispanic origin. We chose not to disaggregate the data in this way because doing so would result in extremely small numbers at the county level. Although Hispanics constitute 8% of North Carolina's overall population, there are many counties in which less than 5% of the population is Hispanic. Nonetheless, it would be possible to perform a separate analysis of the county-level variability in premature mortality between Hispanics and non-Hispanics, and this would be an interesting analysis for another paper.

For the total and the 2 racial groups, we then counted the number of counties with low, medium, high, very high, or extremely high rates of premature mortality for the 1996-2000 period and compared these numbers with counts for the same categories in the 2006-2010 period; we described these variations with choropleth maps. We also calculated the percentage change in premature mortality rates for each county (ie, the percentage increase or decrease from the 1996-2000 base figure). We grouped counties into those in which total premature mortality decreased by 30% or more, those in which it decreased by 15% to 29.99%, those in which it decreased by less than 15% (but still decreased), those in which it increased by less than 15%, and those in which it increased by 15% or more. We also performed this analysis for each racial group (white and nonwhite) for each county.

We then examined the causes of death that contributed most to premature mortality and calculated the percentage of YPLL attributable to each of the 10 leading causes of death for the state as a whole and for each individual county by race. We did not perform these calculations if there were 20 or fewer deaths attributed to an underlying cause. The purpose of this analysis was to reveal the underlying causes of death responsible for increases or decreases in premature mortality for each county as a whole and for the white and nonwhite populations of each county.

Results

The age-adjusted premature mortality rate for North Carolina as a whole was 886.5 YPLL-75/10K for the 1996-2000 baseline period; this rate declined to 768.4 YPLL-75/10K for the 2006-2010 period. This represents a 13.3% reduction in premature mortality for the state as a whole. There were also substantial reductions in premature mortality in some but not all counties; a high degree of variability was found across the state. For instance, in the 1996-2000 period, Wake County had the lowest rate of premature mortality (644.9 YPLL-75/10K), but the rate

for Anson County (1,366.4 YPLL-75/10K) was more than double the rate for Wake County. The variability is shown in Figure 1, which clearly reveals the extent, geography, and racial disparities of early deaths.

Although the rate of premature mortality declined for most counties between the 2 time periods, rates were high in eastern counties in both periods. As shown in Figure 1A, the highest numbers of YPLL in 1996–2000 were observed for Robeson, Anson, Edgecombe, and Hertford counties, which were all in the “very high” category (meaning that they had rates of premature mortality in the range of 1,300–1,599 YPLL-75/10K). During this period, there were also 28 counties in the “high” category (with rates in the range of 1,000–1,299 YPLL-75/10K). By 2006–2010 there was only 1 county in the “very high” category, and there were 14 counties in the

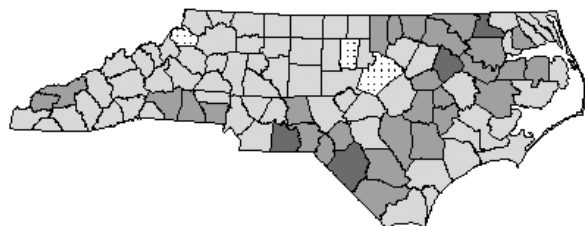
“high” category, although the geographical pattern was similar to that of the earlier period (Figure 1B). Three western counties—Rutherford, Graham, and Swain—had “high” rates of premature mortality in 1996–2000. By 2006–2010, the rates in Rutherford and Graham counties had decreased to “medium,” but the rate in Swain County had increased to “very high.”

Only 3 counties—Wake, Orange, and Watauga—were in the “low” category (400–699 YPLL-75/10K) in the early period. Ten years later, they were joined by 9 additional counties: Cabarrus, Camden, Chatham, Dare, Davie, Durham, Mecklenburg, New Hanover, and Union. A total of 65 counties had rates in the “medium” category (700–999 YPLL-75/10K) in the early period; they were joined by 8 additional counties in 2006–2010.

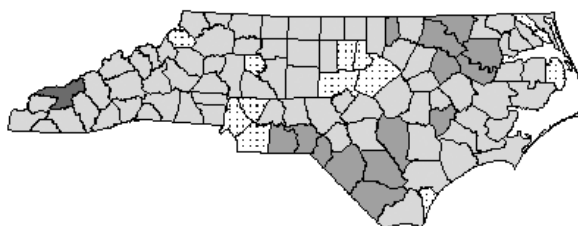
FIGURE 1.

