



**Original Article**

**Nurses' Physical and Psychological Symptoms During the first COVID-19 Lockdown in Italy: a Nationwide Cross-Sectional Study in Stem Cell Transplantation Setting**

Stefano Botti<sup>1\*</sup>, Chiara Cannici<sup>2\*</sup>, Sarah Jayne Liptrott<sup>3\*</sup>, Valentina De Cecco<sup>4</sup>, Elena Rostagno<sup>5</sup>, Gianpaolo Gargiulo<sup>6</sup>, Laura Orlando<sup>7</sup>, Alessandro Caime<sup>8</sup>, Emanuela Samarani<sup>9</sup>, Letizia Galgano<sup>10</sup>, Marco Cioce<sup>11</sup>, Nicola Mordini<sup>12</sup>, Nadia Elisa Mandelli<sup>13</sup>, Lucia Tombari<sup>14</sup>, Sara Errichiello<sup>15</sup>, Nicola Celon<sup>16</sup>, Roberto Lupo<sup>17</sup>, Teresa Rea<sup>18</sup> and Nicola Serra<sup>19</sup>.

<sup>1</sup> Hematology Unit, Azienda USL-IRCCS di Reggio Emilia, viale Risorgimento 80, 42123, Reggio Emilia, Italy.

<sup>2</sup> Division of Hematology, Azienda Ospedaliera SS. Antonio e Biagio e Cesare Arrigo, via Venezia 16, 15121, Alessandria, Italy.

<sup>3</sup> Ente Ospedaliero Cantonale, Via Ospedale, Bellinzona, Switzerland.

<sup>4</sup> Department of Onco-Haematology and Cell and Gene Therapy, Bambino Gesù Children's Hospital IRCCS, Piazza Sant'Onofrio 4, 00165, Rome, Italy.

<sup>5</sup> Oncoematologia Pediatrica, IRCCS Azienda Ospedaliera Universitaria di Bologna, via Giuseppe Massarenti 13, 40138, Bologna, Italy.

<sup>6</sup> Haematology Unit, Federico II University Hospital of Naples, via S. Pansini 5, 80131, Naples, Italy.

<sup>7</sup> Istituto Oncologico della Svizzera Italiana, via A. Gallino 12, 6500, Bellinzona, Switzerland.

<sup>8</sup> Division of Hemato-Oncology, European Institute of Oncology IRCCS, via Ripamonti 435, 20141, Milan, Italy.

<sup>9</sup> Unit of Blood Diseases and Stem Cell Transplantation, ASST Spedali Civili, Piazzale Spedali Civili 1, 25100, Brescia, Italy.

<sup>10</sup> Transfusion Medicine and Cell Therapies, AOU-Careggi, Largo Brambilla 3, 50139, Firenze, Italy.

<sup>11</sup> Hematology and Trasplant Unit, Fondazione Policlinico Universitario A. Gemelli IRCCS, Largo Agostino Gemelli 8, 00168, Rome, Italy.

<sup>12</sup> Hematology Division, AO S. Croce e Carle, via M. Coppino 26, 12100 Cuneo, Italy.

<sup>13</sup> Department of Pediatrics, University of Milano-Bicocca Fondazione MBBM/ASST, via Pergolesi 33, 20900 Monza, Italy.

<sup>14</sup> Hematology and Stem Cell Transplant Center, Azienda Ospedaliera Ospedali Riuniti Marche Nord (AORMN), piazzale Carlo Cinelli 4, 61121 Pesaro, Italy.

<sup>15</sup> Hematology Unit, Azienda Sanitaria Universitaria Friuli Centrale, piazzale Santa Maria della Misericordia 15, 33100, Udine, Italy.

<sup>16</sup> Pediatric Onco-hematology Unit, AOU Padova, via Giustiniani 2, 35128, Padova, Italy.

<sup>17</sup> Emergency Unit, ASL Lecce "San Giuseppe da Copertino" Hospital, via Carmiano 1, 73043, Copertino Lecce, Italy.

<sup>18</sup> Department of Public Health, University Federico II of Naples, via S. Pansini 5, 80131, Naples, Italy.

<sup>19</sup> Department of Public Health, University Federico II of Naples, via S. Pansini 5, 80131, Naples, Italy.

\* These authors contributed equally to this work.

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**Abstract. Background and objective:** Northern Italy was one of the first European territories to deal with the Coronavirus Disease 2019 (COVID-19) outbreak. Drastic emergency restrictions were introduced to contain the spread and limit pressure on healthcare facilities. However, nurses were at high risk of developing physical, mental, and working issues due to professional exposure.

**The aim of this cross-sectional study was to investigate these issues among nurses working in Italian hematopoietic stem cell transplant (HSCT) centers during the COVID-19 pandemic.**

**Methods:** Data were collected online immediately after the first "lockdown" period in order to investigate the prevalence of physical issues, sleep disorders, and burnout symptoms and explore correlations with COVID-19 territorial incidence in Northern Italian regions versus Central and Southern Italian regions.

**Results:** Three hundred and eight nurses working in 61 Italian HSCT Units responded to the survey. Depression, cough, and fever were more frequently reported by nurses working in geographical areas less affected by the pandemic ( $p=0.0013$ ,  $p<0.0001$ , and  $p=0.0005$  respectively) as well as worst sleep quality ( $p=0.008$ ). Moderate levels of emotional exhaustion (mean $\pm$ SD -  $17.4\pm 13.0$ ), depersonalization ( $5.3\pm 6.1$ ), and personal accomplishment ( $33.2\pm 10.7$ ) were reported without significant differences between territories.

**Conclusions:** different COVID-19 incidence among territories did not influence nurses' burden of symptoms in the HSCT setting. However, burnout and insomnia levels should be considered by health care facilities in order to improve preventive strategies.

**Keywords:** COVID-19; Nurse; Pandemic; Burnout; Sleep disorders; Hematopoietic stem cell transplantation.

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Correspondence to: Stefano Botti, BSc. Hematology Unit, Azienda USL-IRCCS di Reggio Emilia, viale Risorgimento 80, 42123, Reggio Emilia, Italy. Tel: +39 052 229 66 61. E-mail [stefano.botti@ausl.re.it](mailto:stefano.botti@ausl.re.it) . ORCID: [0000-0002-0678-0242](https://orcid.org/0000-0002-0678-0242).

