

Health Disparities in Milwaukee by Socioeconomic Status

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ABSTRACT

Background: In 2006, the city of Milwaukee ranked worse than any Wisconsin county for health outcomes and worse than all but 1 county for health determinants.

Methods: To further examine disparities in health, Milwaukee city ZIP codes were stratified into 3 groups (lower, middle, and upper) by socioeconomic status (SES). Health determinants (15 measures) and health outcomes (2 measures) were compared across these ZIP code groups, and to the rest of Wisconsin.

Results: The risk ratio for the lower SES group in comparison to the upper SES group was at least 2.0 for 5 of the 17 measures examined, and was at least 1.5 for 13 of the 17 measures. The upper SES group in Milwaukee, while the healthiest in the city, was worse than the state average in 6 measures.

Conclusions: Large health disparities within the city of Milwaukee are associated with geographic regions of differing socioeconomic status. As the state's largest urban center, Milwaukee's relatively poor health and significant health disparities have a considerable impact on the overall health of the state. To improve population health in Wisconsin, substantial efforts and resources are needed to address these disparities, and their related upstream factors.

INTRODUCTION

Of all 72 Wisconsin counties, Milwaukee County is the most populous; likewise, the city of Milwaukee is the

state's largest city. The 29 ZIP (postal) codes wholly or partially contained within the city of Milwaukee represent approximately 800,000—over 15%—of the state's 5.4 million citizens. The University of Wisconsin Population Health Institute publishes the *Wisconsin County Health Rankings* every year, in part “to summarize the current state of health and distribution of key factors that determine future health.”¹ In 2006, the city of Milwaukee ranked worse than all 72 Wisconsin counties in overall health outcomes, and worse than all but 1 county in health determinants, or risk factors for future health.¹

While some information is available for comparing Milwaukee's health outcomes and health determinants with the rest of the state, little is known about disparities that may exist within the city itself. This analysis examines disparities in health outcomes and health determinants between different areas of the city, as defined by socioeconomic status (SES). In addition, to stimulate further discussion of public health needs and statewide resource distribution, it provides the relative rankings of health outcome and health determinant measures for Milwaukee city as compared to Milwaukee County and other Wisconsin counties.

METHODS

Data and indicators regarding sociodemographic characteristics, health outcomes, and health determinants were retrieved from various existing public health datasets for all 29 ZIP codes wholly or partially contained by the city of Milwaukee. Individual ZIP codes were grouped into upper, middle, and lower tertiles based on a socioeconomic status (SES) index. This index was created by averaging together all collected data at the SES group (tertile) level for each specific health measure to obtain the group-level estimate. This methodology was modeled after a study by Mustard and Frohlich examining the effect of socioeconomic status on population health.⁴

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Socioeconomic Status Index

Income and education data from the 2000 Census² were obtained at the ZIP code tabulation area (ZCTA) level.³ To stratify the Milwaukee ZIP codes by SES into 3 groups, we used an SES index composed of 2 equally-weighted components: the median reported income in the ZIP code (the income component), and the percentage of people with a bachelor's degree in the ZIP code (the educational component). The average and standard deviation of educational level and income across all the ZIP codes were calculated, and a z-score was assigned to each ZIP code by taking the value for the ZIP code minus the average across all the ZIP codes, divided by the standard deviation across all the ZIP codes. Each z-score (for education and for income) was then averaged into 1 score. ZIP codes were ranked and grouped based on this summary index.

Measures of Health Outcomes

Data on health outcomes were obtained from several different sources, building on the model utilized in the *Wisconsin County Health Rankings*. The 2 health outcomes measures we used in this report were overall self-reported health status and infant mortality. Self-reported health status was measured as the percentage of people reporting fair or poor health, a well-accepted measure of morbidity and future mortality,⁵ and was obtained by combining 2002-2005 data obtained from the Behavioral Risk Factor Surveillance System (BRFSS) with 2000-2004 data from the Family Health Survey (FHS). The individual measures from each respective survey were averaged together using population weights provided by the survey data. Both surveys were used in order to increase sample sizes for the ZIP codes, and the wording of the question used in both surveys was identical. Infant mortality data for children <1 year old by ZIP code and county from 1994 to 2004 were obtained from the Wisconsin Interactive Statistics on Health (WISH) database's Infant Mortality module.

