Published in final edited form as:

Am J Prev Med. 2006 November ; 31(5): 383–390.

Identifying Sedentary Subgroups: The NCI Health Information National Trends Survey

Audie A. Atienza, PhD¹, Amy L. Yaroch, PhD¹, Louise C. Mâsse, PhD¹, Richard P. Moser, PhD¹, Bradford W. Hesse, PhD¹, and Abby C. King, PhD²

¹National Cancer Institute, Division of Cancer Control and Population Sciences, Behavioral Research Program, Bethesda, Maryland ²Division of Epidemiology, Department of Health Research & Policy, and Stanford Prevention Research Center, Dept. of Medicine, Stanford University School of Medicine, Stanford University, Stanford, California

Abstract

Background—Developing effective interventions for the 24%–28% of U.S. adults who are sedentary requires a better understanding of the factors related to sedentary lifestyles as well as the communication channels to reach various subgroups. This study identified key sociodemographic and health communication characteristics of various subgroups with high rates of inactivity using signal detection methodology (SDM).

Methods—The sample from the nationally representative Health Information National Trends Survey 2003 (HINTS; N=6369) was randomly split into two samples. Exploratory analyses (conducted 2004–2005) were employed on the first sample to identify various subgroups, and the stability of inactivity rates in those subgroups was examined in the second sample.

Results—Eight subgroups with varying levels of inactivity were identified. Three subgroups had inactivity levels $\geq 40\%$, while the lowest subgroup had a level of $<15\%$. The highest inactivity subgroup consisted of individuals with at least some college education who were in fair/poor health and who watched 4+ hours of television/day. The second highest inactivity subgroup was composed of those without a college education who tended not to utilize nor attend to many communication channels. The third highest inactive subgroup consisted of those without a college education who read the newspaper and were obese. Levels of subgroup inactivity in the second independent sample were not significantly different from those found in the exploratory sample.

Conclusions—This study identified empirically-based, physically inactive subgroups that differed on sociodemographic and health communication characteristics. This information should be useful in creating future evidence-based, targeted, and tailored intervention strategies.

INTRODUCTION

Inactivity has been linked to increased risk of many chronic illnesses,^{1, 2} including increased cancer risk and carcinogenesis for many cancers.^{3–5} Consequently, one of the major goals of

Correspondence and reprint requests: Audie A. Atienza, PhD, National Cancer Institute, Division of Cancer Control and Population Sciences, Behavioral Research Program, Health Promotion Research Branch, 6130 Executive Blvd, EPN 4074A, MSC 7335, Bethesda MD 20892-7335, Phone: (301) 561-9530; E-mail: atienzaa@mail.nih.gov

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

No financial conflict of interest was reported by the authors of this paper.

the Institute of Medicine 2003 report—Fulfilling the Potential of Cancer Prevention and Early Detection—is the development of prevention strategies to reduce sedentary behavior and obesity.⁶ The importance of these prevention strategies is highlighted by national surveys indicating that 24%–28% of adults in the United States are completely sedentary, and that levels of obesity in the U.S. are growing to epidemic proportions.^{2,7} A better understanding of the characteristics of sedentary populations is required to develop effective intervention strategies.

Those who are physically inactive (i.e., sedentary) in all likelihood do not represent just one group, but may consist of several subgroups. Yet, the identification of specific inactivity subgroups has received relatively little attention, and attempts to characterize inactive groups have typically taken a unidimensional perspective by classifying subgroups along one domain (e.g., age, gender, ethnicity) or examining multiple correlates without evaluating possible interactions among the variables.⁸ The characteristics of inactive groups are likely to be complex and an aggregate of various factors. Examining multiple characteristics of sedentary groups may aid in more effective health promotion intervention programs.

Identification of critical communication channels is key in developing effective programs for reaching sedentary subgroups. In addition to traditional face-to-face approaches (e.g., exercise classes), prior physical activity research has focused on either mass media campaigns to promote physical activity or smaller-scale interventions using the telephone and/or print media to provide physical activity advice and information.⁹ Yet, few studies have simultaneously examined the spectrum of mediated communication channels (e.g., television, newspaper, Internet) available to reach the inactive populations, and how these channels can be used to disseminate effective interventions.

The purposes of this study were to (1) identify distinct subgroups with high proportions of inactivity in a nationally derived sample using signal detection methodology (SDM), and (2) examine the stability of the inactivity patterns using an independent sample.

