NIH Public Access
Author Manuscript
Diabetes Care. Author manuscript; available in PMC 2013 January 29.

Published in final edited form as:
Diabetes Care. 2006 September ; 29(9): 2130–2136. doi:10.2337/dc05-1973.

Disparities in HbA_{1c} Levels Between African-American and Non-Hispanic White Adults With Diabetes:

A meta-analysis

Julienne K. Kirk, Pharmd, CDE[1], **Ralph B. D'Agostino Jr, PhD**[2], **Ronny A. Bell, PhD**[2], **Leah V. Passmore, MS**[2], **Denise E. Bonds, MD, MPH**[2,3], **Andrew J. Karter, PhD**[4], and **K.M. Venkat Narayan, MD, MPH, MBA**[5]

[1]Family and Community Medicine, Wake Forest University School of Medicine, Winston-Salem, North Carolina

[2]Public Health Sciences, Wake Forest University School of Medicine, Winston-Salem, North Carolina

[3]Internal Medicine, Wake Forest University School of Medicine, Winston-Salem, North Carolina

[4]Division of Research, Kaiser Permanente, Oakland, California

[5]National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

OBJECTIVE—Among individuals with diabetes, a comparison of HbA_{1c} (A1C) levels between African Americans and non-Hispanic whites was evaluated. Data sources included PubMed, Web of Science, the Cumulative Index to Nursing and Allied Health, the Cochrane Library, the Combined Health Information Database, and the Education Resources Information Center.

RESEARCH DESIGN AND METHODS—We executed a search for articles published between 1993 and 2005. Data on sample size, age, sex, A1C, geographical location, and study design were extracted. Cross-sectional data and baseline data from clinical trials and cohort studies for African Americans and non-Hispanic whites with diabetes were included. Diabetic subjects aged <18 years and those with pre-diabetes or gestational diabetes were excluded. We conducted a meta-analysis to estimate the difference in the mean values of A1C for African Americans and non-Hispanic whites.

RESULTS—A total of 391 studies were reviewed, of which 78 contained A1C data. Eleven had data on A1C for African Americans and non-Hispanic whites and met selection criteria. A meta-analysis revealed the standard effect to be 0.31 (95% CI 0.39–0.25). This standard effect correlates to an A1C difference between groups of ~0.65%, indicating a higher A1C across studies for African Americans. Grouping studies by study type (cross-sectional or cohort), method of data collection for A1C (chart review or blood draw), and insurance status (managed care or nonmanaged care) showed similar results.

© 2006 by the American Diabetes Association.

Address correspondence and reprint requests to Julienne K. Kirk, PharmD, CDE, Associate Professor, Family and Community Medicine, Wake Forest University School of Medicine, Medical Center Boulevard, Winston-Salem, NC 27157-1084. jkirk@wfubmc.edu.

This publication was made possible through a cooperative agreement between the Centers for Disease Control and Prevention (CDC) and the Association of Teachers of Preventive Medicine (ATPM) (award no. TS-0778). Its contents are the responsibility of the authors and do not necessarily reflect the official views of CDC or ATPM.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

CONCLUSIONS—The higher A1C observed in this meta-analysis among African Americans compared with non-Hispanic whites may contribute to disparity in diabetes morbidity and mortality in this population.

Ethnic minorities in the U.S. are disproportionately affected by most diabetes-related complications, including diabetic retinopathy, lower-extremity amputation, and end-stage renal disease (1–4). Although diabetes has a major adverse impact on life-years and quality-adjusted life-years in all U.S. subpopulations, the impact is even greater among minority individuals, including African Americans and Hispanics (5). Specifically, many diabetes complications are experienced at a higher rate in African Americans than in non-Hispanic whites (6). For example, the prevalence and severity of diabetic retinopathy is 46% higher in African Americans than in non-Hispanic whites (2), and African Americans with diabetes are more likely to develop kidney disease and kidney failure requiring dialysis than non-Hispanic whites (7,8). Although racial disparities in complications are somewhat less marked in populations receiving uniform access to care, disparities in HbA_{1c} (A1C) level among African Americans, Asians, and Latinos have been shown compared with non-Hispanic whites (9). Improvements in glycemic control have been shown to prevent microvascular complications, and large trials have demonstrated the need for glucose control among patients with diabetes (10,11). Literature has suggested that A1C control may be poorer among minority populations than among nonminority populations (6). A number of factors may drive differences in A1C control: biological, socioeconomic, and quality-of-care factors have been suggested (9,12). Lack of access to health care may also affect diabetes care among minority individuals (13). African Americans report lower rates of health insurance than non-Hispanic whites. This barrier to care can lead to delayed diagnosis and increased years of exposure to untreated diabetes (14). Other studies have found that African Americans are less likely to have prescription drug coverage, which limits their ability to afford medications once they have been diagnosed (15). Differences in the frequency of obtaining common preventive care measures related to diabetes also have been implicated in the quality-of-care disparity between African Americans and non-Hispanic whites (16). Of special concern is the suggestion that minority populations receive less optimal diabetes care even after they access the health care system (17,18).

