ISSN 1817-7883 eISSN 2522-9354

СОЦІАЛЬНА МЕДИЦИНА, ОРГАНІЗАЦІЯ ОХОРОНИ ЗДОРОВ'Я

DOI: 10.31393/reports-vnmedical-2024-29(3)-21
УДК: 616.24-002-036.12-08:614.2:304.2

ASSESSMENT OF THE EFFECTS OF BIOLOGICAL, SOCIAL, ORGANIZATIONAL FACTORS, AND TREATMENT REGIMENS ON THE RISK OF EXACERBATION OF DISEASES WITH BRONCHO-OBSTRUCTIVE SYNDROME USING THE EXAMPLE OF INSTITUTIONS OF DIFFERENT LEVELS OF MEDICAL CARE

Kokhan B. I.
National Pirogov Memorial Medical University, Vinnytsia (Pirogov st., 56, Vinnytsia, Ukraine, 21018)

Responsible for correspondence:
e-mail: *kohanb648@gmail.com*

Received: May, 12, 2025; Accepted: June, 18, 2025

Annotation. *The relevance of the study is due to the high prevalence of diseases with bronchoobstructive syndrome and the significant social and economic losses they cause. Of particular importance is the need to understand the impact of both treatment regimens and social, biological and organizational factors on the risk of exacerbations, which will increase the effectiveness of medical care at all levels. Taking into account such factors is important both for clinical forecasting and for the development of health care policies. The purpose of the work is to assess the impact of biological, social, organizational factors and treatment regimens on the risk of exacerbation of diseases with bronchoobstructive syndrome, using data from medical institutions of different levels. The study analyzed 731 archival charts of inpatients of three medical institutions in Vinnytsia region for 2019-2024. The effectiveness of ten main and six accompanying treatment regimens was assessed. To model the risks of exacerbations and time intervals to them, a Weibull model with Bayesian MCMC analysis was used based on the R software environment using the libraries «nimble», «coda», «survival», etc. According to the results of the analysis, no significant differences in effectiveness were found between the main treatment regimens. Among the accompanying therapies, regimen No 2 was the least effective with marginal statistical significance. Social and organizational factors were important: employment significantly reduced the risk of exacerbation by 12% (RR=0.885), compliance – by 34% (RR=0.663), and treatment in cluster and supracluster level institutions was associated with a significantly lower risk of exacerbation compared to the interdistrict level (RR≈0.48). The diagnosis of asthma was also associated with a 38% risk reduction compared to COPD. Instead, each year of study was associated with an annual increase in risk of 16%. The individual risk of exacerbation of diseases with bronchoobstructive syndrome depends mainly not on the applied treatment regimen, but on social, organizational factors and patient compliance with the treatment regimen. Optimizing the patient's route and ensuring compliance are key areas for reducing the risk of exacerbations.*

Keywords: *bronchoobstructive syndrome, exacerbation, treatment regimens, social factors, level of medical care, healthcare organization, chronic non-communicable diseases, public health.*

Introduction

Bronchoobstructive diseases, such as asthma (BA) and chronic obstructive pulmonary disease (COPD), are among the most common chronic respiratory diseases in the world, posing a significant burden on health systems and society as a whole [15]. They are characterized by persistent or variable airflow limitation, resulting in dyspnea, cough, wheezing, and other respiratory symptoms. The prevalence of these diseases, their significant morbidity and mortality, and their significant impact on patients' quality of life and economic costs highlight the urgent need for comprehensive research into factors influencing the risk of exacerbations. Asthma (BA) is a chronic inflammatory disease of the airways that affects millions of people worldwide. In recent decades, the prevalence of asthma has increased significantly, especially among children [3, 6]. According to the Global Burden of Disease (GBD) 2019, asthma is one of the most common chronic diseases, affecting an estimated 262 million people worldwide [13]. Some sources indicate that in 2017, there were 272.4 million cases of asthma, with an age-standardized prevalence rate of 3474.8 per 100,000 population [21]. It is predicted that the prevalence of asthma may increase in some Asian and Western countries by 2030 [22]. The global burden of asthma is significant. In 2019, asthma was responsible for 21.6 million disability-adjusted life years (DALYs) and 455,000 deaths [13]. It is a leading cause of emergency department visits and hospitalizations, especially among children [9]. For example, in 2016, 13.8 million children were diagnosed with asthma, and 5.6 million of them had dyspnea requiring treatment [1]. In particular, 4 million new cases of childhood asthma in 2016 were associated with exposure to nitrogen dioxide (NO2) [1]. This highlights the influence of environmental factors on the incidence. The prevalence of asthma varies by geographic region, age, sex, and socioeconomic status [4, 6, 9, 12]. For example, in some countries, such as the United States, the incidence of asthma is 7.8% of the adult population and 8.4% of children [9]. Men are more likely to develop asthma in childhood, while women are more likely to develop asthma in adolescence and adulthood [4].

