

# Comparison of Health Status Indicators in Chicago: Are Black–White Disparities Worsening?

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Healthy People 2000 included 3 overarching goals, 1 of which was to reduce health disparities among different groups of people (e.g., races, genders, ethnicities).<sup>1</sup> Objective 22.1 of Healthy People 2000 also called for the development of a set of health status indicators that would facilitate the evaluation of the pursuit of the Healthy People objectives.<sup>2</sup>

Recently, Keppel et al. at the Centers for Disease Control and Prevention (CDC) issued a report summarizing the nation's progress thus far on 17 health status indicators.<sup>3</sup> This progress toward reducing disparities was examined between 1990 and 1998 for the 5 largest racial/ethnic groups in the United States. Improvement was generally seen for several of the indicators among a majority of the racial/ethnic groups.

On a similar note, Silva et al. published an analysis of Chicago's progress in reducing Black–White disparities that utilized many of these same indicators.<sup>4</sup> Their analysis of 22 different measures found that Black–White disparities (i.e., rate ratios) had increased for 19 of the 22 between 1980 and 1998. Trends at the national level and in Chicago appear contradictory; however, important differences in methodological details and some definitions did not allow direct comparisons. The need for direct comparisons between local and national trends is therefore substantiated.

The purpose of this paper is to examine the progress Chicago is making in reducing racial disparities in health and to compare this with US data trends. Such an activity is notably consistent with one of the stated purposes mentioned in the CDC report, “to facilitate the comparison of health status measures at national, State, and local levels.”<sup>3</sup> In addition, the committee that shaped the details of Objective 22.1 stated that “when possible, states and localities should analyze the indicators for each of the major population groups in their jurisdictions.”<sup>5(p1)</sup>

**Objectives.** This study examined Chicago residents' progress toward the Healthy People 2000 goal of reducing racial disparities in health and compared the results with a recent analysis of US data.

**Methods.** Non-Hispanic Black-to-non-Hispanic White rate ratios were computed for 14 health status indicators for 1990 and for 1998.

**Results.** Nationally and in Chicago, indicators for both Blacks and Whites improved between 1990 and 1998; however, Whites consistently fared better. Nationally, gaps narrowed on 10 indicators; for Chicago, they widened on 10 indicators.

**Conclusions.** Nationally, there is apparent progress in reducing Black–White disparities; this is not true for Chicago. Whether failure to reduce racial disparities is unique to Chicago or is common to other urban centers remains an open question with important implications. (*Am J Public Health.* 2004;94:116–121)

In this analysis we used 14 of the 17 indicators employed by Keppel et al., used the same years (1990 and 1998), and similarly made non-Hispanic Black versus non-Hispanic White comparisons. We hope that such an evaluation will assist Chicago in its pursuit of minimizing and eventually eliminating racial disparities in health.

## METHODS

According to the 2000 census, Chicago is the third largest city in the United States, with almost 3 000 000 people of whom 31% are non-Hispanic White and 36% are non-Hispanic Black.<sup>6</sup>

## Measures

Table 1 presents the 14 indicators employed in this article. In addition to these, Keppel et al. also analyzed work-related death rates, the percentage of children younger than 18 years living in poverty, and the percentage of persons in counties exceeding Environmental Protection Agency air quality standards. Data for the first 2 of these were not locally available, and evaluation of the third would not be relevant to Chicago, which is located in a single county.

All 14 health status indicators were computed for Chicago's Black and White populations for the years 1990 and 1998. These

data were compared with national data for the same indicators and years. Black:White rate ratios were then computed for both Chicago and the United States for both time points to measure the expansion/reduction of racial disparities.

## Measures Employed

The 8 indicators of mortality are age-adjusted using the 1940 US population as the standard and are expressed per 100 000 population (or per 100 000 women for female breast cancer). The corresponding *International Classification of Diseases, Ninth Revision* codes are listed in Table 1. The 1940 US population was used as the standard to make findings comparable to those of Keppel et al.<sup>3</sup> It was also used because it is the recommended standard through 1998. Beginning with 1999 data, the 2000 US population will be implemented as the standard for age-adjusting data.<sup>7</sup>

The infant mortality rate is expressed as the number of deaths among infants (in the first year of life) per 1000 live births. The CDC report employed the linked files of live births and infant deaths for the United States. Because this source was not readily available for Chicago, we employed the number of infant deaths in a given year divided by the number of live births in that same year.

