

# Working From Home During the COVID-19 Pandemic

## The Association With Work Productivity Loss Among Patients and Caregivers

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**Objective:** The aim of this study was to measure the association of working from home (WFH) with work productivity loss due to caregiving responsibilities or health problems during the COVID-19 pandemic. **Methods:** We conducted an online survey of family/friend caregivers (n = 150 WFH/75 non-WFH) and patients (n = 95/91) who worked during the past 7 days in May and July 2020, respectively. Absenteeism and presenteeism were measured using the Valuation of Lost Productivity questionnaire. **Results:** Working from home was associated with higher odds of absenteeism (odds ratio, 2.53; 95% confidence interval, 1.11 to 5.77) and presenteeism (2.79; 1.26 to 6.18) among caregivers and higher odds of presenteeism among patients (2.78; 1.13 to 6.84). However, among caregivers with absenteeism more than 0 days, WFH was significantly associated with fewer absent workdays. **Conclusions:** Working from home was not associated with overall absenteeism and presenteeism in caregivers or patients. Working from home allows a more flexible and inclusive workplace without impacting productivity, although further research is needed.

**Keywords:** working from home, work productivity loss, absenteeism, presenteeism, caregiver, patient

Working from home (WFH) has been researched since the 1980s under a broader term “telework.”<sup>1</sup> The term “telework” was first coined by Nilles<sup>1</sup> as “includes all work-related substitutions of telecommunications and related information technologies for travel (from substitution of telephone calls or electronic mail for personal visits to the use of full-motion videoconferencing as a substitute for executive travel).” Early studies in the 1970s and 1980s focused on telecommuting-induced travel impacts by measuring WFH time and commute distance and time.<sup>1</sup> In more recent studies (2000–2020) systematically reviewed by Athanasiadou and Theriou,<sup>2</sup> there was a lack of universally accepted definition of telework, and terms, such as “telework,” “homeworking,”

“telehomeworking,” “working from home,” “telecommuting,” “remote working,” “virtual work,” and “e-work,” have been used interchangeably in the literature. However, researchers have commonly distinguished and studied three main types of telework: a) home-based work or WFH; b) group-based teleworking in a satellite office or neighborhood office centers that are remote from the main office but close to employees; and c) mobile telework that “usually involves travel and/or spending time at the customers' premises.”<sup>2,3</sup>

Work productivity is one of the main telework outcomes in recent studies.<sup>2,4</sup> According to Athanasiadou and Theriou<sup>2</sup> and a review of national studies from 15 countries conducted by Messenger et al,<sup>4</sup> most studies suggested teleworking improves individual work productivity. A meta-analysis also found a small but positive association between teleworking and perceptions of increased productivity.<sup>5</sup> However, there were a few exceptions. Dutcher<sup>6</sup> demonstrated that teleworking had a positive effect on productivity for creative tasks but a negative effect on productivity for dull tasks. Perez et al<sup>7</sup> showed a negative relationship between telework and productivity when the teleworker has a dual role, including raising children.

Working from home became a more common or only option for many workplaces because of the public health measures at the beginning of the COVID-19 pandemic. Studies have been conducted to measure the impact of WFH on work productivity among working populations during the pandemic. These results were mixed depending on the setting, population, occupation, and time of the survey.<sup>8–18</sup> Smite et al<sup>8</sup> reviewed 13 surveys conducted in different countries to measure the changes in perceived productivity among the software engineers during the pandemic; in four surveys, most respondents reported decreased productivity; in six surveys, most respondents reported no changes; and in three surveys, most respondents reported increased productivity. Based on the Labour Force Survey conducted by Statistics Canada, 90% of employees who usually worked outside the home before the pandemic but worked most of their hours at home during February 14 to 20, 2021, reported being at least as productive as they were in their usual workplace (58% the same and 32% more productive).<sup>19</sup> Awada et al<sup>9</sup> found that the overall perception of productivity did not change compared with in-office productivity before the pandemic among survey respondents who were WFH in the United States. However, the number of hours spent at a workstation increased by 1.5 hours during a typical WFH day. In contrast, Huls et al<sup>10</sup> found that survey respondents from the Netherlands, who had paid work for at least 24 hours per week and worked at home at least 4 hours per week because of lockdown, spent 4.8 less hours per week (14%) on paid work, and their productivity decreased by 5.5%.

