Published in final edited form as:

J Community Health. 2012 April ; 37(2): 434–440. doi:10.1007/s10900-011-9460-9.

Physical Activity Among Amish and Non-Amish Adults Living in Ohio Appalachia

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Abstract

To understand the behavioral lifestyle factors that may contribute to lower cancer incidence rates among the Amish population, this study evaluated differences in physical activity (PA) levels between Amish and non-Amish adults living in Ohio Appalachia. Amish ($n = 134$) and non-Amish ($n = 154$) adults completed face-to-face interviews as part of a cancer-related lifestyle study. Self-report of PA level was measured by the International Physical Activity Questionnaire (IPAQ) and by a diary of steps/day (pedometer: Digi-Walker SW-200). Total metabolic equivalent tasks (MET) minutes was calculated from the IPAQ and average number of steps/day from a pedometer diary. Amish males walked more steps/day (mean $\pm$ standard error (SE): $11,447 \pm 611$ vs. $7,605 \pm 643$; $P < 0.001$) and had a higher IPAQ score (MET min/week) (mean $\pm$ SE: $8,354 \pm 701$ vs. $5,547 \pm 690$; $P < 0.01$) than non-Amish males. In addition, Amish farmers walked significantly more steps/day than Amish non-farmers (mean $\pm$ SE: $15,278 \pm 1,297$ vs. $10,742 \pm 671$; $P < 0.01$). There was a trend for Amish females to walk more steps/day (mean $\pm$ SE: $7,750 \pm 477$ vs. $6,547 \pm 437$;

$P = 0.06$) and to have higher IPAQ scores (mean $\pm$ SE: $4,966 \pm 503$ vs. $3,702 \pm 450$; $P = 0.06$) compared to non-Amish females. Two measures of PA demonstrated a higher PA level among Amish males, especially farmers, and a trend for higher PA level among Amish females. Higher levels of PA warrants further investigation as one factor potentially contributing to lower cancer incidence rates documented among the Amish.

Keywords

Cancer; Physical activity; Appalachian region; Amish

Introduction

There is increasing evidence that the adoption of a healthy lifestyle, including physical activity, reduces an individual's risk for cancer and death from cancer [1-4]. It has also been suggested that an individual's social and built environment plays a role in supporting healthy behaviors, especially increasing physical activity levels [5-7]. In addition, differences in physical activity levels have been demonstrated based on an individual's race, socioeconomic status, and geographic location (rural vs. urban) [8-13]. This information, plus knowledge that cancer incidence rates have been reported to be lower among the Ohio Amish compared to non-Amish living in Ohio [14], suggest that lifestyle factors, possibly physical activity levels, may contribute to the lower cancer incidence rates documented among the Amish.

The Amish, a unique religious community, reside mostly in the Midwest section of the United States. The Holmes County Region in Ohio Appalachia is home to the largest Amish settlement in the world [15, 16]. The Amish lifestyle includes their avoidance of modern conveniences like the use of electricity, telephones, and the automobile. This lifestyle, which does not include watching television, using computers, using automated farm equipment, or automobiles, all which have been shown to decrease physical activity levels, may have implications for preventable chronic diseases, like cancer.

There are only a few studies providing a glimpse into the physical activity levels among the Amish. In one previous study using Ohio Behavioral Risk Factor Surveillance System (BRFSS) data, the Amish reported less leisure-time physical activity than the non-Amish [17]. In another study of an Old Order Amish farming community living in south-eastern Ontario, Canada, high levels of physical activity were documented by measuring average steps/day by pedometer (18,425 for males and 14,196 for females) [18]. More recently, there have been studies documenting more physical activity among Amish children compared to non-Amish children [19-21]. At this time, there are no known studies documenting physical activity levels among the Amish living in the United States using objective measurement by pedometers. To understand the behavioral lifestyle factors that potentially may contribute to lower cancer incidence rates among the Ohio Amish population, this study examined differences in physical activity levels between Amish and non-Amish adults living in Ohio Appalachia.