Chronic obstructive pulmonary disease (COPD), in turn, is a progressive disease characterized by persistent airflow limitation, which is usually caused by significant exposure

to harmful particles or gases, most often tobacco smoke [2]. COPD is the fourth leading cause of death worldwide and is projected to become the third by 2030 [2]. It is estimated that more than 300 million people worldwide suffer from COPD [2]. According to a systematic review and meta-analysis, the global age-standardized prevalence of COPD in 2010 was 10.1% (6.5% in women and 14.3% in men) [2]. Overall, according to 2017, the prevalence of COPD was 251 million cases, and the age-standardized prevalence rate was 3192.2 per 100,000 population [21]. COPD mortality is also significant, with 3.2 million deaths in 2017 [21].

The high prevalence of asthma and COPD, their significant morbidity and mortality, and their significant impact on patients' quality of life and economic costs highlight the importance of comprehensively studying the factors that contribute to the development of these diseases and their exacerbations. Exacerbations of diseases with bronchoobstructive syndrome are clinically significant events that lead to worsening of symptoms, decreased lung function, increased need for medical care, hospitalizations and, in some cases, fatal outcomes [15].

In view of the above, research into the influence of biological, social, organizational factors and treatment regimens on the risk of exacerbations of diseases with bronchoobstructive syndrome is extremely relevant. Understanding these relationships will allow the development of more effective prevention, diagnosis and treatment strategies aimed at improving patient outcomes and reducing the burden of these diseases on the health care system. It is especially important to study these factors using the example of institutions of different levels of medical care, which will allow identifying specific features and developing adapted recommendations for different conditions of medical care.

The purpose of our study is to assess the effects of biological, social, organizational factors, and treatment regimens on the risk of exacerbation of diseases with bronchoobstructive syndrome using the example of institutions of different levels of medical care.

Materials and methods

The study analyzed 731 archival charts of inpatients of pulmonological and therapeutic departments of three hospitals in Vinnytsia region for 2019-2024, namely: Vinnytsia Regional Clinical Hospital named after M.I. Pirogov of Vinnytsia Regional Council - supracluster level - 203 charts; Vinnytsia City Clinical Hospital No. 1 – cluster level – 208 charts; Haisyn Central District Hospital of Haisyn City Council – cluster level – 320 charts.

The following basic treatment regimens were analyzed during the study (since they were the most common and recruited a sufficient number of patients for statistical analysis): regimen 1 Symbicort turbuhaler (manufactured by AstraZeneca AB, Sweden): formoterol + budesonide; regimen 2 Seretide diskus (manufactured by Glaxo Wellcome Production, France): salmeterol + fluticasone; regimen 3 Beclazon-Eco (manufactured by Norton (Waterford) Limited, Ireland): beclomethasone; regimen 4 Budesonide-Inteli (manufactured by LABORATORIO ALDO-UNION, S.L., Spain): budesonide; regimen 5 Zafiron (manufactured by Adamed Pharma, Poland): formoterol.

The supporting (pathogenic and symptomatic) regimens included: regimen 1 Nebutamol (manufactured by Yuria-Pharm LLC, Ukraine): salbutamol; scheme 2 Montel (manufactured by Public Joint-Stock Company "Scientific and Production Center "Borshchagov Chemical and Pharmaceutical Plant", Ukraine) and Montelukast-Teva (manufactured by Teva Operations Poland LLC, Poland): montelukast; scheme 3 Lasolvan max (manufactured by Delpharm Reims, France) and Ambroxol (manufactured by PrJSC "Pharmaceutical Firm "Darnitsa", Ukraine): Ambroxol; scheme 4 ACC Long (manufactured by Salutas Pharma GmbH, Germany): acetylcysteine; scheme 5 Ermucin (manufactured by Edmond Pharma S.r.l., Italy) and Mucytus (manufactured by Macleods Pharmaceuticals Limited, India): erdosteine; scheme 6 L-cet (manufactured by Kusum Healthcare PVT LTD, India): levocetirizine.

