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The impact of the COVID-19 pandemic on mental health of nurses in British Columbia, Canada using trends analysis across three time points

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ABSTRACT

Purpose: This study examined trends over time in the prevalence of anxiety and depression among Canadian nurses: 6 months before, 1-month after, and 3 months after COVID-19 was declared a pandemic.

Methods: This study adopted a repeated cross-sectional design and surveyed unionized nurses in British Columbia (BC), Canada on three occasions: September 2019 (Time 1, prepandemic), April 2020 (Time 2, early-pandemic) and June 2020 (Time 3).

Results: A total of 10,117 responses were collected across three timepoints. This study found a significant increase of 10% to 15% in anxiety and depression between Time 1 and 2, and relative stability between Time 2 and 3, with Time 3 levels still higher than Time 1 levels. Cross-sector analyses showed similar patterns of findings for acute care and community nurses. Long-term care nurses showed a two-fold increase in the prevalence of anxiety early pandemic, followed by a sharper decline mid pandemic.

Conclusions: COVID-19 has had short- and mid-term mental health implications for BC nurses particularly among those in the long-term care sector. Future research should evaluate the impact of COVID-19 on the mental health of health workers in different contexts, such as jurisdictional analyses, and better understand the long-term health and labor market consequences of elevated mental health symptoms over an extended time period.

Introduction

Since COVID-19 was declared a global pandemic, healthcare workers have encountered unprecedented workplace stressors including, but not limited to, insufficient access to personal protective equipment, lack of a solid pandemic management planning, fears of exposure and spreading the virus, and the sudden death of their patients and/or colleagues due to COVID-19 [1–4]. Nursing professionals are one group of healthcare workers with the greatest risk of exposure to the virus [4] and with 15 to 125 higher odds of mortality compared to physicians in many countries [3]. Consequently, nurses are prone to developing unfavorable mental health outcomes due to COVID-19 related stress [2,5,6].

Since the start of the pandemic, a number of systematic reviews have examined the impact of COVID-19 on healthcare workers' mental health. One of the first systematic reviews included 13 studies published until April 2020 with over 33,000 health-

Table 1
Sample sizes and data collection periods for each survey

Surveys	Sample size	Data collection period
Time 1 (prepandemic)	5034	September 22nd–December 2nd, 2019
Time 2 (early-pandemic)	1234	April 7th–May 13th, 2020
Time 3	3849	June 15th–July 22nd, 2020

care workers. This review estimated the prevalence of anxiety and depression respectively as 26% and 30% among nurses up until April 2020 [5]. More recently, a meta-analysis of 65 studies involving 97,333 healthcare workers across 21 countries published between December 2019 and August 2020 estimated the worldwide prevalence of anxiety and depression among healthcare workers as ranging between 15% (North America) and 29% (Middle-East), and 19% (North America) and 35% (Middle-East) respectively [7]. During a similar time period, another meta-analysis of 71 studies found the prevalence of mental health problems particularly anxiety as higher than its prevalence among other healthcare workers [8]. All of these reviews recognized the dearth of repeated studies on the same population over the COVID-19 pandemic as a limitation of the current body of evidence on this topic.

Emerging population studies have pointed to increased prevalence of mental health problems since the start of the pandemic [9–11] with a greater impact on certain populations including healthcare workers [12].

A significant gap in current research is shown by the limited amount of studies that have repeated data on mental health outcomes and include a timepoint preceding the pandemic [13,14]. Therefore, the purpose of this study is to fill this gap, and examine the trend over time in the prevalence of anxiety and depression among Canadian nurses before and during COVID-19 using a unique opportunity where three time points of data were collected on the same nursing population: six months before, and one month and three months after COVID-19 was declared a pandemic. Providing this information is both timely and relevant given the significant gap in nursing supply and demand internationally [15] and since the nursing workforce will continue to play an integral role in responding to subsequent waves of the pandemic.

Material and Methods

Study Design

This is a repeated cross-sectional study of members of the British Columbia Nurses Union (BCNU). The BCNU represents nearly 48,000 nurses across acute, community and long-term care sectors in British Columbia (BC), Canada [16]. As part of two separate studies, the BCNU sent an email invitation to all its members three times between September 22, 2019 and July 22, 2020. To increase response rate, certain strategies were used. For Time 1 and Time 3 surveys, follow-up emails were sent out each week; the surveys were also advertised through the union's social media and print advertisements, and participants were offered a raffle draw for incentives. While Time 1 and Time 3 surveys were sent out only to BCNU membership, the Time 2 survey was part of a larger study recruiting healthcare workers across Canada, in which the BCNU participated [17]. For all time points, the samples were restricted to only BCNU nurse members who were actively working at the time of the survey.

