Published in final edited form as:

J Racial Ethn Health Disparities. 2020 October ; 7(5): 838–843. doi:10.1007/s40615-020-00705-x.

Changes Over Time in Disparities in Health Behaviors and Outcomes by Race in Allegheny County: 2009 to 2015

Susan Devaraj¹, Andrea Stewart¹, Sara Baumann², Thistle I. Elias², Tina Batra Hershey³, Emma Barinas-Mitchell¹, Tiffany L. Gary-Webb^{1,2}

¹Department of Epidemiology, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA, USA

²Department of Behavioral and Community Health Sciences, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA, USA

³Department of Health Policy and Management, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA, USA

Abstract

Racial/ethnic disparities in health behaviors and disease outcomes on the national level have persisted over time despite overall improvements in public health. To better understand the changes over time in racial/ethnic health disparities at the county level, we examined the Allegheny County Health Survey (ACHS) for Pittsburgh, PA and the surrounding area, which was conducted in 2009/2010 and 2015/2016 using random digit dialing of residents aged 18 and older. The prevalence rates and rate ratios at each time period were calculated using survey weights and general linear models. The change in prevalence over time was calculated using race-time interaction terms. The results showed a significant improvement in asthma, stroke, cholesterol, and fair or poor health disparities as well as persistent disparities in diabetes and hypertension after adjustment for socioeconomic factors. The change over time in the prevalence of fair or poor health in black compared to white respondents was significant, with absolute improvement of approximately 5% versus <1%, respectively ($p = 0.01$). These findings demonstrate that some disparities improved while others persist, noting the importance of monitoring the changes over time at the local health department level.

Keywords

Health disparities; Chronic disease; Health behaviors; Local survey data

[✉]Susan Devaraj sud34@pitt.edu.

Author Contributions All the authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Andrea Stewart, Sara Bauman, and Susan Devaraj. Susan Devaraj was primarily responsible for the original manuscript draft preparation. All the authors reviewed and edited the manuscript and provided final approval.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s40615-020-00705-x>) contains supplementary material, which is available to authorized users.

Conflict of Interest Susan Devaraj, Andrea Stewart, Sara Baumann, Thistle I Elias, Tina Batra Hershey, Emma Barinas-Mitchell, and Tiffany L Gary-Webb declare that they have no conflict of interest to report.

Ethics Statement This article does not contain any studies with human participants performed by any of the authors. Deidentified survey data were used for this project.

Introduction

Despite improvements in public health, the racial/ethnic disparities in health behaviors and chronic disease outcomes persist in the USA and are widely documented throughout the literature [1–7]. Though some health disparities by race have narrowed, many disparities remain [2, 5, 6, 8]. According to national data, the difference between non-Hispanic black and non-Hispanic white life expectancy has narrowed overall between years 1980 and 2010 [2, 9]. Nonetheless, across these same population groups, inequalities have increased in national estimates for obesity and diabetes prevalence [2].

Local health departments are tasked with conducting community health assessments to better understand the health disparities for smaller geographic regions and to inform action among those who are best positioned to address disparities at local levels [10–12]. As part of this effort, Allegheny County, which is located in southwestern Pennsylvania and encompasses the city of Pittsburgh, conducted the Allegheny County Health Survey (ACHS). Allegheny County is particularly intriguing as it has an age adjusted mortality rate that is greater than the state of Pennsylvania and the USA, with a recent increase in mortality demonstrated in 2016 [13]. The mortality rate has also been consistently higher for the Black population compared to the White population [13]. A recent report indicates that Pittsburgh may also have a higher mortality rate among Black adults than 98% of similar cities, and a lower mortality rate among White adults than 90% of similar cities [14]. Compared to similar cities, Black adults in Pittsburgh have also demonstrated higher cardiovascular disease, cancer, and tobacco-related mortality compared to White adults [14]. Of the 67 counties in Pennsylvania, the 2016 data indicate that Allegheny County ranks 34th in health outcomes and 46th in health behaviors [15], with noted disparities in behaviors and outcomes by race [12].

