

REVIEW ARTICLE

## Prevalence of Mental and Physical Signs and Symptoms Among Healthcare Professionals at the Height of Covid-19: A Meta-Analysis

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### Highlights

(1) The most prevalent mental signs and symptoms in healthcare professionals who provided direct assistance to patients with COVID-19 were anxiety, depression, stress, post-traumatic stress disorder and burnout syndrome and the predominant physical signs and symptoms were related to the prolonged use of PPE and increased frequency of hand washing and use of alcohol gel, causing injuries, especially to the skin. (2) Health professionals who directly cared for patients with Covid-19 were affected during their care practice, working under strong pressure, dealing with an unknown disease, with high mortality rates, exposed to several negative emotional interactions related to patients, family members and professional colleagues, in addition to occupational overload, scarcity and inadequacy of resources. (3) The effort and dedication of nurses was highlighted throughout the world during the Covid-19 pandemic, especially in regions that were most affected by the disease, such as China, Italy, with emphasis on the Lombardy region, United States, Brazil, India, Mexico, Russia, United Kingdom, France, Spain, Turkey and others, in which thousands of these professionals lost their lives.

### ABSTRACT

**Objective:** A systematic evaluation of the prevalence of mental and physical signs and symptoms among healthcare professionals who provided direct care to patients with COVID-19 at the peak of the pandemic. **Method:** A systematic literature review and meta-analysis, based on Joanna Briggs Institute recommendations, conducted across eleven databases. The meta-analysis considered a random-effects model. **Results:** Seventy-seven studies were included, totaling 31,727 healthcare professionals. Among the mental signs and symptoms, the following prevalences were identified: anxiety 56% (95% CI = 44 to 67%,  $p < 0.005$ ), depression 48% (95% CI = 40 to 57%,  $p < 0.01$ ), stress 60% (95% CI = 47 to 73%,  $p < 0.01$ ), insomnia 54% (95% CI = 42 to 65%,  $p < 0.05$ ), post-traumatic stress disorder 32% (95% CI = 20% to 46%,  $p < 0.01$ ), burnout syndrome 42% (95% CI = 34% to 50%,  $p < 0.01$ ). Regarding physical signs and symptoms, skin lesions related to prolonged use of personal protective equipment and higher frequency of hand washing and use of hand sanitizer prevailed. **Conclusion:** Healthcare professionals who cared for patients with Coronavirus Disease 2019 at the peak of the pandemic exhibited a significant prevalence of mental and physical signs and symptoms, highlighting the need to ensure adequate health and working conditions.

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## INTRODUCTION

The virus responsible for Coronavirus Disease 2019 (COVID-19), called SARS-CoV-2, was first identified in Wuhan, China, in 2019. The disease quickly spread to various countries worldwide, being declared a pandemic by the World Health Organization (WHO) in March 2020<sup>1</sup>.

Throughout the pandemic, SARS-CoV-2 underwent genetic mutations and presented new variants, which raised concerns among international health surveillance agencies. To prevent the contagion and spread of the disease, preventive measures were implemented for the population, such as social distancing and isolation, wearing masks, hand washing, using hand sanitizer with alcohol gel for hand hygiene, and vaccination. Vaccination has produced significant effects in reducing mortality rates and the number of cases<sup>2</sup>.

The work of healthcare professionals providing direct care to patients during the Covid-19 pandemic has gained significant recognition for their dedication and efforts to ensure comprehensive and compassionate care for critically ill hospitalized patients, even under unfavorable working conditions. However, thousands of these professionals, with high exposure to SARS-CoV-2, were infected, developed the disease, and tragically lost their lives. A study conducted by the WHO estimated that 80 to 180 thousand healthcare professionals died due to Covid-19 between January 2020 and May 2021<sup>3</sup>.

In addition to the high proportion of healthcare professionals' deaths, these workers also experienced other impacts on their mental and physical health due to overwork, long hours, lack of understanding of the full pathophysiology of the disease, insufficient resources for care, absence of vaccination, as well as fear of contagion and death, and social discrimination due to fear of transmitting Sars-CoV-2 to others as they were at higher risk of exposure than the general population<sup>4</sup>.

To meet the needs of a large number of symptomatic or Covid-19-infected patients, workplaces underwent several adaptations. Many professionals were relocated to sectors where they lacked skills, such as critical care units. Material resources were scarce, such as a shortage of personal protective equipment, which is essential for providing care, insufficient advanced life support to meet demands, absence of medications, and ineffective treatments, among others. Several professionals had to leave their jobs due to the need for social isolation caused by the pandemic. Others were absent due to being infected with Covid-19 or other diseases triggered by the stress and intense psychological suffering experienced during their professional duties<sup>5</sup>.

In this context, identifying the prevalence of mental and physical outcomes among healthcare professionals who provided direct care to patients during a public health emergency caused by an unknown, infectious disease with high mortality rates, such as the Covid-19 pandemic, will support the formulation of preventive strategies to ensure better working conditions and health for these professionals.

The results of this review are important to support decisions made by managers, professional organizations, and policymakers in public health, aimed at occupational health in emergency and crisis situations. This is because it addresses the grouped and most prevalent mental and physical signs and symptoms in healthcare professionals who directly cared for Covid-19 patients during the peak of the disease incidence.

Therefore, the objective was to systematically evaluate the prevalence of mental and physical signs and symptoms among healthcare professionals who provided direct care to Covid-19 patients at the peak of the pandemic.

## METHOD

### Study design

Systematic literature review and meta-analysis, guided by the precepts of the Joanna Briggs Institute (JBI)<sup>6-7</sup> and adhered to the Prisma (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The guiding question was: What is the prevalence of mental and physical signs and symptoms among healthcare professionals who provided direct care to Covid-19 patients in healthcare settings?

The protocol was registered on the International Prospective Register of Systematic Reviews (Prospero) platform under the number CRD42020213686.

### Selection criteria

For study eligibility, the **CoCoPop acronym (Condition, Context, and Population)** was adopted. Cross-sectional observational studies published from 2019 to 2021 were eligible, with no language restrictions.

The context of this review (Co) included public and/or private healthcare services providing primary, secondary, and tertiary care, such as hospitals, clinics, primary healthcare units, field hospitals, home care services, and other institutions that attended to patients with Covid-19.

The condition (Co) encompassed studies that addressed the mental and physical signs and symptoms experienced by healthcare professionals at any time, during or after providing direct care to patients with Covid-19. Symptoms are defined as abnormal subjective perceptions identified by the patient and not observed by the examiner. Signs, on the other hand, are objective findings identified by both the patient and the examiner, confirmed through clinical analysis or supplementary tests<sup>10</sup>.

The population (Po) consisted of primary articles targeting healthcare professionals such as doctors, nurses, physiotherapists, nutritionists, nursing technicians, nursing assistants, and/or other healthcare professionals, with completed higher or technical education, who provided direct care to patients with Covid-19.

Studies were excluded if participants did not provide direct care to patients with Covid-19; studies involving professionals with pre-existing mental illnesses; and articles that were not obtained in full text, and after three consecutive attempts to contact the authors, did not receive a response.

### Data collection

The search was conducted in the electronic databases PubMed, Excerpta Medica database (Embase), Latin American and Caribbean Literature on Health Sciences (Lilacs), Web of Science, Scopus, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, and Livivo. Grey literature sources included OpenGrey, ProQuest Open, and Google Scholar.

