Catalogue no. 82-003-X
ISSN 1209-1367

Health Reports

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Release date: October 21, 2026

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DOI: https://www.doi.org/10.25318/82-003-x202601000002-eng

Abstract

Background: The objective of this study is to examine temporal trends in accelerometer-measured moderate-to-vigorous physical activity (MVPA) and step counts among Canadian adults from 2007 to 2024 and to assess adherence to a range of activity benchmarks, including levels below current recommendations.

Methods: Using seven cycles of the Canadian Health Measures Survey (2007 to 2024), this study examines MVPA and step counts over time, by age group (18 to 39, 40 to 59, 60 to 79) and by sex (male, female). Survey-weighted linear regression was used to summarize trends over time and average differences between cycles, age groups, and sexes. This study also reports adherence to the current MVPA recommendation (150 minutes per week), as well as targets below the recommendation. Adherence to a range of different step count targets is also presented.

Results: In 2022-2024, 46% of Canadian adults were meeting the physical activity recommendation. Of the 54% not meeting the physical activity recommendation, approximately half (27%) need 5-10 more minutes per day of physical activity to reach the recommendation while the other half (27%) are accumulating less than 10 minutes per day of physical activity. Both age and sex were significantly associated with MVPA. Compared with 18- to 39-year-olds, 60- to 79-year-olds (-11.8 minutes per day) and 40- to 59-year-olds (-4.0 minutes per day) accumulated fewer minutes of MVPA. Females accumulated fewer minutes of MVPA (-5.5 minutes per day) than males. Step counts were lower among 60- to 79-year-olds (-1,272 steps per day) compared with 18- to 39-year-olds and among females (-612 steps per day) compared with males.

Interpretations: The findings of the present study highlight age- and sex-related differences in physical activity participation. They profile not only the proportion of Canadian adults who are meeting the recommended MVPA levels, but also the proportion who are approaching them.

Keywords: accelerometry, moderate-to-vigorous physical activity, step counts, 24-Hour Movement Guidelines, exercise

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What is already known on this subject?

- Between 2022 and 2024, 46% of Canadian adults met the recommendation of 150 minutes of moderate-to-vigorous physical activity (MVPA) per week.
- Physical activity declines with age, and males tend to be more active than females.
- The COVID-19 pandemic caused a disruption in the lifestyle habits of Canadians, including physical activity.

What does this study add?

- The percentage of males meeting the MVPA recommendation has remained stable from 2007 to 2024; however, a 12 percentage point drop was observed among 18- to 39-year-old females between 2018 to 2019 and 2022 to 2024.
- Of the 54% not meeting the physical activity recommendation, approximately half (27%) need 5-10 more minutes per day of physical activity to reach the recommendation while the other half (27%) are accumulating less than 10 minutes per day of physical activity.
- The sex gap in physical activity was evident only among young and middle-aged adults. Males and females aged 60 to 79 years had similar levels of MVPA and daily step counts.
- MVPA was lower among older adults compared with younger adults. Step counts were similar among 18- to 39-year-olds and 40- to 59-year-olds but lower among 60- to 79-year-olds.

Introduction

Given that the health benefits of physical activity are well established,[1] ongoing surveillance is important to monitor population activity levels, evaluate public health initiatives, and advance understanding of how movement relates to health. Accelerometer-based physical activity data have been collected in the Canadian Health Measures Survey (CHMS) since 2007. Despite a transition in accelerometer devices and the occurrence of the COVID-19 pandemic between Cycle 6 (2018 to 2019) and Cycle 7 (2022 to 2024), the proportion of Canadian adults meeting the recommended 150 minutes per week of moderate-to-vigorous physical activity (MVPA) remained relatively stable, declining only slightly from 49%[2] in Cycle 6 (2018 to 2019) to 46% in cycle 7 (2022 to 2024).[3] These overall estimates mask important differences by age and sex and provide a limited perspective on population physical activity patterns. The physical activity research landscape has evolved over the past few decades, with ample evidence supporting the examination of physical activity metrics that capture more modest amounts of MVPA (i.e., less than 150 minutes per week),[4,5,6] lower intensities of movement (e.g., light physical activity [LPA]),[7,8] and incidental movement accumulated across the whole day (i.e., step counts per day).[9]

The Canadian 24-Hour Movement Guidelines[10,11] and the World Health Organization Guidelines on Physical Activity and Sedentary Behaviour[12] recommend that adults accumulate 150 minutes of MVPA per week. Although this threshold provides a useful benchmark for surveillance and public health messaging, growing evidence indicates that the relationship between physical activity and health is continuous rather than dichotomous.[6] Recent accelerometer-based studies have demonstrated that health benefits accrue across the physical activity continuum, with the greatest relative reductions in risk occurring when individuals move from very low to modest levels of activity.[4,5,6] This is important from a population health perspective because it means that even small increases in activity accumulated across a large proportion of the population may yield substantial health benefits, regardless of whether individuals achieve the recommended threshold. Characterizing the proportion of adults who are nearly

meeting current recommendations, as well as those who are meeting them,[13] may provide important insight into the potential impact of achievable shifts in population physical activity levels.

Despite the wealth of detailed data available from accelerometers, there has been a historical focus on quantifying time spent in MVPA to assess adherence to published recommendations. The current Canadian and WHO guidelines do not currently include a daily step count target. In Canada, the *2025 ParticipACTION Report Card on Physical Activity for Adults* referenced 7,500 steps per day as a pragmatic benchmark reflecting a blend of the evidence available at the time.[14] From 2022 to 2024, 32% of Canadian adults accumulated 7,500 steps per day,[14] but it is unknown how many are meeting various step count benchmarks below and above this threshold. While a step target is not part of the primary physical activity recommendation, Australia recently added a companion statement that adults who have the ability to track steps should aim for 7,000 steps per day or more.[15] Unlike MVPA, which reflects time spent above a specific intensity threshold, steps can be accumulated across a wide range of movement intensities[7] and therefore provide a broader measure of total daily activity. Further, the ubiquity of step count information now available to individuals via smartwatches and smartphones has renewed awareness and interest in developing and promoting step count targets. Evidence from systematic reviews and dose-response meta-analyses indicates a generally inverse association between daily step counts and adverse health outcomes, including all-cause mortality, cardiovascular disease,[16-19] and depression.[20] Although some studies have identified step count ranges associated with maximal mortality risk reductions—for example, approximately 6,000 to 8,000 steps per day among older adults and 8,000 to 10,000 steps per day among younger adults[16]—more recent evidence supports a continuous dose-response relationship, with meaningful health benefits observed across a broad range of step counts.[17,18] Collectively, these findings suggest that both the MVPA–health and steps–health relationships exist along a continuum rather than at a discrete threshold, underscoring the value of examining a range of benchmarks when characterizing population physical activity patterns.