**TABLE 1—Health Status Indicators Employed**

Mortality rates (ICD-9 codes)
Heart disease (390-398, 402, 404-429)
Stroke (430-438)
Lung cancer (162.0)
Female breast cancer (174)
Motor vehicle crash (E810-E825)
Suicide (E950-E959)
Homicide (E960-E978)
Total
Birth-related outcomes
Infant mortality rate
Percentage low-birthweight babies
Percentage of women with no prenatal care in first trimester
Live birth rates for adolescent girls aged 15-17 y
Communicable disease incidence
Tuberculosis
Primary and secondary syphilis

Low-birthweight (<2500 g) babies and women with no prenatal care in the first trimester were expressed as percentages.

Live birth rates for adolescent girls aged 15 to 17 years were expressed per 1000 girls.

The 2 communicable disease incidence rates, tuberculosis and primary and secondary syphilis, were calculated per 100 000 population (unadjusted for age).

Communicable disease data were derived from their respective registries maintained by the Chicago Department of Public Health. All other numerators were abstracted from the vital records (birth and death) files maintained by the Illinois Department of Public Health and provided to us by the Chicago Department of Public Health. Population sizes to be used as denominators for 1998 were calculated by employing exponential interpolation between the 1990 and 2000 Chicago census figures.

### Analysis of Trends

To evaluate Chicago's progress in reducing racial health disparities, non-Hispanic Black:non-Hispanic White rate ratios were compared between 1990 and 1998. For the sake of brevity, non-Hispanic Black will henceforth be referred to as "Black" and non-

Hispanic White as "White." The Black-White disparity is said to be widening if the rate ratio is moving away from 1 (regardless of whether it started out as greater than 1 or less than 1). Conversely, the Black-White disparity is said to be narrowing if the rate ratio is moving closer to 1.

### Statistical Analyses

The US data presented in the CDC report included rates for Blacks and Whites but did not always present the rate ratios or the information needed to test these rate ratios for statistical significance.<sup>3</sup> Statistical tests on these national data are therefore not presented in this article.

The success in reducing disparities during the time interval was evaluated for each individual indicator as well as for the overall trend. To assess the significance of improvement in individual indicators between 1990 and 1998, the 95% confidence intervals of the rate ratios were generated and examined for overlap (Chicago only). A Taylor series expansion was used to generate the 95% confidence intervals for rate ratios (Black:White).<sup>8</sup> A rate ratio was deemed statistically significant if its confidence interval did not include 1. If the confidence intervals for 2 rate ratios did not overlap, the ratios were said to be significantly different from one another, implying that the disparity had either significantly widened or significantly narrowed.

The significance of the overall trend between 1990 and 1998 was examined by calculating the binomial probability of the trend. This method was used to determine the probability that a given number of the rate ratios (among the 14 indicators) would move in the observed direction because of chance. For example, one could determine the probability that the rate ratios for at least 10 of 14 indicators would decrease nationally between 1990 and 1998.

A significance level of 5% was employed for all analyses.

## RESULTS

Table 2 presents information for the United States derived from the Keppel report.<sup>3</sup> Trends for improvement were consistent: all 14 indicators improved for Blacks between 1990

and 1998, whereas all but the percentage of low-birthweight babies improved for Whites. Whites fared better than Blacks on 13 indicators in both 1990 and 1998 (the exception being suicide). The level of disparity, as evidenced by the Black:White rate ratios (which moved closer to 1), narrowed between 1990 and 1998 for 10 indicators and widened for 4 (heart disease, female breast cancer, motor vehicle crashes, and suicide). This overall trend of narrowing disparities was marginally significant ( $P=.09$ , binomial probability for trend). Of the 10 disparities that narrowed, only 4 rate ratios decreased by more than 10% and only 1 by more than 20%. The rate ratios, whether they had increased or decreased, remained rather large. In 1998, 10 of the 14 rate ratios were greater than 1.5, 7 were 2 or greater, and 3 were greater than 5.

