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# Development and factor analysis of the „P-COV 2020" questionnaire. Neuropsychiatric symptoms after SARS-CoV-2 infection in the Polish population

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## Abstract

**Background:** Covid-19 pandemic was a global health and economic crisis. A substantial part of the population infected with the SARS-CoV-2 virus reported neuropsychiatric symptoms. The objective of the study is to construct a self-report questionnaire to assess the neuropsychiatric consequences of SARS-CoV-2 infection.

**Participants and procedure**: Data analyzed from 327 participants – 84.1% of participants were female, 62.4% were 26-45 years old. Team of psychiatrists, psychologists and infectious disease specialists constructed the "P-COV 2020" questionnaire, which assesses a wide range of mental health characteristics. The "P-COV 2020" consisted of 62 items and was based on current literature and clinical experience. Snowball sampling was conducted by publishing a survey containing SARS-CoV-2 infection circumstances and a „P-COV 2020" via Internet.

**Results:** The internal consistency reliability of factor I (19 items) describing emotional lability and depressive traits was categorized as excellent (α= 0,935); of factor II (15 items) describing cognitive difficulties as excellent (α=0,949); of factor III (6 items) describing unusual sensory experiences as acceptable (α=0,769); of factor IV (11 items) describing energy level and sleep disturbances as good (α=0,884). Including time-related characteristics, the group showed the highest scores for factors IV and II, and surprisingly, the lowest score for factor III. Items with α<0.4 were excluded from further analysis (11 items).

**Discussion:** Infection with SARS-CoV-2 virus may result in intensified sleep, energy level, and affective and cognitive disturbances. The psychosocial factors of the pandemic should be considered in the analysis of subjective reports.

**Conclusions:** Neuropsychiatric symptoms after SARS-CoV-2 infection are reported. Further research on SARS-CoV-2 infection consequences is needed.

**COVID-19; SARS-CoV-2; questionnaire; infectious diseases; neuropsychiatry**

## INTRODUCTION

Since the beginning of the COVID-19 pandemic in 2019, numerous studies have been conducted to establish the prevalence and severity of persistent symptoms or distant complications resulting from the disease. Multitude of reports

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on long-term consequences of COVID-19 on convalescents' health is still growing as the pandemic continues, along with the occurrence of new SARS-CoV-2 variants [1,2]. Introduction of widely available vaccines against SARS-CoV-2 also presumably plays a crucial role in the incidence and acuity of feasible complications of the disease. Knowledge concerning this issue is constantly growing as new populations are being screened and the amount of data available is multiplied. The term 'long-COVID' is one of many non-standardized descriptions of COVID-related symptoms observed in patients two or more weeks after the infection and the common synonyms used to describe this phenomenon are 'long haulers,' 'post-COVID syndrome' or 'post-acute sequelae of SARS-CoV-2 infection' [3-9]. Among the manifestations considered to constitute long-COVID are a broad range of symptoms, laboratory results, and imaging findings. Available meta-analyses indicate the existence of over 50 different symptoms, including pulmonary, cardiovascular, neurological, psychiatric, and other nonspecific signs, with the most frequent being fatigue, headache, attention deficits, hair loss and dyspnoea [3-8]. Overall, 80% of patients experience at least one long-term symptom of COVID-19. Additionally, the risk of being newly diagnosed with a mental disorder doubles among adults [3, 9-13]. It is important to note that while the group of patients assumed to have the highest risk of prolonged recovery was hospitalized, including those in Intensive Care Units, mild or moderate cases also showed signs of being affected [14-16]. In 2020, the number of reports from patients and caregivers began to grow, with symptoms persisting for three weeks or more after the infection. The evidence that existed during this period was mostly of vague quality or only anecdotal, which prompted the need to design and conduct scientific assessment of post-COVID reports [13-16]. Early in the pandemic, there was a mismatch between medical professionals' assessments and patients' self-reports of COVID-19 acute and long-term symptoms. It has been observed that the incidence of persisting symptoms is higher in self-report surveys than in professional medical assessments, even taking into account sampling bias; hence, there is a need to create tools for research on subjective patients' experiences [17]. Since the beginning of the COVID-19 pandemic, a growing number of self-report questionnaires have been developed to better understand the different psychological and emotional consequences of COVID-19 and the experiences of the pandemic itself. This study aimed to construct a self-report questionnaire to evaluate the mental health consequences of SARS-CoV-2 infection and perform an exploratory factor analysis of the questionnaire on data from the Polish population.

## PROCEDURE

### Study design

We conducted a Web-based study. The survey titled 'Evaluating the consequences of SARS-CoV-2 infection' was designed and published online using the professional platform SurveyMonkey in Polish language. Invitations to participate in the study were published on social media groups, the Facebook page of the University Hospital of Cracow, and online forums concentrating on hobbies and health topics. Data were collected between June 2021 and June 2022. The survey consisted of three parts:1) Circumstances of SARS-CoV-2 infection, which included the following: confirmation of infection, type of test used, date of the first confirmed positive test, type of tissue used in the test (blood/nasopharyngeal specimen), and duration of COVID-19 disease symptoms. 2) Somatic symptoms of acute phase in SARS-CoV-2 infection based on current professional literature [18] 3) „P-COV 2020" questionnaire which measures estimated psychiatric domains after SARS-CoV-2 infection. „P-COV 2020" questionnaire consisted of 62 questions. The questionnaire was designed by team members with clinical experience (Medical Doctors – Specialists in psychiatry and infectious diseases, clinical Psychologists, and clinical Psychotherapists) and academic experience (Professors and PhDs in medical sciences, Masters in psychology). The items were developed in group meetings through a critical review of current literature and clinical observations [19-25]. The answers to each question were positioned on a Likert scale as follows: "Describes me very well,"; "Describes me well,"; "Does not

relate to me,"; "Definitely does not relate to me." Each question was assigned to an additional section to assess the time-related characteristics of the symptoms:1) present before the infection, 2) exacerbated since the infection, and 3) present after the infection. This research project was approved by the Bioethics Committee of Jagiellonian University in Cracow:1072.6120.17.2020.