Methods

This report is from data that were collected as part of a larger cancer-related lifestyle survey study conducted among Amish and non-Amish adults living in the Holmes County, Ohio Region. Written informed consent was obtained from the participants and the study was approved by the Institutional Review Board at The Ohio State University.

Setting

At the time of the study, the Appalachian region of the state of Ohio included 29 of Ohio's 88 counties, or 33% of the state in square miles, accounting for approximately 13% of Ohio's total population [22]. The participants interviewed for this study lived in Holmes and Tuscarawas counties which are counties located within Ohio Appalachia and include the largest Amish community in the world [23].

As compared to other sections of Ohio, the Appalachian region has been characterized by low socioeconomic status, including lower household incomes, higher poverty rates, less education, and lower paying occupations [22, 24, 25]. According to the 2005 Ohio BRFSS, 74.4% of Ohio residents participated in any type of physical activity during the past month, compared with the nation's rate of 76.2% [26]. This trend is similar in 2009 with 73.6% of Ohio residents participating in any type of physical activity compared to a 76.2% rate for the US. Adults aged 18 years and older (2004–2007) living in Appalachia have slightly lower rates of participating in any type of physical activity in the past month compared to adults living in non-Appalachia Ohio (males: 72.0% vs. 79.3% and females: 68.0% vs. 73.7%; Appalachia vs. non-Appalachia respectively [26, 27]).

Participant Selection

The cancer-related lifestyle study was conducted as a follow-up study to a cancer incidence study [14]. The research team worked with Amish leaders to gain trust and approval to conduct the research project. A letter of introduction was mailed about the study to the households that participated in the original cancer incidence study who were randomly selected from the Holmes County, Ohio Amish Directory [23]. Each household was visited by a co-investigator to explain the study in more detail and to arrange a time for the interview. Each adult male and female was asked to complete a face-to-face interview that focused on a variety of cancer-related lifestyle factors and lasted approximately 2 h.

Among the Amish participants, if the individuals died or moved out of the state, then the current residents of the household were recruited if they were Amish. An attempt was made to locate individuals who had moved within the state of Ohio. For households that were no longer Amish and for Amish households that refused to participate, replacements were randomly sampled from households listed in the same Amish church district in the Amish Directory to maintain the target sample size.

The non-Amish sample was randomly selected from Holmes County and Tuscarawas County. The non-Amish households were randomly chosen from the publicly available county auditors' database, and the methods that were used to recruit Amish respondents were used for the non-Amish participants. Only individuals who did not grow up in Amish households were included in the non-Amish sample. Many of the participants lived close to the Amish, and therefore, this comparison group could provide information about whether the Amish physical activity levels were different than their non-Amish neighbors.

Survey

The survey used in this study collected information about many cancer-related lifestyle characteristics. For this report, we include data collected on demographic characteristics, physical activity levels (International Physical Activity Questionnaire [IPAQ] short form) [28], steps per day obtained by pedometer (New Lifestyles Digi-Walker SW-200), and body mass index (BMI) calculated from measured height and weight of each participant.

The IPAQ short form is a reliable and validated instrument used to estimate levels of vigorous activity, moderate activity, walking, and time sitting during the past 7 days. The

developers of the questionnaire suggest that typical examples of activities (e.g., tennis) be replaced by culturally relevant examples with the same metabolic equivalent tasks (MET) levels as determined from the Compendium for Physical Activities [29]. Examples of culturally relevant vigorous activities used in this study were tossing straw bales, chopping or sawing wood, shoveling and digging, and grooming and brushing animals. Moderate activity examples included feeding animals, raking lawns, stacking wood, and gardening. The survey also included items that asked if the participant performed any form of exercise, defined as any physical activity (like going for a walk) for the purpose of improving one's health. In addition to documenting the type of exercise performed for improving one's health, the frequency of the exercise was recorded, as well as the duration of the activity.

A calibrated, electronic scale was used to obtain the weight of each participant in clothing without shoes. Height was measured by a wooden, folding measuring stick. To reduce measurement error, weight and height were each measured twice and the average of each of the two measurements was used to calculate each individual's BMI. Participants were categorized by BMI: normal (<25); overweight (25–29.9); and obese (≥30).

