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G.Z. Korzh, N.V. Korzh, M.M. Ostrovskyy,
M.O. Kulynych-Miskiv, O.I. Varunkiv, I.O. Savelikhina,
K.V. Shvets, U.I. Shevchuk-Budz
Ivano-Frankivsk National Medical University, Ivano-Frankivsk, Ukraine

Pulmonary Rehabilitation of Post-COVID-19 Patients with Bronchial Asthma (Review)

Respiratory diseases rank among the most prevalent ailments affecting both adults and children, marked by diverse clinical manifestations, frequent complications and exacerbations. Long-term hypoxia can disrupt normal metabolic activities, leading to functional impairments and occasionally organic changes in other organs and systems. Bronchial asthma represents a significant global health issue, affecting an estimated 300 million individuals worldwide. Its prevalence is on the rise in many developing countries.

Objective — to synthesise literature data concerning the characteristics and frequency of pulmonary rehabilitation usage in patients with bronchial asthma post-COVID-19. Many patients experience persistent and progressive symptoms that hinder daily activities and result in a reduced overall quality of life. This reduction in quality of life can lead to decreased work productivity and increased healthcare costs. Continuous treatment and the development of prevention strategies are essential to mitigate exacerbations and various complications. Furthermore, this issue has gained increased relevance in the context of the COVID-19 pandemic.

Coronavirus infection impacts not only the respiratory system but the entire body. Therefore, for optimal recovery and a faster return to normal life post-illness, it is recommended to integrate respiratory exercises with strengthening rehabilitation measures and moderate physical activities, tailoring the regimen to the overall health condition of the individual.

Pulmonary rehabilitation for patients with bronchial asthma post-COVID-19 represents a pertinent and effective treatment method but requires broader implementation within the modern healthcare system.

Keywords

Respiratory diseases, bronchial asthma, COVID-19, pulmonary rehabilitation.

Respiratory diseases are characterized by a variety and severity of the clinical course and frequent complications. The prevalence of bronchopulmonary conditions is influenced by adverse environmental factors, industrial emissions, vehicle exhaust fumes, indoor air pollution, low immunity, etc. [1, 4, 10]. This underscores the significance of respiratory conditions as primary contributors to morbidity and mortality across populations in numerous countries, emphasizing the relevance of the issue and the necessity of collaborative efforts among professionals from various fields, including family physicians [1, 3, 10].

Comprehensive medical rehabilitation of patients with respiratory conditions, including a balanced diet, pharmacotherapy, physiotherapy, and adherence to a sanatorium regimen, facilitates the deceleration of disease progression, as well as the reduction in both the frequency and severity of exacerbations, thereby alleviating associated financial burdens [2, 3].

The various clinical and morphological manifestations of respiratory conditions are attributed to the unique structure of the lungs, age-related characteristics, and numerous etiological factors. Genetic factors and age-related characteristics play important

roles in the development of bronchial and pulmonary diseases [4, 10, 14]. The onset of respiratory diseases, however, is determined not only by the influence of pathogenic and background factors but also by the state of the respiratory defense barriers, including aerodynamic filtration, humoral and cellular factors of general and local immunity [1, 24].

Chronic bronchopulmonary changes include more than just alterations in the bronchial tree structure. Long-term hypoxia alters normal metabolic activity and leads to functional impairments, and occasionally, organic changes in other bodily organs and systems [5, 9]. Everywhere, especially in industrially developed countries, there is a significant increase in the prevalence rates of respiratory diseases, which have already risen to rank third to fourth among the causes of population mortality. In almost all countries of the world, the frequency of chronic non-specific lung diseases doubles every 5 to 10 years and accounts for about 20 % of the total morbidity in the adult population [4, 10]. This increase in morbidity is primarily associated with persistent air pollution, cigarette smoking, and the increased incidence of allergies [18, 19].

Bronchial asthma is a heterogenous condition, usually characterized by chronic airway inflammation. It is diagnosed based on the history of respiratory symptoms such as wheezing, dyspnea, chest tightness, and cough, which vary in intensity over time, together with variable expiratory airflow limitation [4, 10]. This pathology is usually associated with airway hyperresponsiveness and inflammation; however, these two characteristics are not necessary and sufficient for making the diagnosis. An estimated 300 million people are affected by bronchial asthma worldwide. It is a significant global health issue as it affects people of all ages. The prevalence of bronchial asthma is increasing in many developing countries [4, 10].

