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## Leisure-time physical activity patterns and risk of colon cancer in women

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### Abstract

Although physical activity has been consistently associated with lower risk of colon cancer, many details of the relationship remain unclear. We assessed the relation between physical activity and risk of colon cancer in 79,295 women aged 40–65 who were free of cancer, ulcerative colitis and Crohn's disease and who reported their leisure-time physical activity in 1986; 547 cases were identified through 2002. Women who expended more than 21.5 metabolic equivalent hr/week of physical activity had a relative risk (RR) of colon cancer of 0.77 (95% CI 0.58–1.01), compared to women who expended <2 metabolic equivalent hr/week. The association was stronger for distal than proximal tumors. Among women whose only reported activity was walking, there was a decreased risk of colon cancer in women walking 1–1.9 hr/week (RR = 0.69, 95% CI 0.47–1.03) compared to those who did not walk. Results were similar for increased amounts of walking, but there was no evidence of a dose response relation. Among women who participated in moderate or vigorous activity, increasing hours of activity were also associated with a decreased risk of colon cancer ( $p$  for trend = 0.01); women exercising >4 hr/week had a 40% lower risk of colon cancer than those exercising <1 hr/week (RR = 0.56, 95% CI 0.33–0.94). Long-term physical activity was not associated with risk of colon cancer, but the number of cases was small. A significant inverse association exists between physical activity, including that of moderate intensity, such as walking, and risk of colon cancer in women that is more pronounced for distal tumors.

### Keywords

physical activity; walking; colon cancer

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Colon cancer is the third most commonly occurring cancer in men and women.<sup>1,2</sup> Evidence linking physical activity with a reduced risk of colon cancer is consistent and convincing.<sup>3</sup> Yet many aspects of the relationship remain to be elucidated; particularly few data on specific aspects of the association exist in women. Research has suggested that participation in long-term physical activity provides the greatest colon cancer risk reduction.<sup>4-6</sup> However, these assessments of long-term activity were based on no more than 2 activity assessments and were conducted exclusively in men. Greater risk reductions appear to occur with more intense activities.<sup>5,7-9</sup> It is also unclear whether risk reductions can be seen with lower intensity activities, such as walking, which is the most common activity carried out among women.<sup>10, 11</sup> Research has suggested that physical activity may have a greater influence on colon cancer risk among those with higher body mass index (BMI), but data are not conclusive.<sup>5,6</sup> Finally, data have suggested that physical activity may be differentially associated with cancer in proximal and distal colon locations, but the data have been inconsistent.<sup>7,12,13</sup>

We sought to investigate these questions in the Nurses' Health Study cohort, for which detailed information on activity intensity and long-term activity patterns, drawing on up to 5 measures of physical activity, are available.

## Material and methods

### Study population

The Nurses' Health Study was established in 1976 when 121,700 US female registered nurses between the ages of 30 and 55 completed a self-administered questionnaire on their health behaviors, lifestyle and medical histories. Subsequent follow-up surveys were sent on a biennial basis to obtain updated information on lifestyle factors and health outcomes. The cohort was administered a comprehensive leisure-time physical activity questionnaire in 1986. Thus, 1986 is considered the baseline for the present analyses of physical activity. This study was approved by the human subjects' protection committee at Brigham and Women's Hospital.

As described earlier, the physical activity cohort began in 1986 with 82,804 women who completed the physical activity questionnaire. Of these, we excluded 216 women reporting colon cancer prior to 1986, 2,489 women with a history of other cancers in 1986, 754 women reporting a diagnosis of ulcerative colitis or Crohn's disease, and 50 women missing year of birth. In addition to deaths reported by next of kin, we used the National Death Index and the US Postal Service to identify fatalities. The final analysis included 79,295 women. The Nurses' Health Study overall response rate through 2002 is 90%. In previous analyses of colon cancer cases from 1986 to 1992, we observed an inverse association between physical activity and colon cancer risk.<sup>7</sup> The present analyses update the follow-up period to 2002, an additional 10 years.