Measures of Health Determinants

Also following the model used in the *Wisconsin County Health Rankings*, data for the study ZIP codes were collected on 2 different categories of health determinants, or risk factors that affect future health: measures of *health care*, and measures of *health behaviors*.

Measures of health care included the proportion of people with no health insurance, people with no recent dentist visit, people who did not receive needed medical care, women ages 65-74 who did not have a biennial mammography within the last 2 years, and diabetics who did not receive recommended diabetic

care. Estimates of diabetic quality of care included the percentage of diabetics who did not receive a recommended eye exam, did not receive a recommended lipid profile, and did not receive a recommended HbA1c test. Self-reported data regarding the prevalence of having no health insurance, no recent dentist visit, and not having received needed medical care were obtained from the Family Health Survey (FHS), using data from 2000 to 2004. Diabetic and mammography-related measures were obtained from Metastar, Inc., which provided data from the Centers for Medicare and Medicaid Services (CMS) on Medicare claims of patients aged 65-74 from 2002 to 2005.

Measures of health behaviors in this report included rates of cigarette smoking, smoking during pregnancy, inadequate fruit and vegetable consumption (defined as consuming <5 servings of fruits or vegetables a day), physical inactivity (defined as <30 minutes per day of moderate physical activity for 5 or more days a week, or <20 minutes per day of vigorous physical activity for 3 or more days a week), obesity (defined as a BMI ≥ 30), binge drinking (defined as having 5 or more drinks in 1 sitting), motor vehicle crash deaths, and sexually transmitted diseases (STDs). We classified motor vehicle crash deaths and STDs as health behaviors rather than health outcomes in order to be consistent with the *Wisconsin County Health Rankings* methodology, which classifies motor vehicle crash deaths and STDs as health behaviors. (While it can be argued that measures such as motor vehicle crash deaths and STDs are health *outcomes*, rather than health *behaviors*, the *Wisconsin County Health Rankings* views motor vehicle deaths and STDs as proxies of risky health behaviors—in this case, drinking and driving, and high risk sexual behavior.) Estimates for cigarette smoking, inadequate fruit and vegetable consumption, physical inactivity, and obesity were obtained from the BRFSS, using self-report survey data from 2002 to 2005. The number of motor vehicle crash deaths from 2001 to 2004 within the city of Milwaukee was obtained from the Crash Outcome Data Evaluation System (CODES), located at the Center for Health Systems Research and Analysis (CHSRA) at the University of Wisconsin-Madison. County-level data on motor vehicle crash deaths came from the Wisconsin Interactive Statistics on Health (WISH) Database, maintained by the Bureau of Health Information and Policy at the Department of Health and Family Services. Data on maternal smoking during pregnancy from 2002 to 2004 were also obtained from WISH.

STD rates were defined as the average total case re-

ports of chlamydia, gonorrhea, syphilis, and genital herpes per 100,000 per year. ZIP-code level data on STDs from 2001 to 2004 were obtained from the STD Program of the City of Milwaukee Health Department, and county-level STD data were obtained from the Bureau of Health Information and Policy at the Department of Health and Family Services.

Other Measures

Population, population density, the percentage of minorities living in the ZIP code, average family size, the percentage of people living in poverty, the percentage of housing units occupied by renters, and percentage of housing units built before 1940 were obtained from the 2000 US Census. Land area of Milwaukee parks was obtained from the Milwaukee County Park System⁶ and divided by total land mass for each respective ZIP code.⁷

Data Analyses

Data were collected at the ZIP code level and entered into a Statistical Analysis Software (SAS) version 8.2 database. Using the 3 ZIP code groups created via the SES index, measures were averaged across each SES group using a weighted average by population to obtain the value of each measure in all 3 SES groups. Risk ratios were then calculated for each measure by comparing the relative risk of each in the lower and middle SES groups with the respective upper SES group risk. (For example, if 60% of women in the lower SES group did not receive a biennial mammogram, and 30% of women in the upper SES group did not receive a biennial mammogram, then the risk ratio for women not receiving a biennial mammogram in the lower SES group as compared to the upper SES group would be $60/30 = 2.0$, or twice as high.)