METHODS

Data Source

Data came from the Health Information National Trends Survey (HINTS) 2003. This survey was developed to collect nationally representative data about the American public's need for, access to, and use of cancer-relevant information (see <http://cancercontrol.cancer.gov/hints/index.jsp>).

Data Collection

Data were collected from October 2002 through April 2003. Trained interviewers used a list-assisted random-digit-dialing method from all working “banks” of telephone numbers within the U.S. One adult (aged 18+ years) within each household was selected for the extended interview during a household screener; final household response rate for the household-level screening interview was 55%. Black/African American and Hispanic residents were oversampled at a 1.8 times higher rate than expected under proportional allocation to increase the number of respondents in these typically underserved groups. Base weights were generated for each sampled identification number in the final data release based on the complex sampling strategy for the survey. The final set of replicate weights included calibrations against comparable population data for gender, age, race, and education publicly available from the Current Population Survey. Extended interviews were completed with 6369 adults. The response rate for the extended interview was 62.8%, a rate comparable to other recent telephone

surveys of adults in the general population.¹⁰ Details regarding the HINTS 2003 sampling design are published elsewhere.¹¹

MEASURES

Outcome variable

Inactivity—The following item was used to create binary outcome of inactivity: “During the past month, did you participate in any physical activities such as running, calisthenics, golf, gardening, or walking for exercise?” This item was taken from the Behavioral Risk Factor Surveillance Survey (BRFSS) 2000 questionnaire.¹² Individuals answering “No” to this question were categorized as sedentary/inactive, and those answering “Yes” were categorized as “active” (i.e., not sedentary/inactive). Cognitive testing was conducted on this as well as other questions in HINTS 2003.

Predictor Variables

Sociodemographic Characteristics—Ethnicity and race were assessed according to Office of Management and Budget standards.¹³ Responses to the ethnicity and race questions were combined into the following four categories: (1) non-Hispanic whites, (2) non-Hispanic African Americans, (3) Hispanics (all races), and (4) non-Hispanic others or more than one race. Other demographic characteristics included age (continuous); gender; marital status (married, divorced, widowed, separated, never been married); education level (less than high school, high school graduate or General Educational Development Test [GED], some college or technical school, college graduate); employment status (employed for wages, self-employed, out of work, homemaker, student, retired, unable to work); household income (>\$25K, \$25K–\$34K, \$35K–\$49K, \$50K–\$75K, \$75K+); and residential setting (metropolitan, suburban, or rural). Respondents were asked about their general health (excellent to poor); whether they had a regular healthcare provider (yes/no); health insurance coverage (yes/no); cancer history (yes/no); and family history of cancer (yes/no). Body mass index (BMI = weight in kg/height in m²) was calculated based on self-reported height and weight.

Health Behaviors—Respondents were asked about whether they believed that exercise reduces cancer risk (yes/no), their fruit and vegetable consumption (continuous), and if they smoked 100+ cigarettes in their lifetime (yes/no).

Communication channels—Respondents were asked whether they ever went online to access the Internet or send/receive e-mails, number of hours TV watched, cable or satellite TV use, number of hours of radio listening on a typical weekday, number of days of newspaper reading during the past 7 days, and number of days of magazine reading during the past 7 days. Respondents were also asked how much attention they paid to health or medical information on the Internet, TV, radio, in newspapers, and in magazines (1=not at all to 4=a lot).

Analysis Plan

Descriptive analyses with the full sample were first conducted, and *t*-test analyses were used to compare inactive versus active individuals on the various characteristics, which provided points of comparison with the results of the signal detection analyses.

The sample was randomly split from HINTS (N=6369) into two samples. Data on inactivity were missing for 106 and 103 respondents in samples 1 and 2, respectively. The sample sizes for analyses were *n*=3076 and *n*=3084 for samples 1 and 2, respectively. SDM (using ROC4 statistical program¹⁴) was applied to the first sample to identify the various subgroups, their levels of inactivity, and the key factors that delineated each subgroup. All sociodemographic, health behavior, and health communication variables were included in the analysis.