Rate of Premature Mortality in North Carolina by County and Race, 1996–2000 and 2006–2010

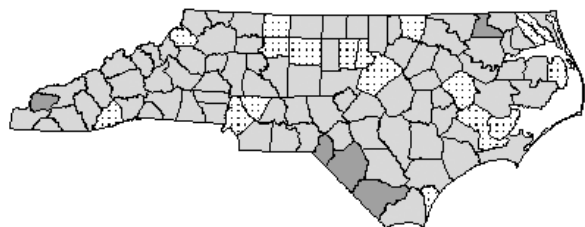
1A. Rate of Premature Mortality for the Entire Population, 1996–2000



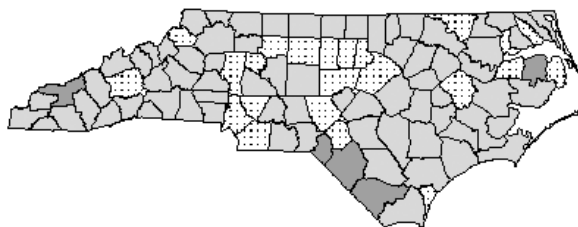
1B. Rate of Premature Mortality for the Entire Population, 2006–2010



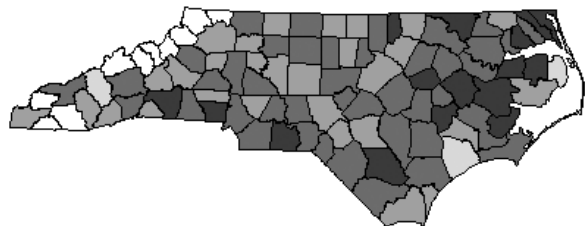
1C. Rate of Premature Mortality for Whites, 1996–2000



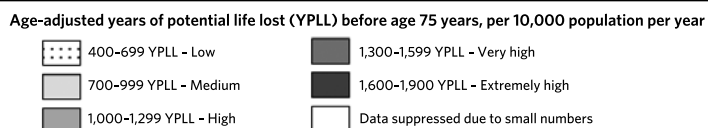
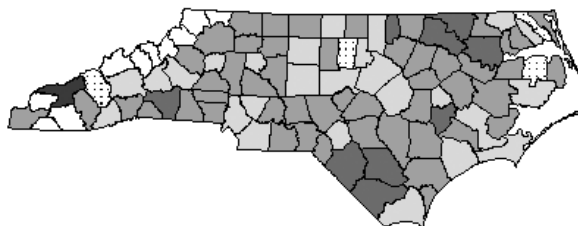
1D. Rate of Premature Mortality for Whites, 2006–2010



1E. Rate of Premature Mortality for Nonwhites, 1996–2000



1F. Rate of Premature Mortality for Nonwhites, 2006–2010



When we disaggregated the data by race, premature mortality for the state's nonwhite population declined by 26.2% over the 10-year period (from 1,375.7 to 1,009.6 YPLL-75/10K). In 58 counties, the premature mortality rate for nonwhite individuals was "very high" or "extremely high" in the 1996-2000 period (Figure 1E). In the early period, the statewide premature mortality rate was nearly 1.9 times higher for nonwhites than for whites (1,375.7 versus 740.5 YPLL-75/10K). Even though the rate for nonwhites declined over 10 years, it remained 1.5 times higher than the rate for whites in 2006-2010. As shown in Figures 1E and 1F, there were 16 counties in which the premature mortality rate for nonwhites was initially in the "extremely high" category, but only 1 county was in that category in the later period (Swain). However, there were still 9 counties in which the rate for nonwhites was "very high" (Robeson, Columbus, Bladen, Lenoir, Northampton, Halifax, Bertie, Vance, and Rutherford). By way of comparison, there were no counties in which the rate for whites was "very high" or "extremely high" in the later period (Figure 1D), and there were only 5 counties in which this rate was "high" (Swain, Scotland, Robeson, Columbus, and Tyrrell).

County-level rates of premature mortality for nonwhites were much higher overall than were rates for whites; although both declined, rates for nonwhites remained well above rates for whites. Indeed, most of the overall decline in premature mortality across the decade is attributable to a reduction in the rates for nonwhites, which have historically been disparately higher. In order to investigate this finding further, we examined percentage change for both racial groups.

Figure 2A shows the percentage change in the county-level premature mortality rate for the entire population (white and nonwhite) across the 2 time periods. The total premature mortality rate declined in 80 counties and increased in 20 counties. There were distinct differences between whites and nonwhites in terms of the percentage change in premature mortality.

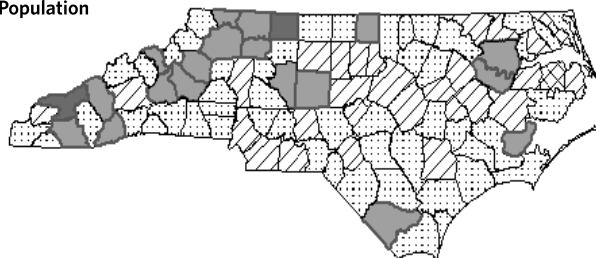
The premature mortality rate for nonwhites declined in all but 5 of 100 counties (Figure 2C). In 23 counties, the rate for nonwhites was reduced by 30% or more. This pattern confirms the observation that premature mortality rates for nonwhites exhibited very large declines between 2000 and 2010; however, those rates started out very high and remained high (Figures 1E and 1F). The 5 counties in which the premature mortality rate for nonwhites increased were Swain, Yadkin, Bertie, Jones, and Tyrrell. All of these counties except for Bertie and Jones have very small nonwhite populations so the percentage increase may be due to small changes in actual numbers of premature deaths.