**Introduction.** Coronavirus Disease 2019 (COVID-19) pandemic rapidly affected health activities worldwide.<sup>1</sup> A higher prevalence of severe complications due to COVID-19 in the frail population, including subjects with co-morbidities such as chronic diseases, cardiovascular illnesses, respiratory issues, and cancer, was well recognized.<sup>2-7</sup> In Italy, the spread of the infection increased exponentially, causing high numbers of deaths, especially in Northern Italian regions<sup>8</sup> after which, the whole country was placed into 'lockdown' from March 9 to May 5, 2020<sup>9</sup> in order to reduce virus' circulation and decrease the pressure on healthcare facilities.

As the literature demonstrated, some pandemic-related factors such as the danger of the disease and the adopted restrictive measures were sources of concern and anxiety among the general population<sup>10-14</sup> and Health Care Professionals (HCPs), leading to increased risk of psychiatric symptoms development.<sup>15,16</sup> Nurses were more prone to develop burnout and stress disorders during the pandemic outbreak<sup>17,18</sup> due to various factors such as their proximity with the patients, the higher work pace, the emotional demands increasing, and the concern of becoming infected by COVID-19 and of transmitting it to others.<sup>19</sup> HCPs directly involved in caring for those in a critical condition were exposed to a greater risk of becoming infected<sup>20</sup> with major psychological pressure related to uncertainty about the duration of the crisis, the lack of proven therapies or vaccines, potential shortages

of healthcare resources including personal protective equipment, and other less estimated factors, such as pre-existing psychological problems and work-related issues.<sup>17,21-24</sup> Stress disorders<sup>25-27</sup> and psychological disturbances such as anxiety, depression, moral distress, and sleep disorders were detected in HCPs treating patients exposed to COVID-19.<sup>21,28-33</sup> However, the literature showed that oncology nurses working frontline with COVID-19 patients had a lower frequency of burnout and were less worried about being infected than colleagues working on usual wards.<sup>25</sup> Thus, few and conflicting results were reported within the cancer setting, and no data were available for onco-hematology and Hematopoietic Stem Cell Transplantation (HSCT) settings where patients were at higher risk of infection.<sup>34</sup>

The pandemic posed several challenges to onco-hematology nurses<sup>35</sup> due to organizational issues, limited resources, and increasing working time with patients exposed to severe infectious complications and occupational risks, contributing to increased stress-related disturbances<sup>36</sup> like burnout or insomnia. Burnout (BO) is defined as a syndrome resulting from chronic workplace stress that was not properly addressed.<sup>37,38</sup>

This investigation may highlight these issues and provide useful information regarding the need for supportive strategies for nurses.<sup>39-41</sup>

The aims of this study were: 1) to investigate the prevalence of BO, sleep disturbances, and other

symptoms on nurses working in stem cell transplantation settings, immediately after the lockdown period in Italy; 2) to identify any differences among Italian regions according to the different incidences of COVID-19.

**Materials and Methods.** A cross-sectional study was designed to assess the prevalence of burnout, sleep disturbances, and other symptoms of nurses working with HSCT patients.

A presentation letter containing the link to an online, voluntary, and anonymous survey available from June 10, 2020, to August 15, 2020 (Google forms survey URL [https://docs.google.com/forms/d/1-ZkE8WgE85HiDk5kFDyJenmZvgY82OBypwoT2I-7t\\_I/edit](https://docs.google.com/forms/d/1-ZkE8WgE85HiDk5kFDyJenmZvgY82OBypwoT2I-7t_I/edit)) was sent to all nurses (n = 178) of the Gruppo Italiano Trapianto di Midollo Osseo (GITMO) network via email. A snowballing procedure was adopted for participants' recruitment asking participants to involve other colleagues. The questionnaire was divided into five sessions: three composed of structured questions (single or multiple or scaled responses) assessing socio-demographic and professional details, perceived COVID-19 pandemic induced working issues, HSCT nurses' concerns and general physical and psychological symptoms experienced; and two sessions containing validated tools evaluating burnout prevalence (Maslach Burnout Inventory - MBI)<sup>38</sup> and sleep quality (Pittsburgh Sleep Quality Index - PSQI).<sup>42,43</sup> The first 3 sessions were developed reviewing the available literature<sup>17,18,21,27-29</sup> by the Nursing Committee of GITMO and tested for understanding, clarity and readability before the start of the study. The online system registered only completed questionnaires.

The MBI is a validated 22 items questionnaire evaluating the 3 dimensions of BO (Emotional Exhaustion - EE, Depersonalization - DP, and Personal Accomplishment - PA) on the third level of severity (low, moderate, high), scored according to the Italian Maslach Manual.<sup>44</sup> However, in line with other authors, we also defined BO as a high level of emotional exhaustion (>27) and/or a high level of depersonalization (>10), while the frequency of low sense of PA was considered separately (>31).<sup>45,46</sup>

The PSQI contains 19 self-rated questions related to 7 sub-scores; these items give a global score from 0 to 21, where higher values (cut off = 5) are associated with poor sleep quality. It is considered the most important tool to assess sleep quality.

Statistical analysis was performed stratifying results: Northern Italian regions (NIT) versus Central and Southern Italian regions (CSIT) according to the different prevalence of COVID-19 in these areas.

The Matrix Laboratory (MATLAB) Statistical toolbox version 2008 (MathWorks, Natick, MA, USA) was used. Descriptive analysis was performed on response frequencies; the Chi-square test was used to

evaluate significant differences between the two groups. Fisher's exact test was used where the Chi-square test was not appropriate. The multiple comparison chi-square test and post hoc Z-test were used to define significant differences among percentages for unpaired data, Mann Whitney test was used as an alternative to the independent samples t-test for not normal distributions. All tests with  $p < 0.05$  were considered significant.