Signal detection methodology is used with recursive partitioning (classification trees), an empirically driven iterative nonparametric process, to produce a series of “and/or” (Boolean) rules on the predictor variables that identify subgroups of individuals who are more or less likely to have a particular outcome according to a selected criterion.^{15, 16} The subgroups identified are mutually exclusive and maximally discriminated from each other with respect to a dichotomous outcome. SDM is ideal for hypothesis-generating activities and when higher order interactions among variables are possible. The partitioning (i.e., cutpoint) process was set up in this study to identify sets of predictors that would optimize both sensitivity and specificity in predicting those who were inactive. After selecting the cut point for the first optimally efficient variable (Step 1), the signal detection program repeats the partitioning process for each “branch” or subgroup, using all initial predictor variables (Step 2 to Step *n*). The stopping rules for the partitioning process included: (1) no evaluation with fewer than 100 participants in a subgroup and (2) $p < 0.001$ significance level at each step; these rules are consistent with prior studies that have employed SDM on large nationally representative samples.^{17–19} Unweighted data were used in this exploratory analysis because SDM cannot incorporate sampling weights that adjust for complex sampling designs.

An advantage of SDM over more traditional parametric methods (e.g., regression) is that missing data are considered for each variable at each cutpoint (rather than requiring list-wise deletion), allowing for the efficient use of all available data for each variable being evaluated. Furthermore, SDM does not assume linearity or normality and uses a decision tree approach to analyze each variable independently. Thus, multicollinearity among the “predictor” variables is not a concern.²⁰ Detailed comparison of SDM versus traditional methods have been discussed by others.^{15, 21}

Using split sample methodology,^{21, 22} a Cochran-Mantel-Haenzel test was conducted comparing the levels of inactivity between the first and second samples stratified by subgroup. SUDAAN, version 9.0.1 (Research Triangle Institute, Research Triangle Park NC, 2005) was used in these analyses to adjust for the complex sampling design (i.e., sampling weights adjust for unequal sampling probabilities). The mutually exclusive subgroups were created in the second sample (i.e., confirmatory sample) based on the critical variable cut points found using SDM in the first sample. Support for split-sample validation would occur if no significant differences in levels of inactivity were noted between Samples 1 and 2 for the paired subgroups identified.

If Samples 1 and 2 were similar in levels of inactivity, descriptive analyses were planned with the full sample to determine whether additional factors were uniquely associated with the various subgroups. These analyses were exploratory in nature and provided a more complete picture of the characteristics of each subgroup. ANOVA procedures with pair-wise comparisons using SUDAAN were used in these additional analyses.

RESULTS

Descriptive characteristics of the full sample (unweighted data) are displayed in Table 1. Overall, about 28% of respondents were sedentary. Bivariate analysis revealed that inactive respondents were older, less educated and of lower income strata; more likely to be women, not married, nonwhite, overweight, and have smoked 100+ cigarettes in their lifetimes; and less likely to live in metropolitan areas, be in poorer general health, have health insurance, believe that exercise lowers cancer risk, and eat 5+ servings/day of fruits and vegetables compared with more active respondents. Regarding communication channels, inactive respondents read newspapers and magazines less, watched TV more, were less likely to have accessed the Internet, and were less likely to attend to health messages on all media channels compared with more active respondents.

As displayed in Figure 1, the overall sedentary proportion was 27.4% in the exploratory sample (Sample 1). Signal detection analyses identified 8 distinct subgroups. While descriptive names are provided for each subgroup, the complex sets of characteristics should be used, rather than the names supplied, to understand and interpret the subgroups. The highest sedentary subgroups are described, followed by intermediate and low inactivity subgroups. Subgroup 5 (Illness-Burdened Couch Potatoes) had the highest level of inactivity (50.0%) and consisted of individuals with at least some college education, who were in fair to poor general health, and watched 4+ hours of TV on a typical weekday. Subgroup 8 (Limited Media Users) had the second highest levels of inactivity (47.8%) and consisted of individuals who did not attend college and did not read the newspaper. Individuals in Subgroup 7 (Obese News Readers) had the third highest levels of inactivity (43.7%) and were composed of those who did not attend college, who read the newspaper at least one day a week and had BMIs ≥ 30.0 . Subgroup 6 (Non-Obese News Readers; inactive=29.3%) had characteristics similar to Subgroup 7, but had BMIs < 30.0 . Those in subgroups 2–4 had intermediate levels of inactivity (25.0% to 27.8%). Subgroup 2 (Overweight Believers; inactive=25.0%) was composed of college educated individuals, who were in good to excellent general health, believed that exercise can lower cancer risk, and had BMIs ≥ 29 . Subgroup 3 (Healthy Non-Believers; inactive=27.8%) consisted of college-educated individuals, who were in good to excellent general health, and did not believe that exercise can lower cancer risk. Subgroup 4 (Illness-Burdened TV Restricters; inactive=26.2%) consisted of college-educated individuals, who were in fair to poor general health, and watched less than 4 hours of TV on a typical weekday. Subgroup 1 (Non-Obese Believers) had the lowest inactivity level (12.9%) and was composed of college educated individuals, who were in good to excellent general health, believed that exercise can lower cancer risk, and had BMIs < 29 .

