



## 3 Sleep in Female Healthcare Workers during COVID-19: A Cross-Sectional Survey Study in Sweden during the Flattening of the First Wave of the Pandemic

The spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) challenges health systems worldwide. At the forefront of the pandemic, healthcare workers may face substantial stress due to overlong working hours and anxiety about being infected with the virus. Such stress may increase the risk of sleep disturbances among healthcare workers (1). For example, a survey in Spanish healthcare workers revealed that subjective sleep disturbances were more frequent in this group than in non-healthcare workers during the March to April (2020) outbreak of the coronavirus disease (COVID-19) (2). Stress during the early part of the COVID-19 pandemic may have differed among countries. For instance, Sweden did not impose strict stay-at-home (“lockdown”) orders, a strategy that may have led to a higher burden on health care and a greater pandemic death toll during the first wave in Sweden, compared with other Nordic countries (3–5). How such conditions may have impacted sleep among Swedish healthcare workers is unknown. Thus, we analyzed data from an anonymous survey in Sweden to compare subjective sleep measures between Swedish healthcare workers and non-healthcare workers both before and during the COVID-19 pandemic.

### Methods

The ICOSS (International COVID-19 Sleep Study) (6) set up anonymous online surveys (with 50 questions on sleep habits and sleep and daytime symptoms) to compare subjective sleep and daytime metrics in the general population before and amid the pandemic across 15 countries/areas (6). In addition to being asked the 50 questions, the respondents in Sweden were asked to state whether they work in health care (the type of specialty or ward was not queried). Information about the existence of the questionnaire was disseminated through television, internet, and social media platforms, as has been done in similar recently published surveys (7). The survey was presented as a means to investigate sleep and associated lifestyle habits during the COVID-19 pandemic. No information was provided about the expected outcome.

In Sweden, the questionnaire was filled out via the online platform Qualtrics XM (Qualtrics) between June 25, 2020, and August 10, 2020. After exclusions due to the lack of information on covariates, exposure, and outcome ( $n = 323$ ), complete survey data of 409 women (25% of whom were healthcare workers) were available for analysis. We restricted our analysis to women, as only 12 out of 137 male respondents worked in healthcare occupations. Note that the anonymous online survey made reidentification of the respondents impossible. Thus, no ethical or legal clearance was required, according to Swedish law.

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Supported by the Novo Nordisk Foundation (NNF19OC0056777), Swedish Brain Research Foundation (FO2020-0044 and FO2020-0334), the Swedish Foundation for Medical Research, and the Göran Gustafsson Foundation.

We used logistic regression, either unadjusted or adjusted, to compare sleep before and amid the pandemic between healthcare workers and non-healthcare workers (used as reference group in the analysis). The following outcomes were analyzed: 1) sleep quality measured by the question “How well have you been sleeping?,” with answers “rather badly” and “badly” being coded as low sleep quality; 2) difficulty falling asleep; 3) early-morning awakening; and 4) excessive daytime sleepiness. The criteria for difficulty falling asleep, early-morning awakening, and excessive daytime sleepiness were fulfilled when respondents stated that they experience these sleep problems either “3–5 days per week” or “daily or almost daily.” Finally, subjects were also asked how satisfied/dissatisfied they were with their current sleep pattern. The answers “dissatisfied” and “very dissatisfied” were coded as low sleep satisfaction. We chose to only control for a more limited number of covariates, as to not increase the uncertainty of the estimate. Unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) are shown, unless otherwise stated.

### Results

Women with healthcare occupations reported a laboratory-confirmed SARS-CoV-2 infection (OR [95% CI], 2.46 [1.23–4.92]) more frequently than women who reported working outside the healthcare system. Irrespective of healthcare working status, women with a SARS-CoV-2 infection had higher odds of experiencing excessive daytime sleepiness (OR [95% CI], 2.33 [1.18–4.60]) than those without a confirmed SARS-CoV-2 infection (reference group). More cohort characteristics can be found in Table 1.

Before the pandemic, no group differences in subjective sleep and daytime metrics were observed (Table 2). Amid the pandemic, healthcare workers had higher odds of suffering from excessive daytime sleepiness and low sleep satisfaction than women not working in healthcare (Table 2). Whereas the association between healthcare workers and higher odds of low sleep satisfaction remained significant, the association between excessive daytime sleepiness and healthcare working status was no longer significant when additionally adjusting for the SARS-CoV-2 infection status (*see* model 2 in Table 2).