In contrast to the premature mortality rate for nonwhites, the rate for whites in North Carolina declined by only 7.2% between the early period and the late period (from 740.4 to 686.8 YPLL-75/10K). Remarkably, the premature mortality rate for whites increased in 35 counties. Although

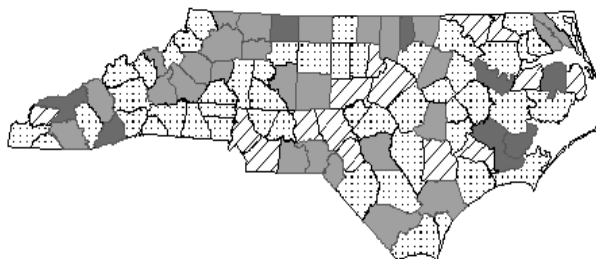
this increase was less than 5% in 10 counties, there were increases of 5%-10% in 11 counties, increases of 10%-15% in 6 counties, and increases of more than 15% in 8 counties (Figure 2B.) Of the counties in which premature mortality for whites increased the most, 4 are located in the eastern part of the state (Tyrrell, Pamlico, Martin, and Craven); 2 are in the Piedmont (Stokes and Vance); and 2 are in the western part of the state (Transylvania and Swain). Given that the state as a whole achieved a reduction in premature mortality, finding counties in which improvement did not occur is important. We were surprised to find so many counties in

FIGURE 2.
Percentage Change in Rate of Premature Mortality in North Carolina Counties: 1996-2000 Compared With 2006-2010

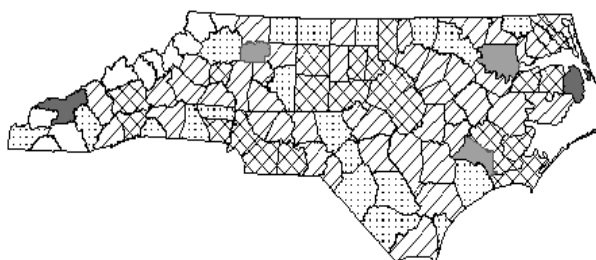
2A. Percentage Change in Rate of Premature Mortality for the Entire Population



2B. Percentage Change in Rate of Premature Mortality for Whites



2C. Percentage Change in Rate of Premature Mortality for Nonwhites



Percentage change in age-adjusted years of potential life lost (YPLL) before age 75 years, per 10,000 population per year

- Large reduction in YPLL (30% or more)
- Medium reduction in YPLL (15%-29.99%)
- Modest reduction in YPLL (0.01%-14.99%)
- Modest increase in YPLL (0.01%-14.99%)
- Medium to large increase in YPLL (15% or more)
- Data suppressed due to small numbers

which the premature mortality rate for whites increased.

The contributions of particular causes of death to premature mortality for whites and nonwhites in each county during the most recent period (2006–2010) are shown in Tables 1, 2, and 3. Cancer is the leading cause of premature mortality for North Carolina as a whole, accounting for 21.2% of all premature mortality (Tables 1, 2, and 3, first row). Heart disease is the cause of another 15% of all YPLL. The other leading causes are unintentional injuries not caused by motor vehicles, unintentional motor vehicle injuries, suicide, homicide, stroke, chronic obstructive pulmonary disease (COPD), diabetes, and kidney disease.

Table 1 shows the percentage contribution of each cause of death to premature mortality for the state's population as

a whole; the 28 counties included in this table are those in which either cancer or heart disease caused a disproportionate share of premature deaths (ie, the contribution to premature mortality for that county was at least 15% greater than for the state as a whole). An expanded table showing data for all 100 counties is available online. The 3 counties with the greatest share of premature deaths attributed to cancer were Granville, Hyde, and Madison. The 3 counties with the greatest share of premature deaths attributable to heart disease were Tyrrell, Mitchell, and Alleghany. In one-third of the state's counties, a disproportionate share of premature mortality was attributable to nonvehicular unintentional injuries, and in 3 of these counties, the county's share of premature mortality was almost double the statewide rate.

TABLE 1 (ABBREVIATED).