A search strategy, using the terms utilized for the PubMed database, was adapted for each specific database according to the Health Sciences Descriptors (DeCS) and the MeSH Database for searches, combined with the boolean operators "AND" and "OR", as detailed in the supplementary material. After identifying the texts, they were transferred and organized in the reference manager

EndNote Web, duplicate studies were removed, and subsequently exported to the Rayyan reference manager<sup>12</sup>.

The study selection occurred in two stages by two independent reviewers: 1) screening of all titles and abstracts identified in the Rayyan reference manager and selecting those eligible for full-text reading; 2) full-text articles were read and evaluated to confirm eligibility. Any discrepancies at any stage were resolved through assessment by a third reviewer.

### Data processing and analysis

The data were extracted by two independent reviewers using a form developed by the authors through Excel® software. The information extracted from the selected studies included: title, journals, DOI, year of publication, language, country where the research was conducted, study objective, location and data collection period, methods and instruments used in data collection, sample size, age and sex, professional category, signs and symptoms mental and physical presented by healthcare professionals, statistical tests, and main results. The accuracy of the extracted information was confirmed by a third reviewer.

The methodological quality of the studies was independently assessed by two reviewers using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data<sup>13</sup>. The tool consists of 9 questions that assess participant selection and sampling characteristics, subject description, instruments used, outcome measurement methods, and statistical tests. The instrument does not have a scoring system, and questions are answered with “Yes,” “No,” “Unclear,” and “Not applicable.” Reviewers were in agreement with the scoring system before conducting the critical appraisals. Any discrepancies were resolved by a third reviewer.

The results were synthesized descriptively and through meta-analysis. In the meta-analysis, data were analyzed using RStudio 4.2.1, including similar studies<sup>14</sup> that evaluated outcomes across multiple professional categories, utilized internationally validated measurement instruments. The random-effects model (Restricted Maximum Likelihood Estimator) was considered for effect measures.<sup>15</sup>

The statistical analyses are reported with a 95% confidence interval (CI) and statistical significance when  $p < 0.05$ . Heterogeneity was assessed using the  $I^2$  (“I” squared) and  $\tau^2$  (Tau squared) tests, represented graphically by the forest plot. To reduce heterogeneity in the overall effect, sensitivity analyses were conducted, excluding outlier studies one at a time for each outcome analyzed. However, there were no significant changes in the results.

### Ethical aspects

This study did not involve human subjects and used published primary studies, therefore it is exempt from approval by the Research Ethics Committee, in accordance with National Health Council Resolution No. 510/2016<sup>16</sup>.

## RESULTS

Data collection took place in April 2021, at the peak of the Covid-19 pandemic. In the first phase, 8,494 studies were identified in databases and grey literature, and after removing duplicates, 2,908 remained for title and abstract screening. Of these, 2,554 studies were excluded, leaving 354 for full-text reading, and 77 studies met the inclusion criteria (Figure 1).

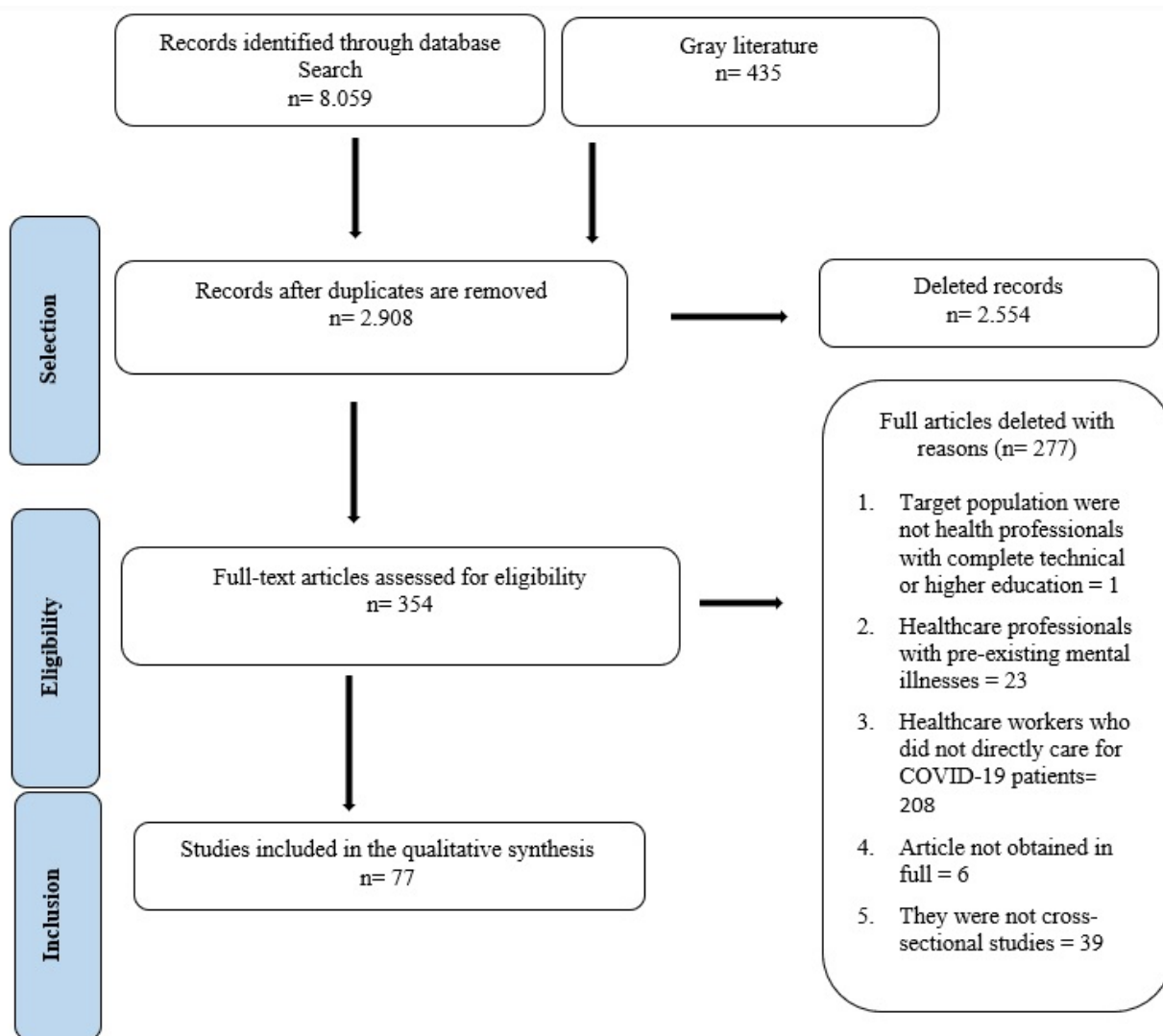


Figure 1 – Flowchart of bibliographic research and selection criteria. Adapted from Prisma. Londrina, Paraná, Brazil, 2023<sup>9</sup>.

This review included 77 cross-sectional observational articles<sup>(17-93)</sup>, with English being the predominant language in the studies (69), followed by Spanish (6) and Portuguese (2).

The healthcare professionals who cared for COVID-19 patients totaled 31,727 participants, with a mean age of 35.4 years, and the predominant gender was female (68%). The majority of studies (88.4%) evaluated more than one professional category: physicians, nurses, physiotherapists, dentists, pharmacists, psychologists, nutritionists, speech therapists, social workers, midwives, technical level professionals (laboratory, nursing), healthcare assistants, radiologists, paramedics, and others not specified, as observed in Table 1.