## STATISTICAL ANALYSIS

Statistical analyses were performed using IBM SPSS Statistics, version 26.0. In the analysis, we use contingency tables with the chi-square independence test or Fisher's exact test when the number of observations is < 5. For the questionnaire assessment, an exploratory factor analysis using the oblique rotation oblimin method was performed. The reliability of subscales was estimated using the $\alpha$ Cronbach coefficient, the point of statistical significance was established as $\alpha$=0,05. Spearman's correlations were used to assess the correlations between the intensity of each factor and demographic data. The Mann–Whitney U test was performed to assess the differences between hospitalized and non-hospitalized participants.

## PARTICIPANTS

The study group consisted of 372 participants. 45 participants were excluded:12 of them chose an option indicating that they had never been infected with SARS-CoV-2, 21 were not often tested for COVID-19, and 12 participants did not provide basic demographic information. In total, 327 observations were included in the analysis.

Table 1 presents descriptive statistics for the demographic variables. Most patients in the study group were female (84.1%). 30.3 Of the participants, 30.3% were 26–35 years old and 32.1% were 36–45 years old. Approximately one-third of the group lived in a city with over 500,000 residents (34.9%), and one-fifth lived in rural areas (21.7%). Half of the participants were highly educated (50.8%) and the second major education group completed secondary education (22.4%).

**Table 1.** Sample characteristics (N = 327)

| Variables | *N* | % |
|---|---|---|
| **Sex** | | |
| Female | 275 | 84.1 |
| Male | 52 | 15.9 |
| **Age (years)** | | |
| 18-25 | 47 | 14.4 |
| 26-35 | 99 | 30.3 |
| 36-45 | 105 | 32.1 |
| 46-55 | 3 | 0.9 |
| 56-65 | 18 | 5.5 |
| 66-75 | 1 | 0.3 |
| 76-85 | 1 | 0.3 |
| **Place of residence** | | |
| Rural areas | 71 | 21.7 |
| City up to 50,000 residents | 55 | 16.8 |
| City from 50,000 up to 150,000 residents | 45 | 13.8 |
| City from 150,000 up to 500,000 residents | 42 | 12.8 |
| City over 500,000 residents | 114 | 34.9 |
| **Education** | | |
| Primary | 4 | 1.2 |
| NVQ / Vocational Training/Education | 11 | 3.4 |
| Secondary | 71 | 21.7 |
| University student | 19 | 5.8 |
| Bachelor of Engineering | 17 | 5.2 |
| Bachelor's degree | 39 | 11.9 |
| Master's degree | 166 | 50.8 |

Table 2 presents medical treatment and diagnostic data. SARS-CoV-2 infection was officially confirmed using real-time PCR (46.6%) and was mainly diagnosed in nasopharyngeal specimens (82.6%). Six percent of the participants were hospitalized, and the mean duration of hospitalization was 14 days. Only 1% of the participants were treated in the Intensive Care Unit and required mechanical ventilation, one in 20 needed oxygen treatment. The duration of acute SARS-CoV-2 infection symptoms ranged from 1 to 387 days; however, 80% of the participants reported persistent symptoms for 1–22 days, with a mean duration of 22 days. The mean time since the first positive SARS-CoV-2 test result was 28.5 weeks (SD=18.73).

**Table 2.** Treatment characteristics (N = 327)

| Variables | Statistics |
|---|---|
| Test – I do not remember what kind. *N (%)* | 100 (30.6) |
| Antigen Test | 23 (7.0) |
| RT Test | 162 (49.5) |
| Serological Test | 42 (12.8) |
| How many weeks ago was the first positive test done. *M (SD)* | 28.49 (18.73)<br>Min-max: 1-92 |
| Material collected *N (%)* | |
| Blood | 57 (17.4) |
| Swab from respiratory tract | 270 (82.6) |
| Duration of symptoms. *M (SD)* | 22.15 (42.43)<br>Min-max: 0-387 |
| Stay in the hospital ward. *N (%)* | 21 (6.4) |
| Length of hospitalization (days). *M (SD)* | 14.05 (13.38)<br>Min-max: 1-50 |
| Treatment in the Intensive Care Unit. *N (%)* | 4 (1.2) |
| Treatment with oxygen through a mask or catheter directly to the airways. *N (%)* | |
| Yes | 19 (5.8) |
| I do not know | 5 (1.5) |
| Mechanical ventilation using a respirator. *N (%)* | 3 (0.9) |

Table 3 presents the frequencies of comorbidities. The most common diseases in the study group were hypertension (13.5%) and obesity (15%). Other diseases occurred in less than 7% of respondents.

**Table 3.** Frequency analysis of comorbidities (N = 327)

| Comorbidities | *N* | *%* |
|---|---|---|
| Obesity | 49 | 15.0 |
| Hypertension | 44 | 13.5 |
| Psychiatric illness diagnosed by a medical doctor | 22 | 6.7 |
| Chronic lung disease | 11 | 3.4 |
| Diabetes | 8 | 2.4 |
| Immune system deficiency treated pharmacologically | 7 | 2.1 |
| Chronic neurological disease | 6 | 1.8 |
| Cancer | 5 | 1.5 |
| Chronic heart disease | 3 | 0.9 |
| Stroke (in the past) | 2 | 0.6 |
| Chronic kidney disease treated with dialysis | 0 | 0 |

Table 4 presents the frequency of individual symptoms during the acute phase of COVID-19. More than half the respondents experienced muscle or joint pain (55.5%), loss or disturbance of taste (57.7%), headache (62.3%), loss or disturbance of smell (67.5%), and asthenia/fatigue (80.1%). The least common symptoms were hemoptysis (0.9%), loss of consciousness (1.2%) or constipation (2.1%). Less than 10% of the respondents experienced vomiting (7.7%), speech difficulties not resulting from respiratory problems (7.1%), extreme difficulty breathing (6.4%), fever of over 39.5 (6.3%), and pale or bluish skin, lips, or nails (5.8%).