Table 3 presents the Chicago data. Consistent with US trends, Blacks improved on all 14 indicators between 1990 and 1998, whereas Whites improved on 13 (percentage low-birthweight babies being the exception). In both 1990 and 1998, Whites fared better than Blacks on 13 of the 14 indicators. Suicide was the only exception to this pattern. Notably, 27 of the 28 rate ratios for both years were statistically significant (with the exception being motor vehicle crash mortality in 1990). The magnitude of disparity evident in the rate ratios remained high in 1998, with 12 being at least 1.5, 7 being greater than 2, and 4 being greater than 5.

Analysis of the Chicago trend reveals narrowing of the Black:White rate ratios between 1990 and 1998 for only 4 of the 14 indicators (Table 3). Specifically, narrowing disparities were seen for suicide, infant mortality, percentage low-birthweight babies, and primary and secondary syphilis. However, only the improvement for primary and secondary syphilis was statistically significant. Although the suicide disparity narrowed, this was the 1 measure for which Blacks fared better than Whites, and therefore a narrowing is not indicative of a relative improvement for the Black population.

The Black:White rate ratios in Chicago widened between 1990 and 1998 for the remaining 10 indicators (Table 3). The magnitudes of several of the increases in disparity were quite alarming: 21% for female breast

**TABLE 2—Health Status Indicators and Rates, by Race and Year, With Associated Black:White Rate Ratios: United States, 1990 and 1998**

Indicator	Year	Blacks	Whites	Black:White Rate Ratio	Percentage Change in Rate Ratio
All-cause mortality <sup>a</sup>	1990	785.2	483.7	1.62	-3.3
	1998	710.7	452.7	1.57	
Heart disease mortality <sup>a</sup>	1990	211.8	145.3	1.46	4.4
	1998	188.0	123.6	1.52	
Stroke mortality <sup>a</sup>	1990	47.8	25.1	1.90	-4.2
	1998	42.5	23.3	1.82	
Lung cancer mortality <sup>a</sup>	1990	50.9	39.8	1.28	-6.1
	1998	46.0	38.3	1.20	
Female breast cancer mortality <sup>b</sup>	1990	27.3	23.0	1.19	17.6
	1998	26.1	18.7	1.40	
Motor vehicle crash mortality <sup>a</sup>	1990	18.3	18.1	1.01	8.4
	1998	17.2	15.7	1.10	
Suicide mortality <sup>a</sup>	1990	7.0	12.5	0.56	-7.7
	1998	6.1	11.8	0.52	
Homicide mortality <sup>a</sup>	1990	39.6	4.1	9.66	-15.6
	1998	26.1	3.2	8.16	
Infant mortality rate <sup>c</sup>	1990	16.9	7.2	2.35	-1.3
	1998	13.9	6.0	2.32	
Low-birthweight babies, %	1990	13.3	5.6	2.38	-15.8
	1998	13.2	6.6	2.00	
No prenatal care, first trimester, %	1990	39.3	16.7	2.35	-6.2
	1998	26.7	12.1	2.21	
Birth rate (aged 15-17 y) <sup>d</sup>	1990	84.9	23.2	3.66	-12.7
	1998	58.8	18.4	3.20	
Tuberculosis case rate <sup>e</sup>	1990	33.0	4.2	7.86	-1.5
	1998	17.8	2.3	7.74	
Primary and secondary syphilis case rate <sup>e</sup>	1990	141.9	2.6	54.58	-38.1
	1998	16.9	0.5	33.80	

<sup>a</sup>Age-adjusted and expressed per 100 000 population.<sup>b</sup>Age-adjusted and expressed per 100 000 women.<sup>c</sup>Number of deaths among infants (in the first year of life) per 1000 live births.<sup>d</sup>Expressed per 1000 adolescent girls aged 15-17 y.<sup>e</sup>Expressed per 100 000 population (unadjusted for age).

cancer mortality, 70% for motor vehicle crash mortality, and 39% for tuberculosis. Of the 10 disparities that widened, 5 did so by more than 20%. Examination of the 95% confidence intervals reveals that the widening of the rate ratios was statistically significant for 3 of the indicators: all-cause mortality, the proportion with no prenatal care in the first trimester, and motor vehicle crash mortality. Although the changes in the rate ratios for the remaining 7 individual indicators were not statistically significant on their own, the overall trend of widening disparities was marginally significant ( $P<.09$ ).

