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Living with a Smoker, Health Risk Behaviors, and Adiposity: An Analysis with Middle-Aged and Older Women

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Abstract

This study investigated: (a) the association between living with a smoker and weight-related health risk behaviors, and (b) the role of these behaviors in indirectly linking living with a smoker to general and central adiposity. Participants were 83,492 women (age $M = 63.5$, $SD = 7.36$) from the Women's Health Initiative Observational Study. In logistic regression analyses at baseline, living with a smoker was associated with increased odds of no exercise (29%), no walking (33%), high dietary fat (62%), and low fruit and vegetable consumption (43%). Using structural equation modeling, bootstrap confidence intervals confirmed a significant indirect effect from living with a smoker to adiposity through health risk behaviors at baseline and prospectively across 3 and 8 years. Health risk behaviors fully explained the living with a smoker–adiposity relationship. These findings integrate clustering and contagion theoretical perspectives on health behaviors and contribute to understanding a novel pathway to adiposity.

Keywords

living with a smoker; second-hand smoke; obesity; waist circumference; physical activity; diet; women's health

Introduction

Two theoretical perspectives address the spread of health behaviors. Health behavior *clustering* describes the co-occurrence of health behaviors in different domains within

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Human subjects: All procedures performed in studies involving human participants were in accordance with the authors' institutional research committee and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all individual participants included in the study.

individuals (Noble et al., 2015; Prendergast et al., 2016). In contrast, health behavior *contagion* describes the co-occurrence of health behaviors in the same domain across individuals (Blok et al., 2017; Clawson et al., 2018; Perry et al., 2016). However, the co-occurrence of health behaviors in different domains across individuals is essentially unexamined. Here, we examine this process in the context of living with a smoker and health risk behaviors involving physical inactivity and unhealthy diet, using data from the Women's Health Initiative Observational Study.

Substantial evidence supports a direct link between second-hand smoke (SHS) exposure and increased morbidity and mortality (Öberg et al., 2011; Richiardi et al., 2009). The possibility that living with a smoker may also be linked to increased health risk through a behavioral pathway is essentially unexamined. Here, we test a novel hypothesis—that living with a smoker is linked to health risk behaviors that increase an individual's risk for general and central adiposity.

Support for a relationship between SHS exposure and higher body mass index (BMI) is available from a small number of studies—all cross-sectional and where the passive smoking–BMI link was often observed incidentally while investigating other research questions. In the context of examining SHS exposure and risk for type 2 diabetes, two studies using large U.S. databases (Kermah et al., 2017; Zhang et al., 2011) found that SHS exposure was associated with higher BMI. Two other studies examining lung and cardiac health in a U.S. Amish community (Reed et al., 2017) and mental health among Scottish adults (Hamer et al., 2010) also observed that higher SHS exposure was correlated with higher BMI. In addition, focusing on household correlates of BMI in a large survey of U.S. families, Abrevaya and Tang (2011) found in additional analyses that spousal smoking was positively associated with BMI.

More recently, research with the U.S. Women's Health Initiative (WHI) Observational Study showed that the predictive link between living with a smoker and body weight is evident prospectively across three-year and eight-year intervals and extends to both general and central adiposity (Holahan et al., 2019). However, only a few studies have considered underlying health behaviors that might provide a mechanism linking SHS exposure and BMI. Abrevaya and Tang (2011) speculated that the association they observed between spousal smoking and partners' higher BMI might reflect partners' own poor physical activity and dietary behaviors. In examining physical activity among almost 2,000 adults in the Midlife Development in the United States sample, we found that individuals living with a smoker, compared to those not living with a smoker, engaged in less physical activity, though we did not measure BMI (Holahan et al., 2015). In examining unhealthy diet across four cultures, Koo et al. (1997) found that women with husbands who smoked, compared to those whose husbands did not smoke, consumed less healthy diets. Although the investigators observed incidentally that having a husband who smoked was also associated with higher BMI, they did not investigate the role of diet in explaining the SHS–BMI relationship.

Present Study

The present study extends previous research on SHS exposure and BMI/adiposity (Holahan et al., 2019; Kermah et al., 2017; Reed et al., 2017) by investigating: (a) the association between living with a smoker and a set of weight-related health risk behaviors, and (b) the role of these health risk behaviors in indirectly linking living with a smoker to general and central adiposity. More broadly, this study contributes to a growing public health focus on multiple health behaviors, which are highly predictive of preventable chronic diseases (Geller et al., 2017).