**Table 4.** Frequency analysis of reported symptoms in acute phase of infection (N = 327)

| **Symptoms** | ***N*** | ***%*** |
|---|---|---|
| Weakness/Fatigue | 261 | 80,1 |
| Loss or alteration of smell | 220 | 67,5 |
| Headache | 203 | 62,3 |
| Loss or alteration of taste | 188 | 57,7 |
| Muscle of joint pain | 181 | 55,5 |
| Stuffy nose | 160 | 49,1 |
| Dry cough (non-productive) | 155 | 47,5 |
| Chills | 138 | 42,3 |
| Fever 37.5 to 38.5 °C | 131 | 40,2 |
| Shortness of breath (feeling of lack of air, breathlessness, difficulty in breathing) | 128 | 39,3 |
| Sore throat | 123 | 37,7 |
| Runny nose | 116 | 35,6 |
| Dizziness | 98 | 30,1 |
| Chest pressure | 91 | 27,9 |
| Heart palpitations (unpleasant, excessive, or irregular heartbeat) | 85 | 26,1 |
| Diarrhea (passing stools more than twice a day or passing loose stools) | 68 | 20,9 |
| Other symptoms not listed above | 64 | 19,6 |
| Nausea (unpleasant sensation of needing to vomit) | 62 | 19,0 |
| Chest pain | 53 | 16,3 |
| Fever 38.5 to 39.5 °C | 49 | 15,0 |
| Dehydration symptoms – dryness of mouth, tongue, eyes, decreased urine output | 49 | 15,0 |
| Wet cough (productive) | 46 | 14,1 |
| Abdominal pain | 45 | 13,8 |
| Disorientation | 43 | 13,2 |
| Walking difficulties not related to musculoskeletal problems | 41 | 12,6 |
| Light hypersensitivity | 38 | 11,7 |
| Conjunctivitis symptoms – redness, swelling, itching, pain, eye discharge | 37 | 11,3 |
| Abdominal discomfort | 36 | 11,0 |
| Vomiting | 25 | 7,7 |
| Speech difficulties unrelated to respiratory problems | 23 | 7,1 |
| Fever above 39.5 °C | 22 | 6,7 |
| Severe difficulties in breathing (gasping for air, inability to speak without catching breath, wheezing while breathing, flaring of nostrils when breathing) | 21 | 6,4 |
| Pale or bluish coloration of the skin, lips, or nails | 19 | 5,8 |
| Constipation (passing stools less than twice a week or passing hard stools) | 7 | 2,1 |
| Loss of consciousness | 4 | 1,2 |
| Difficulty in waking up (e.g. requiring assistance from other person to wake you up) | 4 | 1,2 |
| Coughing up blood (blood in coughed-up phlegm from the lungs) | 3 | 0,9 |

## RESULTS

To assess the internal structure of the questionnaire, we performed exploratory factor analysis using the oblique rotation oblimin method. Based on the scree plot we extracted 4-factor structure for the questionnaire that explained 49.58% of the variance. In the analysis, we excluded questions with factor loadings of less than 0.4 and a comparable degree loaded two or more factors (cross-loading). Eleven questions were excluded, resulting in a final score of 51 items. The reliability of every factor was sustained at a satisfactory level from 0.75 0.95. Internal consistency reliability was acceptable for factor III ($\alpha$=0,769), good for factor IV ($\alpha$=0,884), and excellent for factors I ($\alpha$= 0,935) and II ($\alpha$=0,949). The factor-loading matrices are listed in table 5. Excluded items are listed at the bottom of the table.

Factor I included 19 questions concerning emotional states that considered anxiety, sadness, and emotional lability. Factor II includes 15 questions on cognitive difficulties in terms of memory, attention, learning, and cognitive fatigue. Factor III included six questions concerning atypical sensory impressions. Factor IV included 11 questions concerning energy levels, including sleep behavior and quality.

**Table 5.** Matrix of factor loadings.

| | Factor | | | |
|---|---|---|---|---|
| **Questions included** | I | II | III | IV |
| 20. I think about the future feeling anxious | **0.781** | 0.040 | -0.200 | -0.155 |
| 5. I'm afraid of the future | **0.759** | -0.012 | -0.187 | -0.148 |
| 35. I'm worried | **0.747** | 0.002 | -0.244 | -0.111 |
| 7. I'm suspicious | **0.741** | -0.024 | 0.020 | 0.299 |
| 57. My mood often changes during the day | **0.692** | -0.014 | 0.012 | -0.231 |
| 54. I have trouble controlling my emotions | **0.685** | -0.097 | 0.120 | -0.002 |
| 33. I get irritated for no reason | **0.672** | -0.045 | 0.164 | 0.037 |
| 9. I do not trust others | **0.657** | 0.067 | 0.161 | 0.169 |
| 32. I can feel my anger building up inside me | **0.654** | 0.062 | 0.122 | -0.012 |
| 52. I often feel sad for no reason | **0.643** | -0.093 | -0.051 | -0.143 |
| 36. I'm in a low mood | **0.612** | -0.180 | -0.168 | -0.315 |
| 3. I'm irritated | **0.596** | -0.100 | 0.065 | -0.048 |
| 56. I lose my temper for no reason | **0.591** | 0.104 | 0.325 | -0.114 |
| 11. I easily lose my temper for no reason | **0.590** | -0.111 | 0.117 | 0.046 |
| 60. I fear for my life and health | **0.534** | 0.113 | 0.026 | -0.260 |
| 43. Everyday duties are overwhelming | **0.468** | -0.317 | 0.029 | -0.156 |
| 19. I feel the urge to use the Internet for longer and longer periods of time | **0.453** | -0.109 | -0.169 | -0.046 |
| 49. I cry for no reason | **0.439** | -0.016 | 0.149 | -0.225 |
| 30. Many things lost their importance for me | **0.438** | -0.231 | -0.124 | -0.189 |
| 50. I have difficulties with remembering | -0.019 | **-0.894** | -0.047 | -0.016 |
| 22. It's hard for me to remember things that I used to remember well | -0.152 | **-0.868** | 0.094 | 0.109 |
| 31. I forgot much of what I once knew | -0.007 | **-0.828** | 0.072 | 0.135 |
| 24. I have trouble finding the right words | -0.014 | **-0.798** | 0.022 | -0.016 |
| 13. I don't remember the names of familiar objects | -0.128 | **-0.764** | 0.110 | 0.157 |
| 26. I can't learn new things | 0.067 | **-0.762** | -0.102 | -0.083 |

