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## Faith, Activity, and Nutrition Randomized Dissemination and Implementation Study: Countywide Adoption, Reach, and Effectiveness

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### Abstract

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This study is registered at [www.clinicaltrials.gov](http://www.clinicaltrials.gov) NCT02868866

Portions of findings from this paper have been presented at the annual meeting of the Society of Behavioral Medicine (2016) and at the 2017 annual meeting of the American Public Health Association.

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**Trial Registration:** This study is registered at [www.clinicaltrials.gov](http://www.clinicaltrials.gov) NCT02868866.

**Introduction:** Faith-based organizations can contribute to improving population health, but few dissemination and implementation studies exist. This paper reports countywide adoption, reach, and effectiveness from the Faith, Activity, and Nutrition dissemination and implementation study.

**Study design:** Group-randomized trial. Data were collected in 2016. Statistical analyses were conducted in 2017.

**Setting/participants:** Churches in a rural, medically underserved county in South Carolina were invited to enroll, and attendees of enrolled churches were invited to complete questionnaires ( $n=1,308$  participated).

**Intervention:** Churches ( $N=59$ ) were randomized to an intervention or control (delayed intervention) condition. Church committees attended training focused on creating opportunities, setting guidelines/policies, sharing messages, and engaging pastors for physical activity (PA) and healthy eating (HE). Churches also received 12 months of telephone-based technical assistance. Community health advisors provided the training and technical assistance.

**Main outcomes measures:** The Reach, Efficacy/Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework guided measurement of adoption and reach. To assess effectiveness, church attendees completed post-test only questionnaires of perceptions of church environment, PA and fruit and vegetable (FV) self-efficacy, FV intake, and PA. Regression models controlled for church clustering and predominant race of congregation as well as member age, gender, education, and self-reported cancer diagnosis.

**Results:** Church adoption was 42% (55/132). Estimated reach was 3,527, representing 42% of regular church attendees and 15% of county residents. Intervention church attendees reported greater church-level PA opportunities, PA and HE messages, and PA and HE pastor support ( $p<0.0001$ ), but not FV opportunities ( $p=0.07$ ). PA self-efficacy ( $p=0.07$ ) and FV self-efficacy ( $p=0.21$ ) were not significantly higher in attendees of intervention versus control churches. The proportion of inactive attendees was lower in intervention versus control churches ( $p=0.02$ ). The proportion meeting FV ( $p=0.27$ ) and PA guidelines ( $p=0.32$ ) did not differ by group.

**Conclusions:** This innovative dissemination and implementation study had high adoption and reach with favorable environmental impacts, positioning it for broader dissemination.

## INTRODUCTION

Churches are found within nearly every community and represent trusted sources of information for many.<sup>1</sup> Churches have social systems, environments and physical structures, policies and practices, and often, health ministries, which make them conducive settings for promoting health.<sup>1-3</sup> A large proportion of Americans report a religious affiliation (70.6% Christian).<sup>4</sup> Religious affiliation is highest among older adults, non-Hispanic blacks, and those living in the Southeast.<sup>4</sup> Thus, churches have great potential for addressing health disparities.<sup>2, 5, 6</sup>

Dissemination and implementation (D&I) research is increasingly valued for its potential to address barriers to timely adoption and integration of evidence-based programs and strategies into clinical and community-based public health practice, thus reducing gaps between research and practice.<sup>7, 8</sup> Despite its potential, few faith-based D&I studies exist.

Furthermore, most interventions conducted in faith settings have not targeted organizational change, studied factors influencing implementation, involved lay health leaders, or examined sustainability. The developers of the Reach, Efficacy/Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework,<sup>9</sup> one of the most commonly used evaluation frameworks in D&I research,<sup>10, 11</sup> emphasized the need to better understand how interventions work in complex, real-world community settings. Inherent in this framework, and compatible with ecologic and community-based interventions, is the idea that low-intensity interventions that may be less efficacious but reach more people will have a greater public health impact than highly efficacious interventions with limited reach.<sup>9</sup>

This two-phase study examined D&I of Faith, Activity, and Nutrition (FAN), an evidence-based program previously shown to significantly increase leisure-time physical activity (PA) and fruit and vegetable (FV) intake in churches in South Carolina.<sup>12, 13</sup> Phase 1 was a county-level initiative, whereas Phase 2 (ongoing) is a statewide initiative conducted in partnership with the South Carolina Conference of the United Methodist Church. Both phases include a comprehensive evaluation of implementation (12 months) and maintenance (24 months) and factors influencing them, guided by the Consolidated Framework for Implementation Research.<sup>14</sup> These components will be the focus of future papers. The current paper is focused on Phase 1, and the primary objectives are to (1) describe the trajectory from early formative work to an effectiveness trial, to a D&I study; and (2) report countywide adoption, reach, and effectiveness of FAN, guided by the RE-AIM framework.<sup>9</sup>