Historically, the ACHS has documented disparities for cigarette smoking, general health, hypertension, and asthma by race in 2002 and 2009/2010 [16], with Black adults having significantly poorer outcomes than White adults [16]. An updated ACHS was conducted in 2015/2016. While disparities are noted cross-sectionally in each survey, direct analysis of change in disparities by race has not yet been studied.

The purpose of this manuscript is to describe changes over time in selected health behaviors and health outcomes by race between 2009 and 2015 and to identify improving or worsening changes over time and features of the disease burden in Allegheny County.

Methods

Survey Methods

This analysis considers the changes over time in data across two surveys, conducted from August 2009–September 2010 and August 2015–September 2016, of adults aged 18 and older within Allegheny County [16, 17]. In 2009, participants were selected at random using a digital, direct-dial computer system with oversampling of communities with larger proportions of low income and African American individuals in order to produce meaningful estimates [16]. A full summary of sampling selection by strata and wave is available from

the Allegheny County Health Department [16]. The 2015 ACHS used a dual frame random probability-based sampling of landlines and cellular telephone numbers via the digital, direct-dial computer system to achieve a reproducible and representative sample within each of the 13 County Council Districts [17]. The use of survey weights during analysis accounted for potential differences in sampling across years, also allowing each survey cycle to be representative of the demographic composition of the geographic area at the time of the survey. A verbal informed consent was obtained from all individuals prior to survey administration.

The ACHS is modeled after the Center for Disease Control Behavioral Risk Surveillance Survey (BRFSS). The survey consists of a series of questions about demographic characteristics, health behaviors, health diagnoses, screening tests, and medication use. Only questions regarding health behaviors and health outcomes asked in the same or similar way on both survey time-points were included in this analysis (see appendix). Health behaviors included smoking and alcohol consumption, including frequency of use. Binge drinking was defined as women having 4 and men having 5 drinks on one occasion. Health outcomes included self-reported diabetes, hypertension, high cholesterol, heart attack, stroke, and asthma. The respondents were also asked to define their health status as excellent, very good, good, fair, or poor.

Statistical Analysis

For the purpose of this analysis, the race/ethnicity data were restricted to non-Hispanic Black or African American (“Black”) and non-Hispanic White (“White”) due to small numbers of other racial/ethnic groups. The prevalence of health behaviors and outcomes by race were calculated using survey weights.

Weighted general linear models with a binomial distribution and log-link were used to calculate the prevalence ratios (the prevalence rates in Blacks compared to Whites) separately for 2009 and 2015 data. If models failed to converge, a Poisson distribution with robust standard errors was used. The prevalence ratios were first calculated without adjustment and then subsequently adjusted for age, gender, education, income, and marital status. The missing data for covariates were imputed using a hot-deck method [18]. Models were first run using all non-missing data and then on the full sample using imputed values for covariates. To determine whether the change in prevalence estimates from 2009 to 2015 differed by race, race-time interactions were entered into the fully adjusted models using data from both years, and the statistical significance of the interaction term was examined with an alpha level of 0.05. SAS version 9.4 was used for data management, and Stata version 13 was used for data analysis.

Results

A total of 5422 interviews were conducted in the 2009/2010 survey cycle, with a response rate of 66%. A total of 9032 interviews were conducted in the 2015/2016 survey cycle, with a response rate of 71%. After excluding other race/ethnicities, 5258 (4211 White and 1047 Black) individuals were included in the 2009 analysis, and 8450 (7051 White and 1099

Black) individuals were included in the 2015 analysis. The prevalence rates of health behaviors and outcomes by race in 2009 and 2015 are shown in Fig. 1.