### Discussion

Self-reported excessive daytime sleepiness and low sleep satisfaction were more prevalent among Swedish female healthcare workers than among female non-healthcare workers during the first wave of the SARS-CoV-2 pandemic. Excessive daytime sleepiness has been linked to an increased risk of sustaining a work injury (8) and lower safety performance (9). Thus, healthcare workers should be provided opportunities to reduce excessive daytime sleepiness and related occupational risks, such as taking brief naps during work breaks, having sufficiently long time-off periods, and having work schedules aligned with an individual’s chronotype.

Some symptoms of COVID-19 exhibit a persistent nature, forming what is known as “long COVID-19.” A recent diagnosis of COVID-19 has, for instance, been associated with an increased risk of a later diagnosis of anxiety or insomnia (10). As suggested by our data, prior SARS-CoV-2 infection may also account for excessive daytime sleepiness experienced by healthcare workers, as the association between this daytime problem and healthcare working status was no longer seen when adjusting for the SARS-CoV-2 infection status.

**Table 1.** Female respondent characteristics, stratified by occupational status

Characteristics	Total	Non-healthcare Workers	Healthcare Workers	P Value
N	409	305	104	—
Age, yr, mean (SD)	46.1 (12.9)	47.1 (13.2)	43.3 (11.6)	<b>0.01*</b>
BMI, kg/m <sup>2</sup> , mean (SD)	29.6 (4.9)	29.8 (4.9)	29.1 (4.8)	0.24*
Shift work outside regular hours, n (%)				
Yes, n (%)	36 (8.8)	16 (5.2)	20 (19.2)	<b>&lt;0.001<sup>†</sup></b>
No, n (%)	373 (91.2)	289 (94.8)	84 (80.8)	—
Chronotype, n (%)				
Definitely morning person	60 (14.7)	50 (16.4)	10 (9.6)	0.26 <sup>†</sup>
Probably morning person	107 (26.2)	84 (27.5)	23 (22.1)	—
Intermediate	76 (18.6)	53 (17.4)	23 (22.1)	—
Probably evening person	94 (23.0)	67 (22.0)	27 (26.0)	—
Definitely evening person	72 (17.6)	51 (16.7)	21 (20.2)	—
Marital status, n (%)				
Married or cohabitating	282 (68.9)	204 (66.9)	78 (75.0)	0.12 <sup>†</sup>
Living alone	127 (31.1)	101 (33.1)	26 (25.0)	—
University or doctoral degree, n (%)				
Yes	333 (81.4)	230 (75.4)	103 (99.0)	<b>&lt;0.001<sup>†</sup></b>
No	76 (18.6)	75 (24.6)	1 (1.0)	—
Depression (diagnosed or under treatment), n (%)				
Yes	41 (10.0)	29 (9.5)	12 (11.5)	0.55 <sup>†</sup>
No	368 (90.0)	276 (90.5)	92 (88.5)	—
Pregnancy, n (%)				
Yes	12 (2.9)	8 (2.6)	4 (3.8)	0.52 <sup>†</sup>
No	397 (97.1)	297 (97.4)	100 (96.2)	—
Beer consumption (no. of bottles or cans/wk), n (%)				
0	269 (65.8)	202 (66.2)	67 (64.4)	0.62 <sup>†</sup>
1–7	63 (15.4)	44 (14.4)	19 (18.3)	—
More than 7	77 (19.8)	59 (19.3)	18 (17.3)	—
Frequent hypnotics use before the pandemic, <sup>‡</sup> n (%)				
Yes	25 (6.1)	21 (6.9)	4 (3.8)	0.26 <sup>†</sup>
No	384 (93.9)	284 (93.1)	100 (96.2)	—
Frequent hypnotics use amid the pandemic, <sup>‡</sup> n (%)				
Yes	32 (7.8)	25 (8.2)	7 (6.7)	0.63 <sup>†</sup>
No	377 (92.2)	280 (91.8)	97 (93.3)	—
Did you have a laboratory-confirmed SARS-CoV-2 infection?, n (%)				
Yes	37 (9.0)	21 (6.9)	16 (15.4)	<b>0.009<sup>†</sup></b>
No/I don't know	372 (91.0)	284 (93.1)	88 (84.6)	—

*Definition of abbreviations:* BMI = body mass index; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; SD = standard deviation. Values indicating significance (i.e.,  $P < 0.05$ ) are presented in bold.