Decreased work productivity was also observed among a working population in Austria,<sup>14</sup> workers in manufacturing firms in Japan,<sup>12</sup> and a representative sample of employees and employers in Japan.<sup>18</sup> On the other hand, increased work productivity was observed among certain professions who worked from home only part time in the United States,<sup>11</sup> vocational counseling psychologists in Switzerland,<sup>13</sup> inpatient and infusion pharmacists at a US comprehensive cancer center,<sup>15</sup> pediatric neuroradiologists in a US quaternary pediatric academic hospital,<sup>16</sup> and public health workers from a large local health district in Australia.<sup>17</sup>

In the working-age population, there is a high proportion of people who are living with at least one chronic condition (ie, patients)

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**Ethics Approval and Consent to Participate:** This study was approved by the University of British Columbia–Providence Health Care Research Ethics Board (Ethics Certificate No. H19-00329). The online survey participants provided their consent online to continue the survey.

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or who are providing care or help family members or friends with a chronic condition, a physical or mental disability, or problems related to aging (ie, caregivers who are family members or friends instead of paid professionals). In Canada, the percentage of population that reports having been diagnosed with at least 1 of 10 common chronic conditions is 23.8% in the age group of 20 to 34 years, 31.0% in the age group of 35 to 49 years, and 51.6% in the age group of 50 to 64 years.<sup>20</sup> The proportion of people who are caregivers by age group is 16.8% for 25 to 34 years, 20.4% for 35 to 44 years, 32.9% for 45 to 54 years, and 33.9% for 55 to 64 years.<sup>21</sup> Studies have demonstrated the higher work productivity loss due to health problems among patients<sup>22–25</sup> or caregiving responsibilities among caregivers.<sup>25–27</sup>

Only a few studies measured the impact of WFH on work productivity loss due to health problems during the pandemic. One study among a random sample of employees working in the Austrian finance, insurance, and IT sectors suggested that WFH was not directly associated with increased sickness presenteeism propensity (defined as the probability that an employee chooses presence at work over absence from work when sick).<sup>28</sup> Shimura et al<sup>29</sup> found that remote working 5 days a week was associated with higher odds of worsening health-related presenteeism (defined as work productivity loss at work) compared with 0-day remote working among a sample of workers from 23 companies from tertiary industries in Japan.

The impact of WFH on work productivity loss among patients and caregivers during the COVID-19 pandemic remains unclear. Our objectives were to measure the associations of WFH with having work productivity loss (absenteeism or presenteeism), work productivity loss among those with absenteeism or presenteeism, and total absenteeism and total presenteeism due to a) caregiving responsibilities among caregivers who were caring for a family member or friend living with a chronic condition, and b) health problems among patients.

## METHODS

### Study Design and Population

Both caregivers and patients were recruited from online panel of Ipsos, a market research company, with predefined quota to represent the age (25 to 64 years), sex, and province/region distribution of Canada's caregiver population<sup>30</sup> and patient population.<sup>20</sup> We targeted a sample of 400 caregivers, at least 200 of whom had worked in the past 7 days before completing the survey, and a sample of 200 patients who had worked in the past 7 days. The online survey was conducted among caregivers on May 15, 2020, to June 2, 2020, and among patients on July 11, 2020, to July 17, 2020.

At our screening stage, we defined caregivers as individuals who were “currently caring for a family member or friend living with a chronic condition (a long-term condition diagnosed by a health professional lasting 6 months or longer).” Patients were defined as individuals who were currently living with any of 25 chronic conditions (a long-term condition diagnosed by a health professional lasting 6 months or longer), including allergies; Alzheimer's disease or any dementia; anxiety disorder; arthritis; asthma; autism; bowel disorders; cancer; chronic bronchitis, emphysema, or chronic obstructive pulmonary disease; chronic pain; diabetes; Down syndrome; fibromyalgia; heart disease; high blood cholesterol or lipids; high blood pressure; kidney disease; migraines; mood disorder; multiple sclerosis; osteoporosis; sleep apnea; stomach ulcers; stroke; and urinary incontinence.

This study was approved by the University of British Columbia–Providence Health Care Research Ethics Board (Ethics Certificate No. H19-00329). The online survey participants provided their consent online to continue the survey.

