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FREQUENCY OF ATTENDANCE AT RELIGIOUS SERVICES, CARDIOVASCULAR DISEASE, METABOLIC RISK FACTORS AND DIETARY INTAKE IN AMERICANS: AN AGE-STRATIFIED EXPLORATORY ANALYSIS

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Abstract

Background—Few data have been published on the association of attendance at religious services with cardiovascular morbidity and dietary and metabolic risk factors in representative samples of populations despite a known inverse association with mortality and smoking.

Objective—To test the null hypothesis that frequency of attendance at religious services is unrelated to prevalence or levels of cardiovascular disease, dietary and metabolic risk factors.

Design—Cross-sectional survey of a large national sample.

Participants—American men and women aged 20 years and over with complete data in the Third National Health and Nutrition Examination Survey ($N = 14,192$).

Measurements—Self-reported frequency of attendance at religious services, history of doctor-diagnosed diseases, food intake frequency, 24-hour dietary intake, health status, socio-demographic variables and measured serum lipids and body mass index.

Results—Weekly attenders were significantly less likely to report stroke, even after adjusting for multiple variables only in African American women OR = 0.35, 95% CI 0.19–0.66, $p < 0.01$. No association was seen for heart attack or diabetes. Fish intake at least weekly was more common in weekly attenders, significantly so only in African American women (odds ratio 1.24, 95% CI 1.01–1.58, $p < 0.05$) and in older Mexican American men (odds ratio 2.57, 95% CI 1.45–2.57, $p < 0.01$). In linear regression analyses, no significant independent associations were seen between attendance frequency and serum lipid levels or dietary intake of energy, or fat in g and % of kcal.

Conclusion—Hypotheses generated by these analyses are that in African American women stroke is less prevalent and weekly fish intake more prevalent among weekly attenders than others and that there are no significant independent associations of serum lipids, dietary intake, prevalent CHD, or diabetes with frequency of attendance of religious services. Independent testing of these hypotheses in other samples is needed.

Keywords

cardiovascular disease; metabolic risk factors; dietary intake in Americans

INTRODUCTION

An inverse relationship between religiousness and mortality from all causes and cardiovascular disease including heart attack and stroke has been described in several cohorts [1–8]. One cohort study found lower risk of death from stroke but not from coronary heart disease in weekly attenders of services compared to others [4]. Few data are to be found on cardiovascular morbidity.

Religious affiliation, attendance at religious services and other religious behavior is more prevalent in the United States than in any other industrialized nation [9, 10]. Some of the inverse association of religious attendance and mortality is explained by more favorable health behaviors including avoidance of tobacco and heavy alcohol use among the religious [5, 6]. Social support, which may include reinforcement of healthy behaviors and utilization of health care as well as positive experiences that reduce stress, and improved psychological coping with life stress may also be important for explaining health benefits of religious attendance. However data on religious attendance and other behaviors and risk factors such as dietary energy and fat intake, fish intake, serum lipids and diabetes are mainly studies of special exposure groups which compare religious subgroups with prescribed special dietary practices with general population data [11–19]. Food intake has strong social and cultural associations [7, 8].

In order to test whether frequent attendance at religious services is associated with prevalence of cardiovascular disease (CHD, stroke) and with dietary and metabolic risk factors among adults of all ages independent of age, gender, ethnicity, education, region, cigarette smoking, BMI, and health status in the American population, data on a large, multi-ethnic, national sample of adults from the Third National Health and Nutrition Examination Survey (NHANES III) were examined. Associations with hypertension, blood pressure, obesity, and alcohol intake will be published separately.

METHODS

The Third National Health and Nutrition Examination Survey (NHANES III) was conducted in 1988–1994 on a nationwide multi-stage probability sample drawn from the civilian, non-institutionalized population aged 2 months and over of the United States excluding reservation lands of American Indians. Details of the plan, sampling, operation and response have been published, as have procedures used to obtain informed consent and to maintain confidentiality of information obtained [20, 21].

Demographic data, years of education completed, self-assessed health status, and behavioral information including frequency of attending church or religious services and smoking history were collected by household interview. U.S. Office of Management and Budget race category and Mexican American ethnicity were determined by self-report [20]. Persons were asked for the preceding year, “How often do you attend church or religious services?” Values ranged from 0 to 1,825. Values in excess of 365 ($n = 7$) were coded missing, as were four “don’t know” responses. Since no other items on religion were available, we operationalized religiousness in terms of church attendance, realizing that this captures only the organizational dimension of religiousness. As part of a food frequency questionnaire, interviewers instructed, “Tell me how often you usually ate or drank these foods per day, per

week, per month or not at all.” Foods included “shrimp, clams, oysters, crab and lobster,” and “fish including fillets, fish sticks, fish sandwiches, and tuna fish.” Adult participants were asked “Has a doctor ever told you that you had a heart attack?” in addition to receiving a version of the Rose Angina Questionnaire [22]. Adults were also asked, “Have you ever been told by a doctor that you had diabetes or sugar diabetes?” Women responding yes were asked questions to distinguish gestational from other diabetes.