## Results.

*Socio-Demographic and Professional Details.* Three hundred and eight nurses (82.5% women, mean age 42.2, SD±10.5), who represented one-quarter of the total number of nurses working in HSCT centers of Italy, provided complete responses to the survey. According to COVID-19 disease prevalence, results were stratified in two clusters corresponding to two geographical macro-areas (NIT vs. CSIT). **Table 1** reports the sample characteristics and differences among sub-groups.

The majority of respondents were female across both groups (NIT n=184, 86.0%; CSIT n=70, 74.5%) with a younger nursing population in the NIT group (NIT Mean±SD 40.6±10.1; CSIT Mean±SD 45.9±10.4)

In the CSIT group, significantly fewer respondents lived with a spouse or companion (13.8%,  $p=0.0374$ ) or did not have children (30.9%,  $p=0.0278$ ).

The majority of respondents were staff nurses (n=254, 82.5%), educated to degree level (n=137, 44.5%) and in full time employment (n=263, 85.4%), similar across the two geographical groups.

Respondents worked primarily with adults only (n=229, 74.3%), with fewer respondents working with only pediatric patients, particularly less represented in Central and Southern Italian regions (NIT n=62, 29.0% vs. CSIT n=7, 7.4%;  $p=0.0027$ ), while respondents working with both pediatric and adult patients were more commonly from CSIT areas (8.5%;  $p=0.0310$ ).

Most respondents worked in inpatient units (n=236, 74.3%) but fewer from Central and Southern Italian regions (CSIT n=60, 63.8% vs NIT n=176, 82.2%,  $p=0.0109$ ).

*COVID-19 Pandemic Induced Working Issues.* Several working issues were highlighted during the lockdown, summarised in **Table 2**. At the time of this study, the majority of respondents had been tested for SARS-CoV-2 positivity (n=281; 91.2%), significantly more in the NIT group compared with nurses from CSIT centers (96.3% vs. 79.8%,  $p < 0.0001$ ). However, tests for SARS-CoV-2 had not been performed from the beginning of the pandemic in over half of respondents (n=175; 56.8%), more so in those from NIT regions in contrast to CSIT centers (63.1% vs. 42.5%,  $p=0.0386$ ), and tests were being repeated routinely in less than half of respondents (134; 43.5%).

Half of the sample (162; 52.6%) reported that nurses

**Table 1.** Socio-demographic and professional details of the sample and differences among the two macro-areas.

	<b>Total n = 308 n (%)</b>	<b>NIT n = 214 n (%)</b>	<b>CSIT n = 94 n (%)</b>	<b>p value (test)</b>
Age				
Mean±SD	42.2±10.5	40.6±10.1	45.9±10.4	
Median (IQR)	44.5 (33-51)	43 (31-49),	47 (40-54),	
Mean rank		141.5	184.2	<b>0.0001 (MW)</b>
Reject/Accept Normality, p value	rN, <b>p&lt;0.0001</b>	rN, <b>p&lt;0.0001</b>	aN, p>0.10	
Gender				
Male	54 (17.5)	30 (14.0)	24 (25.5)	
Female	254 (82.5)	184 (86.0)	70 (74.5)	<b>0.0144 (C)</b>
Marital status				0.092 (Cm)
Unmarried	131 (42.5)	96 (44.9)	35 (37.2)	
Married	144 (46.7)	100 (46.7)	44 (46.8)	
Divorced	31 (10.1)	16 (7.5)	15 (16.0)	
Widow/Widower	2 (0.7)	2 (0.9)	0 (0.0)	
Do you have children?				<b>0.0197 (Cm)</b>
Yes > 18 years	59 (19.2)	37 (17.3)	22 (23.4)	
Yes < 18 years	84 (27.3)	54 (25.2)	30 (31.9)	
Both	30 (9.7)	17 (7.9)	13 (13.8)	
No	135 (43.8)	106 (49.5)	29 (30.9)	<b>CSIT***, p=0.0278(Z)</b>
Who do you live with?				<b>0.0036 (Cm)</b>
Parents or relatives	33 (10.7)	16 (7.5)	17 (18.1)	
Spouse / Partner only	75 (24.4)	62 (29.0)	13 (13.8)	<b>CSIT***, p=0.0374(Z)</b>
Spouse / Partner and child(ren)	139 (45.1)	91 (42.5)	48 (51.1)	
Alone	58 (18.8)	42 (19.6)	16 (17.0)	
Other (friends, room mates)	3 (1.0)	3 (1.4)	0 (0.0)	
Job role				<b>0.0304 (Cm)</b>
Nurse (Nurse - Paediatric Nurse)	278 (90.3)	198 (92.5)	80 (85.2)	
Nursing Director	1 (0.3)	0 (0.0)	1 (1.1)	
Head Nurse	27 (8.8)	15 (7.0)	12 (12.8)	
Case Manager	2 (0.6)	1 (0.5)	1 (1.1)	
Nursing Director				
Head Nurse	111 (36.0)	85 (39.7)	26 (27.7)	
Case Manager	35 (11.4)	12 (5.6)	23 (24.5)	<b>CSIT**, p=0.0014(Z)</b>
BSc	137 (44.5)	99 (46.3)	38 (40.4)	
MSc	25 (8.1)	18 (8.4)	7 (7.4)	
PhD	0 (0.0)	0 (0.0)	0 (0.0)	
Job contract				0.23 (Cm)
Permanent full time	263 (85.4)	186 (86.9)	77 (81.9)	
Permanent part time	25 (8.1)	18 (8.4)	7 (7.4)	
Short Fixed-term	17 (5.5)	8 (3.7)	9 (9.6)	
Freelance	3 (1.0)	2 (0.9)	1 (1.1)	
What type of shift did you do during the lockdown?				0.50 (Cm)
Three shifts (with night shifts)	214 (69.5)	152 (71.0)	62 (66.0)	
Two shifts (daily shifts)	52 (16.9)	36 (16.8)	16 (17.0)	
Fixed daily working time	42 (13.6)	26 (12.2)	16 (17.0)	
Type of patients cared for				<b>&lt;0.0001 (Cm)</b>