The purpose of this study is to summarize temporal trends in physical activity among adults from 2007 to 2024 using accelerometer-measured MVPA and step count data from the CHMS. Analyzing adherence to a broader range of MVPA and step count benchmarks using the most recent cycle of data provides a more comprehensive understanding of how many Canadian adults are far below, nearly meeting or meeting the MVPA and step count levels currently recommended in public health guidelines and in the literature. Examining activity levels below the recommended thresholds also allows for the identification of adults who may be within reach of achieving current recommendations through relatively modest increases in physical activity (e.g., approximately five to ten additional minutes of MVPA per day). From a public health perspective, quantifying the proportion of the population that is close to meeting recommended activity levels may help assess the potential impact of realistic, population-wide increases in physical activity.

Methods

Data source

The CHMS is a comprehensive national survey that collects health information to track and better understand the health and wellness of Canadians through direct physical measurement and interviews. CHMS data are obtained through the collection of self-reported and directly measured indicators of health and wellness from Canadians living in the 10 provinces. The survey's coverage excludes people living on reserves and other Indigenous settlements in the provinces, the institutionalized population, and residents of certain remote regions (less than 3% of the target population). The CHMS was approved by the Health Canada and Public Health Agency of Canada Research Ethics Board. Analyses herein include accelerometer-measured data collected for adults aged 18 to 79 years from Cycle 1 (2007 to 2009, n =

2,968), Cycle 2 (2009 to 2011, n = 2,982), Cycle 3 (2012 to 2013, n = 2,529), Cycle 4 (2014 to 2015, n = 2,401), Cycle 5 (2016 to 2017, n = 2,355), Cycle 6 (2018 to 2019, n = 2,381), and Cycle 7 (2022 to 2024, n = 2,279).

Actical accelerometer measurement and data processing (cycles 1 to 6)

All ambulatory respondents were provided with an Actical accelerometer (Philips Respironics, Oregon, United States, models B and Z) to wear on an elasticized belt over the right hip during their waking hours for seven consecutive days. The accelerometers were initialized to begin recording at midnight on the day the participants received the device. Using aggregated one-minute data, total measured time on each valid day spent in MVPA was determined based on the moderate cut-point (1,535 counts per minute or more).[21] The Actical accelerometer is an omnidirectional motion sensor that samples acceleration at 32 hertz and applies proprietary signal-processing algorithms to acceleration signals within the frequency range typical of human movement. Detected acceleration patterns consistent with ambulatory movement are converted into step counts, which are summarized over user-specified epochs (e.g., steps per minute). Although the specific step-detection algorithm is proprietary, validation studies have demonstrated good agreement between Actical-derived and directly observed step counts during normal walking and running.[22] More details of data processing steps used with the CHMS Actical data are available in previous publications.[23,24]

ActiGraph accelerometer measurement and data processing (Cycle 7)

In Cycle 7, participants were instructed to wear an ActiGraph wGT3X-BT (Ametris LLC [formerly ActiGraph LLC], Pensacola, Florida, United States) device continuously (24 hours per day) for seven days. The ActiGraph was initialized to start collecting data at midnight on the day the participants received the device at a sampling rate of 30 hertz. To generate activity counts, the raw acceleration signal is processed and converted into an activity count metric that summarizes movement accumulated during a specified epoch. The resulting activity count metric provides a summary measure of movement intensity accumulated during each user-defined epoch (e.g., one minute). Step counts are generated independently through a proprietary step-detection algorithm that identifies repetitive acceleration patterns consistent with gait and ambulatory movement. Detected steps are subsequently aggregated over the user-defined epoch length. Activity counts and step counts are complementary but distinct measures derived from the same underlying acceleration signal. Using the aggregated one-minute data, time spent in MVPA was summarized using age- and device-specific cut points (moderate intensity: 2,020 counts per minute or greater)[25] and step counts were summed for each valid day.

Derivation of moderate-to-vigorous physical activity and adherence to recommendations (cycles 1 to 7)

Valid days were defined as 10 hours or more, and respondents had to have at least four days of valid data to be included in the final dataset. Average daily time spent in MVPA was calculated as the total number of minutes for all valid days, divided by the number of valid days. Average daily step counts were calculated as the total number of steps for all valid days, divided by the number of valid days. Adherence to the Canadian physical activity recommendation was assessed based on respondents with a weekly sum of at least 150 MVPA minutes.[10,11] Five levels of targets were created for MVPA: less than 5 minutes per day, 5 to less than 10 minutes per day, 10 to less than 15 minutes per day, 15 to less than 21 minutes per day, and 21 or more minutes per day (daily equivalent to the recommended 150 minutes per week). The second last category was used to determine what percentage of Canadians were within five minutes of meeting the daily definition of the MVPA recommendation. Five levels of targets were created for step counts: fewer than 3,000 steps per day, 3,000 to fewer than 5,000 steps per day, 5,000 to fewer than 7,500 steps per day, 7,500 to fewer than 10,000 steps per day, and 10,000 steps or more per day.

Statistical analysis

Descriptive statistics are presented as survey-weighted mean daily minutes of MVPA and mean daily step counts with corresponding 95% confidence intervals (Table 1, Charts 1 and 2). Estimates were calculated separately by survey cycle, age group (18 to 39 years, 40 to 59 years, 60 to 79 years), and sex (males, females). To examine differences across survey cycles while accounting for differences in age and sex composition, survey-weighted linear regression models were fitted with MVPA or daily step count as the dependent variable. Survey cycle was modelled as a categorical variable, with Cycle 1 serving as the reference category. Models included age group and sex as covariates, where applicable. Regression coefficients therefore represent the adjusted difference in MVPA or daily step counts between each survey cycle and Cycle 1 (Table 2). This approach was chosen to estimate differences across cycles without imposing assumptions regarding linear or non-linear temporal trends. Given the transition from the Actical accelerometer in Cycle 6 to the ActiGraph accelerometer in Cycle 7, an additional comparison between cycles 6 and 7 was examined to facilitate the interpretation of potential differences associated with the change in the measurement device and data collection period. In accordance with the recommendation from a device crossover study,[26] comparisons between cycles 6 and 7 are limited to MVPA. Survey-weighted percentages of people meeting various MVPA and step count thresholds were calculated and presented graphically (Charts 3 to 6). All analyses accounted for the complex survey design, including sampling weights and bootstrap replicate weights provided by Statistics Canada, and were conducted using the *survey* and *srvyr* packages in R (version 4.4.1) and SAS (version 9.4.).