Examinations were carried out in a mobile examination center. The standard methods used for blood pressure and biochemistry have been described at length elsewhere [20, 21]. Fasting serum was available for 3,828 persons aged 40 and over, examined in the morning.

The dietary interviews were conducted in English and Spanish by bilingual dietary interviewers in a private room to ensure confidentiality [20, 24–26]. Respondents reported all foods and beverages consumed except plain drinking water (i.e., not bottled) for the previous 24-hour time period (midnight to midnight). An automated, microcomputer-based dietary interview and coding system known as the NHANES III Dietary Data Collection (DDC) System was used to collect all NHANES III dietary recall data. For analysis, only data from respondents whose dietary recalls were coded complete and reliable were used. The primary source of food composition data for NHANES III is the U.S. Department of Agriculture (USDA) Survey Nutrient Database. Dietary recall interviews were edited by the interviewers. A number of quality-control monitoring techniques were employed.

Statistical Analysis

Among 33,994 interviewed persons (85.6% of 39,695 sample persons), 31,311 were examined (78% of original sample). Of these, 17,030 were aged 20 years and over. Of these, 672 of “other race” and 281 pregnant women were excluded. Complete data on frequency of attendance at religious services, serum HDL cholesterol, energy intake, and BMI, were available for 14,094 examined non-pregnant persons aged 20 years and over, forming the sample used for the present analysis. Detailed descriptive statistics and measures of association were computed initially using the Statistical Analysis System (SAS) [27–29]. Correlation results are presented because of their familiarity, ease of interpretation by a wide audience, and use in previous reports that may be compared to the present one. Multivariate logistic regression analysis was used to develop models for controlling for confounding of the association of weight status with frequency of attendance at religious services [30]. Multivariate linear regression was used for models with the dependent variable HDL etc. as continuous variables. Because of documented age, gender and ethnic differences in religiousness and obesity, interaction terms were initially included for age, gender and ethnicity with attendance. These were often significant, confirming the need for separate analyses for women and men of each ethnic group aged 20–59 and 60+, since the effects of attendance are expected to vary by age and gender. All models controlled for age in years. A group of socio-demographic variables and health status were used to control for confounding. All statistical testing and variance estimation were performed using the PROC LOGISTIC or PROC REGRESS procedure for regression models in the SUDAAN system [31].

RESULTS

Cardiovascular Disease Prevalence

Heart Attack—In the analysis sample, 668 persons reported having been told by a doctor they had a heart attack (HA). At age 60+, frequent attenders had the same prevalence of self-reported heart attack as infrequent attenders (10.9% versus 12.3%), but a lower prevalence at age 20–59 (0.9% versus 1.5%, $p = 0.039$). In stratified analyses, logistic regression

models were fit with heart attack status (yes, no) as the dependent variable and frequent-attender status (yes, no). Age-adjusted OR were 0.50 (0.26–0.97) in men and 0.54 (0.22–1.34) in women aged 20–59, but were close to 1.00 at age 60+. After adjusting for all demographic variables, no associations remained significant except for MA men 60+ (OR 0.33, 95% CI 0.18–0.62, $p < 0.001$).

Stroke—In the analysis sample, 403 persons reported having been told by a doctor they had a stroke (Figure 1). Table 1 shows the results of logistic regression analyses in AA and non-AA men and women. A consistent trend of lower stroke prevalence in frequent attenders was significant after adjusting for demographic variables. Even after adjusting also for smoking and self-reported health status, the association remained significant in AA women and non-AA men. After further adjustment for baseline hypertension (blood pressure $\geq 140/90$ or on medication) and physician's assessment of mobility impairment, the association remained significant in AA women (Table 1).

Dietary Intake

Energy, Macronutrient, and Fish Intake—Frequent attenders aged 20 and over reported lower energy intake (kcal/kg/24h) than infrequent attenders: men mean 28.2 versus 30.6 ($p < 0.001$); women mean 23.0 versus 24.1 ($p = 0.058$). However, stratified analyses showed no consistent pattern of energy intake in frequent attenders compared with others. Correlation coefficients were small and inconsistent in sign, indicating only chance variation with no meaningful pattern. Linear regression by gender showed no significant associations (except for men, after adjusted for age only, $\beta = -0.0059$, $p = 0.007$ (not shown in tables)).

