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Late mental sequelae in post-COVID-19 individuals

Późne następstwa psychiczne u osób po COVID-19

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STRESZCZENIE

PÓŹNE NASTĘPSTWA PSYCHICZNE U OSÓB PO COVID-19

Cel pracy. Celem pracy było zbadanie długoterminowych skutków psychicznych u pacjentów, którzy przeszli COVID-19, oraz osób poddanych kwarantannie. Przeanalizowano różnice w zakresie przekonań metapoznawczych oraz ogólnego stanu zdrowia psychicznego, aby ocenić ich wpływ na pojawienie się dystresu psychicznego.

Materiał i metody. W badaniu wzięły udział 122 osoby, w tym pacjenci po COVID-19 oraz osoby przebywające na kwarantannie. Do oceny stanu psychicznego wykorzystano kwestionariusze Metacognitive Questionnaire (MCQ) oraz General Health Questionnaire (GHQ-12), które dostarczyły danych na temat przekonań metapoznawczych oraz ogólnego stanu zdrowia psychicznego.

Wyniki. Wyniki wykazały, że pacjenci po COVID-19 częściej zgłaszali pozytywne przekonania dotyczące zamartwiania się (MCQ1), natomiast osoby na kwarantannie miały wyższe wyniki w zakresie samoświadomości poznawczej (MCQ5) oraz negatywnych przekonań o braku kontroli nad myślami (MCQ4).

Wnioski. W obu grupach stwierdzono podobny poziom ogólnego dystresu psychicznego, co sugeruje, że pandemia miała szeroki wpływ na zdrowie psychiczne, niezależnie od bezpośredniego kontaktu z chorobą. Zarówno pacjenci po COVID-19, jak i osoby na kwarantannie wymagają wsparcia psychologicznego, aby przeciwdziałać negatywnym skutkom psychicznym pandemii. Interwencje terapeutyczne, takie jak terapia poznawczo-behawioralna i techniki mindfulness, mogą pomóc w zarządzaniu stresem oraz ruminacjami.

Słowa kluczowe: COVID-19, zdrowie psychiczne, kwarantanna, metapoznanie, dystres

ABSTRACT

LATE MENTAL SEQUELAE IN POST-COVID-19 INDIVIDUALS

Aim. The aim of the study was to investigate the long-term psychological effects in patients who had experienced COVID-19 and those who underwent quarantine. Differences in metacognitive beliefs and overall mental health were analyzed to assess their impact on the emergence of psychological distress.

Material and methods. The study involved 122 participants, including post-COVID-19 patients and individuals who had been quarantined. To assess mental health, the Metacognitive Questionnaire (MCQ) and the General Health Questionnaire (GHQ-12) were used, providing data on metacognitive beliefs and overall mental health.

Results. Post-COVID-19 patients more frequently reported positive beliefs about worrying (MCQ1), while quarantined individuals scored higher in cognitive self-awareness (MCQ5) and negative beliefs about lack of control over thoughts (MCQ4). Both groups exhibited similar levels of general psychological distress, suggesting that the pandemic had a widespread impact on mental health, regardless of direct contact with the disease.

Conclusions. Both post-COVID-19 patients and quarantined individuals require psychological support to counteract the negative mental effects of the pandemic. Therapeutic interventions, such as cognitive-behavioral therapy and mindfulness techniques, can help manage stress and rumination.

Key words: COVID-19, mental health, quarantine, metacognition, distress

INTRODUCTION

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has led to a global health crisis affecting not only patients' physical health but also their mental well-being. One of the key challenges for researchers and clinicians is the long-term impact of the infection on mental health. The literature identifies two categories of long-term effects: post--COVID (symptoms lasting 4-12 weeks) and long COVID (symptoms persisting beyond 12 weeks) [1]. Neurological and psychiatric symptoms reported by post-COVID-19 patients include mood disorders, sleep disturbances, memory issues, the so-called „COVID fog". Importantly, these symptoms affect not only hospitalized individuals but also those who had mild COVID-19 cases without the need for intensive medical care [2,3,4]. „COVID fog", is a condition characterized by difficulties with concentration, memory, and thinking, that significantly affects patients' quality of life [5]. Neuropsychiatric consequences of COVID-19 can occur in both severe and mild cases, and these symptoms may persist for months or even years [6].

