



Rural-Urban Disparities in Total Physical Activity, Body Composition, and Related Health Indicators: An Atlantic PATH Study

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Abstract:	<p>Purpose: To describe and compare the sociodemographic and lifestyle characteristics of urban and rural residents in Atlantic Canada.</p> <p>Methods: Cross-sectional analyses of baseline data from the Atlantic Partnership for Tomorrow's Health cohort was conducted. Specifically, 17,054 adults (35-69 years) who provided sociodemographic characteristics, measures of obesity, and a record of chronic disease and health behaviors were included in the analyses. Multiple linear regression and logistic regression models were used to calculate the multivariable-adjusted beta coefficients (β), odds ratios (OR) and related 95% confidence intervals.</p> <p>Findings: After adjusting for age, sex, and province, when compared to urban participants, rural residents were significantly more likely to be classified as very active (OR 1.19 [1.11-1.27]), obese (OR 1.13 [1.05-1.21]), to present with abdominal obesity (OR 1.08 [1.01-1.15]), higher body fat percentage (β 0.40 [0.12-0.68]), and fat mass index (β 0.32 [0.19-0.46]). Rural residents were significantly less likely to be regular or habitual drinkers (OR 0.83 [0.78-0.89]). Significant differences remained after further adjustment for confounding sociodemographic, lifestyle, and health characteristics. No significant differences in smoking behavior, fruit and vegetable intake, multimorbidity or waist circumference were found.</p> <p>Conclusions: As expected, obesity prevalence was higher in rural Atlantic Canadians. In contrast to much of the existing literature, we found that rural participants were more likely to report higher levels of total physical activity and lower alcohol consumption. Findings suggest that novel obesity prevention strategies may be needed for rural populations.</p>

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Conclusions: As expected, obesity prevalence was higher in rural Atlantic Canadians. In contrast to much of the existing literature, we found that rural participants were more likely to report higher levels of total physical activity and lower alcohol consumption. Findings suggest that novel obesity prevention strategies may be needed for rural populations.

Introduction

Obesity is a growing health concern in many countries.¹⁻⁷ Higher levels of body mass and more specifically, body fat mass, are associated with numerous chronic conditions such as cardiovascular disease, diabetes mellitus, and many types of cancer.⁷⁻¹² Escalating rates of obesity and related health conditions have resulted in significant financial strain on the healthcare systems of many developed countries.^{13, 14} The obesity epidemic and associated chronic diseases are frequently attributed to lifestyle behaviors including, but not limited to low levels of physical activity (PA), sedentary behavior, sleep, dietary choices, tobacco use and alcohol consumption.¹⁵ While important determinants of obesity, the assessment of lifestyle behaviors in isolation of an understanding of the broader contextual influences or distal risk factors (eg, physical and socioeconomic characteristics associated with rural/urban residence) may result in an incomplete understanding of the growing obesity epidemic.¹⁵

Research in developed countries indicates a trend towards rural residents generally having poorer health outcomes than those living in urban areas. For example, rural residents have been shown to be more likely to be obese and have a higher prevalence of chronic disease than their urban counterparts.¹⁶⁻¹⁹ Studies in the United States,^{1, 10, 13, 16, 19} Canada,^{20, 21} Australia,^{18, 22} and the United Kingdom^{4, 14} have all demonstrated this relationship. These differences in obesity and chronic disease may be due to the lifestyle behaviors that influence body mass as rural residents are more likely to be physically inactive, sedentary, have poorer diets, smoking and drinking behaviors.¹⁶⁻¹⁹ Moreover, research in this area suggests that differences in culture,^{23, 24} socioeconomic status,^{21, 25, 26} and/or environmental conditions (eg, green space, access to recreational facilities, pathways, sidewalks, and parks)^{23, 25, 27} may be important in understanding

