Churches as targets for cardiovascular disease prevention: comparison of genes, nutrition, exercise, wellness and spiritual growth (GoodNEWS) and Dallas County populations

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ABSTRACT

Background  We compared cardiovascular (CV) risk factors (CVRFs) of community-based participatory research (CBPR) participants with the community population to better understand how CBPR participants relate to the population as a whole.

Methods  GoodNEWS participants in 20 African-American churches in Dallas, Texas were compared with age/sex-matched African-Americans in the Dallas Heart Study (DHS), a probability-based sample of Dallas County residents. DHS characteristics were sample-weight adjusted to represent the Dallas County population.

Results  Despite having more education (college education: 75 versus 51%, \(P < 0.0001\)), GoodNEWS participants were more obese (mean body mass index: 34 versus 31 kg/m², \(P < 0.001\)) and had more diabetes (23 versus 12%, \(P < 0.001\)) and hyperlipidemia (53 versus 14%, \(P < 0.001\)) compared with African-Americans in Dallas County. GoodNEWS participants had higher rates of treatment and control of most CVRFs (treated hyperlipidemia: 95 versus 64%, \(P < 0.001\); controlled diabetes: 95 versus 21%, \(P < 0.001\); controlled hypertension: 70 versus 52%, \(P = 0.003\)), were more physically active (233 versus 177 metabolic equivalent units-min/week, \(P < 0.0001\)) and less likely to smoke (10 versus 30%, \(P < 0.001\)).

Conclusions  Compared with African-Americans in Dallas County, CBPR participants in church congregations were more educated, physically active and had more treatment and control of most CVRFs. Surprisingly, this motivated population had a greater obesity burden, identifying them as a prime target for CBPR-focused obesity treatment.

Keywords  African–Americans, cardiovascular risk factors, community-based participatory research, obesity

Introduction

Cardiovascular disease (CVD) is the leading cause of death in the USA, with over 36% of all yearly deaths attributed to CVD.¹ CV risk factors (CVRFs), including hypertension, hyperlipidemia, diabetes and obesity disproportionately affect African-American populations, contributing to a higher burden of CVD.²,³ Physical activity and dietary changes can significantly improve CVRFs and serve as CVD prevention targets,
with interventions that leverage social determinants of health such as social support having greater sustainability.\textsuperscript{4–6} Community-based interventions in faith-based organizations (FBOs) of African-American communities, build on established social networks to promote lifestyle changes\textsuperscript{5} may be effective at improving CVRFs,\textsuperscript{7,8} and are endorsed by organizations such as the American Heart Association.\textsuperscript{9}

While recent studies have focused on design and implementation of community-based interventions for treatment of CVRFs,\textsuperscript{7,10–13} little is known about how the individuals recruited for CBPR programs reflect the community at large. Detailed comparisons of intervention groups and the population they represent can provide a better understanding of the social context in which a community-based intervention occurs, and insight into the capability of interventions to impact those most in need and most likely to benefit from the intervention. In addition, comparative results can potentially identify future targets for interventions. Thus, we sought to compare demographics, anthropometrics and CVRF prevalence, awareness, treatment and control between participants in the GoodNEWS Trial, an intervention promoting lifestyle changes in predominantly African-American churches in Dallas, Texas with age- and sex-matched African-Americans in Dallas County using data from the Dallas Heart Study (DHS), a multi-ethnic, population-based sample of Dallas County residents. As a secondary aim, we evaluated the association between frequency of church attendance and CVRFs within the DHS population to provide further insight into the association between church attendance and CVRFs given the focus on avid church participants in GoodNEWS.