RESULTS

Comparison of Sociodemographic Characteristics Across Groups

The stratification of the ZIP codes into 3 groups by SES illustrates the large differences in the educational level and median income across the city, as well as differences in other descriptive characteristics (Table 1).

Although the ZIP codes were not stratified by geographic location, stratifying by socioeconomic status reveals that the ZIP codes in the lower SES group are all clustered within the central and near-northwest portions of the city of Milwaukee, while the upper SES group was dispersed in pockets along the outsides of the city (Figure 1).

Disparities in Health Outcomes and Health Determinants

The risk ratio for the lower SES group in comparison to the upper SES group was 2.0 or greater for 5 of the 17 measures examined, and was at least 1.5 for 13 of the 17 measures (Table 2). This indicates at least a 50% higher risk in most health measures in the lower SES group as compared to the upper SES group. For 14 of the 17 individual health measures, the lower SES group had the greatest risk, and the upper SES group had the lowest risk. For the 3 measures in which the risk was not consecutively worse with decreasing SES (diabetics who did not receive a recommended lipid profile, diabetics who did not receive a recommended HbA1c test, and binge drinking), the lower SES group still had the greatest risk.

Especially large disparities were found in certain health measures. For example, the difference in the rates of reported sexually transmitted diseases between the 3 groups was greater than 5-fold. The lower SES group had a 4-fold higher risk of having people with no health insurance as compared to the upper SES group. The rates of women reporting smoking during pregnancy, people who did not receive needed health care, and obesity were at least twice as high in the lower SES group as compared to the upper SES group.

Comparing the City and the State

The upper SES group in Milwaukee, while the healthiest in the city, was worse than the state average in several health measures. For infant mortality, STD, self-reported health status, motor vehicle crash deaths, diabetics who did not receive a recommended lipid profile, and diabetics who did not receive a recommended HbA1c test, the upper SES group had a higher risk than the overall state average. For all other health measures examined, the risk in the upper SES group was either comparable to or better than the overall Wisconsin risk.

The lower SES group, the least healthy in the city of Milwaukee, was worse than the statewide average in almost all measures examined (except inadequate fruit and vegetable consumption, physical inactivity, and binge drinking). Furthermore, this group had a higher risk than even the least healthy of Wisconsin's 72 counties in 2 measures: sexually transmitted disease and infant mortality.

DISCUSSION

Often health professionals and policymakers think of SES-related differences in health in terms of poor urban or rural areas as compared to more affluent suburban

Table 1. Sociodemographic Characteristics of City of Milwaukee Residents by Lower, Middle, and Upper Socioeconomic ZIP Code Groups, 2000

Measure Overall	Milwaukee Socioeconomic ZIP Code Group			Wisconsin
	Lower SES group	Middle SES group	Upper SES group	
ZIP Code	53204, 53205, 53206, 53208, 53210, 53212, 53215, 53216, 53218, 53233	53207, 53209, 53214, 53219, 53220, 53221, 53224, 53225, 53227, 53235	53202, 53203, 53211, 53213, 53217, 53222, 53223, 53226, 53228	N/A
Median Income (Range in ZIP Codes)	\$27,331 (\$13,140 - \$32,968)	\$38,897 (\$32,980 - \$42,586)	\$49,089 (\$30,659 - \$74,572)	\$43,791
Percent People with a College Degree (Range in ZIP Codes)	12.3 (4.2-20.2)	17.9 (15.1-21.3)	40.1 (23.1-66.0)	22.4
Total Population	327,404	293,746	199,865	5,363,675
Estimated Population Density	9044/sq. miles	4094/sq. miles	3843/sq. miles	99/sq. miles
Percent Minority	66.6	24.1	13.5	11.1
Median Age	27.6 years	36.6 years	37.1 years	36.0 years
Average Family Size	3.5	3.0	2.9	3.1
Percent Persons Below 100% of Poverty Level	30.0	10.2	7.4	9.0
Percent Occupied Housing Units Occupied by Renters	59.3	43.0	45.3	31.6
Percent Housing Units Built Before 1940	44.5	19.7	29.3	N/A
Parks as % of Total Land	3.4	5.6	4.7	N/A

areas. This study reveals dramatic differences in health outcomes across different SES groups within a single urban area.

