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REVIEWS AND COMMENTARY

Secular Trends in the United States Black/White Hypertension Prevalence Ratio: Potential Impact of Diminishing Response Rates

Kevin M. Gorey¹ and Maurizio Trevisan²

INTRODUCTION

Three decades of research on hypertension prevalence in the United States has clearly demonstrated the relative disadvantaged status of black adults compared with their white counterparts (1–25). During this period of time, blacks, on average, experienced prevalent hypertension at approximately twofold the rate in whites; however, the research literature also suggests that the black/white hypertension prevalence ratio has diminished significantly over time (12, 14). This time trend, that is, the increasing similarity of US black and white samples on hypertension, is postulated to be resultant from changes over time in a number of potentially salient factors: substantive treatment, lifestyle, and other environmental changes and/or *methodological* ones. We are unaware of any study which has empirically examined the relation of the latter to differential changes over time in hypertension prevalence by racial groups in the United States. For example, what is the relation between study response rates and the black/white hypertension prevalence ratio? Two recent studies in this field (26, 27), which reported observations that were disparate from previous

ones, have proposed selective participation or response bias as a possible alternative explanation for their findings, but were not able to directly assess the extent of such bias. The present review will address this concern.

Survey response rates have declined significantly over the past 25 years, and the growing lack of willingness to participate has been most noticeable in large metropolitan areas, and particularly in inner-city areas (28). The potentially confounding influence of this phenomenon is underscored by research findings on responders (participants) versus those who choose not to be included in samples for social, behavioral, or biomedical research. Responders tend to be younger and of higher socioeconomic status than nonresponders (29–33). It is also known that socioeconomic status is associated with other risk factors for high blood pressure (34, 35). In fact, hypertension has been found to be inversely associated with socioeconomic status among both black and white adults in the United States (36–38). Further, response status has been found to be associated with a wide array of lifestyle/behavioral (inverse) and family history-related (direct) risk factors, as well as with numerous morbid and mortal (inverse) health outcomes (39–46). These findings may generally fall under the rubric of the “healthy participator” effect. Such bias, if operative in a racial group comparative study, would clearly tend to attenuate its power to detect group differences. Thus, this review’s primary hypothesis is as follows: Study response rates will be directly associated with the reported black/white hypertension prevalence ratio.

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Abbreviations: NHANES I, first National Health and Nutrition Examination Survey; PR, prevalence ratio; SD, standard deviation.

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REVIEW OF LITERATURE

To identify original reports of results that could be used in this analysis, computer searches were conducted of *Index Medicus* and *Sociological Abstracts* databases for 1965–1996. The following subject keyword scheme was used: “blood pressure” or “hypertension” and “racial stocks” or “blacks” or “minority groups.” These searches were then augmented with a bibliographic review of the retrieved manuscripts. Twenty-five papers were collected which reported hypertension prevalence estimates among both black and white samples. These 25 studies are the database for the present analysis (1–25). Each study represents a unique analysis, although it may not necessarily be completely independent of the others, because several of the studies come from common data sets. For example, two studies used data from the first National Health and Nutrition Examination Survey (NHANES I), but they selected samples of different age ranges and used distinctly different analytic methods (one age-adjusted, the other not) which resulted in divergent hypertension prevalence estimates and response rates. For our analysis, studies which used a common data set, but selected different samples or employed distinct analytic methods (i.e., used different operational measures of hypertension) will be treated as independent studies. It ought to be noted that this integrative review’s results and interpretation were substantively unaffected when each study was represented only once, so all of the data were included in the present analysis.

