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ABSTRACT
Background: Wisconsin has a goal to eliminate health disparities by 2010, but there is no consistent standard used to evaluate progress. Methodological debates persist regarding using individual group change or relative comparisons to monitor disparities.

Objectives: To examine mortality disparities among racial/ethnic populations in Wisconsin using statistically significant changes in individual population mortality rates and rate ratios as measures of disparity. These measures are proposed to monitor and evaluate progress in eliminating racial/ethnic health disparities.

Methods: The Wisconsin Interactive Statistics on Health database was queried to obtain Wisconsin all-cause mortality data by race and age for the 1991-1995 and 1996-2000 periods. Age-specific and age-adjusted rates were compared across 5 major racial/ethnic populations in Wisconsin.

Results: Age-adjusted mortality generally declined for all racial/ethnic populations in Wisconsin from 1991-1995 to 1996-2000. However, disparities increased significantly for African American infants, African Americans 45-64 years old, and Hispanics/Latinos 25-44 years old. Using non-Hispanic whites as a referent resulted in a paradoxical increase in disparities for Hispanics/Latinos despite a significant reduction in mortality in this group.

Conclusion: A statistically significant percent change in mortality rates and rate ratios is a useful standard to monitor health disparities and foster communication and targeted action around Wisconsin’s goal to eliminate racial/ethnic health disparities.

INTRODUCTION
Wisconsin’s state health plan, Healthiest Wisconsin 2010, established a goal to eliminate health disparities (including racial/ethnic health disparities) by 2010, but the plan does not include a standard measure of disparities to evaluate progress toward this goal. Monitoring racial/ethnic health disparities is further challenged by lack of state or national consensus for reporting measures of disparities and comparing disparities across populations. The reconceptualization of race, ethnicity, and minority status in the United States and the impact that such reframing will have on monitoring health disparities and setting priorities are emerging issues in public health and public policy.

Conceptual Considerations
Health disparities are “…differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United States.” Conceptually, health disparities embrace economic and social inequities and do not refer solely to medical health outcomes. Health disparities also have moral implications when they are framed as inequities. Disparities can also refer
to non-specific conceptualizations of ‘poor health’ in
groups that have experienced disparate health status re-
lated to persistent social and economic inequalities. In
the United States, populations with a history of racial
and ethnic subjugation are profoundly affected. These
populations include African Americans, American
Indians, Asians, and Hispanics/Latinos.

Although health disparities normatively refer to racial
and ethnic populations, the attribution of health dispari-
ties to other distinct groups is occurring with increasing
frequency. Accordingly, groups that experience health
differences related to gender, disability status, geographic
residence, or sexual orientation have also been the focus
of health disparity elimination objectives.1,4 The plural-
ization of the health disparities agenda to encompass
multiple population and subpopulation groups raises
questions about the impending focus of health disparities
policy and resources. Our present discussion, however,
centers on methodological concerns with respect to mea-
suring disparities in racial/ethnic groups.

Methodological Considerations
A quantitative definition of a health disparity is “…the
quantity that separates a group from a specified reference
point on a particular measure of health that is expressed
in terms of a rate, percentage, mean, or some other
quantitative measure.”5 Keppel, Pearcy, and Wagener
of the Centers for Disease Control and Prevention pro-
posed an “index of disparity” as a summary measure
of disparities for 17 health status indicators included in
Healthy People 2000.6 The index of disparity calculated
the national average of minority group rates combined
as a percentage of the US total population rate. The in-
vestigators also compared annual rates for each racial/
ethnic group and reported rate ratios comparing the
highest to the lowest population rate for each indica-
tor—or a “best to worst” group comparison.