The large epidemiological study CORE — World Health Survey, launched by the World Health Organization (WHO) across 70 out of 192 countries worldwide, revealed that the prevalence of diagnosed asthma in adults was 4.3 %, ranging from 0.2 % in China to 21.0 % in Australia (CORE, 2018). The available statistical data regarding Ukraine do not correspond to global indicators and are significantly underestimated, representing only half a percent. According to this epidemiological study, the prevalence of «physician diagnosed asthma» (reported by respondents) in our country was nearly six times lower (1.25 %) compared to that identified through symptom-based screening (in particular, wheezing, a marker of asthma) (7.4 %) [4, 18]. On the other hand, defining asthma solely based on the presence of 37 respiratory symptoms may overestimate its global prevalence, especially in resource-poor countries with inadequate access to medical facilities and functional diagnostic services. In addition, there is a growing financial burden of medical expenses for both patients and the community [9, 10].

While the mortality rate associated with asthma does not rank highest among chronic diseases, frequent asthma attacks significantly deteriorate individuals' quality of life, leading to insomnia, fatigue, and reduced activity levels. Therefore, despite significant progress in asthma treatment, it remains a significant challenge to the healthcare system and society due to loss of productivity and considerable hardships for patients' families, especially in pediatric asthma [21, 16].

Asthma risk factors can be categorized into those directly causing the disease and those contributing to its progression; some factors play roles in both aspects. The former include personal factors, primarily genetic predisposition, while the latter typically comprise environmental factors [10, 15]. There is an overlap between factors influencing disease development and those affecting the occurrence of symptoms (exacerbations); for instance, occupational sensitization falls into both categories. The impact of allergens on asthma development is well known, but it depends on the nature of the allergen, the extent and duration of exposure, age, and genetic predisposition [11, 12]. Viral respiratory tract infections constitute a significant source of disease exacerbation. The emergence of coronavirus disease (COVID-19) and its rapid global spread have posed challenges to healthcare professionals, necessitating rapid diagnostics, specialized medical care provision, rehabilitation, and secondary disease prevention [12, 13].

The SARS-CoV-2 pandemic has challenged all national healthcare systems. Old age, along with conditions such as bronchial asthma, chronic obstructive pulmonary disease, cardiovascular diseases, diabetes mellitus, obesity, and several others are recognized as risk factors for increased susceptibility to SARS-CoV-2 infection and severe COVID-19 outcomes [22—24]. Although individuals with asthma, even those with reduced lung function receiving maintenance therapy for bronchial asthma, namely inhaled glucocorticoids, do not seem to be at a higher risk of SARS-CoV-2 infection compared to non-asthmatic individuals, and according to a group of researchers at Rutgers University, asthma does not increase the risk of COVID-19 infection or affect its severity, it should be considered that patients may not always differentiate between symptoms of asthma exacerbation and COVID-19 infection, which results in delayed

patient presentation and treatment [17, 20]. According to a meta-analysis conducted by X. Mo et al. (2020), 47 % of patients were diagnosed with lung function abnormalities due to pulmonary fibrosis at discharge, while 61 % of patients developed fibrotic changes within 3 weeks following the onset of COVID-19 [16].

Cases of prolonged illness and slow return to normal life are causing significant concern. Literature reports indicate the existence of a «post-COVID-19 syndrome», characterized by a complex of symptoms persisting for 12 weeks or longer after the onset of infection and not explained by alternative diagnoses. A recent study conducted in the United Kingdom (n = 186,000) revealed post-COVID-19 symptoms in every fifth patient 5 weeks and every tenth patient 12 weeks after the onset of the disease [13]. Chest pain, weakness, rapid fatigue, fluctuating body temperature, sweating, headache, dizziness, and psycho-emotional disorders (depression and anxiety) were the most common complaints. A decrease in exercise tolerance was noted, accompanied by a rapid drop in blood oxygen saturation (SpO_2) levels, along with tachycardia/arrhythmia, dyspnea, cough, chest pain, and marked fluctuations in blood pressure (BP) ranging from hypotension to hypertensive crisis. Y. Huang et al., who studied lung function in convalescents, found impaired lung diffusion capacity in 52.6 % and ventilation disorders in 56 % of patients [12]. According to a study by Y.M.J. Goërtz et al. (2020), three months after the onset of the disease, the most common complaints among convalescents were fatigue (95 %) and dyspnea (90 %) [11]. The aforementioned symptoms concern even patients who have had a mild course of COVID-19 and significantly impair their quality of life. These data indicate the need to involve all patients, regardless of the severity of COVID-19 and previous hospitalization, in multidisciplinary rehabilitation programs and health monitoring in medical facilities as well as after their discharge [2, 8, 11]. Rehabilitation of patients with post-COVID-19 syndrome should be comprehensive and consider the following: pathological changes in organs and systems caused by the severity of the disease and extent of tissue damage; iatrogenic reactions to medications (cardiotoxicity, hepatotoxicity) and/or medical procedures (tracheostomy, intubation); the impact of comorbidities; psychological characteristics of patients [2, 8].