At the completion of the interview, if participants agreed to monitor their steps per day for 1 week, they were shown how to properly wear the pedometer and how to document their steps in the provided paper diary. Participants wore a pedometer for a period of 7 days and were instructed to put the pedometer on as soon as they got out of bed each morning, wear the pedometer all day, and remove it just before going to bed each night. The participants were asked to write down the number of steps in the diary each day and then re-zero the pedometer for the next day. Two unique features of using pedometers to count steps per day among the Amish were also addressed with the participants in this study. Since riding in a horse-drawn buggy causes extra steps to be counted by the pedometer similar to riding in an automobile as previously described [18], we allowed the Amish in this study to wear the pedometers while riding in their buggies. However, to minimize the extra steps recorded by riding on horse-drawn farm equipment, the farmers who participated in this study were instructed to open the pedometer's case which stopped the step counting function of the pedometer while riding on farm equipment as described in a previous study [18].

All face-to-face interviews were conducted in the participant's home, and, on average, were completed in 1, to 2 h. Each participant (male and female heads of households) was provided a \$25 gift card for appreciation of their time and received an additional \$10 gift card for wearing a pedometer for 1 week. The questionnaire used in the interviews of the Amish adults was slightly modified (religion and education items were revised) for the non-Amish participants.

Statistical Analyses

Descriptive statistics were computed for Amish and non-Amish by sex of the participant. The IPAQ data were summarized by group, and this included the time (minutes) spent per week in vigorous activity, moderate activity, walking, and sitting. The pedometer data were also examined by group and reported as a mean ± standard deviation steps per day. The linear relation between the two primary measures of physical activity, pedometer steps and total MET minutes, was estimated using Spearman's correlation.

Because of the way in which we sampled participants for these studies, there were some married couples who participated in the study. The correlation between male and female partner pedometer data and total MET minutes was estimated for the Amish and non-Amish. To determine if there was a difference between males and females with respect to these two variables, a paired Wilcoxon test was performed separately for Amish and non-Amish participants.

The Amish were compared to the non-Amish with respect to the age-adjusted prevalence of obesity (BMI ≥ 30), average steps walked per day, and time spent per week in the various forms of activity. These analyses were performed separately for males and females. An analysis of covariance (ANCOVA), adjusting for age, was used for the continuous physical activity outcomes. To compare the age-adjusted obesity proportions, Z tests were performed.

The difference between Amish male farmers and non-farmers with respect to the average number of steps walked per day was examined. An ANCOVA model was used to test for a significant difference between these two occupation types.

Results

Letters introducing the study and its purpose were sent to 112 eligible Amish households. Adult men and women ($n = 134$) from 75 households agreed to participate, giving a household response rate of 67%. A member of the research team was able to contact someone in every Amish home. For the non-Amish comparison group, adults ($n = 154$) in 98 out of the 422 eligible households participated giving a 23% household response rate. When a co-investigator went to the non-Amish households to describe the study in detail and try to arrange a convenient time for the interview, adults in only 266 homes were available. The agreement rate, defined as the percentage of contacted households that agreed to participate, was 37% for the non-Amish.

The descriptive statistics for the Ohio Amish and non-Amish comparison group participants are listed in Table 1. The Amish participants were slightly younger, were more likely to be currently married, had less formal education, and reported having always lived in the same county more often compared to the non-Amish participants. Additionally, the current occupation of the Amish males and females were significantly different than the non-Amish participants with about one fifth of the Amish males being farmers compared to none of the non-Amish males and most of the Amish females reporting being homemakers compared to a small percentage of the non-Amish females.

The two measures of physical activity (mean number of step/day and the IPAQ total MET minutes) were significantly correlated among males ($r = 0.53$; $P < 0.0001$) and females ($r = 0.30$; $P = 0.0004$). The age-adjusted physical activity levels for Amish and non-Amish males and females are listed in Table 2.