Table 1 – Characteristics of studies included in the systematic review. Londrina, Paraná, Brazil, 2023

Authors/Year	Country/ Language	Participants	Gender of Total Sample (N*)	Assessment Tools	Outcomes
Ajwa et al. <sup>17</sup>	Saudi Arabia English	Physicians, physiotherapists, dentists, dental hygienists, dental assistants, nurses, emergency medical technicians, and other categories.	295 men 282 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire 9 (PHQ-9)	Depression Anxiety
Al Maqbali e Al Khadhuri <sup>18</sup>	Oman English	Nurses	99 men 1.031 women	Pittsburgh Sleep Quality Index (PSQI) Hospital Anxiety and Depression Scale (HADS) Perceived Stress Scale-10 (PSS-10)	Stress Depression Anxiety Insomnia
Alshekaili et al. <sup>19</sup>	Oman English	Nurses, physicians, and allied healthcare professionals.	228 men 911 women	Depression Anxiety Stress Scale-21 (DASS-21) Insomnia Severity Index (ISI)	Stress Depression Anxiety Insomnia
Altmayer et al. <sup>20</sup>	France English	Physicians, nurses, nursing assistants, and nurse administrators.	15 men 54 women	Hospital Anxiety and Depression Scale (HADS) Post-traumatic Stress Disorder Checklist	Depression Anxiety Insomnia  Post-Traumatic Stress Disorder
Antonijevic et al. <sup>21</sup>	Serbia English	Physicians and nurses	362 men 1.315 women	Perceived Stress Scale-10 (PSS-10) Beck Depression Inventory (BDI) Generalized Anxiety Disorder 7-Item Scale (GAD-7)	Stress Depression Anxiety
Arafa et al. <sup>22</sup>	Egypt e Saudi Arabia English	Physicians, nurses, and other healthcare professionals.	212 men 214 women	Depression Anxiety Stress Scale-21 (DASS-21)	Depression Anxiety Stress Insomnia
Awano et al. <sup>23</sup>	Japan English	Physicians, nurses, administrative staff, and other healthcare professionals	213 men 635 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Center for Epidemiologic Studies Depression Scale Revised (CESD-R-10)	Depression Anxiety
Bates et al. <sup>24</sup>	England English	Physicians, nurses, and allied healthcare professionals.	22 men 74 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Post-traumatic Stress Disorder Checklist	Anxiety Post-Traumatic Stress Disorder

Chapa-Koloffon et al. <sup>25</sup>	Mexico Spanish	Physicians and nurses	51 men 155 women	Acute Stress Disorder Scale (ASD)	Acute Stress Disorder
Chen et al. <sup>26</sup>	China English	Healthcare professionals	55 men 116 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire 9 (PHQ-9)	Post-Traumatic Stress Disorder Anxiety Depression Insomnia
Chen et al. <sup>27</sup>	China English	Physicians, nurses, administrative staff, and other healthcare professionals	283 men 619 women	Maslach Burnout Inventory (MBI) Generalized Anxiety Disorder 7-Item Scale (GAD-7)	Anxiety Depression Burnout Syndrome
Chow et al. <sup>28</sup>	Malaysia English	Nurses, physicians, healthcare aides, and assistants .	79 men 121 women	Hospital Anxiety and Depression Scale (HADS)	Depression Anxiety
Çiriş et al. <sup>29</sup>	Turkey English	Nurses, physicians, midwives, laboratory assistants, anesthesia technicians, paramedics, medical team assistants .	166 men 387 women	Questionnaire developed by the authors	Facial pain, redness, sores around the eyes, ears, and nose. Dryness, irritation, and scarring on the hands. Nutritional disorders. Sleep disorders. Constipation. Urinary infection. Headaches, dry skin, and throat due to dehydration. Odor due to excessive sweating. Dehydration from sweating.
Coelho et al. <sup>30</sup>	Brazil Portuguese	Nurses, physicians, and physiotherapists	181 men 925 women	Questionnaire developed by the authors	Skin injuries
Conti et al. <sup>31</sup>	Italy English	Nurses, physicians, radiology technicians, pharmacists, drivers, laboratory technicians, and other professionals .	219 men 714 women	Patient Health Questionnaire 9 (PHQ-9) Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire 15 (PHQ-15) Impact of Event Scale-Revised (IES-R)	Depression Anxiety Post-Traumatic Stress Disorder



Dal’Bosco et al. <sup>32</sup>	Brazil Portuguese	Nursing professionals	09 men 79 women	Hospital Anxiety and Depression Scale (HADS)	Depression Anxiety
Duan et al. <sup>33</sup>	China English	Physicians, nurses, respiratory therapists, radiologists, and other allied health professions.	NR <sup>†</sup>	Questionnaire developed by the authors	Difficulty breathing. Fatigue. Pressure injuries related to the use of personal protective equipment. Anxiety. Facial acne. Insomnia. Depression. Allergic dermatitis. Hand maceration or foot erosion. Trunk or limb rash. Conjunctivitis or keratitis. Perineal maceration or tinea corporis
Elkholy et al. <sup>34</sup>	Egypt English	Physicians and nurses	251 men 251 women	Insomnia Severity Index (ISI) Perceived Stress Scale-10 (PSS-10) Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire (PHQ)	Depression Anxiety Stress Insomnia
Erize-Herrera et al. <sup>35</sup>	Mexico Spanish	Physicians, nurses, orderlies, and maintenance staff in departments designated to care for COVID-19 patients.	164 men 645 women	Questionnaire developed by the authors	Skin injuries: Xerosis (dryness) Scaling Erythema Fissures Blisters Papules Maceration Itching Increased skin sensitivity Pain
Ferreira et al. <sup>36</sup>	Portugal English	Physicians	NR <sup>†</sup>	Depression Anxiety Stress Scale-21 (DASS-21)	Depression Anxiety Stress
Geng et al. <sup>37</sup>	China English	Physicians, nurses, and other medical professions	NR <sup>†</sup>	Pittsburgh Sleep Quality Index (PSQI) Post-traumatic Stress Disorder Checklist	Post-Traumatic Stress Disorder Insomnia



Guo et al. <sup>38</sup>	China English	Physicians, nurses, and other healthcare professionals	356 men 735 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Pittsburgh Sleep Quality Index (PSQI) Patient Health Questionnaire 9 (PHQ-9)	Depression Anxiety Post-Traumatic Stress Disorder
Gupta et al. <sup>39</sup>	India English	Physicians, nurses, and dentists.	168 men 200 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Sleep Quality Scale (SQS)	Anxiety Insomnia
Gupta et al. <sup>40</sup>	India English	Physicians, nurses, paramedics, administrative staff, and support personnel.	406 men 718 women	Hospital Anxiety and Depression Scale (HADS)	Anxiety Depression
Havlioglu e Demir <sup>41</sup>	Turkey English	Physicians, nurses, and other healthcare professionals.	61 men 34 women	Beck Inventory Anxiety (BAI)	Anxiety
Hawari et al. <sup>42</sup>	Jordan English	Nurses, medical technicians, and pharmacists .	411 men 526 women	Kessler-6 Questionnaire	Stress
Huo et al. <sup>43</sup>	China English	Nurses, physicians, and technicians	114 men 492 women	Maslach Burnout Inventory (MBI) Patient Health Questionnaire 9 (PHQ-9)	Burnout Syndrome
Ilias et al. <sup>44</sup>	Greece English	Nurses, physicians, and technicians	37 men 125 women	Event Scale-Revised (IES-R) Maslach Burnout Inventory (MBI)	Post-Traumatic Stress Disorder Burnout Syndrome
Kong et al. <sup>45</sup>	China English	Nurses and physicians	46 men 161 women	Social Appearance Anxiety Scale (SAAS)	Pressure ulcer Nasal discomfort and sensitivity Ear pain
Korkmaz et al. <sup>46</sup>	Turkey English	Nurses, physicians, and healthcare assistants	79 men 61 women	Pittsburgh Sleep Quality Index (PSQI) Beck Anxiety Inventory (BAI)	Anxiety Insomnia
Lai et al. <sup>47</sup>	China English	Nurses and physicians	293 men 964 women	Patient Health Questionnaire 9 (PHQ-9) Generalized Anxiety Disorder scale-7 Insomnia Severity Index-7 (ISI-7)	Depression Anxiety Insomnia Stress

