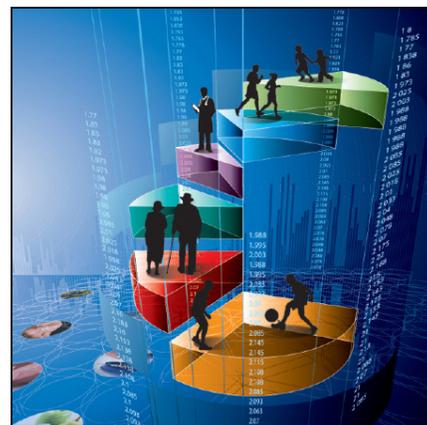


Health Reports

Exercise and screen time during the COVID-19 pandemic

by Rachel C. Colley, Tracey Bushnik, and Kellie Langlois

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Exercise and screen time during the COVID-19 pandemic

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Abstract

Background: The objective of this paper is to describe the exercise and changes in screen time habits, and their relationship with health, among participants of the Canadian Perspectives Survey Series (CPSS).

Data and methods: Between March 29th and April 3rd 2020, CPSS participants (n = 4,524) reported whether they were exercising outdoors or indoors and whether they increased, decreased or maintained their TV, Internet and video game use. Participants also reported their self-perceived general and mental health.

Results: More women reported very good or excellent mental health if they were exercising outdoors (54%) compared with those who were not (41%). More women reported very good or excellent general health if they were exercising outdoors (75%) compared with those who were not (49%), with the same trend evident for those exercising indoors (69%) compared to those who were not (62%). More men (65%) and women (62%) rated their mental and general health as very good or excellent if they maintained or decreased TV time compared with those who increased TV time (57% and 43%, respectively), with the same evident for Internet use in women only (maintained/decreased: 61% versus increased: 44%). More men (63%) and women (52%) rated their mental health as very good or excellent if they maintained or decreased video game time compared with those who increased video game time (48% and 29%, respectively). More men and women reported very good or excellent mental and general health if they increased none or one type of screen and/or were exercising outdoors compared with those who increased 2 or 3 types of screens and who were not exercising outdoors, with the exception of general health among men.

Interpretation: Maintaining opportunities for outdoor exercise and limiting screen time may promote better mental and general health during periods of confinement.

Keywords: coronavirus, mental health, physical activity

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Physical distancing measures to slow the spread of COVID-19 were implemented in Canada in March 2020 and included widespread border, school and business closures. This departure from normality led to a dramatic shift in daily routines as many Canadians suddenly found themselves working from home, homeschooling their children and avoiding unnecessary trips outside their homes. While physical distancing measures are fundamental to reduce virus transmission,¹ prolonged restrictions can lead to decreased opportunities for outdoor exercise² and increased anxiety and depression.³ During the confinement period, fewer Canadians rated their own mental health highly when compared with a sample of Canadians in 2018.⁴ Moreover, many reported increased feelings of anxiety about their own health and that of others.⁵ Those who reported better mental health during the pandemic were more likely to report having exercised outdoors.⁶

The most recent statistics indicate that pre COVID-19 only 1 in 5 Canadian adults are meeting the current recommended level of physical activity (150 minutes per week) and activity levels tend to decline with increasing age.^{7,8} A dose-response relationship between physical activity and the prevention of chronic disease and mortality is well-documented⁹ and health benefits can be obtained from very small doses of physical activity.¹⁰ Exercise, particularly outdoors, is associated with improvements in mood as well as reduced symptoms of anxiety, anger and depression.^{11,12} Physical activity is of particular relevance in the context of a viral outbreak given its ability to protect the

body against the stress of many disease conditions¹³ and to optimize the body's immune function.^{14,15}

Prior to COVID-19, Canadian adults were already spending the majority of their days engaged in sedentary behaviour,¹⁶ and recent evidence indicates that common sedentary behaviours (e.g., using computers and electronic devices) have been increasing over the past few decades.¹⁷ Excessive sedentary time is associated with an increased risk of depression,¹⁸ poorer mental health¹⁹ and poorer physical health outcomes.^{20,21} As physical distancing measures were implemented in response to COVID-19, Canadians became increasingly reliant on their home Internet connections to telework, help their children with school work and interact with friends and family online. Global reports estimate that total Internet traffic grew by 40 to 60% during the spring 2020 global lockdown period^{22,23} with access to newspaper sites, video chat applications, gaming and home-based work and learn programs driving this increase.²⁴ The impact of these inevitable changes in screen behaviour on mental and general health among Canadians is unknown.

Public health officials have noted the important role of healthy active living to counteract the negative effects of prolonged isolation on physical and mental health.^{2,25} The objective of this paper is to describe the exercise habits and changes to screen time behaviours among participants of the Canadian Perspectives Survey Series (CPSS) during the week of March 29th to April 3rd, 2020. This paper also examines relationships between these behaviours and self-perceived mental and general health.