## METHODS

Formative work with South Carolina churches began in 2002 with a Centers for Disease Control and Prevention-funded community-based participatory research study, Health-e-AME Physical-e-Fit.<sup>15, 16</sup> During an in-person training, representatives from 303 churches learned how to promote PA and implement three action-oriented exercise programs. Although there were no differences over time in PA between intervention and control churches, program awareness and perceived pastor support were associated with significant increases in PA.<sup>16</sup> Because of its participatory approach and high church engagement, the NIH's *Principles of Community Engagement* described Health-e-AME Physical-e-Fit as a "successful example in the field."<sup>17</sup>

These lessons informed a group-randomized effectiveness trial to develop, implement, and evaluate a PA and healthy eating (HE) intervention (FAN) in African Methodist Episcopal (AME) churches. Consistent with the idea of "designing for dissemination"<sup>18</sup> and similar principles,<sup>19, 20</sup> FAN was developed using a community-based participatory approach, targeted organizational change, was implemented by church committees, was flexible to meet local church needs and customs, and was tested in a large number of African American churches.<sup>12</sup> FAN was guided by the structural model of health behavior proposed by Cohen et al.<sup>21</sup> that posits that four categories of structural factors influence behavior: availability of protective or harmful products, physical structures (or physical characteristics of products), social structures and policies, and medial and cultural messages (see intervention section and earlier work<sup>12, 13, 22</sup> for model application). Church committees and cooks attended separate 1-day trainings to learn how to make policy, systems, and environmental changes in their

church, consistent with this model. The FAN intervention demonstrated significant improvements in leisure-time PA and FV intake<sup>13</sup> and is indexed in the National Cancer Institute's Research-Tested Intervention Programs where it received a high rating for "dissemination capability."

These two studies led to the development of a D&I proposal to examine these processes in more diverse settings. In 2014, the University of South Carolina was funded by the Centers for Disease Control and Prevention to begin the FAN D&I study.

### Study Sample

The study design was a group-randomized trial. All churches from a rural and medically underserved county were invited to participate; those enrolled were randomized to either an intervention or control (delayed intervention) condition. A community committee comprising representatives from county-level organizations, along with community health advisors and pastors in the county, served as study advisors to ensure the materials and approach were appropriate for the setting.

The study was conducted in Fairfield County, South Carolina (23,956 residents),<sup>23</sup> a medically underserved and health professional shortage area<sup>24</sup> that ranks 38th of 46 counties in the state for overall health outcomes.<sup>25</sup> Relative to the state, a greater proportion of Fairfield County residents are black/African American (59.1% vs 27.9%)<sup>23</sup> and live in poverty (21.2% vs 15.3%), and a lower proportion are high school graduates (82.1% vs 86.0%).<sup>26</sup> Fairfield County was invited because of its public health priority status (rates of chronic disease among the five highest in the state), its close proximity to the university, and its community council's ties to local churches.

Beginning in January 2015, staff used online lists, Internet searches, and county-level audits to identify all churches and verify their existence and operation by phone or visits. Between February and August 2015, staff invited all verified churches to participate. A total of 604 mailings, 694 phone calls (including attempts), 307 e-mails, and 183 in-person visits were conducted. Additionally, recruitment flyers were posted in public places, study staff presented at organizational meetings, and churches were invited to informational presentations held across the county. Representatives from 75 churches attended at least one informational presentation.

Church eligibility included being in the target county, having 20 attendees, and being willing to accept random assignment. Churches that were too small were invited to participate in training, but not enroll in the evaluation study. Interested churches deemed eligible based on a telephone screening were enrolled (N=59). Control churches were trained 12 months after intervention churches, and then received 12 months of technical assistance (TA). Adoption and reach calculations used training data from intervention and control churches.

Using a random number generator, the study biostatistician randomly assigned churches to a condition within two size strata (20–50 or 51 attendees) using an allocation ratio of two

interventions for every one control. In three instances where a pastor led two churches, each pair was randomized to the same condition.

Several adaptations were made to FAN to increase potential for broader dissemination. Community health advisors (versus university staff) were recruited from churches in the target county and trained to deliver the training and TA calls to churches. Details regarding advisor selection and training are reported elsewhere.<sup>27</sup> In brief, they participated in a 1-day, in-person training that included delivery of the church committee training and instruction in facilitation, completed several self-paced modules before and after the in-person training, engaged in practice sessions, and received quarterly telephone-based booster calls. Because of feasibility and cost, the committee member and cook trainings were combined for the FAN D&I study.

The structural model of health behavior by Cohen et al.<sup>21</sup> guided the intervention. Consistent with the four structural factors, the intervention helps churches increase opportunities, set guidelines/policies, share messages, and engage pastors for PA and HE.