Lenzo et al. <sup>48</sup>	Italy English	Nurses, physicians, physiotherapists, speech therapists, psychologists, healthcare aides, social workers, and other professions .	84 men 130 women	Depression Anxiety Stress Scales-21 (DASS-21)	Depression Anxiety Stress
Li et al. <sup>49</sup>	China English	Physicians.	76 men 194 women	Impact of Event Scale-Revised (IES-R) Depression Anxiety Stress Scales-21 (DASS-21)	Depression Anxiety Stress Post-Traumatic Stress Disorder
Liu et al. <sup>50</sup>	China English	Nurses and Physicians.	270 men 1.293 women	Patient Health Questionnaire-9 (PHQ-9) Generalized Anxiety Disorder 7-Item Scale (GAD-7) Impact of Event Scale-Revised (IES-R) Insomnia Severity Index (ISI)	Depression Anxiety Stress Insomnia
Liu et al. <sup>51</sup>	China English	Nurses and Physicians.	292 men 1.062 women	General Health Questionnaire-28 (GHQ-28)	Stress
Liu et al. <sup>52</sup>	China English	Nurses and Physicians.	216 men 874 women	Perceived Stress Scale-10 (PSS-10) Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9)	Anxiety Depression Stress
Magnavita et al. <sup>53</sup>	Italy English	Physicians.	47 men 43 women	Effort Reward Imbalance (ERI) Sleep Condition Indicator (SCI) Goldberg Anxiety and Depression Scale (GADS)	Anxiety Depression Insomnia Stress
Maraqa et al. <sup>54</sup>	Palestine English	Physicians, nurses, and allied healthcare professionals	194 men 235 women	Questionnaire developed by the authors	Stress
Matsuo et al. <sup>55</sup>	Japan English	Physicians, nurses, laboratory technicians, radiology technicians, and pharmacists.	89 men 223 women	Maslach Burnout Inventory (MBI)	Burnout Syndrome

Naldi et al. <sup>56</sup>	Italy English	Physicians and nurses	148 men 557 women	Impact of Event Scale – Revised (IES-R) State-Trait Anxiety Inventory – Form Y (STAI-Y) Maslach Burnout Inventory (MBI)	Anxiety Stress Burnout Syndrome
Orrù et al. <sup>57</sup>	Multicentric English	Physicians, nurses, psychologists, and other healthcare professionals.	91 men 93 women	Maslach Burnout Inventory Human Service Survey (MBI-HSS) Secondary Traumatic Stress Scale (STSS) Perceived Stress Scale-10 (PSS-10)	Post-Traumatic Stress Disorder
Pan et al. <sup>58</sup>	China English	Physicians and nurses	36 men 158 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-15 (PHQ-15)	Depression Anxiety
Parthasarathy et al. <sup>59</sup>	Índia English	Nurses, laboratory technicians, pharmacists, radiologists, administrative officers.	1.437 men 1.646 women	Patient Health Questionnaire-4 (PHQ-4)	Depression Anxiety
Pazmiño et al. <sup>60</sup>	Ecuador Spanish	Nurses, laboratory technicians, physicians, psychologists, physiotherapists.	326 men 702 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Insomnia Severity Index (ISI) Impact of Event Scale (IES) Patient Health Questionnaire-9 (PHQ-9)	Depression Anxiety Post-Traumatic Stress Disorder Insomnia
Peng et al. <sup>61</sup>	China English	Nurses and Physicians.	303 men 428 women	Patient Health Questionnaire-9 (PHQ-9) Generalized Anxiety Disorder 7-Item Scale (GAD-7)	Depression Anxiety
Perera et al. <sup>62</sup>	Sri Lanka English	Nurses, physicians, and allied healthcare professionals.	108 men 404 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Center for Epidemiologic Studies Depression Scale Revised (CESD-R-10)	Depression Anxiety

Pouralizadeh et al. <sup>63</sup>	Iran English	Nurses.	21 men 420 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9)	Depression Anxiety
Qi et al. <sup>63</sup>	China English	Healthcare professionals	256 men 1050 women	Pittsburgh Sleep Quality Index (PSQI)	Insomnia
Robles et al. <sup>65</sup>	Mexico Spanish	Physicians, nurses, social workers, paramedics, psychologists.	1.518 men 4.420 women	Post-traumatic Stress Disorder Checklist Physician Well-Being Index Patient Health Questionnaire-2 (PHQ-2)	Depression Post-Traumatic Stress Disorder Insomnia
Roslan et al. <sup>66</sup>	Malaysia English	Physicians, Nurses, social worker, nutritionist, psychologist, pharmacist, physiotherapist, administrative staff, dietary service, laboratory technician, and other professionals	NR <sup>†</sup>	Copenhagen Burnout Inventory (CBI)	Burnout Syndrome
Saeed et al. <sup>67</sup>	Pakistan, Índia and Sri Lanka English	Physicians, Nurses, physiotherapists, phlebotomists, and clinical assistants	200 men 263 women	World Health Organization Self-Reporting Questionnaire (SRQ-20)	Depression
Samaniego et al. <sup>68</sup>	Paraguay Spanish	Physicians and nurses	22 men 104 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9) Professional Quality of Life Scale (PROQOL) Insomnia Severity Index-7 (ISI-7) Impact of Event Scale-Revised (IES-R)	Depression Anxiety Stress Compassion fatigue Insomnia
Sandesh et al. <sup>69</sup>	Pakistan English	Healthcare professionals	64 men 48 women	Depression Anxiety Stress Scale - 21 (DASS-21)	Depression Anxiety Stress
Saracoglu et al. <sup>70</sup>	Turkey English	Nurses	150 men 58 women	Patient Health Questionnaire (PHQ) Pittsburgh Sleep Quality Index (PSQI)	Depression Insomnia