Percentage of Premature Mortality in North Carolina Attributable to Various Causes, Statewide and in Selected^a Counties, 2006–2010

Geographic region	Percentage of years of potential life lost (before age 75 years) attributable to cause									
	Cancer (all types)	Heart disease	Nonvehicular unintentional injuries	Unintentional motor vehicle injuries	Suicide	Homicide	Stroke	COPD	Diabetes	Kidney disease
Statewide	21.2	15.0	7.9	7.6	4.7	3.6	2.8	2.8	2.5	1.4
Alexander	20.4	17.6**	12.1**	8.3*	7.1**	—	2.9	4.0**	—	—
Alleghany	17.9	20.8**	—	—	—	—	—	4.3**	—	—
Anson	19.3	17.3**	6.9	9.8**	4.4	—	4.5**	1.6	3.9**	2.5**
Avery	24.5**	15.3	10.5**	—	—	—	—	3.9**	—	—
Beaufort	21.7	17.6**	5.5	6.8	4.1	—	4.2**	2.6	3.3**	1.8**
Bladen	17.5	18.3**	8.0	9.9**	—	4.4**	3.0*	4.2**	2.4	1.8**
Carteret	25.3**	17.7**	10.6**	5.8	5.2*	—	2.9	2.9	1.6	1.2
Caswell	22.8*	18.8**	8.5*	9.9**	—	—	—	2.5	—	—
Chowan	24.7**	16.2*	—	—	—	—	—	—	—	—
Columbus	16.1	19.2**	9.3**	10.9**	2.6	3.6	3.5**	2.8	1.9	1.2
Dare	24.9**	16.0*	11.8**	—	6.3**	—	—	1.8	—	—
Gates	26.7**	14.4	—	—	—	—	—	—	—	—
Granville	29.5**	13.7	6.7	8.9**	3.4	—	2.9*	3.1*	3.3**	1.7**
Haywood	23.3*	17.7**	10.4**	6.7	5.9**	—	2.4	2.7	1.9	1.1
Hyde	26.8**	17.7**	—	—	—	—	—	—	—	—
Johnston	22.4*	17.6**	7.1	10.7**	4.4	3.1	2.6	2.4	1.3	1.5*
Macon	24.6**	17.2	13.1**	4.1	—	—	—	2.9	—	—
Madison	27.2**	14.3**	11.8**	8.1*	—	—	1.2	4.2**	2.5	—
Martin	21.1*	19.9**	6.5	4.9	4.3	—	3.4	2.3	2.5	—
Mitchell	21.1	22.8**	13.4**	—	—	—	5.1**	5.1**	—	—
Orange	26.0**	13.7	6.7	7.8	7.3**	2.8	2.2	1.8	1.8	1.6*
Pamlico	25.0**	11.9	—	—	—	—	—	3.2*	—	—
Pasquotank	22.0	17.5**	7.1	—	—	—	2.9	2.5	—	—
Perquimans	26.4**	16.7*	—	—	—	—	—	—	—	—
Polk	25.6**	14.5	10.6**	—	—	—	—	3.4**	—	—
Richmond	19.9	17.5**	7.2	6.5	4.7	3.7	3.8**	3.6**	4.0**	1.9**
Rockingham	21.7	17.7**	8.5*	8.5*	3.8	2.2	2.8	4.0**	1.9	1.1
Tyrrell	18.3	27.9**	—	—	—	—	—	—	—	—

Note. COPD, chronic obstructive pulmonary disease.

^aThis table includes counties in which the premature mortality rate for cancer or heart disease is 15% higher than the rate for North Carolina as a whole. An expanded table containing data for all counties is available in the online version of this article.

*The county's rate of premature mortality for this cause is 5%–14.9% higher than the rate for North Carolina as a whole.

**The county's rate of premature mortality for this cause is at least 15% higher than the rate for North Carolina as a whole.

—Data suppressed because fewer than 20 deaths were attributable to this cause.

Motor vehicle crashes were responsible for a disproportionate share of early deaths in 27 counties; the 5 counties with the highest percentages of early death attributable to motor vehicle injuries were Hoke, Bertie, Montgomery, Currituck, and Duplin (see online version of Table 1).

Table 2 shows the causes of premature mortality among whites in North Carolina; the 45 counties included in this table are those that met at least one of the following conditions: the share of premature mortality that was attributable to either cancer or heart disease was at least 15% greater than the rate for the state as a whole; or the overall premature mortality rate for whites was at least 10% higher in 2006–2010 than that had been in 1996–2000. Again, an expanded version of Table 2 showing data for all 100 counties is available online. In addition to cancer and heart disease, noteworthy causes of early deaths among whites were COPD, suicide, nonvehicular unintentional injuries, and motor vehicle crashes.

The 3 counties in which cancer caused the greatest share of early deaths among whites were Perquimans, Washington, and Granville. The 3 counties with the highest shares of premature mortality attributable to heart disease were Mitchell, Alleghany, and Martin. In 14 counties, the premature mortality rate for whites was at least 10% higher in 2006–2010 than it had been in 1996–2000. COPD contributed a disproportionate share to premature mortality in 8 of these 14 counties; suicide contributed a disproportionate share to premature mortality in 6 of these 14 counties; nonvehicular unintentional injuries contributed a disproportionate share to premature mortality in 7 of these 14 counties; and motor vehicle crashes contributed a disproportionate share to premature mortality in 2 of the 14 counties.