Data and methods

The cross-sectional *Canadian Perspective Survey Series – Impacts of COVID-19 (CPSSI)* collected COVID-19 related information concerning labour market impacts, behaviours and health impacts for the Canadian population 15 years of age or older living in the ten provinces. The CPSSI sample was selected from four Labour Force Survey (LFS) rotation

What is already known?

- The confinement measures put in place during the COVID-19 pandemic limited opportunities for outdoor exercise.
- The confinement measures put in place during the COVID-19 pandemic led to an increased reliance on screens due to telework, homeschooling and online socializing.
- Exercise is positively associated with health while excessive screen time is negatively associated with health.

What this study adds?

- More women rated their mental health as very good or excellent if they were exercising outdoors. More women rated their general health as very good or excellent if they were exercising outdoors or indoors.
- More men and women rated their mental and general health as very good or excellent if they maintained or decreased TV compared with those who increased TV time, with the same evident for Internet time in women only. More men and women rated their mental health as very good or excellent if they maintained or decreased video game time compared with those who increased video game time.
- More men and women reported very good or excellent mental and general health if they increased none or one type of screen and/or were exercising outdoors compared with those who increased 2 or 3 types of screens and who were not exercising outdoors, with the exception of general health among men.

groups that answered the LFS for the last time in 2019. Excluded from the LFS coverage are: persons living on reserves and Aboriginal settlements in the provinces; full-time members of the Canadian Armed Forces; the institutionalized population; and households in extremely remote areas with very low population density (representing less than 2% of the Canadian population aged 15 or older). One household member was selected at random for the CPSSI. Data were collected via a web-based platform between March 29 and April 3, 2020. Of the 7,242 CPSS participants that were invited to complete the COVID-19 survey, 4,627 people responded for a 63.9% response rate. The sample of 4,627 Canadians (2,155 males, 2,472 females) represents a population of 31 million. The current analysis was based on 4,524 adult participants aged 20+ years.

Participants were asked to rate their health and mental health using the same questions as the Canadian Community Health Survey and the Canadian Health Measures Survey.²⁶ Response options are provided in brackets.

- In general, how is your health? (excellent, very good, good, fair, poor)
- In general, how is your mental health? (excellent, very good, good, fair, poor)

Participants were also asked about their exercise and screen time habits. Response options are provided in brackets.

- Are you doing any of the following activities for your health?
 - Exercise outdoors (yes, for my mental health; yes, for my physical health; yes, for both my mental and physical health; no)
 - Exercise indoors (yes, for my mental health; yes, for my physical health; yes, for both my mental and physical health; no)
- Have your weekly habits changed for any of the following activities?
 - Watching TV (increased, decreased, no change)
 - Spending time on the Internet (increased, decreased, no change)

- Playing video games (increased, decreased, no change)

The questions were re-coded to facilitate analysis and interpretation. The mental health and general health questions were dichotomized into excellent/very good versus poor/fair/good. The exercise questions were re-coded into exercised for any reason versus not exercising. The screen time questions were re-coded into increased versus decreased/no change. The three screen time questions were further summarized into increased 2 or 3 types of screens versus increased 0 or 1 type of screen. Descriptive statistics were used to calculate percentages and 95% confidence intervals. All analyses used SAS version 9.4 (SAS Institute, North Carolina, United States) and SUDAAN 11.0. Analyses applied the survey weight to make the results representative of the 10 Canadian provinces combined, and bootstrap weights were used to estimate variance. Where possible, results were presented by age group: 20 to 34, 35 to 54 and 55+ years. Paired t-tests were used to assess differences between sexes and age groups (p value set at < 0.05). Paired t-tests were used to assess differences in percentage reporting very good or excellent mental and general health between those exercising or not and those increasing screen habits or not (presented as $p < 0.05$ and $p < 0.001$ in Figure 1 and Table 2). Paired t-tests were used to assess differences between various combinations of outdoor exercise and screen habits (Figure 2), with the significance level set to < 0.01 to account for multiple comparisons.

Results

Fewer CPSS participants self-perceived their mental health as very good or excellent when compared with the 2018 Canadian Community Health Survey (CCHS) (55 versus 69%). Self-perceived general health was more consistent between CPSS participants and the 2018 CCHS (67 versus 61%). In the CPSS, more men (60%) reported very good or excellent mental health when compared with women (49%), while no sex difference was evident for general health (69% in men vs 66% in women). A higher per-

centage of participants aged 55+ (67%) reported very good or excellent mental health compared with 20 to 34 year olds (44%) and 35 to 54 year olds (48%), while the opposite was true for general health with the percentage reporting very good or excellent declining with age (20-to-34 years: 74%, 35-to-54 years: 69%, 55+: 62%).

Exercise and screen habits

About two thirds of men and women reported exercising outdoors and more women reported exercising indoors compared with men (63 versus 55%, $p < 0.05$) (Table 1). A higher percentage of men aged 55+ years (70%) reported exercising outdoors compared with men aged 20 to 34 years (56%) and 35 to 54 years (59%) ($p < 0.05$). Reasons for exercising outdoors ranged from 2% (mental health), to 10% (physical health), to 52% (both mental and physical health); the remaining 36% reported they were not exercising outdoors. Reasons for exercising indoors ranged from 1% (mental health), to 16% (physical health), to 42% (both mental and physical health); the remaining 41% reported they were not exercising indoors.