Frequent attenders aged 20 and over reported similar total fat and saturated fat intake (% kcal) as infrequent attenders: men mean total 33.4 versus 32.7, saturated 10.9 versus 10.7; women mean total 31.5 versus 32.0, saturated 10.3 versus 10.4. Stratified analyses showed no consistent pattern of % energy intake in frequent attenders compared with others. Correlation coefficients were small and inconsistent in sign, indicating only chance variation with no meaningful pattern. Linear regression by gender showed no significant associations.

Fifty percent of the sample ate fish at least weekly. Intake varied by age, gender, and/or ethnicity. Frequent attenders aged 20 and over more often reported weekly intake (53.3%) than others (47.6%). Stratified analyses showed this association appeared to be independent of ethnicity, age and gender (Table 2). Since possible influence of Roman Catholic teaching on fish consumption would be confined primarily to European and Mexican Americans, these groups as well as age groups were combined for further analysis to improve statistical power for detecting associations within strata. Logistic regression analyses within gender, ethnicity strata controlling for demographic variables showed non-significantly greater prevalence of weekly intake in frequent attenders among all groups except AA men and significantly greater prevalence in older MA men (Table 3). In fully adjusted models, the association in older MA men persisted undiminished. Further, the association in AA women was significant when both age groups were pooled (odds ratio 1.26, 95% CI 1.01–1.58, $p < 0.05$).

Metabolic Risk Factors

Serum Lipids—Frequent attenders aged 20 and over had lower HDL-C (mg/dL) than infrequent attenders in men, mean 42.7 versus 44.3, but not women mean 53.4 versus 53.3. Stratified analyses revealed inconsistent differences between frequent attenders and others for TC, HDL-C, TG, and TC/HDL-C (not shown). Linear regression models of LN frequency of attendance at religious services as a predictor of LN serum lipid levels controlling for demographic variables revealed a lack of meaningful independent

associations between frequency of attendance and serum lipids (not shown) except for MA men 20–59 ($\beta = -0.0062$, $p < 0.001$ for HDL-C; $\beta = 0.0055$, $p = 0.0035$ for TC/HDL-C).

Diabetes—In stratified analyses, prevalence of doctor-diagnosed diabetes was not higher in frequent attenders in most age-, gender-, ethnicity-subgroups (not shown) nor did adjusted OR differ significantly from 1.00 within gender-, ethnicity strata(not shown). Among diagnosed diabetics, odds of treatment varied by attendance only in women over 60 (OR = 0.49, 95% CI 0.27–0.86, $p = 0.014$). Among treated persons, age-adjusted odds of diabetic control (glycated hemoglobin <9%) did not differ by attendance within age- and gender strata. Fasting plasma glucose (FPG) was available for a sub-sample of 6,324 persons over 20 years of age who were examined in the morning having fasted 9–24 hours and met other inclusion criteria for this analysis as described above. The percentage of diabetics (criteria: FPG ≥ 126 mg/dL or taking hypoglycemic medication, $N = 542$) among those who attended frequently was similar to that among others at age 60+y 12.2 vs 14.4, but a higher prevalence at age 20–59y 4.7 vs 2.6 ($p = 0.007$).

DISCUSSION

In 2000, stroke was the third leading cause of death (167,661 deaths) and poor diet and physical inactivity were estimated to have caused an estimated 400,000 deaths in the United States, second only to tobacco (435,000) [32, 33]. The rate of decline of CHD and stroke mortality has decreased since peaks in the 1970s [34, 35]. Church attendance may be associated with mortality and health behaviors, but large, population-based studies are few [1–6]. This report describes the largest study to date of religiousness, prevalence of cardiovascular disease, dietary intake, and metabolic risk factors. NHANES III data show that there were no consistent associations with any of the variables examined. However, a few post-hoc findings suggest hypotheses for testing in future studies: CHD prevalence was not significantly associated with attendance, but prevalence of stroke was lower in AA women attending frequently even after controlling for socio-demographic variables and health status. Serum lipid concentrations, dietary energy and macronutrient intake failed to show consistent associations with frequency of attendance at religious services, but intake of fish was consistently more frequent among frequent attenders of religious services. Like obesity in NHANES III, crude diabetes rates were higher in frequent attenders, but this association was explained by socio-demographic variables.