Table 1
Average daily minutes of moderate-to-vigorous physical activity and step counts from 2007 to 2024, by age group and sex

	Moderate-to-vigorous physical activity (minutes per day)						Average daily step counts					
	Males			Females			Males			Females		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
	minutes per day	from	to	minutes per day	from	to	Steps	from	to	Steps	from	to
18 to 39 years												
Cycle 1 (2007 to 2009)	33	29	37	25	21	30	9,978	9,004	10,951	8,916	8,380	9,452
Cycle 2 (2009 to 2011)	30	24	36	21	18	24	9,487	8,696	10,278	8,035	7,607	8,462
Cycle 3 (2012 to 2013)	35	31	39	32	24	40	9,461	8,891	10,032	8,347	7,619	9,075
Cycle 4 (2014 to 2015)	32	26	38	26	21	31	9,520	8,467	10,573	8,503	7,577	9,430
Cycle 5 (2016 to 2017)	37	30	44	24	19	29	9,494	8,539	10,449	7,599	6,822	8,376
Cycle 6 (2018 to 2019)	33	26	39	29	23	34	8,598	7,915	9,281	8,175	7,135	9,215
Cycle 7 (2022 to 2024)	34	31	37	24	19	28	6,878	6,364	7,391	6,619	6,164	7,073
40 to 59 years												
Cycle 1 (2007 to 2009)	26	22	31	21	18	25	9,996	9,141	10,851	8,677	8,096	9,258
Cycle 2 (2009 to 2011)	23	19	26	17	14	21	8,901	8,362	9,439	7,618	7,145	8,092
Cycle 3 (2012 to 2013)	26	19	33	20	17	23	9,013	7,879	10,147	7,641	6,978	8,304
Cycle 4 (2014 to 2015)	27	20	34	21	16	25	9,783	8,802	10,763	8,021	7,382	8,660
Cycle 5 (2016 to 2017)	29	23	36	24	19	28	9,220	8,482	9,958	8,260	7,772	8,748
Cycle 6 (2018 to 2019)	33	29	38	25	19	31	9,638	8,646	10,630	8,037	7,204	8,870
Cycle 7 (2022 to 2024)	28	24	32	25	21	29	7,051	6,515	7,586	6,767	6,269	7,264
60 to 79 years												
Cycle 1 (2007 to 2009)	17	11	23	12	10	15	7,876	7,109	8,644	6,971	6,413	7,528
Cycle 2 (2009 to 2011)	15	12	19	11	8	13	7,443	6,800	8,087	6,203	5,615	6,790
Cycle 3 (2012 to 2013)	16	12	19	13	10	15	7,522	6,636	8,408	6,412	5,939	6,885
Cycle 4 (2014 to 2015)	18	15	21	14	11	18	7,361	6,748	7,975	6,394	5,626	7,162
Cycle 5 (2016 to 2017)	18	15	20	18	13	22	7,632	7,093	8,172	6,968	6,341	7,596
Cycle 6 (2018 to 2019)	19	16	23	21	16	26	7,389	6,593	8,185	7,125	6,538	7,713
Cycle 7 (2022 to 2024)	20	14	26	17	13	21	5,709	5,007	6,412	5,915	5,382	6,449

Source: Statistics Canada, Canadian Health Measures Survey, 2007 to 2024.

Results

Moderate-to-vigorous physical activity

Survey-weighted estimates of average daily minutes of MVPA by age group and sex are presented in Table 1. The visual trends of these estimates are shown in Chart 1. After adjustment for age group and sex, no significant differences were observed in MVPA for cycles 2 to 7 versus Cycle 1 (Table 2). Across survey cycles, 40- to 59-year-olds accumulated an average of 4.0 fewer minutes of MVPA per day than 18- to 39-year-olds ($p < 0.05$), 60- to 79-year-olds accumulated an average of 11.8 fewer minutes of MVPA per day than 18- to 39-year-olds ($p < 0.001$), and females accumulated an average of 5.5 fewer minutes of MVPA per day than males ($p < 0.001$) (Table 2). When examined separately by sex, the difference between females aged 40 to 59 years and 18 to 39 years became non-significant. When examined separately by age group, the sex difference was evident among 18- to 59-year-olds, but not 60- to 79-year-olds. No difference was observed between cycles 6 and 7 for average daily minutes of MVPA (Table 2 & Chart 1).

Table 2
Linear regression analysis results showing model-adjusted mean differences in moderate-to-vigorous physical activity and step counts by survey cycle, age group, and sex

	Overall			Males			Females			18 to 39 years			40 to 59 years			60 to 79 years		
	Mean difference	Standard error	p-value	Mean difference	Standard error	p-value	Mean difference	Standard error	p-value	Mean difference	Standard error	p-value	Mean difference	Standard error	p-value	Mean difference	Standard error	p-value
									minutes per day									
Primary moderate-to-vigorous physical activity model (Cycle 1 reference)																		
Predictor																		
Cycle 2 vs Cycle 1	-3.3	1.9	0.097	-2.8	2.4	0.242	-3.7	1.8	0.043	-3.6	2.6	0.174	-3.8	2.0	0.058	-1.5	2.0	0.453
Cycle 3 vs Cycle 1	0.9	2.1	0.664	-0.2	2.5	0.948	2.0	2.2	0.371	4.1	3.0	0.173	-1.3	2.5	0.614	-0.5	2.0	0.796
Cycle 4 vs Cycle 1	0.1	2.0	0.945	0.0	2.7	0.995	0.3	2.0	0.882	-0.1	2.5	0.967	-0.2	2.5	0.928	1.5	2.0	0.473
Cycle 5 vs Cycle 1	2.1	2.0	0.302	2.7	2.6	0.313	1.6	1.9	0.395	1.3	2.8	0.632	2.5	2.6	0.337	3.1	2.0	0.130
Cycle 6 vs Cycle 1	3.2	2.0	0.114	1.8	2.3	0.429	4.7	2.2	0.034	0.9	2.5	0.709	4.4	2.6	0.091	5.5	2.4	0.023
Cycle 7 vs Cycle 1	1.6	1.9	0.406	1.3	2.2	0.548	1.8	1.9	0.365	-0.6	2.2	0.783	2.4	2.4	0.326	4.0	2.4	0.090
Middle age group (40 to 59) vs youngest age group (18 to 39)†	-4.0	1.3	0.003	-6.0	1.6	<0.001	-2.0	1.4	0.162	...	...	...	...	...	...	...	...	...
Oldest age group (60 to 79) vs youngest age group (18 to 39)†	-11.8	1.6	<0.001	-14.6	2.1	<0.001	-8.9	1.6	<0.001	...	...	...	...	...	...	...	...	...
Females vs Males†	-5.5	0.8	<0.001	...	...	...	...	...	...	-8.5	1.1	<0.001	-4.4	1.0	<0.001	-2.6	1.7	0.116
Focused comparison: Cycle 7 vs Cycle 6																		
Predictor																		
Cycle 7 vs Cycle 6	-1.7	1.8	0.354	-0.49	1.86	0.791	-2.91	2.19	0.184	-1.55	2.41	0.52	-2.07	2.38	0.385	-1.44	2.48	0.561
									steps per day									
Primary step count model (Cycle 1 reference)																		
Predictor																		
Cycle 2 vs Cycle 1	-777	276	0.006	-674	391	0.085	-882	252	<0.001	-610	370	0.100	-1035	328	0.002	-575	357	0.107
Cycle 3 vs Cycle 1	-724	285	0.013	-701	394	0.076	-747	247	0.003	-538	392	0.170	-1020	437	0.020	-461	391	0.238
Cycle 4 vs Cycle 1	-505	346	0.148	-432	436	0.322	-575	329	0.081	-429	486	0.378	-489	405	0.228	-547	376	0.146
Cycle 5 vs Cycle 1	-633	307	0.043	-598	431	0.165	-667	251	0.008	-891	438	0.042	-608	384	0.114	-138	355	0.696
Cycle 6 vs Cycle 1	-695	356	0.055	-949	429	0.028	-449	364	0.219	-1,061	449	0.019	-569	450	0.207	-177	382	0.643
Middle age group (40 to 59) vs youngest age group (18 to 39)†	36	157	0.818	82	204	0.688	-29	170	0.864	...	...	...	...	...	...	...	...	...
Oldest age group (60 to 79) vs youngest age group (18 to 39)†	-1,272	179	<0.001	-1,476	256	<0.001	-1,099	192	<0.001	...	...	...	...	...	...	...	...	...
Females vs males†	-612	104	<0.001	...	...	...	...	...	...	-684	181	<0.001	-820	140	<0.001	-237	218	0.277