A personalized approach should be used to maximize the effectiveness of each rehabilitation method based on the patient's existing pathological changes [2, 8]. Before developing a pulmonary rehabilitation program, the patient's general condition should be assessed, particularly their functional status, physical activity, and nutritional status. Post-COVID-19 patients with impaired lung function should undergo a comprehensive pulmonary rehabilitation program 6—8 weeks after discharge, adhering to established international standards [8, 9]. This program is based on a thorough patient assessment, facilitating the selection of personalized therapies aimed at preserving physical fitness (physiotherapy) and fostering lifestyle and behavioral changes to enhance both physical and psychological well-being [14, 15].

Respiratory (pulmonary) rehabilitation, as defined by the American Thoracic Society, refers to a medical strategy involving the development and implementation of personalized and multidisciplinary programs encompassing the diagnosis and associated concerns, as well as treatment, which includes respiratory physiotherapy, psychological support, and education [23, 24]. The goals of the comprehensive pulmonary rehabilitation are as follows:

1) to monitor, reduce, and ideally eliminate the pathophysiological and psychopathological phenomena occurring in patients with respiratory disorders, both primary or secondary;
2) to restore the patient's maximum functional capabilities in line with the observed changes in their respiratory system and other factors (e.g., comorbidities or age);
3) to improve quality of life and extend lifespan.

There are two types of pulmonary rehabilitation:

1) pulmonary/drainage complexes (PDC);
2) respiratory/ventilation complexes (RVC). PDC aims to restore mucociliary clearance through extrapulmonary vibration and postural drainage, intrapulmonary percussion, coughing, huffing, and breathing exercises, as well as vacuum massage and bronchoalveolar lavage [22—24].

The only indication to the procedures restoring bronchial tree patency is the accumulation of secretions in the bronchial tree. The main factor determining the efficacy of postural drainage is the correct localization of secretion accumulation [20]. The main contraindications to its implementation include acute stroke, suspicion of intracranial hemorrhage, aortic aneurysm, acute myocardial infarction, severe arrhythmias, and ascites. To enhance the effectiveness of the procedure, techniques such as chest wall vibration, chest percussion, forced expiratory technique, and active cycle of breathing technique are used [19, 20].

Controlled breathing involves a series of exercises designed to be prescribed individually, as each has its own advantages and disadvantages. The advantages of purse-lip breathing include:

1) reducing respiratory rate at rest with simultaneous increasing in tidal volume;

2) relieving dyspnea;
3) reducing partial pressure of CO_2 in the blood; increasing SpO_2.

The benefits of respiratory muscle training include:

1) increasing respiratory muscle endurance and strength;
2) increasing maximal oxygen consumption (VO_{2max}) and exercise tolerance;
3) reducing dyspnea;
4) reducing nocturnal hemoglobin oxygen desaturation in individuals with weak inspiratory muscles. In active expiration, active contraction of abdominal muscles during expiration increases intra-abdominal pressure, thereby improving the conditions for diaphragmatic contraction [16, 18].

Breathing exercises, used independently or as part of breathing gymnastics, are a widely accessible method for normalizing, restoring, or activating key functions of external respiration, which promotes maximal blood oxygen saturation (through the efficient ventilation-perfusion ratio in the lower lung regions) with minimal energy expenditure [18, 19]. The motion of the diaphragm during breathing creates a gentle massaging effect on the liver and other internal organs, thereby improving peripheral circulation and vascular tone (including the portal venous system), promoting digestion, and improving gastrointestinal and adrenal functions. In addition, breathing exercises relieve muscle tension and restore mobility in the lower back, pelvic, and abdominal regions, especially in patients who spend prolonged periods lying or sitting, and have a positive impact on psycho-emotional well-being [18, 19].