The majority of participants reported that they increased their TV time (60% of men and 66% of women) and Internet usage (63% of men and 69% of women) while less than a quarter reported increased video game participation (Table 1). More women increased their TV and Internet usage compared with men, while more men reported increased video game use compared with women. The percentage reporting increases in screen habits declined with increasing age.

Exercise and mental health

The percentage of men who reported very good or excellent mental health did not vary according to whether they were exercising outdoors or indoors (Figure 1a). More women reported very good or excellent mental health if they were exercising outdoors. When examined overall for women aged 20+ years, the percentage reporting very good or excellent mental health did not vary according to whether they were exercising indoors or not ($p = 0.06$) (Figure 1a); however, significant differences were noted in women aged 35 to 54 (46 versus 37%, $p < 0.001$) and 55+ (67 versus 58%, $p < 0.001$).

Exercise and general health

The percentage of men who reported very good or excellent general health did not vary according to whether they exercised outdoors or indoors (Figure 1b); however, when examined separately by age group, more men aged 55+ reported very good or excellent general health if they reported outdoor exercise (66%) compared with those who did not (51%) ($p < 0.05$). More women reported very good or excellent general health if they reported doing outdoor ($p < 0.001$) or indoor exercise ($p < 0.05$) (Figure 1b), with the difference for outdoor exercise driven by women aged 35+ years ($p < 0.001$) and the difference for indoor exercise driven by women aged 35 to 54 years ($p < 0.05$).

Screen habits and mental health

More men reported very good or excellent mental health if they maintained or decreased TV and video game usage compared with men who had increased time in these behaviours (Table 2). The difference for video games was driven by men aged 35 to 54 years. More women reported very good or excellent mental health if they maintained or decreased

Table 1
Percentage of men and women who reported outdoor exercise, indoor exercise and increases in TV, Internet or video game use

Age Group	Exercised outdoors			Exercised indoors			Increased TV			Increased Internet			Increased video games			Increased 2 or 3 types of screens		
	%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95% CI	
		from	to		from	to		from	to		from	to		from	to		from	to
20 years and older																		
Men	62.5	58.7	66.0	54.9	51.5	58.4	59.8	56.3	63.2	63.5	60.2	66.6	24.1	21.2	27.3	52.7	49.1	56.2
Women	64.4	61.1	67.6	63.0*	59.6	66.3	66.0*	63.2	68.6	68.7*	65.6	71.6	16.0*	13.6	18.6	56.7	53.4	60.0
20 to 34 years																		
Men	56.4	47.8	64.6	54.5	46.1	62.6	59.6	50.4	68.2	75.8	67.6	82.5	50.6	42.3	58.9	63.9	54.9	72.1
Women	62.9	55.0	70.2	65.2	57.8	72.0	72.7*	66.2	78.3	74.8	67.5	80.9	29.4*	23.1	36.6	67.8	60.7	74.3
35 to 54 years																		
Men	58.8	52.9	64.4	56.7	51.1	62.1	61.8	56.2	67.2	62.9[†]	57.2	68.2	21.3[†]	17.5	25.6	53.6[†]	48.2	58.9
Women	62.2	56.7	67.4	60.8	55.3	66.0	68.1	63.6	72.4	74.2*	69.8	78.3	15.5^{††}	11.8	19.9	60.0[†]	55.0	64.8
55 and over																		
Men	69.7^{††}	64.4	74.5	53.7	48.7	58.5	58.1	53.4	62.7	55.9[†]	51.1	60.7	7.2^{†††}	5.1	10.0	43.3[‡]	38.2	48.6
Women	67.2	62.1	71.9	63.4	58.6	68.0	60.2^{††}	55.7	64.5	60.5^{††}	55.8	65.1	7.3^{††}	5.5	9.7	46.3[‡]	41.2	51.4

* significantly different from males, $p < 0.05$

[†] significantly different from 20-to-34 year olds, $p < 0.05$

[‡] significantly different from 35-to-54 year olds, $p < 0.05$

[§] use with caution, co-efficient of variation > 16.6

Note: CI: confidence interval.

Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1).