A recent review of studies reported overall poorer glycemic control in U.S. adults with diabetes as measured by A1C (19). The consistency of a higher A1C across comparative studies of African Americans and non-Hispanic whites with diabetes has not been examined. To get a better representation of whether differences in A1C levels exist between African Americans and non-Hispanic whites with diabetes, we reviewed the literature (1993–2005) for which comparisons between populations were made and conducted a meta-analysis using standardized statistical methods. This time period was selected because the A1C measurement has become more standardized over the past 10 years.

RESEARCH DESIGN AND METHODS

Identification of studies

We conducted a Medline search in PubMed, the Cumulative Index to Nursing and Allied Health, the Combined Health Information Database, the Cochrane Library, and the Web of Science using Medical Subject Heading (MeSH) and free text forms for the period 1993 through 2005. We used the search terms, “Diabetes Mellitus”[MeSH] AND “U.S.” [MeSH] AND “Hemoglobin A, Glycosylated”[MeSH] OR glycemia OR glycemic control OR A1C with Limits: All Adult: 19+ years and English language. We initially retrieved 1,596 abstracts. The search was further limited to articles containing race or ethnicity (305 total articles). The literature accepted had to include patients with diabetes and contain comparative data for both African Americans and non-Hispanic whites. We rejected

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

abstracts that included patients with gestational diabetes or pre-diabetes. We collected additional references from bibliographies of reviews, original research articles, and other articles of interest.

To conduct as broad an analysis as possible, we included any study design that was statistically valid. For retrospective chart review studies, we evaluated the most recent A1C data. We included observational data on A1C control. For four studies (20–23) in which sample size and A1C summary statistics were not provided in the original publication, we were able to retrieve this information from the authors. We only accepted author-reported data if we received written validation that the information was obtained from the original computerized dataset. If the SD of the A1C was not reported or otherwise obtained, we did not include the study in the meta-analysis. We did not exclude studies that failed to categorize the type of diabetes, as the diabetic population primarily consists of people with type 2 diabetes; this is especially true among African Americans.

Data extraction

Two investigators (J.K.K. and R.A.B.) independently reviewed each study for the following data: *1*) sample size, *2*) mean (±SD) participant age, *3*) number of male and female subjects, *4*) mean (±SD) A1C, *5*) geographic location of the research, and *6*) study design.

We initially retrieved 1,581 abstracts of English-language studies conducted in the U.S. from PubMed and found 15 additional abstracts in other data sources, resulting in a total of 1,596 abstracts. We rejected 1,151 abstracts because they did not meet the inclusion criteria. Of the 445 articles initially considered, review of the full citation resulted in 55 being excluded for not meeting the inclusion criteria. Of the 391 articles that were ultimately evaluated, 78 studies contained glycemia data for minority populations. Eighteen of the studies contained glycemia data for African Americans and non-Hispanic whites. If mean (±SD) glycemic information was not available, the authors were contacted to provide these data. Because of lab variability, we only analyzed A1C values, resulting in elimination of three studies that reported glycosylated hemoglobin (24–26). Four of the remaining studies reported comparative A1C data for African Americans but were not included for a variety of reasons: not providing SD for A1C (27), using pooled A1C data from multiple studies (28), and not defining the breakdown of an ethnic group (29); an additional intervention trial was excluded due to the possibility of patient selection bias in participant recruitment (30). Eleven studies that reported A1C were represented in our final analysis, including 3 prospective cohort studies (9,20,31) and 8 cross-sectional studies (12,21–23,32–35). Only a minor portion of patients in the studies reviewed had type 1 diabetes, with 15 reported in one study (9), and another study did not discuss any breakdown of patients by diabetes type (21).

Statistical analysis

A primary meta-analysis was conducted on the 11 studies (9,12,20–23,31–35) that met the inclusion criteria (Table 1). To judge the sensitivity of the results and justify the conclusions of the primary analysis, individual meta-analyses were conducted on subsets including study type (cohort and cross-sectional studies), managed care or nonmanaged care, and method of data collection for A1C (chart review or blood draw). Characteristics of the 11 studies are summarized in the table. An effect size (mean difference in A1C divided by the pooled SD) was calculated for the difference in A1C measurements between African Americans and non-Hispanic whites. For each study, a 95% CI for the effect size was also calculated.

Homogeneity of the effect sizes across studies was first assessed using a χ^2 test to determine whether a fixed- or random-effects approach should be implemented. A fixed-effects approach considers the set of studies as homogenous and representing all potential studies of

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

interest, whereas the random-effects approach treats the studies as heterogeneous and considers them to be a sample from a population of comparable studies. With the exception of the managed care subset, the homogeneity test results led to the use of a random-effects model to pool effect-size estimates and compute a treatment effect. All tests of effect were two sided, and $P < 0.05$ was considered statistically significant. Results are reported for the entire dataset and then stratified by sex, study design, and data collection type for A1C.

RESULTS

Variability existed in the age of participants across studies, but most studies included patients aged >50 years. The sample sizes also varied widely across studies; that variability, however, was accommodated through the analysis for heterogeneity/homogeneity. Of the 11 studies in our meta-analysis, significant differences between African Americans and non-Hispanic whites were originally reported in 5 studies (12,31–33,35), no significant differences were reported in 1 study (34), and 1 study did not test for significant differences between ethnic groups (9). For four of the studies included in this meta-analysis, we contacted the authors for A1C data and tests for differences between African Americans and non-Hispanic whites that were not provided (20–23).