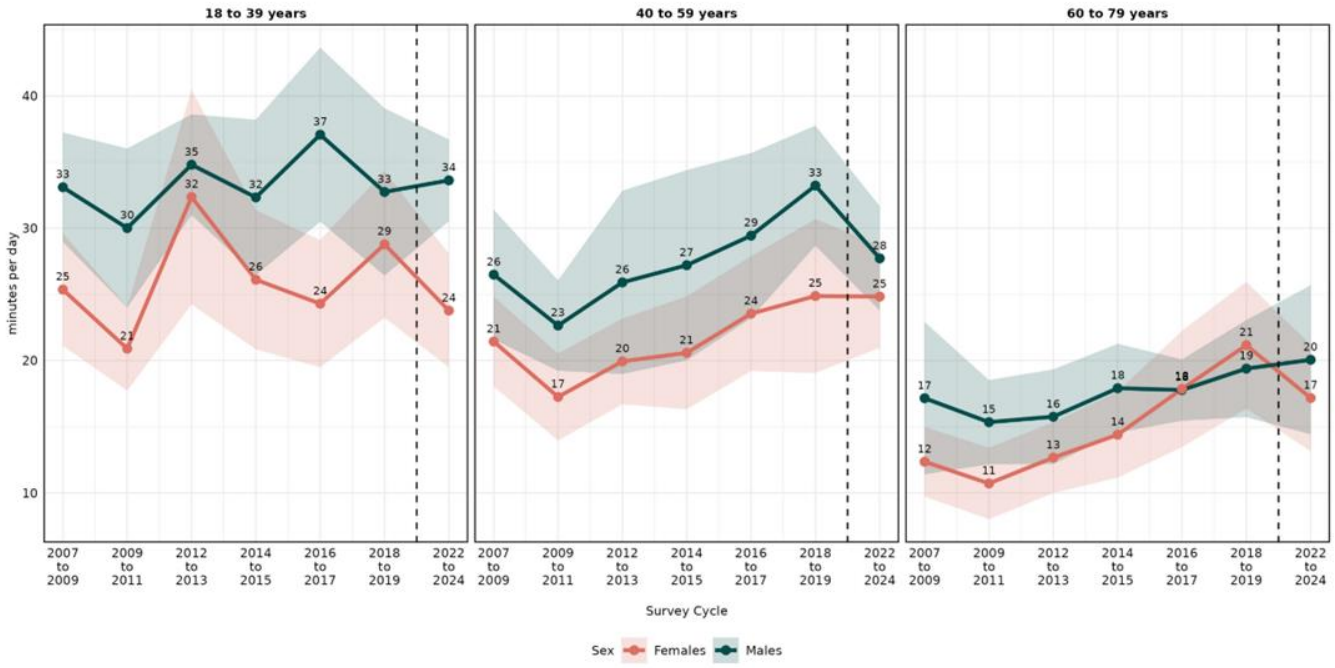
† reference category

... not applicable

Note: Step counts were not compared between Cycle 7 and any other cycles because of device transition. See text for further information.

Source: Statistics Canada, Canadian Health Measures Survey, 2007 to 2024.

Chart 1
Average daily minutes of moderate-to-vigorous physical activity among Canadian adults from 2007 to 2024, by age group and sex