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3 the differences in obesity-related risk factors and associated health outcomes in urban and rural
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5 populations.
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7 Approximately 20% of all Canadians are classified as living in a rural region; however, in
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9 Atlantic Canada, an average of 46% of the population are considered rural (44.5% Nova Scotia,
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11 49% New Brunswick, 42.4% Newfoundland and Labrador, and 55% Prince Edward Island).²⁸
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13 Notably, compared to the rest of Canada, Atlantic Canadians also generally exhibit poorer health
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15 profiles and higher rates of chronic disease.²⁹ While lifestyle risk factors are often described as
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17 the proximal precursors of disease, research has suggested that the social and economic
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19 disparities often encountered in rural populations are at the root of chronic disease.³⁰
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21 Accordingly, the purpose of the current study was to describe and compare the
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23 sociodemographic and lifestyle characteristics of Atlantic Canadians residing in rural versus
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25 urban populations. Based on previous research among developed countries,^{1, 16-19} we
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27 hypothesized that those living in rural areas would have poorer health behaviors and higher rates
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29 of obesity and multimorbidity than those in urban areas.
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35 **Methods**

36 *Study Design*

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38 This study was a cross-sectional analysis of data from the Atlantic Partnership for
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40 Tomorrow's Health (Atlantic PATH), the Atlantic chapter of the Canadian Partnership for
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42 Tomorrow Project (CPTP). CPTP is a pan-Canadian prospective, longitudinal cohort study. A
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44 detailed description of the study has been previously published.³¹ The Atlantic PATH study aims
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46 to examine and better understand the interplay between modifiable and non-modifiable risk
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48 factors that contribute to the development of cancer and other chronic diseases in Atlantic
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3 Canada.³² Additionally, the larger CPTP study aims to determine the differences in the regional
4 cohorts and how this may impact disease development and management.
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8 Detailed data collection procedures have been previously described.³² In brief, between
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10 2009-2015, 31,173 participants aged 35-69 years across all four Atlantic provinces completed a
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12 standardized set of questionnaires designed to assess sociodemographic characteristics, health
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14 status, disease history, and lifestyle behaviors (ie, diet, smoking, alcohol use, and PA). Measures
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16 of body composition were collected at an assessment center or mobile clinic by a research nurse.
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18 All participants provided informed consent. Participants with all relevant variables completed
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20 were included in the final analyses (ie, complete-case analysis), for a total of 17,054 complete
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22 cases.
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25 26 *Measures*

27 28 *Participant Characteristics*

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30 Demographic variables were used to describe the sample. For analyses, categorical
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32 variables were categorized as follows: ethnicity (white/non-white), education (high school or
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34 lower/college level/university level or higher), marital status (married or living together/single,
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36 divorced, separated, or widowed), smoking behavior (non-smoker/former smoker/current
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38 smoker), and alcohol consumption (abstainer/occasional drinker/regular drinker/habitual
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40 drinker). Multimorbidity was defined as having \geq two self-reported chronic conditions from a list
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42 of 21 conditions assessed at baseline.³³
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46 47 *Anthropometrics and Body Adiposity*