### Colon case identification

The ascertainment of colon cancer has been detailed elsewhere.<sup>14</sup> In brief, on each biennial questionnaire, we asked whether cancer of the colon or rectum had been diagnosed during the previous 2 years. When a diagnosis of cancer of the colon or rectum was reported we asked the participant or next of kin for permission to obtain medical records and pathology reports pertaining to the diagnosis. A study physician blinded to exposure reviewed the records and extracted information on histologic type, anatomic location and stage. Proximal colon cancers were defined as those from the cecum to and including the splenic flexure, and distal colon cancers were defined as those in the descending and sigmoid colon. Cancers other than confirmed adenocarcinomas were excluded. We excluded rectal cancer cases as evidence suggests no association between physical activity and rectal tumors.<sup>3,15</sup>

## Physical activity

In 1986, women were asked to report the average time per week spent in each of 8 common leisure-time activities: walking or hiking outdoors, jogging, running, bicycling, lap swimming, playing tennis, playing squash or racquetball, and participating in calisthenics, aerobics, aerobic dance or use of a rowing machine. Individuals also reported their usual walking pace and number of flights of stairs climbed daily. Usual walking pace was reported as easy (less than 2 mph), normal (2–2.9 mph), brisk (3–3.9 mph) or very brisk (4 mph or faster). These data were used to derive a weekly physical activity score expressed in metabolic equivalent (MET) hours per week.<sup>16</sup> A MET is the ratio of work metabolic rate to a standard resting metabolic rate of 1.0 (4.184 kJ kg<sup>-1</sup> hr<sup>-1</sup>).<sup>17</sup> One MET is the resting metabolic rate while sitting<sup>17</sup>; activities between 3 and 6 METs are considered moderate intensity, while activities >6 METs are considered vigorous intensity.<sup>18</sup> This assessment of physical activity was found to be reliable and valid in a similar cohort of younger nurses. In the validity analysis, the questionnaire had good correlation with a weekly recall ( $r = 0.79$ ) and the average of four, 7-day activity diaries administered over 1 year ( $r = 0.56$ ).<sup>19</sup> In 1988, 1992, 1994 and 1996 women completed similar physical activity questionnaires.

## Statistical analysis

In the first set of analyses, physical activity in 1986 was categorized in quintiles according to the distribution of the study population. We used Woolf's test of heterogeneity to test for differences by tumor site.<sup>20</sup> In the second set of analyses, we divided women into those who had participated in moderate or vigorous intensity activity other than walking and those reporting only walking in 1986. We categorized women according to hours per week spent in walking, and to hours spent in moderate or vigorous activity other than walking. In the third analysis addressing long-term physical activity patterns, we additionally categorized, in quintiles, activity reported at each questionnaire from 1988 to 1996. Women who were in the lowest quintile of activity at each questionnaire from 1986 to 1996 were considered to have a continuously low level of activity. Women who were in the highest 2 quintiles at each questionnaire from 1986 to 1996 were considered to have a continuously high level of activity as this reflected meeting current physical activity recommendations.<sup>18</sup> Women who were in the second and third quintiles at each questionnaire were assigned to a third moderate group. Decisions to group quintiles were made *a priori*. We also considered average physical activity level (MET hr/wk) from 1986 to 1996.

In analyses of leisure-time physical activity, walking and moderate or vigorous activity in 1986, person-years of follow-up were computed from the date of return of the 1986 questionnaire to the date of colon cancer diagnosis, death from any cause, or May 31, 2002, whichever came first. Relative risks (RRs) and their 95% confidence intervals (CIs) were calculated with the lowest quintile as the reference. The analyses of long-term physical activity were limited to cases arising between 1996 and 2002 (subsequent to the exposure period).