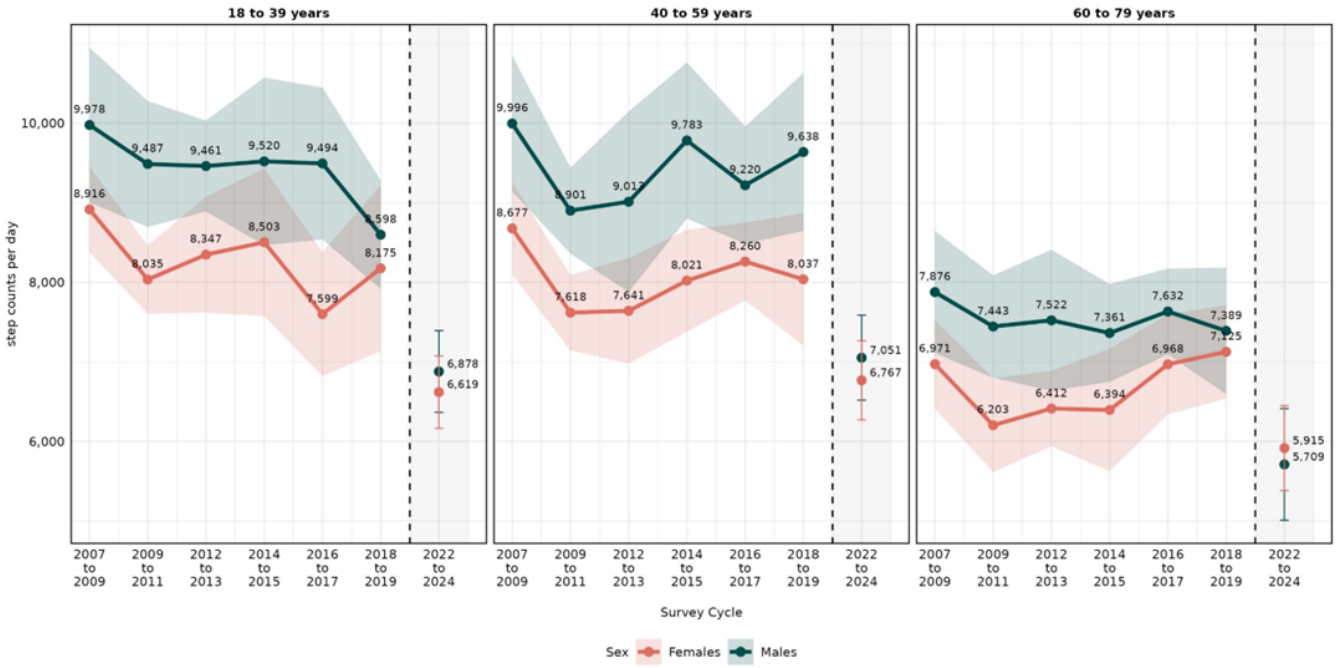


Notes: MVPA = moderate-to-vigorous physical activity. Shaded regions represent 95% confidence intervals. Vertical dotted lines denote transition from Actical to ActiGraph.
Source: Statistics Canada, Canadian Health Measures Survey, 2007 to 2024.

Step counts

Survey-weighted estimates of average daily step counts by age group and sex are presented in Table 1. The visual trends of these estimates are shown in Chart 2. After adjustment for age group and sex, step counts were significantly lower in Cycle 2 (β = -777 steps per day), Cycle 3 (β = -724 steps per day), and Cycle 5 (β = -633 steps per day) compared with Cycle 1 (all $p < 0.05$) (Table 2). Across survey cycles, 60- to 79-year-olds (β = -1,272 steps per day) accumulated fewer steps per day than 18- to 39-year-olds ($p < 0.001$), while there was no difference between 40- to 59-year-olds and 18- to 39-year-olds. When examined separately by sex, the similarity in step counts among 18- to 39-year-olds and 40- to 59-year-olds remained. When examined separately by age group, sex differences in step counts were evident among 18- to 59-year-olds, but not 60- to 79-year-olds. Direct comparisons were not made between cycles 6 and 7 for step counts.

Chart 2
Average daily step counts of Canadian adults from 2007 to 2024, by age group and sex

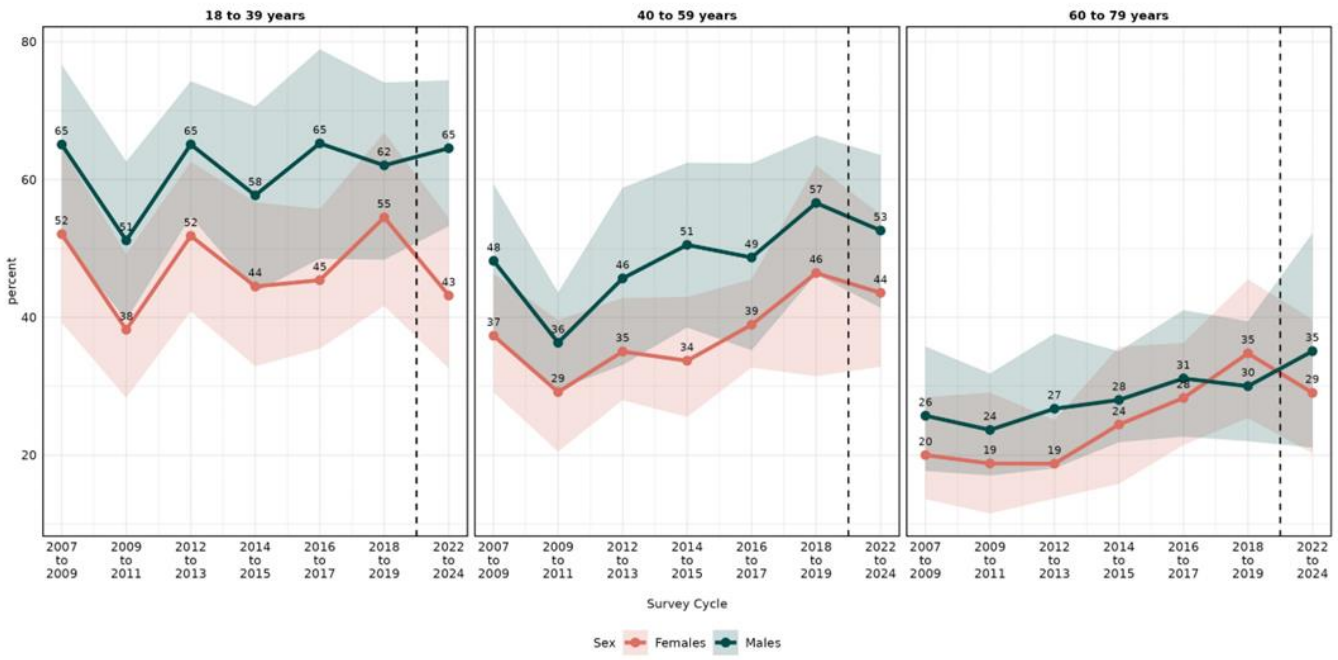


Notes: Shaded regions represent 95% confidence intervals. Vertical dotted lines denote transition from Actical to ActiGraph.
Source: Statistics Canada, Canadian Health Measures Survey, 2007 to 2024.

Adherence to moderate-to-vigorous physical activity recommendation

The percentage of people aged 40 to 59 years and 60 to 79 years meeting the MVPA recommendation was higher in 2022 to 2024 compared with 2007 to 2009 (among 40- to 59-year-olds: +5 percentage points in males, +7 percentage points in females; among 60- to 79-year-olds: +9 percentage points in both sexes) (Chart 3). The percentage of 18- to 39-year-old males meeting the MVPA recommendation was the same in 2022 to 2024 as in 2007 to 2009, while a decrease was observed among females in this age group, from 52% in 2007 to 2009 to 43% in 2022 to 2024. In 2022 to 2024, the sex difference in meeting the MVPA recommendation was 22 percentage points among 18- to 39-year-olds (65% of males versus 43% of females), 9 percentage points among 40- to 59-year-olds (53% of males versus 44% of females), and 6 percentage points among 60- to 79-year-olds (35% of males versus 29% of females).