### Dependent Variables

The Valuation of Lost Productivity (VOLP) questionnaire was the main component of the online survey. The VOLP, measuring

productivity loss due to health problems among patients, has been validated and used for different diseases such as rheumatoid arthritis, asthma, systemic autoimmune rheumatic disease, cardiovascular disease/risk, and multiple sclerosis.<sup>31–39</sup> The VOLP was then adapted and validated to measure work productivity loss due to caregiving responsibilities among caregivers.<sup>40</sup> The dependent variables of this study were absenteeism and presenteeism. Absenteeism was defined as the number of absent work days due to caregiving responsibilities for caregivers or due to health for patients in the past 3 months. Presenteeism, indicating reduced work productivity while working, was measured by the percentage time loss while working in the past 7 days due to caregiving responsibilities for caregivers or due to health for patients. The percentage time loss was derived from the following formula:  $\frac{A-B}{A}$ , where  $A$  is the total hours survey respondents took to complete all work in the past 7 days, and  $B$  is the total hours survey respondents would take to complete the same work if they did not have caregiving responsibilities or did not experience any health problems.<sup>32,40</sup>

### Key Independent Variable

Among those who answered yes to “In the past 7 days, have you worked” in the VOLP, we further asked whether they worked from home (yes vs no). The survey respondents were then categorized into WFH and non-WFH groups.

### Potential Confounders

We considered the following potential confounders: 1) demographic characteristics including age as a categorical variable (25 to 34, 35 to 44, 45 to 54, or 55 to 64), sex (male or female), ethnicity (Asian, European, or others), marital status (currently married or common law vs widowed, divorced, separated, or never married), and province; 2) socioeconomic status including personal income as a categorical variable (<\$50,000, \$50,000 to \$99,999, and \$100,000 or more) and highest education completed (high school or under, college or technical/trade, university, and postgraduate or professional designation); 3) health status including self-rated health status (excellent or very good, good, or fair or poor), patient self-rated chronic condition severity level (mild, moderate, or severe), and care receiver's chronic condition severity level as rated by caregivers; and 4) work-related characteristics including current employment status (full time, part time, or self-employed) and occupation (management; business, finance, and administration; natural and applied sciences and related; education, law and social, community and government services; sales and service; or other), which was categorized based on the National Occupation Classification 2016 version 1.1.<sup>41</sup>

For patient respondents, we also measured their work habits (usually sit; stand or walk quite a lot; or often have to climb stairs or hills, usually lift or carry light loads, or do heavy work or carry very heavy loads) and the frequency of working within a team (none or a little of the time, some of the time, or most or all of the time). For caregiver respondents, we measured caregiver respondents including caregiving length (less than 1 year, 1 to 3 years, 3 to 5 years, or more than 5 years), caregiving hours (total hours spent on all caregiving responsibilities including household activities and tasks, personal care, practical support, emotional support, and other responsibilities) in the past 7 days, whether they were compensated for their caregiving time (yes or no), and whether their care receivers received care from other informal or professional caregivers at home in the past 7 days (yes or no). The categorization of each variable above ensured at least five respondents for each category by WFH status.

### Statistical Analysis

Descriptive statistics of the WFH and non-WFH groups among caregivers and patients were reported. Categorical variables were compared using Pearson chi-square or Fisher exact tests, whereas continuous variables were compared using the Wilcoxon rank sum test. Because of inflated zeros and highly skewed data distribution, we used two-part models as suggested from previous studies<sup>42–44</sup> to measure

the association between WFH and work productivity loss (absenteeism or presenteeism) among patients and caregivers separately. Logistic regression models were used for the first part to measure the probabilities of having any absenteeism or having any presenteeism. Gamma regression was used for the second part of absenteeism >0 because of the skewed data distribution,<sup>42-44</sup> whereas Beta regression was used for presenteeism >0 because of the presenteeism outcome range of 0 to 1.<sup>42,45</sup> The average marginal effects of WFH on overall absenteeism and presenteeism and 95% confidence interval (CI) were then calculated using Bootstrap methods with 5000 replications.

For final model selection, we started by including all potential confounders that differed between the WFH group and the non-WFH group with *P* < 0.2 among caregivers or patients.<sup>46</sup> In our final multivariable regressions, we adjusted for all possible confounders except income for four reasons: 1) its associations with the outcomes were not significant at  $\alpha = .05$  in all the multivariable logistic regressions; 2) removing the variable from the regression models did not change the coefficient size of the association of WFH with all the outcomes; 3) removing the variable improved the model fit in terms of the Bayesian Information Criterion from all logistic regression models; and 4) removing the variable increased sample size for both patients and caregivers because a higher proportion of survey participants preferred not to report their income. We performed all analyses using SAS version 9.4 (SAS Institute, Cary, NC).

## RESULTS

Among the targeted 400 caregivers, we excluded respondents who did not work in the past 7 days (*n* = 159), reported total caregiving hours deemed too long (ie, more than 126 hours in the past 7 days assuming the average individual would get 6 hours of sleep) (*n* = 9), or did not provide valid answers for confounders (*n* = 7). The final sample size included for analysis was 225 caregivers. Among the targeted 200 patients, after excluding respondents who did not have at least one chronic condition (*n* = 1) or did not work in the past 7 days (*n* = 13), we ended up with a sample size of 186 patients.