The levels of inactivity (weighted data) between respective subgroups in Sample 1 versus 2 are displayed in Figure 2. Concerning the stability of subgroup inactivity across the two random samples, some shrinkage in the levels of inactivity was noted between Samples 1 and 2 (as one would expect in split-sample validation analyses). However, results indicated **no** significant differences in physical inactivity levels between the respective subgroups in Samples 1 and 2 (CMH $\chi^2=0.35$; $p=0.55$).

Descriptive analyses results, examining additional unique characteristics among various subgroups, are displayed in Table 2. In addition to the characteristic noted using SDM, the Limited Media Users (Subgroup 8) were more likely to be nonwhite and of lower income strata; not have a regular healthcare provider nor health insurance; and less likely to have a family history of cancer, be married, have accessed the Internet, read magazines, or attended to health information on various communication channels compared with the other subgroups. Further analyses revealed that Limited Media Users were more likely to be Hispanic/Latino (29%) compared with the other subgroups (5%–14% Hispanic/Latino). The Obese News Readers (Subgroup 7) were less likely to live in metropolitan areas and had the second lowest income level of all the other subgroups. Further analyses revealed that the Obese News Readers were more likely to live in suburban areas (27%) compared with the levels of other subgroups (11%–21%). The Non-Obese Believers (Subgroup 1) were more likely to be white and younger compared with the other subgroups. The Illness-Burdened Couch Potatoes (Subgroup 5) were less likely to be employed, but attended more to health messages on TV compared with the other subgroups. The Overweight Believers (Subgroup 2) had significantly more men compared to the other subgroups, with the exception of the Healthy Non-Believers subgroup.

DISCUSSION

Approximately one quarter of the U.S. adult population remains sedentary. This study was conducted to identify empirically distinct subgroups with varying sedentary levels. Overall,

results suggest that subgroups with similar levels of inactivity can have quite different defining characteristics. Furthermore, the inactivity patterns found using SDM were found to stable in an independent sample.

Prior studies on inactivity have typically not considered the complex interactions among predictive factors and, therefore, may have missed important subgroups. For example, other studies using correlational and regression techniques with nationally representative samples have found lower educational attainment to be associated with greater inactivity.^{8,23} This study had similar findings in bivariate analyses and when evaluating the first partitioning; specifically, those with higher educational attainment had significantly lower inactivity levels (20.2%) compared with lower educational attainment (37.5%). Yet, substantive differences in sedentary levels existed between subgroups within education level. The Illness-Burdened Couch Potatoes (a high-inactivity subgroup) was composed of those with higher (not lower) educational attainment in conjunction with other health and behavioral factors (i.e., in fair to poor general health and greater TV watching). This important sedentary subgroup would likely have been overlooked if the complex interactions were not examined.

Results may facilitate the development of interventions targeted and tailored specifically for the subgroups identified.^{15,24} Study results also highlight the role of communication variables as key factors that define inactive subgroups. As noted earlier, watching TV 4+ hours/day was one of the significant characteristics defining a high sedentary subgroup, the Illness-Burdened Couch Potatoes. A possible intervention program targeting this subgroup might focus on substituting TV with more active behaviors,^{25–28} taking into consideration the health status of individuals in this subgroup. Given the fair to poor general health status of individuals in this subgroup, the content of the health message may need to emphasize activities aimed as secondary prevention (e.g., improve strength function, activities to manage disability), rather than primary health promotion. Another high-inactive subgroup, the Limited Media Users, was less-educated, did not read the newspaper, and had the lowest scores on most communication variables. This subgroup was also more likely to be Hispanic/Latino, not have a regular healthcare provider or health insurance, and have lower incomes. This may be a difficult subgroup to reach for health promotion purposes, particularly since they attend less to health messages through most media channels. However, this subgroup did complete the HINTS telephone interview and may be amenable to culturally sensitive, health promotion counseling by phone or potentially through community settings that they regularly visit (e.g., community centers, churches). Prior research has found telephone counseling aimed at increasing physical activity among adults, including Latino adults, to be effective.^{29–31} As another example, newspaper ads or tailored print may be effective in recruiting those in the Obese News Reader subgroup (particularly in suburban areas) to a health promotion program focused on increasing activity and weight loss, although these materials should be written for an audience with a lower education level. This tailored information could then be incorporated within a theoretically based, behavioral intervention.²⁴