The prevalence ratios, both adjusted and unadjusted, are reported in Table 1. The model results were similar when missing covariate data were imputed, so the results using imputed covariates for the full sample are reported. In 2009, Blacks reported significantly higher adjusted rates of asthma, diabetes, hypertension, stroke, and poor or fair general health, while Whites had a higher rate of cholesterol. Blacks were more likely to report diabetes and hypertension after adjustment in 2015, while the disparities for asthma, stroke, cholesterol, and poor or fair health were no longer observed.

The results of regression analysis showed a significant difference in the rate of change from 2009 to 2015 by race for fair or poor general health ($p = 0.01$) and high cholesterol ($p = 0.01$). The absolute decrease in prevalence of fair or poor health from 2009 to 2015 was 5% in Blacks, compared with < 1% in Whites (Fig. 1). For high cholesterol, the change in disparities appears to be due to Whites doing *better* in 2015, with a 4% decline in high cholesterol, while Blacks saw only a 1% reduction in prevalence (Fig. 1).

Discussion

These data from representative surveys indicate that certain disparities between Blacks and Whites persist in Allegheny County, while others have improved between 2009 and 2015. A significant difference was noted in the *rate of change* in fair or poor health in Blacks compared to Whites, with a significantly greater decline in Black respondents indicating fair or poor health compared to good, very good, or excellent health. This difference in change over time implies a greater improvement in self-rated health status among Black individuals compared to Whites over time, even after considering demographic and socioeconomic characteristics. Additionally, many of the observed disparities appear to be related to socioeconomic factors, such as education and income, as observed when the prevalence ratios became nonsignificant after adjusting for age, gender, income, education, and marital status. Yet, persistent disparities in diabetes and hypertension remained after the adjustment for these factors.

The ACHS health behavior data demonstrate some similarities and differences compared to the national prevalence that changes over time reported in the literature. Health behaviors assessed in the ACHS represent current behavior at the time of the survey. The National Health Interview Survey (NHIS) data from 2005 to 2015 indicate no notable difference in cigarette smoking prevalence by race [19, 20], which is consistent with adjusted ACHS estimates. Smoking appears to be more prevalent in ACHS compared to NHIS data, which likely reflects the variability previously shown in smoking prevalence in county level data and demonstrates the need to look at local level data [21]. Alcohol consumption is highly variable among different subpopulations according to national data [22]. The adjusted ACHS data show no disparity in binge drinking behavior by race.

Health outcomes in the ACHS also demonstrate similarities and differences compared to national data. The national data on heart attack among US adults reveal no difference

between whites and blacks [23], which is consistent with ACHS data. We saw improvements over time in stroke disparity, which differs from national trends demonstrating persistent disparities [5, 24]. While unable to be captured here, the national data demonstrate a persistently higher prevalence of total cardiovascular disease among Black compared to White adults, and a higher incidence of heart attack among Black compared to White adults [23]. The ACHS demonstrated a significant improvement in reported health status among Black individuals to the point that no disparity was noted in adjusted estimates in 2015 data. This differs from the national data from NHIS demonstrating persistent disparities [5]. We also saw an improvement in asthma disparity. This disparity persists in the national data; however, this trend may be limited to children [25, 26]. Persistent disparities in hypertension and diabetes are consistent with historic national changes over time [27, 28]. The higher prevalence of high cholesterol among Whites in Allegheny County 2009 data is also consistent with the national data, though this disparity was no longer present in 2015 [23].

The changes over time in health disparities reflect changes in the determinants of health. Within Allegheny County, the disparities are present in marital status, education, and income, among other factors in Blacks compared to Whites [29]. The timing of this analysis is of interest due to its correspondence with the passage and implementation of the Affordable Care Act, which may have had a potential impact on access to care. While this cannot be directly ascertained in this analysis, future research could address changes in outcomes alongside access to care. Additional monitoring of the changes over time in access to care and other social determinants of health will continue to inform trends in health indicators.