Research suggests that SARS-CoV-2 can attack the central nervous system (CNS) in several ways [4]. The most likely mechanism of direct viral action on the brain is through interaction with the ACE-2 receptor (angiotensin--converting enzyme 2), found not only in the lungs, heart, and kidneys but also in nerve cells [7]. Consequently, changes in CNS function can occur, leading to the emergence of neuropsychiatric symptoms. Other key mechanism affecting the brain is the so-called cytokine storm, an excessive immune response to infection. In response to the presence of SARS-CoV-2, the body can produce large amounts of pro-inflammatory cytokines, which may enter the brain, causing neuron inflammation and other forms of neural cell damage [7]. Moreover, the virus may cause damage to blood vessel endothelium, leading to microthrombi and ischemia in certain brain regions. Reduced blood flow and oxygenation in the brain can impair cognitive function, leading to problems such as memory disturbances, concentration issues, and other cognitive deficits. Brain ischemia, caused by clots and vascular damage, has been described in COVID-19 patients, even in those without prior vascular disease predispositions [4,5,6].

One of the most concerning aspects of COVID-19's neuropsychiatric sequelae is that for many patients, these symptoms may persist long after the physical symptoms of the infection have subsided. Studies indicate that long COVID patients may experience these symptoms for many months, and in some cases, even years. Importantly, individuals who were not hospitalized but had mild infections may also report similar long-term neurological and mental health issues [1,3,5].

Long COVID, defined as a syndrome of symptoms lasting more than 12 weeks after infection, affects a broad range of patients, regardless of the severity of the initial illness. This means that neuropsychiatric symptoms can occur even in individuals who were not hospitalized and had mild COVID-19. Studies show that these long-term problems may include not only physical symptoms like fatigue but also significant mental health disorders, including depression and anxiety [1,5,6].

Given the scale of the problem, more research is focusing on developing therapeutic strategies to minimize COVID--19's neuropsychiatric sequelae. Psychological interventions, such as cognitive-behavioral therapy (CBT), may be helpful in treating symptoms of depression and anxiety in post--COVID-19 patients. Additionally, stress management techniques and mindfulness can be used to alleviate „COVID fog" symptoms. Pharmacotherapy, including antidepressants and anxiolytics, is also considered for patients with more severe mental health disorders [2,5,7,8,9].

AIM

Our goal was to investigate the long-term psychological effects in patients who had experienced COVID-19 and those who underwent quarantine without confirmed infection. Differences in metacognitive beliefs and overall mental health were analyzed to assess their impact on the emergence of psychological distress.

MATERIALS AND METHODS

The study was conducted with a group of 122 individuals, divided into two equal groups of 61. The first group consisted of patients who had experienced a COVID-19 infection, while the second group comprised individuals who had been quarantined but did not have a confirmed COVID-19 diagnosis. Both groups were assessed 3 to 6 months after the end of the illness or quarantine.

To minimize the influence of confounding variables, only generally healthy individuals without prior diagnoses of mental illness, either personally or in their family history, were included in the study. These criteria were intended to eliminate potential factors that could affect results related to metacognition and mental health.

Participants were recruited from two sources: public health centers and quarantine registration databases. Individuals who had experienced COVID-19 were identified through contact with local health centers where they had received a diagnosis of SARS-CoV-2 infection. In the case of the quarantined group, recruitment was carried out through the mandatory registry of individuals reported for quarantine provided by health centers. All individuals interested in participating had the option to register online or via telephone.

Eligibility was determined based on the following criteria:

1. **COVID-19 Group**: This group included individuals who had been infected with SARS-CoV-2, confirmed by an official PCR or antigen test. Verification of test results was done by the participants providing medical documentation or confirmation from the health center where the test was conducted.
2. **Quarantine Group**: This group included individuals who had been quarantined due to contact with an infected person but did not receive a positive COVID-19 test result. These individuals also had to meet general health criteria and not report any symptoms related to COVID-19.