Each participating church formed a committee (three to five volunteer church members) that: (1) attended a 1-day training, (2) created and submitted a plan and budget for how program components would be implemented in their church, (3) held a kick-off event, (4) had regular committee meetings to plan program implementation, (5) implemented the program in their church, (6) participated in brief monthly TA calls, and (7) participated in evaluation activities. The church FAN coordinator, who oversaw program implementation and was the study liaison, was a required committee member, and pastor participation was strongly recommended. Committee membership was otherwise flexible, although the study provided suggestions (e.g., church cooks or hospitality committee members, health champions/members passionate about health, people with health backgrounds, youth directors).

The church committee training provided an overview of PA and HE guidelines and benefits.<sup>27–29</sup> The training emphasized the scriptural relevance of physical health from a Christian tradition without reference to specific denominations or doctrines. Churches went through an active assessment and planning process organized according to the theoretic model.<sup>21</sup> For each of the structural factors, churches assessed current activities and selected ways to add, enhance, or expand them. Churches had substantial flexibility in how they addressed each of the structural factors to ensure tailoring to local needs and interests. All churches were asked to implement a core set of activities: distribute bulletin inserts or handouts, share messages during worship services about PA and HE, distribute educational materials, create a FAN bulletin board to display PA and HE materials to congregants, and suggest guidelines/policies that the pastor could set.

Three PA breaks in the training demonstrated how churches could integrate active breaks into meetings and events, and food served was consistent with intervention recommendations. A simple food demonstration and tasting was included (i.e., fruit and yogurt parfait). Each church received an assessment and planning guide (interactive workbook) along with a binder of resources and materials (also provided via a flash drive) to support implementation of the program. Churches began a FAN program plan during

training, and upon submission and approval of the plan and budget, received a modest incentive as a thank you for participating in evaluation activities and to cover program-related expenses. Small churches (20–50 attendees) received \$300 and large churches ( 51 attendees) \$500. Each attendee received a pedometer with encouragement to be a role model for members.

Following the training, community health advisors called each church monthly over the 12-month intervention to deliver TA using a semi-structured call script, with church FAN coordinators receiving up to eight calls and pastors up to four. The brief calls (~10 minutes) focused on successes, challenges, and problem solving to overcome implementation barriers. TA call completion was high at 92% for intervention churches.

## Measures

The FAN D&I evaluation results were guided by the RE-AIM Framework.<sup>9, 30</sup> Implementation and maintenance will be the focus of future papers.

Adoption was defined as the percentage of churches (both intervention and control/delayed intervention) in the county that attended a FAN training and the percentage of pastors and church FAN coordinators from enrolled churches who were trained. To address representativeness of churches, adopting churches were compared to non-adopting churches on church size, predominant race of congregation, church denomination, and whether the church took part in an earlier county-level initiative focused on tobacco policy.

FAN focused on environmental change in the church setting. Individuals who attended the church were presumed to be exposed to the intervention. Reach was defined as the pastor-reported number of individuals who typically attended worship services among churches that adopted the program as compared to both the number of attendees at non-adopting churches and the total county population.

The group randomized study design with post-test measures was decided a priori based on two considerations. First, D&I research emphasizes assessment of program adoption, reach, implementation, and maintenance over behavioral effects, as the study is evidence based. Second, it would not have been feasible to collect data both pre- and post-program at 54 churches because of extensive travel, church scheduling, and personnel demands. Eight to 12 months after the training of early intervention churches, data collectors blind to intervention assignment visited 54 churches (all but one on a Sunday) and distributed anonymous, seven-page self-administered questionnaires with the offer of interviewer administration and assistance. Brief self-report measures were chosen to minimize participant burden, accommodate conducting church visits in a short period of time, ensure feasibility of collecting data following a worship service, and enhance response rates. To calculate survey response rate, data collectors counted the number of adults present at the worship service. When data collectors were not invited to the worship service ( $n=6$ ), pastor-reported church attendance was used. Attendees also reported basic sociodemographic and health-related characteristics.<sup>31</sup>



Items developed in the effectiveness trial were modified to assess member-perceived changes in opportunities, messages, and pastor support for PA and HE<sup>32</sup> for use in this study. Items have expert-based face and content validity as the items were systematically developed based on the conceptual model,<sup>21</sup> and are setting- and project-specific. The questionnaire asked attendees how often, since December 1, 2015 (i.e., after early intervention trainings), there were opportunities for PA (four items) and FV (two items) before, during, or after church events; PA (five items) and HE (four items) messages; and support from the pastor for PA (two items) and HE (one item) (i.e., including PA and HE messages during church services and talking about wearing pedometer). Scores on each item could range from 1 (not at all/rarely or never) to 4 (almost all of the time/about weekly), and items were averaged for each index. These items could be viewed as an indicator of implementation; however, implementation was conceptualized a priori based on church FAN coordinator interviews.

A 5-item measure of self-efficacy for overcoming common barriers to PA<sup>33</sup> and an 8-item measure of self-efficacy for eating FV in various situations<sup>34</sup> were administered. Responses ranged from 1 (not at all confident) to 7 (very confident). A mean score was computed for each scale.