## DISCUSSION

Although a recent report intended to help monitor progress toward the Healthy People 2000 goal of reducing health disparities concluded that the majority of racial health disparities in the indicators had declined nationally between 1990-1998,<sup>3</sup> the current analysis (which focused specifically on Black-White disparities) found no evidence of a similar decline occurring in Chicago. Whereas 10 of the 14 Black-White disparities narrowed in the United States, 10 widened in Chicago. Both trends were marginally statistically significant ( $P=.09$ ). Although data were not available that would allow us to test the individual national disparities for significance, we were able to do this for Chicago. Three of these disparities widened by a statistically significant amount: all-cause mortality, the percentage with no prenatal care in the first trimester, and motor vehicle crash mortality. This evidence certainly suggests that the Healthy People 2000 goal of reducing health disparities was not achieved in Chicago.

In examining these results, it is important to keep in mind the caveats associated with defining disparities as either "widening" or "narrowing." For example, in Chicago the disparity associated with suicide was said to be narrowing over the time interval because it moved closer to 1. However, suicide was the only health status indicator for which Blacks fared better than Whites in both 1990 and 1998. Therefore, a narrowing rate ratio means that a rate ratio that started off less than 1 grew closer to 1. This result was produced because the degree of improvement in the White

**TABLE 3—Health Status Indicators, by Race and Year, With Associated Black:White Rate Ratios and 95% Confidence Intervals (CIs): Chicago, 1990 and 1998**

Indicator	Year	Blacks	Whites	Black:White Rate Ratio (95% CIs)	Percentage Change in Rate Ratio
All-cause mortality <sup>a</sup>	1990	946.6	614.7	1.54 (1.50, 1.58)	6.3
	1998	827.2	505.7	1.64 (1.59, 1.69)	
Heart disease mortality <sup>a</sup>	1990	247.6	196.0	1.26 (1.20, 1.33)	5.9
	1998	212.0	158.4	1.34 (1.27, 1.41)	
Stroke mortality <sup>a</sup>	1990	45.2	27.0	1.67 (1.49, 1.88)	8.4
	1998	40.0	22.0	1.82 (1.60, 2.06)	
Lung cancer mortality <sup>a</sup>	1990	60.4	42.8	1.41 (1.27, 1.57)	6.5
	1998	56.1	37.4	1.50 (1.34, 1.68)	
Female breast cancer mortality <sup>b</sup>	1990	32.0	25.2	1.27 (1.04, 1.55)	20.8
	1998	28.6	18.6	1.54 (1.23, 1.91)	
Motor vehicle crash mortality <sup>a</sup>	1990	15.5	15.0	1.03 (0.82, 1.30)	69.7
	1998	14.9	8.5	1.76 (1.33, 2.32)	
Suicide mortality <sup>a</sup>	1990	8.1	13.1	0.61 (0.47, 0.80)	12.9
	1998	6.8	9.8	0.69 (0.51, 0.94)	
Homicide mortality <sup>a</sup>	1990	64.9	7.5	8.63 (6.69, 11.12)	18.9
	1998	55.3	5.4	10.25 (7.63, 13.78)	
Infant mortality rate <sup>c</sup>	1990	23.3	7.6	3.05 (2.50, 3.73)	-21.0
	1998	16.5	6.9	2.41 (1.88, 3.09)	
Low, birthweight babies, %	1990	15.4	6.4	2.41 (2.25, 2.58)	-7.9
	1998	15.3	6.9	2.22 (2.05, 2.39)	
No prenatal care, first trimester, %	1990	38.3	17.5	2.19 (2.11, 2.28)	23.2
	1998	31.0	11.5	2.70 (2.55, 2.85)	
Birth rate (aged 15-17 y) <sup>d</sup>	1990	117.0	27.1	4.32 (3.86, 4.84)	23.1
	1998	91.2	17.1	5.32 (4.57, 6.20)	
Tuberculosis case rate <sup>e</sup>	1990	35.7	8.7	4.11 (3.27, 5.16)	38.9
	1998	28.1	4.9	5.70 (4.19, 7.76)	
Primary and secondary syphilis case rate <sup>e</sup>	1990	133.0	4.5	29.32 (21.99, 39.08)	-72.1
	1998	20.6	2.5	8.19 (5.37, 12.48)	

