The impact of COVID-19 on relative health outcomes among healthcare workers in Canada

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Abstract

Although the COVID-19 pandemic increased stress and anxiety for most people, frontline workers have been particularly vulnerable. This article focuses on doctors and nurses and analyzes their perceived mental and life stress relative to allied healthcare workers. The study uses data from Statistics Canada's crowdsource initiative, analyzed within a multinomial logistic regression framework. Results point to increased stress among these workers. More specifically, results suggest that compared with pre-COVID-19, mental stress increased for doctors. In contrast, although mental stress did not increase for nurses, it remained poor, similar to that experienced pre-COVID-19.

Introduction

It is well understood that having a job has numerous benefits, ranging from financial to psychological.[1] Employment provides an opportunity to meet different people and make friends, enhances one's feeling of self-worth, and allows for intellectual stimulation.[2] Having a job has also been known to help facilitate recovery from illness.[3]

However, when work becomes stressful, it has the potential to do much harm. From a health perspective, stress can result in psychological distress and mental illness.[4,5] On-the-job stress can also decrease worker productivity and increase absenteeism.[6-8] When stress leads to productivity losses, it creates a wedge between pay and output per worker, resulting in high costs for the employer.[9]

Although job-related stress can impact any employee, healthcare workers are particularly vulnerable to it. According to the World Health Organization, work-related stress results when people are presented with work demands that do not match their knowledge and abilities. This stress can be made worse if employees do not have control over their work processes or if there is little opportunity to exercise any choice or control.[10]

Healthcare workers have had little opportunity to exercise control or choice during the COVID-19 pandemic; doctors, nurses, and allied healthcare workers worldwide were required to continue working despite the risks associated with the pandemic.[11,12] This may have resulted in increased burnout and worsened mental health for them.

Several studies have documented burnout and poor mental health among healthcare workers pre-COVID-19. For example, a study conducted in a cardiovascular centre in Toronto reported that of the total respondents, 77% of nurses reported burnout in the previous 3 months.[13] In two separate papers, the same authors reported that about 73% of allied healthcare workers (physical, respiratory, and occupational therapists, pharmacists, social workers, dietitians, and speech-language pathologists) and about 65% of doctors reported burnout and distress.[14,15]

During the pandemic, healthcare workers worked long hours with insufficient access to Personal Protective Equipment (PPE),

the risk of exposure to the virus, and many patients' deaths.[16,17] Not surprisingly, numerous studies have reported high levels of anxiety and depression among these professionals. For example, a meta-analysis of 65 studies involving 97,333 healthcare workers across 21 countries showed a high prevalence of moderate depression (21.7%), anxiety (22.1%), and post-traumatic stress disorder (21.5%).[18]

Recent studies have pointed to vicarious trauma as a key factor responsible for elevated levels of burnout among healthcare workers.[19] Vicarious trauma is experienced through the accumulation of stress by continued empathic engagement with another individual's trauma.[20] Therefore, healthcare workers can be impacted emotionally and psychologically by their patients' traumatic histories and incidents, resulting in compassion fatigue.[21]

Reports and studies on vicarious trauma during the COVID-19 pandemic have highlighted its prevalence across a broad spectrum of healthcare workers, from nurses and doctors[22-24] to social workers[25] and pharmacists.[26] If left unchecked, vicarious trauma can lead to poor clinical judgements,[27] poor patient outcomes,[28] lower staff productivity, and a decline in service quality,[29] resulting in high staff turnover rates[30] which can be costly for organizations.

In Canada, studies have documented increased burnout and mental stress during the COVID-19 pandemic for nurses[31] and doctors.[32] There are also descriptive studies examining the mental health and well-being of Canadian healthcare workers.[33] This paper extends that research by analyzing the mental health outcomes of a group of healthcare workers relative to another group of healthcare workers within a regression framework. The study should help direct resources toward promoting mental well-being of healthcare workers most

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vulnerable to mental stress in their workplace, particularly during a traumatic event.