\*For the comparison of non-healthcare workers with healthcare workers,  $P$  values were derived from unpaired Student's  $t$  tests.

<sup>†</sup>For the comparison of non-healthcare workers with healthcare workers,  $P$  values were derived from chi-square tests.

<sup>‡</sup>Did/do you use sleeping pills (hypnotics by prescription)? Answer options were "never or less frequently than once per month," "less frequently than once per week," "1–2 nights per week," "3–5 nights per week," and "every night or almost every night." The last two options were coded as frequent hypnotics use.

Several weaknesses must be kept in mind during the interpretation of our data:

1. Sweden, where the survey was distributed, had very lenient lockdown measures compared with other countries.
2. As our survey was disseminated across, for example, social media, it is possible that it only reached certain types of respondents and may not be representative for all of Sweden. Because of our survey's limited size, we were furthermore unable to control for several factors that may be of relevance, such as certain comorbidities.
3. Many subjects who filled out the survey anonymously were excluded for missing data, which may have introduced selection bias.
4. We do not have information about the type of healthcare work and work hours.

**Author disclosures** are available with the text of this letter at [www.atsjournals.org](http://www.atsjournals.org).

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**Table 2.** Prevalence of sleep problems before and amid the COVID-19 pandemic

Outcome	Healthcare-Worker Status [n (%)]		Healthcare-Worker Status by Model			
	No	Yes	No OR (95% CI)	Yes		
				OR (95% CI) Unadjusted	OR (95% CI) Model 1	OR (95% CI) Model 2
Low sleep quality						
Before the pandemic	45 (14.8)	16 (15.4)	1	1.05 (0.57–1.95)	1.21 (0.64–2.33)*	—
Amid the pandemic	93 (30.5)	35 (33.7)	1	1.16 (0.72–1.86)	1.25 (0.76–2.06)†	1.20 (0.73–1.98)
Change from before to amid the pandemic	+48 (+15.7)	+19 (+18.3)	—	—	—	—
Difficulty falling asleep						
Before the pandemic	42 (13.8)	10 (9.6)	1	0.67 (0.32–1.38)	0.77 (0.36–1.68)*	—
Amid the pandemic	72 (23.6)	26 (25.0)	1	1.08 (0.64–1.81)	1.12 (0.65–1.94)†	1.08 (0.62–1.89)
Change from before to amid the pandemic	+30 (+9.8)	+16 (+15.4)	—	—	—	—
Early-morning awakenings						
Before the pandemic	40 (13.1)	9 (8.7)	1	0.63 (0.29–1.34)	0.69 (0.32–1.48)*	—
Amid the pandemic	67 (22.0)	21 (20.2)	1	0.90 (0.52–1.56)	0.98 (0.56–1.72)†	0.95 (0.54–1.68)
Change from before to amid the pandemic	+27 (+8.9)	+12 (+11.5)	—	—	—	—
Excessive daytime sleepiness						
Before the pandemic	35 (11.5)	14 (13.5)	1	1.20 (0.62–2.33)	1.19 (0.60–2.35)*	—
Amid the pandemic	100 (32.8)	45 (43.3)	1	1.56 (0.99–2.47)	<b>1.63 (1.01–2.61)†</b>	1.53 (0.95–2.48)
Change from before to amid the pandemic	+65 (+21.3)	+31 (+29.8)	—	—	—	—
Low sleep satisfaction						
Before the pandemic	—	—	—	—	—	—
Amid the pandemic	95 (31.1)	44 (42.3)	1	<b>1.62 (1.03–2.56)</b>	<b>1.80 (1.11–2.92)†</b>	<b>1.81 (1.12–2.94)</b>

Definition of abbreviations: CI = confidence interval; COVID-19 = coronavirus disease; OR = odds ratio; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

Values indicating significance (i.e.,  $P < 0.05$ ) are presented in bold. Low sleep satisfaction before the pandemic was not surveyed. Model 2 adjusted for self-reported age (continuous), reports of frequent hypnotics use amid the pandemic (binary), and SARS-CoV-2 infection.

\*Adjusted for self-reported age (continuous) and reports of frequent hypnotics use *before* the pandemic (binary).

†Adjusted for self-reported age (continuous) and reports of frequent hypnotics use *amid* the pandemic (binary).

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