Women, along with children, have the greatest exposure to second-hand smoke worldwide (Samet & Yoon, 2010), with more than a third of female non-smokers exposed to second-hand smoke (Öberg et al., 2011). The WHI Observational Study, with its large sample size, minority representation comparable to the U.S. population by age, and long duration (Langer et al., 2003), presents a unique opportunity to examine living with a smoker, health risk behaviors, and adiposity in a large sample of middle-aged and older women. We hypothesized that living with a smoker would be positively associated with weight-related health risk behaviors among middle-aged and older women. In addition, we predicted that these health risk behaviors would provide an indirect pathway linking living with a smoker to general and central adiposity. Figure 1 depicts the conceptual model.

Methods

Sample Selection and Characteristics

The present study uses the WHI Observational Study sample. The Observational Study examined the relationship between lifestyle, health risk factors, and disease outcomes. The Observational Study tracked the medical history and health habits of 93,676 women who were between 50 and 79 years of age at enrollment and were postmenopausal. Women were recruited through 40 individual clinical centers throughout the U.S. Each clinical center used recruitment strategies tailored to local community needs. The clinical centers were supported and monitored at the national level by the National Institutes of Health and the WHI Clinical Coordinating Center. Recruitment materials included mass mailings, supplemented by community presentations, newspaper articles and ads, and public service announcements (Hays et al., 2003).

Health behavior data were collected at a baseline enrollment period (1993 to 1998), a 3-year follow-up, and five additional annual follow-ups across a total of 8 years (through 2005) with an average follow-up response rate of over 94% among participants due for contact. Participants were excluded at baseline if they had medical conditions that predicted survival of less than 3 years. The inclusion of participants from racial/minority groups proportionate to their age-group representation in the U.S. was a priority. The present study included 83,492 participants who provided data on all predictive variables and at least one adiposity outcome at baseline (age $M = 63.5$, $SD = 7.36$). This study was approved by the University of Texas at Austin Institutional Review Board (Approval Number 2009-03-0079).

Measures

Living with a smoker.—Living with a smoker at baseline was indexed by responding “yes” to both of two items: “Since age 18, have you ever lived with someone who smoked cigarettes inside your home?”, and, if yes, “Does anyone living with you now smoke cigarettes inside your home?”.

Health Risk Behaviors: We indexed health risk behaviors at baseline in two domains—physical inactivity and unhealthy diet. Because the health behavior measures were not normally distributed, we created binary indexes for each measure. In fact, the associations of the health behavior measures with other study variables were very similar whether health behaviors were indexed on binary or continuous scales.

Physical inactivity.: Participants completed a questionnaire on their usual physical activity. Measures encompassed exercise and walking, including their frequency and duration (Chomistek et al., 2013).

Exercise was defined as moderate (e.g., aerobics or jogging) or strenuous (e.g., using an exercise machine, such as a stationary bicycle or a treadmill, or calisthenics) exercise at least once each week, excluding walking. “No exercise” was given a score of 1 and “any exercise” was given a score of 0. Forty-two percent of participants engaged in no exercise. *Walking* was defined as average, fairly fast, or very fast walking outside the home for more than 10 minutes without stopping at least once each month. “No walking” was given a score of 1 and “any walking” was given a score of 0. Forty-one percent of participants engaged in no walking.

Unhealthy diet.: Participants completed a food questionnaire, which assessed usual frequency and portion size of 122 foods or food groups. Based on evidence from the WHI Dietary Modification Trial that weight loss was associated with decreased percentage of energy from fat and increased vegetable and fruit servings (Howard et al., 2006), we focused on these two variables.

Percent dietary fat was defined as the percent of total calories from fat. “High dietary fat” (score = 1) was defined as consuming > one-third of calories from fat and “low dietary fat” (score = 0) was defined as consuming < one-third of calories from fat. Thirty-five percent of participants consumed > one-third of calories from fat. *Fruit and vegetable servings* was defined as combined medium-sized daily servings of fruits and vegetables. “Low fruits and vegetables” (score = 1) was defined as consuming < 3 servings of fruits and vegetables and “high fruits and vegetables” (score = 0) was defined as consuming ≥ 3 servings of fruits and vegetables. Thirty-two percent of participants consumed < 3 servings of fruits and vegetables.