Through the meta-analysis, 10 of 11 studies indicated significantly higher A1C levels in African Americans than in non-Hispanic whites (Fig. 1). The summary effect size was −0.32 ($P < 0.0001$), which indicated that African Americans had A1C values that were, on average, 0.32 SD above those of non-Hispanic whites. This corresponds to an estimated 0.65% A1C difference. To evaluate the potential bias in the results due to sex, a meta-analysis conducted to compare the A1C levels between men and women, independent of race, had an estimate effect of 0.0024 ($P = 0.9882$).

The effects were similar regardless of study design. The cross-sectional studies had an estimated effect of 0.30 ($P < 0.0001$), and the prospective cohort studies had an estimated effect of −0.42 ($P < 0.0010$). Similarly, when studies were divided into two groups according to data collection type, the effects were consistent with the results from the summary analysis. Studies in which the A1C values were collected from chart reviews had an estimated effect of −0.31 ($P < 0.0001$), and studies in which the values were obtained from baseline blood draws had an estimated effect of −0.34 ($P = 0.0041$). When studies were divided into managed care or nonmanaged care, the effects were again consistent with the primary results. Studies in which the patients had managed care insurance had an estimated effect of −0.27 ($P < 0.0001$), and studies in which the patients did not have managed care insurance had an estimated effect of −0.38 ($P < 0.0001$).

A meta-analysis conducted for the comparison between the two ethnic groups among men had an estimated effect of −0.29 ($P = 0.0026$). Individually, four of the six studies providing sex-specific information would not have found a strong significant difference in men. However, the combination of the six studies through meta-analytic techniques demonstrates the significant difference between African Americans and non-Hispanic whites (Fig. 2). Likewise, the meta-analysis conducted for women showed a significant difference ($P < 0.0001$) between the ethnic groups with an estimated effect of −0.36 (Fig. 3).

CONCLUSIONS

This meta-analysis shows that African Americans have elevated A1C compared with non-Hispanic whites. The effect size estimate for this difference translates into an ~0.65% difference (pooled SD for A1C across studies of 2.1) in A1C levels between African Americans and non-Hispanic whites. Our findings confirm those of Trivedi et al. (36), who,

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

in a recent analysis of 1.8 million individual-level observations from 183 health plans, reported disparities between African Americans and non-Hispanic whites in glucose control.

Poor glycemic control is an important risk factor for diabetes complications, particularly microvascular complications (10). The difference between racial groups found in this meta-analysis represents a potentially significant increase in the micro- and macrovascular complications associated with diabetes. The U.K. Prospective Diabetes Study found a 21% reduction in any outcome for every 1% reduction in A1C (37). Thus, the difference found in this meta-analysis represents an ~15% reduction in risk for vascular complications among non-Hispanic whites. However, this does not explain the magnitude of difference in diabetes complications between African Americans and non-Hispanic whites. Although A1C control among African Americans likely contributes to their elevated risk of complications, it accounts for only a portion of their excess risk. The need to control A1C, blood pressure, and cholesterol risk factors among patients with diabetes has been previously reviewed (19).

The consistency of the findings is no-table: 10 of 11 studies showed significance such that the range of effect sizes did not include zero. Furthermore, all analyses provided the same general results and therefore strongly support the conclusion that there are significant differences in A1C between African Americans and non-Hispanic whites. In addition, two of the largest studies indicated similar point estimates for the standard effect size (Fig. 1) (20,22).

The strengths of this analysis are its inclusion of a variety of study designs, the ability to examine A1C differences by sex and study type, and the use of previously unpublished data (20–23). The results of this meta-analysis, however, depend in part on the accuracy and reliability of the A1C measurement across studies. Variability in tests of glycemia has been an issue in the field, and standardization of A1C was not widespread until the last decade (38). In more recent years, the International Federation of Clinical Chemistry and the National Glycohemoglobin Standardization Program have been working toward a certification of diagnostic equipment as being traceable to the Diabetes Control and Complications Trial reference method (38,39). In addition, persistence of hereditary fetal hemoglobin may cause a spurious elevation of A1C (40). However, type 1 diabetes and insulin treatment seem to be more associated with fetal hemoglobin production (41).

Another limitation of the analysis is publication bias; however, we performed numerous searches on this topic and contacted multiple investigators to retrieve the data for A1C means and SDs. The heterogeneity of the studies adds to the limitations of the analysis. Nevertheless, results are likely generalizable to African-American and non-Hispanic white adult patients with type 2 diabetes because the data included a broad range of patient ages, geographic settings, and study types. An additional limitation of this meta-analysis is that despite the comprehensive review of abstracts, the potential for omission exists if an abstract initially reviewed through our search process did not specifically address racial disparities.

The cause of the disparity in glucose control is multifactorial. Previous studies that have examined differences by ethnicity have found significant variation in rates of medical insurance coverage (42). Other studies of patients with diabetes have found that most have some form of medical insurance and that African Americans and non-Hispanic whites have similar rates of coverage (43). We were unable to obtain data on insurance status for eight studies included in the meta-analysis; however, two of the largest studies were conducted in managed care settings where all subjects were insured (9,23). In these studies, all of the patients had access to health care, but, even then, disparity in A1C levels was seen for minority groups.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Differences in the intensity of treatment may also account for a portion of the variation in A1C control. Determining bias is difficult, and we were unable to examine it in this study. Patient preferences for a type of treatment or comprehension of the disease and its treatment may account for some of the differences. Studies examining acceptance of cardiac procedures and renal transplants have found variation by ethnicity and race; however, differences in preference probably contribute only to a small portion of the variation in care (44,45).