Among males, the Amish walked significantly more steps per day (mean $\pm$ SE: $11,447 \pm 611$ vs. $7,605 \pm 643$; $P < 0.001$) and had a higher total IPAQ score (mean $\pm$ SE: $8,354 \pm 701$ vs. $5,547 \pm 690$; $P < 0.01$) compared to non-Amish males. Amish males spent more time in moderate activity and walking and less time sitting compared to non-Amish males. A significantly ($P < 0.05$) higher percent of non-Amish males (46.9%) reported currently trying to exercise (doing a physical activity) for their health than Amish males (21.0%). BMI for Amish males was not significantly different than the BMI for the non-Amish males (mean: 27.6 vs. 29.4; $P = 0.09$).

Among females, there was a trend for the average number of steps walked per day to be greater among the Amish females (mean $\pm$ SE: $7,750 \pm 477$ vs. $6,547 \pm 437$; $P = 0.06$) and there was a trend for a higher total IPAQ score (mean $\pm$ SE: $4,966 \pm 503$ vs. $3,702 \pm 450$; $P = 0.06$) compared to non-Amish females. Amish females spent more time in moderate activity ($P < 0.01$) and less time sitting compared to non-Amish females ($P < 0.01$). A significantly ($P < 0.001$) higher percent of non-Amish females (58.9%) reported currently trying to exercise (doing a physical activity) for their health than Amish females (27.8%). The average BMI among Amish females was not significantly different than the BMI for the non-Amish females (mean: 30.2 vs. 29.1; $P = 0.29$).

When comparing male and female couples among both groups ($n = 86$), males were more active as recorded by their mean steps per day (9,582) compared to their female partners (7,592; $P < 0.001$). Additionally, total IPAQ scores ($n = 116$) among males (4,378) was higher compared to females (2,914; $P < 0.01$).

There were no significant differences between the age-adjusted BMI categories for Amish and non-Amish participants (Table 3). Additionally, the average number of steps per day by BMI category was evaluated for male and female participants (Table 3). Although there was not a significant interaction between BMI category and group (Amish versus non-Amish) for either males or females, there was a significant ($P < 0.001$) main effect for BMI category among females, with obese Amish and non-Amish females walking significantly fewer steps per day compared to normal and overweight females.

Focusing on the participants' occupation, a significant difference was documented in the average number of steps taken per day among Amish males (Table 4) who reported being farmers ($n = 12$) compared to Amish males reporting other occupations (mean: 15,278 vs. 10,742; $P < 0.01$) and a significant difference in the IPAQ scores for Amish farmers versus Amish males in other occupations (mean: 12,496 versus 7,834; $P < 0.05$). Additionally, Amish males who reported being farmers had significantly lower BMIs compared to Amish males who reported other occupations (mean: 24.7 versus 28.4; $P < 0.05$). No comparison could be made among the non-Amish males since none of them reported being farmers.

Discussion

Increased levels of physical activity among Amish males and a trend for higher physical activity levels among Amish females were documented in this study. The higher level of physical activity among the Amish may be a contributing factor to the reduced cancer incidence rates among the Amish living in the Holmes County Region of Ohio Appalachia.

The physical activity levels among the Amish in this study, however, are lower than the physical activity levels previously reported among Amish adults living in Ontario, Canada [18]. Among Ohio Amish males, the average number of steps/day (11,447) was less than that reported by Canadian Amish males (18,425) and the average number of steps/day was also less among Ohio Amish females (7,750) compared to Canadian Amish females (14,196). The total IPAQ scores were also lower for Ohio Amish males (8,354) and females (4,966) compared to the Canadian Amish males (17,952) and females (12,438).

The prevalence of obesity was also higher among the Ohio Amish compared to the obesity prevalence rates reported among the Amish in Canada [18]. Among Ohio Amish males, 48.9% were overweight and 33.9% were obese compared to 25 and 0%, respectively, among Canadian Amish males. Among Ohio Amish females, 36.3% were overweight and 55.9% were obese compared to 27 and 9%, respectively, among Canadian Amish females.