Participants

Table 1 shows the sample size and data collection period for each survey time point. The number of responses for each survey ranged between 1234 and 5034, representing 3% to 10% of the BCNU membership across the three surveys. Together over all time

periods, 10,117 respondents were recruited. Precise response rates are difficult to estimate due to the nature of the BCNU database, and the convenience-based sampling approach which creates uncertainty around the number of email invitations that reached members. Previous research noted similar issues in nurse recruitment [18,19]. Although comparison with the source population of the membership of the BCNU is challenging given the limited information available on the membership, we found our cross-sectional samples are closely representative of BCNU membership with respect to healthcare sector (for more information, see Table 2). Based on the most recent BCNU annual report, it is estimated that 71% of the membership works in acute care settings, 17% in community care, and 12% in long-term care [16].

Research instruments

Main Outcomes

The Generalized Anxiety Disorder screener (GAD-7) [20], and the Patient Health Questionnaire screener (PHQ-9) [21] were administered in Time 1 and Time 3 surveys, with shorter versions of each of these scales, known as GAD-2 and PHQ-2 administered at Time 2. For measurement equivalence, this study used GAD-2 and PHQ-2 scores (consisting of the first two-items on the GAD-7 and PHQ-9 scales) to measure anxiety and depression respectively across all three surveys. For each scale, the range of possible scores are between zero and six. A cutoff point of three or greater on the GAD-2 has been recommended as a screening point to further assess the potential for anxiety disorders [20]. For the PHQ-2, the same cutoff point of three or greater has been suggested as a screening point for major depression [21].

Covariates

We used information consistently captured in each of the three surveys to calibrate the samples (i.e., make the samples as similar as possible to each other). Information included in the calibration process included age group (categorized into 10-year age groups), sex, workplace location (urban, suburban, rural), the respondent's role (direct care, leader, other), and the sector they worked in (acute care, community care, long-term care).

Data analyses

To calibrate each of the survey samples across time periods, we conducted a multinomial logistic regression, where survey time was the outcome and the calibrating variables were entered as predictors. Each person in the sample was assigned the inverse probability estimate associated with the time period that they completed the survey. To help stabilize the probability weights, an empty regression model was also run, with these probabilities being assigned as the numerator for the probability weights [22]. Weights were assessed for normality. For Time 1 respondents, the median weight was 0.98, with the range from the 5th to 95th percentile being 0.78–1.32. For Time 2, the median weight was 0.96 (0.67–1.47); and for Time 3 respondents the median weight was 1.03 (0.76–1.25). The same procedure was conducted to assign sector specific weights.

Once the samples were calibrated to be similar with respect to the calibrating variables, we then estimated the proportion of each

Table 2

Sample distribution across each survey time, before and after calibration of samples through multinomial logistic regression

	Before Calibration				After Calibration			
	Time 1	Time 2	Time 3	*p*	Time 1	Time 2	Time 3	***p***
Total	5034	1234	3849					
Complete data	4349	1128	3434					
% With complete data	86.4%	91.4%	89.2%	<0.001				
Age Group								
18–24 years	4.4%	3.1%	3.0%	<0.001	4.0%	4.0%	4.0%	1.00
25–34 years	33.1%	22.0%	25.9%		28.7%	28.9%	28.7%	
35–44 years	25.1%	28.5%	26.4%		26.0%	26.0%	26.1%	
45–54 years	21.6%	24.7%	24.3%		23.1%	23.1%	23.0%	
55+ years	15.8%	21.8%	19.8%		18.2%	18.0%	18.1%	
Sex								
Male	8.5%	7.8%	6.5%	<0.001	7.6%	7.7%	7.5%	0.99
Female	91.5%	92.2%	93.5%		92.4%	92.4%	92.5%	
Geography								
Urban	62.5%	59.3%	63.1%	<0.001	62.4%	62.3%	62.5%	1.00
Suburban	17.6%	24.3%	20.1%		19.5%	19.6%	19.4%	
Rural	19.9%	16.4%	16.8%		18.2%	18.1%	18.1%	
Role								
Direct Care	88.4%	85.8%	83.9%	<0.001	86.1%	86.3%	86.3%	1.00
Leader	7.7%	11.0%	10.5%		9.3%	9.1%	9.2%	
Other	3.9%	3.2%	5.6%		4.5%	4.6%	4.5%	
Sector								
Acute	73.5%	66.5%	62.4%	<0.001	68.1%	68.1%	68.2%	1.00
Community	17.8%	23.7%	24.6%		21.2%	21.1%	21.3%	
Long-Term Care	8.7%	9.8%	13.0%		10.7%	10.9%	10.5%	