This is the first meta-analysis of racial and ethnic differences in glycemic control among patients with diabetes. Although the studies included used a variety of designs, a consistency in the degree of disparity of glycemic control was found regardless of study type. Multiple separate meta-analyses were conducted across study types and sex with the same outcome. African Americans with diabetes have an ~0.65% higher A1C than non-Hispanic whites; this difference may explain a portion of the excess microvascular complications in this population nationally. We need to understand more fully why this disparity in glycemic control exists and act to eliminate the factors that are modifiable (e.g., improved access to and delivery of care). Further research is needed to elucidate why African Americans with diabetes have poorer glycemic control than non-Hispanic whites and to identify interventions that might prevent or reduce the disparities.

Acknowledgments

The authors thank Carol Hildebrandt for her expertise in assembling the references and editing the manuscript.

References

1. Cowie CC, Port FK, Wolfe RA, Savage PJ, Moll PP, Hawthorne VM. Disparities in incidence of diabetic end-stage renal disease according to race and type of diabetes. N Engl J Med. 1989; 321:1074–1079. [PubMed: 2797067]
2. Harris MI, Klein R, Cowie CC, Rowland M, Byrd-Holt DD. Is the risk of diabetic retinopathy greater in non-Hispanic blacks and Mexican Americans than in non-Hispanic whites with type 2 diabetes? A U.S. population study. Diabetes Care. 1998; 21:1230–1235. [PubMed: 9702425]
3. Lavery LA, Ashry HR, van Houtum W, Pugh JA, Harkless LB, Basu S. Variation in the incidence and proportion of diabetes-related amputations in minorities. Diabetes Care. 1996; 19:48–52. [PubMed: 8720533]
4. Pugh JA, Stern MP, Haffner SM, Eifler CW, Zapata M. Excess incidence of treatment of end-stage renal disease in Mexican Americans. Am J Epidemiol. 1988; 127:135–144. [PubMed: 3276155]
5. Narayan KM, Boyle JP, Thompson TJ, Sorensen SW, Williamson DF. Lifetime risk for diabetes mellitus in the United States. JAMA. 2003; 290:1884–1890. [PubMed: 14532317]
6. Tull, ES.; Roseman, JM. Diabetes in African Americans. In: National Diabetes Data Group. , editor. Diabetes in America. 2nd ed.. Bethesda, MD: National Institutes of Health; 1995. p. 613-630.
7. Young BA, Maynard C, Boyko EJ. Racial differences in diabetic nephropathy, cardiovascular disease, and mortality in a national population of veterans. Diabetes Care. 2003; 26:2392–2399. [PubMed: 12882868]
8. Young BA, Pugh JA, Maynard C, Reiber G. Diabetes and renal disease in veterans. Diabetes Care. 2004; 27(Suppl. 2):B45–B49. [PubMed: 15113782]
9. Karter AJ, Ferrara A, Liu JY, Moffet HH, Ackerson LM, Selby JV. Ethnic disparities in diabetic complications in an insured population. JAMA. 2002; 287:2519–2527. [PubMed: 12020332]
10. The UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet. 1998; 352:837–853. [PubMed: 9742976]
11. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med. 1993; 329:977–986. [PubMed: 8366922]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

12. Gary TL, McGuire M, McCauley J, Brancati FL. Racial comparisons of health care and glycemic control for African American and white diabetic adults in an urban managed care organization. Dis Manag. 2004; 7:25–34. [PubMed: 15035831]

13. Rhee MK, Cook CB, Dunbar VG, Panayioto RM, Berkowitz KJ, Boyd B, George CD, Lyles RH, El-Kebbi IM, Phillips LS. Limited health care access impairs glycemic control in low income urban African Americans with type 2 diabetes. J Health Care Poor Underserved. 2005; 16:734–746. [PubMed: 16311495]

14. Killilea T. Long-term consequences of type 2 diabetes mellitus: economic impact on society and managed care. Am J Manag Care. 2002; 8:S441–S449. [PubMed: 12408407]

15. Briesacher B, Limcangco R, Gaskin D. Racial and ethnic disparities in prescription coverage and medication use. Health Care Financ Rev. 2003; 25:63–76. [PubMed: 15124378]

16. Kirk JK, Bell RA, Bertoni AG, Arcury TA, Quandt SA, Goff DC, Narayan KMV. A qualitative review of studies of diabetes preventive care among minority patients in the United States, 1993–2003. Am J Man Care. 2005; 11:349–360.