Saricam <sup>71</sup>	Turkey English	Nurses.	32 men 91 women	Spielberg's State-Trait Anxiety Inventory (STAI Form TX-1)	Anxiety
Sharma et al. <sup>72</sup>	India English	Nurses and Physicians.	76 men 108 women	Depression, Anxiety and Stress Scale - 21 Items (DASS-21) Insomnia Severity Index (ISI)	Depression Anxiety Stress Insomnia
Shen et al. <sup>73</sup>	China English	Nurses and Physicians.	14 men 629 women	Chinese Perceived Stress Scale (CPSS) Generalized Anxiety Disorder 7-Item Scale (GAD-7) Athens Insomnia Scale (AIS)	Anxiety Insomnia Stress
Sunjaya et al. <sup>74</sup>	Indonesia English	Nurses, Physicians and others..	124 men 420 women	Burnout Inventory (BI) Center for Epidemiologic Studies Depression Scale Revised (CESD-R-10)	Depression Anxiety Burnout
Suryavanshi et al. <sup>75</sup>	India English	Nurses, Physicians and others	96 men 101 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9)	Depression Anxiety
Teshome et al. <sup>76</sup>	Ethiopia English	Nurses, Physicians, pharmacists, laboratory technicians, public health officers.	489 men 316 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7)	Anxiety
Than et al. <sup>77</sup>	Vietnam English	Nurses, Physicians and others Healthcare professionals.	55 men 118 women	Impacto of Event Scale – Revised (IES-R) Insomnia Severity Index (ISI) Depression, Anxiety and Stress Scale - 21 Items (DASS-21)	Depression Anxiety Stress Insomnia Post-Traumatic Stress Disorder
Tiete et al. <sup>78</sup>	Belgium English	Nurses and Physicians.	140 men 507 women	Insomnia Severity Index (ISI) Depression, Anxiety and Stress Scale - 21 Items (DASS-21) Stanford Professional Fulfillment Index (PFI)	Depression Anxiety Stress Insomnia Burnout Syndrome
Torrente et al. <sup>79</sup>	Spain English	Nurses, Physicians and others Healthcare professionals.	171 men 472 women	Maslach Burnout Inventory (MBI)	Burnout Syndrome

Tran et al. <sup>80</sup>	Vietnam English	Nurses, Physicians and others healthcare professionals.	2.408 men 4.716 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9)	Depression Anxiety
Urzúa et al. <sup>81</sup>	Chile Spanish	Physicians, nurses and others professionals.	15 men 110 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9) Impact of Event Scale – Revised (IES-R) Insomnia Severity Index-7 (ISI-7)	Depression Anxiety Stress Insomnia
Veeraraghavan e Srinivasan <sup>82</sup>	India English	Physicians.	44 men 56 women	Beck Depression Inventory (BDI) Beck Anxiety Inventory (BAI)	Depression Anxiety
Wang et al. <sup>83</sup>	China English	Physicians and other healthcare professionals.	710 men 1.291 women	Pittsburgh Sleep Quality Index (PSQI) Hospital Anxiety and Depression Scale (HADS)	Depression Anxiety Insomnia
Wang et al. <sup>84</sup>	China English	Physicians and nurses	332 men 1.565 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9) Impacto of Event Scale – Revised (IES-R)	Depression Anxiety Post-Traumatic Stress Disorder
Wańkowitz et al. <sup>85</sup>	Poland English	Healthcare professionals	211 men 230 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9) Insomnia Severity Index-7 (ISI-7)	Depression Anxiety Insomnia
Yang et al. <sup>86</sup>	China English	Physicians, Nurses, and allied healthcare professionals.	404 men 804 women	Depression Anxiety Stress Scales-21 (DASS-21)	Depression Anxiety Stress
Yitayih et al. <sup>87</sup>	Ethiopia English	Physicians, Nurses and healthcare professionals.	118 men 131 women	Insomnia Severity Index (ISI)	Insomnia

Zakaria et al. <sup>88</sup>	Malaysia English	Physicians, Nurses, and assistants	48 men 168 women	Questionnaire form adaptade for Michelle Post	Burnout Syndrome
Zartash et al. <sup>89</sup>	Pakistan English	Physicians and nurses	68 men 102 women	Generalized Anxiety Disorder 7-Item Scale (GAD-7)	Anxiety
Zhang et al. <sup>90</sup>	China English	Physicians, Nurses, technicians, and administrative staff	96 men 546 women	Posttraumatic Stress Disorder (PTSD)	Post-Traumatic Stress Disorder
Zheng et al. <sup>91</sup>	China English	Nurses	04 men 613 women	DepressionAnxiety Stress Scales-21 (DASS-21)	Depression Anxiety Stress
Zhou et al. <sup>92</sup>	China English	Nurses and others healthcare professionals	88 men 1.843 women	Pittsburgh Sleep Quality Index (PSQI)	Insomnia
Zhou et al. <sup>93</sup>	China English	Healthcare professionals and laypersons	440 men 1.255 women	Insomnia Severity Index (ISI) Generalized Anxiety Disorder 7-Item Scale (GAD-7) Patient Health Questionnaire-9 (PHQ-9)	Depression Anxiety Insomnia

Among the selected studies, none achieved a positive assessment (yes response) in all questions of the Studies Reporting Prevalence Data. The domains that received the most negative or uncertain responses were regarding the sampling process and response rate.

The most prevalent mental signs and symptoms identified in the studies were Depression, Anxiety, Stress, Insomnia, Post-Traumatic Stress Disorder (PTSD), and Burnout syndrome.

The prevalence of Anxiety among healthcare professionals who provided direct care to patients with COVID-19 was 56% (95% CI = 44 to 67%,  $p < 0.005$ ). Among the studies, the lowest prevalence was 12.6% (study 50), and the highest was 100% (study 69). The largest sample was in the study conducted in Vietnam, with 1,923 participants. Regarding Depression, the prevalence was 48% (95% CI = 40 to 57%,  $p < 0.01$ ). In a study conducted in China (study 50), the lowest Depression rate was reported (18.6%), while researchers from Poland (study 85) identified a prevalence of 99.5% among healthcare professionals, as observed in the forest plot graphs in Figure 2