| | | | | |
|---|---|---|---|---|
| 17. It's difficult for me to learn new things | 0.010 | **-0.714** | -0.175 | -0.233 |
| 46. I don't remember the numbers that I used to know by heart | -0.020 | **-0.682** | 0.301 | -0.007 |
| 8. I get distracted easily | 0.187 | **-0.681** | -0.052 | -0.015 |
| 14. Focusing on something doesn't come easily to me | 0.158 | **-0.671** | 0.025 | -0.034 |
| 6. I'm often distracted | 0.151 | **-0.654** | -0.070 | -0.150 |
| 38. I feel as if I'm in a fog | -0.092 | **-0.646** | 0.170 | -0.269 |
| 48. It's difficult for me to gather my thoughts | 0.200 | **-0.630** | 0.027 | -0.122 |
| 42. I get tired quickly during mental work | 0.041 | **-0.529** | 0.013 | -0.443 |
| 37. Engaging in professional tasks is challenging to me | 0.225 | **-0.466** | -0.067 | -0.235 |
| 39. I see unusual things. like flashes. shapes | 0.115 | -0.084 | **0.685** | 0.121 |
| 41. I sense strange or unusual smells and tastes | 0.003 | -0.035 | **0.644** | -0.153 |
| 51. I hear things that others don't | 0.218 | 0.046 | **0.631** | -0.055 |
| 18. I can't taste or smell food | -0.175 | -0.098 | **0.549** | -0.194 |
| 40. I sometimes lose orientation in familiar places | 0.026 | -0.405 | **0.484** | 0.127 |
| 61. I'm hypersensitive to sounds | 0.114 | -0.036 | **0.473** | -0.216 |
| 29. Sleep brings me no rest | 0.254 | -0.119 | -0.020 | **-0.633** |
| 28. My sleep is shallow | 0.109 | -0.053 | 0.104 | **-0.624** |
| 53. I can't fall asleep | 0.087 | 0.025 | 0.156 | **-0.594** |
| 2. I wake up at night | 0.118 | -0.085 | -0.024 | **-0.562** |
| 59. I feel like I can't catch my breath | -0.160 | -0.167 | 0.335 | **-0.556** |
| 58. I get tired easily | 0.102 | -0.320 | -0.012 | **-0.543** |
| 16. I feel tired all the time | 0.186 | -0.368 | -0.155 | **-0.497** |
| 55. I've been having strong headaches | -0.043 | -0.045 | 0.348 | **-0.477** |
| 23. I have no energy to live | 0.292 | -0.358 | -0.126 | **-0.462** |
| 21. I have no appetite | 0.115 | 0.123 | 0.363 | **-0.437** |
| 44. I have severe headaches | -0.041 | -0.116 | 0.380 | **-0.409** |
| Reliability (Cronbach α) | 0.935 | 0.949 | 0.769 | 0.884 |
| % explained variance | 32.79 | 6.99 | 5.16 | 4.64 |
| **Questions excluded:** | | | | |
| 15. I stress eat | 0.366 | 0.243 | 0.02 | 0.194 |
| 12. The world seems unreal and untrue to me | 0.341 | -0.17 | 0.304 | 0.104 |
| 25. I have a lack of desire for sex or difficulty maintaining arousal | 0.32 | 0.044 | 0.032 | -0.245 |
| 62. My mood changes a lot depending on the phase of the menstrual cycle (for women) | 0.286 | 0.024 | 0.18 | 0.004 |
| 27. I drink an alcohol too much or too often | 0.244 | 0.058 | 0.196 | 0.164 |
| 10. I feel like sleeping all the time | 0.3 | 0.345 | -0.087 | -0.172 |
| 47. Sometimes I freeze and lose track of time | 0.298 | 0.368 | 0.397 | 0.09 |
| 45. My surroundings seem unreal to me | 0.23 | 0.223 | 0.372 | -0.012 |
| 34. I have nightmares | 0.329 | 0.017 | 0.333 | -0.211 |
| 1. Things that used to bring me pleasure no longer do | 0.334 | 0.177 | -0.106 | -0.362 |
| 4. I hear my own thoughts | 0.372 | 0.046 | 0.109 | 0.008 |

Scoring values for each factor were calculated with grading as follows: "Definitely does not relate to me" – 0; "Does not relate to me" – 1; "Describes me well" – 2; "Describes me very well" – 3. Score values were obtained by the addition of individual scores in each question according to the grading as above, and divided by the number of items characterized by a certain factor. Each question was assigned to an additional section to assess the time-related characteristics of a symptom:1) present before the infection, 2) exacerbated since the infection, or 3) present since the infection. Additional analyses considering only people with symptoms exacerbated since infection or present since infection were inconsistent owing to the small number of observations.

The section dedicated to time-related characteristics was analyzed by multiplying the factor scoring values of every question by the time-related characteristics graded as follows:0 or 1, present before infection; 1 or 2, exacerbated since infection; or 2 or 3, present since infection. The resulting scores for each factor, including and excluding time-related characteristics, are presented in Table 6.

**Table 6.** Descriptive statistics of the factors.

| Variables (intensity / time-related data) | *M* | *Me* | *SD* | *Sk.* | *Kurt.* | *Min.* | *Max.* |
|---|---|---|---|---|---|---|---|
| **Scoring 0-1-2-3 / 0-1-2** | | | | | | | |
| Factor I | 1.09 | 0.80 | 1.11 | 0.89 | -0.01 | 0.00 | 4.50 |
| Factor II | 1.62 | 1.33 | 1.53 | 0.74 | -0.34 | 0.00 | 5.87 |
| Factor III | 1.10 | 0.67 | 1.41 | 1.43 | 1.54 | 0.00 | 6.00 |
| Factor IV | 1.51 | 1.14 | 1.40 | 0.87 | 0.07 | 0.00 | 6.00 |
| **Scoring 0-1-2-3 / 1-2-3** | | | | | | | |
| Factor I | 2.49 | 2.44 | 1.67 | 0.36 | -0.56 | 0.00 | 7.07 |
| Factor II | 3.08 | 2.97 | 2.23 | 0.40 | -0.67 | 0.00 | 8.80 |
| Factor III | 1.94 | 1.08 | 2.14 | 1.17 | 0.77 | 0.00 | 9.00 |
| Factor IV | 3.00 | 2.82 | 2.04 | 0.50 | -0.38 | 0.00 | 9.00 |
| **Scoring 0-1-2-3 (no time-related)** | | | | | | | |
| Factor I | 1.30 | 1.34 | 0.63 | -0.22 | -0.31 | 0.00 | 2.79 |
| Factor II | 1.36 | 1.33 | 0.72 | 0.08 | -0.49 | 0.00 | 3.00 |
| Factor III | 0.80 | 0.83 | 0.57 | 0.26 | -0.55 | 0.00 | 2.50 |
| Factor IV | 1.40 | 1.38 | 0.69 | -0.01 | -0.37 | 0.00 | 3.00 |