17. Isaacs R. Ethical implications of ethnic disparities in chronic kidney disease and kidney transplantation. Adv Ren Replace Ther. 2004; 11:55–58. [PubMed: 14730538]

18. Ofili E. Ethnic disparities in cardiovascular health. Ethn Dis. 2001; 11:838–840. [PubMed: 11763309]

19. Kirk JK, Bell RA, Bertoni AG, Arcury TA, Quandt SA, Goff DC Jr, Narayan KM. Ethnic disparities: control of glycemia, blood pressure, and LDL cholesterol among US adults with type 2 diabetes. Ann Pharmacother. 2005; 39:1489–1501. [PubMed: 16076917]

20. Bonds DE, Zaccaro DJ, Karter AJ, Selby JV, Saad M, Goff DC Jr. Ethnic and racial differences in diabetes care: the Insulin Resistance Atherosclerosis Study. Diabetes Care. 2003; 26:1040–1046. [PubMed: 12663570]

21. Bell RA, Camacho F, Goonan K, Duren-Winfield V, Anderson RT, Konen JC, Goff DC Jr. Quality of diabetes care among low-income patients in North Carolina. Am J Prev Med. 2001; 21:124–131. [PubMed: 11457632]

22. Harris MI, Eastman RC, Cowie CC, Flegal KM, Eberhardt MS. Racial and ethnic differences in glycemic control of adults with type 2 diabetes. Diabetes Care. 1999; 22:403–408. [PubMed: 10097918]

23. Brown AF, Gregg EW, Stevens MR, Karter AJ, Weinberger M, Safford MM, Gary TL, Caputo DA, Waitzfelder B, Kim C, Beckles GL. Race, ethnicity, socioeconomic position, and quality of care for adults with diabetes enrolled in managed care: the Translating Research Into Action for Diabetes (TRIAD) study. Diabetes Care. 2005; 28:2864–2870. [PubMed: 16306546]

24. Martin TL, Selby JV, Zhang D. Physician and patient prevention practices in NIDDM in a large urban managed-care organization. Diabetes Care. 1995; 18:1124–1132. [PubMed: 7587847]

25. Maggs D, Shen L, Strobel S, Brown D, Kolterman O, Weyer C. Effect of pramlintide on A1C and body weight in insulin-treated African Americans and Hispanics with type 2 diabetes: a pooled post hoc analysis. Metabolism. 2003; 52:1638–1642. [PubMed: 14669170]

26. Agrawal L, Emanuele NV, Abraira C, Henderson WG, Levin SR, Sawin CT, Silbert CK, Nuttall FQ, Comstock JP, Colwell JA. Ethnic differences in the glycemic response to exogenous insulin treatment in the Veterans Affairs Cooperative Study in Type 2 Diabetes Mellitus (VA CSDM). Diabetes Care. 1998; 21:510–515. [PubMed: 9571333]

27. Eberhardt MS, Lackland DT, Wheeler FC, German RR, Teutsch SM. Is race related to glycemic control? An assessment of glycosylated hemoglobin in two South Carolina communities. J Clin Epidemiol. 1994; 47:1181–1189. [PubMed: 7722552]

28. Werk EE Jr, Gonzalez JJ, Ranney JE. Lipid level differences and hypertension effect in blacks and whites with type II diabetes. Ethn Dis. 1993; 3:242–249. [PubMed: 8167540]

29. Wisdom K, Fryzek JP, Havstad SL, Anderson RM, Dreiling MC, Tilley BC. Comparison of laboratory test frequency and test results between African-Americans and Caucasians with diabetes: opportunity for improvement: findings from a large urban health maintenance organization. Diabetes Care. 1997; 20:971–977. [PubMed: 9167108]

30. Wing RR, Anglin K. Effectiveness of a behavioral weight control program for blacks and whites with NIDDM. Diabetes Care. 1996; 19:409–413. [PubMed: 8732700]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