Mechanisms

A number of religious groups advocate or proscribe intake of dietary items that may influence health [5–8]. In recent times, large American-Christian religious bodies generally have abandoned widespread religious regulations for diet. However, the Roman Catholic teaching of avoiding meat but allowing fish on Fridays was widespread in the United States until the reforms of Vatican II in the 1960s and it is likely that many older Roman Catholics continued consuming fish on Fridays during the period of the NHANES III survey (1988–1994; personal communication, D. P. Sullins, Ph.D., The Catholic University of America). This might help explain the strong effect seen in Mexican-American men over 60, which could not be explained statistically in regression models (demographic adjusted OR = 2.57, 1.45–2.57, demographic-health-adjusted OR = 2.61 95% CI 1.47–4.62, $p < 0.01$). Fish intake has shown inverse relationships to CHD, sudden cardiac death, and stroke in other studies likely due to their high content of omega-3-unsaturated fatty acids and might help explain the paradox of unexpectedly low mortality in older U.S. Hispanics. The overall lack of association with lipids and dietary intake other than fish is consistent with the lack of religious teaching in this area among major groupings.

The associations in African-American women remain unexplained. Attendance at religious services is more prevalent and importance of religion greater and stroke rates higher than in other groups [9, 10]. Meals served at African-American churches frequently have featured chicken or fish, usually fried, as the main protein source. Women working in service jobs may be more likely exposed to fish meals on Fridays, still a tradition in many institutions. Fish oil so derived and from relatively inexpensive canned fish might have a beneficial effect on ischemic stroke, the most common type in all U.S. groups.

Comparisons with Previous Reports

NHANES III is the largest study to provide population-based data on the association of attendance at religious services and CHD, stroke, serum lipids, dietary intake, and diabetes in nation-wide representative samples of Americans and the first to provide such data for U.S. Mexican Americans. Few studies have examined religiousness and non-fatal CHD or stroke occurrence. In Washington County, Maryland, white women 45–64 years old and over who attended church ≥ 1 time/week had a 5-year arteriosclerotic heart disease death rate per 1,000 of 8.5 compared to 18.1 for less frequent attenders (127 deaths, relative risk 2.1) with similar results seen in men in preliminary analyses [36]. In a follow-up study of 2,812 person age 65 and over in Connecticut, a significant inverse association of attendance at religious services with stroke incidence was found, which could be explained statistically by controlling for other stroke risk factors such as hypertension [37]. Stroke mortality was inversely associated with frequency of attendance in the Alameda County cohort study [4]. Reports on public or private religious practice and occurrence of Type II diabetes are lacking. Several published studies showed a positive association of attendance at religious services or church membership and overweight or obesity [11, 12]. In a small sample, significant unadjusted correlations of religion or spirituality measures have been reported for the ratio of cholesterol and HDL, and triglycerides [18]. Two larger surveys failed to find significant correlations with cholesterol or HDL independent of age, sex, and ethnicity [13]. In a large Jewish sample in Israel, degree of religious observance was inversely related to cholesterol, triglyceride levels in adolescents and their parents [14, 15]. Jewish subgroups differed in food selection, especially consumption of dairy products. In a Swedish study, denomination and participation was associated with serum cholesterol in that religiously active Seventh-day Adventists had lower total serum cholesterol, and intake of coffee, ground meat, and fish [16].

Limitations and Strengths

At least 12 dimensions of religiousness have been defined [38]. Attendance at religious services is an indicator of organizational religiousness. Since data on multiple dimensions were unavailable in NHANES III, it was used because it is correlated with other dimensions of public and private religiousness and provided data that are directly comparable with a body of research data on this variable spanning many decades. Over-reporting of religious attendance is likely [39]; however the NHANES III variable should serve well to separate more frequent from less frequent attenders, the latter including never attenders. Results of this analysis may have been different had measures of private (e.g., prayer, Bible reading, media use) or subjective (e.g., importance of religion in one's life) religiousness or spirituality been used singly or in combination.

Self-reports of CHD, stroke and diabetes are subject to error. Errors in dietary report would likely have the effect of biasing the regression coefficients toward the null. Excluded subject are likely to be older and in poorer health possibly producing selection bias away from the null. Due to the large number of tests performed the few statistically significant findings may have been due to chance alone. One test in each table might be expected by chance. The cross-sectional study design does not allow the exclusion of reverse causation, i.e., persons

who suffer stroke may become more religious, however they may also be able to attend services less often. Given the small number of cases, non-linear effects of attendance could not be assessed. The representativeness of the sample and the use of sample weights provide generalizability of the results to United States non-institutionalized population of the same ages, but not necessarily to other nations or smaller U.S. ethnic groups such as American Indians. Future research should include replication of the current findings, and longitudinal studies of multiple dimensions of religiousness and stroke incidence, dietary intake [40–44].