As noted above, the premature mortality rate for the nonwhite population declined for the state as a whole; however, this rate increased by 10% or more in 8 counties (Bertie, Jones, Watauga, Yadkin, Dare, Swain, Avery, and Clay). With the exception of Bertie and Jones, however, these 8 counties had very small numbers of nonwhite residents, so the increases in the premature mortality rate were likely due to small fluctuations in the numbers. Although the nonwhite category included African Americans, Asians, Native Americans, and individuals of other races, this group consisted mostly of African Americans, particularly in the eastern region of the state.

Table 3 shows the leading causes of death that contributed to premature mortality for nonwhites. The 47 counties included in the table are those that met at least one of the following conditions: the share of premature mortality that was attributable to cancer or heart disease was at least 15% higher than in the state as a whole; the premature mortality rate was at least 10% greater in 2006–2010 than it had been in 1996–2000; or African Americans comprised at least 35% of the population. The online version of Table 3 includes data for all 100 counties.

The 3 counties in which cancer caused the greatest share

of early deaths among nonwhites were Gates, Caswell, and Granville. The 3 counties with the greatest share of premature deaths attributed to heart disease were Surry, Davie, and Rockingham. In 19 counties, African Americans made up 35% or more of the population [23]. In these 19 counties, several causes of death contributed an above-average share of the premature mortality rate for nonwhites: stroke, diabetes, homicide, heart disease, and kidney disease. Surprisingly, these are not the same causes of death that stood out in the analysis of premature mortality for whites.

Stroke caused a disproportionate share of early deaths for nonwhites in 11 of the 19 counties with a high concentration of African Americans. Homicide was responsible for a disproportionate share of early death in 7 of these 19 counties; in Durham and Vance counties, the percentage of premature mortality attributable to homicide was more than double the rate for the state as a whole. Diabetes also contributed a greater share of premature mortality for nonwhites in the counties with large African-American populations; in 12 of these 19 counties, the percentage of premature mortality attributable to diabetes was at least 15% greater than the statewide rate. Finally, the percentage of premature mortality among nonwhites attributable to kidney disease was at least 15% greater than the statewide rate in Cumberland, Durham, Edgecombe, Lenoir, Nash, Vance, and Wilson counties.

Discussion

Although there was substantial improvement in premature mortality in North Carolina over the first decade of the 21st century, the state is far from achieving the premature mortality benchmark set forth in the Robert Wood Johnson Foundation's County Health Rankings and Roadmaps [24]. The target suggested for states is 531.7 YPLL-75/10K, a figure representing a desired level of outcome at the 90th percentile of states. North Carolina's 5-year rate for 2006–2010 was 768.4 YPLL-75/10K, which is almost 45% higher than the target rate. In states that are so far away from the benchmark, perhaps the goal should be to achieve a consistent rate of improvement. In Wisconsin, a baseline of at least 1% improvement per year (a standard developed for Healthy People 2020 goals) was used to evaluate the trend in premature deaths [25]. Over the course of a decade, premature mortality in North Carolina decreased by 13.3%, which would be a rate of improvement of slightly better than 1% per year. For nonwhites, the improvement was twice as great—a reduction of 26.6%—but the baseline rate was 160% higher than the County Health Rankings benchmark, and the rate for nonwhites in North Carolina remained almost twice as high as the rate for whites. Can an improvement of 1% per year be sustained in the future?

It is quite remarkable that the reduction in premature mortality for whites was only 7.2% and that premature mortality among whites actually increased in more than one-third of counties. Cancer and heart disease account for some

TABLE 2 (ABBREVIATED).

Percentage of Premature Mortality Among White North Carolinians Attributable to Various Causes, Statewide and in Selected^a Counties, 2006–2010

