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QUALITY OF LIFE INDICATORS FOR THE PATIENTS WHO SUFFERED FROM COMMUNITY-ACQUIRED PNEUMONIA CAUSED BY SARS-CoV-2

Introduction. Respiratory pathology, both acute and chronic, remains one of the key problems of modern medicine in Ukraine and in the world in general, which is explained by its significant prevalence, negative impact on patients' work capacity, their quality of life, as well as the economic burden on society.

The aim of the study – to analyze the subjective state of health using the SF-36 questionnaire for patients who undergone community-acquired pneumonia caused by SARS-CoV-2 in 1 year after inpatient treatment.

Research Methods. A retrospective study of the medical records of 208 patients who had been hospitalized for non-hospital pneumonia with a negative smear test for the SARS-CoV-2 virus was conducted. The severity of pneumonia was calculated according to the PORT scale. The comparison group consisted of patients with SARS-CoV-2 nucleic acid identification and the absence. A telephone survey to assess the quality of life of the participants of the first stage of our study 1 year after discharge from the hospital were performed. The general investigator SF-36 was used to assess quality of life. Statistical analysis of data was carried out using the "STATISTICA 7.0" software.

Results and Discussion. Physical functioning according to SF-36 was the lowest in the observation group IV and probably differed in relation to the data of the observation group II and the comparison group. Analyzing the general state of health, the values were found to be probably lower for patients who suffered from community-acquired pneumonia of 3rd and 4th categories of severity compared to the data of the observation group II and the comparison group.

Conclusion. Thus, it was established low quality of life in patients after pneumonia caused by COVID-19. Practical value of the work consists in improving diagnostics and therapy, as well as improving the rehabilitation of patients who suffered from community-acquired pneumonia caused by SARS-CoV-2.

KEY WORDS: **pneumonia; COVID-19; SF-36; physical health; mental health.**

INTRODUCTION. The impact of a respiratory infection on a person's quality of life as a consequence of a respiratory infection is currently a subject of the study [1]. Recently there were published few systematic reviews and meta-analyses on infection consequences and their impact on quality of life [2–4]. Tarraso et al. point out that many patients with pneumonia associated with infection SARS-CoV-2, have developed fibrous changes, shortness of breath and impaired lung function a year later after inpatient treatment, therefore, it is needed further monitoring of patients who have suffered a severe pneumonia caused by COVID-19 to study prolonged fibrous lesions progression [5]. Within 6 months after inpatient treatment about a third of patients with severe pneumonia are observed to have fibrous changes which are defined as the presence of parenchymatous screeds, traction bronchiectasis [6], and 25 % of patients who were hospitalized for pneumonia COVID-19, had visible X-ray changes in 1 year after hospital treatment,

moreover, subpleural changes were the most frequent residual change (13 %) [7]. Newly published research by Wu et al. analyzed functional changes within 1 year for those patients who suffered from severe COVID-19 pneumonia, except patients who needed artificial ventilation of lungs [8]. The researchers report about improvement of pulmonary functions during remote observation, but 33 % of patients demonstrated violation of the diffusion capacity of the lungs for monoxide carbon, while fibrous changes were described less than in 5 % of patients.

Measuring of health-related quality of life is often used in clinical trials, quality control programs, and the health care system. In clinical practice, several methods are available for correct assessment of quality of life data [9]. Among the various questionnaires, Short Form 36 Health Survey (SF-36), which is developed by Medical Outcome Study (MOS), is used most often in the world to compare general and specific population groups, to measure health deficits and treatment effectiveness. The

long-term outcomes of treatment for patients with COVID-19 and patients with COVID-19 pneumonia cause concern [10–12], but the interaction between COVID-19 and pneumonia including their consequences in 1 year after the diagnosis of COVID-19 have not yet been fully investigated. The study of risk factors associated with the prognosis will help doctors to choose even more effective treatment and develop an algorithm for monitoring such patients.

MATERIALS AND METHODS. The first stage of our study was a retrospective non-interventional cohort study of the medical records of 208 patients who were hospitalized to Ternopil Regional Clinical Hospital from mid-January to the end of April 2021. The patients were diagnosed with non-hospital pneumonia with a negative smear test for the SARS-CoV-2 virus.

Inclusion criteria were: probable epidemiological history of SARS-CoV-2 infection with identification of SARS-CoV-2 nucleic acid in swabs from the throat or lower respiratory tract using real-time polymerase chain reaction no later than 1 month before admission to the hospital; signs of pneumonia in high-resolution computed tomography.