Adults	229 (74.3)	150 (70.1)	79 (84.1)	
Paediatrics	69 (22.4)	62 (29.0)	7 (7.4)	<b>CSIT***, p=0.0027(Z)</b>
Both	10 (3.3)	2 (0.9)	8 (8.5)	<b>CSIT**, p=0.0310(Z)</b>
Transplant programs settings				<b>0.0018 (Cm)</b>
In-patients ward	236 (76.6)	176 (82.2)	60 (63.8)	<b>CSIT***, p=0.0109(Z)</b>
Out-patients, ambulatory	38 (12.4)	21 (9.8)	17 (18.1)	
Both	34 (11.0)	17 (7.9)	17 (18.1)	
Years of experience				
Mean±SD	18.0±10.8	17.9±11.3	18.3±9.5	
Median (IQR)	18.0 (8-27)	17.5 (7-28),	19.5 (10-24),	
Mean rank		154.2	155.2	0.92 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	aN, p>0.1	
Years of experience in HSCT				
Mean±SD	11.8±9.0	11.5±9.2	12.3±18.4	
Median (IQR)	10 (4-20)	10 (3-20)	12 (5-20)	
Mean rank		150.9	162.6	0.29 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p=0.0039</b>	

RN = Registered Nurse; BSc = Bachelor of Science; MSc = Master of Science; PhD = Doctorate; SD = standard deviation; IQR= Interquartile range; aN=accept Normality (p>0.05); rN=reject Normality (p<0.05); MW = Mann-Whitney test; C = Chi-square test; F = Fischer's exact test; Cm = multi-comparison chi-square test; Z= post hoc Z test; \*\* = significant more frequent; \*\*\* = significant less frequent. **In bold:** significant p values.

**Table 2.** Working issues during the lockdown period.

Items	Total n = 308 n (%)	NIT n = 214 n (%)	CSIT n = 94 n (%)	p value (test)
Have you been tested for SARS-Cov-2 positivity?				
Yes	281 (91.2)	206 (96.3)	75 (79.8)	<b>&lt;0.0001 (C)</b>
No	27 (8.8)	8 (3.7)	19 (20.2)	
Have the tests been performed since the beginning of health emergency <sup>#</sup> in your area? (+)				
Yes	115 (37.3)	76 (35.5)	39 (41.5)	<b>0.0386 (C)</b>
No	175 (56.8)	135 (63.1)	40 (42.5)	
Missing	18 (5.9)	3 (1.4)	15 (16.0)	
Have the tests been repeated routinely? (+)				
Yes	134 (43.5)	97 (45.3)	37 (39.4)	0.75 (C)
No	154 (50.0)	114 (53.3)	40 (42.6)	
Missing	20 (6.5)	3 (1.4)	17 (18.0)	
Have any healthcare workers (nurses, auxiliary nurses, head nurses, doctors) been moved from your ward to work on COVID-19 wards/units during the emergency?				
Yes	162 (52.6)	119 (55.6)	43 (45.7)	0.11 (C)
No	146 (47.4)	95 (44.4)	51 (54.3)	
Please specify how many nurses (+)				
0	154 (50.0)	108 (50.5)	46 (48.9)	0.44 (Cm)
1-3	109 (35.4)	72 (33.6)	37 (39.4)	
>3	39 (12.7)	30 (14.0)	9 (9.6)	
Missing	6 (1.9)	4 (1.9)	2 (2.1)	
Please specify how many physicians (+)				
0	182 (59.1)	114 (53.3)	68 (72.3)	<b>0.0079 (Cm)</b> <b>CSIT**, p=0.0409(Z)</b>

1-3	73 (23.7)	57 (26.6)	16 (17.0)	
>3	44 (14.3)	36 (16.8)	8 (8.5)	
Missing	9 (2.9)	7 (3.3)	2 (2.1)	
Do you think you received adequate training from your organization on the correct use of Personal Protective Equipment (PPEs)?				
Yes	214 (69.5)	160 (74.8)	54 (57.4)	<b>0.0024 (C)</b>
No	94 (30.5)	54 (25.2)	40 (42.6)	
Was PPE available in your centre appropriate to the situation?				
Yes	171 (55.5)	122 (57.0)	49 (52.1)	0.43 (C)
No	137 (44.5)	92 (43.0)	45 (47.9)	
Did you have contact (professional or social) with a SARS-CoV-2 positive subject?				
Yes	186 (60.4)	137 (64.0)	49 (52.1)	<b>0.0494 (C)</b>
No	122 (39.6)	77 (36.0)	45 (47.9)	
Did you have family income loss due to the lockdown?				
Yes	103 (33.4)	65 (30.4)	38 (40.4)	0.085 (C)
No	205 (66.6)	149 (69.6)	56 (59.6)	
Did the lockdown prevent you meeting close family members?				
Yes	263 (85.4)	180 (84.1)	83 (88.3)	0.34 (C)
No	45 (14.6)	34 (15.9)	11 (11.7)	

SD = standard deviation; IQR= Interquartile range; aN=accept Normality( $p>0.05$ ); rN=reject Normality ( $p<0.05$ ); C = Chi-square test; F = Fischer's exact test; Cm = multi-comparison chi-square test; Z= post hoc Z test; \*\* = significant more frequent; \*\*\* = significant less frequent; + = the statistical analysis was performed without missed cases; # The beginning of the health emergency is defined as 31<sup>st</sup> January (Italian Government decided to declare the state of emergency). **In bold:** significant p values.

and physicians in their center had been redeployed from HSCT wards to inpatient units caring for patients affected by COVID-19 in order to deal with the emergency, more commonly nurses rather than medical staff ( $n=148$ , 48.1% vs.  $n=117$ , 38.0%). The movement of nurses from caring for HSCT patients to working on COVID-19 dedicated wards was similar between regions; however, respondents from Central and Southern regions reported that no physicians were moved in most cases (72.3%,  $p=0.0409$ ).

Sixty percent of the respondents acknowledged having had contact with someone positive for SARS-CoV-2, more frequently in NIT regions (64%,  $p=0.0494$ ). Little over half ( $n=171$ ; 55.5%) felt they had the appropriate availability of Personal Protective Equipment (PPE) during the lockdown period while 69.5% ( $n=214$ ) felt they had received adequate training on PPE use, significantly more in respondents from NIT centers (74.8%,  $p=0.0024$ ).