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49 A Tanita bioelectrical impedance device (Tanita BC-418, Tanita Corporation of America
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51 Inc., Arlington Heights, Illinois) was used to measure body weight (kg) and percentage fat mass
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53 (%), height (cm) was measured with a Seca stadiometer. Waist and hip circumference (cm) were
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3 measured using a standard measuring tape. Abdominal obesity was defined as a waist
4 circumference ≥ 102 cm for men or ≥ 88 cm for women.³⁴ Height and weight measures were
5 used to calculate body mass index (BMI; weight in kilograms divided by height in meters
6 squared; kg/m^2). Obesity was defined as a BMI ≥ 30 kg/m^2 . Fat mass index (FMI) and fat free
7 mass index (FFMI; kg/m^2) was calculated by dividing fat mass and fat free mass in kilograms by
8 height in meters squared, respectively.
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19 Participants were asked to report their levels of PA and sitting time using open-ended
20 questions in the International Physical Activity Questionnaire (IPAQ) long- and short-forms
21 which asks participants to indicate the frequency and duration of activities over the past seven
22 days.^{35,36} The IPAQ-Long Form (IPAQ-LF) specifies four activity domains, including
23 occupational (ie, activity done while at work), transportation (ie, how they commuted to work),
24 domestic (ie, time spent gardening or doing housework), and leisure-time (ie, any other activity
25 completed not part of the other domains). A measure of sedentary behaviors (ie, time spent
26 sitting and motor vehicle use) is also included. Within each domain, participants are asked to
27 indicate for each intensity how many days in the last week they performed the activity (ie,
28 frequency) and for how many hours and/or minutes each session lasted (ie, duration). The IPAQ-
29 Short Form (IPAQ-SF) asks general questions regarding amounts of sitting, walking, moderate,
30 and vigorous intensity activity accumulated in all aspects of daily living. Participants were asked
31 to separately report how many hours and minutes per day were spent sitting on an average
32 weekday and weekend day. Participants were asked only to report activities that were in bouts of
33 10 minutes or more. Each question defined the specific intensity and domain and provided
34 examples. The IPAQ is a commonly used as a measure of population levels of PA and both the
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3 long and short forms have been shown to provide reliable and valid data that are comparable to
4 other self-report measures.^{35,36}
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8 Using the IPAQ guidelines for data processing and analyses,³⁷ daily and weekly
9 metabolic equivalents of a task (MET) values were calculated using data from both the long and
10 short forms. Total activity minutes and MET-minutes were then converted into hours and MET-
11 hours. This method was chosen to reduce the number of missing cases as only 67% of the study
12 sample had completed the IPAQ-LF. Depending on the time of study entry (2009-2015) not all
13 participants had access to the IPAQ-LF. Overall, 67% of participants completed the LF.
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21 As self-reported moderate-to-vigorous PA data was highly skewed in the current study,
22 sex-specific, data driven tertiles were calculated for both the LF and SF to determine high,
23 moderate, and low levels of activity. This method has been previously utilized to allow
24 comparisons between participants who completed either the long or short form of the IPAQ.³⁸
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30 *Diet*

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33 Measurement of fruit and vegetable consumption (including 100% fruit and vegetable
34 juice) was adapted from the Canadian Community Health Survey (Cycles 1.1 and 3.1).^{39,40} Total
35 daily servings of fruit, vegetables, and 100% fruit or vegetable juice was assessed by the
36 following three questions: 1) In a typical day, how many servings of vegetables do you eat? One
37 serving is about ½ cup or 125ml of fresh, frozen, canned or cooked vegetables; 2) In a typical
38 day, how many servings of fruit do you eat? One serving is about ½ cup or 125ml of fresh,
39 frozen, or canned fruit; 3) On a typical day, how many servings of 100% fruit or vegetable juice
40 do you drink? One serving is about ½ cup or 125ml. For the present study, the number daily
41 servings of fruits, vegetables, and 100% fruit juices was summed. The combined value was
42 expressed as the overall number of daily servings of fruit and vegetables. Adequate fruit and
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3 vegetable intake was then defined as consuming at least 7 servings of combined daily servings of
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5 fruits, vegetables, and 100% fruit juices.
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7 8 *Alcohol Consumption*

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10 Measure of alcohol use was adapted from the Canadian Health Measures Survey (cycle 1
11 – Household Survey).⁴¹ Specifically, participants were asked to indicate whether they had ever
12 consumed alcohol (yes/no). If so, they were asked to complete an addition item detailing the
13 average frequency of alcohol consumption over the last year (never, less than monthly, about
14 once a month, 2-3 times per month, once a week, 2-3 times per week, 4-5 times per week, 6-7
15 times per week). Respondents were then classified as abstainer, occasional drinker (>0 to ≤ 2 -3
16 times/month), regular drinker (≥ 1 time/week to ≤ 2 -3 times/week), and habitual drinker (≥ 4 -5
17 times/week).
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28 *Smoking Behavior*