**Methods**

**Study design and population**

A cross-sectional analysis was done comparing baseline data from all GoodNEWS participants and Dallas County African-Americans using DHS data. The GoodNEWS trial is a CBPR study aiming to reduce CVRF burden among African-Americans, using a lay health promoter (LHP) approach by training church members to serve as health educators in the FBO setting. At baseline, 392 GoodNEWS participants, aged 18–70, completed a self-administered survey which included demographics, achieved education, medical and medication history, the Diet History Questionnaire and 7-day physical activity recall (PAR), underwent blood testing for fasting lipids and blood glucose, and completed blood pressure and anthropometric measurements in 2008. Individuals with complete baseline data for demographics, physical activity, CVRFs and anthropometrics were included in this analysis ($n = 357$). The GoodNEWS trial was approved by the Institutional Review Board of UT Southwestern Medical Center and all participants provided written informed consent to participate in the study.

The DHS is a probability sample of Dallas County residents aged 18–65 ($n = 6101$) designed to study CVD with data collected from 2000 to 2002. Details of study design and variable definitions have been published previously.\textsuperscript{14} To allow extrapolation of DHS prevalence data to the general population of Dallas County, sample weights were calculated for each participant reflecting the probability of selection for DHS based on ethnicity, age, gender and geographic stratum. Sample-weighted DHS data allowed the comparison of the GoodNEWS cohort with African-Americans in Dallas County. The study was approved by the Institutional Review Board of UT Southwestern Medical Center and all participants provided written informed consent. To prevent confounding of CVRF prevalence due to age- and sex-distribution differences between the cohorts, four African-American participants from DHS ($n = 1104$) were matched with each GoodNEWS participant ($n = 357$) based on age and sex. If four controls were not available for a GoodNEWS participant, three or fewer controls were matched to maximize the number of DHS participants in the study and provide a more representative sample of Dallas County African-American adults. 78% ($n = 279$) of GoodNEWS participants were matched to four DHS controls.

**Baseline measurements in the GoodNEWS trial**

Blood pressure was measured using an established protocol,\textsuperscript{15} and the average of two blood pressure measurements was taken with a recently calibrated automatic blood pressure cuff (Welch Allyn, Inc., Series 52000). If the first two blood pressure measurements varied by $>20$ mmHg systolic or 10 mmHg diastolic, a third measurement was performed and the average recorded. Fingerstick capillary blood was drawn for analysis of plasma lipids and glucose (Cholestech LDX) after a 12-h fast. LDL-c was estimated by using Friedewald Equation. Anthropometrics included weight, height, body mass index (BMI), waist circumference (WC), hip circumference (HC) and waist-to-hip ratio (WHR). Weight was measured using a calibrated digital scale (Detecto Platform Balance Scales, Webb City, MO, for weights $\leq 300$ lbs and Health-O-Meter Model 320 KL, Alsip, IL, for $\geq 300$ lbs). Height was measured using a stadiometer (Seca Portable Stadiometer, Ontario, CA). BMI was then calculated as weight (kg)/height$^2$(m$^2$). WC and HC
were measured according to guidelines developed by a National Heart, Lung and Blood Institute Expert Panel.\textsuperscript{16} Each participant completed a 7-day PAR. This questionnaire measures intensity, frequency and type of activity within the previous 7 days and is established as a reliable and validated instrument.\textsuperscript{17} Energy expenditure was estimated by asking the participants to recall how much time was spent in: (i) sleep, (ii) moderate activity, (iii) hard activity and (iv) very hard activity. Total metabolic equivalent units (METS) were calculated by multiplying time in each category by a standard conversion for metabolic equivalent units\textsuperscript{18} and summing the total of activity categories 3 and 4, excluding the reported sleep and moderate activity time given that these categories were not included in the physical activity metric for DHS.

Prevalent CVRFs were defined using standard cut-points,\textsuperscript{15,19,20} self-reported personal medical history and self-reported medication use. Hypertension was defined as blood pressure $\geq 140/90$ mmHg, history of hypertension or antihypertensive medication. Hyperlipidemia was defined as \textit{LDL-c} $\geq 160$ mmol/dl, history of hyperlipidemia or lipid-lowering medication. Diabetes was defined as fasting glucose $\geq 126$ mmol/dl, history of diabetes, or anti-diabetic medication. Tobacco use was based on self-report from the participant survey.