The study used two psychometric tools: the General Health Questionnaire-12 (GHQ-12) and the Metacognitive Questionnaire-30 (MCQ-30).

- **GHQ-12** is a screening tool used to assess general mental health and psychological distress. It consists of 12 items that estimate non-psychotic mental health disorders, such as anxiety, depression, and overall discomfort. GHQ-12 scores are obtained by assigning points of 0 or 1 for answers, with a score of 3 or higher indicating the presence of mental health disorders.
- **MCQ-30** measures metacognition, or how individuals evaluate their thought processes. It consists of 30 items divided into five subscales:
  - **MCQ1**: Positive beliefs about worrying
  - **MCQ2**: Negative beliefs about thoughts concerning uncontrollability and danger
  - **MCQ3**: Cognitive confidence
  - **MCQ4**: Negative beliefs about uncontrollability of thoughts
  - **MCQ5**: Cognitive self-consciousness

Each MCQ item is rated on a 5-point Likert scale, with higher scores indicating stronger beliefs in each respective aspect of metacognition.

The study was conducted between October 2021 and January 2022, during the dominance of the Delta variant of the SARS-CoV-2 virus. Participants completed the questionnaires online or in paper format, depending on availability. All tools were adapted to Polish cultural conditions and translated according to psychometric standards. Each participant was informed of the study's objectives, and participation was voluntary. Demographic data, including gender, age, education, and marital status, were collected to allow for a detailed characterization of the study groups and control for sociodemographic variables.

Data were analyzed using the independent t-test to compare the results of both groups in the MCQ and GHQ-12 scales. When the assumption of variance homogeneity was not met, an adjusted version of the t-test was used. A p-value of less than 0.05 was considered statistically significant. Additionally, Cohen's d was used to determine the effect size of the differences between groups (small effect: d = 0.2; medium effect: d = 0.5; large effect: d = 0.8).

The analysis also included mean values and standard deviations in the individual MCQ subscales to compare the results between post-COVID-19 patients and quarantined individuals. Additionally, the GHQ-12 results were transformed into a binary scale (0/1), where a score of 3 or higher was interpreted as indicating the presence of mental health disorders.

The study was conducted in accordance with the principles of the Helsinki Declaration. All participants gave informed consent to participate in the study, and their personal data were anonymized during the analysis stage to ensure full privacy protection. Ethical approval for the study was obtained under the number KE-0254/172/2021 of Medical University of Lublin, Poland.

RESULTS

Among studied participants women constituted the majority with 66.4% (n=81). The dominant group was respondents aged 25-39, representing 54.9% of the sample (n=67), and the smallest group was those aged 18-24, comprising 4.9% of participants (n=6). Most respondents, 77% had completed higher education (n=94), while 23% (n=28) secondary education. The largest group of respondents consisted of divorced individuals (n=35), while married and widowed individuals formed almost equal groups, with n=31 and n=30, respectively. The smallest group was represented by single individuals (n=26). Characteristic of study participants was provided in Tab. 1.

Tab. 1. Sociodemographic data of the surveyed participants

	N	%
Gender		
Woman	81	66.4
Man	41	33.6
Total	122	100
Age groups (years)		
18-24	6	4.9
25-39	67	54.9
40-59	36	29.5
60-79	13	10.7
Total	122	100
Education level		
Higher	94	77
Secondary	28	23
Total	122	100
Marital Status		
Single	26	21,3
Married	31	25,4
Divorced	35	28,7
Widowed	30	24,6
Total	122	100

GHQ-12 Questionnaire

Based on the diagnostic results from the GHQ-12, participants' responses were summed, assigning a value of 0 for scores of 0 and 1, and a value of 1 for scores of 2 and 3, following the recommendations of the authors of the Polish adaptation of this tool [11]. A score of 3 was considered the diagnostic threshold for the presence of mental disorders related to experienced stress.