We used Cox proportional hazards models to adjust for age and other potential confounding variables including BMI, smoking, multivitamin use, aspirin use, family history of colon cancer, endoscopic history, previous colorectal polyp, red meat intake, processed meat intake, vitamin D intake, calcium intake and alcohol consumption. Covariates were updated throughout follow-up based on responses to subsequent questionnaires. Covariates were modeled based on *a priori* cutpoints typically used in the Nurses' Health Study: age in 5-year categories; BMI in 4 categories based on height reported in 1976 and weight reported in 1986; smoking in 4 categories of pack-years; multivitamin as yes, no and past; aspirin as current, never and past; alcohol intake in 4 current categories plus past; red meat intake in 5 categories each for processed meat and beef as a main dish; vitamin D in 3 categories based on RDA; and calcium in 3 categories. In analysis stratified by baseline BMI, we categorized women into 4

levels: BMI less than 23, 23–24.9, 25–29.9 and 30 or more kg/m<sup>2</sup>. We used the medians of each activity category as a continuous variable to calculate the tests for trend; the *p* values for tests are 2-sided. In analyses stratified by tumor location and activity intensity, the distribution of some covariates resulted in a model that failed to converge. In that case, we restricted the analysis to the 98% of women without a previous polyp.

## Results

Among the 79,295 women in the present analyses, we identified 547 cases of colon cancer (245 distal, 302 proximal) during 1,230,354 person-years of follow-up. Compared to less active women, those who were more active had lower BMIs, were less likely to smoke and were more likely to take a multivitamin (Table I). The most active group was also slightly more likely to report a family history of colon cancer.

### Total leisure-time physical activity

In multivariable analyses controlling for confounders, risk of colon cancer was inversely related to leisure-time physical activity in these updated analyses (Table II). Compared to women expending less than 2 MET hours per week, women who expended more than 21.5 MET hours per week had an RR of 0.77 (95% CI 0.58–1.01, *p* for trend = 0.08). The association with physical activity differed between the proximal and distal colon tumors (*p* = 0.01). The inverse association was more pronounced in the distal colon; women in the highest quintile of leisure-time activity were approximately half as likely to develop a distal colon tumor compared to women in the lowest quintile (RR = 0.54, 95% CI 0.34–0.84, *p* for trend = 0.004). No significant trend was observed for proximally located tumors. The association between activity and colon cancer did not vary across strata of BMI (*p* = 0.82, data not shown).

### Intensity of physical activity

Among women who participated only in walking in 1986, walking in leisure time was associated with a reduced risk of colon cancer (Table III). Women who walked for 1–1.9 hr/week had a 31% lower risk of colon cancer, of borderline significance (RR = 0.69, 95% CI 0.47–1.03), than women who did not report any walking or other physical activities. The effect appeared to plateau, with little additional risk reduction for greater amounts of walking (RR for 2–3.9 hr/week of walking versus 0 hr/week of physical activity = 0.64, 95% CI 0.41–1.00) and no significant trend (*p* = 0.17). Walking pace was marginally associated with risk of colon cancer (RR for women reporting very brisk versus easy walking pace = 0.43, 95% CI 0.17, 1.05).

Among women who participated in some moderate or vigorous intensity activity other than walking in 1986, there was a significant trend of decreased risk with increasing hours spent in moderate or vigorous activities (*p* = 0.01) (Table III). Women who reported 4 or more hours per week in moderate or vigorous activities had a 44% lower risk of colon cancer (RR = 0.56, 95% CI 0.33–0.94) compared to women who reported less than 1 hr of moderate or vigorous activity per week. There was also a suggestive association between participation in moderate or vigorous intensity activity and risk of distal colon cancer. This analysis was restricted to women without a history of polyps due to nonconvergence in the model with all women adjusting for polyp history. A suggestive, but not significant, inverse association was seen for proximal colon cancer.