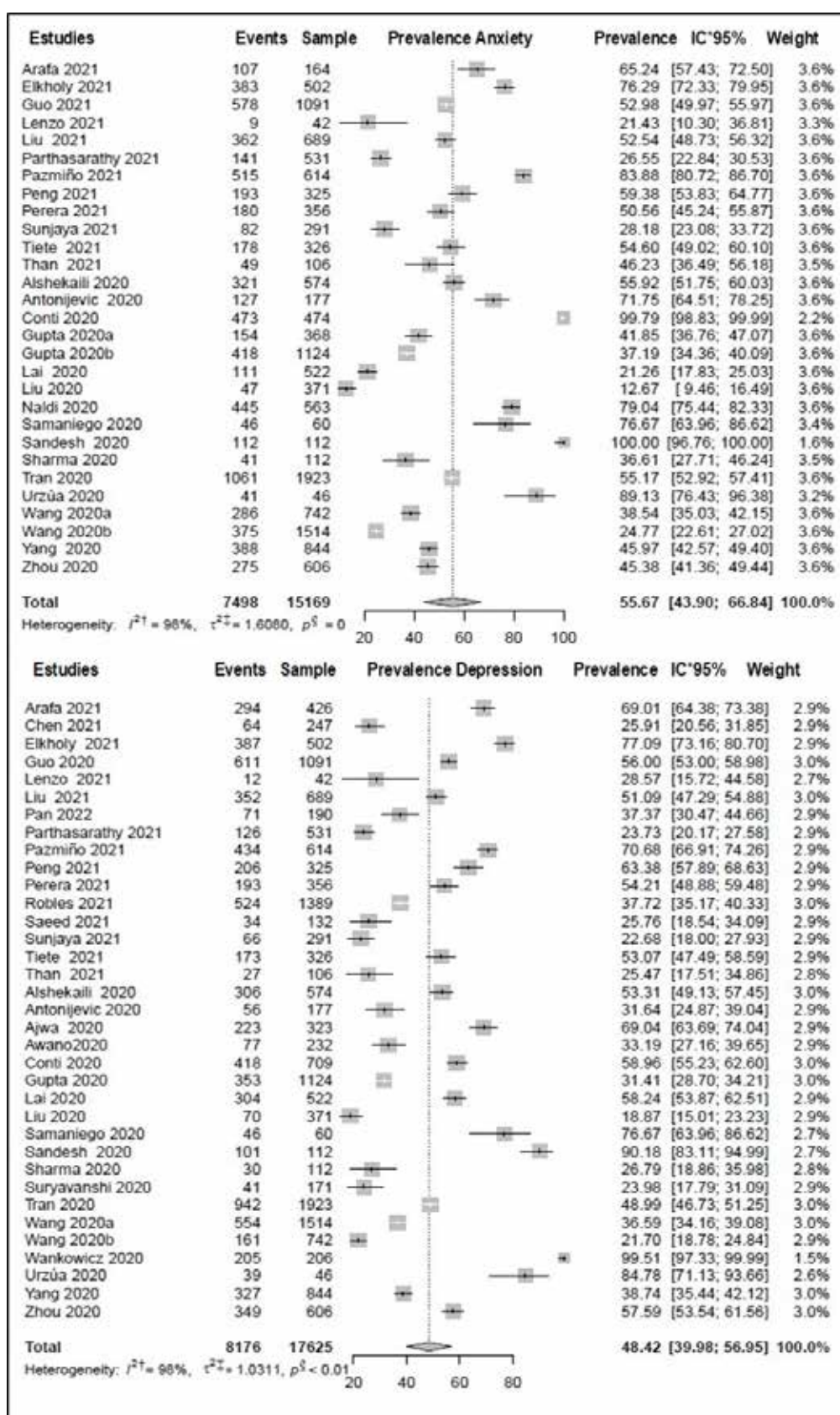


Figure 2 – Prevalence of Anxiety and Depression among professionals who provided direct care to patients with Covid-19. Londrina, Paraná, Brazil, 2023.

\*CI= Confidence Interval;  $I^2$ = I-squared;  $\tau^2$ = Tau-squared;  $p$ =p-value

Regarding Stress, a prevalence of 60% (95% CI = 47 to 73%,  $p < 0.01$ ) was observed, with variation rates ranging from 18% (study 77) to 96% (study 69). The prevalence of Insomnia was 54% (95% CI = 42 to 65%,  $p < 0.05$ ), ranging from 13.5% (study 92) to 100% (study 85), as presented in Figure 3.

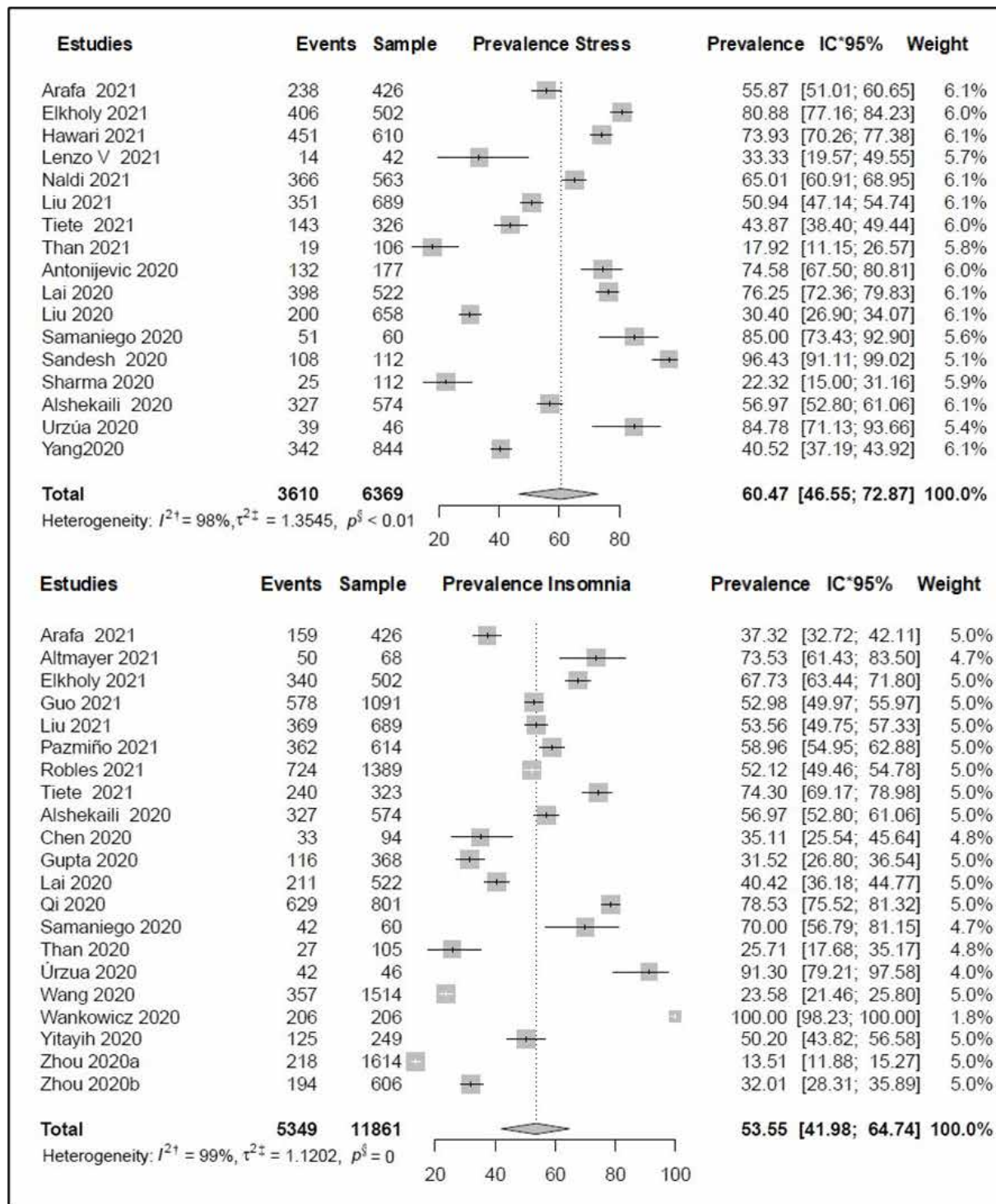


Figure 3 – Prevalence of Stress and Insomnia among professionals who provided direct care to Covid-19 patients. Londrina, Paraná, Brazil, 2023.

\* CI=; Confidence Interval † $I^2$ = I-squared; ‡ $\tau^2$ = Tau-squared; § $p$ =p-value

The prevalence of Post-Traumatic Stress Disorder among healthcare professionals who provided direct care to patients with COVID-19 was the lowest rate among the evaluated outcomes (32%, 95% CI = 20% to 46%,  $p < 0.01$ ), ranging from 11% to 81%. Burnout Syndrome was observed in seven studies, with a prevalence of 42% (95% CI = 34% to 50%,  $p < 0.01$ ) among healthcare professionals, with rates ranging from 26% to 51%, as depicted in the forest plot in Figure 4.