In both groups, most participants (73.8% in both groups) scored at or above the diagnostic threshold for mental disorders (score of 3 or higher). Importantly, the scores indicating more severe disorders, such as 5 and 6, were the most prevalent, suggesting that a significant portion of participants experienced considerable psychological distress related to the COVID-19 pandemic. The analysis indicates that, regardless of the group (COVID-19 or quarantine), most participants exceeded the diagnostic threshold for mental disorders, highlighting the significant impact of the pandemic on the mental health of both those infected and those in isolation. The distribution of GHQ-12 scores in both study groups is provided in Table 2.

Tab. 2. Distribution of GHQ-12 scores in the COVID-19 and Quarantine groups. Most participants in both groups scored between 5 and 6, indicating a significant psychological impact. Each score is accompanied by its frequency, valid percentage, and cumulative percentage for both groups

GHQ-12 Score	COVID-19 group		Quarantine group	
	N	%	N	%
0	8	13.1	8	13.1
1	8	13.1	8	13.1
2	3	4.9	2	3.3
3	3	4.9	3	4.9
4	5	8.2	5	8.2
5	11	18.0	11	18.0
6	11	18.0	11	18.0
7	3	4.9	3	4.9
8	4	6.6	5	8.2
9	2	3.3	2	3.3
10	2	3.3	2	3.3
11	1	1.6	1	1.6
Total	61	100	61	100

MCQ-30 Questionnaire

The COVID-19 group scored higher on one of the five subscales of Metacognitive Questionnaire: "Positive beliefs about worrying" (MCQ1). In case of other scales: higher scores were obtained in the Quarantine group. However, statistically significant differences between the groups were observed in three scales: Positive beliefs about worrying, Cognitive self-awareness and Negative beliefs about uncontrollability of thoughts. The comparative analysis of MCQ-30 results was provided in Table 3.

Tab. 3. The results of the MCQ (Metacognitive Questionnaire) subscales between the COVID-19 patients and the quarantined individuals. The table includes mean values ± standard deviation, variances, effect sizes (Cohen's d). and significance levels (p), for each MCQ subscale

Scale	COVID-19	Quarantine	Variances	Cohen's d	p
MCQ3: Cognitive confidence (measuring confidence in attention and memory)	10.77±3.96	11.66±3.61	Equal	0.24	0.2
MCQ1: Positive beliefs about worrying	10.38±2.85	8.25±2.97	Equal	0.74	0.000
MCQ5: Cognitive self-awareness (tendency to focus on thought processes)	8.89±2.65	11.80±2.89	Equal	1.06	0.000
MCQ4: Negative beliefs about uncontrollability of thoughts	9.80±3.48	11.90±4.15	Unequal	0.56	0.003
MCQ2: Negative beliefs about threat and lack of control	6.05±1.92	6.59±2.29	Equal	0.26	0.16

DISCUSSION

The results of the study provide valuable insights into the differences in metacognition and cognitive beliefs between post-COVID-19 patients and individuals who underwent quarantine without infection. Although the differences between the groups vary, each of the MCQ subscales analyzed offers important information about the psychological state of both groups.

The first variable analyzed was **cognitive confidence (MCQ3)**, referring to the evaluation of confidence in cognitive abilities such as attention and memory. The results did not show significant differences between the groups, suggesting that both post-COVID-19 patients and quarantined individuals perceive their cognitive abilities at similar levels [12]. This result is particularly interesting in the context of reports of „COVID fog," which may impair cognitive functions in post-COVID-19 individuals [13]. The lack of significant differences may indicate that the self-assessment of cognitive abilities in the pandemic context is not strictly related to the illness itself but rather to general pandemic stress [14].

In the case of **positive beliefs about worrying (MCQ1)**, the results showed significantly higher values in post-COVID-19 patients than in quarantined individuals. This may suggest that post-infection patients more often view worrying as an adaptive strategy for dealing with uncertainty. While worrying is generally associated with negative psychological outcomes, in this context, it may have served a protective function, helping patients mentally prepare for future health challenges. However, excessive worrying over the long term may lead to chronic stress and increase the risk of mental disorders such as anxiety and depression, emphasizing the need for psychological support for post-COVID-19 patients [15].