### Long term physical activity

Long-term participation in physical activity was not associated with risk of colon cancer. Compared to women who were consistently in the lowest quintile of activity from 1986 to 1996, women who were consistently in either of the highest 2 quintiles of physical activity had

an RR of 0.95 (95% CI 0.62–1.45) (Table IV). Average long-term activity from 1986 to 1996 was not associated with risk of colon cancer (RR for quintile 5 versus quintile 1 = 0.95, 95% CI 0.53–1.70) nor was it associated with risk of distal colon cancer (RR for quintile 5 versus quintile 1 = 0.83, 95% CI 0.28–2.47) (data not shown).

## Discussion

We observed that higher levels of leisure time physical activity in women were associated with a decreased risk of colon cancer, particularly for tumors in the distal colon. The present findings extend our previous findings<sup>7</sup> and support other findings of an association between colon cancer and recreational physical activity in women.<sup>3,7,13</sup> Participation in moderate to vigorous intensity activity was associated with a significant reduction in overall colon cancer risk, and even walking for 1 hr/week, was sufficient to reduce risk of colon cancer in women.

As shown in previous studies of women,<sup>7</sup> men,<sup>8,21–24</sup> or men and women combined,<sup>25,26</sup> the inverse association of leisure time physical activity was stronger for distally located colon tumors. However, several studies<sup>6,13,27–29</sup> have found stronger associations for cancer of the proximal colon. Previous research has suggested that the etiology may differ between tumors of the proximal versus distal colon, possibly due to molecular or genetic differences.<sup>12</sup> The association we found for distal tumors was attenuated as compared with previous analyses in this population that used cases through 1992.<sup>7</sup> While this attenuation could be a result of the influence of activity lessening as the time between exposure and outcome increases, we found no violation of the proportional hazards assumption. Of the cases occurring since the previous analysis in this cohort, 29.6% occurred in the distal colon (as compared to 46.7% of cases from 1986 to 1992). As screening is more likely to remove distal adenomas and thus change the proportions of distal and proximal tumors, the attenuation of the relative risk is not surprising.

In contrast to previous research,<sup>5</sup> we found that the association between leisure activity and colon cancer did not vary across strata of BMI. These results add to the body of evidence that physical activity reduces risk colon cancer in women, regardless of weight.<sup>3,13,30</sup> It is possible that BMI is an intermediate in the pathway between physical activity and colon cancer. However, removing it from the analyses did not change the associations.

We found no association between long term engagement in physical activity and risk of colon cancer. When assessing physical activity at 2 time points, research has suggested that those who are consistently active have a lower risk when compared to those who are consistently inactive,<sup>4</sup> but results are not consistent<sup>30</sup> and are exclusively in men. Despite the short follow-up and limited number of cases, our research adds to the growing body of evidence examining the influence of physical activity over longer periods of time and is the first prospective study of women examining physical activity at multiple time points in relation to risk of colon cancer. Our analyses may also suggest that distant past physical activity is the most important period for protection against colon cancer. If that is the case, 1986 may be the most relevant time period of those examined and updating exposure using the long term activity measure masks the protective benefit of activity by including non-relevant recent physical activity, in effect, misclassifying subjects.

Leisure time walking was associated with a reduced risk of colon cancer. The association for overall activity seen with distal tumors was extended to walking. Among women who walk, walking at a faster pace may provide any greater benefit than walking at an easy or normal pace. This suggests that women can participate in non-vigorous activity, such as walking, and reduce their risk of colon cancer, but the activity needs to be of sufficient quantity. These findings are consistent with previous reports of a reduced risk of colon cancer with engagement

in moderate intensity activity,<sup>4,31</sup> but disagree with previous research that did not find an association between walking and colon cancer risk.<sup>13</sup> We found that walking, at lower levels than reported in that study, was associated with a reduced colon cancer risk. Given that walking is a commonly reported activity, and is the most common activity among middle-aged and older women,<sup>10,11</sup> our findings that colon cancer risk can be reduced by engaging in recommended levels of walking are important. Additional research on the benefits of walking, particularly those using objective measurement tools, such as accelerometers, may help answer questions of duration and pace necessary for protective benefit.