Consistent with the 2008 Physical Activity Guidelines for Americans,<sup>27</sup> the proportion of attendees inactive (<10 minutes/week of PA) and regularly active (≥150 minutes/week of moderate PA, ≥75 minutes/week of vigorous PA, or an equivalent combination) was computed using six questions from the 2010 Behavioral Risk Factor Surveillance System PA module.<sup>31</sup> This measure was chosen because of its brevity, ease of administration, sensitivity to change in a previous intervention of midlife and older adults,<sup>35</sup> and demonstrated group-level validity.<sup>36</sup>

Following a detailed list of examples of 1 cup equivalents,<sup>37</sup> the questionnaire asked attendees to report: *About how many cups of fruit (including 100% pure fruit juice) do you eat or drink each day?* with a parallel vegetable question. This measure was sensitive to change in several other faith-based studies.<sup>34, 38–41</sup>

Data from the earlier effectiveness trial<sup>13</sup> were used to estimate effect sizes and intraclass correlation coefficients for PA and FV. Planned enrollment was 60 churches (40 intervention) with an average of 15 attendees per church (N=900), which provided 80% power to detect a small difference between groups (d=0.20). In reality, 54 churches (35 intervention) participated in effectiveness data collection, with an average of 24 attendees per church, yielding a similar level of power to detect small between-group differences.

## Statistical Analysis

The authors conducted mixed linear (SAS PROC MIXED) and logistic models (SAS PROC GLIMMIX) to assess differences in outcomes between intervention and control churches. Two outcomes initially conceptualized as continuous variables violated normality assumptions and were dichotomized: FV consumption (≥5 cups/day vs <5 cups/day) and FV opportunities (almost all of the time versus less frequent). For one outcome (FV intake), where the intraclass correlation was 0, church clustering was accounted for with robust SEs

(SAS PROC SURVEYLOGISTIC). Otherwise, variance components were estimated for church-level random effects. Missing participant-level data were not imputed.

Attendee age, gender, and education, variables related to PA and HE in the literature, were selected as covariates. Self-reported cancer history also differed by study condition and was added as a covariate. Attendee race almost completely overlapped with church race, which was unequally distributed between study conditions. Therefore, analyses controlled for predominant race of church.

Effect sizes (Cohen's *d* for continuous outcomes; OR for dichotomous outcomes) were computed comparing intervention and control churches. Improbable values were set to missing prior to analyses ( 8 cups/day of fruits, 8 cups/day of vegetables, 480 minutes/day of moderate PA, 240 minutes/day of vigorous PA).

## RESULTS

As shown in Figure 1, of the 132 active churches in Fairfield County, 59 were interested, eligible, and randomized. Thirty-six of the 39 intervention churches and 18 of the 20 control churches (delayed intervention) were trained. One church ineligible because of size was also trained and considered an adopting church. Thus, adoption was 42% of churches (55/132) in the target county. Of those churches randomized, 92% (54/59) of church FAN coordinators and 64% (38/59) of pastors attended training. All trained churches submitted a program plan.

Table 1 presents differences between adopting and non-adopting churches. Churches with predominantly black/African American attendees and those that had participated in an earlier tobacco-free county initiative were significantly more likely to adopt. Church size and denomination were unrelated to adoption.

Church membership rosters often overestimate engagement in church services and events; therefore, pastor reports of typical worship service attendance were used. Six churches (all non-adopting) were missing church attendance; for these churches, the mean attendance for all other non-adopting churches 64.4 (SD=53.3) was imputed. The estimated weekly worship attendance of the 132 churches in the county was 8,484. The estimated weekly worship attendance of the 55 trained churches was 3,527. Thus, >42% of regular church attendees and 15% of county residents were reached. To assess representativeness, characteristics of all exposed to the intervention would need to be compared with all church-going residents. Such data do not exist; however, Appendix Table 1 compares sample characteristics to available county-level estimates.

Questionnaires were completed by 1,423 attendees; 115 were not used because they were missing a covariate, leaving a sample of 1,308. Across churches,  $\cong$ 71% of church attenders completed the questionnaire. Intervention and control churches did not differ on church-level characteristics (Table 1). Intervention church attendees were younger and more self-reported cancer (Table 2). Only three of 54 churches were predominantly white, with a total of 94 members, and by chance a majority of these were in the control condition. Because of the small number of white churches and members, there is insufficient power to establish the



effects of race on the intervention, but it was included as a covariate at the church level. Table 3 shows results for effectiveness (described below).

Intervention church attendees reported more frequent PA opportunities, HE and PA messages, and pastor support for HE and PA than control church attendees ( $p$ -values $<0.0001$ ). These intervention effects were large ( $d = 0.80$ ). A high proportion of church attendees reported FV opportunities most of the time, but this proportion did not differ by group assignment ( $p=0.07$ ).