Chart 3
Percentage of Canadian adults meeting the moderate-to-vigorous physical activity recommendation, by age group and sex

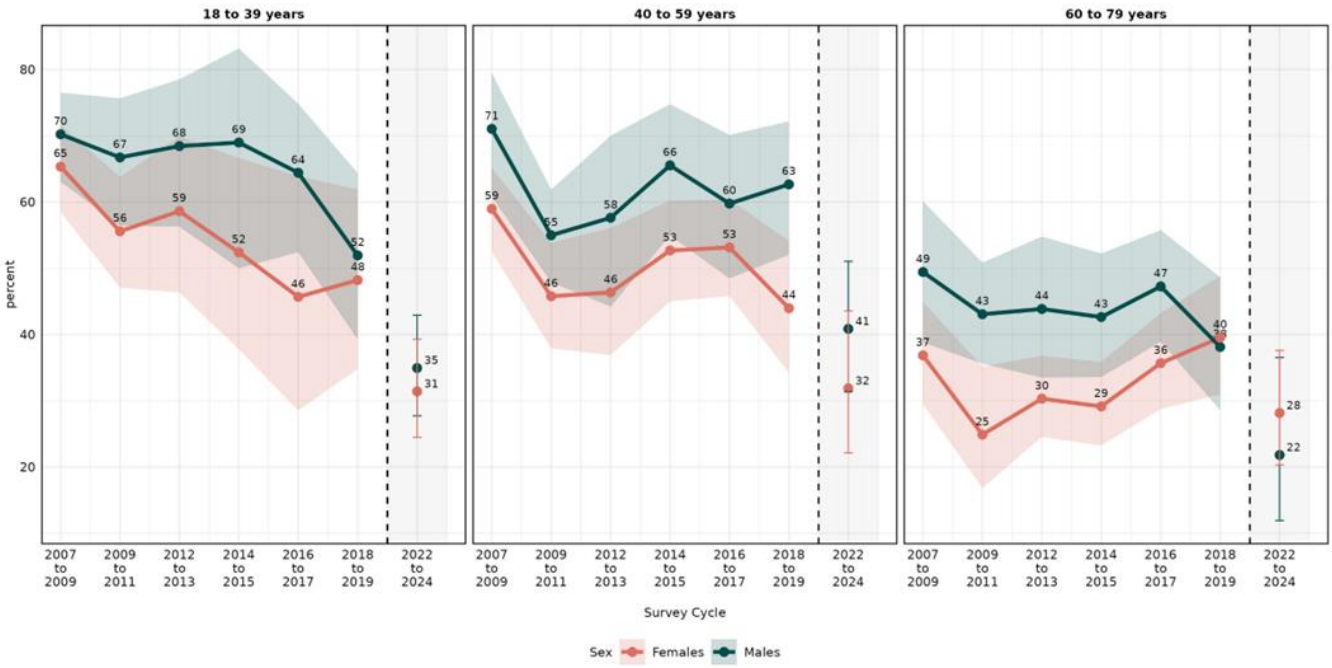


Notes: MVPA = moderate-to-vigorous physical activity. Shaded regions represent 95% confidence intervals. Vertical dotted lines denote transition from Actical to ActiGraph.
Source: Statistics Canada, Canadian Health Measures Survey, 2007 to 2024.

Adherence to 7,500 daily step threshold

With the exception of 60- to 79-year-old females, the percentage of adults meeting a daily step target of 7,500 decreased from Cycle 1 to Cycle 6 (Chart 4). Among 18- to 39-year-olds and 60- to 79-year-olds, there was minimal difference in the percentage meeting the 7,500 steps per day target between males and females in Cycle 6, while there was an 19 percentage point difference between males and females aged 40 to 59 years. The percentage meeting the 7,500 steps per day target in Cycle 7 was similar between sexes, with adherence among 60- to 79-year-old females (28%) surpassing that of males (22%).

Chart 4
Percentage of Canadian adults accumulating 7,500 steps per day, on average, by age group and sex

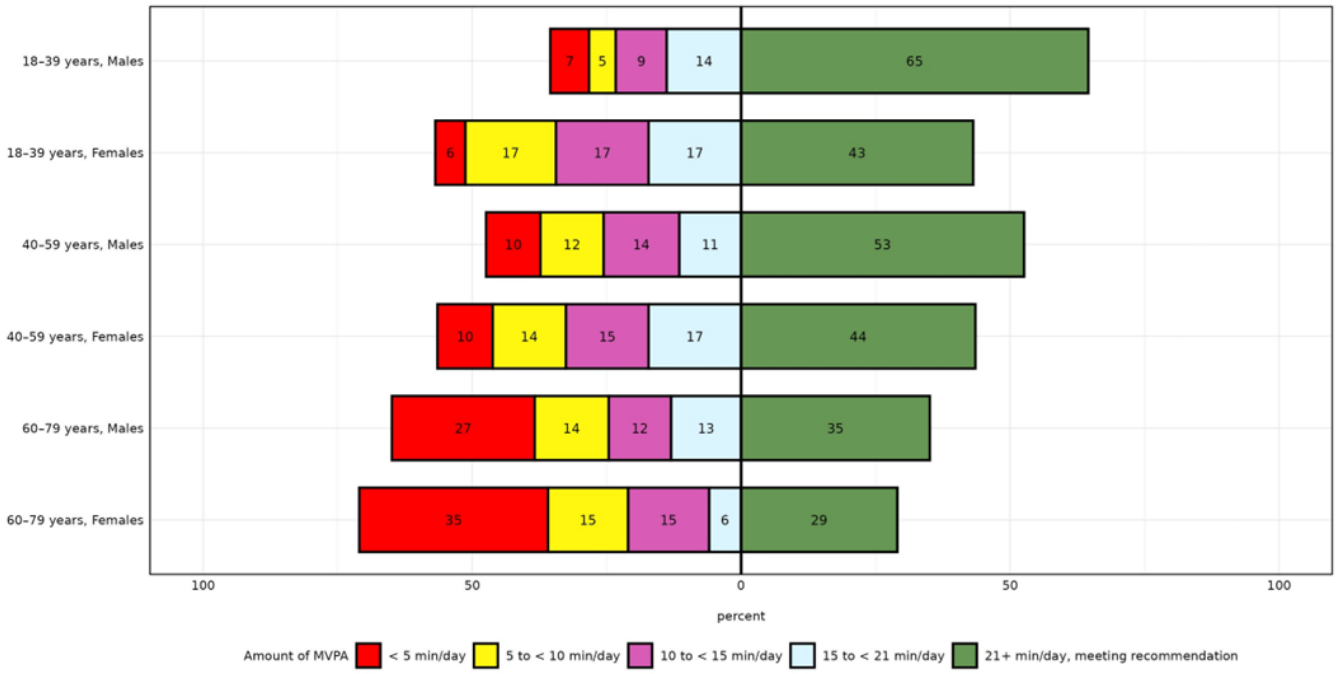


Notes: Shaded regions represent 95% confidence intervals. Vertical dotted lines denote transition from Actical to ActiGraph.
Source: Statistics Canada, Canadian Health Measures Survey, 2007 to 2024.