sample who had GAD-2 and PHQ-2 scores of three and higher, using the weighted sample. A concurrent analysis examined the relative risk for having GAD-2 and PHQ-2 scores of 3 and higher, with Time 1 being the reference time point. Proportions were estimated using PROC SURVEYFREQ in SAS, with the variances around each proportion estimated using Taylor series variance estimation.

Results

Table 2 compares the initial distributions for each of the calibrating variables across each sample before after calibration. Prior to calibration, respondents with missing data on calibrating variables (age, sex, geographic, role and sector) or on the main outcomes (anxiety and depression symptoms) were removed, which left a total sample of 8911 (88% of the original sample). Before calibrating samples, statistically significant differences were noted across each of the calibrating variables for each of the surveys. After the application of the probability weights to calibrate the samples, no significant differences were observed for the distribution of any of the calibrating variables across variables at each of the time points.

Table 3 presents the prevalence of anxiety and depressive symptoms for the full sample and stratified by sector. In the full sample we observed a significant increase in anxiety symptoms and depression symptoms between Time 1 and 2, and relative stability in estimates between Time 2 and 3. Time 3 levels were significantly higher than Time 1 levels. Between Time 1 and Time 2, the proportion of the sample with anxiety symptoms (GAD-2 scores ≥3) increased by 13.9% (95% CI: 10.6%–17.2%), from 30.8% of the sample to 44.7% of the sample. The prevalence remained stable, reducing slightly to 42.8% at Time 3 which still higher than Time 1 prevalence of 30.8%. Similar patterns were observed for depression symptoms (PHQ-2 scores ≥3) with an increase in prevalence from 20.3% at Time 1 to 30.9% at Time 2, remaining stable at 29.7% at Time 3.

Cross-sector analyses showed that the patterns in the full sample were replicated in the acute and community care sectors, but not in the long-term care sector. Among respondents working in

Table 3

The prevalence of anxiety and depression across each time point

	Time 1(95% CI)	Time 2(95% CI)	Time 3(95% CI)
All			
Anxiety (GAD-2*)	30.8 (29.4–32.2)	44.7 (41.7–47.7)	42.8 (41.2–44.5)
Depression (PHQ-2*)	20.3 (19.1–21.5)	30.9 (28.1–33.7)	29.7 (28.2–31.3)
Acute Care			
Anxiety (GAD-2*)	30.8 (29.2–32.4)	42.5 (38.9–46.2)	43.7 (41.5–45.8)
Depression (PHQ-2*)	20.1 (18.7–21.5)	30.2 (26.8–33.7)	29.3 (27.4 – 31.3)
Community Care			
Anxiety (GAD-2*)	31.7 (28.4–35.0)	43.5 (37.3–49.8)	43.5 (40.2–46.9)
Depression (PHQ-2*)	19.8 (17.0–22.6)	29.8 (24.0–35.6)	32.2 (29.0–35.4)
Long-Term Care			
Anxiety (GAD-2*)	29.6 (24.9–34.2)	61.2 (50.8–71.6)	36.8 (32.2–41.3)
Depression (PHQ-2*)	23.5 (19.2–27.8)	35.3 (25.3–45.3)	27.3 (23.1–31.5)

Abbreviations: CI = confidence interval; GAD-2 = Generalized Anxiety Disorder-2 measure; PHQ-2 = Patient Health Questionnaire-2 measure.
* GAD-2 and PHQ-2 scores ≥ 3 indicate anxiety and depression respectively.

long-term care, we observed a much greater increase in anxiety between Time 1 and 2, with a significant interaction between sector and time for anxiety symptoms ($p < 0.001$). In addition, for symptoms of anxiety there was a significant decline between Time 2 and 3 among respondents in the long-term care sector, although estimates at time 3 were still significantly higher than the prevalence estimate at time 1 (36.8% at Time 3 compared to 29.6% at Time 1).