### Sample Characteristics by WFH Status

Table 1 and Table S1 (in Supplemental Digital Content 1, <http://links.lww.com/JOM/B176>) present caregiver and patient characteristics by WFH status. There were 150 caregivers and 95 patients WFH and 75 caregivers and 91 patients not WFH in the past 7 days. There was a higher proportion of WFH caregivers who had higher education levels, higher incomes, occupations in management, business, finance and administration, and natural and applied sciences, had fair or poor health status, who were not compensated for their caregiving time, and who received help from other informal or professional caregivers than non-WFH caregivers. Working from home patients had higher education levels and incomes and occupations in management and natural

**TABLE 1.** Study Sample Characteristics by WFH Status

Variable	Caregivers			Patients		
	WFH (n = 150)	Non-WFH (n = 75)	<i>P</i>	WFH (n = 95)	Non-WFH (n = 91)	<i>P</i>
Age			0.125			0.199
25–34 y	32 (21.3%)	25 (33.3%)		14 (14.7%)	13 (14.3%)	
35–44 y	31 (20.7%)	14 (18.7%)		25 (26.3%)	13 (14.3%)	
45–54 y	60 (40.0%)	20 (26.7%)		24 (25.3%)	25 (27.5%)	
55–64 y	27 (18.0%)	16 (21.3%)		32 (33.7%)	40 (44.0%)	
Female	75 (50.0%)	31 (41.3%)	0.220	57 (60.0%)	46 (50.5%)	0.195
Married/common law <sup>a</sup>	93 (62.0%)	47 (62.7%)	0.923	56 (59.6%)	57 (62.6%)	0.669
Ethnicity <sup>a</sup>			0.417			0.799
Asian	41 (27.7%)	14 (19.7%)		19 (20.7%)	19 (21.6%)	
European	94 (63.5%)	49 (69.0%)		63 (68.5%)	62 (70.5%)	
Others	13 (8.8%)	8 (11.3%)		10 (10.9%)	7 (8.0%)	
Highest level of education completed			<0.001			0.026
High school or less	21 (14.0%)	16 (21.3%)		12 (12.6%)	21 (23.1%)	
College or technical/trade	25 (16.7%)	28 (37.3%)		27 (28.4%)	36 (39.6%)	
University	68 (45.3%)	19 (25.3%)		42 (44.2%)	27 (29.7%)	
Postgraduation or professional designation	36 (24.0%)	12 (16.0%)		14 (14.7%)	7 (7.7%)	
Personal income <sup>a</sup>			<0.001			0.004
Less than \$50,000	32 (21.9%)	34 (47.2%)		21 (23.6%)	42 (47.2%)	
\$50,000–\$99,999	74 (50.7%)	26 (36.1%)		53 (59.6%)	39 (43.8%)	
\$100,000 or more	40 (27.4%)	12 (16.7%)		15 (16.9%)	8 (9.0%)	
Current employment status			0.443			0.002
Employed full time	110 (73.3%)	54 (72.0%)		71 (74.7%)	64 (70.3%)	
Employed part time	22 (14.7%)	15 (20.0%)		8 (8.4%)	22 (24.2%)	
Self-employed	18 (12.0%)	6 (8.0%)		16 (16.8%)	5 (5.5%)	
Occupation			0.005			< 0.001
Management	66 (44.0%)	20 (26.7%)		33 (34.7%)	15 (16.5%)	
Business, finance, and administration	17 (11.3%)	5 (6.7%)		22 (23.2%)	20 (22.0%)	
Natural and applied sciences and related	22 (14.7%)	7 (9.3%)		18 (18.9%)	5 (5.5%)	
Education, law and social, community and government services	13 (8.7%)	11 (14.7%)		7 (7.4%)	7 (7.7%)	
Sales and service	18 (12.0%)	14 (18.7%)		8 (8.4%)	19 (20.9%)	
Others	14 (9.3%)	18 (24.0%)		7 (7.4%)	25 (27.5%)	
Self-rated health status			0.090			0.478
Excellent or very good	65 (43.3%)	39 (52.0%)		32 (33.7%)	24 (26.4%)	
Good	51 (34.0%)	28 (37.3%)		46 (48.4%)	46 (50.5%)	
Fair or poor	34 (22.7%)	8 (10.7%)		17 (17.9%)	21 (23.1%)	

Chi-square or Fisher exact test was used for categorical variables.