Clinic-assessed anthropometric measures.: BMI (calculated as weight (kg) ÷ height (m)²) and waist circumference were assessed by certified clinic staff at baseline and Year 3 according to standard anthropometric measurement training (Anderson et al., 2003). We used binary cut-offs for general and central adiposity based on previous findings relating BMI and waist circumference to mortality among women in the WHI cohorts (Chen et al.,

2017). *General adiposity* was indexed as a BMI in the obese range (BMI ≥ 30). Height was measured to the nearest 0.1 cm using a wall-mounted stadiometer. Weight was measured to the nearest 0.1 kg using a balance-beam scale. At baseline, 25% of participants were obese. *Central adiposity* was indexed as a waist circumference in the high-risk range (waist circumference ≥ 90 cm). Waist circumference was measured at the narrowest part of the torso at the end of a participant's normal expiration to the nearest 0.5 cm using a standardized measuring tape. At baseline, 31% of participants had a high waist circumference.

Self-reported weight.: In addition to the clinic-assessed anthropometric measures at baseline and Year 3, participants were asked to report their weight at the last Observational Study assessment, Year 8. This information and clinic-assessed height at Year 3, allowed us to compute a self-report measure of obesity at Year 8.

Covariates.: Covariates at baseline included: age, educational level, ethnic/racial group, income level, marital status, and participants' own current smoking.

Statistical analyses.: All analyses used Mplus Version 8.1 (Muthén & Muthén, 2017). Logistic regression analyses were used to examine the association between living with a smoker and health risk behaviors at baseline. Structural equation modeling was used to derive bias-corrected bootstrap confidence intervals (based on 500 bootstrap samples) for the indirect effect from living with a smoker to adiposity at baseline and prospectively at Year 3 and Year 8 operating through health risk behaviors. All analyses controlled for age, educational level, ethnic/racial group, income level, marital status, and participants' own current smoking. Prospective analyses also adjusted for baseline clinic-assessed obesity or high waist circumference in respective analyses.

Results

Living with a Smoker and Health Risk Behaviors

In separate logistic regression analyses at baseline, we examined the association of living with a smoker with health risk behaviors. Controlling for all covariates, living with a smoker at baseline was associated with 29% increased odds of engaging in no moderate/strenuous exercise and 33% increased odds of engaging in no walking (see Table 1). Controlling for all covariates, living with a smoker at baseline was associated with 62% increased odds of consuming a high fat diet and 43% increased odds of consuming a diet low in fruits and vegetables (see Table 2).

Mediational Model

We used structural equation modeling to test the indirect effect from living with a smoker to adiposity operating through health risk behaviors. Living with a smoker and health risk behaviors were indexed at baseline. Separate models examined the clinic-assessed obesity and high waist circumference outcomes cross-sectionally at baseline and prospectively at Year 3. To account for shared relationships among the health behaviors (intercorrelations ranged from .15 to .28), the four health risk behaviors were modeled as a latent construct,

with a positive score indicating more health risk behavior. We assumed correlations between the unique variances for the two measures of physical inactivity and between the unique variances for the two measures of unhealthy diet. In the measurement models, factor loadings for each of the health risk behaviors were significant at the .001 level.

Key parameters in the structural equation models are shown in Table 3. Path *a* is the association from living with a smoker to the health risk behaviors mediator. Path *b* is the association from the health risk behaviors mediator to the adiposity outcomes. The product *ab* is the indirect effect between living with a smoker and adiposity through health risk behaviors. We tested mediation with bias-corrected bootstrap confidence intervals of the indirect effect.

Controlling for all covariates and for baseline clinic-assessed obesity or high waist circumference in respective analyses, in all four models, mediation paths *a* and *b* were statistically significant ($p < .001$). Bootstrap 95% confidence intervals confirmed a significant indirect effect from living with a smoker to adiposity through health risk behaviors for both obesity and a high waist circumference cross-sectionally at baseline and prospectively at Year 3. Health risk behaviors fully explained the living with a smoker–adiposity link at baseline and Year 3. In all models, the previously demonstrated (Holahan et al., 2019) significant direct effect of living with a smoker on adiposity at baseline and Year 3 was no longer significant. At baseline, the indirect effect through health risk behaviors explained 95% and 89%, respectively, of the total effect of living with a smoker on obesity and on a high waist circumference. At Year 3, the indirect effect through health risk behaviors explained 47% and 64%, respectively, of the total effect of living with a smoker on obesity and on a high waist circumference.