Participants with a CVRF were considered ‘aware’ if they self-reported the risk factor. Participants who were aware of a risk factor were considered ‘treated’ if they reported medication use targeting the risk factor. Participants were classified as having a ‘controlled’ risk factor if the risk factor was treated to clinically accepted target levels (i.e. blood pressure $<140/90$ mmHg, \textit{LDL-c} $<160$ mmol/dl and fasting glucose $<126$ mmol/dl).\textsuperscript{15,19,20}

**Baseline measurements in the DHS**

Methods for DHS baseline measurements have been described previously.\textsuperscript{14} Visit 1 for DHS involved a home visit for collecting demographic and survey data and anthropometrics, including BMI, WC and HC, by a trained DHS employee. Visit 2 involved collecting fasting blood and urine samples. Baseline measurements in DHS (i.e. BMI, WC, HC, fasting lipids and glucose, tobacco use and achieved education) were completed in a similar manner as in the GoodNEWS trial. In DHS, awareness, treatment and control of prevalent hypertension, hyperlipidemia and diabetes were defined as described above for GoodNEWS. However, there were differences in the measurement of blood pressure and physical activity in DHS compared with methods described for GoodNEWS. In DHS, five sequential blood pressure measurements were taken and the average of the final three blood pressure measurements were recorded and used in analyses. In DHS, self-reported leisure-time physical activity was converted into METs based on the activity type and length in minutes, using a validated conversion scale for the intensity of the activity into METs.\textsuperscript{19} Exercise dose was calculated as the sum of METs multiplied by minutes of physical activity for all activity occurring over a week. Finally, church attendance, which was only surveyed in DHS, was defined as self-reported frequency of weekly attendance of church or religious activities.

**Statistical analysis**

Continuous data are presented as means (standard error of the mean) and categorical data as proportions. Statistical testing comparing the cohorts was performed using the Student’s \textit{t}-test or Wilcoxon rank-sum test, as appropriate, for continuous variables and the chi-square test for categorical variables. All DHS prevalence data were sample-weight adjusted and thus the reported proportions reflect those in the Dallas County population, not the study population. Sample-weighted regression models were used to assess trends in CVRF prevalence across categories of church attendance in the African-American DHS population. Logistic regression analysis was used to determine the association between prevalent obesity and church attendance independent of age and sex among African-Americans in the DHS. Two-sided \textit{P}-values of $\leq 0.05$ were considered statistically significant. All analyses were performed with SAS 9.2 Software.

**Results**

Demographic and clinical characteristics for the study populations are presented in Table 1. The proportion of individuals attaining at least some college education was higher in the GoodNEWS cohort than in African-American adults in Dallas County (75 versus 51%, $P < 0.01$), while marital status was similar between the populations (52 versus 50%, $P = \text{NS}$). GoodNEWS participants had a significantly lower prevalence of current smoking than Dallas County residents (10 versus 30%, $P < 0.01$). Blood pressure was slightly yet statistically significantly lower for GoodNEWS participants than that for African-Americans in Dallas County (systolic blood pressure: $126.0 \pm 1.0$ versus $129.6 \pm 1.0$ mmHg, $P < 0.05$; diastolic blood pressure: $79.5 \pm 0.5$ versus $81.1 \pm 0.5$ mmHg, $P < 0.05$).

BMI and WC were both significantly higher for GoodNEWS participants than African-Americans in Dallas County. The average BMI for GoodNEWS participants was
Dallas County residents (higher (123.7 versus 108.1, \(P < 0.01\)) and HDL-c was significantly lower (\(P = 0.04\)) in the GoodNEWS group than that the Dallas County population; however, total cholesterol and LDL-c were similar between the two groups (\(P = \text{NS for each}\)).