Sample description

The sample of studies were predominantly cross-sectional ($n = 20$), and, of the five cohorts, only their cross-sectional components are included in the present analysis. These studies gathered data from 1960 to 1991 from 13 national US samples (the second National Health and Nutrition Examination Survey (NHANES II), five; the National Health Examination Surveys (NHES), three; NHANES I, two; and one each from the third National Health and Nutrition Examination survey (NHANES III), the Hypertension Detection and Follow-Up Program (HDFP) Cooperative Group, and the Community Hypertension Evaluation Clinic (CHEC) Program) and 12 regional/state-wide (Georgia, two; North Carolina, two; South Carolina, two; California; Maryland; and Texas) or local ones (Chicago, Detroit, and Minneapolis/St. Paul). More than three-quarters of the studies used random selection ($n = 19$), the remainder were convenience sample-based, and only slightly more than half of them used procedures for age-adjustment in

calculating the black/white hypertension prevalence ratio ($n = 14$). Twenty-three of the studies sampled from general adult populations (age ≥ 18 years; one used the criterion age 15 years), while two sampled older adult populations (age ≥ 65 years). Not surprisingly, the white population samples (median = 3,554) were much larger than the black samples (median = 1,061).

Secular trend of response rates. Outcomes of the 12 studies undertaken prior to 1976 were compared with the 13 initiated during 1976 or later. Consistent with the trends observed among related research fields, response rates were found to be significantly lower among the more recent surveys in this field, i.e., for data collected 1976 or later, mean 69.2 percent (standard deviation (SD) 6.9) ($t(19) = 4.52, p < 0.05$) versus data collected from 1960 to 1975, mean 86.1 percent (SD 9.1). So participation rates have diminished by nearly 20 percent over this research field’s three-decade lineage. Surely, this methodological caveat ought to be considered when interpreting this extant research. Given the known associations of response status with numerous health outcomes, and more specifically, its likely association with this review’s central variable of interest, that is, hypertension, response bias may itself account for any observed relative change in hypertension among black and white adults over time. The question is: How much of the change over time in the black/white hypertension prevalence ratio may be accounted for by changing participation rates?

Response rates and the black/white hypertension prevalence ratio

As were response rates, the black/white hypertension prevalence ratio was found to diminish significantly over time among both women (prevalence ratio (PR) = 2.59 vs. 1.77) and men (PR = 2.20 vs. 1.38) (see table 1). It would seem that perhaps due to more effective identification and treatment strategies, the relative health status of blacks, as indicated by their more prevalent experience of uncontrolled hypertension, has improved significantly during the past 30 years. However, this explanation of the observed black/white hypertension secular trend is confounded by potential response bias among the 25 reviewed studies. Study response rates were also found to be associated with the black/white hypertension prevalence ratio. After grouping the studies by their median response (≥ 70 percent, < 70 percent), it was observed that studies with higher response rates reported significantly larger black/white hypertension prevalence ratios among both women (PR = 2.66 vs. 1.71) and men (PR = 2.28 vs. 1.32).

TABLE 1. The black/white hypertension prevalence ratio by study characteristics in 25 studies in the United States (1960–1991) (1–25)

Characteristic group	No. of studies	Black/white hypertension prevalence ratio			
		Females		Males	
		Mean	(SD) [†]	Mean	(SD)
Years data collected*					
1960–1975	12	2.59	(0.85)	2.20	(0.71)
1976 or later	13	1.77	(0.44)	1.38	(0.29)
Response rate (%)*,‡					
≥70	11	2.66	(0.78)	2.28	(0.70)
<70	10	1.71	(0.45)	1.32	(0.23)

* All between-group comparisons among both female and male subsamples are significant at a minimum of $p < 0.05$ (independent samples t -test, two-tailed).

[†] SD, standard deviation.

[‡] Four studies did not report response rates.

A final interpretive adjunct analysis force entered study response rates into a multiple linear regression model with the black/white hypertension prevalence ratio as its criterion variable. Study response rates accounted for substantial criterion variability: women ($R^2 = 0.362$) and men ($R^2 = 0.469$), both $p < 0.05$. Among the 25 reviewed studies, response rates may account for a third to nearly a half of the variability in black-white hypertension differentials. In fact, after study response rate entered the model, no other coded study characteristic (sample's age or sex distribution, sample size, region of country, local/national, urban/rural, definition of hypertension, and so on), including the *year of data collection*, would enter. Moreover, because none of these parenthetical variables were found to be significantly associated with both study response rates and their reported black/white hypertension prevalence ratio, they can not confound this integrative review's central analysis.