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30 Items adapted from the Canadian Health Measures Survey (Cycle 1 – Household
31 Survey)⁴¹ and the Canadian Tobacco Survey⁴² were also used to assess cigarette smoking
32 behavior. Participants were first asked if they had smoked at least 100 cigarettes in their lifetime.
33 If yes, they were asked to respond to additional questions as applicable including at what age
34 they smoked their first whole cigarette, what their smoking behavior was at present, at what age
35 they began daily smoking, how many cigarettes per day they smoke now (or did when a daily
36 smoker), and for how many years they were a daily smoker. Participants were then categorized
37 as non-smoker, former smoker, and current smoker.
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49 *Urban or Rural Residency*

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51 The Postal Code Conversion File Plus (PCCF+, version 6C, Statistics Canada) was used
52 to classify study participants as living in urban or rural areas according to their reported
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3 residential postal code.²⁶ The most recent file available based on year of baseline survey (2009-
4 2015) was used when classifying participants as rural or urban since the community status may
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6 have changed from the time they filled out the baseline questionnaire to time of analysis.
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9 10 *Analyses*

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12 Descriptive statistics including counts, percentages, means and standard deviations were
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14 used to describe the sample. Preliminary groups differences between urban and rural residents
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16 were examined with chi-square cross tabulation for categorical variables and independent
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18 samples t-test for continuous variables. Multiple linear regression and logistic regression models
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20 were then applied to explore differences in health behaviors and self-reported chronic disease
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22 based on residence location. Model 1 was adjusted for age, sex, and province of residence.
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24 Model 2 was further adjusted for ethnicity, education, marital status, fruit and vegetable intake,
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26 smoking, alcohol use, multimorbidity, BMI, and total PA as applicable.¹⁸ The same modelling
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28 procedure was used to determine differences in measures of body adiposity. Participants living in
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30 urban areas were chosen as the reference group. When smoking, alcohol use, and PA were
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32 treated as the confounding factors in the multivariable regression analyses, they were kept as the
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34 categorical variables with multiple categories as shown in Table 1. Whereas, when they were
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36 considered as our study outcomes, they were dichotomized as binary variables (yes/no). For
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38 example, current smokers vs. non-smokers and former smokers, regular and habitual drinkers vs.
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40 not regular and habitual drinkers, and those who engaged in high levels of PA vs those who
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42 engaged in low-to-moderate levels.
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49 **Results**

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51 Characteristics of both urban and rural groups are presented in Table 1. Over 40% of the
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53 study sample had a university education and the majority were female (71.4%), white (91%),
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3 was married or had a partner (81%). The average age and BMI of this sample was 54.0 years and
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5 28.3 kg/m² respectively. Approximately 35% of participants that were coded with PCCF+ were
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7 classified as rural residents. Chi-square and t-test analyses revealed that rural residents were
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9 more likely than urban residents to be female ($P<.001$), married ($P<.001$), and older ($P<.001$),
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11 but less likely to have completed higher education degrees ($P<.001$),
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14 *Rural-Urban Disparities in Health Behaviors*

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17 Chi-square and t-test analyses revealed significant differences between rural and urban
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19 residents for frequency of alcohol consumption ($P<.001$), PA level ($P<.001$), and sitting
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21 time/sedentary behaviors ($P<.001$). Differences in smoking behavior ($P=.352$), multimorbidity
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23 ($P=.617$), and fruit and vegetable intake ($P=.380$) were non-significant.
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27 Multiple logistic regression analyses showed that when compared to urban participants,
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29 rural residents were significantly less likely to be regular or habitual drinkers (OR 0.83 [95% CI
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31 0.78 to 0.89]). Rural residents were more likely to be highly active (1.19 [1.11 to 1.27]) but were
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33 more likely to be classified as obese (1.13 [1.05 to 1.21]) and present with abdominal obesity
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35 (1.08 [1.01 to 1.15]) (Model 1). Significant differences remained for drinking status (0.84 [0.79
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37 to 0.90]), activity level (1.16 [1.08 to 1.24]), and obesity classification (1.12 [1.04 to 1.20]) after
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39 adjusting for potential confounding factors (Model 2). The likelihood for abdominal obesity
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41 became marginally significant (1.07 (1.00 to 1.14)). Likelihood of being a current smoker,
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43 having adequate fruit and vegetable intake, or having multimorbidity did not differ significantly
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45 between rural and urban residents in either Model 1 or Model 2. Detailed results can be found in
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47 Table 2.
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50 *Rural-Urban Disparities in Body Adiposity*