Health disparities within Milwaukee have been previously reported anecdotally or on specific measures such as infant mortality,⁸ teen pregnancy,⁹ and cancer.¹⁰ Some information, such as the citywide snapshot provided in the *Wisconsin County Health Rankings*,¹¹ has also been made available to help compare Milwaukee's health outcomes and health determinants with the rest of the state. However, this is the first comprehensive analysis to our knowledge that compares multiple measures of both health outcomes and health determinants across socioeconomic strata within the city itself.

As a group, the lower SES ZIP codes in Milwaukee have many sociodemographic differences relative to the middle and upper SES groups, including higher levels of poverty, relative lack of education, much higher population density, and lower median income. In this study we found evidence on multiple measures that these sociodemographic differences are strongly associated with worse health outcomes.

Some might argue that poor health outcomes are a function of poor health behaviors; that it is individual choice regarding individual health behaviors that drives health (or frustratingly, illness). Clearly, "helping in-

dividuals to change unhealthy behavior will always be part of health promotion."¹² However, widely disparate environmental and socioeconomic contexts mean that not every individual has the same opportunity to initiate or sustain healthy choices. For this reason, others have argued that the "social determinants of health ... should be the concern of the entire health care community, not just public health practitioners."¹³ Individual physicians, medical societies, schools of public health and of medicine, and local and state health departments are urged to work together¹⁴ for several reasons. Clearly these professionals must identify community resources to bolster individual patient care and help empower at-risk individuals to improve their behaviors. Simultaneously—and perhaps more fundamentally—they must work together to help change public policy so that individuals are more likely to live, work, and interact in environments that facilitate and support healthy behaviors in the first place. This approach is consistent with the Institute of Medicine's definition: "Public health is what we, as a society, do collectively to assure the conditions for people to be healthy."¹⁵ If we as a society fail to collectively provide for these conditions, it is difficult for people to live healthy lives.

Our findings are generally consistent with other studies regarding the association between health and

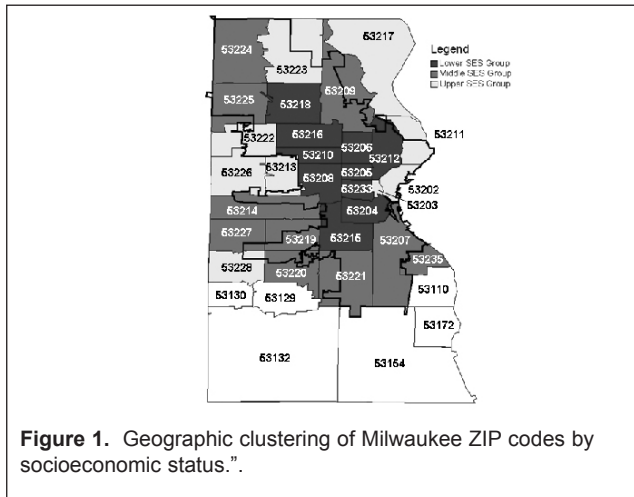


Figure 1. Geographic clustering of Milwaukee ZIP codes by socioeconomic status.”.

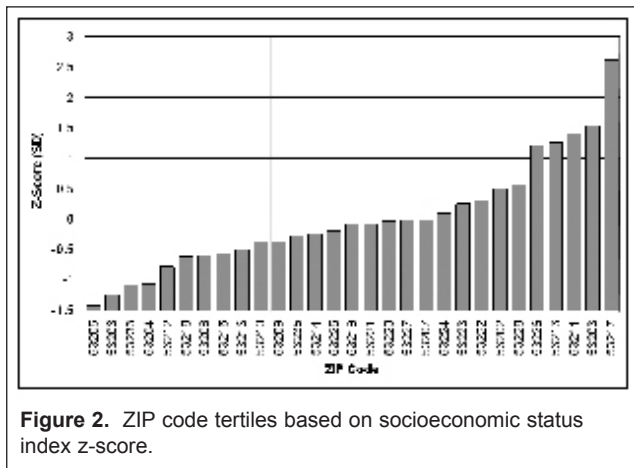


Figure 2. ZIP code tertiles based on socioeconomic status index z-score.