A limitation of the methods proposed by Keppel
and colleagues is the inability to consistently track
improvements or worsening of disparities for specific
racial/ethnic populations. The practice of comparing
minority population rates with total population rates
results in non-independent comparisons of rates that
can artificially attenuate the disparity gap for dispa-
rately-burdened minority populations or widen the gap
for minority populations that may have more favorable
documented health outcomes than the majority racial
population. Using the rate ratio as a gold standard mea-
sure of disparities also becomes flawed in the absence
of a consistent reference population, which makes it
difficult to track disparities in specific populations. It is
generally recommended when monitoring racial/ethnic
populations that a comparison population be explicit-
ly-stated and differences acknowledged both within
and across populations.5,7 Failure to do so can obscure
important information needed for identifying priority
populations with disparate health status and justifying
decisions regarding monitoring disparities and report-
ing data.3

This paper proposes simple measures to monitor
Wisconsin’s progress in eliminating racial/ethnic health
disparities. The rate ratio—comparing the individual ra-
cial/ethnic minority group rate to the Wisconsin white
population rate—is recommended as a standard measure
of disparity in Wisconsin. Consistent with the justifica-
tion provided by several methodologists3,5,7 and adopted
in the 2004 Wisconsin Minority Health Report,8 this
standard is proposed because the white population pro-
vides a statistically stable reference group, and using the
total population rate to compare with minority popula-
tion rates can minimize disparities. We also recommend
that both absolute and relative measures of disparity be
used. Accordingly, we propose that statistically signifi-
cant percent changes in individual population mortal-
ity rates and the mortality rate ratios over 2 consecu-
tive 5-year periods be accepted as minimum standards
for monitoring racial and ethnic health disparities in
Wisconsin.

METHODS
The Wisconsin Interactive Statistics on Health (WISH)
query system was used to obtain Wisconsin all-cause
mortality by race and age for the 1991-1995 and 1996-
2000 periods. Mortality was aggregated over 5 years
to increase the reliability of data collected on minority
populations that are small compared to the white popu-
lation. Data were requested separately for non-Hispanic
black, non-Hispanic American Indian, non-Hispanic
Asian, and non-Hispanic white racial groups and for
Hispanic/Latino ethnicity. Racial and ethnic groups
were designated according to the federal minimum stan-
dards for collection of data on race and ethnicity.9

Seven age intervals were selected for analysis: <1 year,
1-14 years, 15-24 years, 25-44 years, 45-64 years, 65-74
years, and ≥75 years. The denominator population for
each racial/ethnic and age-group combination was ob-
tained from bridged-race population estimates from the
National Center for Health Statistics.10

Age-specific mortality rates were calculated for each
racial/ethnic group, stratified by the 7 age intervals. In
addition, overall age-adjusted mortality rates were cal-
culated for each racial/ethnic group using the year 2000
US population standard. All mortality rates were reported as deaths per 100,000 population except for the infant mortality rates, which were presented as infant deaths per 1000 live births.

The summary measure of disparity used was the rate ratio that was computed by dividing the mortality rate in a minority population by the mortality rate in the non-Hispanic white population. Also, the percent changes in mortality rates and rate ratios between 1991-1995 and 1996-2000 were computed for each racial/ethnic group. The Chi-square test was used to test for statistically significant differences in mortality between a racial/ethnic population and the white population, and the Breslow-Day statistic was used to evaluate the significance of changes in the rate ratios between the 2 5-year periods. Cross-tabulations and statistical analyses in the current study were performed with Microsoft Excel and SAS statistical software packages.

RESULTS

Age-Adjusted Findings

Age-adjusted mortality from all causes generally declined for racial/ethnic populations in Wisconsin from 1991-1995 to 1996-2000 (see Table 1). The age-adjusted mortality rate decreased 2.7% for African Americans, 5.1% for American Indians, and 11.8% for Hispanics/Latinos. Mortality declined 2.9% for Asians and 2.7% for non-Hispanic whites, but these changes were not statistically significant.