Data and methods

Data from Statistics Canada's 2020 "Impacts of COVID-19 on Healthcare Workers: Infection Prevention and Control (ICHCWIPC)" crowdsource initiative were used for the analysis.[34] The information was collected from on-line questionnaires and contains responses from healthcare workers living in ten provinces and three territories in Canada. These workers include doctors, nurses, massage therapists, dentists, dietitians, and other technical and support staff such as receptionists, technicians, cleaning and food services staff, and security personnel.

The data contains responses from 18,139 healthcare workers who provided information on their demographics, job type and setting, training, personal protective equipment use and personal health. In particular, the survey collected data on three variables that served as the key outcome measures: (perceived) mental health, (perceived) life stress, and mental health compared to pre-COVID-19 (together referred to as "mental/life health"). For the analysis, healthcare workers were classified as doctors, nurses, allied health professionals, and other workers (see Table 1 notes for details). These categories are the primary independent variables.

Since each of the three response variables has multiple possible outcomes (eg, "poor," "fair/good," and "very good/excellent" for mental health), the data from Statistics Canada were analyzed using multinomial logistic regressions. That is, three separate regressions were run, and results for doctors, nurses, and other workers were analyzed relative to allied healthcare workers. Since the group "other workers" consists of respondents whose job functions differ significantly from one another, the discussion focuses on the outcomes for doctors and nurses compared with allied healthcare workers.

Other variables considered include the respondent's age, sex, province/territory of residence, whether working full-time or part-time, whether a visible minority, and whether an immigrant. The regressions were run in Stata. For ease of interpretation, multinomial logistic coefficients were exponentiated and are presented as Relative Risk Ratios (RRRs).

Discussion

Table 1 contains descriptive information on healthcare workers. The table shows that most respondents were nurses or allied healthcare workers. More specifically, there were 5,361 nurses (or about 30% of the respondents), 6,813 (or 38%) allied workers, and 572 (or 3%) doctors. The data also show that 81% of all the respondents were less than 55 years old. Further, almost 88% of the respondents were female. Across groupings, nurses had the most female respondents (at 94%), followed by allied healthcare workers (at 85%) and doctors (at 69%).

According to the table, 11% of the respondents were visible minorities or immigrants. It is noteworthy that among those workers who reported that they were a visible minority, about 66% were nurses or allied healthcare workers. The table also shows that most respondents (46%) were located in Ontario and were employed full-time (70%).

Finally, regarding our three variables of interest, the mental/life health variables, about 82% of healthcare workers reported that their mental health was "fair" or "very good." However, a large majority reported high levels of life stress and worsening mental health compared with pre-COVID-19.

While the above results point to mental/life stress for healthcare workers during COVID-19, we need to analyze the results in a broader regression framework by controlling for the impact of the variables presented in the table. In doing so, we will be able to ascertain, more clearly, the differences in mental/life stress between healthcare workers.

Table 2 presents mental/life health regression results with healthcare workers as the sole independent variable. That is, the control variables include nurses, doctors, and other workers as indicators or dummy variables with allied healthcare workers as the reference category. Panel A of the table shows that compared with allied healthcare workers, nurses were significantly more likely to report "poor" mental health relative to the outcome of "very good/excellent" mental health. The results were not significant for doctors.

For life stress (panel B), results show that compared with an outcome of "no life stress," both doctors and nurses had "some stress" or "stressful" as their outcomes. Results were significant for both workers. Finally, the only significant results for "mental health compared with pre-COVID-19" (panel C) were for nurses: nurses were "somewhat worse/much worse" in terms of their mental health relative to allied healthcare workers.

Table 3 extends Table 2 by adding all the other variables (from Table 1) as controls. Since some of the effects observed for healthcare workers in Table 2 may be on account of factors excluded from the regression equation, adding these variables allows us to isolate and better understand the differences in mental/life health outcomes between healthcare workers.

Estimates from panel A show that relative to an outcome of "very good/excellent" mental health for allied healthcare workers, doctors and nurses had significantly "poor" mental health during COVID-19. Although the estimates also suggest "fair/good" mental health for these workers, these outcomes are inferior to the baseline category "very good/excellent." Also, the coefficients associated with "poor" mental health for doctors and nurses are larger than those associated with "fair/good" mental health. Note that although these results are similar to those in panel A of Table 2, the coefficients are different, suggesting that outcomes in Table 2 also reflected the impact of the variables that were excluded from the analysis.