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3 Differences in various measures of body adiposity are presented in Table 3. Model 1
4 revealed that rural residents were significantly more likely to have higher BMI (β (95% CI) =
5 0.50 (0.32 to 0.69)), body fat percentage (0.40 (0.12 to 0.68)), and fat mass index (0.34 (0.20 to
6 0.47)) than urban residents. After full adjustment in Model 2, significant differences remained in
7 favor of the urban residents for BMI (0.48 (0.29 to 0.66)), body fat percentage (0.35 (0.07 to
8 0.63)) and fat mass index (0.32 (0.19 to 0.46)). No differences in waist circumference were noted
9 in either model.
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19 Discussion

20 The aim of the current study was to describe and compare sociodemographic, PA and
21 related health behaviors of Atlantic PATH participants based on rural or urban residency.
22 Overall, we found that despite reporting greater levels of vigorous PA, rural residents were more
23 likely to have higher BMI, body fat percentage, and fat mass index. These results partially
24 support our hypothesis and much of the literature which suggests that rural residents generally
25 have higher levels of obesity than urban residents.^{2,16-19} For example, studies using data from the
26 US National Health and Nutrition Examination Survey (NHANES) found that obesity levels
27 were higher among rural participants while PA levels were lower.¹⁶⁻¹⁹ Canadian data has
28 similarly demonstrated higher rates of obesity in rural populations.² In contrast, to these studies
29 however,^{2,16-19} we did not find that rural participants were more likely to demonstrate an overall
30 poorer health profile. Specifically, the finding of greater levels of vigorous PA, less sitting time,
31 lower rates of regular or habitual alcohol consumption, and no significant differences in smoking
32 behaviors, fruit and vegetable consumption, and multimorbidity was in contrast to the bulk of the
33 existing literature.
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3 Although it is unclear why the results of Atlantic PATH are contrary to these studies, as
4 noted by Fan et al.,¹⁷ the variance in disparities between PA behaviors in rural and urban
5 populations changes with the chosen method of PA measurement. Although a commonly utilized
6 and well validated self-report measure of PA, relative to objective measures of PA (eg,
7 accelerometers), the IPAQ has been reported to substantially overestimate PA levels. For
8 example, a recent Statistics Canada study reported that 90% of respondents using the IPAQ-LF
9 self-reported meeting the minimal PA guidelines (ie, 150 minutes of moderate-to-vigorous PA
10 per week), while fewer than 30% met guidelines when assessed with an objective measure.⁴³
11 Similarly, the short form has been demonstrated to overestimate PA by as much as 36-173%.⁴⁴
12 However, as all Atlantic PATH participants completed either the long or short version of the
13 IPAQ, overestimation of PA alone should not account for the difference in total PA between
14 rural and urban residents seen in the current study. Notwithstanding, although the IPAQ has
15 demonstrated acceptable measurement properties across diverse study samples, some studies
16 have shown lower scale reliability in rural populations.³⁵ Thus, while differences in PA may be
17 the result of variability in the type and/or patterns of PA, other variables (ie, education, culture)
18 may also play a role in how participants interpret and respond to items in the questionnaire.^{35,45}