M, mean; Me, median; SD, standard deviation; Sk, standard deviation – skewness; Kurt.: kurtosis; min: minimum value; max. – maximal value

To assess differences in the investigated factors between males and females we used Levene's test to estimate the equality of variances; there were no statistically significant differences. In further analysis, we performed a Spearman's correlation test, which showed a lack of statistically significant correlations between the intensity of factor scores (without time-related characteristics), sex, age, and location of residence. Statistically significant strong positive correlations were observed between symptom duration and scores for all factors. Additionally, the time since the first SARS-CoV-2 test was significantly positively correlated with factors I, II, and IV. Female sex was positively correlated with the scores for factors I, II, and III. The Mann-Whitney U-test showed a statistically significant intensity of Factors I (p=0.03), II (p=0.02), and IV (p=0.04) in the hospitalized group.

**Table 7.** Spearman's correlation analysis between intensity of individual Factors (no time-related), demographic data and time periods related to SARS-CoV-2 infection.

| | Factor I | Factor II | Factor III | Factor IV |
|---|---|---|---|---|
| Sex | **0,145*** | **0,233*** | **0,213*** | 0,117 |
| Age | -0,024 | -0,071 | -0,106 | -0,031 |
| Location of residence | -0,078 | 0,057 | -0,054 | -0,108 |
| Education | -0,100 | 0,026 | -0,034 | -0,116 |
| Duration of symptoms | **0,182**** | **0,273**** | **0,242**** | 0,305** |
| Time since the first positive SARS-CoV-2 test performed | **0,150*** | **0,217**** | 0,106 | 0,164* |

* – $p < 0.05$; ** – $p < 0.005$

## DISCUSSION

This study aimed to develop and present the initial psychometric properties of self-reported measures to assess neuropsychiatric symptoms after SARS-CoV-2 infection in a Polish population. The „P-COV 2020" questionnaire assessed the broad impact of COVID-19 on mental health. As a result of the conducted analysis, the developed measure included 51 statements and had four factor structure which demonstrated acceptable to excellent internal consistency reliability.

The first scale of the „P-COV 2020" questionnaire assessed the emotional states of depressive and anxiety symptoms, emotional lability, and emotional dysregulation. The second scale estimates subjective cognitive difficulties, such as problems in remembering and recalling, attention, learning, and cognitive fatigue. The third scale refers to atypical sensory experiences (flashes, sounds, changes in taste, and smell) and hypersensitivity to sound. The fourth scale assesses sleep behavior and quality, general level of energy, and troubles in breathing. The respondents were asked about the time of symptom onset. We differentiated whether the symptoms 1) were present before the onset of the disease, 2) were present before the onset of the disease but intensified after developing the infection, and 3) developed after the onset of the infection. The time-related description was retrospective and should be interpreted with caution. We chose to assess the time-related characteristics in two grades but also presented scores for every factor without time-related characteristics. The results indicated that sleep difficulties first appeared or intensified after SARS-CoV-2 infection. The second most intensified factor was related to cognitive difficulties at a level similar to that of factor I, which was related to depressive traits and emotional lability. With similar scores for factors I, II, and IV, factor III emerged as the least intense, regardless of the time-related characteristics.

Our results are consistent with those of previous studies. In a meta-analysis of 1458 scientific articles, the most common neuropsychiatric condition was sleep disturbance, with a prevalence of 31% (95% CI:18%-43%) [9-12]. In a study performed in 13 countries with partnership of 22 300 adult participants, clinical insomnia symptoms were reported by 36.7% of the respondents, and 17.4% met the criteria for probable insomnia disorder [26-28]. Cognitive dysfunction is one of the three most common symptoms of post-covid syndrome [9-12]. It has been shown that COVID-19 patients have performed poorer than control groups on neuropsychological tests measuring cognitive functions such as attention and executive function, divided attention, selective attention, visual vigilance, intrinsic alertness, working memory, episodic memory, and visuospatial processing. Depending on the type of measuring tool used, the frequency of different cognitive impairments oscillated between 2-4 times higher than that in healthy controls [29-31]. In our study, this group did not accurately reflect the general population in terms of demographic data. Most of our participants were up to 65 years old, whereas two-thirds were 25-45 years old. Half of the participants were high-

ly educated. These factors could significantly influence the results of cognitive functioning and should be noted before drawing conclusions in the general population [32]. Nevertheless, it is necessary to conduct more detailed neuropsychological examinations of the selected groups. Research and clinical observations suggest that people infected with SARS-CoV-2 often struggle with anxiety, depression, cognitive dysfunction, sleep disturbances, fatigue, and unusual sensory symptoms [3-8]. Previous epidemics of other coronaviruses, such as MERS and SARS, have been observed to cause long-term psychiatric complications, including anxiety, depression, trauma-related disorders, and sleep problems, sustained for up to 12 years after the initial infection [33]. In our analysis, female sex was associated with the intensity of factors I, II, and III. These data are consistent with a growing number of scientific reports indicating that females are more prone to developing long-COVID symptoms [34-41].

Surprisingly, Factor III, which accounted for atypical sensory experiences (flashes, sounds, changes in taste, and smell), was the least intensified. Data were collected between June 2021 and June 2022. Until June 2022, the Polish population had been exposed to at least four variants of SARS-CoV-2, with a dominance of Delta and Omicron variants during the data collection period [1-3]. Despite big concerns regarding symptoms associated with changes in taste and smell in mass media, research data show minimal occurrence of such disease manifestations. In a Polish study investigating over two thousands COVID-19 using professional clinical examinations, anosmia was prevalent in only 2.9% of delta cases and 9.6% of omicron cases [42]. Interestingly, most participants in our study reported diminished taste and smell during the acute phase of SARS-CoV-2 infection. Despite numerous alarming data concerning the emergence of post-covid psychiatric symptoms, several studies have suggested that they might not be as persistent as in previous coronavirus epidemics. A systematic review involving over 6000 participants showed that although the COVID-19 pandemic might have a worsening effect on overall psychiatric health, SARS-CoV-2 infection itself leaves no or mild psychiatric symptoms for at least one month after its onset [43-45]. However, there are indications that the severity of post-COVID psychiatric symptoms might be most noticeable six months after half a year from the onset of infection. In our study, the correlation between the time period since the first positive SARS-CoV-2 test (mean time of 200 days) and the intensity of factors I, II, and IV supports the hypothesis that various symptoms may aggravate over time. In a 2022 meta-analysis, the prevalence of neurological and neuropsychiatric symptoms (anxiety and depression) of post-COVID-19 syndrome was shown to be higher when assessed at or beyond six months (long-term) than when assessed between three and six months (mid-term); moreover, these symptoms seem to increase in prevalence over time rather than resolve [3].