<sup>a</sup>With respondents who did not provide valid answers.

and applied sciences, were more likely to work full-time or be self-employed, usually sat during the work day, and worked less frequently within a team than non-WFH patients.

Caregivers and patients were asked to select any chronic conditions that their care receivers or they had (a full list can be found in Tables S2 and S3, Supplemental Digital Content 1, <http://links.lww.com/JOM/B176>). Among all caregivers, the most common chronic conditions care receivers had were diabetes (27.1%), arthritis (26.2%), high blood pressure (24.9%), chronic pain (23.1%), anxiety disorder (15.6%), and high blood cholesterol or lipids (15.6%) (Table S2). For patients, the common chronic conditions were allergies (39.2%), high blood pressure (25.3%), asthma (18.8%), high blood cholesterol or lipids (18.8%), and anxiety disorder (17.2%) (Table S3).

### Absenteeism and Presenteeism by WFH Status

More caregivers were absent from work in the past 3 months in the WFH group compared with the non-WFH group (50.0% vs 33.3%; Table 2). Among those with absenteeism, the median number of absent workdays was similar among WFH caregivers (4 days; Q1–Q3, 2 to 6) and non-WFH caregivers (4 days; 2 to 10 days). More caregivers also had presenteeism in the past 7 days in the WFH group compared with the non-WFH group (42.7% vs 22.7%). Among those with presenteeism, the median percentage time loss while working was 20% (13% to 33%) in WFH caregivers compared with 25% (11% to 38%) in non-WFH caregivers.

A similar proportion of patients was absent from work in the past 3 months between the WFH and non-WFH groups (33.7% vs 37.4%). Working from home patients were more likely to have time loss while working than non-WFH patients (38.9% vs 23.1%). Among those with presenteeism, the percentage time loss while working was similar between WFH and non-WFH patients (median, 20% [13% to 38%] vs 20% [13% to 33%]).

### Association of WFH With Absenteeism and Presenteeism

After adjusting for the confounders, the first part of the two-part models using a logistic regression model showed that WFH was significantly associated with a higher odds of being absent from work

in the past 3 months (odds ratio, 2.53; 95% CI, 1.11 to 5.77) as well as having time loss while working in the past 7 days (2.79; 1.26–6.18) among caregivers (Fig. 1). Working from home patients were not significantly more likely to be absent from work (1.36; 0.57–3.23) but were more likely to have time loss while working (2.78; 1.13–6.84).

Among those with absenteeism >0 days, WFH was associated with fewer absent work days in both caregivers (n = 75 WFH vs 25 non-WFH; coefficient = -0.62 [standard error, 0.24]) and patients (n = 32 WFH vs 34 non-WFH; coefficient = -0.18 [0.24]), although the association was not significant for patients (see Table S4, Supplemental Digital Content 1, <http://links.lww.com/JOM/B176>). Among those with presenteeism >0% time loss, WFH was associated with lower percentage time loss while working in caregivers (n = 64 vs 17; coefficient = -0.24 [0.27]) or patients (n = 37 vs 21; coefficient = -0.49 [0.33]), but the associations were not significant.

By combining the estimates obtained from two-part models, the average marginal effects of WFH on absenteeism and presenteeism were -0.99 (95% CI, -4.68 to 2.48) and 4% (-2% to 10%) for caregivers and -0.03 (-3.84 to 3.66) and 3% (-6% to 13%) for patients, respectively (Table 3). The 95% CI crossed 0 mainly because of the opposite effects of WFH in the two parts observed above: positive association with the probability of having absenteeism or presenteeism and negative association with the time loss from absenteeism and presenteeism among those having absenteeism or presenteeism.

Because the associations of the confounding variables with absenteeism and presenteeism were not the focus of the study, we highlighted significant associations in the Supplemental Digital Content 1, <http://links.lww.com/JOM/B176>. Their associations differed by work productivity loss outcome, the probability of absenteeism and presenteeism in the first part model (see Figure S1, Supplemental Digital Content 2, <http://links.lww.com/JOM/B177>, and Figure S2, Supplemental Digital Content 3, <http://links.lww.com/JOM/B178>), or the time loss from absenteeism and presenteeism in the second part model (see Table S4, Supplemental Digital Content 1, <http://links.lww.com/JOM/B176>), as well as by caregivers and patients.