The slightly higher FV ( $p=0.21$ ) and PA ( $p=0.07$ ) self-efficacy in intervention church attendees did not differ significantly from control church attendees, and effect sizes were small ( $d = 0.20$ ).

The proportion of inactive attendees was lower in intervention than control churches ( $p=0.02$ ), but the proportion meeting FV ( $p=0.27$ ) and PA ( $p=0.32$ ) recommendations did not differ by group.

## DISCUSSION

In this D&I study, all churches in a rural, medically underserved county of South Carolina were invited to enroll. Church attendees had a high prevalence of chronic disease, comparable to or higher than county estimates, demonstrating that residents who could benefit from increased PA and HE were reached. High countywide reach and adoption were achieved—42% of churches in the county were trained (adoption) and the same proportion of county church-goers reached. Even considering the potential for pastors to over-report church attendance because of social desirability biases, these numbers likely underestimate true reach, as they do not consider that church attendees are part of families and social networks where practices and information are shared. African American churches were significantly more likely to adopt the program. Giger and colleagues<sup>5</sup> pointed out that the mission of black churches extends beyond worship and spiritual growth. This more holistic approach may account for the greater participation that was observed.

Faith-based organizations are increasingly recognized as important partners in health promotion efforts.<sup>42</sup> For example, the revised National PA Plan ([www.physicalactivityplan.org](http://www.physicalactivityplan.org)) added faith-based settings as one of nine societal sectors deemed important in promoting PA. Evidence-based programs that can be scaled up and implemented in faith-based settings are needed. To date, only one dissemination study of an evidence-based diet program in faith-based settings could be located, Body & Soul, which included 15 churches.<sup>38</sup> Although there is a growing body of research targeting PA, HE, and obesity treatment or prevention in faith-based settings, most of these interventions target individual members rather than the church environment, and few studies are rated highly in methodologic quality.<sup>43–46</sup> A broader evidence base of faith-based ecologic interventions could help prompt the development of recommendations by the Community Preventive Services Task Force ([www.thecommunityguide.org/](http://www.thecommunityguide.org/)), leading to greater potential for population-level changes.

Multiple recruitment contacts were made to each church over the 7-month recruitment period, and churches that had participated in an earlier initiative were more likely to participate in the study. Thus, building relationships, having a community presence, and making multiple contacts are important ingredients for engaging churches in health promotion efforts.

The FAN D&I study is innovative in several ways. First, it is the only study to date that uses a D&I framework to examine an intervention targeting PA and HE in churches, and as such, provides important information about adoption, reach, and effectiveness. Second, the intervention targets church policies, systems, and environments rather than individual behaviors (i.e., a public health approach), while supporting a flexible implementation plan that allows for tailoring to match the cultural context of diverse church settings. Smaller changes among larger numbers of people are expected, with the potential for a greater public health impact.<sup>47</sup> Third, the study engaged community health advisors from the targeted communities to train and support leaders embedded within each church to deliver the intervention. This approach may advance dissemination efforts by replacing health professionals who are more costly and more socially distant from congregation members during the implementation process. Results from this D&I study were generally consistent with those reported in the earlier effectiveness trial where research staff trained the churches, indicating this model has potential for large-scale dissemination and sustainability. The use of lay leaders has not been successful in several other faith-based interventions,<sup>48, 49</sup> perhaps because of the study design, in which some participants were exposed to professional leaders and others to lay volunteers, or to suboptimal implementation. Finally, a large number of churches were reached.

### Limitations

There are notable limitations to the effectiveness assessment, including exclusive reliance on brief, self-report measures and a post-test only design. Alternative approaches might have been to administer mail or online surveys at pre- and post-intervention or to conduct more intensive assessments in a randomly chosen subsample of churches. Nonetheless, intervention church attendees were significantly more likely than control church attendees to report experiencing the environmental targets of FAN, except for perceived FV opportunities, and the magnitude of these differences was large. This pattern of findings is the same as reported in the earlier effectiveness trial,<sup>32</sup> demonstrating reproducibility. Given the importance of pastors as role models, the large effect sizes for pastor support of PA and HE were particularly encouraging. Attendees from both intervention and control churches rated FV opportunities higher than all other intervention targets, indicating that churches often provided FV when food was served, and thus may have had less room for improvement. Statistically significant intervention effects were not found in attendees' self-efficacy for increasing PA and HE, or meeting FV or PA recommendations, although the direction of findings and the effect sizes were similar to the earlier effectiveness trial.<sup>13</sup> Although over-reporting of PA in this sample was likely, the lower proportion of inactivity in intervention versus control churches may reflect the use of active breaks demonstrated during training. Finally, study results may not generalize to very large churches, urban churches, or churches with congregations that are not predominantly African American.