Table 2

Percentage of participants who self-rated their mental or general health as very good or excellent according to whether or not they increased TV, Internet or video game time

Age group	Percentage who reported very good or excellent mental health						Percentage who reported very good or excellent general health					
	Men			Women			Men			Women		
	%	95% CI		%	95% CI		%	95% CI		%	95% CI	
		from	to		from	to		from	to		from	to
Increased TV												
20 years and older												
Yes	57.0	52.3	61.6	42.8	39.1	46.6	65.7	61.2	70.0	62.9	58.6	67.0
No	65.2*	59.8	70.3	62.0**	57.4	66.4	73.9*	69.1	78.3	71.8*	67.4	75.8
20 to 34 years												
Yes	49.5	38.9	60.1	30.7	23.8	38.6	71.2	59.7	80.5	70.5	61.2	78.3
No	59.9	46.2	72.1	44.0	32.8	56.0	77.9	65.9	86.6	80.5	70.8	87.5
35 to 54 years												
Yes	50.7	43.1	58.2	37.4	31.5	43.7	70.1	62.4	76.9	61.7	55.1	68.0
No	59.6	51.3	67.4	52.4*	44.8	59.9	78.2	70.9	84.0	73.1*	66.0	79.3
55 years and older												
Yes	68.0	61.7	73.7	57.3	50.9	63.4	57.9	51.8	63.8	58.5	51.8	64.9
No	73.1	66.0	79.2	75.9**	69.6	81.2	68.1*	60.5	74.9	67.3	60.4	73.6
Increased Internet												
20 years and older												
Yes	58.4	53.7	62.8	44.5	40.8	48.2	68.7	64.4	72.7	63.3	59.4	67.1
No	63.2	57.6	68.5	60.5**	55.1	65.7	68.6	63.0	73.8	70.8*	65.1	76.0
20 to 34 years												
Yes	52.0	42.0	62.0	31.8	25.4	39.0	71.6	61.4	80.0	68.0	59.0	75.8
No	58.9	43.4	72.9	43.0	28.7	58.4	81.3	67.2	90.1	88.4*	79.8	93.6
35 to 54 years												
Yes	53.7	46.9	60.3	39.5	33.8	45.5	73.0	66.9	78.3	62.7	56.6	68.5
No	55.0	45.1	64.5	49.5	40.5	58.5	72.4	61.8	81.0	71.6	62.6	79.1
55 years and older												
Yes	68.6	62.4	74.2	59.0	52.9	64.9	61.9	55.6	67.9	60.5	54.4	66.3
No	71.0	63.6	77.3	74.4*	67.1	80.5	61.3	53.7	68.4	63.8	55.0	71.7
Increased Video Games												
20 years and older												
Yes	48.2	40.6	55.8	28.5	21.8	36.3	69.6	61.9	76.4	63.8	55.0	71.9
No	63.2*	59.2	67.1	52.1**	48.7	55.5	69.0	65.0	72.7	66.8	63.1	70.2
20 to 34 years												
Yes	49.0	37.3	60.7	18.9	11.3	29.9	73.7	61.2	83.3	72.3	58.0	83.1
No	58.4	46.9	69.0	40.9*	33.0	49.3	74.1	63.1	82.8	73.7	64.7	81.0
35 to 54 years												
Yes	39.3	29.5	50.1	31.6	20.4	45.4	64.9	54.2	74.3	54.2	40.4	67.3
No	57.6*	51.0	63.9	43.5	38.1	49.1	75.0	68.6	80.5	68.2	62.4	73.4
55 years and older												
Yes	69.8	52.9	82.6	49.4	34.8	64.2	61.4	44.1	76.2	59.3	44.7	72.5
No	70.0	64.8	74.6	65.7	60.4	70.6	61.9	56.3	67.1	62.0	56.3	67.4

* significantly different from increasing that type of screen time, $p < 0.05$

** significantly different from increasing that type of screen time, $p < 0.001$

Notes: CI: confidence interval. "Yes" includes those who reported that they had increased their TV, Internet or video game time while "no" includes those who reported they had decreased or not changed their TV, Internet or video game time.

Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1).

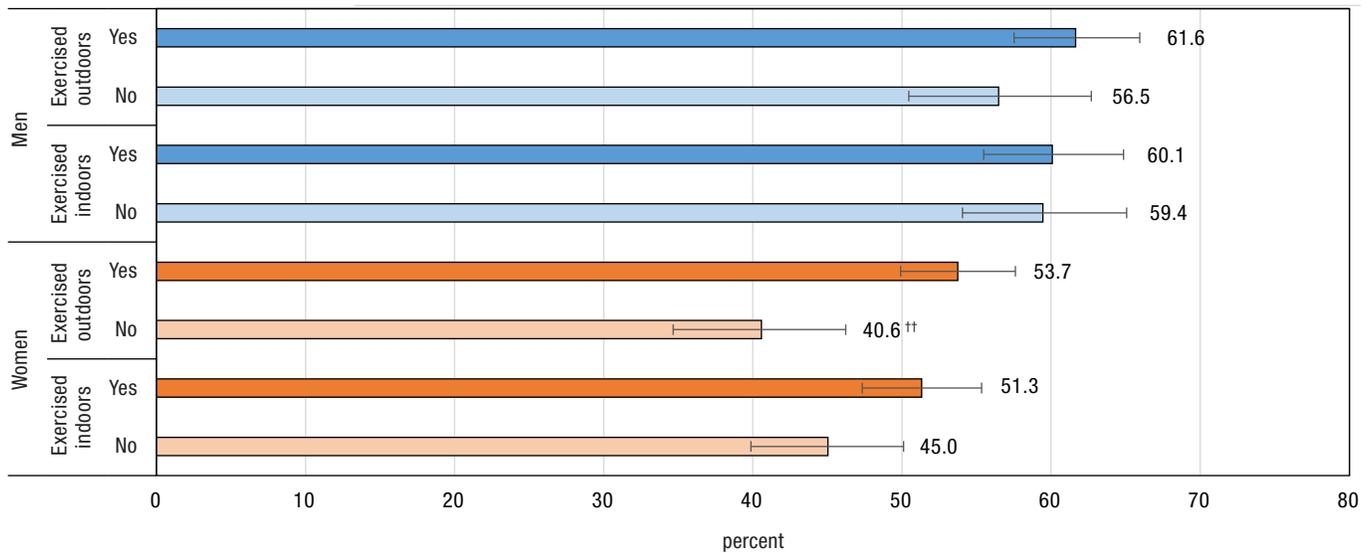
TV, Internet and video game time compared with women who increased any of these screen behaviours. This difference was driven by women aged 35+ for TV, women aged 55+ for Internet and women aged 20 to 34 years for video games.