According to the severity of pneumonia, the patients were divided into three groups: group II – patients with pneumonia of the 2nd category of severity (n=124), group III – patients with pneumonia of the 3rd category of severity (n=68), group IV – patients with pneumonia of the 4th category of severity (n=16). The severity of pneumonia was calculated according to the PORT scale [13]. The comparison group consisted of patients (n=27) who were admitted to the pulmonology department of Ternopil Regional Clinical Hospital in the same period with a negative result of a smear test for the SARS-CoV-2 virus (at the time of admission), but who had a reliable epidemiological history of SARS-CoV-2 infection with identification of SARS-CoV-2 nucleic acid in swabs from the throat or lower respiratory tract using PCR method by real-time reverse transcription no later than 1 month before admission to inpatient treatment; acute respiratory symptoms; absence of pneumonia on high-resolution computed tomography.

The second stage of our research was a telephone survey aimed at assessing the quality of life of the participants of the first stage of our research (170 patients who suffered non-hospital pneumonia caused by SARS-CoV-2 and 20 people from the comparison group) in 1 year after inpatient treatment. We recorded that among 208 patients who suffered from non-hospital pneumonia caused by SARS-CoV-2, 8 people died (3.85 % of mortality), including 3 women and 5 men; 4 elderly and 4 middle-aged patients; 3 patients had 2nd category of severity and 5 patients had 3rd category of severity of non-hospital pneumonia.

One of the researchers conducted a telephone survey of patients' quality of life in 1 year after the patients had pneumonia caused by SARS-CoV-2. The researcher conducting the survey was not acquainted with the patients and had no involvement in their care to reduce potential social desirability, meaning the patients reported a more positive outcome to please the treating staff.

At the second stage of our study, 8 patients who died before conducting the telephone survey; 12 patients whose interview was complicated by re-hospitalization due to stroke, myocardial infarction or pulmonary embolism and other complications; and 18 patients who refused to participate in the study were excluded. In total, 106 patients with pneumonia of the 2nd category of severity, 52 patients with pneumonia of the 3rd category of severity, 12 patients with pneumonia of the 4th category of severity, and 20 patients of the comparison group were included in the 2nd stage of the study.

A general SF-36 questionnaire was used to assess the quality of patients' life. The SF-36 questionnaire was developed at the Center for the Study of Medical Outcomes (USA) in 1992 by John E. Ware and Cathy Donald Sherbourne [14]. Adaptation of SF-36 into the Ukrainian language was conducted in 1998–2001 according to the procedure of the international center assessing the quality of life IQOLA (The International Quality of Life Assessment, Boston, USA) [15]. The level of well-being was determined by 8 scales – physical functioning or activity (PF), the role of physical problems in limiting life activities (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning or activity (SF), the role of emotional problems in limiting life activities (RE) and mental health (MH). The eight subdomain scores were combined into two summaries: the Physical health Composite Score (PCS) and the Mental health Composite Score (MCS), with a low MCS or PCS (<50) indicating poor quality of life [16].

Before starting the study, all documents, including the research protocol and data collection questionnaires, were reviewed by experts and approved by the Bioethics Commission of I. Horbachevsky Ternopil National Medical University. Patients were included in the study only after they received full information about it and signed a written consent to participate in the present research. All the collected information, regarding the state of patients' health, is provided with confidentiality in accordance to the law of Ukraine. Before starting the research, all the exploratory group signed a non-disclosure agreement.

Statistical analysis of data was carried out using the "STATISTICA 7.0" software. Absolute indicators are presented in the form of the average value (Mean) and its standard deviation (SD). Comparative analysis of absolute indicators was carried out using the parametric ANOVA test. The comparison of relative values, which were presented in the form of a percentage ratio, was carried out by the Pearson test. The difference was considered statistically significant at $p < 0.05$. Correlations were calculated using the Pearson coefficient. The analysis of the SF-36 questionnaire was carried out according to the generally accepted methodology. The Cronbach's alpha coefficient was used to calculate the internal consistency of the scales of the questionnaire.

RESULTS AND DISCUSSION. The analysis of the received responses due to the SF-36 questionnaire showed a probably lower indicator of the Physical health Composite Score for patients with non-hospital pneumonia of the 3rd and the 4th categories of severity compared to patients with non-hospital pneumonia of the 2nd category of severity and the comparison group. Physical functioning according to SF-36 was the lowest in the observation group IV and probably differed in relation to the data of the observation group II and the comparison group. The component of the quality of life – physical functioning, determined by the physical condition, was characterized by the lowest value for patients who suffered from non-hospital pneumonia of 3rd and 4th categories of severity in relation to the data of the observation group II and the comparison group. The index of pain intensity

changed similarly, while for patients of the observation group II it was probably lower than the data of the comparison group. Analyzing the general state of health, the values were found to be probably lower for patients who suffered from non-hospital pneumonia of 3rd and 4th categories of severity compared to the data of the observation group II and the comparison group (Table 1).