### DISCUSSION

To the best of our knowledge, this is the first study assessing the association of WFH with work productivity loss including absenteeism

**TABLE 2.** Absenteeism and Presenteeism by WFH Status

Variable	Caregivers			Patients		
	WFH (n = 150)	Non-WFH (n = 75)	P	WFH (n = 95)	Non-WFH (n = 91)	P
Absenteeism in the past 3 mo						
Absent from work			0.018			0.600
No	75 (50.00%)	50 (66.67%)		63 (66.32%)	57 (62.64%)	
Yes	75 (50.00%)	25 (33.33%)		32 (33.68%)	34 (37.36%)	
No. absent workdays						
Mean (SD)	3.66 (8.97)	4.03 (13.60)	0.833	1.65 (4.16)	2.09 (9.50)	0.689
Median (Q1–Q3)	0.50 (0.00–4.00)	0.00 (0.00–2.00)	0.037	0.00 (0.00–1.00)	0.00 (0.00–2.00)	0.621
No. of absent workdays >0						
Mean (SD)	7.32 (11.61)	12.08 (21.66)	0.303	4.91 (6.00)	5.59 (15.04)	0.808
Median (Q1–Q3)	4.00 (2.00–6.00)	4.00 (2.00–10.00)	0.651	3.00 (1.00–5.00)	2.50 (1.00–5.00)	0.974
Presenteeism in the past 7 d						
Time lost while working			0.003			0.020
No	86 (57.33%)	58 (77.33%)		58 (61.05%)	70 (76.92%)	
Yes	64 (42.67%)	17 (22.67%)		37 (38.95%)	21 (23.08%)	
Percentage time loss while working						
Mean (SD)	0.11 (0.17)	0.06 (0.16)	0.078	0.10 (0.18)	0.06 (0.17)	0.161
Median (Q1–Q3)	0.00 (0.00–0.19)	0.00 (0.00–0.00)	0.005	0.00 (0.00–0.17)	0.00 (0.00–0.00)	0.027
Percentage time loss while working >0						
Mean (SD)	0.25 (0.17)	0.28 (0.25)	0.587	0.26 (0.21)	0.28 (0.25)	0.729
Median (Q1–Q3)	0.20 (0.13–0.33)	0.25 (0.11–0.38)	0.871	0.20 (0.13–0.38)	0.20 (0.13–0.33)	0.821

Fisher exact test was used for binary variables; *t* test and Wilcoxon rank sum test were used for continuous variables.

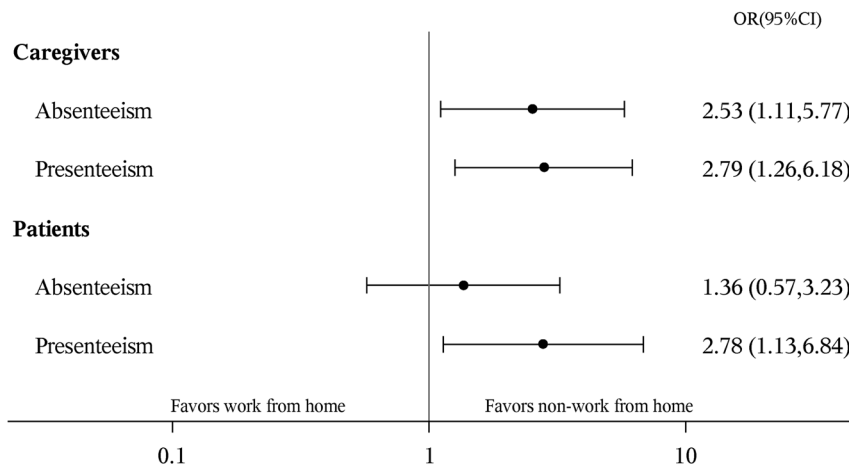


FIGURE 1. Logistic regression results for the association between WFH and absenteeism and presenteeism. OR, odds ratio.

and presenteeism among caregivers and patients during the COVID-19 pandemic. Our findings suggested that WFH was associated with a higher odds of absenteeism or presenteeism among both caregivers and patients. However, when focusing on the relatively smaller subgroups with absenteeism or presenteeism, WFH may be associated with lower work productivity loss. These two opposite associations led to no significant associations of WFH with overall absenteeism and presenteeism among both caregivers and patients.