Screen habits and general health

More men and women reported very good or excellent general health if they maintained or decreased their TV time compared with participants who had increased TV time, with the difference in men driven by those aged 55+ years and

the difference in women driven by 35 to 54 year olds (Table 2). More women reported very good or excellent general health if they maintained or decreased Internet time compared with women who had increased Internet time, with this finding driven by women aged 20 to 34 years.

Figure 1A
Percentage of men and women reporting very good or excellent mental health, according to outdoor and indoor exercise

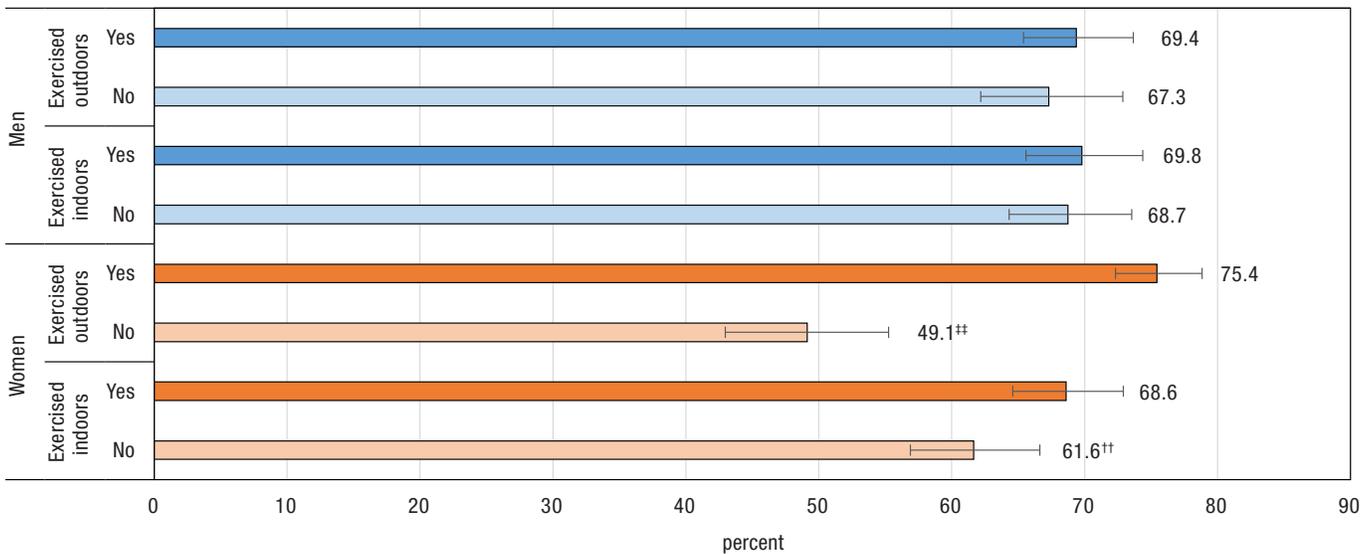


^{††} significantly different from those who exercised, $p < 0.05$

Note: Error bars represent 95% confidence intervals.

Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1).

Figure 1B
Percentage of men and women reporting very good or excellent general health, according to outdoor and indoor exercise



^{††} significantly different from those who exercised, $p < 0.05$

^{††} significantly different from those who exercised, $p < 0.001$

Note: Error bars represent 95% confidence intervals.

Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1).