Age-Specific Findings

Age-specific rates in each population showed more substantial declines (see Table 1). The largest magnitude decline in the mortality rate across the 2 5-year periods was 46% for American Indians age 1-14 years. Mortality declined 33% for Hispanics/Latinos age 25-44 years and 20% for Hispanics/Latinos age 45-64 years. African Americans aged 15-24 showed a 20% decline in mortality. Mortality declined 23% for Asians aged 1-14 years, but this was not statistically significant (Figure 1). There were no statistically significant increases or decreases in the mortality rates for non-Hispanic whites in Wisconsin from 1991-1995 to 1996-2000, although there was a downward trend for most age groups in this population.

Disparity Trends

Except in the African American and Hispanic/Latino populations, there was no statistically significant narrowing or widening of the mortality rate ratios between minority racial/ethnic groups and the non-Hispanic white population from 1991-1995 to 1996-2000 (see

Table 1. Mortality Rates by Race and Age, Wisconsin, 1991-2000

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African American (non-Hispanic)

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White (non-Hispanic)

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* Rates are per 100,000 population; the infant rate is per 1000 live births.
† Age-adjusted to the 2000 US standard population.
‡ P<.05
Table 2). The largest positive increase in the disparity ratio occurred in African American infants. The ratio increased 22% across the 2 periods—from 2.3 during 1991-1995 to 2.9 during 1996-2000. Also, disparities increased 7% for blacks aged 45-64 years and decreased 15% for blacks aged 15-24 years.

From 1991-1995 to 1996-2000, mortality among Hispanics/Latinos 25-44 years declined 33%—a significant decrease relative to non-Hispanic whites of that same age. The reduction in mortality among Hispanics/Latinos increased the rate ratio by 34%, but this widening disparity resulted from the rate ratio moving further from “1” on the negative axis. Among American Indians 1-14 years, the rate ratio declined 38%, but this was not statistically significant. For Asians, the percent change in the disparity ratio in different age groups ranged from <1% to 33%. However, none of these changes were statistically significant (Figure 2).

**Summary**

In summary, a statistically significant percent change standard for the mortality rate and/or rate ratio can be used to monitor group-specific and age-specific trends in mortality and disparities for racial/ethnic populations in Wisconsin. From 1991-2000, mortality rates and disparities decreased dramatically for African American teens and young adults, but showed negligible change among middle age and elderly blacks. The disparity ratio between African American and white infants increased 22% over the time period. For American Indians, the most significant change occurred in the 1-14 age group, with a 46% decline in mortality.

Consistent with past trends, mortality among Asians remained significantly less than non-Hispanic whites. However, the percent changes over time in the mortality rates and rate ratios for Asians did not attain statistical significance. Similarly, overall and age-specific mortality was lower among Hispanics/Latinos than non-Hispanic whites. The disparity ratio must be interpreted cautiously for Asian and Hispanic/Latino populations. Both populations have declining mortality, but show increasing disparities when non-Hispanic whites are used as the reference group.

**DISCUSSION**

In contrast to a previous study in the *Wisconsin Medical Journal* that found a general increase in minority population mortality rates and rate ratios during 1980-2000, the present study shows an opposite trend of an overall reduction in minority group mortality and narrowing of the mortality gap for many age groups—although with limited statistical significance. Disparities did increase significantly for African American infants (22%) and African Americans 45-64 years (7%). The 34% increase in the disparity ratio for Hispanics/Latinos 25-44 years was due to a significant decline in the Hispanic/Latino mortality rates relative to non-Hispanic whites.