Although many studies have investigated the impact of WFH on work productivity during COVID-19, the results varied by population, setting, occupation, and time of measurement.<sup>8-18</sup> Only a few studies have measured the impact of WFH on absenteeism and presenteeism due to health problems during the pandemic.<sup>28,29</sup> However, their study design and methods to measure presenteeism differed from ours and thus are not comparable. Gerich<sup>28</sup> measured the association of WFH with sickness presenteeism propensity among 517 employees in the

finance, insurance, and IT sectors of Austria between February and March 2021. Sickness presenteeism propensity was calculated as the number of sickness presence days divided by the sum of sickness presence and absence days in the past 12 months. Presenteeism propensity of employees with and without WFH experience in the past 12 months was found not significantly different, but using WFH for additional work after regular office hours, on weekends or days off, was associated with increased sickness presenteeism propensity. Steidelmüller et al<sup>47</sup> found a positive relationship between WFH and sickness presenteeism propensity using the 2015 European Working Conditions Survey. Shimura et al<sup>29</sup> measured presenteeism using the short form of Work Limitation Questionnaire (WLQ) in 2019 and 2020 among survey participants at 23 companies from tertiary industries of Japan who had never engaged in remote work in 2019. The WLQ presenteeism score was interpreted as the percentage of productivity loss due to health problems in the past 2 weeks. The 1-year change in presenteeism from 2019

TABLE 3. Average Marginal Effects of WFH on Overall Absenteeism and Presenteeism

Variable	Caregivers			Patients		
	WFH	Non-WFH	Difference	WFH	Non-WFH	Difference
Absenteeism in the past 3 mo						
Part 1: predicted probability of having absenteeism	0.49 (0.42 to 0.58)	0.34 (0.22 to 0.46)	0.16 (0.02 to 0.31)	0.38 (0.27 to 0.50)	0.33 (0.23 to 0.44)	0.05 (-0.13 to 0.23)
Part 2: predicted number of absent workdays <sup>a</sup>	7.11 (5.03 to 17.04)	13.19 (6.02 to 33.84)	-6.08 (-20.05 to 1.32)	5.27 (3.26 to 32.20)	6.31 (2.54 to 45.94)	-1.04 (-23.40 to 9.22)
Total number of absent workdays	3.56 (2.60 to 6.19)	4.54 (1.83 to 9.04)	-0.99 (-4.68 to 2.48)	1.68 (1.03 to 6.51)	1.71 (0.77 to 6.85)	-0.03 (-3.84 to 3.66)
Presenteeism in the past 7 d						
Part 1: predicted probability of having presenteeism	0.42 (0.34 to 0.50)	0.23 (0.13 to 0.35)	0.19 (0.03 to 0.34)	0.40 (0.29 to 0.51)	0.22 (0.12 to 0.33)	0.18 (-0.00 to 0.35)
Part 2: predicted percentage time loss while working <sup>b</sup>	0.31 (0.22 to 0.36)	0.35 (0.19 to 0.52)	-0.04 (-0.23 to 0.10)	0.30 (0.21 to 0.48)	0.39 (0.21 to 0.65)	-0.09 (-0.33 to 0.14)
Total percentage time loss while working	0.12 (0.09 to 0.15)	0.08 (0.03 to 0.13)	0.04 (-0.02 to 0.10)	0.11 (0.07 to 0.18)	0.08 (0.03 to 0.14)	0.03 (-0.06 to 0.13)

95% CI was estimated based on 5000 Bootstrapped replications.

<sup>a</sup>Among those having number of absent work days >0.

<sup>b</sup>Among those having percentage time loss while working >0.

to 2020 was not significantly different across the frequency of remote work (0 days, 1 to 2 days, 3 to 4 days, or 5 days a week). Only remote working 5 days a week was associated with a higher odds of increased presenteeism between 2019 and 2020 compared with no remote working.

Despite different study designs or presenteeism outcomes, our study findings are consistent with those of these three studies that WFH is associated with higher chance of working while ill or presenteeism in patients.<sup>28,29,47</sup> We did not find a significant association between WFH and the probability of absenteeism in patients. The findings suggested that WFH, patients are more likely to choose to keep working while ill and thus have productivity loss at work instead of taking sickness absence. Working from home offers less barriers for patients to work despite illness because of the avoided commute to office, convenient home environment for their illness management, and less chance of being noticed by their supervisors or colleagues. Holland and Collins<sup>48</sup> distinguished between voluntary and involuntary sickness presenteeism and suggested that although working despite illness is voluntary, it can improve productivity among workers with rheumatoid arthritis. The rapid transition to WFH during COVID-19 allowed people with a chronic condition to much more easily work during their illness voluntarily, thus minimizing their lost productivity. This might partly explain why we found that WFH was not associated with increased overall work productivity loss.