SES,^{16,17} and we likewise observed a linear relationship in which health indicators tended to be associated with higher SES. The Public Health Disparities Geocoding Project, for example, found that risk for adverse health outcomes was greater at higher levels of census tract-level poverty for almost all health outcomes examined, including low birthweight and lead poisoning, infectious disease and injury, cancer incidence, and overall mortality.¹⁸ Such census tract-level analysis may reveal even greater health disparities than seen in this analysis, due to some unavoidable heterogeneity of ZCTA-level data.^{3,18}

One limitation of this analysis is that the division of ZIP codes into tertile groups caused some arbitrary boundaries to be drawn between similar ZIP codes (Figure 2). For example, even though ZIP codes 53209 and 53210 had nearly identical SES-index Z-scores, they fell into 2 different groups as a result of grouping the SES Z-scores by tertile. However, our approach is supported by research showing that differences in health status are often associated with economic inequal-

ity¹⁹ and not merely absolute level of economic status. Furthermore, the 10 ZIP codes in our lower SES group correspond almost precisely to the city of Milwaukee Department of City Development’s (DCD) accepted 9-ZIP-code definitions of Milwaukee’s “Central City,” lending additional credence to our method (53215 is the only ZIP code not included in the DCD definition).²⁰ Future research could look at using a more empirical approach, perhaps by defining more absolute boundaries in SES, rather than using relative levels of SES as cutoffs.

Additional limitations of this analysis relate to the BRFSS data. First, BRFSS data are self-reported, and thus subject to the biases inherent in self-reported data. Second, BRFSS data are weighted for analysis at the county- and state-level, not the ZIP code level. However, because individual ZIP codes were not reported in this analysis, but instead averages of at least 9 ZIP codes were used, any variation would likely average out over the relatively large groups of ZIP codes. A related limitation to consider is that the *Wisconsin County Health Rankings* uses data from 1998 to 2005 for the BRFSS, and 1999 to 2004 for Family Health Survey (FHS). In this analysis, we were limited to data with available ZIP code information, so the data for the Milwaukee ZIP codes came from 2000 to 2005 for the BRFSS and 2000 to 2004 for the FHS. Because we used the most recently available data, however, and because the majority of the years still overlapped, this is not likely to be a critical limitation in comparing the city to the state. Similarly, combining data from the BRFSS and FHS to increase sample size in the ZIP codes does leave open the possibility that a respondent could be included in both surveys; however, the possibility of this happening is negligible, due to the random digit-dial (RDD) methodology and the large population in Milwaukee. This method is also consistent with that used in the *Wisconsin County Health Rankings*.

It is important to note that since this analysis compares population-level measures of health indicators and health outcomes across levels of relative SES of large geographic areas, it cannot serve as a proxy for associations between individual SES and individual health outcomes and determinants. For example, the fact that low SES-level areas of Milwaukee have worse health outcomes and health determinants as a group does not mean that a given individual living in a low SES area of Milwaukee has a higher risk of worse health determinants or health outcomes than another individual living in a different part of town. Furthermore, since this study design does not test for causality, one cannot

Table 2. Health Outcome and Health Determinant Measures and Risk Ratios, Milwaukee ZIP Code SES Groups and Wisconsin