Assessment of Physical health Composite Score for patients with non-hospital pneumonia demonstrates that this indicator is probably lower for patients who suffered from non-hospital pneumonia of 3rd and 4th categories of severity in relation to the data of the observation group II and the comparison group. At the same time, the lowest level of the Mental health Composite Score was found for the patients of the observation group IV, probably also differing from the data of the group II. We should note that all of Mental health Composite Score indicators, namely, vital activity, social functioning, role functioning caused by emotional state, were probably lower for patients with non-hospital pneumonia of 3rd and 4th categories of severity compared to the data of the observation group II and the comparison group. At the same time, in the observation groups II and I, the indicators of social functioning and role functioning caused by the emotional state probably exceeded such data for patients who suffered from non-hospital pneumonia of the 4th category of severity (Table 2).

It should be noted that when comparing the age of patients with non-hospital pneumonia caused by SARS-CoV-2 in 1 year after inpatient treatment with general indicators of Physical and Mental health Composite Score based on the results of the

Table 1 – **Evaluation of the Physical health Composite Score based on the results of the analysis of the SF-36 questionnaire for patients with non-hospital pneumonia caused by SARS-CoV-2 in 1 year after inpatient treatment**

	Indicator	group II	group III	group IV	CG	p<0.05*
PCS	general score	42.36±9.00	38.33±9.16	35.00±6.54	48.85±7.46	$p_{II-III, II-IV}$ $p_{II-CG, III-CG}$ p_{IV-CG}
PF	general score	62.58±26.07	53.71±29.21	40.00±21.29	84.07±19.47	$p_{II-IV, II-CG}$ p_{III-CG} p_{IV-CG}
	PH-Z	-0.96±1.14	-1.35±1.28	-1.94±0.93	-0.02±0.85	
RP	general score	63.52±41.93	43.18±40.56	28.13±27.20	78.70±33.76	$p_{II-III, II-IV}$ p_{III-CG} p_{IV-CG}
	RH-Z	-0.52±1.24	-1.12±1.20	-1.57±0.80	-0.07±1.00	
BP	general score	62.66±20.19	51.39±18.48	45.12±18.03	74.15±21.94	$p_{II-III, II-IV}$ $p_{II-CG,}$ p_{III-CG} p_{IV-CG}
	BP-Z	-0.54±0.86	-1.02±0.78	-1.29±0.77	-0.06±0.93	
GH	general score	51.68±9.86	42.38±13.86	40.69±9.64	55.89±6.97	$p_{II-III, II-IV}$ p_{III-CG} p_{IV-CG}
	GH-Z	-0.99±0.35	-1.38±0.36	-1.56±0.48	-0.81±0.35	

Note.
1. CG is a comparison group.
2. * is a statistically significant difference.

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Table 2 – **Evaluation of the Mental health Composite Score based on the results of the analysis of the SF-36 questionnaire for patients with non-hospital pneumonia caused by SARS-CoV-2 in 1 year after inpatient treatment**

Indicator		group II	group III	group IV	CG	p<0.05*
MCS	general score	45.54±5.94	40.77±7.86	35.07±6.30	46.76±5.59	$p_{II-III, II-IV}$, $p_{III-CG, III-IV}$, p_{IV-CG}
VT	general score	55.78±10.46	49.39±13.63	41.87±13.15	65.56±12.43	$p_{II-III, II-IV}$, $p_{II-CG, III-CG}$, p_{IV-CG}
	VT-Z	-0.25±0.50	-0.56±0.65	-0.92±0.63	0.22±0.60	
SF	general score	66.77±18.65	55.70±25.13	39.06±17.00	73.61±16.75	$p_{II-III, II-IV}$, $p_{III-CG, III-IV}$, p_{IV-CG}
	SF-Z	-0.72±0.75	-1.14±0.94	-1.99±0.76	-0.45±0.75	
RE	general score	70.22±34.50	51.01±37.08	18.75±20.97	80.25±28.13	$p_{II-III, II-IV}$, $p_{III-CG, III-IV}$, p_{IV-CG}
	RE-Z	-0.34±1.04	-0.92±1.12	-1.89±0.63	-0.03±0.85	
MC	general score	59.32±12.28	48.41±15.11	48.50±11.67	64.74±11.42	$p_{II-III, II-IV}$, $p_{III-CG, IV-CG}$
	MH-Z	-0.83±0.55	-1.35±0.52	-1.46±0.65	-0.56±0.63	

Note.
1. CG is a comparison group.
2. * is a statistically significant difference.

analysis of the SF-36 questionnaire, a probable negative association was established, however the strength of the relationship was more significant between age and the Physical health Composite Score (r=-0.59, p<0.001), while the relationship with the Mental health Composite Score was weak (r=-0.20, p=0.002).