31. de Rekeneire N, Rooks RN, Simonsick EM, Shorr RI, Kuller LH, Schwartz AV, Harris TB. Racial differences in glycemic control in a well-functioning older diabetic population: findings from the Health, Aging and Body Composition study. Diabetes Care. 2003; 26:1986–1992. [PubMed: 12832300]
32. Cook CB, Erdman DM, Ryan GJ, Greenlund KJ, Giles WH, Gallina DL, El-Kebbi IM, Ziemer DC, Ernst KL, Dunbar VG, Phillips LS. The pattern of dyslipidemia among urban African-Americans with type 2 diabetes. Diabetes Care. 2000; 23:319–324. [PubMed: 10868858]
33. Sharma MD, Pavlik VN. Dyslipidaemia in African Americans, Hispanics and whites with type 2 diabetes mellitus and hypertension. Diabetes Obes Metab. 2001; 3:41–45. [PubMed: 11213598]
34. Summerson JH, Bell RA, Konen JC. Coronary heart disease risk factors in black and white patients with non-insulin-dependent diabetes mellitus. Ethn Health. 1996; 1:9–20. [PubMed: 9395544]
35. Weatherspoon LJ, Kumanyika SK, Ludlow R, Schatz D. Glycemic control in a sample of black and white clinic patients with NIDDM. Diabetes Care. 1994; 17:1148–1153. [PubMed: 7821134]
36. Trivedi AN, Zaslavsky AM, Schneider EC, Ayanian JZ. Trends in the quality of care and racial disparities in Medicare managed care. N Engl J Med. 2005; 353:692–700. [PubMed: 16107622]
37. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA, Hadden D, Turner RC, Holman RR. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ. 2000; 321:405–412. [PubMed: 10938048]
38. Goldstein DE, Little RR, Lorenz RA, Malone JI, Nathan D, Peterson CM, Sacks DB. Tests of glycemia in diabetes. Diabetes Care. 2004; 27:1761–1773. [PubMed: 15220264]
39. Jeffcoate SL. Diabetes control and complications: the role of glycated haemoglobin, 25 years on. Diabet Med. 2004; 21:657–665. [PubMed: 15209755]
40. Bry L, Chen PC, Sacks DB. Effects of hemoglobin variants and chemically modified derivatives on assays for glycohemoglobin. Clin Chem. 2001; 47:153–163. [PubMed: 11159762]
41. Egede LE, Obah E, Lorch T, Oussova T. Spurious elevation of hemoglobin A1c by hereditary persistence of fetal hemoglobin. South Med J. 2000; 93:62–64. [PubMed: 10653068]
42. Koskinen LK, Lahtela JT, Koivula TA. Fetal hemoglobin in diabetic patients. Diabetes Care. 1994; 17:828–831. [PubMed: 7525170]
43. Carrasquillo O, Himmelstein DU, Woolhandler S, Bor DH. Going bare: trends in health insurance coverage, 1989 through 1996. Am J Public Health. 1999; 89:36–42. [PubMed: 9987462]
44. Harris MI. Racial and ethnic differences in health insurance coverage for adults with diabetes. Diabetes Care. 1999; 22:1679–1682. [PubMed: 10526734]
45. Sedlis SP, Fisher VJ, Tice D, Esposito R, Madmon L, Steinberg EH. Racial differences in performance of invasive cardiac procedures in a Department of Veterans Affairs Medical Center. J Clin Epidemiol. 1997; 50:899–901. [PubMed: 9291874]
46. Ayanian JZ, Cleary PD, Weissman JS, Epstein AM. The effect of patients' preferences on racial differences in access to renal transplantation. N Engl J Med. 1999; 341:1661–1669. [PubMed: 10572155]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