Local action to address health disparities is another potential driver of change. Initiatives to improve health with an emphasis on reducing and eliminating health disparities have been started due in part to findings from the 2009 ACHS [30, 31]. The cross-sectional racial disparities noted in 2002 and 2009 informed data analyses for the Allegheny County Community Health Assessment [16, 32]; however, this project is the first to directly analyze change over time in disparities by race and to control for potential confounding factors. In a collaborative effort involving stakeholders from organizations across Allegheny County and driven by data in the Community Health Assessment and prior ACHS surveys, the Allegheny County Health Department has developed a Plan for a Healthier Allegheny (PHA) [30]. The PHA initiative outlines key priority areas to improve health outcomes and provides actionable steps to achieve objectives promoting health equity by addressing issues such as access to and quality of care and environmental factors within each priority area [30, 31]. In addition, a CDC-funded Racial and Ethnic Approaches to Community Health project focusing on chronic disease prevention in African American communities was just started in Allegheny County in 2019. However, these initiatives are likely too new to be reflected in the current analysis, and continued monitoring over time will reflect their effectiveness. The current findings and future direct analyses of disparities will further inform local action to promote health equity.

While the ACHS data offer a valuable opportunity to monitor changes over time in health among the representative sample of adults residing in Allegheny County, there are limitations. The ACHS data were self-reported with inherent potential for misclassification;

however, this type of survey is consistent with other population-based surveillance assessments. Given the random digit dialing approach to survey data collection, different individuals were sampled at each time point. Additionally, the change analysis was limited to survey questions that were asked in both 2009 and 2015. Also, there were little data available from individuals who did not identify as non-Hispanic Black/African American or non-Hispanic White. This is in line with the demographic make-up of Allegheny County; however, demographic diversity may be shifting, and future analysis may allow additional subgroups to be considered. Finally, this analysis was restricted to individuals aged 18 and over as we were focused on risk factors and outcomes related to chronic disease, and that is the age captured in the ACHS. Future analysis could consider changes over time in racial disparities among children as some disparities, such as asthma hospitalizations among children [33] and infant mortality [13], have been noted in Allegheny County.

Future research efforts addressing changes over time in disparities related to socioeconomic status, gender, and the role of access to care and quality of care will help to further inform trends in health. The ACHS data indicate that some health disparities persist by race, while others have improved. Additional efforts to monitor and intervene to address disparities in health continue to be essential to promoting health equity.

Acknowledgments

Funding Information Allegheny County Health Department; Cardiovascular Epidemiology Training Program; National Heart, Lung, and Blood Institute; National Institutes of Health (NIH), T32HL083825.

References

1. Brown EJ, Polsky D, Barbu CM, Seymour JW, Grande D. Racial disparities in geographic access to primary care in Philadelphia. *Health Aff.* 2016;35(8):1374–81.
2. Bleich SN, Jarlenski MP, Bell CN, LaVeist TA. Health inequalities: trends, progress, and policy. *Annu Rev Public Health.* 2012;33:7–40. [PubMed: 22224876]
3. Mensah GA, Mokdad AH, Ford ES, Greenlund KJ, Croft JB. State of disparities in cardiovascular health in the United States. *Circulation.* 2005;111(10):1233–41. [PubMed: 15769763]
4. National Center for Health S. Health, United States In health, United States, 2016: with chartbook on long-term trends in health. Hyattsville (MD): National Center for Health Statistics (US); 2017.
5. Health, United States, 2015. U.S. Department of Health of Human Services; 2015.
6. Singh GK, Daus GP, Allender M, Ramey CT, Martin EK, Perry C, et al. Social determinants of health in the United States: addressing major health inequality trends for the nation, 1935–2016. *Int J MCH AIDS.* 2018/01/26. 2017;6(2):139–64. [PubMed: 29367890]
7. Chang MH, Moonesinghe R, Athar HM, Truman BI. Trends in disparity by sex and race/ethnicity for the leading causes of death in the United States-1999–2010. *J Public Heal Manag Pr.* 2015/05/07 2016;22(Suppl 1):S13–24.
8. Singh GK, Siahpush M, Azuine RE, Williams SD. Widening socioeconomic and racial disparities in cardiovascular disease mortality in the United States, 1969–2013. *Int J MCH AIDS.* 2015;3(2):106–18. [PubMed: 27621991]
9. Kochanek KD, Murphy SL, Xu J, Tejada-Vera B. Deaths: final data for 2014. *Natl Vital Stat Rep.* 2016;65(4):1–122.
10. Board PHA. Public Health Accreditation Board standards and measures version 1.5 [Internet]. 2013. Available from: <http://www.phaboard.org/wp-content/uploads/SM-Version-1.5-Board-adopted-FINAL-01-24-2014.docx.pdf>