Additional Analyses

Obesity at eight years.—We also used the structural equation model described above to test the indirect effect from living with a smoker to the self-report measure of obesity at the last Observational Study assessment, Year 8, operating through health risk behaviors ($N = 82,691$). Controlling for all covariates and for baseline clinic-assessed obesity, mediation paths (unstandardized) *a* (0.18) and *b* (0.32) were statistically significant ($p < .001$) in prospectively predicting obesity eight years later. The bootstrap 95% confidence interval confirmed a significant indirect effect from living with a smoker to obesity at Year 8 through health risk behaviors (95% CI = 0.05, 0.08). Health risk behaviors fully explained the living with a smoker–obesity link at Year 8. The previously demonstrated (Holahan et al., 2019) significant direct effect of living with a smoker on obesity at Year 8 was no longer significant. The indirect effect through health risk behaviors explained 60% of the total effect of living with a smoker on obesity at Year 8.

Tests of moderation.—For all analyses, we tested potential moderation by participants' own current smoking. In the case of the logistic regression analyses examining the association between living with a smoker and health risk behaviors at baseline there was evidence that the association varied according to participant smoking status for walking (interaction OR = 1.18, $p < .05$) and fruit and vegetable servings (interaction OR = 1.17, p

< .05). For both walking and fruit and vegetable servings, follow-up analyses indicated that the effect of living with a smoker on these health risk behaviors was significant for both participants who were and were not current smokers, with the effect stronger for participants who were not current smokers.

Discussion

Our finding that living with a smoker is associated with non-smoking-related health risk behaviors encompassing both physical inactivity and unhealthy diet identifies an additional public health risk of cigarette smoking that is essentially unrecognized (also see Holahan et al., 2015; Koo et al., 1997). More broadly, these results integrate *clustering* (Noble et al., 2015; Prendergast et al., 2016) and *contagion* (Blok et al., 2017; Clawson et al., 2018; Perry et al., 2016) theoretical perspectives on the spread of health behaviors, demonstrating the co-occurrence of health behaviors in different domains across individuals. These findings may involve behavior modeling (Perry et al., 2016) by smokers, who tend to engage in multiple health risk behaviors (Noble et al., 2015). These findings may also reflect a household culture characterized by a lower commitment to health in households with a smoker (Holahan et al., 2015).

The present mediational findings extend previous research on SHS exposure and BMI/adiposity (Holahan et al., 2019; Kermah et al., 2017; Reed et al., 2017) by identifying a behavioral pathway underlying the link between living with a smoker and adiposity. Health risk behaviors fully explained the living with a smoker–adiposity relationship. These findings have significant public health relevance. Obesity is increasing worldwide and is linked to many cancers, cardiovascular disease, diabetes, kidney disease, and musculoskeletal disorders (GBD 2015 Obesity Collaborators, 2017). Physical inactivity and unhealthy diet are key determinants of obesity (Silva et al., 2010; Stoutenberg et al., 2015). For both women and men at age 60, a history of two weight-related cardiometabolic diseases predicts more than a decade reduction in longevity (Emerging Risk Factors Collaboration, 2015). Because the vulnerability to SHS exposure (Gan et al., 2015) increases with social disadvantage, these findings are also relevant to health disparities.

These results highlight a need for household-level interventions for families living with a smoker integrating smoking- and obesity-prevention efforts, intervention domains that are traditionally addressed separately (Schauer et al., 2013). Focusing first on tobacco would address the initiating influence of household smoking (Prochaska et al., 2008). Escoffery and colleagues (2016) describe an intervention to promote home smoking bans that targets both smokers and nonsmokers and requires minimal burden to implement. Focusing next on physical activity and dietary behaviors at the household level would address contagion of these behaviors among household members. Gorin and colleagues (2013) describe a household-level intervention that simultaneously addresses physical activity and diet, as well as partner support.

Study Limitations and Strengths

Strengths of this study are a novel hypothesis, a diverse sample of over 80,000 middle-aged and older women, and clinic-based anthropometric measures at baseline and Year 3. A

limitation of the WHI Observational Study is its reliance on some self-report measures. However, there is evidence that the WHI smoking-related and physical activity measures are reliable based on a 3-month test-retest (Langer et al., 2003) and that the WHI dietary measures are valid in comparison to short-term dietary recall and recording methods (Patterson et al., 1999). In addition, the present findings are specific to middle-aged and older women. Future research examining this question should be broadened to other groups. Cross-sectional findings suggest that the association between SHS exposure and higher BMI pertains to men as well as women (Abrevaya & Tang, 2011; Hamer et al., 2010; Kermah et al., 2017). In addition, there is prospective evidence of a link between SHS exposure and increased BMI and obesity among children and adolescents (Pagani et al., 2016).

