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# Personalized Weight Management Interventions for Cardiovascular Risk Reduction: A Viable Option for African-American Women

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ABSTRACT

Obesity is an independent contributor to cardiovascular disease (CVD) and a major driving force behind racial/ethnic and gender disparities in risk. Due to a multitude of interrelating factors (i.e., personal, social, cultural, economic and environmental), African-American (AA) women are disproportionately obese and twice as likely to succumb to CVD, yet they are significantly underrepresented in behavioral weight management interventions. In this selective review we highlight components of the limited interventions shown to enhance weight loss outcomes in this population and make a case for leveraging Web-based technology and artificial intelligence techniques to deliver personalized programs aimed at obesity treatment and CVD risk reduction. Although many of the approaches discussed are generally applicable across populations burdened by disparate rates of obesity and CVD, we specifically focus on AA women due to the disproportionate impact of these non-communicable diseases and the general paucity of interventions targeted to this high-risk group.



As a leading cause of morbidity and mortality worldwide, cardiovascular disease (CVD) is a pervasive problem with annual healthcare costs estimated at $273 billion in the United States (US) alone.[1] This is especially disturbing given the fact that at least 80% of premature cases of CVD and related events (myocardial infarction/MI and stroke) are largely preventable through lifestyle modification.[2–4] A solid base of empirical evidence indicates a strong relationship between obesity and incidence and prevalence of CVD risk factors.[3,5] Furthermore, excess fat is a direct result of poor diet, low levels of physical activity (PA; i.e., structured exercise and/or leisure time PA/LTPA), and high levels of sedentary behavior, each of which has been independently linked to the development of CVD.[2,3,5]

More than one-third of adults in the US are considered obese (defined as having a body mass index at or above 30 kg/m$^2$).[6] Obesity is also well documented as a major driving force behind CVD-related racial and ethnic health disparities.[7] This holds especially true for African-American (AA) women.[7,8] Compared to whites, AA women are disproportionately obese, more likely to have low-nutrient, energy-dense diets, less likely to be physically active, and, unfortunately, twice as

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| Abbreviations and Acronyms |
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| **AA** = African-American |
| **AI** = artificial intelligence |
| **CVD** = cardiovascular disease |
| **LTPA** = leisure-time physical activity |
| **PA** = physical activity |
| **US** = United States |
| **WMI** = weight management intervention |

likely to succumb to CVD yet they are significantly underrepresented in behavioral weight management interventions (WMIs).[4,8,9] While prevention and health promotion efforts in the US have addressed such disparities in nutrition and PA guidelines,[2,3] continued rises in the incidence and prevalence of CVD in this population coupled with mounting rates of obesity point to information gaps and ineffective messaging.

The majority of recommendations are generic and impersonal (i.e., "eat 5 servings of fruit and vegetables a day", "exercise 20–60 minutes a day", etc.), intended to reach the general population with little consideration of the specific needs, preferences, and abilities of underrepresented groups.[2,10,11] Certainly, many interrelating factors (i.e., personal, social, cultural, economic and environmental) may present barriers to behavior change among AA women and thereby influence their risk of CVD.[12,13] Due to the existence of such barriers, many of which are uncontrollable, more tailored and targeted approaches are needed to personalize WMIs and health-related programs aimed at this population.

The use of Web-based technology generally offers an innovative and potentially beneficial avenue for countering obesity and reducing CVD risk among AA women and other disparate populations by providing an accessible and affordable means of delivering dietary and PA programs and interventions.[14,15] But the potential contribution of this technology does not stop there. Artificial intelligence (AI) programs provide a possible means of better personalizing WMIs offered by way of the Web.[16,17] These programs are essentially knowledge-based computer software (algorithms) built to mimic the unique problem-solving abilities of human experts. Algorithms can be designed to collect a plethora of information based on predetermined data (i.e., information obtained from electronic medical records) and/or user responses to directed questions aimed at determining their demographic, socioeconomic and other characteristics in addition to their specific needs, preferences and lifestyles. Data collected can then be leveraged to generate custom tailored feedback and personalized solutions (i.e., dietary and PA plans), which are directly accessible to target users by way of an Internet-connected computer or mobile device (tablets and smartphones).[17–19]

Since 80% of AAs utilize Web-based media through a computer and/or mobile device, with health-related usage being highest among women when compared to their male counterparts,[14,20,21] this technology has the capability to reach a large proportion of this population, providing greater accessibility to WMIs. However, in the absence of personalization components, interventions might not reach their full potential in terms of enhancing weight loss and related health outcomes. In this selective review we focus on strategic approaches for personalizing interventions targeted for obesity treatment and CVD risk reduction among AA women. To carry this out, we initially conducted a literature search centered on traditional and Web-based dietary and PA interventions for the management of CVD and related-risk factors using a range of sources including scholarly, peer-reviewed journal articles (i.e., systematic reviews, meta-analyses, and original research papers) indexed in PubMed and CINAHL, grey literature, and reputable Web sites and other Internet-based media. In addition to the literature examined, certain theoretical contexts laid out in this review are built upon related work and professional experiences of the authors.

To provide a background for understanding the potential value of personalizing WMIs we begin by focusing on 1) key barriers to weight loss among AA women and 2) components of the limited behavioral lifestyle interventions that have been proven effective for weight loss and CVD risk reduction in this population. In the remainder of this discussion we 3) highlight tactical approaches for using Web-based technology and AI techniques to personalize WMIs aimed at AA women. Although many of the approaches discussed are generally applicable across populations burdened by disparate rates of obesity and CVD (i.e., racial/ethnic minorities, low-income groups, and women in general), we specifically focus on AA women due to the disproportionate impact of these non-communicable diseases and the general paucity of interventions targeted to this high-risk group.

## Barriers to weight loss among African-American women that interventions need to address

Weight management through behavioral lifestyle intervention is a critical target for reduction of CVD-related health disparities in AA women,[2,6,22] which presents a challenge due to the already complex and multifaceted nature of behavior change in general. This is further complicated by the fact that a large majority of existing data supporting the effectiveness of WMIs have been derived from studies of mostly white women[23,24] so there is little empirical insight into why weight loss is comparably more difficult among AA women. There is, however, evidence that differences in weight loss-promoting behaviors across racial/ethnic and socioeconomic groups are greatly influenced by the environments they are in and all the situational variables (i.e., biological, social and cultural) that determine their circumstances from day-to-day.[12,23,24] Therefore, excluding the role of such factors may very well reduce the impact of interventions targeted to AA women and other disparate populations.

Behavioral lifestyle interventions have, by and large, been grounded in various theoretical models of behavior change including the Theory of Reasoned Action/Theory of Planned Behavior, the Transtheoretical Model (or Stages of Change), and the Social Cognitive Theory.[25–28] However, it is debatable whether or not inclusion of such frameworks in the design of WMIs could either enhance or diminish weight loss.[27,28] These theoretical frameworks are collectively based on