The prevalence of diabetes and hyperlipidemia was also significantly higher in the GoodNEWS population than that in African-American adults in Dallas County (Fig. 1A). While awareness of prevalent diabetes was lower in the GoodNEWS population, awareness of prevalent hypertension and hyperlipidemia was not statistically different between the groups (Fig. 1B). However, treatment and control rates of these CVRFs were higher among the GoodNEWS population (Fig. 1C and D). Over 90% of GoodNEWS participants aware of prevalent diabetes, hypertension and hyperlipidemia reported treatment for these diseases (\(P < 0.05\) for diabetes and hyperlipidemia treatment as compared with Dallas County adults). Finally, GoodNEWS participants treated for CVRFs were significantly more likely to have control of diabetes (95 versus 21%, \(P < 0.05\)) and hypertension (70 versus 52%, \(P < 0.05\)) than African-American adults in Dallas County. Although obesity was more prevalent in the GoodNEWS population, participants in this study reported significantly higher rates of weekly physical activity than in the Dallas County population.

When comparing prevalent CVRFs based on self-reported monthly church attendance in the Dallas County population, there were no differences in prevalent diabetes, hypertension or hyperlipidemia; however, those with the most frequent church attendance had a significantly lower prevalence of current smoking (Supplementary data, Table S1). Among African-Americans in Dallas County, individuals who reported going to church four or more times per month had significantly greater BMI and WC than those who went to church less frequently (\(P < 0.05\) for each; Fig. 2A and B). Frequent church attendance (\(\geq 4\) times per month) was associated with prevalent obesity (BMI \(\geq 30\) kg/m\(^2\)), independent of age and sex as compared with those who reported no church attendance (odds ratio (OR): 1.26, 95% confidence interval (CI) = 1.05–1.52, \(P = 0.01\); Table 2).

**Discussion**

**Main findings of this study**

Comparing the GoodNEWS cohort with African-Americans in Dallas County provides unique insights into differences between those recruited for a church-based intervention and the general community population. In addition, the comparison highlights potential methods in future projects to reduce CV risk in the African-American community through church-based interventions. We have identified the GoodNEWS cohort as an at-risk population with a higher prevalence of obesity and downstream obesity-related risk factors (including diabetes, low HDL and high triglycerides), as compared with African-Americans of similar ages and sex in Dallas County. In contrast, GoodNEWS participants exercised more, smoked less and were more likely to undergo pharmacologic treatment with the control of CVRFs than the general population. These findings about GoodNEWS participants, a population of frequent churchgoers, were supported by analyses within DHS, where more frequent church attendance was associated with obesity and a lower probability of smoking.
These data provide important insights regarding the potential role of the African-American church as a site for community-based interventions. On the one hand, the church-based population appears more educated and motivated to engage in several healthy behaviors, including avoidance of smoking and treatment and control of existing risk factors. On the other hand, obesity rates are actually higher in those with more frequent church attendance. This finding highlights a ‘disconnect’ between obesity and other preventable CVRFs. It suggests that the pervasive factors contributing to obesity in modern society overwhelm the usual benefits of greater education and engagement with the health-care system that is demonstrated among those with more frequent church attendance.

These findings suggest that the most pressing needs in the GoodNEWS population are targeting obesity treatment through lifestyle modification as opposed to improving awareness, treatment and control of prevalent diabetes, hypertension and hyperlipidemia. The GoodNEWS participants also report more physical activity than the African-American Dallas County population, suggesting that...
they may need specific tools emphasizing appropriate inten-
sity and proper form for physical activity that promotes
weight loss. The relationship between frequent church at-
tendance and obesity confirmed in the DHS population also
emphasizes that linking church activities with lifestyle inter-
ventions for obesity treatment in African-American popula-
tions may be ideal. Moreover, developing a physical and
social environment within African-American churches that is
conducive to physical activity and healthy eating may also be
important. Impacting obesity within the African-American
church community may potentially impact the obesity epi-
demic in the overall African-American population.

What is already known on this topic
Previous work advocates for the church as a focus for
community-based interventions given the church's role in
providing social support and social networks that can re-
inforce necessary changes in health behavior, but little
has been known about who may actually be recruited by
these church-based interventions. These data support the
hypothesis that church-based interventions can identify and
target an at-risk population.