What complicates the assessment of post-covid symptoms is the existence of evidence for both biological and socioeconomic factors that contribute to the reported ailments. It is challenging to differentiate between the consequences of psychological and socioeconomic stressors (e.g., lockdown, employment insecurity, uncertainty of a new disease) and the results of the infection itself [43]. The most intense factors in our study were energy level and sleep behavior disturbances. In a multi-center study that concentrated on insomnia symptoms during the COVID-19 pandemic, the authors showed that greater financial burden, living alone or with more than five people in the same household, or living in confinement for four to five weeks significantly elevated the risk of insomnia [26]. The assessment of psychological factors associated with the COVID-19 pandemic as a social phenomenon could be useful to better understand the possible sources of existing symptoms, and the number of tools addressing this issue is constantly growing. The COVID-19 Stress Scale is a 36-item questionnaire that focuses on COVID-19 distress. It consists of five scales: COVID danger and contamination fears, COVID fears about economic consequences, COVID Xenophobia; COVID compulsive checking and reassurance seeking and COVID traumatic stress symptoms [46]. Another tool developed to identify the presence of anxiety syndrome features associated with the COVID-19 pandemic as a psychosocial challenge is the Covid-19 Anxiety Syndrome Scale (C-19ASS) [47-49]. It is a brief

measure consisting of nine items (six assessing the presence of perseverative thinking and three assessing avoidance). Examples of measures aimed at assessing multifaceted psychological reactions to the pandemic are the COVID-19 Impact Battery (CIB) and COVID-19 pandemic mental health questionnaire (CoPaQ). The COVID-19 Impact Battery comprises three scales to assess behavioral, worrying, and dysfunctional responses to COVID-19. This questionnaire has been shown to have good psychometric properties. A short version of the measure was developed as well [50]. The COVID-19 Pandemic Mental Health Questionnaire evaluates a broad spectrum of psychosocial aspects of the pandemic: COVID-19 contamination anxiety, countermeasure necessity and compliance, mental health impact, COVID-19-specific stressor impact, social media usage, interpersonal conflicts, paranoid ideations, institutional and political trust, conspiracy beliefs, and social cohesion [51]. Our study included an extensive survey of treatment methods and information about hospitalization. The number of hospitalized patients was small. Nevertheless, analyses were conducted to compare hospitalized and non-hospitalized patients. Results indicate that Hospitalized patients reported higher levels of emotional and cognitive difficulties, sleep problems, and fatigue. Owing to the small number of respondents and significant numerical inequality in both groups, the data should be treated with great caution. However, the results are consistent with those of previous studies showing that patients requiring treatment in the intensive care unit experience more psychological problems, such as higher levels of PTSD and depressive symptoms [52,53].

## LIMITATIONS

We did not use existing validated questionnaires designed to assess similar constructs such as cognitive deficits or emotional disturbances. This decision limited our results in the impossibility of assessing discriminant and convergent validity. Given the novelty of mental health issues related to COVID-19, the authors chose to refrain from conducting confirmatory factor analysis, which presupposes a priori definition of factors. Considering the dynamic nature of the SARS-CoV-2 infection and the evolving course of the pandemic, test-retest reliability was not ascertainable. The snowball sampling method using social media is also a limitation of this study. Social media groups targeted with the questionnaire were, in many cases COVID-oriented, which might result in an overestimation of the frequency of reported symptoms, as people experiencing them might actively seek support and comprise members of the mentioned groups in greater proportions than their representation in the general population [14]. Additionally, current research indicates an overrepresentation of personality and affective disorders in psychological studies through self-selection bias [54]. To minimize that effect, the title of the shared survey in our study did not suggest psychological evaluation and was called "Evaluating the consequences of the SARS-CoV-2 infection." Most respondents in our study were women – it is debatable whether the higher proportion of women in covid-oriented support groups reflects a real gender difference in the incidence of long-covid [35-38]. Finally, the authors did not evaluate psychological and socioeconomic factors that could influence the mental health of the respondents during the pandemic.

The authors considered the usefulness of a less specific diagnostic tool for assessing mental health symptoms in various systemic infections, which could be implemented to compare the characteristics of mental functioning between a number of infectious and multi-organ diseases.

## CONCLUSIONS

The presented study shows a diagnostic tool called "P-COV 2020" questionnaire, designed to assess neuropsychological and psychiatric traits of SARS-CoV-2 infection. Exploratory factor analysis extracted four distinctive factors with acceptable-to-excellent internal consistency and reliability. The highest scores for factors IV and II mainly reflected sleep, energy-related, and cognitive difficulties.