In 2020, Liu Kai et al. conducted a prospective, experimental study involving 72 patients, with 36 participants undergoing pulmonary rehabilitation [13]. For respiratory muscle training, patients used a commercial hand-held resistance device (Threshold PEP; Philips Co.) After six weeks of rehabilitation, significant differences were observed in forced expiratory volume in one second (FEV_1), the ratio of forced expiratory volume in one second to forced vital capacity (FEV_1/FVC %), diffusing capacity of the lungs for carbon monoxide (DLCO), and the 6-minute walk test [13]. The study showed that lung function improved significantly six weeks following breathing exercises. This phenomenon could be attributed to the involvement of the intercostal and abdominal wall muscles during respiratory muscle training, as these muscles play a pivotal role in sustaining respiratory function [6, 14].

Sound respiratory gymnastics is used to train respiratory muscles and enhance lung ventilation uniformity. Cardiorespiratory training stimulates blood/lymph circulation in the muscles, restores ventilation-perfusion capabilities of lung tissue, and enhances exercise tolerance during the later stages of rehabilitation. The main methods used are therapeutic walking, Nordic walking, terrenkur, breaststroke swimming, and cycling training [3, 8].

Active cyclic breathing technique is used to increase the uniformity of lung ventilation and stimulate cough clearance in cases of difficult expectoration. The mechanism of action is based on the combination of three respiratory techniques: breathing control, thoracic expansion exercises, and forced expiratory technique or huffing. Breathing control involves diaphragmatic breathing to regulate inspiration/expiration at a relaxed pace, aimed at relaxing the airways and muscles and serving as a connecting link between cycles of active breathing techniques, facilitating air delivery to the most distal branches of the patient's bronchial tree. Moreover, this technique increases air flow in peripheral airways, significantly increasing air volumes and mobilizing tracheobronchial secretions [9, 11, 12].

According to MVF Donadio et al., enhancement in lung auscultatory parameters serves as an indicator of the effectiveness of active cyclic breathing techniques [8]. The latest official American Thoracic Society (ATS)/European Respiratory Society (ERS) document indicates that pulmonary rehabilitation results in reducing dyspnea, increasing exercise tolerance, and improving quality of life in patients with asthma [7, 24].

Conclusions

Thus, modern medicine has a wide array of rehabilitation methods for post-COVID-19 patients. Furthermore, the meticulous selection of suitable rehabilitation techniques and the customization of rehabilitation programs based on individual clinical contexts facilitate the avoidance and prevention of functional impairments, thereby restoring quality of life for these patients. This approach promotes a quicker and more successful recovery from post-COVID-19 lung impairments and is simple to implement, making it suitable for use in both adults and children. It should be noted that coronavirus infection affects not only the respiratory system but the entire body; therefore, for maximal recovery and a quicker return to normal life after the illness, it is recommended to combine respiratory exercises with strengthening rehabilitation measures and moderate physical activities, adjusting the regimen according to the overall condition of the body.

There are no conflicts of interest.
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References