Some limitations of this study include the cross-sectional study design, which limits the ability to establish causality. Furthermore, HINTS 2003 did oversample ethnic/minority groups such as African Americans and Hispanics, but there was limited information on other groups (e.g., Asian Americans, American Indians); hence, results cannot be generalized to these other underrepresented groups. Another limitation concerns the one item measure used to assess inactivity. Although taken from another national survey and cognitively tested prior to being used, this measure may not accurately capture the levels of inactivity of the subgroups identified. However, given that reporting bias in the physical activity arena tends to involve **underreporting** of inactivity (and overreporting of activity), it is likely that those individuals identifying themselves as inactive were truly sedentary. Moreover, respondents provided self-reports on all the behaviors measured, including BMI and media use (e.g., television, radio,

Internet), which could have resulted in overreported or underreported this information (due to poor recall, social desirability, or other reporting biases). Addressing these potential self-reporting biases may require objective measures or measurement triangulation in future research. Although this study focuses on various media communication channels used by respondents, little information is available concerning the specific information/message content that would be most useful or appropriate for decreasing sedentary behavior among the subgroups. Tailoring programs on both the communication channel and message content will likely be needed to create significant and sustained behavior change.

Overall, this study's inactivity proportion (i.e., 27.6%) was comparable to the national averages. This study adds to the literature in that it is the first to validate the results of a SDM using a nationally representative sample. Researchers have argued that a "one-size-fits-all" approach to health promotion may not be as effective as programs that target specific groups and/or tailor according to individual characteristics,³² and the current results represent a first step in attempting to identify relevant subgroups for subsequent intervention targeting and development.

Acknowledgements

The views presented in this paper represent those of the authors and not the National Cancer Institute. The authors gratefully acknowledge Drs. Helena Kraemer and David Berrigan for their comments on earlier drafts of this manuscript.

References

1. Eyre H, Kahn R, Robertson RM, et al. Preventing cancer, cardiovascular disease, and diabetes: a common agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Circulation* 2004;109(25):3244–55. [PubMed: 15198946]
2. U.S. Department of Health and Human Services. Physical activity and health: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996.
3. Calle EE, Kaaks R. Overweight, Obesity and cancer: epidemiological evidence and proposed mechanisms. *Nat Rev Cancer* 2004;4(8):579–91. [PubMed: 15286738]
4. Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med* 2003;348(17):1625–638. [PubMed: 12711737]
5. IARC Working Group. IARC Handbook of Cancer Prevention. 6. Lyon, France: IARC Press; 2002. IARC Working Group on the evaluation of cancer-preventive strategies.
6. Institute of Medicine & National Research Council. Fulfilling the potential of cancer prevention and early detection. Washington (DC): The National Academies Press; 2003.
7. U. S. Department of Health and Human Services and U.S. Department of Agriculture. Dietary guidelines for Americans. 6. Washington (DC): U.S. Government Printing Office; 2005.
8. Yancey AK, Wold CM, McCarthy WJ, et al. Physical inactivity and overweight among Los Angeles County adults. *Am J Prev Med* 2004;27(2):146–152. [PubMed: 15261902]
9. Marcus BH, Owen N, Forsyth LH, Cavill NA, Fridinger F. Physical activity interventions using mass media, print media, and information technology. *Am J Prev Med* 1998;15(4):362–378. [PubMed: 9838978]
10. Krosnick, JA.; Chang, L. A comparison of the random digit dialing telephone survey methodology with Internet survey methodology as implemented by Knowledge Networks and Harris Interactive. Columbus (OH): Ohio State University; 2001.
11. Nelson DE, Kreps GL, Hesse BW, et al. The Health Information National Trends Survey (HINTS): development, design, and dissemination. *J Health Commun* 2004;9(5):443–60. [PubMed: 15513791] discussion 481–444
12. Centers for Disease Control and Prevention. BFRSS 2000 questionnaire. [Accessed March 15, 2006]. <http://www.cdc.gov/brfss/questionnaires/pdf-ques/2000brfss.pdf>