Adherence to multiple moderate-to-vigorous physical activity thresholds

Chart 5 shows the percentage distribution of Canadian adults meeting the MVPA recommendation (21 minutes per day, equivalent to the recommended 150 minutes per week) from 2022 to 2024, as well as the percentage meeting more modest MVPA targets. Among the 54% of adults aged 18 to 79 not meeting the physical activity recommendation, approximately half (27%) need 5-10 more minutes per day of physical activity to reach the recommendation while the other half (27%) are accumulating less than 10 minutes per day of physical activity (data not shown in Figure 5). For females, 17% of those aged 18 to 59 and 6% of those aged 60 to 79 years are in the category just below meeting the daily MVPA target (i.e., 15 to fewer than 21 minutes per day). For males, 14% of those aged 18 to 39 years, 11% of those aged 40 to 59 years and 13% of those aged 60 to 79 years are within the same category. About one-third of older adults (27% of males and 35% of females aged 60 to 79 years) are getting less than five minutes per day of MVPA.

Chart 5
Distribution of the percentage meeting various moderate-to-vigorous physical activity thresholds in 2022 to 2024, by age group and sex

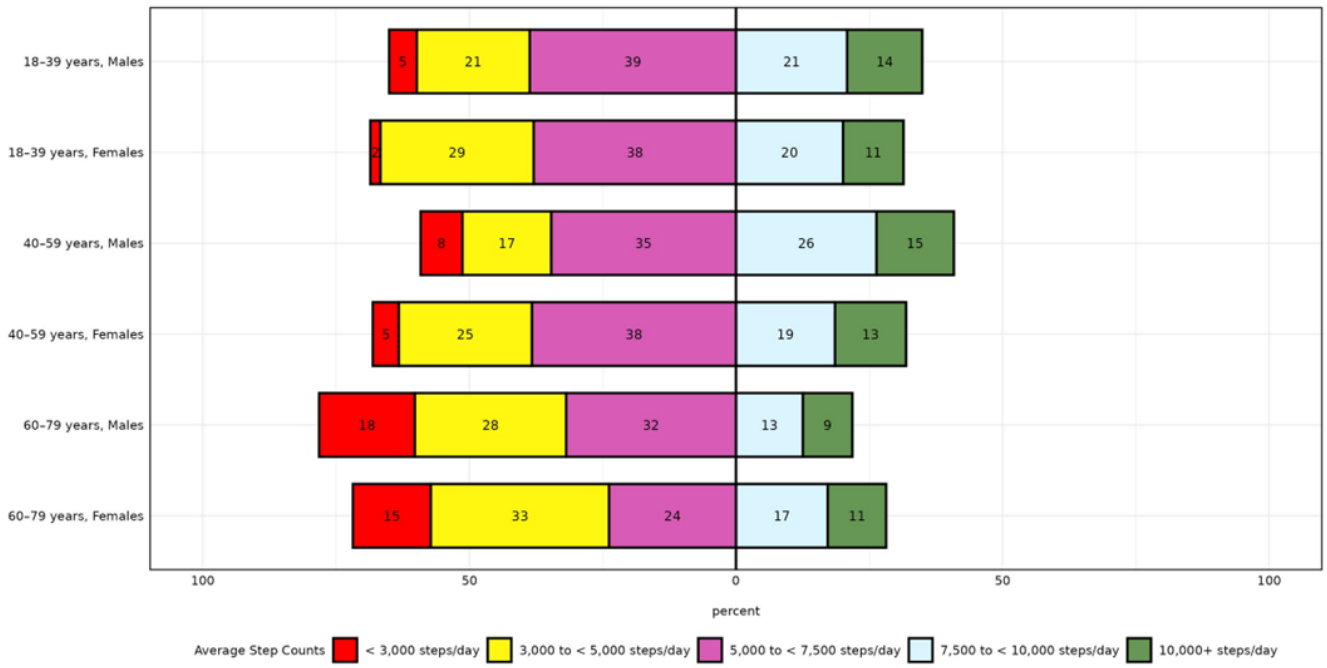


Notes: MVPA: moderate-to-vigorous physical activity. Right side of figure (green bars) shows the precent meeting the MVPA recommendation. Left side of figure shows the distribution of those not meeting the MVPA recommendation.
Source: Statistics Canada, Canadian Health Measures Survey, 2022 to 2024.

Adherence to multiple step count thresholds

Chart 6 shows the percentage distribution of Canadian adults meeting various daily step count benchmarks from 2022 to 2024. Few adults are accumulating 10,000 steps or more per day (9% to 15% across all age and sex groups). The percentage of each group accumulating at least 7,500 steps per day is highest for males aged 40 to 59 years (41%) and lowest for males aged 60 to 79 years (22%). More females aged 60 to 79 years (28%) are accumulating 7,500 steps per day compared with males in the same age group (22%). Fewer 18- to 39-year-olds are accumulating less than 3,000 steps per day (2% of females, 5% of males) than 40- to 59-year-olds (5% of females, 8% of males) and 60- to 79-year-olds (15% of females, 18% of males).

Chart 6
Distribution of the percentage meeting various daily step count thresholds in 2022 to 2024, by age group and sex



Notes: Right side of figure shows the precent meeting accumulating 7,500 steps per day or more. Left side of figure shows the distribution of those accumulating less than 7,500 steps per day.
Source: Statistics Canada, Canadian Health Measures Survey, 2022 to 2024.

Interpretation

This study examined trends in MVPA, step counts, and adherence to physical activity recommendations among Canadian adults aged 18 to 79 years from 2007 to 2024. Overall, average daily minutes of MVPA remained relatively stable over time, while average daily step counts decreased slightly. Both age and sex were significantly associated with MVPA and step counts overall, with older adults accumulating less MVPA and fewer steps than younger adults and females accumulating less MVPA and fewer steps than males. Unlike MVPA, which was lower among older compared with younger adults, step counts were relatively similar among ages 18 to 39 and 40 to 59, and lower only among those aged 60 to 79 years. Females accumulated less MVPA than males from ages 18 to 59 years, after which no significant sex difference was observed. The proportion of males meeting the physical activity recommendation remained relatively stable over time, while the proportion of females meeting the recommendation increased between 2014 and 2019 before declining in the most recent cycle (2022 to 2024), particularly among 18- to 39-year-olds (55% in 2018-2019 & 43% in 2022-2024). An examination of the proportion of Canadian adults almost meeting the MVPA recommendation indicates that half (27%) need 5-10 more minutes per day of physical activity to reach the recommendation while the other half (27%) are accumulating less than 10 minutes per day of physical activity. Together, the findings highlight persistent age- and sex-related differences in physical activity and offer a more detailed breakdown of the distribution in adherence to various thresholds of physical activity.