1. Ільюк ІА, Постовітенко КП, Баранова ІВ та ін. Сучасні аспекти легеневої реабілітації в умовах пандемії COVID-19. Український пульмонологічний журнал. 2021;29(3):66-72. doi: 10.31215/2306-4927-2021-29-3-66-72.
2. Магльований АВ, Мухін ВМ, Магльована ГП. Основи фізичної реабілітації. Львів: Ліга-Прес; 2006. 147 с.
3. Михайловська НС, Кулинич ТО та ін. Реабілітація пацієнтів із захворюваннями органів дихання в практиці сімейного лікаря: Навчальний посібник для студентів VI курсу медичного факультету за програмою навчальної дисципліни «Загальна практика — сімейна медицина», спеціальності «Медицина» і «Педіатрія». Запоріжжя: ЗДМУ; 2021.188 с.
4. Фещенко ЮІ, Полянська МО. Сучасні підходи лікування бронхіальної астми згідно GINA 2023. Український пульмонологічний журнал. 2023;31(4):5-13. doi: 10.31215/2306-4927-2023-31-4-5-13.
5. Carfi A, Bernabei R, Landi F. Persistent symptoms in patients after acute COVID-19. JAMA. 2020 Aug 11;324(6):603-5. doi: 10.1001/jama.2020.12603. PMID: 32644129; PMCID: PMC7349096.
6. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020 Feb 15; 395(10223):507-13. doi: 10.1016/S0140-6736(20)30211-7. PMID: 32007143; PMCID: PMC7135076
7. Demchuk A, Chatburn R. Performance characteristics of positive expiratory pressure devices. Respiratory Care. 2021 March;66(3):482-93. doi: 10.4187/respcare.08150.
8. Donadio MVF, Campos NE, Vendrusculo FM, et al. Respiratory physical therapy techniques recommended for patients with cystic fibrosis treated in specialized centers. Braz J Phys Ther. 2020 Nov;24(6):532-8. doi: 10.1016/j.bjpt.2019.11.003.
9. Enwemeka CS, Bumah VV, Masson-Meyers DS. Light as a potential treatment for pandemic coronavirus infections: A perspective. Journal of Photochemistry and Photobiology. 2020 June;(207):111891. doi: 10.1016/j.jphotobiol.2020.111891.
10. GINA. Global Initiative for Asthma. 2023 GINA Report-Global Strategy for Asthma Management and Prevention. Available online: https://ginasthma.org/wp-content/uploads/2023/07/GINA-2023-Full-report-23_07_06-WMS.pdf (accessed on 27 October 2023).
11. Goërtz Y, Herck MV, Jeannet M. Delbressine J, et al. Persistent symptoms 3 months after a SARS-CoV-2 infection: the post-COVID-19 syndrome. ERJ Open Research. 2020 Oct;6:00542-2020. doi: 10.1183/23120541.00542-2020.
12. Huang Y, Tan C, Wu J, et al. Impact of coronavirus disease 2019 on pulmonary function in early convalescence phase. Respir Res. 2020 June;21(1):163. doi: 10.1186/s12931-020-01429-6.
13. Liu Kai, Zhang Weitong, Yang Yadong, et al. Respiratory rehabilitation in elderly patients with COVID-19: a randomized controlled study. Complementary Therapies in Clinical Practice. 2020 May;39:101166. doi: 10.1016/j.ctcp.2020.101166. PMID: 32379637; PMCID: PMC7118596.
14. Lu-Lu Yang, Ting Yang. Pulmonary rehabilitation for patients with coronavirus disease 2019 (COVID-19). Chronic Diseases and Translational Medicine. 2020 June;6(2):79-86. doi: 10.1016/j.cdtm.2020.05.002.
15. McIlwaine M, Button B, Nevitt SJ. Positive expiratory pressure physiotherapy for airway clearance in people with cystic fibrosis. Cochrane Database Syst Rev. 2019 Nov 27;2019(11):CD003147. doi: 10.1002/14651858.CD003147.pub5. PMID: 31774149; PMCID: PMC6953327.
16. Mo X, Jian W, Su Z, et al. Abnormal pulmonary functionin COVID-19 patients at time of hospital discharge. European Respiratory Journal. 2020;55(6):2001217. doi: 10.1183/13993003.01217-2020. PMID: 32381497; PMCID: PMC7236826.
17. Mokmeli S, Vetrici M. Low level laser therapy as a modality to attenuate cytokine storm at multiple levels, enhance recovery, and reduce the use of ventilators in COVID-19. Can J Respir Ther. 2020 Jul;56:25-31. doi: 10.29390/cjrt-2020-015. PMID: 32844112; PMCID: PMC7428000.
18. Nannini LJ, Neumayer NS, Brandan N, et al. Asthma-related hospitalizations after implementing SABA-free asthma management with a maintenance and anti-inflammatory reliever regimen. European Clinical Respiratory Journal. 2022 Aug 8; 9(1):2110706. doi: 10.1080/20018525.2022.2110706. PMID: 35959199; PMCID: PMC9361757.
19. Osadnik CR, McDonald CF, Miller BR, et al. The effect of positive expiratory pressure (PEP) therapy on symptoms, quality of life and incidence of re-exacerbation in patients with acute exacerbations of chronic obstructive pulmonary disease — a multicentre, randomised controlled trial. Thorax. 2014 Feb;69(2):137-43. doi: 10.1136/thoraxjnl-2013-203425.
20. Perrin R, Riste L, Hann M, et al. Into the looking glass: Post-viral syndrome post COVID-19. Med Hypotheses. 2020 Nov:144:110055. doi: 10.1016/j.mehy.2020.110055. PMID: 32758891; PMCID: PMC7320866.
21. Reddel HK, Brusselle G, Lamarca R et al. Safety and effectiveness of as-needed formoterol in asthma patients taking inhaled corticosteroid (ICS)-formoterol or ICS-salmeterol maintenance therapy. The Journal of Allergy and Clinical Immunology: In Practice. 2023 Jul;11(7):2104-14.e3. doi: 10.1016/j.jaip.2023.03.046. PMID: 37054881.
22. Shukla M, Chauhan D, Raj R. Breathing exercises and pranayamas to decrease perceived exertion during breath-holding while locked-down due to COVID-19 online randomized study. Complement Ther Clin Pract. 2020 Nov;41:101248. doi: 10.1016/j.ctcp.2020.101248. PMID: 33074110; PMCID: PMC7554491.
23. Sigman SA, Mokmeli S, Vetrici MA. Adjunct low level laser therapy (LLLT) in a morbidly obese patient with severe COVID-19 pneumonia: A case report Can J Respir Ther. 2020 Sep 28;56:52-6. doi: 10.29390/cjrt-2020-022. PMID: 33043132; PMCID: PMC7521601.
24. Singh SJ, Barradell AC, Greening NJ, et al. British Thoracic Society survey of rehabilitation to support recovery of the post-COVID-19 population. BMJ Open. 2020 Dec 2;10(12):e040213. doi: 10.1136/bmjopen-2020-040213. PMID: 33268418; PMCID: PMC7712930.