Results for the other coefficients present some interesting information: health workers in the Atlantic provinces and Quebec had significantly better mental health outcomes than workers in Ontario. That is, compared with Ontario, healthcare workers in these provinces were significantly less likely to report "poor" mental health relative to "very good/excellent" mental health.

Table 1. Distribution of healthcare workers.

	Doctors[a]	Nurses[b]	Allied workers[c]	Other workers[d]
N	572	5,361	6,813	5,393
Age				
Less than 35 years of age	73	1,804	1,801	1,490
35 to 44 years	163	1,426	1,986	1,407
45 to 54 years	126	1,202	1,752	1,392
55 years and older	205	920	1,263	1,062
Not stated	5	9	11	42
Sex				
Females	392	5,056	5,813	4,652
Visible minority status				
Visible minority	83	489	766	568
Not a visible minority	424	4,740	5,903	4,544
Not stated	65	132	144	281
Immigrant status				
Non-immigrant	422	4,753	5,877	4,579
Immigrant or permanent resident	101	522	838	599
Not stated	49	86	98	215
Location				
Atlantic provinces	43	1,248	605	665
Quebec	17	85	585	473
Ontario	301	1,986	3,838	2,227
Manitoba and Saskatchewan	57	594	489	560
Alberta	71	907	768	843
British Columbia	83	490	504	596
Territories	0	51	24	29
Employment status				
Full-time	417	3,845	4,453	3,901
Part-time	93	1,346	2,034	1,079
Skip	4	31	176	78
Not stated	58	139	150	335
Perceived mental health				
Poor	39	547	394	490
Fair	135	1,520	1,479	1,364
Good	165	1,744	2,188	1,773
Very good	155	1,181	1,947	1,297
Excellent	78	366	803	464
Not stated	0	3	2	5
Perceived life stress				
Not at all stressful	4	27	86	49
Not very stressful	24	229	625	352
A bit stressful	186	1,734	2,934	2,082
Quite a bit stressful	246	2,536	2,576	2,170
Extremely stressful	109	815	569	717
Not stated	3	20	23	23
Mental health compared to pre-COVID-19				
Much better now	4	41	91	78
Somewhat better now	15	83	232	138

(continued)

Table 1. (continued)

	Doctors[a]	Nurses[b]	Allied workers[c]	Other workers[d]
About the same	150	1,119	2,028	1,532
Somewhat worse now	299	2,801	3,430	2,715
Much worse now	104	1,308	1,022	925
Not stated	0	9	10	5

[a]Includes family doctors and specialists.
[b]Includes registered nurses, nurse practitioners, psychiatric nurses, clinical nurse specialists, and registered or licensed practical nurses.
[c]Includes respiratory therapists, psychologists, social workers, counsellors, optometrists, opticians, chiropractors, massage therapists, physiotherapists, occupational therapists, naturopaths, nutritionists, dietitians, midwifes, audiologists, and speech-language pathologists.
[d]Includes laboratory workers, dentists, pharmacists, student, and support services.

Table 2. Regression results for mental/life health.

	Poor mental health		Fair/Good mental health		Not stated	
A. Mental health	RRR	SE	RRR	SE	RRR	SE
Reference = allied healthcare workers						
Nurses	2.468***	.18	1.582***	.06	2.666	2.44
Doctors	1.168	.21	.966	.09	.000	.01
Other workers	1.942***	.14	1.336***	.05	3.904*	3.27
Constant	.143***	.01	1.333***	.03	.001***	.00

	Some stress		Stressful		Not stated	
B. Life stress	RRR	SE	RRR	SE	RRR	SE
Reference = allied healthcare workers						
Nurses	1.641***	.13	2.959***	.23	2.415***	.76
Doctors	1.610**	.33	2.866***	.58	3.312*	2.13
Other workers	1.258***	.09	1.628***	.11	1.773*	.53
Constant	4.127***	.17	4.423***	.18	.032***	.01