As noted by others,<sup>13</sup> findings that easily translate into public health recommendations, such as those for walking, are needed. Public health messages need to disentangle the effects of duration and intensity of activity as long duration at low intensity or short duration at high intensity can yield the same MET hours per week score. Analyses only of MET hours of activity per week have a limited ability to provide this information. Thus, we separately evaluated weekly duration of lower intensity activity (walking) and moderate or vigorous intensity activities. In addition, we were interested in determining if a dose-response relationship between physical activity and colon cancer exists among those with some physical activity (*i.e.*, is more better than some?). In fact, we found a significant ( $p = 0.01$ ) dose response relationship in those with some moderate or vigorous intensity physical activity. Our findings suggest that participation in lower intensity activities may be sufficient to reduce risk though more vigorous activity provides comparable or perhaps additional risk reduction.

Several mechanisms have been proposed for the role of physical activity in preventing colon cancer. Physical activity's role of energy balance may lead to mechanisms associated with insulin resistance and hyperinsulinemia and their associated growth factors.<sup>32</sup> Physical activity may also act *via* anti-inflammatory pathways. Physical activity directly influence immune functioning or may act through other pathways, including obesity.<sup>33</sup> It has also been suggested that activity reduces stool transit time, decreasing the exposure of the colon to carcinogens. More active individuals are also likely to have more opportunity for sun exposure and thereby higher vitamin D levels, which may also be associated with a reduced risk of colon cancer.<sup>34,35</sup>

Certain aspects of our analyses merit discussion. Despite having repeated measures of physical activity, we cannot adjust our consistency measure for measurement error, as methods for this are not yet available. While validation studies have shown our measures to be valid and reliable, our exposures and covariates are self-reported, leading to underestimation of the magnitude of the protective benefit.<sup>7</sup> Although the study sample size was large, the number of colon cancer cases may have limited our power to detect differences across physical activity levels.

This study also has several strengths; the longitudinal study design allows prospective assessment variables included in our analyses. Information on covariates is updated over time, reducing bias caused by misclassification and allowing a finer degree of control for confounding. Confirmation of our disease outcomes ensures a high level of validity. Ours is the first study to look at long term physical activity assessed at more than 2 time points with respect to colon cancer. This allows our analyses to provide a more comprehensive picture of long term physical activity patterns than has been used in previous research.

In summary, physical activity is associated with a significantly reduced risk of colon cancer in women and appears to be more strongly associated with cancers of the distal colon. Even participation in moderate intensity activity such as walking is sufficient to reduce risk. Leisure-time physical activity should be encouraged for all adults for health benefits, including colon cancer prevention.

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### Abbreviations

<b>BMI</b>	body mass index
<b>CI</b>	confidence interval
<b>CPS</b>	Cancer Prevention Study
<b>hrs/wk</b>	hours per week
<b>MET</b>	metabolic equivalent
<b>RR</b>	relative risk
<b>RDA</b>	recommended dietary allowance

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CHARACTERISTICS OF THE STUDY POPULATION AT BASELINE BY QUINTILES OF MET-HOURS PER WEEK, NURSES' HEALTH STUDY

**TABLE 1**

Characteristic <sup>1</sup>	MET hours per week				
	<2	2.1-4.5	4.6-10.3	10.4-21.4	≥21.5
No. of subjects	15,412	15,815	16,091	15,750	16,227
BMI, mean (kg/m <sup>2</sup> ) <sup>2</sup>	26.5	25.9	25.4	24.9	24.4
Pack years of smoking, mean	16.0	13.4	12.1	11.5	11.3
Family history of colorectal cancer (%) <sup>3</sup>	7.8	7.8	8.2	8.1	8.3
Aspirin, any current use (%)	68.3	71.2	71.4	70.3	69.3
Multivitamin, current use (%)	36.7	39.3	42.7	44.8	46.7
Alcohol, ≥10g per day (%)	20.9	20.6	22.2	23.8	26.8
Beef as a main dish, ≥1 serving per week (%)	79.5	79.7	78.2	75.9	72.2
Processed meat, ≥1 serving per week (%)	40.4	38.6	36.3	34.0	30.7
Vitamin D, ≥200 units per week (%)	55.6	59.7	63.5	66.3	69.0
Calcium, take supplements (%)	41.0	45.1	50.4	54.7	57.6
Previous endoscopy (%)	12.5	12.4	13.1	12.8	12.5
Previous colorectal polyp (%)	1.9	1.7	1.9	1.8	1.7

<sup>1</sup> Standardized for age at baseline.