One-third of respondents ( $n=103$ ; 33.4%) reported a loss of income due to the lockdown situation, with the majority being unable to meet close relatives in this period (263; 85.4%).

*HSCT Nurses' Concerns and Symptoms.* Despite the difference in the prevalence of COVID-19 between the two groups of regions, the effects of COVID-19 on work,

physical and psychological effects, and impact on daily life were significantly less underestimated by CSIT HSCT nurses ( $p=0.0124$ ) (**Table 3**). Most nurses ( $n=254$ ; 82.5%) did not experience relationship difficulties with patients (e.g., providing remote support). However, where reported, challenges were greater in nurses from CSIT regions (30.7% vs. 11.9%,  $p>0.0001$ ). The need for emotional or psychological support was felt by just over one-third of respondents ( $n=115$ ; 37.3%), almost all having had support after the first wave of COVID-19 ( $n=103$ ; 33.4%), particularly those from central and southern Italian regions (CSIT 41.5% vs. NIT 29.9%,  $p=0.0472$ ). Few nurses ( $n=23$ ; 7.5%) asked for formal help from a psychologist, and in less than one-quarter of centers, psychological support was available and provided by the institution where respondents were working ( $n=70$ ; 22.7%). Thirty-eight nurses (12.3%) reported requiring medication for anxiety or depression induced by the pandemic situation, mostly from Central and Southern Italian regions (CSIT 29.8% vs. NIT 4.7%,  $p<0.0001$ ). Secondary analysis on our database (not published material) showed that nurses who had emotional or psychological support were significantly younger (mean  $40.5\pm 10.4$  vs  $43.1\pm 10.4$  years;  $p=0.0269$ ) than those who did not need it.

During the lockdown period, nurses' main concerns (**Figure 1a**) were both the risks of transmitting infections

**Table 3.** Nurses' problems and perceptions.

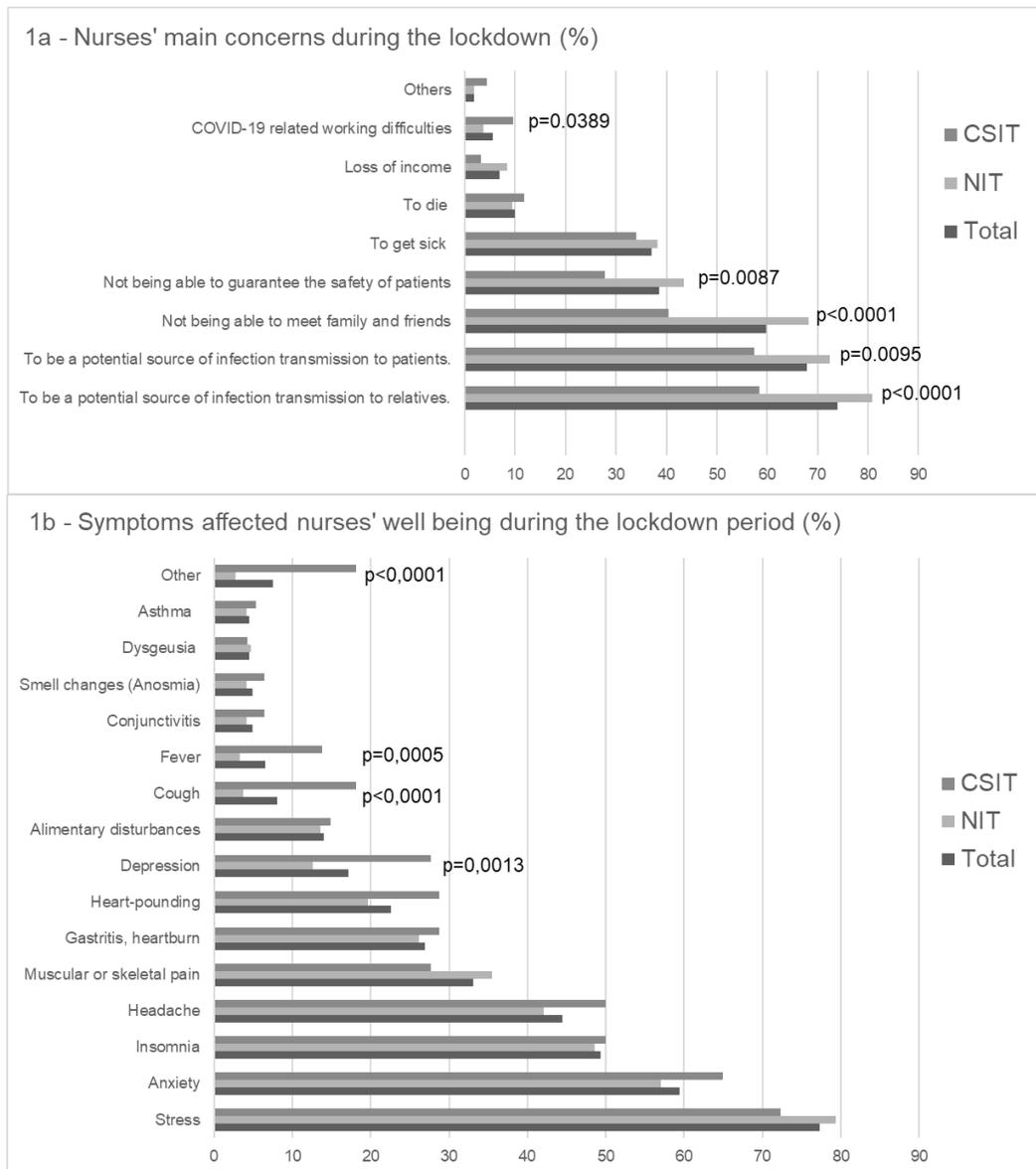
Items	Total n = 308 n (%)	NIT n = 214 n (%)	CSIT n = 94 n (%)	p value (test)
During the lockdown period, did you have any relationship difficulties with patients (e.g. providing remote support)?				
Yes	54 (17.5)	25 (11.7)	29 (30.9)	<b>&lt;0.0001 (C)</b>
No	254 (82.5)	189 (88.3)	65 (69.1)	
During the lockdown period, did you feel in emotional or psychological support?				
Yes	115 (37.3)	74 (34.6)	41 (43.6)	0.13 (C)
No	193 (62.7)	140 (65.4)	53 (56.4)	
During the lockdown period, did you ask for emotional or psychological support?				
Yes	103 (33.4)	64 (29.9)	39 (41.5)	<b>0.0472 (C)</b>
No	205 (66.6)	150 (70.1)	55 (58.5)	
Who did you ask for help? (multiple answers)				0.49 (Cm)
Nobody	199 (64.4)	147 (68.7)	52 (55.3)	
Colleagues	45 (14.6)	28 (13.1)	17 (18.1)	
Friends	48 (15.5)	31 (14.5)	17 (18.1)	
Family	68 (22.1)	45 (21.0)	23 (24.5)	
Psychologists	23 (7.5)	15 (7.0)	8 (8.5)	
Others	3 (1.0)	2 (1.0)	1 (1.1)	
Was psychological support provided by your health institution during the lockdown period?				
Yes	70 (22.7)	46 (21.5)	24 (25.5)	0.44 (C)
No	238 (77.3)	168 (78.5)	70 (74.5)	
Did you need medication for anxiety or depression as consequence of the pandemic situation?				
Yes	38 (12.3)	10 (4.7)	28 (29.8)	<b>&lt;0.0001 (C)</b>
No	270 (87.7)	204 (95.3)	66 (70.2)	
Did you leave your job due to stress induced by the pandemic situation?				<b>0.0184 (Cm)</b>
Yes, I changed it	3 (1.0)	2 (0.9)	1 (1.1)	<b>CSIT**, p=0.0408 (Z)</b>
No, I never considered this option	229 (74.3)	169 (79.0)	60 (63.8)	
I thought it but I didn't do it	76 (24.7)	43 (20.1)	33 (35.1)	
Are you considering changing your job now?				
Yes	80 (26.0)	46 (21.5)	34 (36.2)	<b>0.0068 (C)</b>
No	228 (74.0)	168 (70.5)	60 (63.8)	
Did you expect it to have such an impact at the start of pandemic? (1-10 Likert scale: 1 = "not at all" – 10 = "a lot")				
Mean±SD	4.4±2.5	4.7±2.5	3.9±2.4	<b>0.0124 (MW)</b>
Median (IQR)	5.0 (2-6)	5.0 (3-7)	3.5 (2-5)	
Mean rank		162.8	135.5	
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Please assess your working stress during the lockdown period (1-10 Likert scale: 1 = "no stress" – 10 = "high stress level")				
Mean±SD	6.3±2.3	6.7±2.1	5.4±2.6	<b>&lt;0.0001 (MW)</b>
Median (IQR)	7.0 (5-8)	7.0 (5-8)	5.0 (3-8)	
Mean rank		168.4	122.9	
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p=0.0006</b>	
Please assess your actual health status (1-10 Likert scale: 1 = "healthy" – 10 = "sick")				
Mean±SD	7.2±1.9	7.6±1.6	6.4±2.2	<b>&lt;0.0001 (MW)</b>
Median (IQR)	8.0 (6-9)	8.0 (7-9)	7.0 (5-8)	
Mean rank		169.5	120.4	
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p=0.0008</b>	