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40 Interestingly, the study by Fan and colleagues¹⁷ reported that accelerometry data showed
41 that rural participants were less active than urban residents; however, when subjective measures
42 were used, rural residents reported more total PA than urban residents. In contrast to the current
43 study which suggests that rural residents engage in more vigorous PA, Fan et al.¹⁷ found that
44 rural residents appeared to engage in less high-intensity PA, with the primary difference in total
45 PA being attributed to the higher reporting of domestic activities. Similarly, Patterson et al.¹⁸
46 noted that men living in non-urban areas reported an average of 19% more minutes of total PA
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3 per week (8% after adjusting for individual and socioeconomic factors). However, they also
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5 found that rural residents reported lower active transportation and leisure-time activities, but
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7 higher levels of domestic and occupational activities than their urban counterparts; suggesting
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9 that rural residents may acquire PA in different activity domains than urban residents.¹⁸ Although
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11 both Befort et al.¹⁶ and Trivedi et al.¹⁹ reported that rural residents were less likely to meet PA
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13 guidelines than those dwelling in urban areas, the measure of PA in both studies was limited to
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15 recreational PA. Notably, a recent study by Robertson and colleagues⁴⁶ found that rural residents
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17 engage in higher levels of total PA, but less recreational PA. Unique to this study was the
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19 inclusion of muscular strengthening activities. As resistance training has been demonstrated to
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21 play an important role in weight management, the finding that rural residents were less likely to
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23 participate in leisure-time resistance training is an important area of future study. Moreover,
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25 while research has shown occupational and domestic PA can reduce the risk of some chronic
26
27 diseases, recreational or leisure-time PA has been suggested to confer greater and potentially
28
29 unique health benefits.⁴⁷ As we combined data from both the long- and short-form IPAQ
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31 measures, thus necessitating the aggregation of domain-specific measures and the use of
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33 categorical indicators of total PA (ie, total vigorous, moderate, low PA), we were not able to
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35 distinguish where, if any domain specific differences might be within the current study. While
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37 this represents an area of need of further study, our findings support previous work which
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39 suggests that that rural residents may in engage in more total overall PA^{17, 46}; however, the
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41 method (ie, objective vs. subjective, domain specific self-report) of assessment of PA is likely to
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43 substantially influence study findings.
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51 Although the PA literature is somewhat mixed and perhaps ultimately dependent on the
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53 measure used to capture PA, the finding of higher rates of obesity in rural participants is
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3 consistent with the bulk of the literature. However, the finding of less sedentary behavior (ie,
4 sedentary sitting time), lower rates of regular and habitual alcohol use, and the lack of
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6 pronounced differences in smoking, fruit and vegetable intake, and multimorbidity was
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8 unexpected. When individual health behaviors and socio-economic and demographic factors
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10 were included in the multivariate analyses of obesity, rural residents continued to be at greater
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12 risk of obesity. These findings suggest, as with PA, that the outcome is likely influenced by the
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14 measure itself, self-report biases, and/or additional factors beyond those examined in this study
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19 **Strengths and Limitations**

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21 Atlantic PATH is the largest cohort study in the region and with the other CPTP cohorts,
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23 is the largest health cohort in Canada. However, limitations of this study include the cross-
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25 sectional nature of the data, using self-report measures of health behaviors and chronic disease
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27 incidence, and the potential selection bias of recruitment methods. Atlantic PATH had recently
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29 completed recruitment, and as such, only baseline data was available for analyses; however,
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31 future follow-up measures will permit further observations. Additionally, provincial level health
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33 data will be linked Atlantic PATH which will allow for objective determination of health care
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35 utilization and chronic disease status. During recruitment, this study was clearly a health-related
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37 study and therefore, it is possible that the sample recruited were more motivated and in general,
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39 healthier than the average population. The study population was also wealthier and more
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41 educated than the average population.³² Moreover, while Atlantic PATH made concerted efforts
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43 to recruit rural residents (eg, mobile clinics, mailed study packs), our cohort is not fully
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45 representative of the rural population of the Atlantic provinces.
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51 **Conclusions**