## CONCLUSIONS

In summary, high countywide adoption and reach, particularly in predominantly African American churches, combined with favorable environmental impacts were found. Given these findings and the fairly minimal training and intervention time associated with FAN, this program may be well suited for wider dissemination.

## ACKNOWLEDGMENTS

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### Appendix Table 1.: Characteristics of Church Attendees Who Completed Post-Test Surveys as Compared to County-Level Data

Characteristic	Sample of church attendees	Fairfield county	Data source for Fairfield county
Adults aged 65 years, %	28.0	14.9	2010 Census
Self-rated health, %			County Health Rankings & Roadmaps (2015 BRFSS)
Poor or fair	19.2	22 (21–22)	
Weight status, %			SC County Health Profile Application (3-year average of 2013–2015 BRFSS)
Obese	50.3	39.9	
Gender, %			2010 Census (note that gender data for Fairfield County includes residents of all ages)
Men	31.3	47.9	
Women	68.7	52.1	
Race, %			2010 Census (note that race data for Fairfield County includes residents of all ages)
White	7.3	38.6	
African American	91.4	59.1	
More than one race	1.0	1.1	
All others	0.3	1.3	
Education, %			American Community Survey (2012–2016 5-Year Estimates)
High school graduate	90.6	82.1	
Bachelor's degree	23.4	17.4	

Characteristic	Sample of church attendees	Fairfield county	Data source for Fairfield county
Self-reported health conditions, %			SC County Health Profile Application (3-year average of 2013–2015 BRFSS)
Diabetes	23.9	25.3	
Hypertension	55.0	43.5	
Heart attack	2.5	5.8	
Coronary heart disease	4.6	3.0	
Stroke	3.1	2.5	
Asthma	9.3	6.0	
Engage in no leisure-time physical activity, %	13.6	27 (22–31)	County Health Rankings & Roadmaps (2013 BRFSS)
Consume <5 cups/day (servings) of fruits and vegetables, %	74.4	85.8	South Carolina Nutrition, Physical Activity, and Obesity Fact Sheets for Youth and Adults (SCDHEC) (2009 BRFSS)

*Note:* Number of decimal points reported in table varies because data sources vary. In addition, for county-level data, the error margins are provided in parentheses when provided by data source.

2010 Census: [https://factfinder.census.gov/faces/nav/jsf/pages/community\\_facts.xhtml](https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml).

American Community Survey (2012–2016): <https://www.census.gov/quickfacts/fact/table/US/PST045216>.

County Health Rankings & Roadmaps: <http://www.countyhealthrankings.org/>.

South Carolina County Health Profile Application (DHEC): <https://gis.dhec.sc.gov/chp/>.

South Carolina 2009 BRFSS: <http://www.dhec.sc.gov/library/CR-009958.pdf>.

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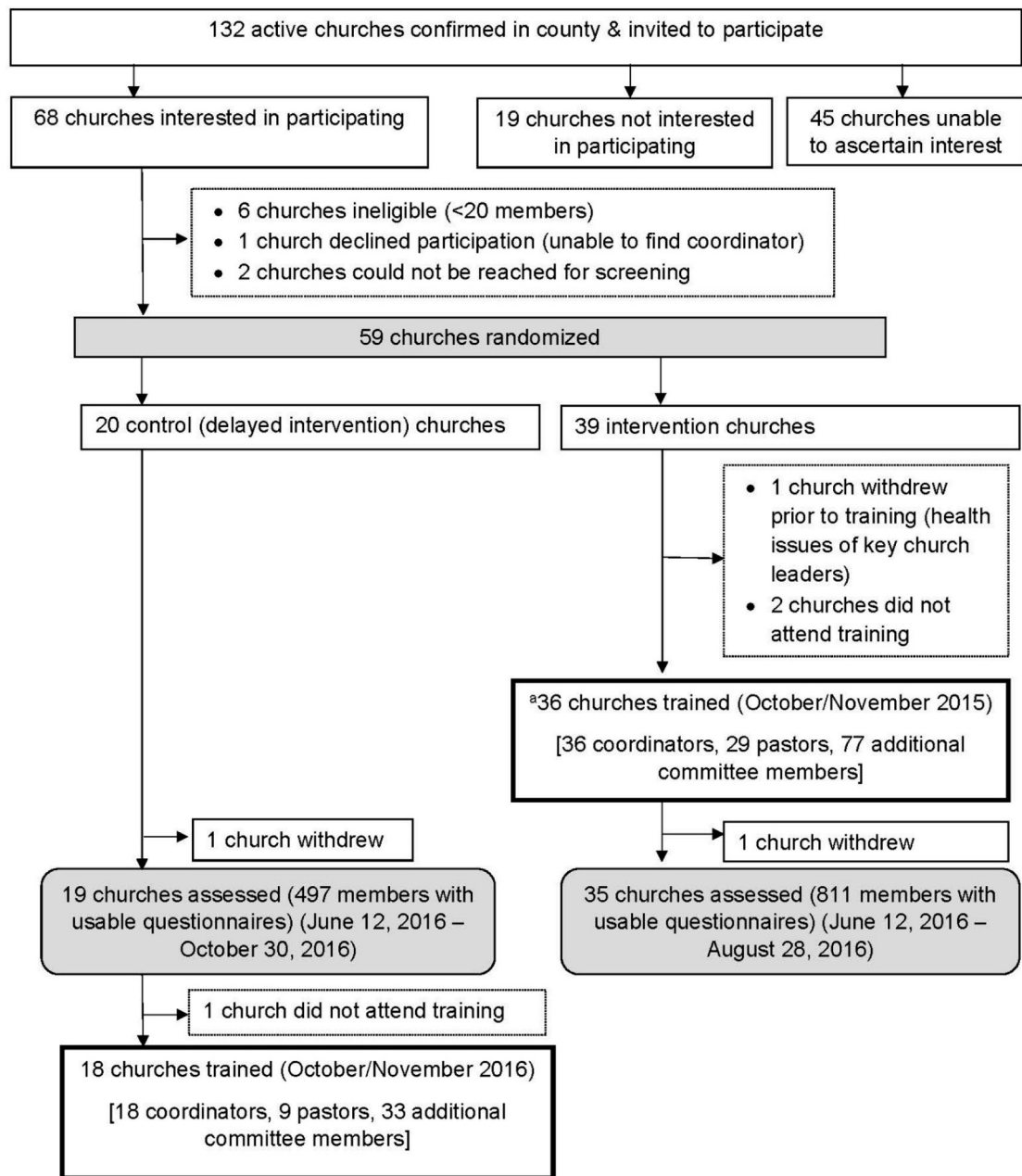
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**Figure 1.**