Conclusions

No consistent associations of frequency of attendance at religious services and prevalence or levels of cardiovascular disease, dietary intake, or metabolic risk factors were found. Hypotheses generated for testing in future studies include a possible inverse association of frequency of attendance at religious services with stroke prevalence and a positive association with fish intake.

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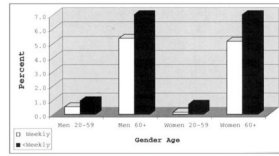


Figure 1. Prevalence of stroke in persons aged 20 years and over by frequency of attendance at religious services, gender, and age in the United States: The Third National Health and Nutrition Examination Survey, 1988–1994.

Table 1

Adjusted Odds Ratios (95% CI) of Weekly Religious Attendance (Reference = No) with Prevalence of Stroke (Yes/No) by Age, Gender, and Ethnicity in NHANES III

Variable	N	Demographic-adjusted odds ratio ^d	95% CI	Demographic-and health-adjusted odds ratio ^b	95% CI
African American (AA) men	1822	0.65	0.32–1.35	0.81	0.32–2.05
Non-AA men	4971	0.61	0.41–0.90**	0.72	0.48–1.06
AA women	2148	0.34	0.19–0.61*	0.35	0.19–0.66*
Non-AA women	5251	0.57	0.32–1.00	0.70	0.41–1.19

^a Adjusted for age (y), education <12 years (yes/no), marital status (married/single), region (South vs. other), metropolitan residence (yes/no); N = 14,093, 20 years and over.

^b Adjusted for the above and mobility limitation (yes/no), current smoking status (smoker/nonsmoker) and poor self-reported health (yes/no) and hypertension (yes/no); N = 13,707, 20 years and over.

* $p < 0.01$.

**

$p < 0.05$ (interpret with caution due to large number (24) of tests).

Table 2

Prevalence (%) of Fish Intake at Least Weekly by Age, Gender, Ethnicity, and Frequency of Attendance at Religious Services: NHANES III

	N	Weekly attendee ^a	Ethnicity		
			European American	African American	Mexican American
Men					
20–59 years	1,262	Yes	51.6	60.7	42.2
	3,272	No	46.9	57.4	36.2
60+ years	984	Yes	58.1	66.4	48.7*
	1,272	No	52.6	61.9	28.9
Women					
20–59 years	2,009	Yes	51.9**	62.6*	41.7**
	3,049	No	44.9	55.0	37.2
60+ years	1,364	Yes	52.4	64.0	39.7
	971	No	50.4	59.2	32.7

Note: Non-Hispanic European American, Non-Hispanic African American, and Mexican American only.

^a >= 52 times/year.

* $p < 0.01$.

** $p < 0.05$.

Table 3

Adjusted Odds Ratios (95% CI) of Weekly Religious Attendance (Reference = No) with Fish Intake at Least Weekly (Yes/No) by Age, Gender, and Ethnicity in NHANES III

Variable	Demographic-adjusted odds ratio	95% CI	Demographic- and health-adjusted odds ratio	95% CI
EA Men				
20–59 years	1.18	0.90–1.55	1.06	0.80–1.40
60+ years	1.32	0.96–1.83	1.28	0.92–1.80
EA Women				
20–59 years	1.23	0.99–1.53	1.18	0.96–1.47
60+ years	1.11	0.88–1.39	1.07	0.84–1.37
AA Men				
20–59 years	1.07	0.76–1.52	1.06	0.75–1.49
60+ years	1.06	0.66–1.72	1.00	0.62–1.62
AA Women				
20–59 years	1.23	0.96–1.58	1.24	0.96–1.61
60+ years	1.22	0.83–1.79	1.28	0.87–1.87
MA Men				
20–59 years	1.28	0.95–1.73	1.28	0.94–1.74
60+ years	2.57*	1.45–2.57	2.61*	1.47–4.62
MA Women				
20–59 years	1.12	0.93–1.36	1.13	0.94–1.37
60+ years	1.35	0.82–2.20	1.31	0.80–2.14

EA = Non-Hispanic European American, AA = Non-Hispanic African American, and MA = Mexican American only.

* $p < 0.01$ ($p < 0.05$ not reported due to n of tests, 24).