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3 Though some of our results differ from previous literature, the majority of research to
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5 date has not been conducted within the Canadian context. While not fully representative of the
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7 Atlantic Canadian population, this study adds important insight to a growing body of literature
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9 which has explored the rural-urban disparities in health behaviors and outcomes in a
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11 geographically and culturally diverse Canadian setting.
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14 Consistent with previous literature in developed countries, the current study found that
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16 rural residents were more likely to be obese.^{1, 4, 10, 13, 14, 16, 18, 19, 22} Interestingly, we found this
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18 relationship despite total PA levels, sedentary behaviors, and regular and habitual alcohol
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20 consumption favoring the rural participants. Follow-up assessments from Atlantic PATH
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22 participants will provide important data to help confirm or refute these findings and better
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24 elucidate the prospective association between health behaviors, anthropometric measures (eg,
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26 BMI, abdominal obesity), and rurality. The consideration and addition of objective measures of
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28 health indices (ie, PA) and neighborhood characteristics (eg, green space, retail and services, and
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30 walkability scores) would add a level of detail that would be valuable in future research.
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Table 1 Characteristics of Study Participants^a

	Urban (n=11,132)		Rural (n=5922)		p-values
Age, years M(SD)[†]	53.7	(9.0)	54.2	(8.7)	<.001
Female, n(%)[‡]	7761	(69.7)	4330	(73.1)	<.001
Province, n(%)[‡]					<.001
Nova Scotia	6359	(57.1)	3514	(59.3)	
New Brunswick	2999	(26.9)	1738	(29.3)	
Newfoundland and Labrador	1468	(13.2)	442	(7.5)	
Prince Edward Island	306	(2.7)	228	(3.9)	
Ethnicity, n(%)[‡]					.003
White	10131	(91.0)	5346	(90.3)	
Non-white	637	(5.7)	323	(5.5)	
DNK/PNA	364	(3.3)	253	(4.3)	
Education, n(%)[‡]					<.001
Less than high school	1684	(15.1)	1245	(21.0)	
College level	4194	(37.7)	2599	(43.9)	
University level or higher	5223	(46.9)	2059	(34.8)	
DNK/PNA	31	(0.3)	19	(0.3)	
Marital status, n(%)[‡]					<.001
Married or living together	8542	(76.7)	5047	(85.2)	
Single, divorced, separated, or widowed	2562	(23.0)	865	(14.6)	
DNK/PNA	28	(0.3)	10	(0.2)	
Smoking status, n(%)[‡]					.352
Never	5722	(51.4)	2976	(50.3)	
Former	4451	(40.0)	2420	(40.9)	
Current	892	(8.0)	481	(8.1)	
DNK/PNA	67	(0.6)	45	(0.8)	
Alcohol use, n(%)[‡]					<.001
Abstainer	1013	(9.1)	671	(11.3)	
Occasional drinker	4420	(39.7)	2494	(42.1)	
Regular drinker	3551	(31.9)	1684	(28.4)	
Habitual drinker	1965	(17.7)	959	(16.2)	
DNK/PNA	183	(1.6)	114	(1.9)	
Multimorbidity^b, n(%)[‡]					.617
None	3983	(35.8)	2082	(35.2)	
One	3652	(32.8)	1983	(33.5)	
Two or more	3497	(31.4)	1857	(31.4)	
Physical activity level^c, n(%)[‡]					<.001
Low activity	3770	(33.9)	1913	(32.3)	
Moderate activity	3939	(35.4)	1944	(32.8)	
High activity	3423	(30.7)	2065	(34.9)	
Body weight, kg, M(SD)[†]	78.0	(17.5)	78.9	(19.1)	.004
Body height, cm, M(SD)[†]	166.5	(7.2)	166.2	(7.0)	.037