DISCUSSION

A number of general data trends were revealed by this review which may be of particular importance to the epidemiologic researcher or public health policy planner. First, replicating previous research, the black-white hypertension gap was found to have diminished significantly (by 50 percent or more) over the past three decades, and, during the same period of time, the public's willingness to take part in research has declined markedly. Next, a direct association was observed between these two factors. Approximately one-third to half of the diminishment over time in the black/white hypertension prevalence ratio was accounted for by declining study response rates. Finally, after accounting for diminished response rates, no

secular trend of black/white hypertension prevalence was observed. The observed trend of relatively increased health status (lower hypertension prevalence) among blacks may merely be a methodological artifact, a function of decreasing survey participation over time.

It is not difficult to imagine how such response bias may have intruded on this body of research. Given the known interrelations among survey participation and health and socioeconomic statuses, response bias is certainly as plausible an explanation for the observed black/white hypertension prevalence ratio diminishment as is more recently effective treatment among blacks. As response rates declined over time, the tendency for respondents, both black and white, to resemble each other on socioeconomic status and various indicators of health status (i.e., to be better off and healthier) more than their respective general population counterparts, would have increased in-kind. Consequently, although black and white *respondents* have been observed to be increasingly similar on hypertension prevalence, the same is probably not true among all (responder and nonresponder) black and white adults in the United States.

It ought to be underscored that the above discussed data trends were review-generated and are ecologic in character. It remains possible, as some have suggested, that increasingly effective treatment and control of hypertension among blacks, particularly among women, explains the diminished black-white hypertension gap (47). Others, focusing on problems of access and cost, have provided evidence to the contrary (48, 49). Other cultural factors such as racial discrimination are probably also important, although they have not yet been accounted for in this field's extant aggregate database (50, 51). The results of this study imply that it is plausible that the methodological artifact of declining response rates explains a significant proportion of the phenomenon. The unconfounding of these alternative explanations will ultimately require investment in a large, population-based study with probability sampling and procedures which ensure very high participation among both black and white adults. It is possible, however, that such a study could become prohibitively expensive. A seemingly obvious solution would be to conduct secular trend investigations of blood pressure controlling for socioeconomic status and other potentially important confounders in populations of interest. Certainly, the large national studies may be thought to have samples robust enough to address the issue. However, even though potential response bias has been an issue of long-standing concern to NHANES principals, who have, for example, included remuneration for partici-

pation (\$10 in the 1970s), nonparticipation problems have burgeoned, as have problems related to selective mortality; blacks are twice as likely to be lost to follow-up (31, 52, 53). Assurance of very high prevalent participation among more circumscribed, localized samples, would be a most welcome next practical step in this field.

SUMMARY

In this integrative review, the authors analyzed 25 studies on hypertension prevalence among black and white adults (1960–1991). The authors made the following inferences: 1) both female (2.59 vs. 1.77) and male (2.20 vs. 1.38) black/white hypertension prevalence ratios have diminished by approximately a third over the past three decades; 2) response rates were significantly lower among the more recent surveys (i.e., 1976 or later, mean 69.2 percent (standard deviation (SD) 6.9) vs. 1960 to 1975, mean 86.1 percent (SD 9.1)); and 3) these two trends are directly associated—response rates may account for a third (women, $R^2 = 0.362$) to nearly a half (men, $R^2 = 0.469$) of the variability in black-white hypertension differentials. These findings suggest that although respondent-based research has found black and white adults in the United States to be increasingly similar in hypertension prevalence, the same may not be true of the entire adult population (responders and nonresponders). The apparent diminishment over time in the black-white hypertension gap is as likely to be a methodological artifact allied with declining response rates as a true parametric phenomenon resultant from substantive factors such as enhanced treatment effectiveness among blacks.

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