Clustering of exercise and screen habits and mental health

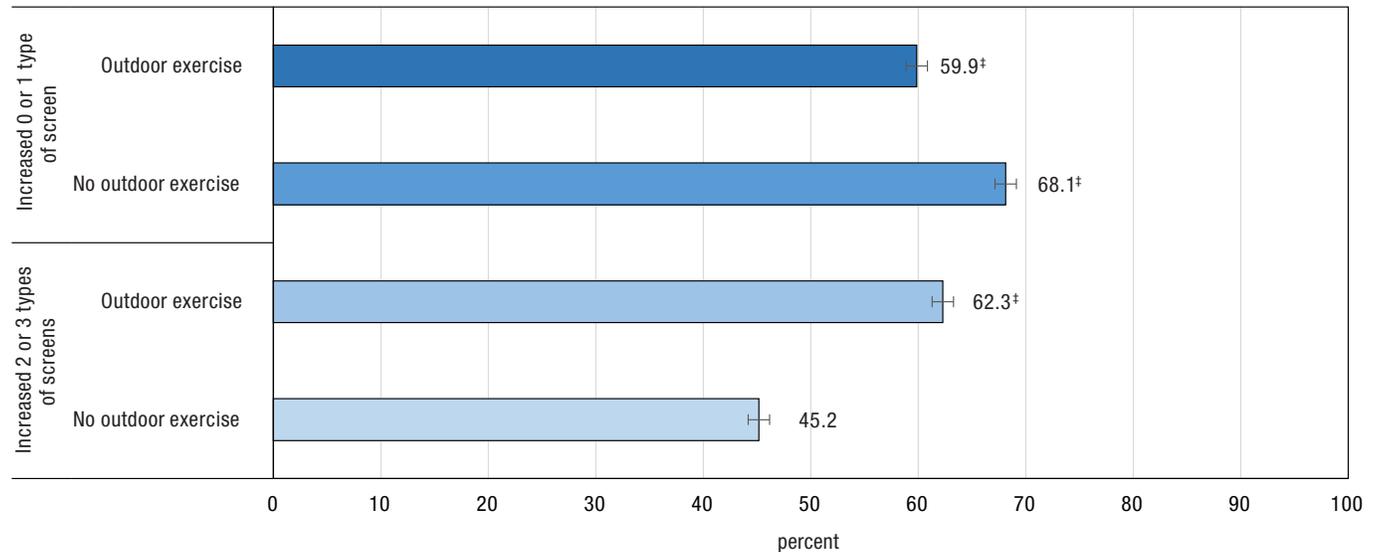
Men and women who increased none or 1 type of screen and/or were exercising outdoors were more likely to report

very good or excellent mental health, when compared to those who reported increasing 2 or 3 types of screens and who were not exercising outdoors (Figure 2a,b).

Clustering of exercise and screen habits and general health

The percentage of participants reporting very good or excellent general health did not vary by the various combina-

Figure 2A
Percentage of men reporting very good or excellent mental health, according to various combinations of screen and outdoor exercise behaviours

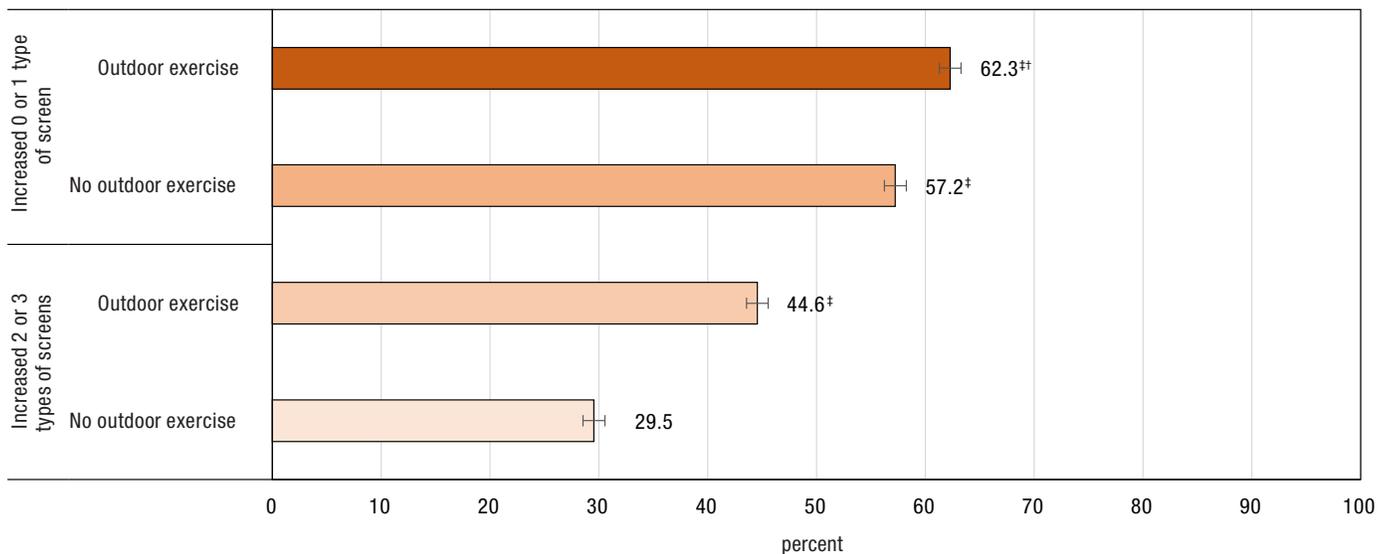


[†] significantly different from increasing 2 or 3 types of screens + no outdoor exercise, $p < 0.01$

Note: Error bars represent 95% confidence intervals.

Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1).

Figure 2B
Percentage of women reporting very good or excellent mental health, according to various combinations of screen and outdoor exercise behaviours



[†] significantly different from increasing 2 or 3 types of screens + outdoor exercise, $p < 0.01$

^{††} significantly different from increasing 2 or 3 types of screens + no outdoor exercise, $p < 0.01$

Note: Error bars represent 95% confidence intervals.

Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1)

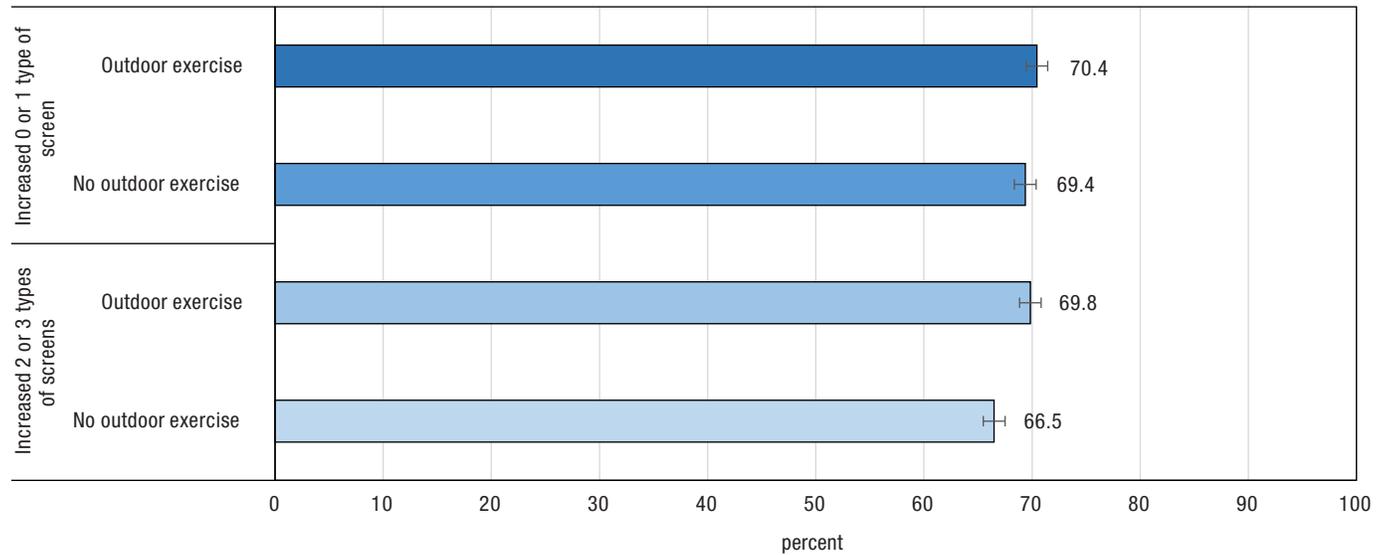
tions of screen and exercise habits for men (Figure 2c), but did for women (Figure 2d). Regardless of screen habits, women who were exercising outdoors reported better general health than those

who were not exercising outdoors. The highest percentage observed was for women who increased none or 1 type of screen and who were also exercising outdoors (79%).

Interpretation

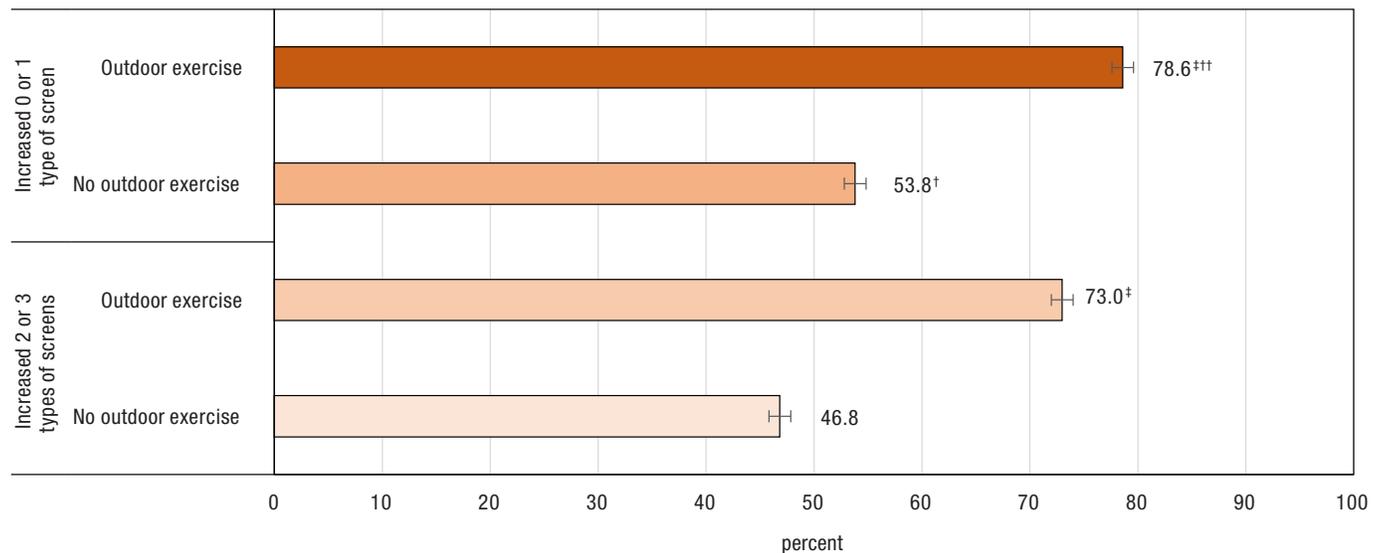
In general, the present study found that participants who were exercising outdoors and limiting increases in screen