Another significant finding was **cognitive self-consciousness (MCQ5)**, which was significantly higher in quarantined individuals compared to post-COVID-19 patients. High cognitive self-awareness may result from prolonged isolation, which promotes introspection and excessive focus on one's thoughts [16]. Such over-focus on thought processes can lead to rumination-repetitive, negative thoughts-which, in turn, may increase the risk of anxiety and depression. This finding suggests that quarantined individuals may be more vulnerable to the psychological effects of isolation and may need psychological interventions to help manage negative thoughts more effectively [17].

The results related to **negative beliefs about uncontrollability of thoughts (MCQ4)** also revealed significant differences. Quarantined individuals had higher levels of these beliefs, which may be due to social isolation and the uncertainty associated with it [18]. Fears of losing control over one's thoughts can lead to an increased sense of threat and anxiety, highlighting the need for interventions aimed at reducing negative beliefs and improving strategies for coping with difficult thoughts [18].

The final variable analyzed was **negative beliefs about threat and lack of control (MCQ2)**, which did not show significant differences between the groups. This may sug-

gest that both post-COVID-19 patients and quarantined individuals experienced similar levels of anxiety related to perceived threats, likely attributable to overall pandemic stress [15]. Both groups may have shared similar concerns about health, safety, and the future, regardless of whether they were directly infected or merely isolated.

The **GHQ-12 questionnaire** provided additional information on the overall mental health and distress levels in both groups. The analysis showed that about 70% of individuals in both groups exhibited symptoms of psychological distress, indicating a significant impact of the pandemic on mental health, both among post-COVID-19 patients and quarantined individuals [16]. This result confirms that the pandemic caused widespread psychological effects in the general population, regardless of whether the individual contracted the virus [19].

It is worth noting that although the level of distress was high, no significant differences were found between the groups. This suggests that the overall pandemic experience-including fear of infection, social isolation, and uncertainty-had a strong influence on mental health, regardless of direct illness experience [18].

The study results have important clinical implications. First, post-COVID-19 patients, due to their higher levels of worrying, should receive psychological support to help them manage stress and concerns related to future health threats. On the other hand, quarantined individuals, who exhibit a greater tendency toward introspection and negative beliefs about lack of control over their thoughts, may benefit from cognitive-behavioral therapy (CBT) or mindfulness techniques to help manage excessive rumination and isolation-related stress [12, 19].

Long-term monitoring of the mental health of both groups is necessary to prevent the development of more serious mental health issues, such as depression or anxiety disorders. Psychological support programs should be available to both post-COVID-19 patients and quarantined individuals to minimize the long-term psychological effects of the pandemic.

Differences between the study groups indicate that both recovering from COVID-19 and undergoing quarantine can impact mental health, but in different ways. Post-COVID-19 individuals seem more likely to adopt positive beliefs about worrying, which may stem from their health experiences, fear of relapse, or further consequences of the infection. Meanwhile, quarantined individuals seem more concerned about losing control over their thoughts, likely due to prolonged isolation, lack of social contact, and an excess of time for introspection.

Study Limitations

The study had several limitations that should be considered when interpreting the results. First, the relatively small sample size (n=122) limits the ability to generalize the findings to the broader population. Second, the study was conducted in only one region of Poland, which may restrict the cultural and geographical scope of the obtained results. Additionally, the lack of long-term follow-up of participants prevents the assessment of the persistence of the psychological and metacognitive differences observed.

CONCLUSIONS

The results of the study highlight the complexity of the psychological and metacognitive effects of the COVID-19 pandemic. Post-COVID-19 patients exhibit higher levels of worrying, while quarantined individuals show a greater tendency toward introspection and concerns about lack of control over thoughts. Both experiences have the potential to cause mental disorders, indicating the need for appropriate therapeutic interventions and further research into the long-term psychological effects of the pandemic on the population.

The differences in the results between post-COVID-19 patients and quarantined individuals indicate that both groups experience significant mental challenges, though their nature is different. High levels of worrying in post-COVID-19 individuals and greater self-awareness and negative beliefs about thoughts in quarantined individuals require further attention and intervention. This study provides important insights into potential mechanisms leading to mental health issues during the pandemic and underscores the need for further research in this area.

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