Geographic region (race) ^{b,c}	Percentage of years of potential life lost (before age 75 years) attributable to cause									
	Cancer (all types)	Heart disease	Nonvehicular unintentional injuries	Unintentional motor vehicle injuries	Suicide	Homicide	Stroke	COPD	Diabetes	Kidney disease
Statewide (white and nonwhite)	21.2	15.0	7.9	7.6	4.7	3.6	2.8	2.8	2.5	1.4
Statewide (white)	22.8	15.0	9.5	8.2	6.0	2.2	2.4	3.4	2.1	1.0
Alleghany	17.9	21.1**	—	—	—	—	—	4.4**	—	—
Avery	24.8**	15.2	10.7**	—	—	—	—	4.0**	—	—
Bladen	20.0	18.2**	11.2**	10.0**	—	—	1.7	4.9**	—	—
CAMDEN	22.6*	15.5	—	—	—	—	—	—	—	—
Carteret	25.6**	18.1**	11.3**	5.6	5.5**	—	2.5	3.1*	1.6	1.2
Caswell	20.5	19.3**	10.8**	—	—	—	—	—	—	—
Chatham	24.8**	15.0	7.3	10.5**	5.7**	—	2.5	1.7	2.7*	—
Cherokee	21.2	17.5**	12.4**	—	6.3**	—	2.3	3.7**	—	—
Chowan	26.8**	14.9	—	—	—	—	—	—	—	0.0
Columbus	16.2	18.9**	12.3**	11.0**	4.4	—	3.0*	3.5**	1.8	—
CRAVEN	22.3*	13.5	9.1**	5.4	5.8**	—	2.5	3.4**	2.1	1.3
Dare	25.5**	15.7	11.3**	—	6.8**	—	—	1.9	—	—
Davie	24.5**	14.4	10.9**	9.3**	7.6**	—	2.0	2.9	—	—
Edgecombe	25.3**	18.2**	6.5	—	—	—	2.8	3.0*	3.0**	—
Granville	30.6**	12.1	7.8	10.1**	4.3	—	2.9	2.7	2.1	—
Halifax	24.9**	13.9	8.1	—	7.7**	—	3.0*	2.7	4.6**	—
Haywood	23.3*	17.7**	10.5**	6.7	6.0**	—	2.3	2.6	1.9	—
Hertford	30.0**	14.4	—	—	—	—	—	—	—	—
Hyde	29.4**	17.2*	—	—	—	0.0	—	—	—	—
Jackson	25.5**	16.2*	13.5**	—	6.1**	—	1.9	3.1*	—	—
Johnston	23.4*	17.3**	7.3	12.0**	5.4*	3.2	2.7	2.5	1.1	1.5*
Lenoir	22.5*	19.0**	7.4	8.0*	5.1*	—	2.0	3.6**	2.6	—
MARTIN	19.7	20.5**	—	—	—	—	—	3.6**	—	—
Mitchell	21.3	22.7**	13.5**	—	—	—	4.8**	5.1**	—	—
New Hanover	25.5**	12.7	12.2**	5.9	7.4**	1.7	2.8	2.9	1.9	1.0
Northampton	25.1**	16.3*	—	—	—	0.0	—	—	—	—
Orange	26.9**	12.8	7.6	9.0**	8.6**	—	2.3	1.8	1.9	—
PAMLICO	26.7**	10.5	—	—	—	—	—	—	—	—
Pasquotank	23.7*	17.9**	8.7*	—	—	—	2.9	2.7	—	—
Perquimans	31.9**	15.2	—	—	—	0.0	—	—	—	—
PERSON	23.2*	15.6	10.3**	9.6**	4.9	—	2.5	4.9**	3.0**	—
Polk	25.7**	14.6	10.9**	—	—	—	—	3.6**	—	—
RANDOLPH	23.0*	15.3	8.6*	8.1*	6.4**	2.3	2.5	4.3**	2.4	0.9
Rutherford	24.1*	17.4**	12.9**	5.6	5.1*	—	3.1*	4.6**	2.2	1.1
Scotland	24.6**	15.2	7.0	9.5**	—	—	—	4.1**	—	—
STOKES	22.3*	16.0*	9.4**	8.4*	7.1**	—	2.0	4.3**	1.9	—
SWAIN	21.9	17.3**	11.7**	—	—	—	—	—	—	—
TRANSYLVANIA	20.4	13.1	16.2**	8.6*	6.9**	—	—	3.8**	—	—
TYRRELL	21.1	—	—	—	—	0.0	—	—	—	0.0
VANCE	20.9	16.3*	8.9*	8.7*	—	—	2.5	5.1**	—	—
Wake	25.1**	12.5	8.1	8.9**	7.1**	1.7	2.1	2.0	1.5	0.8
WARREN	24.7**	17.0*	—	—	—	—	—	—	—	0.0
Washington	31.6**	18.3**	—	—	—	0.0	—	—	—	—
WILKES	21.0	12.6	15.6**	10.5**	5.4*	—	2.0	3.6**	2.5	—
Wilson	25.6**	14.1	4.8	10.4**	4.9	—	2.1	2.4	3.0**	—
YADKIN	24.1*	12.6	11.8**	8.2*	5.8**	—	2.0	4.3**	2.5	—

Note. COPD, chronic obstructive pulmonary disease.

^aThis table includes counties in which the premature mortality rate for cancer or heart disease is 15% higher than the rate for North Carolina as a whole and counties in which the overall premature mortality rate for whites was at least 10% higher in 2006–2010 than it had been in 1996–2000. An expanded table containing data for all counties is available in the online version of this article.

^bCounties listed in **BOLD CAPS** are those in which the premature mortality rate among whites increased 10% or more between 1996–2000 and 2006–2010.