11. Shah GH, Sheahan JP. Local health departments' activities to address health disparities and inequities: are we moving in the right direction? *Int J Environ Res Public Health*. 2015;13(1):ijerph13010044.
12. Allegheny County Health Department website: Plan for a healthier Allegheny.
13. Hacker KMM. Allegheny County Mortality Report: 2016. Allegheny Cty Heal Dep 2018.
14. Howell J, Goodkind S, Jacobs LA, Branson D, Miller L. Pittsburgh's inequality across gender and race. Pittsburgh; 2019.
15. County Health Ranking and Roadmaps. Pennsylvania: Allegheny 2019.
16. Documét PI Green HH BTM. Results from the 2009-2010 Allegheny County health survey (ACHS): measuring the health of adult residents. Pittsburgh Allegheny Cty Heal Dep Eval Inst 2012.
17. Results from the 2015-2016 Allegheny County health survey (ACHS): measuring the health of adult residents. Allegheny Cty Heal Dep Pittsburgh, PA 2017.
18. Andridge RR, Little RJ. A review of hot deck imputation for survey non-response. *Int Stat Rev*. 2010;78(1):40–64. [PubMed: 21743766]
19. Jamal A, King BA, Neff LJ, Whitmill J, Babb SD, Graffunder CM. Current cigarette smoking among adults - United States, 2005-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65(44):1205–11. [PubMed: 27832052]
20. Phillips E, Wang TW, Husten CG, Corey CG, Apelberg BJ, Jamal A, et al. Tobacco product use among adults - United States, 2015. *MMWR Morb Mortal Wkly Rep*. 2017;66(44):1209–15. [PubMed: 29121001]
21. Dwyer-Lindgren L, Mokdad AH, Srebotnjak T, Flaxman AD, Hansen GM, Murray CJ. Cigarette smoking prevalence in US counties: 1996–2012. *Popul Health Metrics*. 2014;12(1):5.
22. Delker E, Brown Q, Hasin DS. Alcohol consumption in demographic subpopulations: an epidemiologic overview. *Alcohol Res*. 2016;38(1):7–15. [PubMed: 27159807]
23. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R, et al. Heart disease and stroke statistics-2017 update: a report from the American Heart Association. *Circulation*. 2017;135(10):e146–603. [PubMed: 28122885]
24. Prevalence of stroke—United States, 2006–2010. *MMWR Morb Mortal Wkly Rep*. 2012;61(20):379–82. [PubMed: 22622094]
25. Akinbami LJ, Moorman JE, Bailey C, Zahran HS, King M, Johnson CA, et al. Trends in asthma prevalence, health care use, and mortality in the United States, 2001–2010. *NCHS Data Brief*. 2012;(94):1–8.
26. Oraka E, Iqbal S, Flanders WD, Brinker K, Garbe P. Racial and ethnic disparities in current asthma and emergency department visits: findings from the National Health Interview Survey, 2001–2010. *J Asthma*. 2013;50(5):488–96. [PubMed: 23544662]
27. Pool LR, Ning H, Lloyd-Jones DM, Allen NB. Trends in racial/ethnic disparities in cardiovascular health among US adults From 1999–2012. *J Am Heart Assoc*. 2017;6(9).
28. Zhang Q, Wang Y, Huang ES. Changes in racial/ethnic disparities in the prevalence of Type 2 diabetes by obesity level among US adults. *Ethn Health*. 2009;14(5):439–57. [PubMed: 19360513]
29. Pittsburgh's Racial Demographics 2015: Differences and disparities. Pittsburgh, PA: University of Pittsburgh School of Social Work.
30. Plan for a healthier Allegheny [Internet]. Allegheny County; 2015 Available from: <https://www.alleghenycounty.us/Health-Department/Resources/Data-and-Reporting/Chronic-Disease-Epidemiology/Plan-for-a-Healthier-Allegheny.aspx>. Accessed 3 Aug 2018.
31. Live Well Allegheny. Improving the health and wellness of Allegheny County residents. [Internet]. Available from: <http://www.livewellallegheny.com/about-us/>. Accessed 8 Aug 2018.
32. Kurta M Monroe C, Bring LTL. Allegheny County Health Department. 2015 Community health assessment [internet]. Allegheny County Health Department; 2015 Available from: http://www.county.allegheny.pa.us/uploadedFiles/Allegheny_Home/Health_Department/Resources/Data_and_Reporting/Chronic_Disease_Epidemiology/CHA_Report-Final_42815.pdf.