13. Office of Management and Budget. Office of Information and Regulatory Affairs. Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity. Federal Register. [Accessed February 25, 2004]. <http://www.whitehouse.gov/omb/fedreg/1997standards.html>
14. ROC4 software. 2002. Department of Veteran's Affairs MIRECC.
15. Kiernan M, Kraemer HC, Winkleby MA, King AC, Taylor CB. Do logistic regression and signal detection identify different subgroups at risk? Implications for the design of tailored interventions. *Psychol Methods* 2001;6(1):35–48. [PubMed: 11285811]
16. Kraemer, HC. Evaluating medical tests: Objective and quantitative guidelines. Newbury Park: Sage; 1992.
17. Collins R, Winkleby MA. African American women and men at high and low risk for hypertension: a signal detection analysis of NHANES III, 1988–94. *Prev Med* 2002;35(4):303–12. [PubMed: 12453706]
18. Rodriguez MA, Winkleby MA, Ahn D, Sundquist J, Kraemer HC. Identification of population subgroups of children and adolescents with high asthma prevalence: findings from the Third National Health and Nutrition Examination Survey. *Arch Pediatr Adolesc Med* 2002;156(3):269–75. [PubMed: 11876672]
19. Winkleby MA, Cubbin C, Ahn DK, Kraemer HC. Pathways by which SES and ethnicity influence cardiovascular disease risk factors. *Ann N Y Acad Sci* 1999;896:191–209. [PubMed: 10681898]
20. Smith PM, Kraemer HC, Miller NH, DeBusk RF, Taylor CB. In-hospital smoking cessation programs: who responds, who doesn't? *J Consult Clin Psychol* 1999;67(1):19–27. [PubMed: 10028205]
21. James KE, White RF, Kraemer HC. Repeated split sample validation to assess logistic regression and recursive partitioning: an application to the prediction of cognitive impairment. *Stat Med* 2005;24(19):3019–35. [PubMed: 16149128]
22. Hair, JF., Jr; Anderson, RE.; Tatham, RL. *Multivariate Data Analysis*. 2. New York: Macmillan; 1987.
23. Varo JJ, Martinez-Gonzalez MA, De Irala-Estevez J, Kearney J, Gibney M, Martinez JA. Distribution and determinants of sedentary lifestyles in the European Union. *Int J Epidemiol* 2003;32(1):138–46. [PubMed: 12690026]
24. Napolitano MA, Marcus BH. Targeting and tailoring physical activity information using print and information technologies. *Exerc Sport Sci Rev* 2002;30(3):122–8. [PubMed: 12150571]
25. Fung TT, Hu FB, Yu J, et al. Leisure-time physical activity, television watching, and plasma biomarkers of obesity and cardiovascular disease risk. *Am J Epidemiol* 2000;152(12):1171–8. [PubMed: 11130623]
26. Hu FB, Li TY, Colditz GA, Willett WC, Manson JE. Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. *Jama* 2003;289(14):1785–91. [PubMed: 12684356]
27. Jakes RW, Day NE, Khaw KT, et al. Television viewing and low participation in vigorous recreation are independently associated with obesity and markers of cardiovascular disease risk: EPIC–Norfolk population-based study. *Eur J Clin Nutr* 2003;57(9):1089–96. [PubMed: 12947427]
28. Jeffery RW, French SA. Epidemic obesity in the United States: are fast foods and television viewing contributing? *Am J Public Health* 1998;88(2):277–80. [PubMed: 9491022]
29. Albright CL, Pruitt L, Castro C, Gonzalez A, Woo S, King AC. Modifying physical activity in a multiethnic sample of low-income women: one-year results from the IMPACT (Increasing Motivation for Physical ACTivity) project. *Ann Behav Med* 2005;30(3):191–200. [PubMed: 16336070]
30. King AC, Baumann K, O'Sullivan P, Wilcox S, Castro C. Effects of moderate-intensity exercise on physiological, behavioral, and emotional responses to family caregiving: a randomized controlled trial. *J Gerontol A Biol Sci Med Sci* 2002;57(1):M26–36. [PubMed: 11773209]
31. King AC, Pruitt LA, Phillips W, Oka R, Rodenburg A, Haskell WL. Comparative effects of two physical activity programs on measured and perceived physical functioning and other health-related quality of life outcomes in older adults. *J Gerontol A Biol Sci Med Sci* 2000;55(2):M74–83. [PubMed: 10737689]