Discussion

This study provides a novel examination of trends in symptoms of anxiety and depression among healthcare workers in BC prior to, and during early and mid phases of the COVID-19 pan-

demic. We had several key findings. First, compared to prepandemic data, a greater proportion of nurses met the criteria for both anxiety and depression early-pandemic (15% increase versus 10% increase), followed by a slight decline in both mental health outcomes at Time 3. Like many other countries [23–27], Canada experienced COVID-19 shock, due to a suboptimal level of preparedness that resulted in many challenges for healthcare workers, including, but not limited to, significant shortages of personal protective equipment (PPE) [1,17,28,29], daily or more frequent changes in organizational policies and protocols [28,30], poor workplace safety [1,2,17], and tremendous fears of COVID-19 exposure and/or spreading the virus home [28,31]. Emerging pandemic evidence has linked these COVID-19 related challenges to unfavorable mental health outcomes among healthcare workers [17,29,32].

The prevalence of both anxiety and depression were higher during the mid phases of the pandemic [33] than the prepandemic levels. For context, during the time period where the second survey was completed, BC averaged 30 COVID-19 cases per day. This reduced to 17 cases per day during the period where the third survey was conducted. The increase in mental health symptoms may be attributed to the continuous uncertainty around the virus pathophysiology, mode of transmission, and lack of a treatment which is a profoundly fear-provoking experience particularly for high-risk populations including healthcare workers [32,34,35]. For example, after many months of controversy and debate, only recently has the Public Health Agency of Canada recognized the risk of airborne transmission of the virus [36]. Despite this recognition, the Canadian COVID-19 PPE guidelines have not been updated to reflect this change, and the discordance in official information may pose an additional source of anxiety for nurses.

Second, cross-sector analyses demonstrated similar patterns of change for acute and community care nurses but their long-term care peers indicated a more worrying trend in comparison. We found a sharper increase in anxiety and depression for long-term care nurses compared to their counterparts in other sectors during the early-pandemic period, followed by a stronger decline at Time 3, particularly for anxiety. For acute and community care nurses, the prevalence of anxiety and depression respectively increased by about 12% and 10% early pandemic, followed by no to little decline (0%–2.4%) during Time 3. For long-term care nurses, the prevalence of anxiety increased by about 32%, nearly two-fold higher than its pre-pandemic levels. This increase was followed by a 24% decline at Time 3. Depression did not grow to the same extent in long-term care sector, though it still showed a greater jump than that found in other sectors.

The significant increase in long-term care nurse anxiety could be explained by the severity of COVID-19 impact in this sector. Canadian Institute of Health Information reported more than 840 outbreaks in long-term care settings accounting for 81% of the COVID-19 related mortalities in the country by May 25, 2020 [37]. This proportion is double the rate found in other OECD countries [37]. In other words, the long-term care sector became an epicentre of COVID-19 in Canada and given the lack of a robust pandemic management plan, more nurses in this sector developed unfavorable mental health outcomes.

The strong decline in anxiety and depression in the long-term care sector between the Time 2 and Time 3 surveys could be explained by a "healthy worker survivor effect," where workers maintaining their employment tend to be healthier than those who leave [38]. It is possible that long-term care nurses who were more anxious about COVID-19 left their positions in greater numbers than their counterparts who experienced fewer adverse mental health outcomes, therefore resulting in an apparent reduction in the prevalence of anxiety in this sector by June/July 2020 (Time 3). Although detailed cross-sector data on nurse turnover rates in the context of the pandemic is not available in Canada, we spec-

ulate that a greater proportion of long-term care nurses left their jobs during the pandemic, particularly at the time of the third survey, compared to their counterparts in other sectors. This is plausible given the disproportionate impact of the pandemic on the long-term care sector as evidenced by this sector accounting for the highest rates of COVID-19 mortalities both nationally and internationally [39]. According to WorkSafeBC statistics [40], compared to other healthcare sectors and their workforce size, long-term care staff accounted for the highest proportion of COVID-19 compensation claims in the province. Consistently, emerging studies show nurses who are more fearful of COVID-19 are more likely to suffer from poor mental health and to subsequently think about leaving the organization or profession altogether [41,42]. Future research should examine the impact of COVID-19 on nurse turnover behaviors across different sectors.

Comparing our study to other studies is challenging given that most studies examining the mental health of healthcare workers during the COVID-19 pandemic have been limited to a single time point. A systematic review that included 13 studies up until April 2020, reported the prevalence of depression and anxiety among nurses respectively as 30.9% and 25.8% [5]. Another systematic review of a subset of 59 studies with 54,707 healthcare workers estimated the prevalence of depression and anxiety respectively as 21% and 24% between December 2019 and May 2020 [43]. In our study, however, we observed a much higher prevalence compared to these systematic reviews [5,43], particularly for early-pandemic anxiety (Time 2 anxiety = 44.7%). A Pan-Canadian study of 7358 nurses conducted by Canadian Federation of Nurses' Union (CFNU) between May and September 2019 found 36.4% (vs. 30.8% in Time 1) of the sample met the criteria for depression and 26.1% (vs. 20.3% in Time 1) for anxiety.