There is limited evidence on the impact of WFH on caregivers' work productivity. Perez et al<sup>7</sup> suggested WFH may hinder employees' productivity if they are in dual roles of caring children and working at home. More studies and policies focused on the potential benefits of WFH on improving work-life balance and increasing labor force participation of specific groups such as older workers, women with young children, caregivers, and people with disabilities.<sup>2,4</sup> People with chronic conditions and caregivers may have been more likely to stop working during the pandemic given that they are already at higher risk of work stoppage or early retirement due to their health problems or caregiving responsibilities. By focusing on those who had worked, our study could not capture the potential impact of WFH on the labor force participation (eg, work stoppage), which is also one important component of work productivity loss.

Different methods and questionnaires are used to measure absenteeism and presenteeism among caregivers and patients. The questions measuring absenteeism mainly vary by the recall period from 1 week, 1 month, 3 months, to 12 months.<sup>49</sup> The questionnaires measuring presenteeism vary by the construct, measurement method, and recall period. The three common measurement methods for presenteeism (work productivity loss while working) include a 0 to 10 scale (eg, the Work Productivity and Activity Impairment questionnaire<sup>50</sup> and the World Health Organization Health and Work Performance Questionnaire<sup>51</sup>), direct hour estimation (eg, the Health and Labour Questionnaire<sup>52</sup> and the VOLP), and a multidimensional questionnaire (eg, the WLQ<sup>53</sup>). The questionnaires using the three different methods gave a wide range of lost time presenteeism estimates.<sup>54,55</sup> Thus, using different questionnaires to measure absenteeism and presenteeism might lead to different findings on the impact of WFH.

One of our study limitations was the cross-sectional design. The impact of WFH on absenteeism and presenteeism might change over time. Biron et al<sup>56</sup> measured sickness absenteeism (number of work hours missed because of a health problem in the last week) and presenteeism (number of days worked while having a health problem in the last week) among workers who were WFH at least 80% of their work hours in the past 7 days in Quebec, Canada, over three waves during the COVID-19 pandemic: the early strict lockdown period (April 2020), the reopen period (end of June 2020), and the second strict lockdown period (end of November and early December 2020). They found presenteeism remained stable, but absenteeism decreased from the first period to the latter two periods.

Again, because of the cross-sectional design, we cannot rule out the reverse causation between absenteeism and presenteeism and WFH and unobserved heterogeneity. Caregivers and patients who had absenteeism and presenteeism might choose WFH to adapt their work to their caregiving or health needs. However, WFH was the only option for most workplaces during the early COVID-19 pandemic, which might mitigate the self-selection of WFH. In our regression models, we also controlled for potential confounders including age, sex, self-rated health, education, occupation, employment status, caregiving characteristics, and job-related characteristics. Despite this, some unobserved variables related to both WFH and work productivity loss outcomes (such as home office environment and technological and workplace support) might still bias the results. Thus, longitudinal studies or even randomized controlled trials<sup>57</sup> are needed in the future to measure the impact of WFH on work productivity loss among caregivers and patients.

Another limitation is that our WFH status was determined by asking whether the survey respondents worked from home in the past 7 days. Their WFH status and hours worked from home might change over the past 3 months. The limitation is expected to have a larger impact on our absenteeism outcome in the past 3 months than our presenteeism outcome in the past 7 days. Our data collection time was from May 15 to June 2, 2020, for caregivers, so the past 3 months included 1 month before strict lockdown and 2 months in the strict lockdown period in Canada. The past 3 months for the collection time for patients (July 11 to 17, 2020) included the 1-month strict lockdown period to the 2-month reopening period in Canada. Based on a report by Statistics Canada, about 40% of employees worked most of their hours from home in April 2020, which dropped to about 27% in July 2020.<sup>58</sup> Thus, WFH status in the past 7 days might not accurately represent WFH status in the 3-month recall period.

Our findings have important practical implications. Working from home arrangements are expected to continue for many workplaces and occupations even after the pandemic. The survey conducted by Statistics Canada showed that 80% of employees would like to work at least half of their hours from home once the pandemic is over.<sup>19</sup> Our study reinforced that WFH is not associated with increased absenteeism and presenteeism among caregivers and patients who already have high work productivity loss.<sup>22-27</sup> Working from home could also be offered by organizations to support their employees in adapting their work to their caregiving and health requirements.

## CONCLUSION

Working from home was associated with an increased likelihood of absenteeism and presenteeism for caregivers and patients but lower work productivity loss among those with absenteeism and presenteeism. Consequently, WFH was not associated with total absenteeism or total presenteeism among caregivers and patients. The pandemic accelerated the transition to WFH for many people. Our results suggest that this represents an opportunity for increased flexibility and inclusion of people with chronic conditions and caregivers in the workplace without impacting productivity, although further research is needed. Our findings also emphasize the importance of considering sociodemographic differences.

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