<sup>a</sup>Age, adjusted and expressed per 100 000 population.<sup>b</sup>Age, adjusted and expressed per 100 000 women.<sup>c</sup>Number of deaths among infants (in the first year of life) per 1000 live births.<sup>d</sup>Expressed per 1000 adolescent girls aged 15-17 y.<sup>e</sup>Expressed per 100 000 population (unadjusted for age).

rate was greater than the degree of improvement in the Black rate. Therefore, in the case of suicide, a narrowing is not suggestive of a relative improvement for the Black population. It is thus the case that 11 of 14 disparities worsened, a trend which is statistically significant ( $P=.029$ ).

Certain methodological issues need to be kept in mind when analyzing vital statistics data sets. First, there is likely to be some miscoding of race and ethnicity on both birth and death certificates,<sup>9</sup> but the magnitude of miscoding described in previous reports has been very small (<1%) for Blacks and Whites in a national sample.<sup>10</sup> It is likely that some people of Hispanic origin were misclassified into 1 of the 2 groups studied, primarily into the White group. As part of a recent publication examining disparities in Chicago, Silva et al. reported on the differences in age-adjusted all-cause mortality rates between non-Hispanic Whites and all Whites (Hispanic and non-Hispanic).<sup>4</sup> The age-adjusted rates for the 2 groups were found to differ by no more than 5% between 1989 and 1998. We are therefore confident that any misclassification would not have had a significant impact on our results.

It is also well established that poor residents of urban areas are undercounted by the census, perhaps by about 5%.<sup>11</sup> If the undercount were corrected, this would have the effect of improving the indicators for Blacks, perhaps by about 5% and thus decreasing the absolute size of the Black-White disparities. However, because the essence of the analysis in this report is the changing nature of disparities over a 9-year interval, it would be unlikely that the conclusions would be affected by either misclassification or undercount, because there is no reason to suspect that these would change over this interval.

For similar reasons, miscoding that may occur regarding the cause of death or birth-related outcomes (e.g., prenatal care in the first trimester) is also unlikely to alter the comparisons presented here. As noted in the Methods section, the infant mortality rate was calculated differently for the United States (where linked birth-death files were used) and Chicago (where such files were not readily available for these years). However, it is once again unlikely that this difference in calcula-

tion would account for the substantial difference in comparisons between 1990 and 1998 within Chicago and comparisons between 1990 and 1998 within the United States.

It is known that sexually transmitted disease reporting tends to be incomplete and biased.<sup>12</sup> Generally, cases among patients attending public sector clinics are more likely to be reported, and the population attending public sector clinics often differs in its racial/ethnic distribution from that of private sector clinics. As a result, it is likely that rates used for primary and secondary syphilis are understated for the White population. The effect would be a magnified rate ratio. However, there is no reason to suspect that such biases in reporting have changed over the time interval, and therefore it is not likely that the overall conclusions related to the trend would change if this bias were somehow corrected.

The 2000 Chicago population consisted of 907 000 White, 1 053 000 Black, and 754 000 Hispanic people. Because Chicago has a large Hispanic population, we analyzed Hispanic–White disparities as well. However, the data (not shown) did not reveal any noticeable trends. The Hispanic–White rate ratios were sometimes less than 1 and sometimes greater than 1. Sometimes the disparities increased or decreased slightly. Ultimately, the entire issue of measures of Hispanic health is intertwined in the “Hispanic health paradox.”<sup>13</sup> This paradox arises because a group of people who are generally poor nonetheless exhibits very good measures of health. To what extent these measures of Hispanic health reflect reality and to what extent they are due to deficits in data collection is still being actively discussed.<sup>14,15</sup>

For these reasons, this analysis did not present Hispanic data.