The noted variation in prevalence estimates across studies during the COVID-19 pandemic may be explained in part by cultural and measurement differences across anxiety and depression instruments. For example, the systematic review noted above found wide ranges for the prevalence of anxiety (22 studies: 9%–90%) and depression (19 studies: 5%–51%) were reported among healthcare workers during the pandemic [43]. While 68% of these studies were conducted in China, remaining studies spanned across at least seven other countries. No Canadian study was included in this systematic review. Therefore, a strength of our study is the repeated measurements using the same instruments among Canadian nurses, prior to and during the COVID-19 pandemic. This allows us to directly compare prevalence estimates over three time periods, while cultural and other socio-demographic characteristics are held stable.

Strengths and Limitations

The results of this study should be interpreted in light of the following strengths and limitations. This study examined the impact of COVID-19 on mental health outcomes of BC nurses across three data points using validated scales for screening purposes. Correlational analyses showed strong positive correlations between GAD-2 and GAD-7 scores ($r = 0.93$, $p < 0.001$) at both times and between PHQ-2 and PHQ-9 scores at Time 1 ($r = 0.87$, $p < 0.001$) and Time 3 ($r = 0.88$, $p < 0.001$). Despite the strength of our findings, the convenience sampling strategies used and low survey response rates are limitations of the study. In comparing our sample to the BCNU membership, however, we found that the population frame was closely representative of our sample with respect to healthcare sector. The BCNU member profile showed 71% of the membership works in acute care settings, 17% in community care, and 12% in long-term care, which is comparable proportions to our sample characteristics across the three surveys. The low response rates preclude us generalizing our findings to all workers

in the health care sector in British Columbia over this time period. However, through taking advantage of a unique data collection opportunity, we were able to construct three relatively large cross-sectional samples, and make them similar in relation to age, sex, working location, sector, and occupational role. As such, we believe we have isolated trends in mental health symptoms over the short, and mid-term phases of the COVID-19 pandemic. Regardless, we recommend caution in generalizing the findings beyond the study sample, particularly to members of other unions or other Canadian provinces.

Overall, the findings of this study raise concerns about the mental health implications of COVID-19 for nurses especially those working in long-term care facilities in BC and beyond. Compared to BC, other Canadian provinces like Ontario and Quebec were harder hit by the COVID-19 pandemic particularly in the long-term care sector. The COVID-19 impact was severe enough in these provinces that public inquires were ordered into their long-term care sectors [44]. The subsequent reports revealed many concerning findings, including that these challenges were known and already existing before the pandemic [45].

While our study provides important new information, we note there is an urgent need for evidence-based practice and policy recommendations that prevent and mitigate the mental health implications of COVID-19 on nurses as they will continue to respond to future waves of the pandemic. Given the emerging research evidence [1,17,28,29], we believe systematic efforts ensuring that nurses' PPE and infection prevention and control needs are met are an important first step to improving the mental health of the nursing workforce. We emphasize that optimal pandemic management is not possible without a healthy and optimized health workforce that can respond to public health needs in an effective and timely manner.

Conclusion

The COVID-19 pandemic has deteriorated the mental health of the nursing workforce in BC with increased prevalence of anxiety and depression early-pandemic, which has not declined which has not declined to pre-pandemic levels. The negative impact of COVID-19 on nurses was disproportionate across healthcare sector, with long-term care nurses most significantly impacted. Future research should evaluate the impact of COVID-19 on mental health of health workers in jurisdictions and contexts most severely affected by COVID-19, and better understand the long-term health and labor market consequences of elevated mental health symptom over an extended time period.

Author contributions

F.H. and P.S. conceptualized the ideas; F.H., P.S and J.O. collected the data; P.S. analyzed the data; F.H., P.S., J.O. and G.G.P. interpreted the findings; F.H. led the writing; F.H., P.S., J.O. and G.G.P. reviewed and edited the draft.

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Ethics Disclosure

For each survey, approval was obtained from the ethics review board of the participating universities (Time 1: H18-02724; Time 2: 39267; Time 3: H20-01861). Participants were informed that survey completion and submission would imply informed consent.

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