Г.З. Корж, Н.В. Корж, М.М. Островський, М.О. Кулинич-Міськів, О.І. Варунків,
І.О. Савеліхіна, К.В. Швець, У.І. Шевчук-Будз
Івано-Франківський національний медичний університет

Легенева реабілітація хворих на бронхіальну астму після перенесеної COVID-19 (огляд літератури)

Хвороби органів дихання належать до найпоширеніших захворювань у дорослих і дітей. Вони характеризуються різноманітністю й тяжкістю клінічного перебігу, частими ускладненнями та розвитком загострень. Тривала гіпоксія призводить до спотворення метаболічних процесів, функціональних, а іноді й органічних змін з боку інших органів та систем. Однією з таких патологій є бронхіальна астма, яка становить глобальну проблему охорони здоров'я. У світі близько 300 млн осіб страждають на це захворювання. Це серйозна глобальна проблема охорони здоров'я, що є актуальною для всіх вікових груп.

Мета роботи — провести огляд даних літературних джерел щодо особливостей та частоти застосування легеневої реабілітації в пацієнтів із бронхіальною астмою після перенесеної коронавірусної хвороби-2019 (COVID-19). У багатьох хворих відзначено збереження та розвиток симптомів захворювання, що перешкоджають виконанню повсякденної активності, є причиною низької якості життя та можуть призвести до зниження продуктивності праці й збільшення витрат на охорону здоров'я. Зазначена патологія потребує постійного лікування, розробки методів запобігання розвитку загострень і різноманітних ускладнень. Ця проблема набула ще більшої актуальності в умовах пандемії COVID-19.

Коронавірусна інфекція вражає не тільки легеневу систему, а й весь організм, тому для максимального відновлення та скорішого повернення в звичайний темп життя після хвороби рекомендується поєднувати дихальну гімнастику з загальнозміцнюючими засобами реабілітації, помірними фізичними навантаженнями, залежно від загального стану організму.

Легенева реабілітація в пацієнтів із бронхіальною астмою після перенесеної COVID-19 є актуальним та ефективним методом лікування, але потребує ширшого впровадження в сучасну систему охорони здоров'я.

Ключові слова: хвороби органів дихання, бронхіальна астма, COVID-19, легенева реабілітація.

***Контактна інформація** / Corresponding author*

Корж Галина Зіновіївна, к. мед. н., доцент
https://orcid.org/0000-0002-7491-2016
E-mail: galyna4@gmail.com

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- Korzh GZ, Korzh NV, Ostrovskyy MM, Kulynych-Miskiv MO, Varunkiv OI, Savelikhina IO, Shvets KV, Shevchuk-Budz UI. The Pulmonary Rehabilitation of Post-COVID-19 Patients with Bronchial Asthma (Review). Туберкульоз, легеневі хвороби, ВІЛ-інфекція. 2024;2:78-83. doi: 10.30978/TB2024-2-78.
- Korzh GZ, Korzh NV, Ostrovskyy MM, Kulynych-Miskiv MO, Varunkiv OI, Savelikhina IO, Shvets KV, Shevchuk-Budz UI. The Pulmonary Rehabilitation of Post-COVID-19 Patients with Bronchial Asthma (Review). Tuberculosis, Lung Diseases, HIV Infection (Ukraine). 2024;2:78-83. http://doi.org/10.30978/TB2024-2-78.