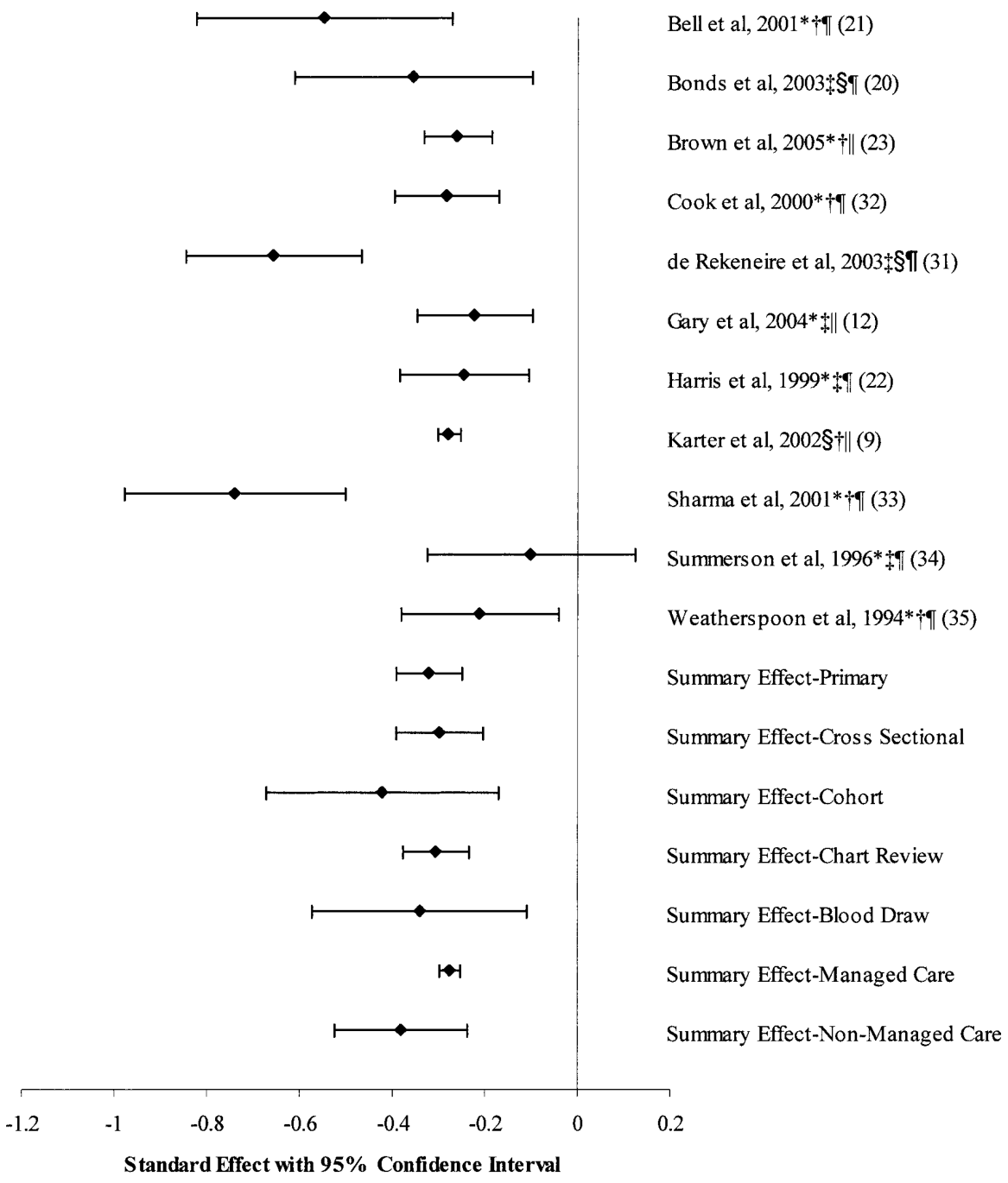

Figure 1.
Standard effect size summary for the difference between A1C in African Americans and non-Hispanic whites. *Cross-sectional study; †data obtained from chart review; ‡A1C sample from study-initiated blood draw; §prospective cohort study or clinical trial; ‖managed care; ¶nonmanged care.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

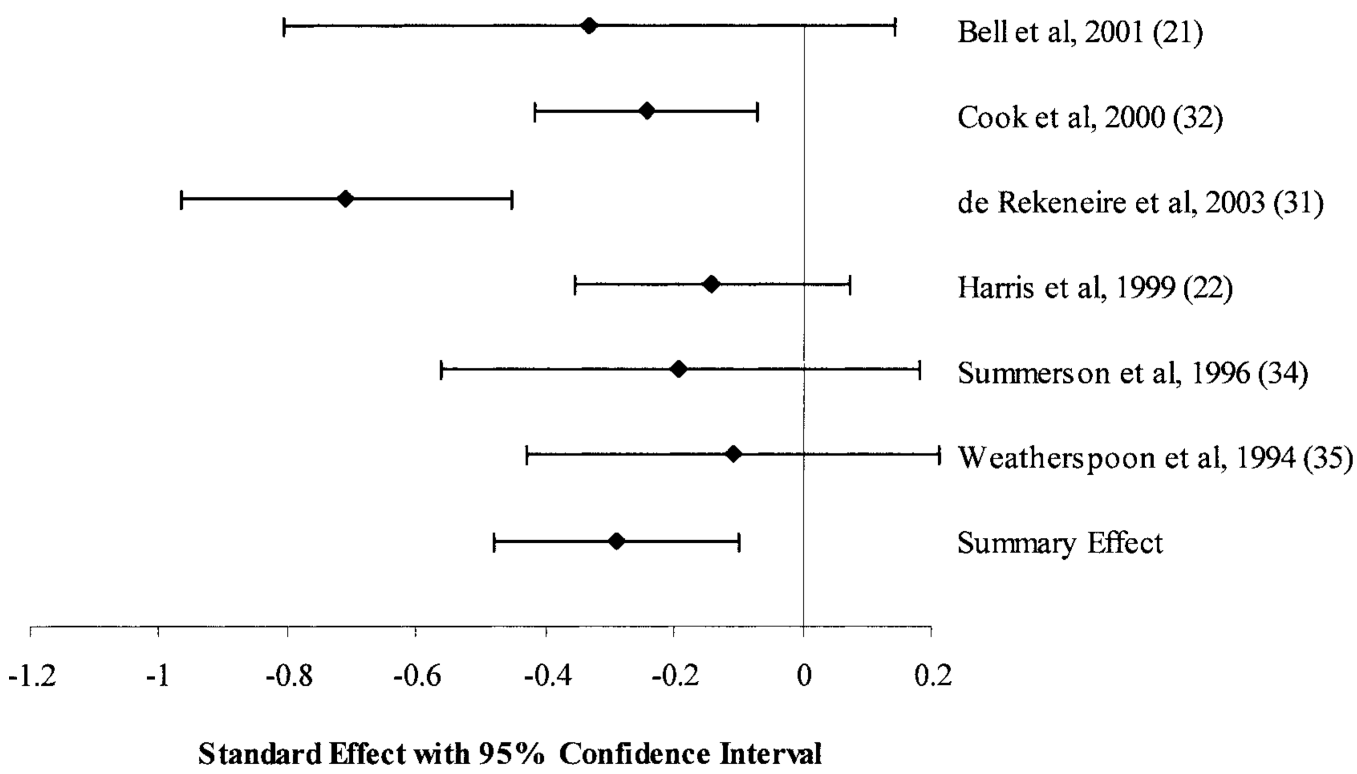

Figure 2.
Standard effect size for the difference between A1C in African-American and non-Hispanic white men.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