<sup>2</sup> Weight in kilograms reported in 1986; height in meters reported in 1976.

<sup>3</sup> History of colorectal cancer in a parent or sibling. MET, metabolic equivalent; BMI, body mass index.

## RELATIVE RISKS OF COLON CANCER, 1986–2002, BY LEVEL OF PHYSICAL ACTIVITY IN 1986, NURSES' HEALTH STUDY

TABLE II

	MET hours per week					<i>p</i> for trend <sup>1</sup>
	<2	2.1–4.5	4.6–10.3	10.4–21.4	≥21.5	
All colon cancer						
Number of cases	123	111	112	103	98	
Age adjusted RR	1.00 (ref)	0.84	0.85	0.75	0.70	
95% CI		0.65–1.09	0.66–1.10	0.58–0.99	0.54–0.92	
Multivariable RR <sup>2</sup>	1.00 (ref)	0.88	0.91	0.82	0.77	0.08
95% CI		0.68–1.14	0.70–1.17	0.62–1.07	0.58–1.01	
Distal Colon Cancer						
Number of cases	55	54	56	49	31	
Age adjusted RR	1.00 (ref)	0.90	0.94	0.82	0.51	
95% CI		0.62–1.32	0.65–1.37	0.56–1.21	0.32–0.79	
Multivariable RR <sup>2</sup>	1.00 (ref)	0.93	0.99	0.87	0.54	
95% CI		0.64–1.36	0.68–1.44	0.59–1.29	0.34–0.84	0.004
Proximal Colon Cancer						
Number of cases	68	57	56	54	67	
Age adjusted RR	1.00 (ref)	0.80	0.77	0.70	0.86	
95% CI		0.56–1.14	0.54–1.11	0.48–1.01	0.61–1.22	
Multivariable RR <sup>2</sup>	1.00 (ref)	0.84	0.84	0.77	0.97	0.77
95% CI		0.59–1.20	0.58–1.20	0.53–1.12	0.68–1.38	

<sup>1</sup> Test for trend was calculated by use of the median of each MET hours per week category as a continuous variable in the multiple regression model. *p*-values are two-sided.

<sup>2</sup> Adjusted for age, body mass index, smoking, multivitamin use, aspirin use, alcohol intake, red meat intake, vitamin D, calcium, family history of colon cancer, history of endoscopy, and history of polyps. MET, metabolic equivalent.

**TABLE III**  
**RELATIVE RISKS OF COLON CANCER, 1986–2002, BY HOURS PER WEEK OF WALKING AND MODERATE OR VIGOROUS ACTIVITY IN 1986, NURSES' HEALTH STUDY**