Flow chart of church recruitment, enrollment, measurement, and training.

<sup>a</sup> Note that one of the six ineligible churches (<20 attendees) was trained but is not included in this count.

Characteristics of Adopting Versus Non-Adopting Churches and Intervention Versus Control (Delayed Intervention) Adopting Churches

Table 1.

Characteristics	<sup>a</sup> Adopting (n=55)	Non-Adopting (n=77)	p-value	Intervention (n=35)	Control (n=19)	p-value
Church size			0.24			0.79
<25 attendees	12.7 (7)	23.9 (17)		10.53 (2)	14.29 (5)	
25–49 attendees	40.0 (22)	33.8 (24)		31.58 (6)	40.00 (14)	
50–74 attendees	23.6 (13)	14.1 (10)		26.32 (5)	25.71 (9)	
75 attendees	23.6 (13)	28.2 (20)		31.58 (6)	20.00 (7)	
Predominant race of attendees			<0.0001			0.19
Black/African American	92.7 (51)	50.7 (39)		97.14 (34)	84.21 (16)	
Caucasian	5.5 (3)	46.8 (36)		2.86 (1)	10.53 (2)	
Multi-racial	1.8 (1)	2.6 (2)		0.00 (0)	5.26 (1)	
Religious denomination			0.07			0.55
Baptist	45.5 (25)	36.4 (28)		45.71 (16)	47.37 (9)	
Non-denominational or independent	20.0 (11)	23.4 (18)		25.71 (9)	10.53 (2)	
Presbyterian	5.5 (3)	16.7 (13)		5.71 (2)	5.26 (1)	
African Methodist Episcopal (AME) / AME Zion	14.6 (8)	3.9 (3)		11.43 (4)	15.79 (3)	
Pentecostal	7.3 (4)	7.8 (6)		8.57 (3)	5.26 (1)	
Methodist	5.5 (3)	2.6 (2)		2.86 (1)	10.53 (2)	
Episcopal	1.8 (1)	2.6 (2)		0.00 (0)	5.26 (1)	
Other	0 (0)	6.5 (5)		0.00 (0)	0.00 (0)	
Participated in earlier tobacco-free initiative			<0.0001			0.14
Yes	67.3 (37)	22.1 (17)		74.3 (26)	52.6 (10)	
No	32.7 (18)	77.9 (60)		25.7 (9)	47.4 (9)	

Note: Boldface indicates statistical significance ( $p < 0.0001$ ).

<sup>a</sup> One ineligible church (<20 attendees) was trained and is included in this column.