Unlike MVPA, which tends to reflect engagement in higher-intensity movement, such as organized sports and exercise sessions or very active occupational tasks, step counts capture a more holistic summation of total daily movement accumulated across all movement intensities.[7] Previous research has shown that younger adults accumulate most of their steps in MVPA or at the higher end of LPA, while older adults accumulate most of their steps at the lower end of LPA.[7] Changes in the types and contexts of physical activity with age may contribute to these changes. For example, younger and middle-aged adults are

more likely to engage in structured or sport- and occupation-based activities, whereas physical activity among older adults often consists primarily of lower-intensity activities, such as walking, incidental movement throughout the day and household chores.[27,28] While these lower-intensity activities may not always register as MVPA on an accelerometer, they will still lead to the accumulation of steps. This likely explains, in part, why MVPA was lower among older compared with younger adults, whereas step counts remained relatively stable through middle adulthood, highlighting the importance of interpreting these measures as complementary rather than interchangeable indicators of physical activity.

Although males accumulated more MVPA than females in the youngest age group, this sex difference narrowed among 40-to-59-year-olds and disappeared among 60-to-79-year-olds. Sex differences in physical activity participation are well documented, with males generally accumulating more MVPA than females,[29] particularly in early and mid-adulthood.[30,31] Both Canadian (49% of males vs. 38% of females)[30] and American (43% of males vs. 33% females)[32] studies report about a 10 percentage point difference in adherence to the MVPA recommendation between males and females. When specific types of activities are examined, a gender gap exists for sports and exercise but not for walking.[33] In the present study, sex differences in MVPA and step counts were observed among adults aged 18 to 39 years and 40 to 59 years but were not evident among adults aged 60 to 79 years. Although relatively few studies have examined how sex differences in objectively measured physical activity vary across the adult lifespan, some evidence suggests that age-related declines in activity occur in both sexes, which may reduce the absolute magnitude of the sex gap in older populations. A study using accelerometer-measured data from the National Health and Nutrition Examination Survey (NHANES) found that males were more active than females until age 60, where a crossover occurred, and after that age, females spent more time active at all intensities compared with males.[34] According to the NHANES study, females maintained their LPA levels into older adulthood, while males transitioned some MVPA to sedentary time. The present study did not examine LPA specifically but did capture a combination of LPA and MVPA within the step count data, which also showed no sex difference among 60- to 79-year-olds. The present study is in line with other studies that indicate that sex differences in overall activity levels and patterns become smaller in older adults. This convergence appears to be driven, at least in part, by age-related declines in MVPA in both sexes and a shift toward lower-intensity activities.

The most recent cycle of the CHMS revealed a notable decline in the proportion of younger females (18 to 39 years) meeting the MVPA recommendation. Between 2018 to 2019 and 2022 to 2024, adherence in this group dropped from 55% to 43%, whereas adherence among older females and males of all ages remained relatively stable. This pattern suggests that younger females may be experiencing unique barriers to maintaining physical activity. Potential contributing factors may include pandemic-related shifts in work–life demands, caregiving responsibilities, and changing social or recreational opportunities, although these influences were not directly measured in the present study. Previous studies have shown that the presence of children in the home is associated with lower physical activity among mothers[35] and that the presence of children in the household during the COVID-19 pandemic was associated with an increase in chronic disease lifestyle risk factors among adults, such as increased engagement in sedentary behaviours.[36] Other Canadian research published during the pandemic showed that while physical activity among adults remained stable during the pandemic, a notable decrease was observed among youth.[37] It is worth noting that some of the youth in the pandemic period (2020 to 2024) have now aged into the young adulthood range and may increasingly lead to an overall decline in physical activity levels as more youth transition to young adulthood. These findings highlight the importance of monitoring trends by both sex and age to identify subgroups at risk of declining physical activity, particularly in relation to the lifestyle changes faced during the pandemic. Further research is needed to elucidate the specific drivers of this decline and to develop strategies to support sustained engagement in MVPA among younger females.

Recent findings from a meta-analysis using device-measured physical activity data demonstrate that modest increases in MVPA (e.g., five minutes per day) could prevent a meaningful proportion of deaths

at the population level.[4-6] Improvements in health have been observed at activity levels below current recommendations, highlighting the importance of promoting small incremental increases in physical activity rather than focusing solely on guideline attainment. The presentation of results at multiple benchmarks below the current Canadian MVPA recommendation (Chart 5) shows that 6% to 17% of Canadian adults are within five minutes of achieving the MVPA recommendation. Further, the more detailed breakdown offers an opportunity for future research examining the health impacts of moving across these categories of MVPA. Importantly, Ekelund and colleagues showed that the largest reduction in mortality risk occurs when the least active group becomes slightly more active, and additional benefits accrue at higher volumes but with diminishing returns.[4,5] Support for promoting incremental increases in movement, regardless of baseline level, may inform future revisions of the physical activity guidelines. This study's examination of meeting a range of targets below the benchmark of 150 minutes per week is in line with the literature that supports the benefits of increasing physical activity by modest amounts regardless of the baseline. This analytical approach is also in line with supplementary points added to the benchmark of 150 minutes per week, such as the Physical Activity Guidelines for Americans, which note, "adults who sit less and do any amount of moderate-to-vigorous physical activity gain some health benefits."[38] Together, these findings reinforce the principle that every minute of physical activity counts and may contribute to future discussions regarding how physical activity recommendations are communicated and monitored at the population level.

The CHMS is one of few datasets globally with ongoing nationally representative and objectively measured physical activity data. The continuity in data collection and close attention to analytical methods further augment the utility of this data source for researchers and policy makers. The primary limitation of the present study is the transition in device and wear protocol between cycles 6 and 7. A crossover study examining the comparability of the two devices concluded that high-level comparisons could be made for MVPA only.[26] The addition of future cycles using the ActiGraph will help elucidate whether the apparent decrease in MVPA among young female adults is sustained or whether the observed sex gap in MVPA continues to shrink with increasing age. The inclusion of step count results is important given the increasing familiarity with the step count construct in the general population. In addition, MVPA and step counts capture different aspects of movement. MVPA requires a certain level of exertion and thus shows some age group and sex differences that are not captured in comparisons of average daily step counts between sexes. A notable challenge in the present study was the lack of a singular step count recommendation at the time of publication. This was compounded by a literature base that shows health benefits across a wide range of daily step count targets.[16-19] More work is needed to determine the extent to which the total volume of daily steps and the intensity at which steps are accumulated contribute to health outcomes. In addition, examining how the device-based estimates compare with self-reported physical activity would help improve the understanding of the contextual factors that affect physical activity among various subgroups in the Canadian population.

The aim of this study was to provide a high-level summary of trends in MVPA and step counts since 2007 in Canada. Examining the data by cycle, age group and sex revealed important nuances in the trends that are masked in the overall estimates. A slight increase in physical activity among older females and a drop among younger females are notable observations. Males continue to outpace females when it comes to MVPA in early adulthood, but more work is needed to examine whether this is true for lighter-intensity movement and steps interspersed throughout the day. Overall, this study underscores the value of understanding the distribution of individuals not meeting recommended activity levels, as the amount of additional activity needed to reach the recommendation varies across the population.

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