An important difference between this study on the physical activity levels and prevalence of obesity among the Amish living in Ohio compared to the study of the Amish living in Canada is the fact that 78% of the males in the Canadian study were farmers compared to only 19.4% of the Amish males in this study. This difference in the frequency of farming may partially account for the differences in physical activity and obesity observed, as Amish farmers in Ohio took more steps, had higher IPAQ scores, and had lower BMI than Ohio Amish males who were not farmers. Differences in occupation were also observed among Amish females, with only 69% of Canadian females identifying as homemakers, compared to 97.2% of Amish females living in Ohio, and the nature of homemaking work may differ between groups. The number of Amish in the Holmes County community who actively participate in farming has been decreasing during the past several decades, with an estimated

32.8% of the Amish being farmers in 1988, 24.6% in 1995, 16.9% in 2000, and only 11.8% in 2005 [15, 23]. This dramatic change in occupation among the Amish living in Ohio Appalachia may be responsible for the difference noted in the physical activity levels and indirectly for the obesity levels compared to the Amish living in Canada.

There is also recent evidence that individuals living in rural areas of the United States are less physically active and have a higher prevalence of obesity than residents of urban areas [10, 11, 13]. This difference may be a reflection of the change from an agricultural lifestyle to a more sedentary occupation lifestyle and may also partially reflect more barriers (lack of sidewalks, lights, and gyms) associated with physical activity in rural areas of the country. Additionally, changes observed in the nature of farm work accompanying mechanization may further complicate the relationship between occupation and physical activity.

There are several limitations to this study. First, while the response rate among the Amish households was moderate (67%), there were some Amish who refused to participate. In many cases these individuals reported that they were too busy to complete the 2 h interview. The response rate was much lower (23%) among the non-Amish living in the same Ohio counties. Unlike the Amish who were usually at home, the non-Amish individuals were extremely difficult to reach in person to arrange the interviews. Poor response rates to survey research is becoming more common [30] and strategies to overcome this limitation are important for future community-level behavioral research.

Another limitation of this study relates to the fact that only one Amish community was sampled. While the Holmes County Amish community is the largest Amish community in the United States, caution should be taken in assuming that these findings can be generalized to other Amish communities. In fact, one Amish order that is very strict accounts for approximately one-fifth of the Amish living in the Holmes County, Ohio region and since its members are not listed in the Holmes County Amish Directory they were not part of the sampling frame for this study [23]. It is not known what the physical activity rates are among this strict order of Amish. Finally, this study was based on self-reports of physical activity within the past 7 days which may vary from actual physical activity [31], however the information from the physical activity questionnaire correlated moderately well with the steps per day recorded from the pedometers.

This study has several strengths. Participants were randomly selected from the population, face-to-face interviews were conducted, the two measures of physical activity were moderately well-correlated, height and weight were measured to calculate BMI, and the results of the Amish were compared to a local Ohio Appalachia non-Amish sample of the same race and ethnicity.

In conclusion, physical activity levels in this study showed a significantly higher activity level among Ohio Amish males, especially among males who are farmers. The Amish males who were farmers also had significantly lower BMI compared to the Amish males participating in other occupations. Although there was also a trend for higher activity level among Amish females compared to non-Amish females, the Amish females also had higher BMI. The unique cultural aspects of the Amish population that cause them to have increased physical activity levels may play a role in the reduced cancer incidence rates observed in this population. The changing trend from an agricultural community to a less active workforce among the Amish may have implications for cancer incidence rates in the future among this special population.

Acknowledgments

Funding (1) NIH P50 CA015632; (2) The Ohio State Comprehensive Cancer Center's Behavioral Measurement Shared Resource, NIH P30 CA16058; (3) NCI K07 CA107079 (MLK); and 4) Coleman Leukemia Research Foundation.