32. Marcus BH, Nigg CR, Riebe D, Forsyth LH. Interactive communication strategies: implications for population-based physical-activity promotion. *Am J Prev Med* 2000;19(2):121–6. [PubMed: 10913903]

Figure 1.
Signal detection analysis for inactivity, Sample 1
CA, cancer

Figure 2.
 Stability of inactivity rates by subgroup, Samples 1 vs. 2
 Cochran-Mantel-Haenszel Test =0.35; $p=0.55$

Table 1
Descriptive statistics of full sample (unweighted data)

Variables	Full sample % or mean(SD)	Inactive % or mean(SD)	Active % or mean(SD)	Bivariate significant level
Sedentary/inactive	27.6%	-	-	-
Sociodemographic and health				
Age (years)	47.7(17.4)	49.2(17.6)	47.2(17.2)	$p < 0.0001$
Gender (female)	60.4%	64.2%	58.9%	$p < 0.0001$
Married	52.8%	49.2%	54.2%	$p < 0.001$
Race/ethnicity (white)	67.1%	64.1%	71.5%	$p < 0.0001$
Education ^a	2.8(1.0)	2.4(1.0)	2.9(1.0)	$p < 0.0001$
Employed	59.3%	57%	60%	n.s.
Income ^b	5.5(2.1)	5.0(2.2)	5.8(2.1)	$p < 0.0001$
County in metro area	81.2%	77.5%	82.7%	$p < 0.0001$
General health ^c	2.7(1.1)	3.1(1.1)	2.5(1.0)	$p < 0.0001$
Provider (yes)	67.3%	68.3%	65.9%	n.s.
Health insurance (yes)	87.3%	82.5%	89.2%	$p < 0.0001$
Ever had cancer (yes)	12.0%	12.0%	12.3%	n.s.
Family member	62.9%	61.3%	63.8%	n.s.
Ever had cancer (yes)				
Body mass index	26.7(5.7)	27.9(6.5)	26.3(5.2)	$p < 0.0001$
Health behaviors				
Believes that exercise lowers cancer risk	78.0%	69.0%	81.4%	$p < 0.0001$
Eat 5+ fruits & vegetables per day	16.6%	10.0%	19.0%	$p < 0.0001$
Smoked 100+ cigarettes in your life	47.2%	52.2%	45.0%	$p < 0.0001$
Health communications				
Access the Internet	62.6%	50.9%	67.5%	$p < 0.0001$
TV (hrs/day)	3.1(2.5)	3.7(2.9)	3.0(2.3)	$p < 0.0001$
Cable/satellite TV	80.7%	80.4%	80.9%	n.s.
Radio (hrs/day)	2.4(2.8)	2.4(2.9)	2.4(2.8)	n.s.
Newspaper (days/wk)	3.5(2.9)	3.0(3.0)	3.7(2.9)	$p < 0.0001$
Magazine (days/wk)	1.8(2.1)	1.4(2.0)	2.0(2.1)	$p < 0.0001$
Attends to health messages on... ^d				
Internet	1.8(1.1)	1.6(1.1)	1.9(1.2)	$p < 0.0001$
TV	3.0(0.9)	2.9(1.0)	3.0(0.9)	$p < 0.0001$
Radio	2.3(1.1)	2.1(1.1)	2.4(1.1)	$p < 0.0001$
Newspapers	2.6(1.1)	2.3(1.2)	2.7(1.1)	$p < 0.0001$
Magazine	2.6(1.1)	2.3(1.2)	2.6(1.1)	$p < 0.0001$

^a2 = high school graduate, 3 = some college, 4 = college graduate

^b4 = "\$20,000 to <\$25,000", 5 = "\$25,000 to <\$35,000", 6 = "\$35,000 to <\$50,000", 7 = "\$50,000 to <\$75,000"

^c2 = very good, 3 = good, 4 = fair

^d1 = not at all, 2 = a little, 3 = some, 4 = a lot

n.s., not significant

Table 2

HINTS subgroup characteristics of identified subgroups – full sample with weighted data