Figure 2C
Percentage of men reporting very good or excellent general health, according to various combinations of screen and outdoor exercise behaviours



Note: Error bars represent 95% confidence intervals.
 Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1)

Figure 2D
Percentage of women reporting very good or excellent general health, according to various combinations of screen and outdoor exercise behaviours



[†] significantly different from increasing 2 or 3 types of screens + outdoor exercise, $p < 0.01$
[†] significantly different from increasing 2 or 3 types of screens + no outdoor exercise, $p < 0.01$
^{††} significantly different from increasing none or 1 type of screen + no outdoor exercise, $p < 0.01$
 Note: Error bars represent 95% confidence intervals.
 Source: Canadian Perspective Survey Series – Impacts of COVID-19 (CPSS1)

time during the COVID-19 pandemic were more likely to self-perceive their mental and general health highly, and this finding tended to be more pronounced in women. Exercise and screen habits appeared to impact self-perceived mental health more than general health. Previous research has found that exercise is an important strategy for managing mental health²⁷ and a link between excessive screen time and depression¹⁸ as well as poor mental health has been reported.¹⁹ The present study also found that minimizing the number of screens increased combined with outdoor exercise offered additional benefit beyond either behaviour alone, especially among women; a finding that is consistent with previous research demonstrating the importance of balancing screen behaviour with adequate levels of physical activity.^{28,29}

The differences observed in the percentage reporting very good or excellent general or mental health according to exercise and screen habits were consistently greater among women when compared with men. Further, the cluster analysis (Figure 2) indicated there was a relatively stronger effect from outdoor exercise when compared to screen behaviour in women. Providing an explanation for this sex difference in the link between healthy exercise and screen behaviours with self-perceived health is difficult with the limited data available in this survey; however this finding is consistent with some previous studies that observed a stronger association between physical activity and reducing depressive

symptoms among women when compared with men.^{30,31}

The CPSS is providing information during a time when normal health surveillance mechanisms are on hold in Canada, but important limitations should be noted. This study could only report whether a participant had increased, decreased or not changed their screen behaviours. No information was available about baseline or pre-pandemic screen time levels nor was any information available about the reason why participants increased their Internet time. Some aspects of increased Internet time could be considered positive (e.g., communication with family and friends) while other reasons could have a negative effect on mental health (e.g., excessive focus on a negative news cycle). In the present study, fewer participants reported very good or excellent mental health if they had increased their Internet time and this may indicate a negative association between increased Internet usage and mental health. The CPSS exercise questions are not comparable with previous Statistics Canada surveys and information about the frequency, dose or change in exercise habits relative to pre-pandemic levels was not captured. Further, the exercise questions did not include examples of what constitutes “exercise” and this could have led to some confusion around inclusion of lighter intensity activities such as gardening or chores. The cross-sectional design and timing of the survey amidst the COVID-19 pandemic limits any causal interpretations about the general

link between exercise or screen behaviour and health. It is also likely that the association is bi-directional. It is possible that reduced mental or general health during the pandemic period may have led to increased screen time and/or decreased exercise. Moreover, the ability to engage in outdoor exercise may also reflect socio-economic status and/or proximity to greenspace. While beyond the scope of the present study, a gradient was evident between exercise and level of education such that those with a bachelor degree or higher were more likely to report indoor and outdoor exercise compared to those with lower education. The social determinants of these associations are important areas to examine in future analyses. Nonetheless, the study identifies potential behavioural targets that appear to promote improved perceptions of health during a challenging time in the lives of Canadians.

The results of the present study suggest that avoiding excessive screen time and engaging in exercise, particularly outdoors, were important behaviours associated with better perceived mental and general health during the COVID-19 pandemic. It is impossible to predict when the COVID-19 pandemic will subside and it is possible that physical distancing measures will be a necessary part of life for the foreseeable future. Physical activity has always been important for a variety of health outcomes and this study supports the notion that healthy active living is particularly vital during times of confinement to help people maintain their mental and physical health.

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