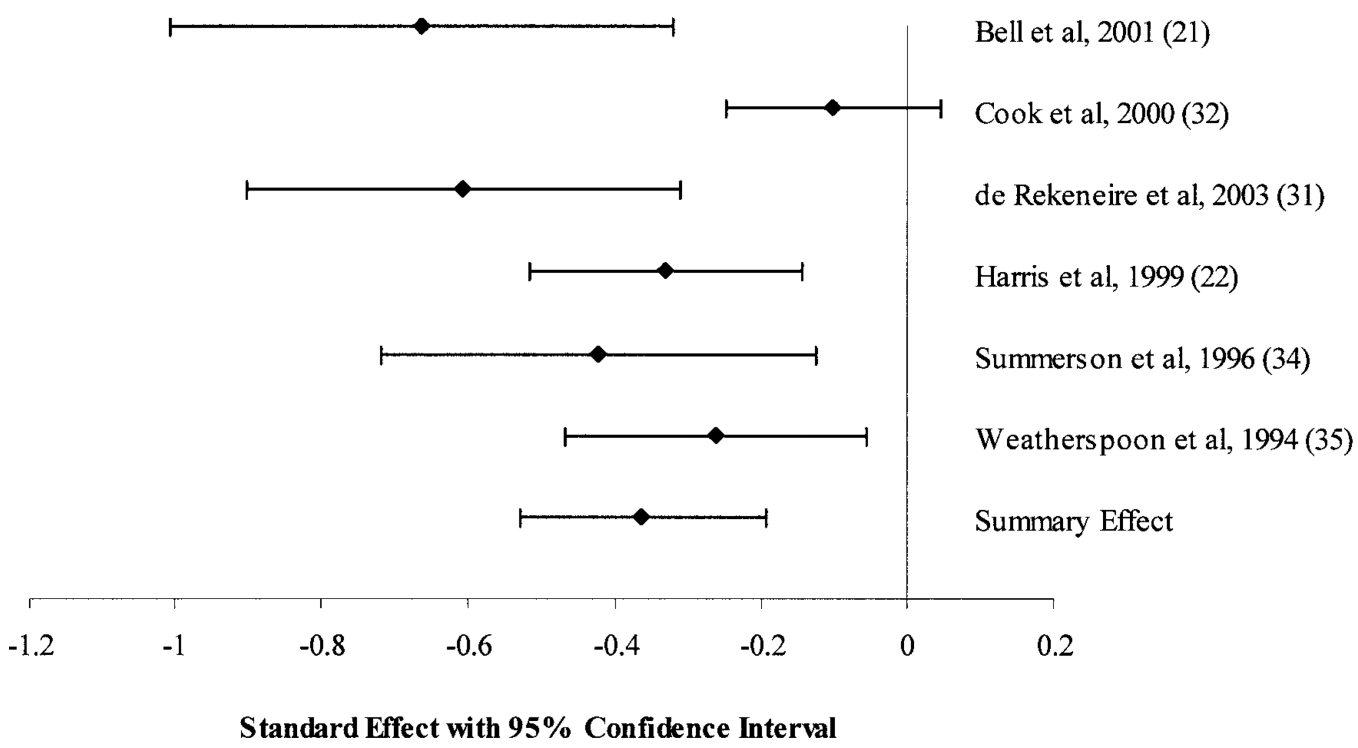

Figure 3.
Standard effect size for the difference between A1C in African-American and non-Hispanic white women.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Table 1

Characteristics of 11 studies among African Americans and non-Hispanic whites

	Non-Hispanic whites			African Americans				
Study group (ref. no.)	***n***	**Age (years)**	**A1C (%)**	***n***	**Age (years)**	**A1C (%)**	**Site**	**Study design**
Bell et al. (21) *	105	55 ± 15	7.9 ± 1.7	103	54 ± 14	9.1 ± 2.6	Medical record data from outpatient clinics across NC	Retrospective chart review
Bonds et al. (20) *	144	62 ± 8	7.4 ± 1.8	102	61 ± 7	8.0 ± 2.0	IRAS cohort in CO, TX, and two sites in CA	Prospective cohort study
Brown et al. (23)	2,787	61 ± 13	7.8 ± 1.7	965	59 ± 13	8.2 ± 2.1	TRIAD study of diabetes in managed care, nationwide	Prospective cohort study with cross-sectional analysis
Cook et al. (32)	328	54 ± 11	8.6 ± 1.8	4,014	53 ± 13	9.3 ± 2.5	Registry data from outpatient diabetes clinic in GA	Retrospective chart review
de Rekeneire et al. (31)	194	74 ± 3	7.4 ± 1.2	274	74 ± 3	8.4 ± 1.7	Health ABC study in PA and TN	Prospective cohort study
Gary et al. (12)	374	≥30	8.5 ± 2.2	732	≥30	9.1 ± 2.9	Medical claims from university-affiliated managed care organization on east coast	Cross-sectional study of average A1C
Harris et al. (22) *	486	≥20	7.6 ± 1.9	335	≥20	8.1 ± 2.2	NHANES III data	Cross-sectional study
Karter et al. (9)	40,025	61 ± 13	8.4 ± 1.8	8,496	59 ± 13	8.9 ± 1.8	Northern California Kaiser Permanente patients	Prospective cohort study
Sharma and Pavlik (33) *	111	63 ± 13	9.4 ± 2.9	209	64 ± 33	11.4 ± 2.6	Community clinic patients in TX	Retrospective chart review
Summerson et al. (34)	168	59 ± 17	7.4 ± 1.8	140	58 ± 17	7.6 ± 2.2	Academic family practice and community health center in NC	Cross-sectional study
Weatherspoon et al. (35)	279	60 ± 13	7.3 ± 1.7	249	56 ± 14	7.7 ± 2.1	Public clinics accessible to low-income patients in central FL	Retrospective chart review

Data are means ± SD.

* A1C mean (±SD) received following communication with author.

ABC, Aging and Body Composition; IRAS, Insulin Resistance Atherosclerosis Study; NHANES III, Third National Health and Nutrition Examination Survey; TRIAD, Translating Research Into Action for Diabetes.