^cRates for all counties are for whites only.

*The rate of premature mortality among whites in this county for this cause is 5%–14.9% higher than the rate for North Carolina as a whole (white and nonwhite).

**The rate of premature mortality among whites in this county for this cause is at least 15% higher than the rate for North Carolina as a whole (white and nonwhite).

—Data suppressed because fewer than 20 deaths were attributable to this cause.

TABLE 3 (ABBREVIATED).

Percentage of Premature Mortality Among Nonwhite North Carolinians Attributable to Various Causes, Statewide and in Selected^a Counties, 2006–2010

Geographic region (race) ^{b,c}	Percentage of years of potential life lost (before age 75 years) attributable to cause									
	Cancer (all types)	Heart disease	Nonvehicular unintentional injuries	Unintentional motor vehicle injuries	Suicide	Homicide	Stroke	COPD	Diabetes	Kidney disease
Statewide (white and nonwhite)	21.2	15.0	7.9	7.6	4.7	3.6	2.8	2.8	2.5	1.4
Statewide (nonwhite)	17.7	15.2	4.7	6.2	2.0	6.4	3.8	1.7	3.3	2.2
ANSON	18.3	20.3**	—	—	—	—	5.3**	—	4.5**	—
Avery ⁺⁺	—	—	0.0	—	0.0	0.0	0.0	0.0	0.0	—
Beaufort	18.4	19.5**	—	—	—	—	5.2**	—	—	—
BERTIE ⁺⁺	18.8	14.2	—	12.7**	—	—	3.5**	—	4.2**	—
Bladen	14.8	18.4**	—	9.7**	—	—	4.4**	—	—	—
Burke	14.5	19.7**	—	—	—	—	—	—	—	—
Cabarrus	17.1	20.3**	6.1	—	—	7.3**	4.7**	—	2.0	—
Caswell	26.8**	18.0**	—	—	—	—	—	—	—	—
Chatham	16.6	18.2**	—	—	—	—	—	—	—	—
Chowan	22.4*	17.7**	—	—	—	—	—	—	—	—
Clay ⁺⁺	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Columbus	15.9	19.5**	5.0	10.7**	0.0	6.4**	4.3**	—	2.2	2.0**
CUMBERLAND	15.7	14.2	4.8	7.1	2.6	6.8**	3.5**	1.8	3.7**	2.5**
Dare ⁺⁺	—	—	—	—	0.0	0.0	—	—	0.0	0.0
Davie	23.0*	22.8**	—	0.0	—	—	—	—	—	—
DURHAM	18.6	13.6	6.5	3.9	2.1	8.4**	3.4**	1.8	3.5**	2.5**
EDGECOMBE	18.6	16.6*	4.2	6.5	—	5.6**	4.5**	1.2	3.2**	2.8**
Gates	31.2**	15.9*	—	—	—	—	—	—	—	—
Granville	27.2**	16.6*	—	—	—	—	3.1*	—	5.6**	—
GREENE	15.3	13.4	—	—	—	—	—	—	—	—
HALIFAX	18.8	17.6**	3.3	9.6**	—	—	3.9**	1.8	4.5**	1.4
HERTFORD	20.1	12.6	—	—	—	—	4.1**	—	4.7**	—
Johnston	19.3	18.8**	6.7	—	—	—	2.2	—	1.8	—
Jones ⁺⁺	23.3*	14.8	—	—	—	—	—	—	—	—
Lee	12.0	19.4**	—	—	—	12.7**	4.7**	—	—	—
LENOIR	19.9	14.2	5.5	—	—	—	4.2**	2.8	3.6**	2.6**
MARTIN	22.6*	19.2**	—	—	—	—	4.6**	—	—	—
NASH	17.5	17.3**	3.0	4.5	—	7.2**	3.3**	1.8	3.0**	2.5**
NORTHAMPTON	19.6	16.5*	—	11.9**	—	—	—	—	4.4**	—
PASQUOTANK	20.0	17.0*	—	—	—	—	—	—	—	—
Perquimans	16.6	19.5**	—	—	0.0	—	—	—	—	—
Randolph	17.6	18.3**	—	—	—	—	—	—	—	—
Richmond	13.7	19.6**	—	—	—	—	5.6**	—	4.9**	—
Rockingham	19.2	20.7**	5.8	—	—	—	3.9**	3.1*	2.5	—
Rowan	14.6	19.5**	—	—	—	8.1**	3.3**	—	4.3**	3.0**
SCOTLAND	19.7	17.0*	7.8	—	—	9.9**	3.8**	—	3.4**	—
Stanly	15.6	17.6**	—	—	—	—	—	—	—	—
Surry	19.8	22.5**	—	0.0	—	—	—	—	—	—
Swain ⁺⁺	11.6	14.9	—	—	—	—	—	—	—	—
TYRRELL	—	—	0.0	—	—	0.0	—	—	—	0.0
VANCE	17.5	17.8**	6.3	4.8	—	8.2**	2.4	—	2.2	2.2**
WARREN	20.1	15.5	—	14.2**	—	—	—	—	—	—
WASHINGTON	19.1	15.8*	—	—	0.0	—	—	—	—	—
Watauga ⁺⁺	—	—	0.0	0.0	—	0.0	—	—	0.0	0.0
WILSON	20.7	14.4	3.5	6.3	—	5.6**	2.9	1.3	4.4**	2.8**
Yadkin ⁺⁺	—	—	—	—	—	0.0	—	0.0	—	—