**Table 2.**

Characteristics of Church Attendees Who Completed Post-Test Surveys, by Randomization Assignment (N=1,308)

Characteristics	Intervention (n=811)		Control (Delayed intervention) (n=497)		p-value
	n	Mean (SD) or %	n	Mean (SD) or %	
Age, years	811	53.00 (15.64)	497	56.68 (15.40)	<0.0001
Self-rated health	811	2.81 (0.83)	495	2.87 (0.83)	0.22
BMI, kg/m <sup>2</sup>	725	31.28 (6.91)	439	30.56 (6.71)	0.08
Weight status category, %	725		439		0.50
Underweight	8	1.10	3	0.68	
Normal weight	101	13.93	72	16.40	
Overweight	242	33.38	152	34.62	
Obese	374	51.59	212	48.29	
Total health conditions, n	811	1.79 (1.61)	497	1.90 (1.58)	0.22
Self-reported health conditions (ever told by healthcare provider), %					
Diabetes	187	23.35	121	24.69	0.59
High blood pressure	437	54.02	281	56.54	0.39
High cholesterol	279	34.62	190	38.31	0.19
Heart attack	19	2.35	13	2.64	0.85
Angina or coronary heart disease	38	4.71	21	4.27	0.78
Stroke	24	2.97	16	3.26	0.74
Arthritis	277	34.28	167	33.74	0.86
Osteoporosis	61	7.56	48	9.70	0.18
Asthma	81	10.01	40	8.08	0.28
Cancer	46	5.67	47	9.46	<b>0.01</b>
Gender, %	811		497		0.30
Men	245	30.21	164	33.00	
Women	566	69.79	333	67.00	
Race, %	824		499		<0.0001
White	16	1.99	78	15.82	
Black/African American	773	96.26	412	83.57	
More than one race or other	14	1.73	3	0.61	
Education, %	811		497		0.37
Less than high school	85	10.48	38	7.65	
High school graduate	321	39.58	204	41.05	
1 to 3 years college	220	27.13	134	26.96	
College graduate	185	22.81	121	24.35	
Worship attendance, %	791		489		0.67
4 times per month	617	78.00	387	79.14	
<4 times per month	174	22.00	102	20.86	

Characteristics	Intervention (n=811)		Control (Delayed intervention) (n=497)		p-value
	n	Mean (SD) or %	n	Mean (SD) or %	
Duration of church attendance, years	791	31.64 (21.92)	488	33.01 (23.38)	0.29

*Note:* Boldface indicates statistical significance ( $p < 0.01$ ). Due to the small number of participants who reported multiple races or other race, the  $p$ -value reflects a statistical test that compared the proportion white versus non-white.

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**Table 3.** Physical Activity and Healthy Eating-Related Post-Test Outcomes, by Randomization Assignment (N=1,308)

Outcome	Model, n	Intervention Mean (SE)	Control Mean (SE)	Effect size (d or OR, 95% CI)	F (for group)	p-value
Intervention targets (member report of church environment)						
Percentage reporting fruit and vegetable opportunities “almost all of the time”	1,286	71.68 (5.95)	62.65 (6.59)	OR: 1.51 (0.96, 2.38)	3.34	0.07
Physical activity opportunities	1,284	2.48 (0.13)	1.65 (0.13)	d: 0.96	53.56	<0.0001
Healthy eating messages	1,289	2.71 (0.14)	1.48 (0.14)	d: 1.22	107.04	<0.0001
Physical activity messages	1,278	2.47 (0.14)	1.33 (0.14)	d: 1.20	86.66	<0.0001
Pastor support for healthy eating	1,285	2.63 (0.14)	1.51 (0.13)	d: 1.08	95.04	<0.0001
Pastor support for physical activity	1,223	2.25 (0.15)	1.27 (0.15)	d: 1.03	60.64	<0.0001
Self-efficacy						
Fruit and vegetable self-efficacy	1,289	4.47 (0.14)	4.33 (0.13)	d: 0.09	1.63	0.21
Physical activity self-efficacy	1,283	3.79 (0.14)	3.60 (0.13)	d: 0.13	3.54	0.07
Behavioral outcomes						
Percentage meeting fruit and vegetable recommendations	1,244	27.20 (3.95)	24.15 (3.29)	OR: 1.17 (0.88, 1.56)	1.21	0.27
Percentage inactive	1,247	9.76 (2.65)	15.71 (3.62)	OR: 0.58 (0.37, 0.91)	6.03	<b>0.02</b>
Percentage meeting physical activity recommendations	1,247	77.10 (3.90)	74.54 (3.91)	OR: 1.18 (0.85, 1.65)	1.02	0.32

Note: Boldface indicates statistical significance ( $p < 0.05$ ). Models are adjusted for church clustering, predominant race of congregation (church-level), age, gender, education, and self-report of cancer diagnosis. For intervention targets (member report of church environment), scores can range from 1 to 5 (5 indicates most frequent). For self-efficacy, scores can range from 1 to 7 (7 indicates very confident). The intraclass correlation coefficients (ICCs) were 0.12701 for healthy eating opportunities, 0.41606 for physical activity opportunities, 0.52954 for healthy eating messages, 0.53732 for physical activity messages, 0.42556 for pastor support for healthy eating, 0.44592 for pastor support for physical activity, 0.03553 for fruit and vegetable self-efficacy, 0.01655 for physical activity self-efficacy, 0.00000 for meeting fruit and vegetable recommendations, 0.06561 for inactive, and .02198 for meeting physical activity recommendations.