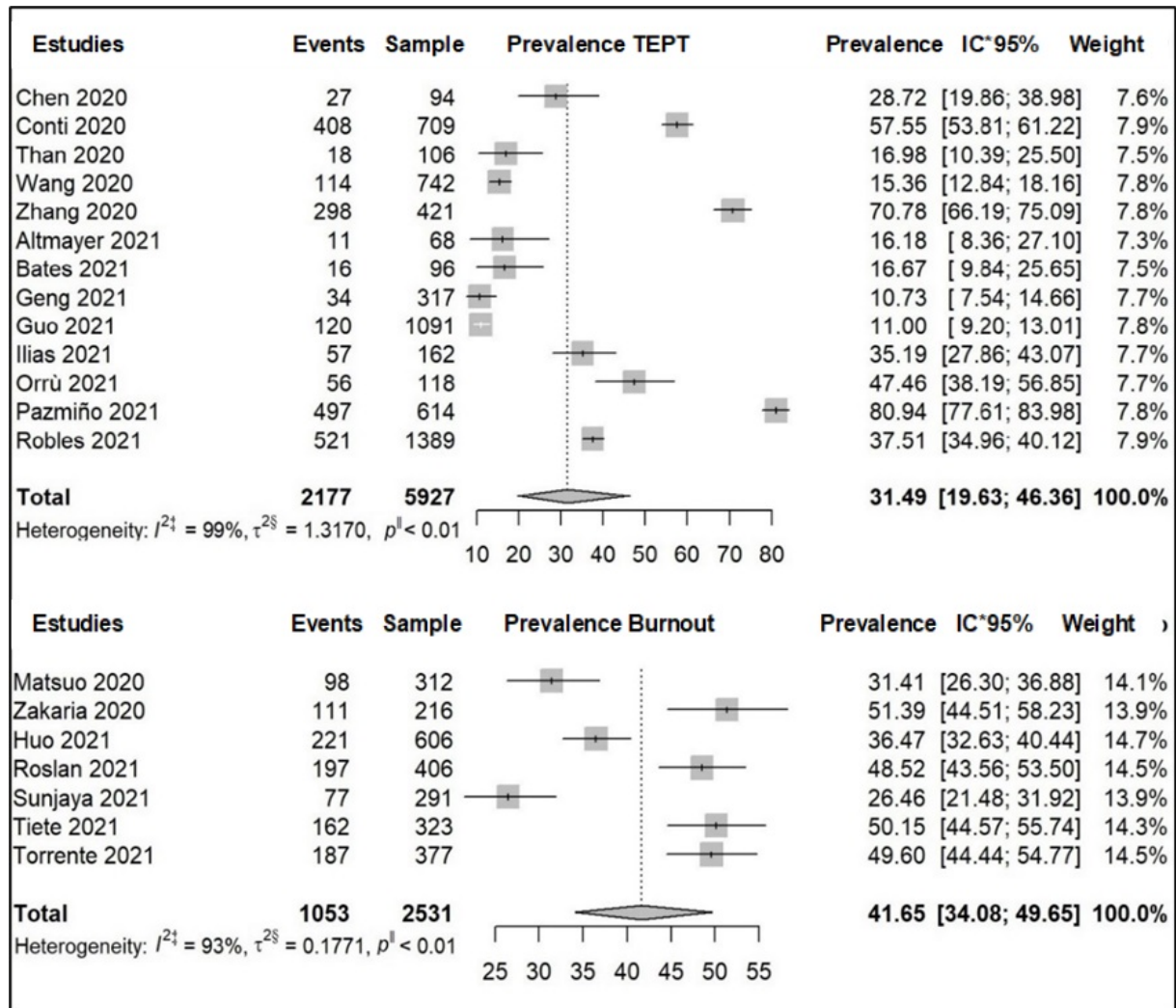


Figure 4 – Prevalence of post-traumatic stress disorder and burnout syndrome among professionals who provided direct care to patients with COVID-19. Londrina, Paraná, Brazil, 2023.

\*TEPT=Post-Traumatic Stress Disorder; †CI=Confidence Interval; ‡I²=I-squared; §τ²= Tau-squared; ||p=p-value

In studies that assessed physical symptoms, no similarity was identified among the data for conducting the meta-analysis.

The outcomes were related to the use of personal protective equipment (PPE) by healthcare professionals and the increased frequency of handwashing and use of hand sanitizer during the Covid-19 pandemic

Among the outcomes related to the use of PPEs, the most prevalent were: facial pain, redness, and wounds around the eyes, ears, and nose with a prevalence of 89.3%; xerosis, irritation, and scarring on the hands (91.7%); nutritional disorders (46.5%); constipation (26.2%); urinary infection (40.7%); dehydration headache (74.1%); dry skin due to dehydration (74.5%); dry throat due to



dehydration (80.1%); odor due to sweating (74.9%); dehydration due to sweating (79.4%)<sup>29</sup>. Another study<sup>30</sup> indicated the following as the most prevalent: skin lesions (69.4%), device-related pressure injuries (13%), facial acne (10%), foot erosion (4%), trunk or limb rash (3%), conjunctivitis or keratitis (2%), perineal maceration or tinea corporis (2%). Chinese researchers<sup>33</sup> identified a higher prevalence of nasal sensitivity (88.7%), and in another analysis<sup>45</sup> they observed a prevalence of 89.3% for ear pain.

The most prevalent signs and symptoms observed on the skin due to increased handwashing frequency and the use of hand sanitizer were: allergic dermatitis (4%), hand maceration (4%)<sup>33</sup>, scaling (64.8%), erythema (63.1%), fissures (35.6%), blisters (24.6%), papules (16.1%), itching (68.9%), increased sensitivity (40.9%), and pain (32,7%)<sup>35</sup>.

## DISCUSSION

This review analyzed 77 studies and found that the most prevalent mental symptoms among professionals who cared for Covid-19 patients were anxiety, depression, stress, insomnia, post-traumatic stress disorder, and burnout syndrome. Regarding physical symptoms, the most frequent outcomes were skin lesions related to prolonged use of PPE and increased handwashing frequency and use of hand sanitizer.

During the pandemic, healthcare professionals directly involved in diagnosing, treating, and caring for Covid-19 patients, especially physicians and nurses, developed psychological and physical disorders due to relentless work processes to ensure equitable care for all patients<sup>94</sup>. A systematic review, in subgroup analysis, revealed gender and occupation differences, with female healthcare professionals and nurses showing higher rates of psychological symptoms than other healthcare teams<sup>95</sup>.

The effort and dedication of nurses were highlighted worldwide, especially in regions most affected by the pandemic such as China, Italy, notably the Lombardy region, the United States, Brazil, India, Mexico, Russia, the United Kingdom, France, Spain, Turkey, and others, where thousands of these professionals lost their lives due to Covid-19<sup>3</sup>.

Brazilian scholars<sup>5</sup> pointed out that 95% of healthcare workers had their lives altered by the Covid-19 pandemic. Approximately 50% of these professionals worked more than 40 hours per week, and 45% needed more than one job to meet their economic needs. The data also revealed that many experienced exhaustion and suffered significant impacts on mental health due to the high risk of exposure and contagion by Sars-CoV-2, dealing with the high number of patient deaths, deaths of colleagues, and family members, fear, insecurity, and unfavorable working conditions.

Given this scenario, with multiple stressors embedded in the work environment, the prevalence of Anxiety among healthcare professionals identified in this meta-analysis was substantial (56%). A meta-analysis<sup>96</sup> found that 25.8% of healthcare professionals who provided care to Covid-19 patients in hospital settings developed anxiety. A study conducted in Turkey with 363 healthcare professionals from emergency sectors identified that 40.8% of participants developed anxiety during the Covid-19 pandemic<sup>97</sup>.

Anxiety is a condition that already affected the global population before the pandemic. Approximately 3.6% of people worldwide suffer from anxiety<sup>98</sup>. In anxiety disorders, individuals experience excessive fear or phobias in common situations. These feelings cause mental strain, and individuals spend most of their time trying to resolve their psychological conflicts, affecting their quality of life and their ability to perform work activities<sup>96</sup>. Early identification of these symptoms, treatment, psychological support, and adequate working conditions will contribute to healthcare professionals being supported in their health needs and performing their duties with higher quality and safety.