The implications of these changes in disparities may be better understood with an example using all-cause mortality. Nationally, the Black:White all-cause mortality rate ratio decreased by 3.3% over this 9-year interval (Table 2). This may be seen (roughly, due to some notable methodological considerations) as an annual decrease of 0.37%. If this level of decrease were to continue, the 1998 rate ratio of 1.57 would be reduced to equality (1.00) in 127 years. (Recall that most of 1998 US rate ratios were larger than 1.5.) In Chi-

cago the change in the all-cause mortality rate ratio was similar (6.3% between 1990 and 1998) but instead was in the opposite direction. In other words, disparities were in fact increasing. In this report we have been responding to the call of Healthy People 2000 to *reduce* disparities. But at the same time it is essential to keep in mind that the call of Healthy People 2010 is to *eliminate* these disparities.<sup>16</sup> If current trends were to continue, the 2010 goal would certainly not be reached, in either Chicago or the United States.

Other research has, of course, investigated disparities like those analyzed in this report, but there have been some differences in race/ethnicity categories, geography, and time. For example, Silva et al. found increasing Black–White disparities in Chicago between 1980 and 1998 on 19 of 22 measures.<sup>4</sup> Williams, in separate reports, found increasing Black–White disparities in infant mortality and life expectancy between 1980 and 1991<sup>17</sup> and in almost every one of the leading causes of death between 1950 and 1995<sup>18</sup> in the United States. Pappas et al. reported growing Black–White disparity in all-cause mortality rates between 1960 and 1986 for the United States.<sup>19</sup> Similarly, Geronimus located increasing Black–White disparities between 1980 and 1990 in age-standardized annual excess death rates in the United States.<sup>20</sup> A recently published analysis has predicted that US Black–White disparities in life expectancy will never be eliminated if trends operative between 1945 and 1999 continue unchanged.<sup>21</sup> Finally, a recent analysis of US natality files from 1981 to 1998 revealed reductions in Black–White disparities related to the timing and quality of prenatal care received.<sup>22</sup> This is consistent with the results of the analysis of national data here presented, which revealed a reduction in disparity of 6.2% in the lack of receipt of prenatal care in the first trimester. However, for Chicago this disparity increased significantly from a rate ratio of 2.19 to one of 2.70 (or 23%).

The CDC report by Keppel et al. is the first we have been able to locate that shows declining Black–White disparities for many measures for the United States. This uniqueness is likely due to the use of recent data (only starting in 1990 and going through 1998). Nevertheless, it is encouraging that racial disparities

in more recent years are finally decreasing at the national level, even if only by a little. However, the situation for Chicago is very different. The evidence suggesting that disparities for most of the indicators, and several other measures as well, have at the least not been improving and may have even been worsening for almost 20 years<sup>4</sup> is quite sobering, to say the least.<sup>23</sup> Whether the lack of decline and potential widening of disparities in Chicago is a unique phenomenon or is common to other US urban centers is an important question. The answer will have implications for improving the health of all people in the United States and eventually narrowing and then eliminating disparities in health. Large urban centers, where there is generally substantial racial and ethnic diversity, are no doubt important venues for such efforts.

A report in the Healthy People 2000 series entitled *Health Status Indicator Reports: State of the Art* notes: “Since the Health Status Indicators are intended for use at the local level, some States have published data for local areas (county, region, or health department district).”<sup>24</sup> In a listing of such local area analyses, none were for cities. The development and distribution of health status indicator data as a way of evaluating the Healthy People objectives is valuable. Much, however, can be added by performing such evaluations at the city level. We look forward to additional such analyses. ■

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#### Contributors

H. Margellos analyzed the data and contributed to the writing of the paper. A. Silva assisted with the analysis and writing. S. Whitman conceived the idea for the paper and contributed to the analysis and writing. All authors helped to conceptualize ideas, interpret findings, and review drafts of the manuscript.

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### Human Participant Protection

This was an analysis of anonymous vital statistics records and was therefore exempt from institutional review board review.

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