	Somewhat better/ About the same		Somewhat worse/ Much worse		Not stated	
C. Mental health compared to pre-COVID	RRR	SE	RRR	SE	RRR	SE
Reference = allied healthcare workers						
Nurses	1.180	.23	2.048***	.39	1.998	.99
Doctors	1.661	.86	2.059	1.06	.000	.00
Other workers	.862	.14	.954	.15	.583	.33
Constant	24.835***	2.66	48.923***	5.18	.110***	.04

Notes: ***$P \le .01$; **$P \le .05$; *$P \le .10$; healthcare workers are the only control variable (with allied healthcare workers as the reference category); In panel A, the reference group is "very good/excellent mental health," in panel B, the reference group is "no stress," and in panel C, the reference group is "much better"; RRR represents relative risk ratio; SE represents standard error.

Further, those working "full-time" (relative to part-timers) and those "not self-employed" (relative to those self-employed) had worse mental health outcomes. Results also suggest no significant difference between male and female healthcare workers but worse outcomes for those less than 35 years of age compared with older age groupings. Finally, immigrants and visible minorities had better mental health outcomes compared with non-immigrants and those who were not a visible minority, respectively.

For life stress (panel B), results are similar to those reported above. That is, compared with allied healthcare workers who had "no stress," estimates for doctors and nurses suggest that these groups found COVID-19 to be "stressful." While the results for almost all the other variables are similar to those reported in panel A, two noticeable exceptions are sex and age. According to the estimates for sex, female healthcare workers were significantly more likely to have had a "stressful"

Table 3. Regression results of the impact of COVID-19 on mental/life stress among healthcare workers, controlling for various factors.

| Variable | A. Mental health (reference = very good/excellent mental health) | | | | B. Life stress (reference = no stress) | | | | C. Mental health compared to pre-COVID-19 (reference = much better) | | | |
| | Poor mental health | | Fair/Good mental health | | Some stress | | Stressful | | Somewhat better/About the same | | Somewhat worse/Much worse | |
	RRR	SE	RRR	SE	RRR	SE	RRR	SE	RRR	SE	RRR	SE
Healthcare workers (reference = allied workers)												
Nurse	1.88***	.16	1.29***	.06	1.20**	.11	2.11***	.19	.73	.17	1.10	.26
Doctor	1.84***	.35	1.35***	.13	2.17***	.46	4.40***	.91	2.13	1.11	3.53**	1.84
Other workers	1.67***	.14	1.18***	.05	1.02	.08	1.23***	.10	.63**	.12	.62**	.12
Province/Territory of residence (reference = Ontario)												
Atlantic provinces	.64***	.06	.81***	.04	.87	.08	.55***	.05	1.12	.29	.80	.20
Quebec	.47***	.07	.74***	.05	.62***	.07	.72***	.08	.74	.21	.63*	.17
Manitoba/Saskatchewan	.84	.09	.96	.06	1.19	.14	1.11	.13	1.84*	.66	1.94*	.69
Alberta	1.05	.09	.93	.05	1.10	.11	1.11	.11	.75	.16	.90	.19
British Columbia	.94	.10	.96	.06	1.16	.13	1.12	.12	1.17	.31	1.27	.33
Territories	.98	.34	.62**	.13	.61	.20	.42***	.14	.46	.29	.33*	.21
Whether self-employed (reference = self-employed)												
Not self-employed	1.63***	.18	1.45***	.07	1.54***	.13	1.89***	.16	1.93***	.41	2.54***	.54
Not stated	1.27	.22	1.26***	.10	1.45***	.20	1.81***	.25	2.14**	.72	2.86***	.95
Whether working full-time (reference = part-time)												
Working full-time	1.34***	.10	1.10***	.04	1.23***	.08	1.72***	.12	.95	.16	1.16	.20
Not stated	1.20	.19	1.13	.09	.93	.11	.92	.11	.59**	.14	.52***	.13
Age (reference = less than 35 years)												
35 to 44	.56***	.04	.77***	.04	.94	.08	1.04	.09	.68*	.14	.58***	.12
45 to 54	.29***	.02	.60***	.03	.79	.07	.87	.07	.84	.18	.49***	.10
55 and over	.14***	.02	.44***	.02	.62***	.05	.52***	.04	1.02	.24	.42***	.10
Not stated	.42*	.21	.66	.18	.80	.32	.82	.33	1.03	.85	.65	.53
Sex (reference = male)												
Female	1.13	.11	1.45***	.07	1.49***	.12	1.76***	.14	1.02	.20	1.24	.24
Whether visible minority (reference = not a visible minority)												
Visible minority	.80*	.09	.77***	.05	.86	.10	.75***	.08	.66**	.14	.45***	.10
Whether immigrant (reference = not immigrant)												
Immigrant	.73***	.09	.82***	.05	.78**	.08	.73***	.08	.50***	.11	.36***	.08
Not stated	.99	.19	.78**	.05	.76	.13	.72**	.12	.43***	.14	.33***	.10
Constant	.20***	.03	1.21***	.05	2.84***	.33	1.93***	.22	31.26***	9.19	62.94***	18.37