Conclusions

We show that living with a smoker is associated with increased odds of engaging in health risk behaviors that, in turn, operate as a mechanism linking living with a smoker to general and central adiposity. These findings highlight an essentially unrecognized health risk associated with living with a smoker and contribute to understanding a novel pathway to adiposity. The present study also extends recent interest in “carry-over mechanisms” that may underlie shared co-variation in multiple health behaviors (Geller et al., 2017), demonstrating that such mechanisms include social contextual as well as intra-individual processes. A fuller understanding of social influences across different health domains can broaden the reach and effectiveness of disease-prevention efforts.

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Figure 1.

Conceptual model depicting the role of health risk behaviors in mediating between living with a smoker and adiposity. Observed variables are shown in rectangles and the latent variable for health risk behaviors is shown in an ellipse.

Table 1

Results of Logistic Regression Analyses at Baseline with Living with a Smoker Predicting Physical Activity, Controlling for All Covariates among Middle-Aged and Older Women in the Women's Health Initiative Observational Study (1993–2005) (N = 82,805)

Predictors at Baseline	n%	No Exercise ^a		No Walking ^b	
		OR	95% CI	OR	95% CI
Age in Years		1.00	(1.00, 1.00) ^d	1.00 ^{***}	(1.00, 1.01)
Educational Level					
< High School ^c	4.7%				
High School	16.1%	0.88 ^{***}	(0.81, 0.95)	0.91 [*]	(0.85, 0.99)
Some School After High School	36.6%	0.68 ^{***}	(0.63, 0.73)	0.74 ^{***}	(0.69, 0.80)
College Degree	42.6%	0.55 ^{***}	(0.51, 0.59)	0.57 ^{***}	(0.53, 0.61)
Ethnic/Racial Group					
White/Non-Hispanic ^c	88.8%				
American Indian/Alaskan Native	0.4%	1.00	(0.81, 1.23)	1.11	(0.89, 1.37)
Asian/Pacific Islander	2.9%	1.31 ^{***}	(1.21, 1.43)	1.45 ^{***}	(1.34, 1.58)
Black	7.9%	1.25 ^{***}	(1.18, 1.32)	1.80 ^{***}	(1.71, 1.90)
Hispanic	3.5%	1.22 ^{***}	(1.13, 1.32)	1.37 ^{***}	(1.27, 1.48)
Unknown/Other	1.1%	1.01	(0.88, 1.15)	1.21 [*]	(1.06, 1.38)
Income Level					
< \$10,000 ^c	45.1%				
\$10,000 to < \$20,000	11.5%	0.83 ^{***}	(0.77, 0.90)	0.90 ^{**}	(0.83, 0.97)
\$20,000 to < \$35,000	23.3%	0.72 ^{***}	(0.67, 0.78)	0.75 ^{***}	(0.70, 0.81)
\$35,000 to < \$50,000	20.2%	0.65 ^{***}	(0.60, 0.70)	0.65 ^{***}	(0.60, 0.71)
\$50,000 to < \$75,000	20.2%	0.60 ^{***}	(0.55, 0.65)	0.61 ^{***}	(0.56, 0.66)
\$75,000	20.5%	0.47 ^{***}	(0.43, 0.51)	0.53 ^{***}	(0.49, 0.58)
Marital Status					
Unmarried ^c	38.3%				
Married	61.7%	1.03	(1.00, 1.06) ^d	1.05 ^{**}	(1.01, 1.08)
Participant Smoking					
Current Smoker ^c	6.3%				
Non-Current Smoker	93.7%	0.67 ^{***}	(0.63, 0.71)	0.69 ^{***}	(0.65, 0.73)
Living with Smoker					
No ^c	92.8%				
Yes	7.2%	1.29 ^{***}	(1.22, 1.37)	1.33 ^{***}	(1.26, 1.41)

^aExercise was defined as moderate or strenuous exercise, excluding walking at least once each week (no exercise = 1, any exercise = 0).

^b Walking was defined as average, fairly fast, or very fast walking outside the home for more than 20 minutes without stopping at least once each month (no walking = 1, any walking = 0).