SD = standard deviation; IQR= Interquartile range; aN=accept Normality(p>0.05); rN=reject Normality (p<0.05); C = Chi-square test; F = Fischer's exact test; MW = Mann-Whitney test; Cm = multi-comparison chi-square test; Z= post hoc Z test; \*\* = significant more frequent; \*\*\* = significant less frequent. **In bold:** significant p values.

to relatives (n=228, 74.0%) or patients (n=209; 67.9%), being a particular concern for those working in NIT regions (p<0.0001 and p=0.0095 respectively). The impossibility to meet family and friends (n=184; 59.7%) and concern being unable to ensure patients' safety (n=119; 38.6%) were other important factors, especially in the NIT area (p<0.0001 and p=0.0087 respectively). No significant difference was found regarding the fear of developing COVID-19 between the groups.

The key physical and psychological symptoms reported by nurses' during the lockdown period (**Figure 1b**) included stress (n=238; 77.3%), anxiety (n=183; 59.4%), insomnia (n=152; 49.3%), headache (n=137;

44.5%), muscular and skeletal pain (n=102; 33.1%), gastritis and indigestion (n=83; 26.9%), palpitations (n=69; 22.6%), and changes in eating habit (e.g. over/under eating) (n=43; 14.0%). No significant differences between groups were observed. Depression (n=53; 17.2%), fever and cough were more frequently reported in respondents from CSIT regions (p=0.0013; p=0.0005 and p<0.0001 respectively) as well as other minor symptoms (p<0.0001). Minor symptoms listed included physical: (breathing difficulty, unrefreshing sleep, extrasystole, restlessness, itching, nocturia, hunger, menopause), social (loud noises, family problems, noisy neighbors, children not sleeping, buying a home), and



**Figure 1.** Nurses' concerns (a) and symptoms (b) during the lockdown period.

emotional (anxiety, suicidal thoughts, fear of contagion, uncertainty, fear of not emotionally overcoming the period, bereavement, fear of dying, pain, crowded mind).

A Likert scale rating working stress during the lockdown period (1 = no stress to 10 = worst stress imaginable), a median score of 7 (IQR 5-8) was observed, significantly higher in NIT regions ( $p<0.0001$ ). However, three-quarters of nurses did not consider changing their job during the lockdown period ( $n=229$ ; 74.3%) or at the time of completing the questionnaire ( $n=228$ ; 74.0%), especially in NIT centers ( $p=0.0068$ ). NIT nurses mainly considered this option both during the lockdown period and afterward ( $p=0.0408$  and  $p=0.0068$ ) (Table 3). The median score of respondents' self-assessed actual health status at the time of the questionnaire was 8 (IQR 6-9) on a 1 to 10 Likert scale, being significantly higher in nurses from NIT regions ( $p<0.0001$ ).