Covid-19 pandemic is important psychological and physiological stress for people all over the world [10]. In previous research it was established that patients with community-acquired pneumonia caused by SARS-CoV-2 probably have higher values of C-reactive protein, procalcitonin, and ferritin than controls, while the studied indicators probably increase with increasing pneumonia severity category [17]. This research for the first time held a comprehensive analysis of subjective quality of life of Ukrainian patients who underwent non-hospital pneumonia caused by SARS-COV-2 in 1 year after inpatient treatment. Chen et al. showed that quality of life decreases among patients with Covid-19 after 1 month of observation [18]. Plural linear regressions demonstrated that age is negatively associated with PF, RP, but positively associated with VT (p<0.05). Multivariate analysis showed that the more serious condition of patients are, the heavier impact it has on physical, emotional and mental health of a patient after inpatient treatment [18]. Other multicenter research has shown that Covid-19 significantly affects the quality of life, connected with health, within three months

after inpatient treatment [19]. Some studies have shown a general average quality of life indicator from 60.4 [20] to 86.4 [21], where higher SF-36 indicator reflects better health of patients which undergone prolonged Covid-19. The lowest quality of life indicator (60.4) was among older patients (>65 years old), and the highest quality of life indicator (86.4) was among younger patients (54 %, 18–46 years old) and all the patients without concomitants diseases. Tarraso et al. [5] argue that functional recovering after severe pneumonia caused by COVID-19 is completed within 1 year after inpatient treatment, however about one third of patients (39.8 %) has low quality of life indicators. These conclusions are consistent with our results and the obtained data from Chinese cohorts [8], as well as meta-analysis developed by Fabbri [22]. Thus, about one third of patients after pneumonia caused by COVID-19 have low quality of life.

CONCLUSION. According to the results of the analysis of the SF-36 questionnaire for patients with acquired non-hospital pneumonia of the 3rd and 4th categories of severity caused by SARS-CoV-2 in 1 year after inpatient treatment, there were established lower indicators of physical (role functioning, determined by physical condition and general health, intensity of pain, general state of health) and mental (life activity, social functioning, role functioning caused by emotional state) health composite score in relation to patients with pneumonia of the 2nd category of severity and the comparison group.

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ТЕРНОПІЛЬСЬКИЙ НАЦІОНАЛЬНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ ІМЕНІ І. Я. ГОРБАЧЕВСЬКОГО МОЗ УКРАЇНИ

ПОКАЗНИКИ ЯКОСТІ ЖИТТЯ ХВОРИХ, ЯКІ ПЕРЕНЕСЛИ НЕГОСПІТАЛЬНУ ПНЕВМОНІЮ, СПРИЧИНЕНУ SARS-CoV-2

Резюме

Вступ. *Патологія органів дихання, як гостра, так і хронічна, залишається однією з ключових проблем сучасної медицини в Україні та світі загалом, що можна пояснити її значною поширеністю, негативним впливом на працездатність пацієнтів, якість їх життя, а також економіку суспільства.*

Мета дослідження *– проаналізувати за допомогою опитувальника SF-36 суб'єктивний стан здоров'я пацієнтів, які перенесли негоспітальну пневмонію, спричинену SARS-CoV-2, через 1 рік після виписування зі стаціонару.*

Методи дослідження. *Проведено ретроспективне дослідження медичних карт 208 пацієнтів, яких було госпіталізовано з приводу негоспітальної пневмонії з негативним результатом мазка на вірус*

SARS-CoV-2. Ступінь тяжкості пневмонії розраховували за шкалою PORT. Групу порівняння становили пацієнти з ідентифікацією та відсутністю нуклеїнової кислоти SARS-CoV-2. Проведено телефонне опитування для оцінки якості життя учасників першого етапу нашого дослідження через 1 рік після виписування зі стаціонару. Для оцінки якості життя використовували загальний опитувальник SF-36. Статистичну обробку даних проводили за допомогою програмного забезпечення STATISTICA 7.0.

Результати й обговорення. *Фізична працездатність, за опитувальником SF-36, була найнижчою в IV групі спостереження і вірогідно відрізнялася від даних II групи спостереження та групи порівняння. Аналізуючи загальний стан здоров'я хворих, які перенесли негоспітальну пневмонію 3–4 категорій тяжкості, встановили, що показники вірогідно нижчі порівняно з даними II групи спостереження та групи порівняння.*

Висновки. *Таким чином, встановлено низьку якість життя хворих на пневмонію, спричинену COVID-19. Практична цінність роботи полягає в удосконаленні діагностики і терапії, а також покращенні реабілітації пацієнтів, які перенесли негоспітальну пневмонію, спричинену SARS-CoV-2.*

КЛЮЧОВІ СЛОВА: **негоспітальна пневмонія; COVID-19; опитувальник SF-36; фізичне здоров'я; психічне здоров'я.**

ОРИГІНАЛЬНІ ДОСЛІДЖЕННЯ