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## REFERENCES

1. World Health Organisation. WHO COVID-19 Dashboard. Geneva: World Health Organization; 2020 [cited 2023 Apr 25]. Available from: https://covid19.who.int/.
2. Pilecki M, Dimter A, Siwek M, Styczeń K, Rodak W, Krupa A, Śmierciak N, Dudek D. Transformacja i zasady działania psychiatrycznego oddziału jednoimiennego w trakcie pandemii COVID-19 [Transformation and rules of operation of a psychiatric single-name department during the COVID-19 pandemic]. Psychiatr Pol. 2020;54(5):865-75.
3. Lopez-Leon S, Wegman-Ostrosky T, Perelman C, Sepulveda R, Rebolledo PA, Cuapio A, et al. More than 50 long-term effects of COVID-19: a systematic review and meta-analysis. Sci Rep. 2021 Dec;11(1).
4. Català M, Mercadé-Besora N, Kolde R, Trinh NTH, Roel E, Burn E, et al. The effectiveness of COVID-19 vaccines to prevent long COVID symptoms: staggered cohort study of data from the UK, Spain, and Estonia. Lancet Respir Med. 2024 Mar;12(3):225-36.
5. Lenz C, Slack MPE, Shea KM, Reinert RR, Taysi BN, Swerdlow DL. Long-Term effects of COVID-19: a review of current perspectives and mechanistic insights. Crit Rev Microbiol. 2023;50(3):315-28.
6. Xie Y, Choi T, Al-Aly Z. Long-term outcomes following hospital admission for COVID-19 versus seasonal influenza: a cohort study. Lancet Infect Dis. 2024 Mar;24(3):239-55.
7. Zeng N, Zhao YM, Yan W, Li C, Lu QD, Liu L, et al. A systematic review and meta-analysis of long term physical and mental sequelae of COVID-19 pandemic: call for research priority and action. Mol Psychiatry. 2023 Jan;28(1):423-33.
8. Atchison CJ, Davies B, Cooper E, Lound A, Whitaker M, Hampshire A, et al. Long-term health impacts of COVID-19 among 242,712 adults in England. Nat Commun. 2023 Oct 24;14(1):6588.
9. Premraj L, Kannapadi NV, Briggs J, Seal SM, Battaglini D, Fanning J, et al. Mid – and long-term neurological and neuropsychiatric manifestations of post-COVID-19 syndrome: A meta-analysis. J Neurol Sci. 2022;434.
10. Kim Y, Bae S, Chang HH, Kim SW. Characteristics of long COVID and the impact of COVID-19 vaccination on long COVID 2 years following COVID-19 infection: prospective cohort study. Sci Rep. 2024 Jan 9;14(1):854.
11. Păunescu RL, Miclu Ia IV, Verişezan OR, Crecan-Suciu BD. Acute and long term psychiatric symptoms associated with COVID 19 (Review). Biomed Rep. 2022 Nov 17;18(1):4.
12. Kubota T, Kuroda N, Sone D. Neuropsychiatric aspects of long COVID: A comprehensive review. Psychiatry Clin Neurosci. 2023 Feb;77(2):84-93.
13. Rogers JP, David AS. A longer look at COVID-19 and neuropsychiatric outcomes. Lancet Psychiatry. 2021 May;8(5):351-2.
14. Goërtz YMJ, van Herck M, Delbressine JM, Vaes AW, Meys R, Machado FVC, et al. Persistent symptoms three months after SARS-CoV-2 infection: post-COVID-19 syndrome. ERJ Open Res. 2020 Oct;6(4):00542-2020.
15. Fernandez-de-Las-Peñas C, Notarte KI, Macasaet R, Velasco JV, Catahay JA, Ver AT, et al. Persistence of post-COVID symptoms in the general population two years after SARS-CoV-2 infection: A systematic review and meta-analysis. J Infect. 2024 Feb;88(2):77-88.
16. Richard SA, Pollett SD, Fries AC, Berjohn CM, Maves RC, Lalani T, et al. Persistent COVID-19 Symptoms at 6 Months After Onset and the Role of Vaccination Before or After SARS-CoV-2 Infection. JAMA Netw Open. 2023 Jan 3;6(1)
17. Ladds E, Rushforth A, Wieringa S, Taylor S, Rayner C, Husain L, et al. Persistent symptoms after Covid-19: qualitative study of 114 "long Covid" patients and draft quality principles for services. BMC Health Serv Res. 2020 Dec;20(1).
18. Wiersinga WJ, Rhodes A, Cheng AC, Peacock SJ, Prescott HC. Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19): A Review. JAMA. 2020;324(8):782-93.
19. Ellul MA, Benjamin L, Singh B, Lant S, Michael BD, Easton A, et al. Neurological associations of COVID-19. Lancet Neurol. 2020 Sep;19(9):767-83.
20. Correia AO, Feitosa PWG, Moreira JLS, Nogueira SAR, Fonseca RB, Nobre MEP. Neurological manifestations of COVID-19 and other coronaviruses: A systematic review. Neurol Psychiatry Brain Res. 2020 Sep;37:27-32.
21. Ahmed MU, Hanif M, Ali MJ, Haider MA, Kherani D, Memon GM, et al. Neurological Manifestations of COVID-19 (SARS-CoV-2): A Review. Front Neurol. 2020 May 22;11:518.
22. Roy D, Ghosh R, Dubey S, Dubey MJ, Benito-León J, Kanti Ray B. Neurological and Neuropsychiatric Impacts of COVID-19 Pandemic. Can J Neurol Sci. 2021 Jan;48(1):9-24.
23. Dinakaran D, Manjunatha N, Naveen Kumar C, Suresh BM. Neuropsychiatric aspects of COVID-19 pandemic: A selective review. Asian J Psychiatr. 2020 Oct;53:102188.

