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Patterns of cancer-related health behaviors among middle-aged and older adults: Individual- and area-level socioeconomic disparities

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ABSTRACT

Multiple health behaviors could have greater impact on chronic diseases than single behaviors, but correlates of behavioral clusters are relatively understudied. Using data from NIH-AARP Diet and Health Study (initiated in 1995) for 324,522 participants from the U.S. (age 50–71), we conducted exploratory factor analysis to identify clusters of adherence to eight cancer prevention behaviors. Poisson regressions examined associations between cluster scores and neighborhood socioeconomic deprivation, measured with census block group (1) poverty and (2) low education. Four clusters emerged: Movement (adequate physical activity/less TV); Abstinence (never smoked/less alcohol); Weight control (healthy body mass index/high fruits and vegetables); and Other (adequate sleep/receiving cancer screenings). Scores on all clusters were lower for participants in neighborhoods with the highest poverty (most deprived quintile versus least deprived: relative risk [RR] = 0.95 (95% confidence interval [CI] = 0.94–0.96) for Movement, 0.98 (95% CI = 0.97–0.99) for Abstinence, 0.94 (95% CI = 0.92–0.95) for Weight control, and 0.94 (95% CI = 0.93–0.95) for Other; all $p < 0.001$). Scores on three clusters were lower for participants in neighborhoods with the lowest education (RR = 0.88 (95% CI = 0.87–0.89) for Movement, 0.89 (95% CI = 0.88–0.90) for Weight control, and 0.90 (95% CI = 0.89–0.91) for Other; all $p < .001$). Health behaviors among older adults demonstrated four clusters. Neighborhood deprivation was associated with lower scores on clusters, suggesting that interventions to reduce concentrated deprivation may be an efficient approach for improving multiple behaviors simultaneously.

The National Cancer Institute estimated that the 2016 cancer incidence rate was 454 per 100,000 people per year (Howlader et al., 2016) in the United States. Many of these cases will be detected in adults ages 65 years of older (Howlader et al., 2016). However, up to 50% of cancer cases could be prevented through behavior change (Song and Giovannucci, 2016), including avoiding smoking, limiting alcohol use, consuming a healthy diet, and maintaining a physically active lifestyle.

Many Americans fail to meet these guidelines and remain at excess risk of cancer (Kabat et al., 2015; Song and Giovannucci, 2016; Warren Andersen et al., 2016). Epidemiologic research has evaluated correlates of cancer prevention behaviors, finding consistent differences by factors such as race/ethnicity (Wang and Beydoun, 2007; Williams and Collins, 1995) and individual- or area-level socioeconomic status (Braveman et al., 2010; Wang and Beydoun, 2007; Williams and Collins, 1995). Less research has examined how behaviors overlap with one another, but evidence suggests that individuals who engage in one prevention behavior are more likely to engage in others (Berrigan et al., 2003; Kabat et al., 2015; Patterson et al., 1994; Pronk et al., 2004). For example, individuals who routinely consume high numbers of fruits and vegetables are more likely to be physically active and individuals who smoke are more likely to be heavy drinkers (Berrigan et al., 2003; Patterson et al., 1994). To date, most research on clusters of health behaviors have focused on individual-level correlates, with less analysis of area-level correlates.

Intervening to affect overlapping clusters of health behaviors may be more efficient than single-behavior interventions for resource allocation and impact on public health (Noar et al., 2008; Prochaska et al., 2008). A better understanding of the prevalence of these clusters as well as their individual- and area-level correlates could inform interventions aiming to change multiple health behaviors with the goal of reducing cancer risk.

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In this study, we leveraged data from a cohort study including more than half a million participants, the National Institutes of Health (NIH)-AARP Diet and Health Study (Schatzkin et al., 2001) (formerly, the American Association of Retired Persons (AARP)), to understand the epidemiology of clusters of health behaviors related to cancer risk, examining intrapersonal and neighborhood correlates of these clusters. The findings from this analysis could inform future interventions aiming to improve cancer prevention behaviors among middle-aged and older adults.

1. Methods

1.1. Data source

The NIH-AARP Diet and Health Study is a prospective study of individuals who were members of AARP, focusing on the relationship between dietary factors and health among middle-aged and older adults (Schatzkin et al., 2001). Eligible participants were ages 50–71 years (selected to optimize analysis of cancer outcomes) and lived in selected states and metropolitan areas (California; Florida; Pennsylvania; New Jersey; North Carolina; Louisiana; Atlanta, Georgia; or Detroit, Michigan). In 1995–1996, NIH-AARP sent baseline questionnaires (primarily asking about diet and lifestyle factors related to health) to 3.5 million AARP members, and 567,169 eligible participants returned completed questionnaires (~18% response rate). In 1996–1997, NIH-AARP sent additional questionnaires focused on risk behaviors to the baseline cohort. Data collection for NIH-AARP was approved by the institutional review board of the National Cancer Institute. More details on the design and administration of NIH-AARP are available (Schatzkin et al., 2001).