Depression also affected healthcare professionals during the pandemic, who directly cared for Covid-19 patients. Depression is characterized by a set of negative symptoms such as low self-esteem, sadness, insomnia, fatigue, and loss of interest in daily activities or work, which can be sporadic, recurrent, or continuous, and in more extreme cases can result in suicide<sup>97,99</sup>.

Researchers from Turkey<sup>100</sup> identified a prevalence of 77.6% of depression among healthcare professionals who worked on the front lines attending to Covid-19 patients. In Spain, scholars identified a prevalence of 27.4% of depression in active Healthcare professionals during the pandemic<sup>101</sup>.

The WHO estimates that 4.4% of the global population suffers from depression, and these rates may have worsened during the pandemic, especially among healthcare professionals who provided direct assistance to Covid-19<sup>99</sup> patients. Factors such as lack of understanding and management of the Sars-CoV-2 virus, increased risk of exposure to the virus, long working hours with few rest periods, and insufficient or inadequate PPE led many professionals to experience depressive crises and be removed from their positions.

In addition to anxiety and depression, another prevalent symptom among healthcare professionals was stress. Stress is understood as a response of the body to threatening situations, in which the person remains on high alert to react to danger. If the situation becomes prolonged, the individual enters a state of exhaustion, which can lead to physical and mental impairments<sup>102</sup>.

Corroborating with the results of this study, a meta-analysis<sup>103</sup> found a prevalence of 44.8% of Stress among healthcare professionals who worked during the pandemic. In a crisis situation like the Covid-19 pandemic, professionals experienced high levels of Stress in their work environments, compromising not only their performance but also causing harm to their mental and physical health<sup>104</sup>.

Amidst the many negative effects on mental health caused by the high rate of exposure to the Covid-19 virus, Healthcare professionals had their sleep quality affected by Insomnia. The data from this study align with a meta-analysis<sup>105</sup> that found an overall prevalence of Insomnia of 32% among Healthcare professionals during the pandemic.

Insomnia is characterized by difficulty falling asleep or maintaining sleep after falling asleep, and it can be caused by various factors such as excessive worries, anxiety, depression, chronic pain, among others<sup>106</sup>.

The pandemic context triggered concerns among healthcare professionals, resulting in difficulties falling asleep and staying asleep. Many worked continuously, sometimes without rest or with reduced sleep hours, to meet the needs of patients, often in critical condition, and the demands of healthcare services. Sleep is part of the survival process and needs to be adequate for good quality of life and health<sup>107</sup>.

Post-traumatic stress disorder (PTSD) was also identified in healthcare professionals who provided direct assistance to Covid-19 patients. The results found in this study were similar to those of another meta-analysis that analyzed the mental effects of the pandemic, which identified a combined prevalence of post-traumatic symptoms of 0.32 (95% CI = 0.26-0.37) among frontline healthcare workers<sup>108</sup>.

PTSD affects some individuals after experiencing traumatic events such as accidents, disasters, loss of family members or loved ones, or situations of violence, causing them to relive the trauma through painful memories, recurring dreams, and nightmares. People with PTSD may develop symptoms such as insomnia, difficulty concentrating, restlessness, and feelings of guilt<sup>109</sup>.

Exposure to negative factors, such as being closer to patients and dealing with bad news, high mortality rates, and the loss of colleagues, family members, and loved ones during the pandemic, led many Healthcare professionals to develop PTSD. A study conducted in China demonstrated that 10.1%

of healthcare professionals who worked in high-risk exposure areas to Sars-CoV-2 showed positive symptoms of PTSD, and 8.3% of participants had suicidal thoughts in the last month.

Concluding the results regarding the mental outcomes identified in this study, a prevalence of 42% of burnout syndrome was observed among healthcare professionals. This result is similar to a meta-analysis<sup>108</sup> where the prevalence of burnout among healthcare personnel during the pandemic was 37%.

Burnout syndrome is characterized by physical, emotional, or mental exhaustion due to excessive physical or mental effort<sup>109</sup>. It is a significant issue that routinely affects healthcare professionals<sup>111</sup>. Faced with prolonged work hours and the overload of activities, exacerbated during the Covid-19 pandemic, healthcare professionals working in direct patient care experienced reduced performance, leading to negative attitudes and the onset of burnout syndrome<sup>112</sup>.

Similarly, physical signs and symptoms were prevalent among healthcare professionals during the Covid-19 pandemic in clinical practice, and this review found that they were related to the use of personal protective equipment (PPE). Due to the high infectivity of Sars-CoV-2 and the contact with patients, fluids, and secretions, healthcare professionals needed to be equipped with various PPE simultaneously for long hours to prevent contamination. The prolonged use of PPE led to many discomforts and injuries, particularly on the skin<sup>33,35</sup>.

Corroborating with these findings, a study conducted in Turkey found that 95.6% of Healthcare professionals who worked during the Covid-19 pandemic reported skin problems associated with the use of at least one personal protective equipment (PPE), particularly surgical/N95 masks (97.1%) and gloves (96.8%). The most commonly reported issues were skin dryness (74%) and itching (72.1%).

The constant need for hand hygiene among healthcare professionals during the COVID-19 pandemic, whether through handwashing or the use of hand sanitizer, led to the development of skin lesions, especially on the hands, as also observed in a study with healthcare professionals in Ireland<sup>114</sup>. In this study, 270 participants were interviewed, and among them, 223 (82.6%) reported signs and symptoms of skin lesions due to increased handwashing frequency and the use of hand sanitizer. The hands were the most affected area (76.47%), and the most commonly reported symptom was dry skin (75.37%).

The results identified in this systematic review and meta-analysis show how much healthcare professionals who directly cared for Covid-19 patients were affected during their clinical practice, working under intense pressure, dealing with an unknown disease, high mortality rates, and exposed to various negative emotional interactions related to patients, families, and colleagues. Additionally, they faced occupational overload, resource scarcity, and inadequacy.

Therefore, institutional and governmental programs to support mental health, along with adequate working conditions, are essential for healthcare professionals to achieve the balance and appropriate well-being necessary to carry out their activities, especially during crisis situations like the Covid-19 pandemic.

This study presents a limitation in the high degree of statistical heterogeneity among the studies, which was expected as they were conducted in different countries, with diverse measurement scales and sample sizes. Sensitivity analyses were performed to confirm the certainty of the generated evidence, and after these checks, there were no changes in the overall results.

Indeed, understanding and identifying the factors that affect the mental and physical health of healthcare professionals who provide direct assistance to patients in emergency situations such as a pandemic will assist healthcare service managers and government agencies in developing preventive actions and effective public policies. These measures can support these workers in facing emergency situations.

## CONCLUSION

It is concluded that the most prevalent mental signs and symptoms among healthcare professionals who provided direct assistance to Covid-19 patients were anxiety, depression, stress, post-traumatic stress disorder, and burnout syndrome. Additionally, the predominant physical signs and symptoms were related to the prolonged use of personal protective equipment (PPE) and increased frequency of hand washing and alcohol gel use, leading to injuries, especially on the skin.

It is important to emphasize the need for measures that preserve health and enable adequate working conditions that provide a safe work environment for professionals directly involved in caring for patients, especially in extreme situations like the Covid-19 pandemic.

Institutions and public health authorities should plan and formulate strategies to protect healthcare professionals and mitigate the risk factors that lead to illness during their professional duties, especially in emergency public health situations.

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