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3	Body mass index, kg/m², M(SD)[†]	28.1 (5.9)	28.5 (6.4)	<.001
4	Waist Circumference, cm, M(SD)[†]	93.2 (14.7)	93.6 (14.8)	.137
5	Percentage fat mass, %, M(SD)[†]	33.4 (9.1)	33.9 (9.3)	.004
6	Fat mass index, kg/m², M(SD)[†]	9.7 (4.3)	10.0 (4.7)	<.001
7	Fat free mass index, kg/m², M(SD)[†]	18.4 (3.1)	18.5 (3.3)	.126
8	Fruit and vegetable intake,			
9	 serving/day, M(SD)[†]	5.4 (2.7)	5.5 (2.6)	.380
10	Sitting time, hours/day, M(SD)[†]	5.8 (2.9)	5.4 (2.7)	<.001
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12				

DNK = Do Not Know; PNA = Prefer Not to Answer.

[†] = t-test; Φ = chi square.

^aData are means (standard deviation) and number of participants (percentage).

^bSelf-reported chronic conditions.

^cData driven tertiles

For Review Only

Table 2 Differences in the Prevalence of Health Behaviors, Obesity, and Multimorbidity Between Participants Living in Urban and Rural Areas

	ORs (95% CIs)			
	Case/n	Urban	Case/n	Rural
Current smoker				
Model 1	892/11132	Reference	481/5922	1.03 (0.92, 1.16)
Model 2		Reference		1.00 (0.89, 1.13)
Regular or habitual alcohol drinker				
Model 1	5516/11132	Reference	2643/5922	0.83 (0.78, 0.89)
Model 2		Reference		0.84 (0.79, 0.90)
High physical activity				
Model 1	3423/11132	Reference	2065/5922	1.19 (1.11, 1.27)
Model 2		Reference		1.16 (1.08, 1.24)
Adequate fruit and vegetable intake				
Model 1	3324/11132	Reference	1763/5922	0.98 (0.91, 1.05)
Model 2		Reference		1.01 (0.94, 1.08)
Obesity				
Model 1	3523/11132	Reference	1975/5922	1.13 (1.05, 1.21)
Model 2		Reference		1.12 (1.04, 1.20)
Abdominal obesity				
Model 1	5571/11132	Reference	3125/5922	1.08 (1.01, 1.15)
Model 2		Reference		1.07 (1.00, 1.14)
Multimorbidity				
Model 1	3497/11132	Reference	1857/5922	0.97 (0.90, 1.04)
Model 2		Reference		0.94 (0.88, 1.01)

Categories presented in Table 1 were used in the final regression models.

Model 1, adjusted for age, sex, and province.

Model 2, further adjusted for ethnicity, education, marital status, adequate fruit & vegetable intake, smoking, alcohol use, multimorbidity, BMI, abdominal obesity, and total physical activity (where applicable) based on model 1.

Table 3. Differences in Body Adiposity Measures Between Participants Living in Urban and Rural Areas

	β coefficients (95% CIs)	
	Urban (n=11132)	Rural (n=5446)
Body adiposity measures		
BMI, kg/m²		
Model 1	Reference	0.50 (0.32, 0.69)
Model 2	Reference	0.48 (0.29, 0.66)
Waist Circumference, cm		
Model 1	Reference	0.45 (-0.01, 0.91)
Model 2	Reference	0.38 (-0.08, 0.85)
Percentage body fat, %		
Model 1	Reference	0.40 (0.12, 0.68)
Model 2	Reference	0.35 (0.07, 0.63)
Fat mass index, kg/m²		
Model 1	Reference	0.34 (0.20, 0.47)
Model 2	Reference	0.32 (0.19, 0.46)

Categories presented in Table 1 were used in the final regression models

Model 1, adjusted for age, sex, and province.

Model 2, further adjusted for ethnicity, education, marital status, adequate fruit & veg intake, smoking, alcohol use, multimorbidity, and total physical activity based on model 1.