What this study adds
Our study is one of the first to systematically compare a
church-based intervention cohort to the overall representa-
tive community from which the participants originate, pro-
viding insights for future interventions. Thus, targeting weight
loss as a part of the GoodNEWS church-based intervention
may serve as an important method for secondary prevention
and treatment of CVRFs in this population.

GoodNEWS participants appear to be motivated for life-
style changes as evidenced by their increased physical activity
as compared with the Dallas County population; therefore,
the GoodNEWS population may need training about exer-
cise that promotes weight loss or improvement in CVD risk
factors. Moreover, they likely also need comprehensive
dietary education. Prior studies suggest that church-based
interventions can promote weight loss in African-American
church communities using LHPs or a combination of LHPs
and health professionals as program facilitators. In
addition, weight loss interventions may need to incorporate
a spiritual component that serves as a motivational tool in
the church-going population. In the Love, Inspiration,
Feedback and Education program, African-American
women in the spirituality-based educational program had
significant reductions in weight, BMI and SBP as compared
with the women in the non-spiritual intervention.

Data from DHS regarding the association between
church attendance and obesity support prior studies that
show evidence of a relationship between religiosity and
obesity. Prior work suggests that this link between
church attendance or religiosity and obesity may be related
to a lack of encouragement in religious settings to avoid
overeating as opposed to other vices, such as smoking. The
higher prevalence of obesity with lower prevalence of
current smoking among GoodNEWS participants suggests
that these individuals are similar to those who attend church
four or more times per month in the DHS population.
Given that those who frequently attend church are more
likely to be obese, incorporating exercise into the church
activities through the GoodNEWS intervention may be es-
ternal. Our group's previous study also suggests that in-
corporating physical activity into the GoodNEWS program
may decrease the prevalence of metabolic syndrome in this
population. Finally, future studies may investigate targeting
the physical and social environment in the African-American
church to improve access to physical activity and appropriate
nutrition and to reduce obesity.
Thus, our research shows African-Americans from church congregations recruited to participate in a community-based lifestyle intervention have a higher prevalence of obesity and obesity-related CVRFs than the general population. However, these participants had higher education, higher treatment and control of CVRFs, lower tobacco abuse and higher weekly exercise levels compared with the general population. This suggests African-American churchgoers recruited for a CBPR program are at risk for CVD, yet are knowledgeable, utilize the healthcare system and are motivated to implement lifestyle changes. Therefore, the African-American church-based population appears to be a prime target for community interventions for obesity treatment and CVD prevention.

Limitations of this study

Important strengths of DHS include the cohort size and sample weighting, which allows the extrapolation of findings to the overall Dallas County population. There are, however, limitations to this work. The data for the cohorts are cross-sectional; therefore, no inferences of causality can be made in associations between church attendance and prevalent CVRFs. Differences in survey administration methods and physical activity and blood pressure measurements may contribute to differences between the groups; however, these methodological differences are unlikely to significantly impact study findings. Additionally, physical activity was self-reported, subjecting it to misclassification bias. The DHS cohort was enrolled between 2000 and 2002, whereas the GoodNEWS cohort was formed in 2008. The time difference may have contributed in part to differences in obesity rates, although this small time difference is unlikely to explain the full differences between groups. Sample-weighted DHS data, which is only available from 2000 to 2002, provided an opportunity to compare the GoodNEWS cohort to Dallas County African-Americans, likely improving the validity of the findings. The GoodNEWS population consists of volunteers for the study who may not be representative of all church-going Dallas County African-Americans. However, this cohort likely represents African-Americans who would volunteer in similar church-based lifestyle interventions throughout Dallas County.

Supplementary data

Supplementary data are available at the Journal of Public Health online.

Authors’ contributions

T.M.P-W and K.B-R contributed equally to this project and share primary authorship of this manuscript.

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