Note. COPD, chronic obstructive pulmonary disease.

^aThis table includes counties in which the premature mortality rate for nonwhites for cancer or heart disease is 15% higher than the rate for North Carolina as a whole, counties in which the overall premature mortality rate for nonwhites was at least 10% higher in 2006–2010 than it had been in 1996–2000, and counties in which African Americans comprised at least 35% of the population. An expanded table containing data for all counties is available in the online version of this article.

^bCounties listed in **BOLD CAPS** are those in which at least 35% of the population is comprised of African Americans, based on the 2010 decennial census.

^cRates for all counties are for nonwhites only.

⁺⁺Counties in which the premature mortality rate for nonwhites increased at least 10% between 1996–2000 and 2006–2010.

^{*}The rate of premature mortality among nonwhites in this county for this cause is 5%–14.9% higher than the rate for North Carolina as a whole (white and nonwhite).

^{**}The rate of premature mortality among nonwhites in this county for this cause is at least 15% higher than the rate for North Carolina as a whole (white and nonwhite).

—Data suppressed because fewer than 20 deaths were attributable to this cause.

of the increase in premature mortality among whites. Was the increase due to health behaviors, access to care, or quality of care? Access to preventive services and to timely and appropriate medical care should be investigated in counties with a disproportionate share of premature mortality. In addition, cause-specific culprits of premature mortality were found to include COPD, suicide, nonvehicular unintentional injuries, and motor vehicle crashes. COPD in particular begs for attention. It has become the third leading cause of death in the United States [26], and smoking is the primary cause of COPD [27]. Smoking is also a primary cause of lung cancer [28]. Are smoking rates in these counties not decreasing, or are they not decreasing sufficiently? If so, the public health community should increase efforts to help people quit smoking and should undertake more effective educational campaigns to convince people not to start smoking. Physicians must do a better job of diagnosing COPD and warning patients about the risks of smoking. Public health professionals conducting community health assessments should also focus attention on suicide prevention, injury prevention, and quality of trauma services in counties in which these causes contribute a disproportionate share to premature mortality.

In their community health assessments and interventions, counties with large nonwhite populations should consider focusing on the diseases and traumas that contribute disproportionately to early deaths among the county's population as a whole and among nonwhites in particular. Although programs and services to address heart disease and cancer are important for nonwhites, attention should also be given to stroke, diabetes, and kidney disease—and to the underlying risk factors for these conditions. In addition, programs that address social pathologies that underlie homicide could have a dramatic effect on YPLL, because many homicide victims are young people.

The data presented here are the result of an initial attempt to get more detailed information from the available mortality statistics. The major limitations of this analysis are the definitions of race and ethnicity, the presence of populations that are too small to be analyzed, and the unreliability of the reported underlying cause of death. Death certificates may overreport heart disease as a cause of death [29], and specification of the underlying cause of death becomes more complicated as the number of comorbidities increases. Cause of death is also likely to be less accurate for older individuals with multiple chronic conditions [9]. That is one reason to define YPLL in terms of deaths before age 75 years. However, death certificates are the best data that is consistently gathered that we can use to compare populations. Another limitation is that we have not examined differences between men and women. Kindig and Cheng recently reported that female mortality rose in 42.8% of US counties between 1992 and 2006 [30]; analysis of trends in premature mortality by sex is needed. We are also unable to report time series trends due to space limitations.

Future analyses should look more closely not only at

specific causes of premature mortality but also at the age groups affected by particular causes. Also, although premature mortality is a good summary measure, it does not tell the whole story. Why do we see so much variation in early death among counties with large nonwhite populations? And why has there been so little progress among whites in certain counties?

These data lend support to the suggestion by Olshansky and colleagues that life expectancy may be declining in the United States in the 21st century [31], possibly because of obesity. Is that what we are seeing in North Carolina? Is the decline in overall improvement in premature mortality (and the increase in premature mortality in some counties) the result of obesity and its effect on multiple systemic chronic diseases? If so, is this trend the result of what people eat, how much they eat, sedentary lifestyle, or smoking? Continued and more precise surveillance of mortality and premature mortality by age group, race, and sex is necessary. **NCMJ**

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