***$P \le .01$; **$P \le .05$; *$P \le .10$; Results for the "not stated" categories have been supressed; RRR represents relative risk ratio; SE represents standard error.

COVID-19 experience compared with their male colleagues. The results for age suggest that there was no significant difference in life stress for workers in the age group 35 to 54 years compared with those under 35 years of age; only those 55 and over had a relatively less "stressful" experience.

Regression results for "mental health compared with pre-COVID-19" are presented in panel C. The results are only significant for doctors with "somewhat worse/much worse" mental health compared with pre-COVID-19. Although nurses also had "somewhat worse/much worse" mental health

compared to pre-COVID-19, the results are not significant for the group.

Panel C also presents some interesting results for the other variables: compared with Ontario, healthcare workers in Manitoba/Saskatchewan had significantly worse mental health relative to pre-COVID-19. On the other hand, workers in Quebec had significantly better mental health than their Ontario counterparts. As well, relative to those self-employed, workers who were not self-employed fared significantly worse in mental health during the pandemic.

Results also suggest no significant difference between male and female healthcare workers' mental health outcomes pre-/post-COVID-19. Finally, relative to those under 35 years of age, the older age groups had better mental health outcomes during the pandemic than pre-pandemic outcomes.

Together, these results offer some interesting insights. First, panels A and C suggest that while mental health for doctors worsened during COVID-19, outcomes for nurses continued to be poor, similar to the pre-COVID-19 period. These results are not surprising given the discussion earlier about vicarious trauma. During the pandemic, doctors and nurses dealt with unprecedented suffering and tragedy among their patients, which likely worsened their mental health and added to their overall life stress. Second, the results suggest that older healthcare workers fared relatively better compared with those under 35 years. It is possible that the older and, therefore, more experienced workers had better coping mechanisms that may have resulted in better mental health outcomes for those groups.

Given the above evidence, health leaders have a vital role in developing interventions that address drivers of burnout among healthcare workers. These interventions can be at the individual level, such as education and stress-reduction techniques, particularly for the younger, less-experienced workers, or at the organizational level, such as managerial support, training to increase worker confidence with unfamiliar tasks, addressing workplace characteristics such as overtime, and supporting workers experiencing moral distress.[35] Such interventions are necessary not only from the standpoint of health system cost savings but also from the viewpoint of better patient outcomes. Any improvement in mental/life stress for healthcare workers should translate into increased quality of care for their patients.

While the regression results suggest poor mental/life health outcomes for healthcare workers during the pandemic, they should be treated with some caution. For instance, the crowdsourcing data were collected via voluntary participation and may not be a randomized selection of healthcare workers. Therefore, the results may not be generalizable to the entire population of healthcare workers because of the possibility of self-selection bias. Nevertheless, similar to other studies, results do point to mental/life stress among health workers during COVID-19. These results help us understand which population groups in our workforce are most vulnerable to mental/life stress, which may get exacerbated during events such as the COVID-19 pandemic. Seen alternatively, this research highlights groups that may benefit most from interventions that may be designed to lower stress.

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