Health Measure	Value for Health Measure						
	Wisconsin			Milw. City ZIP Code Groups (Risk Ratio compared to Upper SES group)			
	Best County	State Average	Worst County	Milw. County	Lower SES	Middle SES	Upper SES
Sexually transmitted disease (per 100,000)	39	483	1554	1492	3164 (5.4)	790 (1.4)	582 (1.0)
No health insurance (%)	2.1	6.1	20.9	7.6	14.1 (4.1)	7.6 (2.2)	3.4 (1.0)
Did not receive needed health care (%)	0.0	2.2	5.0	3.0	4.4 (2.4)	3.2 (1.8)	1.8 (1.0)
Smoking during pregnancy (%)	6.9	14.6	41.6	12.5	14.8 (2.3)	12.2 (1.9)	6.4 (1.0)
Physical inactivity (%)	13.5	46.8	66.0	50.3	32.5 (2.0)	22.1 (1.3)	16.6 (1.0)
Obesity (%)	15.9	22.1	54.8	20.7	30.7 (1.9)	23.7 (1.5)	16.3 (1.0)
Infant mortality (deaths <1 yr per 1000 births)	3.6	6.9	14.5		14.5 (1.9)	8.1 (1.1)	7.7 (1.0)
Cigarette smoking (%)	10.5	22.7	36.0	25.9	34.0 (1.8)	25.1 (1.3)	19.4 (1.0)
Diabetics who did not receive recommended diabetic eye exam	10.6	22.4	32.8	27.4	32.2 (1.6)	26.9 (1.3)	20.6 (1.0)
Motor vehicle crash deaths (per 100,000)	7.7	14.3	75.0	8.1	33.1 (1.5)	31.5 (1.5)	21.7 (1.0)
No biennial mammography (%)	21.7	30.7	51.9	34.9	42.2 (1.5)	34.9 (1.3)	27.5 (1.0)
No recent dentist visit (%)	33.6	44.9	65.7	50.4	63.3 (1.5)	48.3 (1.1)	42.3 (1.0)
Self-reported health status (%) (fair/poor health)	5.6	12.5	19.6	15.3	21.7 (1.5)	15.6 (1.1)	14.6 (1.0)
Diabetics who did not receive recommended diabetic lipid profile (%)	5.9	10.7	21.2	12.3	16.5 (1.4)	11.8 (1.0)	11.6 (1.0)
Diabetics who did not receive recommended diabetic HbA1c testing (%)	4.5	8.7	20.3	11.0	13.8 (1.3)	10.0 (0.9)	10.9 (1.0)
Inadequate fruit and vegetable consumption (%)	62.4	77.9	90.1	77.1	77.6 (1.0)	79.2 (1.1)	74.4 (1.0)
Binge drinking (%)	6.8	24.4	41.4	24.4	23.5 (1.0)	20.4 (0.9)	22.9 (1.0)

conclude from our findings alone that living in a certain part of town or having a certain SES level is a causal factor in either individual or group-level health. At the same time, there are many plausible reasons why having lower SES status or living in a lower SES group could be causal factors in having worse health determinants and health outcomes, either at an individual or a group level. Furthermore, the strong group-level associations between SES and health found using this population-level study design may be very useful for planning and implementing population-level investments and interventions to improve health, as well as for guiding future research into specific health measures within the city.

Clearly, the lower SES areas of Milwaukee are in greatest need of increased public health resource investments overall. At the same time, 2 particular problems stand out: STDs and infant mortality. Not only does the least healthy part of the city have an STD rate twice as high as the worst-performing county in Wisconsin, but even the healthiest part of the city has a higher STD rate than the state overall. This trend is echoed for the infant mortality rate: the least healthy part of Milwaukee has

the same infant mortality rate (IMR) as the worst-performing county in the state, and the IMR for even the healthiest part of Milwaukee is worse than the state's overall average.

From a statewide health rating perspective, Milwaukee's poor health outcomes and large population disproportionately affect overall health outcomes in Wisconsin. Furthermore, upstream factors such as income, education, urban planning, and policies regarding housing and employment have only recently been seen as closely linked to health. Yet upstream, population-level interventions such as urban/neighborhood design facilitating physical activity, and policies aimed at addressing economic and educational disparities may be among the most important tools we have to improve overall health as well as to reduce health disparities.⁵ It is nearly impossible for Wisconsin as a whole to be healthy if Milwaukee is not, and Milwaukee as a whole cannot be healthy when its people with the lowest SES are not. Therefore, the findings from this study can serve as a guide to targeting population-level interventions most needed within the city, and those interven-

tions can improve the state's overall health as well.

Given these large disparities in health along socioeconomic lines, significant improvements in Milwaukee's—and therefore Wisconsin's—overall health will require everyone concerned, including health care systems, public health professionals, businesses, community groups, and policymakers, to attend to the upstream social and economic factors and their attendant disparities across race and geography, particularly in the state's largest urban center.

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