24. Jasti M, Nalleballe K, Dandu V, Onteddu S. A review of pathophysiology and neuropsychiatric manifestations of COVID-19. J Neurol. 2021 Jun;268(6):2007-12.
25. Steardo L Jr, Steardo L, Verkhratsky A. Psychiatric face of COVID-19. Transl Psychiatry. 2020 Jul 30;10(1):261.
26. Morin CM, Bjorvatn B, Chung F, Holzinger B, Partinen M, Penzel T, et al. Insomnia, anxiety, and depression during the COVID-19 pandemic: an international collaborative study. Sleep Med. 2021 Nov;87:38-45.
27. Tobin SY, Halliday TM, Shoaf K, Burns RD, Baron KG. Associations of Anxiety, Insomnia, and Physical Activity during the COVID-19 Pandemic. Int J Environ Res Public Health. 2024 Apr 1;21(4):428.
28. Li J, Luo C, Liu L, Huang A, Ma Z, Chen Y, et al. Depression, anxiety, and insomnia symptoms among Chinese college students: A network analysis across pandemic stages. J Affect Disord. 2024 Jul 1;356:54-63.
29. Delgado-Alonso C, Valles-Salgado M, Delgado-Álvarez A, Yus M, Gómez-Ruiz N, Jorquera M, et al. Cognitive dysfunction associated with COVID-19: A comprehensive neuropsychological study. J Psychiatr Res. 2022 Jun;150:40-6.
30. Ladds E, Darbyshire JL, Bakerly ND, Falope Z, Tucker-Bell I. Cognitive dysfunction after covid-19. BMJ. 2024 Feb 1;384
31. Duindam HB, Mengel D, Kox M, Göpfert JC, Kessels RPC, Synofzik M, et al. Systemic inflammation relates to neuroaxonal damage associated with long-term cognitive dysfunction in COVID-19 patients. Brain Behav Immun. 2024 Mar;117:510-20. Erratum in: Brain Behav Immun. 2024 May 9(24)00368-4.
32. Lövdén M, Fratiglioni L, Glymour MM, Lindenberger U, Tucker-Drob EM. Education and cognitive functioning across the lifespan. Psychol Sci Public Interest. 2020;21(1):6-41.
33. Tzeng NS, Chung CH, Chang CC, Chang HA, Kao YC, Chang SY, et al. What can we learn from SARS while facing mental health issues related to the COVID-19 pandemic? A nationwide cohort study in Taiwan. Transl Psychiatry. 2020 Dec;10(1).
34. Fernández-de-Las-Peñas C, Martín-Guerrero JD, Pellicer-Valero ÓJ, Navarro-Pardo E, Gómez-Mayordomo V, Cuadrado ML, et al. Female Sex Is a Risk Factor Associated with Long-Term Post-COVID Related-Symptoms but Not with COVID-19 Symptoms: The LONG-COVID-EXP-CM Multicenter Study. J Clin Med. 2022; 11(2):413.
35. Rodríguez Onieva A, Soto Castro CA, García Morales V, Aneri Vacas M, Hidalgo Requena A. Long COVID: Factors influencing persistent symptoms and the impact of gender. Semergen. 2024 Jul-Aug;50(5):102208.
36. Gebhard CE, Sütsch C, Gebert P, et al. Impact of sex and gender on post-COVID-19 syndrome, Switzerland, 2020. Euro Surveill. 2024 Jan;29(2):2300200.
37. Bielecka-Dabrowa A, Sakowicz A, Gryglewska-Wawrzak K, et al. The Effect of Sex on the Risk of Long-COVID and Cardiovascular Complications in Healthy Patients without Comorbidities: Data from a Polish Long-COVID Cardiovascular (PoLoCOV-CVD) Study. J Clin Med. 2024; 13(6):1559.
38. Matta J, Pignon B, Kab S, et al. Depressive symptoms and sex differences in the risk of post-COVID-19 persistent symptoms: A prospective population-based cohort study. Nat Mental Health. 2024;1:1-9.
39. Perlis RH, Santillana M, Ognyanova K, et al. Prevalence and Correlates of Long COVID Symptoms Among US Adults. JAMA Netw Open. 2022;5(10):e2238804.
40. Bai F, Tomasoni D, Falcinella C, et al. Female gender is associated with long COVID syndrome: a prospective cohort study. Clin Microbiol Infect. 2022;28(4):611.e9-611.e16.
41. Ghosn J, Bachelet D, Livrozet M, et al. Prevalence of post-acute coronavirus disease 2019 symptoms twelve months after hospitalization in participants retained in follow-up: analyses stratified by gender from a large prospective cohort. Clin Microbiol Infect. 2023;29(2):254.e7-254.e13.
42. Dobrowolska K, Brzdęk M, Zarębska-Michaluk D, et al. Differences between the course of SARS-CoV-2 infections in the periods of the Delta and Omicron variants dominance in Poland. Pol Arch Intern Med. 2023;133(1):1-7.
43. Bourmistrova NW, Solomon T, Braude P, Strawbridge R, Carter B. Long-term effects of COVID-19 on mental health: A systematic review. J Affect Disord. 2022;299:118-132
44. Novotný JS, Gonzalez-Rivas JP, Kunzová Š, Skladaná M, Pospíšilová A, Polcrová A, et al. The long-term effects of consecutive COVID-19 waves on mental health. BJPsych Open. 2023;10(1):e15.
45. Pietrzak P, Hanke W. The long COVID and its mental health manifestations – the review of literature. Int J Occup Med Environ Health. 2024;18(6):187950.
46. Taylor S, Landry CA, Paluszek MM, Fergus TA, McKay D, Asmundson GJ. Development and initial validation of the COVID Stress Scales. J Anxiety Disord. 2020;72:102232.
47. Nikčević AV, Spada MM. The COVID-19 anxiety syndrome scale: Development and psychometric properties. Psychiatry Res. 2020;292:113322.
48. Seydavi M, Troulli MD, Akbari M, Nikčević AV, Spada MM. An assessment of the psychometric properties and psychological correlates of the Greek COVID-19 Anxiety Syndrome Scale (C-19ASS). Clin Psychol Psychother. 2023 Aug 16.
49. Zvolensky MJ, Bakhshaie J, Redmond BY, Smit T, Nikčević AV, Spada MM, Distaso W. Coronavirus Anxiety, COVID Anxiety Syndrome and Mental Health: A Test Among Six Countries During March 2021. Clin Psychol Psychother. 2024;31(2):e2988.
50. Schmidt NB, Allan NP, Koscinski B, Mathes BM, Eackles K, Accorso C, et al. COVID-19 impact battery: Development and validation. J Psychopathol Behav Assess. 2022;44(2):326-343.
51. Rek SV, Bühner M, Reinhard MA, Freeman D, Keeser D, Adorjan K, et al. The COVID-19 pandemic mental health

questionnaire (CoPaQ): Psychometric evaluation and compliance with countermeasures in psychiatric inpatients and non-clinical individuals. BMC Psychiatry. 2021;21(1):2.

52. Sayde GE, Stefanescu A, Conrad E, Nielsen N, Hammer R. Implementing an intensive care unit (ICU) diary program at a large academic medical center: Results from a randomized control trial evaluating psychological morbidity associated with critical illness. Gen Hosp Psychiatry. 2020 Nov-Dec;66:96-102.
53. Fjone KS, Buanes EA, Småstuen MC, Laake JH, Stubberud J, Hofsø K. Post-traumatic stress symptoms six months after ICU admission with COVID-19: Prospective observational study. J Clin Nurs. 2024;33(1):103-114.
54. Kaźmierczak I, Zajenkowska A, Rogoza R, Jonason PK, Ścigała D. Self-selection biases in psychological studies: Personality and affective disorders are prevalent among participants. PLoS One. 2023;18(3):e0281046.