	Subgroup 1	Subgroup 2	Subgroup 3	Subgroup 4	Subgroup 5	Subgroup 6	Subgroup 7	Subgroup 8
	Non-obese believers (<i>n</i> = 1798) Educ ≥ some college, Health ≥ Good, Believer = Y, BMI < 29 Inactive = 14%	Overweight believers (<i>n</i> = 455) Educ ≥ Some College, Health ≥ Good, Believer = Y, BMI ≥ 29 Inactive = 27%	“Healthy” non-believers (<i>n</i> = 319) Educ ≥ Some College, Health ≥ Good, Believer = N Inactive = 25%	Illness-burdened TV restricters (<i>n</i> = 319) Educ ≥ Some College, Health < Good, TV < 4 hrs/day Inactive = 25%	Illness burdened couch potatoes (<i>n</i> = 218) Educ ≥ Some College, Health < Good, TV ≥ 4 hrs/day Inactive = 43%	Non-obese news readers (<i>n</i> = 1245) Educ < Some College, Newspaper ≥ 1 day/wk, BMI < 30.0 Inactive = 29%	Obese news readers (<i>n</i> = 475) Educ < Some College, Newspaper ≥ 1 day/wk, BMI ≥ 30.0 Inactive = 40%	Limited media users (<i>n</i> = 807) Educ < Some College, Newspaper < 1 day/wk Inactive = 46%
Sociodemographic and health								
Age (years)	41.5	44.1	46.0	45.4	47.6	48.6	48.9	43.1
Gender (female)	53%	42%	47%	57%	62%	52%	52%	51%
Married	65%	67%	63%	63%	56%	57%	62%	48%
Race/ethnicity (white)	82%	77%	75%	69%	65%	73%	67%	53%
Education ^a	3.5	3.4	3.5	3.4	3.3	3.3	3.2	3.5
Employed (yes)	68%	72%	66%	63%	40%	53%	55%	56%
Income ^b	6.6	6.5	6.4	5.8	5.2	5.0	4.7	4.2
County in metro area	87%	84%	88%	81%	78%	76%	67%	80%
General health ^c	2.1	2.5	2.2	4.2	4.2	2.7	3.2	3.1
Provider (yes)	67%	74%	67%	74%	75%	62%	68%	47%
Health insurance (yes)	92%	92%	92%	90%	87%	84%	82%	70%
Ever had cancer (yes)	9%	9%	10%	15%	19%	14%	12%	9%
Family member ever had cancer (yes)	63%	67%	67%	67%	70%	61%	64%	54%
BMI	23.8	33.1	26.1	27.9	30.2	24.7	34.8	27.1
Health behaviors								
Believes that exercise lowers cancer risk	100%	100%	0%	80%	77%	72%	67%	72%
Eat 5+ fruits & vegetables per day	20%	17%	14%	14%	13%	14%	11%	13%
Smoked 100+ cigarettes in your life	39%	41%	49%	53%	62%	53%	52%	54%
Health communications								
Access the Internet	88%	85%	80%	78%	67%	46%	43%	35%
TV (hrs/day)	2.4	3.0	2.8	2.0	5.8	3.5	3.9	3.7
Cable/satellite TV	85%	88%	87%	84%	82%	81%	84%	74%
Radio (hrs/day)	2.2	2.6	2.4	2.3	2.5	2.6	2.8	2.6
Newspaper (days/wk)	3.7	3.8	4.2	3.7	3.7	4.4	4.4	0
Magazine (days/wk)	2.1	2.1	2.1	2.1	2.0	1.7	1.6	0.8
Attend Internet ^d	2.2	2.0	2.0	2.2	2.1	1.5	1.5	1.4
Attend TV ^d	3.0	3.1	2.9	3.0	3.2	2.9	3.1	2.8
Attend radio ^d	2.4	2.4	2.3	2.3	2.2	2.2	2.2	2.1
Attend newspaper ^d	2.8	2.7	2.6	2.8	2.7	2.7	2.8	1.6
Attend magazine ^d	2.5	2.8	2.5	2.6	2.7	2.4	2.4	1.9

^a 1 = Less than HS, 2 = High School Graduate, 3 = Some College, 4 = College Graduate

^b 4 = “\$20,000 to <\$25,000”, 5 = “\$25,000 to <\$35,000”, 6 = “\$35,000 to <\$50,000, 7 = “\$50,000 to <\$75,000”

*c*₂ = very good, 3 = good, 4 = fair

*d*₁ = not at all, 2 = a little, 3 = some, 4 = a lot