33. Review of available childhood asthma data in Allegheny County (2008-2016) [Internet]. Allegheny County Health Department. 2018 Available from: <https://www.alleghenycounty.us/Health-Department/Programs/Air-Quality/Asthma.aspx> . Accessed 28 Dec 2019.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Fig. 1.

Unadjusted prevalence (as percentages) of health behaviors and outcomes in 2009 and 2015 with 95% confidence intervals

Unadjusted and adjusted relative Black-White disparity in prevalence of health behaviors and outcomes in 2009 and 2015

Table 1

Indicator	Unadjusted		Adjusted for age, income, education, and marital status			
	2009 (n = 5258)	2015 (n = 8450)	P value*	2009 (n = 5258)	2015 (n = 8450)	P value*
Current Smoker	1.58 (1.40, 1.78)	1.71 (1.50, 1.97)	0.373	1.08 (0.95, 1.23)	1.03 (0.89, 1.18)	0.607
Binge Drinking	1.11 (0.95, 1.31)	1.20 (1.05, 1.37)	0.492	0.96 (0.81, 1.14)	0.88 (0.76, 1.01)	0.645
Asthma	1.62 (1.37, 1.91)	1.60 (1.36, 1.88)	0.924	1.33 (1.09, 1.62)	1.18 (0.99, 1.41)	0.602
Diabetes	1.40 (1.18, 1.65)	1.23 (1.01, 1.49)	0.313	1.42 (1.20, 1.67)	1.38 (1.15, 1.66)	0.808
Fair or Poor health	1.77 (1.55, 2.03)	1.44 (1.24, 1.68)	0.043	1.38 (1.20, 1.59)	1.06 (0.91, 1.24)	0.012
Heart Attack	0.97 (0.72, 1.32)	1.06 (0.79, 1.43)	0.696	0.96 (0.72, 1.30)	1.12 (0.84, 1.50)	0.563
Hypertension	1.26 (1.15, 1.39)	1.10 (0.99, 1.21)	0.041	1.37 (1.25, 1.50)	1.28 (1.17, 1.41)	0.345
High Cholesterol	0.82 (0.73, 0.92)	0.95 (0.84, 1.07)	0.086	0.88 (0.78, 0.98)	1.09 (0.98, 1.21)	0.011
Stroke	1.73 (1.30, 2.31)	1.40 (1.00, 1.96)	0.347	1.64 (1.23, 2.19)	1.42 (0.99, 2.02)	0.532

* P-value for significance of change 2009–2015 using race-year interaction