**Burnout.** BO (high EE and/or high DP) was present in 76

respondents (24.7%), with 52 from NIT regions and 24 from CSIT regions (24.3% and 25.5%, respectively); however, findings were not statistically significant. PA was low in almost one-third of nurses ( $n=95$ , 30.8%), with greater incidence in Central and Southern Italian regions (NIT  $n=61$ , 28.5% vs. CSIT  $n=34$ , 36.2%), without significant p-value.

According to the reference scores,<sup>47</sup> mean EE was 17.4 (SD±13.0), DP was 5.3 (SD±6.1), and PA was 33.2 (SD±10.7), showing a moderate level of BO on all three dimensions of the total sample. Less than half of the nurses ( $n=163$ ; 52.9%) reported low levels of EE, and a quarter ( $n=80$ ; 26.0%) reported high levels. DP was high in 65 participants (21.1%) and low in half of them ( $n=158$ ; 51.3%), while PA was high in 143 respondents (46.4%) and low in just under one-third of the total sample ( $n=90$ ; 29.2%). No significant differences were observed on global scores or on severity grading between nurses working in the different geographical regions

(Table 4a). In a secondary analysis (not published material), nurses who have had emotional or psychological support during the lockdown period reported a higher level of DP (p=0.0003) and EE (p<0.0001). Of them, those who received professional support from psychiatrists or psychologists showed significantly higher levels of EE (p=0.007) and PA (p=0.0167).

Table 4. Burnout (a) and Sleep Quality (b) indexes.

a) Maslach Burnout Inventory	Total n = 308 n (%)	NIT n = 214 n (%)	CSIT n = 94 n (%)	p value (test)
MBI - Grading				
Emotional Exhaustion				0.37(Cm)
Low (≤14)	163 (52.9)	108 (50.5)	55 (58.5)	
Moderate (15-23)	65 (21.1)	46 (21.5)	19 (20.2)	
High (≥ 24)	80 (26.0)	60 (28.0)	20 (21.3)	
Depersonalization				0.45(Cm)
Low (≤3)	158 (51.3)	113 (52.8)	45 (47.9)	
Moderate (4-8)	85 (27.6)	60 (28.0)	25 (26.6)	
High (≥ 9)	65 (21.1)	41 (19.2)	24 (25.5)	
Personal Accomplishment				0.15(Cm)
Low (≤ 29)	90 (29.2)	56 (26.2)	34 (36.2)	
Moderate (30-36)	75 (24.4)	57 (26.6)	18 (19.1)	
High (≥37)	143 (46.4)	101 (47.2)	42 (44.7)	
MBI - Global score				
Emotional Exhaustion				
Mean±SD	17.4±13.0	17.6±12.6	16.2±13.4	
Median (IQR)	14.0 (8-24)	14.0 (8-26)	12.0 (6-20)	
Mean rank		158.8	144.7	0.20 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Depersonalization				
Mean±SD	5.3±6.1	4.5±5.0	6.6±7.9	
Median (IQR)	3.0 (1-7)	3.0 (1-7)	4.0 (1-9)	
Mean rank		149.6	165.6	0.14 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Personal Accomplishment				
Mean±SD	33.2±10.7	34.3±9.3	31.3±13.2	
Median (IQR)	35.0 (27-42)	36.0 (29-41)	34.5 (16-43)	
Mean rank		157.9	146.8	0.31 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
b) Pittsburgh Sleep Quality Index	Total n = 308 n (%)	NIT n = 214 n (%)	CSIT n = 94 n (%)	p value (test)
PSQI - Sub-scores				
Sleep Duration				
Mean±SD	1.1±1.1	0.9±1.0	1.6±1.3	
Median (IQR)	1.0 (0-2)	1.0 (0-2)	2.0 (0-3)	
Mean rank		139.9	187.8	<0.0001 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Sleep Disturbances (scores)				
Mean±SD	1.3±0.7	1.2±0.5	1.5±0.8	
Median (IQR)	1.0 (1-2)	1.0 (1-1)	1.0 (1-2)	
Mean rank		146.8	172.1	0.0054 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Sleep Latency (scores)				
Mean±SD	1.5±1.0	1.4±1.1	1.5±1.0	
Median (IQR)	1.0 (1-2)	1.0 (1-2)	2.0 (1-2)	
Mean rank		151.9	160.5	0.42 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Day Disfunctions (scores)				
Mean±SD	1.1±0.7	1.1±0.7	1.2±0.7	
Median (IQR)	1.0 (1-2)	1.0 (1-1)	1.0 (1-2)	

Mean rank		151.2	161.9	0.27 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Habitual Sleep Efficiency (scores)				
Mean±SD	1.2±1.2	1.1±1.1	1.3±1.3	
Median (IQR)	1.0 (0-2)	1.0 (0-2)	1.0 (0-3)	
Mean rank		149.4	166.1	0.11 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Sleep Quality (scores)				
Mean±SD	1.4±0.7	1.4±0.7	1.5±0.8	
Median (IQR)	1.0 (1-2)	1.0 (1-2)	2.0 (1-2)	
Mean rank		148.9	167.3	0.07 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
Medication use (scores)				
Mean±SD	0.4±0.8	0.2±0.7	0.7±1.0	
Median (IQR)	0.0 (0-0)	0.0 (0-0)	0.0 (0-1)	
Mean rank		143.2	180.2	<0.0001 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	
PSQI – Global Score				
Mean±SD	7.8±4.5	7.2±4.0	9.3±5.2	
Median (IQR)	7.0 (4-11)	7.0 (4-10)	9.0 (5-14)	
Mean rank		144.1	178.2	0.0019 (MW)
Reject/Accept Normality, p value	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	<b>rN, p&lt;0.0001</b>	

MBI = Maslach Burnout Inventory; PSQI = Pittsburgh Sleep Quality Index; SD = standard deviation; IQR= Interquartile range; MW = Mann-Whitney test; aN=accept Normality (p>0.05); rN=reject Normality (p<0.05). **In bold:** significant p values.