	Hours per week				<i>p</i> for trend <sup>1</sup>
	0	<1	1–1.9	2–3.9	
<b>All Colon Cancer</b>					
Walking <sup>2</sup>					
Number of cases	59	87	47	31	41
Age adjusted RR	1.00 (ref)	0.81	0.64	0.59	0.66
95% CI		0.58–1.13	0.43–0.94	0.38–0.92	0.44–1.00
Multivariate RR <sup>3</sup>	1.00 (ref)	0.85	0.69	0.64	0.73
95% CI		0.61–1.19	0.47–1.03	0.41–1.00	0.48–1.10
Moderate and vigorous activity <sup>4</sup>					
Number of cases	145	145	70	49	18
Age adjusted RR	1.00 (ref)	1.00 (ref)	0.85	0.72	0.54
95% CI			0.63–1.13	0.52–1.01	0.32–0.91
Multivariate RR <sup>3</sup>	1.00 (ref)	1.00 (ref)	0.85	0.74	0.56
95% CI			0.64–1.14	0.53–1.04	0.33–0.94
<b>Distal colon cancer</b>					
Walking <sup>2</sup>					
Number of cases	27	46	19	18	14
Age adjusted RR	1.00 (ref)	0.92	0.58	0.77	0.51
95% CI		0.57–1.50	0.32–1.05	0.42–1.42	0.26–0.98
Multivariate RR <sup>3</sup>	1.00 (ref)	0.96	0.61	0.81	0.54
95% CI		0.59–1.56	0.34–1.11	0.44–1.50	0.28–1.06
Moderate and vigorous activity <sup>4</sup>					
Number of cases	61	61	36	17	7
Age adjusted RR	1.00 (ref)	1.00 (ref)	1.09	0.62	0.49
95% CI			0.72–1.65	0.36–1.07	0.21–1.12
Multivariate RR <sup>3,5</sup>	1.00 (ref)	1.00 (ref)	1.10	0.63	0.51
95% CI			0.73–1.66	0.36–1.10	0.22–1.17
<b>Proximal Colon Cancer</b>					
Walking <sup>2</sup>					
Number of cases	32	41	28	13	27
Age adjusted RR	1.00 (ref)	0.72	0.68	0.44	0.79
95% CI		0.45–1.14	0.41–1.14	0.23–0.86	0.47–1.33
Multivariate RR <sup>3</sup>	1.00 (ref)	0.76	0.77	0.49	0.89
95% CI		0.48–1.22	0.46–1.30	0.25–0.97	0.52–1.51
Moderate and vigorous activity <sup>4</sup>					
Number of cases	85	85	34	32	10
Age adjusted RR	1.00 (ref)	1.00 (ref)	0.67	0.80	0.59
95% CI			0.45–1.02	0.53–1.22	0.30–1.13
Multivariate RR <sup>3</sup>	1.00 (ref)	1.00 (ref)	0.73	0.73	0.53
95% CI			0.42–1.27	0.40–1.34	0.21–1.33

<sup>1</sup> Test for trend was calculated by use of the median of each hours per week category as a continuous variable in the multiple regression model. *p*-values are two-sided.

<sup>2</sup> Analyses restricted to women whose only reported activity is walking.

<sup>3</sup> Adjusted for age, body mass index, smoking, multivitamin, aspirin, alcohol intake, red meat intake, vitamin D, calcium, family history of colon cancer, history of endoscopy, and history of polyps.

- <sup>4</sup> Analyses restricted to women reporting some moderate or vigorous intensity activity other than walking.
- <sup>5</sup> Adjusted for age, body mass index, smoking, multivitamin, aspirin, alcohol intake, red meat intake, vitamin D, calcium, family history of colon cancer, history of endoscopy in women without a history of polyps.

**TABLE IV**  
 RELATIVE RISKS OF COLON CANCER, 1996–2002, BY LONG TERM PHYSICAL ACTIVITY FROM 1986–1996, NURSES' HEALTH STUDY

	Long term physical activity <sup>1</sup>		
	Low	Moderate	High
Number of cases	89	32	38
Age adjusted RR	1.00 (ref)	1.29	0.89
95% CI		0.85–1.95	0.59–1.33
Multivariate RR <sup>2</sup>	1.00 (ref)	1.39	0.95
95% CI		0.91–2.11	

<sup>1</sup> Low, lowest quintile of activity at each time point from 1986–1996, Moderate, second or third quintile at each time point from 1986–1996, High, highest two quintiles at each time point from 1986–1996.

<sup>2</sup> Adjusted for age, body mass index, smoking, multivitamin, aspirin, alcohol intake, red meat intake, vitamin D, calcium, history of endoscopy, family history of colon cancer and history of polyps.