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Table 1
Demographic characteristics of Amish and non-Amish Ohio Appalachian participants by sex

	Males		Females	
	Amish (n = 62)	Non-Amish (n = 64)	Amish (n = 72)	Non-Amish (n = 90)
Age (years)				
Mean ± SD	52.4 ± 13.8	58.8 ± 15.9	52.9 ± 15.1	56.8 ± 15.3
Range	22–84	24–92	21–89	22–90
Marital status				
Never married	3.2%	1.6%	0%	2.2%
Married	95.2%	82.5%	93.1%	74.2%
Divorced/sep	0%	14.3%	0%	9.0%
Widowed	1.6%	1.6%	6.9%	14.6%
Education level				
<High school (HS)	98.4%	12.5%	100%	12.2%
HS degree	1.6%	46.9%	0%	52.2%
>HS degree	0%	40.6%	0%	35.6%
Always lived in county	61.3%	31.3%	61.1%	34.4%
Occupation				
Farmer	19.4%	0%	0%	2.2%
Homemaker	–	–	97.2%	3.3%
Other occupation	80.6%	100%	2.8%	94.5%

* P values obtained from unadjusted statistical tests

Table 2

Physical activity among Amish and non-Amish participants by sex

	Males		Females	
	Amish	Non-Amish	Amish	Non-Amish
Steps per day				
Mean $\pm$ SE	11,447 $\pm$ 611	7,605 $\pm$ 643	7,750 $\pm$ 477	6,547 $\pm$ 437
Range	2,025–30,487	318–17,641	287–22,403	333–16,821
IPAQ score				
Mean $\pm$ SE (MET min/week)	8,354 $\pm$ 701	5,547 $\pm$ 690	4,966 $\pm$ 503	3,702 $\pm$ 450
Vigorous h/week	6.0 $\pm$ 0.9	4.6 $\pm$ 0.9	2.6 $\pm$ 0.6	2.6 $\pm$ 0.5
Moderate h/week	13.9 $\pm$ 1.2	8.3 $\pm$ 1.2	8.7 $\pm$ 0.9	4.8 $\pm$ 0.8
Walking h/week	10.7 $\pm$ 1.3	6.7 $\pm$ 1.2	8.2 $\pm$ 1.2	6.7 $\pm$ 1.0
Sitting h/day	3.8 $\pm$ 0.4	5.8 $\pm$ 0.4	2.8 $\pm$ 0.6	5.1 $\pm$ 0.5
Exercising for health [yes]	21.0%	46.9%	27.8%	58.9%
Body mass index (kg/m ²)	27.6 $\pm$ 0.8	29.4 $\pm$ 0.8	30.2 $\pm$ 0.7	29.1 $\pm$ 0.7

Mean $\pm$ SE (standard error), adjusted for age[†] P-values obtained from ageadjusted statistical tests

Table 3

Body mass index (BMI) category and average steps per day by BMI category among Amish and non-Amish participants by sex

	Males		Females	
	Amish^a	Non-Amish^a	Amish^a	Non-Amish^a
BMI group (kg/m ²)				
Normal: BMI<25	17.2%	28.7%	17.8%	28.1%
Overweight: BMI 25–29.9	48.9%	47.8%	36.3%	35.7%
Obese: BMI 30	33.9%	23.5%	45.9%	36.2%
Steps/day (Mean ± SE, adjusted for age) by BMI group (kg/m ²)				
Normal: BMI<25	13,225 ± 1,117	9,024 ± 1,389	8,549 ± 989	8,452 ± 819
Overweight: BMI 25–29.9	11,218 ± 885	7,460 ± 990	9,544 ± 757	6,608 ± 666
Obese: BMI 30	10,348 ± 1,253	7,013 ± 1,021	5,814 ± 686	5,193 ± 699

BMI body mass index

^a Age-adjusted proportions

Table 4

Physical activity and body mass index of Amish males by occupation type

Amish males		
	Farmers (n = 12)	Non-farmers (n = 50)
Steps per day		
Mean $\pm$ SE ^a	15,278 $\pm$ 1,297	10,742 $\pm$ 671 ^{**}
IPAQ score (MET min/week)		
Mean $\pm$ SE	12,496 $\pm$ 1,594	7,834 $\pm$ 778 [*]
BMI (kg/m ²)		
Mean $\pm$ SE	24.7 $\pm$ 1.3	28.4 $\pm$ 0.6 [*]

IPAQ International Physical Activity Questionnaire, *BMI* body mass index^{*}
P < 0.05;^{**}
P < 0.01 (*P* values obtained from age-adjusted statistical test)^a Adjusted for age