^c Reference category

^d CI crosses 1.0

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$

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Table 2

Results of Logistic Regression Analyses at Baseline with Living with a Smoker Predicting Dietary Behavior, Controlling for All Covariates among Middle-Aged and Older Women in the Women's Health Initiative Observational Study (1993–2005) (N = 83,416)

Predictors at Baseline	n%	High Dietary Fat ^a		Low Fruits/Vegetables ^b	
		OR	95% CI	OR	95% CI
Age in Years		1.00 *	(1.00, 1.00)	0.97 ***	(0.97, 0.97)
Educational Level					
< High School ^c	4.7%				
High School	16.1%	0.94	(0.87, 1.01)	0.84 ***	(0.78, 0.91)
Some School After High School	36.6%	0.73 ***	(0.68, 0.79)	0.58 ***	(0.54, 0.62)
College Degree	42.6%	0.53 ***	(0.49, 0.57)	0.38 ***	(0.35, 0.40)
Ethnic/Racial Group					
White/Non-Hispanic ^c	88.8%				
American Indian/Alaskan Native	0.4%	1.20	(0.97, 1.48)	1.19	(0.96, 1.48)
Asian/Pacific Islander	2.9%	0.83 ***	(0.76, 0.91)	1.38 ***	(1.27, 1.51)
Black	7.9%	1.37 ***	(1.30, 1.45)	1.55 ***	(1.46, 1.63)
Hispanic	3.6%	1.05	(0.97, 1.14)	1.68 ***	(1.56, 1.82)
Unknown/Other	1.1%	0.86 *	(0.74, 0.99)	1.20 *	(1.05, 1.38)
Income Level					
< \$10,000 ^c	45.0%				
\$10,000 to < \$20,000	11.5%	0.88 **	(0.81, 0.95)	0.95	(0.88, 1.03)
\$20,000 to < \$35,000	23.4%	0.79 ***	(0.73, 0.85)	0.82 ***	(0.76, 0.89)
\$35,000 to < \$50,000	20.1%	0.70 ***	(0.65, 0.76)	0.74 ***	(0.68, 0.80)
\$50,000 to < \$75,000	20.2%	0.60 ***	(0.55, 0.65)	0.67 ***	(0.62, 0.73)
\$75,000	20.4%	0.49 ***	(0.45, 0.53)	0.64 ***	(0.59, 0.70)
Marital Status					
Unmarried ^c	38.3%				
Married	61.7%	1.16 ***	(1.12, 1.20)	0.83 ***	(0.80, 0.86)
Participant Smoking					
Current Smoker ^c	6.3%				
Non-Current Smoker	93.7%	0.51 ***	(0.48, 0.54)	0.52 ***	(0.49, 0.55)
Living with Smoker					
No ^c	92.8%				
Yes	7.2%	1.62 ***	(1.53, 1.71)	1.43 ***	(1.35, 1.52)

^aPercent Dietary Fat was defined as the percent of total calories from fat. High dietary fat (score = 1) was defined as consuming > one-third of calories from fat and low dietary fat (score = 0) was defined as consuming one-third of calories from fat.

^bFruits and Vegetables was defined as combined daily servings of fruits and vegetables. Low fruits and vegetables (score = 1) was defined as consuming < 3 servings of fruits and vegetables and high fruits and vegetables (score = 0) was defined as consuming ≥ 3 servings of fruits and vegetables.

^cReference category

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$

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Table 3

Parameters from Structural Equation Models Testing the Indirect Effect from Living with a Smoker to Adiposity Operating Through Health Risk Behaviors at Baseline and Prospectively at Year 3, Controlling for All Covariates among Middle-Aged and Older Women in the Women's Health Initiative Observational Study (1993–2005)

	Obesity			High Waist Circumference		
	Mediation Path <i>a</i>	Mediation Path <i>b</i>	Indirect Effect (<i>ab</i>) 95% CI	Mediation Path <i>a</i>	Mediation Path <i>b</i>	Indirect Effect (<i>ab</i>) 95% CI
Baseline	0.20 ***	0.91 ***	(0.16, 0.20)	0.20 ***	0.93 ***	(0.17, 0.21)
Year 3	0.18 ***	0.25 ***	(0.04, 0.06)	0.18 ***	0.39 ***	(0.06, 0.08)

Note. Baseline $N = 83,491$ for both Obesity and Waist Circumference, Year 3 Obesity $N = 82,691$, Year 3 Waist Circumference $N = 83,240$. Path *a* is the association from living with a smoker to health risk behaviors and is a linear regression weight. Path *b* is the association from health risk behaviors to adiposity and is a probit. The product *ab* is the indirect effect between living with a smoker and adiposity through health risk behaviors.

 $p < .001$