Further investigation is warranted to help explain what factors contributed to specific mortality changes in respective groups and develop policies and programs to reverse negative trends or buttress favorable changes. For example, the significant decrease in mortality and the disparity ratio among African Americans ages 15-24 may be associated with reductions in unintentional injuries and homicides—the leading causes of death for black males and females in this age group. Low birthweight is a known risk factor contributing to black infant mortality that has not improved over the study periods. The increasing disparities for black infants should sound an alarm for maternal-child health advocates to expand evidence-based programs that address fundamental causes and comprehensive, community-centered approaches to improve family and community health and not solely address the individual health of mothers and infants. The 46% decline in mortality for American
Racial and ethnic health disparities are associated with a myriad of individual, socioeconomic, environmental, and health care factors. However, we did not access individual-level or neighborhood-level demographic, economic, or other health-related data for the current study, and therefore we are limited from confidently attributing related factors or causes for the observed mortality group disparities and trends. Socioeconomic status is a compelling, but inconclusive reason for the noted disparities. Racial discrimination has also been highlighted as a fundamental cause of health disparities linked to multiple outcomes through multiple pathways. Nonetheless, one must be cautious to infer links between ecologic indicators (e.g., neighborhood income, civil rights laws) and mortality trends for the diverse populations and brief period under study. Unequal treatment in health care is a documented cause of health care disparities for which medical professionals can make positive contributions to reversing unintentional patient-professional biases or institutional regulations that harm health. Overall, interdisciplinary approaches that address both proximal health outcomes and distal factors in the social and economic environment appear most likely to facilitate understanding and resolution of health disparities.

**Implications for Public Health and Medical Practice**

Health disparities command significant interest in public health, public policy, and medical circles, but the issues are complex and the data are often inconsistent and misinterpreted. This paper proposes simple statistical methods using percent changes in rates and rate ratios to assess progress in eliminating racial/ethnic health disparities over 5-year intervals. The emphasis on statistical significance in this paper provides a scientific standard for reporting and monitoring health disparities that can influence community health assessment, intervention, research, and policy activities in Wisconsin and improve communication around minority health. However, non-significant changes in rates or rate ratios may still have relevant implications for health practitioners, policymakers, and communities most impacted by the burden of disparities. Based on prior experiences, we suggest a minimum 5% change in the rate or rate ratio for any population or age group as a meaningful finding, regardless of statistical significance.

**CONCLUSION**

This study helps to fill a gap for more empirical findings on racial/ethnic mortality disparity trends in Wisconsin.

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**Table 2. Mortality Rate Ratios by Race and Age, Wisconsin, 1991-1995 to 1996-2000**

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* The rate ratio is the minority group rate divided by the white population rate. Rates are per 100,000 population; the infant rate is per 1000 live births.
† Age-adjusted to the 2000 US standard population.
‡ P<.05

Indians ages 1-14 may be related to reductions in unintentional injuries, which was the leading cause of death in this age group. Although no statistically significant mortality changes were observed among Asians, aggregated data obscure health status trends that may be different within the Hmong population. These hypotheses are speculative, and further studies are welcomed to investigate relative similarities and differences in mortality and morbidity trends in the 2001-2004 period and beyond.
Results of the decade-long period under study may serve as a baseline for the goal to eliminate disparities for racial and ethnic populations in Wisconsin by 2010, and the proposed methods may be used to estimate progress. We have highlighted specific populations where the disparities are observed to be increasing or decreasing and provided direction to practitioners and researchers for more detailed study to understand underlying causes of mortality. Retroactive and longitudinal monitoring of mortality and other health indicators is encouraged to elicit more informed perspectives about health disparities in Wisconsin. Proactive attempts should also be made to reinforce positive contributing factors and galvanize community support around positive health trends.

Government, health care, and community institutions can assist in the goal to eliminate racial and ethnic health disparities by producing sound racial/ethnic-specific data that reflect diverse segments of the population. Acceptance of standardized disparity measures and improved availability and accessibility of data can help minority health advocates move beyond discussions of basic surveillance issues and focus more substantive attention on intervention research and programs to reduce and ultimately eliminate racial/ethnic health disparities in Wisconsin.

ACKNOWLEDGMENTS
The authors gratefully acknowledge the anonymous reviewers for their suggestions and Dr. Peggy Hatfield for her editorial assistance.

REFERENCES
10. United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS). Bridged-Race Population Estimates, United States, 1990-2002, by Age Groups. Compiled from the April 1, 2000 resident population developed by the Bureau of the Census in collaboration with the NCHS on CDC WONDER on-line Database.
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