1.2. Analytic sample

The current analysis draws upon data from participants who completed both the baseline and risk factor questionnaires (n = 334,921). Additional exclusion criteria included having a proxy respondent on either questionnaire (i.e., if another person filled out the questionnaire on behalf of the participant), not providing an address at baseline, and having a cancer diagnosed before completing the baseline questionnaire. Thus, the analytic sample comprised 324,522 participants.

1.3. Measures

1.3.1. Cancer prevention behaviors

Behavioral variables of interest in the present study included adherence or non-adherence to several guidelines from national organizations (when available) or recent scientific research about cancer risk reduction (Song and Giovannucci, 2016). We created dichotomous indicators of whether participants had never smoked (U. S. Department of Health Human Services, 2014); had a body mass index (BMI) of < 25 kg/m^2 at baseline (NHLBI Obesity Education Initiative, 2010); consumed ≥2 fruits and 3 vegetables per day (Department of Health and Human Services, 2015); engaged in ≥60 min of physical activity per week (Office of Disease Prevention and Health Promotion, 2008); consumed ≤2 servings of alcohol per day (Department of Health and Human Services, 2015); slept ≥7 h per night (Office of Disease Prevention and Health Promotion, 2018); spent ≤2 h per day watching television (Keadle et al., 2015; Matthews et al., 2008; Patel et al., 2010); and had received selected cancer screenings in the past 3 years (males: received screenings for colorectal and prostate cancer; females: received screenings for colorectal, breast, and ovarian cancer) (Centers for Disease Control and Prevention, 2012). Complete details about item wording are available through the NIH-AARP Diet and Health Study website (www.dietandhealth.cancer.gov). Each variable was coded such that *1* indicated that the participant engaged in the behavior and *0* indicated that the participant had not engaged in the behavior.

1.3.2. Socioeconomic factors

Each participant's residential address at baseline was linked to census block groups (99% of participants in the analytic sample were matched), which we used as a proxy for participants' neighborhood. Using data from the 2000 U.S. Census, neighborhood socioeconomic deprivation was estimated with two measures (Krieger et al., 2002): (1) the percent of residents (all ages) in each census block group living below the federal poverty line, and (2) the percent of adults (ages 18+ years) in each census block group with less than a high school degree. Data were divided into quintiles based on the distribution of the sample, with 20% of participants in each quintile. Quintiles were scored such that the first quintile was the least socioeconomically deprived while the fifth quintile was the most deprived.

1.3.3. Covariates

We controlled for individual-level sociodemographic and health information. Sociodemographic covariates were sex (male or female); age category at baseline (< 65 years or 65+ years); race/ethnicity (non-Hispanic white or other, due to small sample sizes in the non-white categories (Schatzkin et al., 2001)); marital status (married/living as married or other); and educational attainment (high school degree or less, or more than high school degree). We used self-reported health status (less than very good, or excellent or very good) to summarize baseline health.

1.4. Statistical analysis

First, we conducted a descriptive analysis of participants' health behaviors. We estimated the prevalence of engaging in each behavior and generated a phi correlation matrix of the correlations among each pair of behaviors (Stokes et al., 2012). The phi correlation coefficient summarizes correlations between dichotomous variables and theoretically ranges from −1 to +1. Then, we conducted an exploratory factor analysis to determine which behaviors clustered together. Specifically, we implemented a principal component analysis with an oblique promax rotation (Kim and Mueller, 1978) for all eight behaviors. We retained factors with eigenvalues > 1 (n = 4) and examined which factor each of the behaviors loaded on most strongly. We created factor scores by summing (with equal weights) participants' responses on the behaviors that loaded on each factor. We examined the associations between scores on each factor and the socioeconomic factors and covariates by conducting chi-square tests.

Next, we examined the associations between neighborhood socioeconomic deprivation and scores on the factors. Using multivariable Poisson regression to model the "count" scores on each factor, we modeled the association between participants' poverty or education quintile and each health behavior score, adjusting for covariates. We had > 90% power to detect an association between neighborhood SES quintile and the dependent variables, assuming an alpha of 0.05 and based on the observed distribution of health behavior factors scores.

Finally, we examined the cross-level interactions between socioeconomic deprivation and covariates with health behavior scores. We repeated the Poisson regressions with multiplicative interaction terms for the product of neighborhood poverty or education quintile and each covariate. Wald chi-square tests analyzed whether each interactions term contributed significantly to the model. If so, we probed the interactions by stratifying models across levels of the covariates.

Supplementary analyses included alternate combinations of behaviors. We examined the associations between neighborhood socioeconomic deprivation and (1) an a priori factor summing participants' scores on four behavioral recommendations from the American Cancer Society (ACS) (Kabat et al., 2015; Kushi et al., 2012) (having a healthy BMI, engaging in frequent physical activity, high fruit and vegetable consumption, and low alcohol consumption) and (2) an additive index of all eight health behaviors. In addition, we examined the associations between neighborhood poverty and education (simultaneously) with