*Sleep Quality.* The Median PSQI global score was 7.0 (Mean 7.8; SD±4.5). Of the 308 participants, 194 (63%) had a PSQI global score higher than 5, indicating poor sleep quality. Sixty of them (63.8%) worked in Central and Southern Italian centers and 134 (62.6%) in Northern centers. A statistically significant difference was found on the PSQI values global score, where the nurses of the Central and Southern regions referred to worse sleep quality (p=0.0019). This difference was supported by all PSQI sub-scores, particularly by the "Sleep Duration" score (p<0.0001), "Sleep Disturbances" score (p=0.0054), and "Medication Use" score (p<0.0001) (**Table 4b**). In addition, nurses who have had emotional or psychological support and those who received professional support showed significantly higher levels of PSQI global score (p<0.0001 and p=0.0017, respectively).

**Discussion.** This study aimed to evaluate the impact of COVID-19 on HSCT nurses' burnout, sleep disorders, symptoms, and their distribution across Italian regions. Assuming that during health emergencies, the psychological stress of HCPs is expected to increase, thus favoring burnout and other psychological issues.<sup>32,48</sup>

A previous study<sup>49</sup> highlighted that patients developing COVID-19 were managed by intensive care units or COVID-19 dedicated services. This meant that HSCT nurses responding to our survey continued to work in COVID-19 free wards. Considering the high competency level for infection control from HSCT nurses and their skills in using PPEs during daily practice,<sup>49</sup> it may be reasonable to consider that HSCT nurses are at a lower risk of hospital contagion. However, emergency-related factors may have increased emotional

strains and physical exhaustion, leading to faster burnout.<sup>35,36</sup>

As described above, the main concerns of nurses during the lockdown period were related to isolation from family and friends and the risk of being a potential source of infection transmission to patients or relatives, while nurses' own fear of becoming ill themselves appeared a secondary issue. These findings confirm the high sense of responsibility that characterized nurses during the pandemic.<sup>50-52</sup>

In this study, nurses reported a moderate to high level of health status and a moderate level of stress. However, stress prevalence was high in our sample and major symptoms reported by nurses such as anxiety, headache, heartburn, joint pain, palpitations, and sleep disturbances, seemed to be part of an important burden of psychological disturbances due to stress, as reported in the literature.<sup>52</sup> In addition, our results highlighted the discrepancy among the nurses' need for psychological support and the options offered by their institutions, which may have conditioned the direction of nurses' request for help, opting for informal rather than formal aid. During and after the lockdown period, psychiatric services were closed or switched to telemedicine activity in many health care facilities,<sup>23</sup> causing access difficulties and negatively impacting psychiatrists' supportive, educational and triaging role.<sup>53</sup>

The global prevalence of burnout observed according to Shanafelt's MBI scoring<sup>45</sup> was not comparable to previously reported data on palliative home care nurses<sup>54</sup> and oncology ward nurses.<sup>25</sup> Significant lower BO frequencies than in the past<sup>55,56</sup> were shown in this study despite the recruited population being at higher risk of psychological issues developing due to the pandemic.

However, a lower prevalence of EE was clearly reported while other dimensions were controversial. Comparing our results with those provided by literature was difficult due to different settings, tools, and scoring systems used and the wide range of variables influencing BO.

In our study, no significant differences were found over the three-dimension BO severity grading among clustered regions, and no differences were found calculating BO according to other criteria.<sup>45</sup>

Barello and colleagues<sup>57</sup> reported frequencies and mean values of high-level EE and DP of a frontline HCP cohort significantly higher than our study, suggesting a higher prevalence of burnout among them. Authors also reported a lower frequency of low PA than findings from this study, confirming the results of other studies on this particular dimension.<sup>21,25,54</sup> Similar findings were obtained comparing our results with another study involving nurses working in various settings in the northwest of Italy with different exposition to the virus.<sup>58</sup>

In contrast, various studies reported lower levels of BO in frontline HCPs compared with those working in COVID-free settings<sup>25,59</sup> or with the pre-pandemic situation.<sup>55</sup> It may be assumed that the real impact of the COVID-19 pandemic on burnout remains unclear due to many variables, including the characteristics of the targeted sample.<sup>56,60-62</sup>

Sleep disturbances are one of the most frequently reported disorders of the psychological sphere described as a consequence of the COVID-19 pandemic in HCPs<sup>33,63,64</sup> and are correlated with anxiety increasing, reduction in self-efficacy,<sup>65</sup> and depression development in nurses.<sup>65</sup> Our study confirmed insomnia as one of the more frequent symptoms referred by HSCT nurses, and poor sleep quality was reported in two-thirds of participants. However, no differences were found among territories on the number of participants with poor sleep quality and the scored mean values of PSQI, suggesting that a higher incidence of COVID-19 did not impact this dimension of nurses' quality of life. Our findings provided information on a specific set of care that may be useful to understand better the situation experienced by HCPs working in COVID-19, not-exposed environments. As reported in the literature, health care facilities directions and policymakers should consider

the consequence of restrictive measures as well as other pandemic-related economic and social factors on nurses' mental health, keeping in mind that the development of stress-related issues and/or mental disturbances in this population did not appear necessarily linked to their proximity with the infected patients, and it could decrease the compliance to the protective measures.<sup>66-68</sup>

This study has various limitations. The cross-sectional design described a situation in a short time frame, providing a valuable insight but not allowing the evolving COVID-19 related situation understanding. No data were collected on pre-existing situations preventing inferential considerations regarding BO and sleep disorders. Moreover, to limit the questionnaire size, some aspects such as work problems and physical and psychological issues were recognized using not validated tools. Various factors may prevent the generalization of our results, including the particularities of COVID-19 spread across Italy and the organization of the National Health System on a regional basis. Some differences among the two groups (NIT and CSIT) may act as confounders, such as age, gender, family conditions, job role, and working setting. Finally, all the data were collected online.

**Conclusions.** This study is the first performed in the HSCT setting, providing valuable information regarding BO, sleep disturbances, and symptoms experienced by nurses.

Our results provided evidence of nurses' concerns and psycho-somatic manifestations during the first phase of the COVID-19 pandemic in Italy. These findings would suggest that different prevalence of COVID-19 on geographical regions did not have an impact on burnout and sleep quality. Nevertheless, the health institutions should carefully consider the reported frequency of these issues and the high prevalence of other stress-related symptoms to plan and prioritize adequate supportive interventions for nurses.

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