The international analytical system R was used for calculations:

R version 4.3.1 (2023-06-16): platform aarch64-apple-darwin20; arch aarch64; os darwin20; system aarch64, darwin20.

The software module was written by us in the R language using libraries «nimble», «coda», «readxl», «ggplot2», «survival»

The modeling of the intervals to the occurrence of events was carried out based on the Weibull model. This name is derived from the Weibull distribution, which conveniently describes the distribution of intervals to the occurrence of events using only two parameters, namely the shape parameter (kap, κ) and the scaling (lambda, λ). The time interval distribution function t f(t) and the risk function h(t) are described, respectively, as

$$f(t) = \kappa\lambda t^{\kappa-1} exp(-\lambda t^{\kappa}) \quad (1)$$

$$h(t) = \kappa\lambda t^{\kappa-1} \quad (2)$$

The Weibull survival function S(t) is also calculated as a two-parameter function:

$$S(t) = exp(-\lambda t^{\kappa}) = f(t)/h(t) \quad (3)$$

A unique property of the Weibull model is that it is simultaneously:

1) proportional hazards model, since the parameter has a multiplicative effect on *h(t)*;

2) accelerated failure time model (AFT), since it has a time-dependent risk function *h*, i.e. *h(t)*.

The linear predictor through which the influence of factors is studied is expressed through the scaling parameter (lambda, λ) of the model, namely:

$$\lambda = exp(\beta_0 + \beta_1 x_1 + \ldots + \beta_p x_p) \quad (4)$$

where x are factors, and $\beta_0 \ldots \beta_p$ corresponding regression coefficients

According to the unique properties of the Weibull model, we can estimate the effect of factors in two ways:

1) by (4) based on the effects β on the risk of an event. Accordingly, positive values of the effects indicate an increase in risk, and negative values indicate a decrease.

2) from property 2, we can obtain the coefficients gam (γ), which measure the effect of factors on the duration of intervals before the occurrence of events, which are obtained from the effects β as:

$$\gamma_p = -\frac{\beta_p}{\kappa} \quad (5)$$

The effects usually have opposite directions, because the factor that reduces the risk simultaneously increases the intervals before the occurrence of events.

In different statistical libraries, the scaling parameter has different signet alternatives. We used two of them:

1. The scale of the hazard in the dweib() R function of the NIMBLE library, which is represented in formulas (1-4) as λ and which is denoted as *b* in Wikipedia

2. The scale of the Weibull distribution, represented as λ in Wikipedia and as scale in R (e.g., in the rweibull(), pweibull(), qweibull() functions used by us.

There is a connection between these alternatives, which we use, namely:

Scale = $\lambda^{-1/\kappa}$ (6)

Results. Discussion

We analyzed two types of factor effects: on the risk of the next exacerbation, as well as on the time interval to the next exacerbation. Both the first and second types of effects have their own specifics of practical application. If risk is a scientific category of studying the influence of exposure on the outcome and prevails in evidence-based medicine, the term to exacerbation is more convenient for individual prognosis, as well as for understanding the effectiveness and importance of the factor in the natural dimension.

Let us first consider the effects of factors on the risk of the next exacerbation. Fig. 1 shows the traceplots of the MSMS chains of the model parameters and the corresponding densplots of the posterior distributions obtained from the script text. The traceplots are shown on the left of each pair and indicate the achievement of stationarity with the exception of the model constant. The shape of the traceplot in the form of a «fat hairy caterpillar» indicates the stationarity of the MSMS chain. Achieving stationarity ensures the validity of the conclusions regarding the posterior distribution of the parameter. Achieving stationarity of chains of regression effects is somewhat questionable. $\beta_2, \beta_6, \beta_2, \beta_8$. MSMS modeling has many advantages over the classical one, which is based on maximizing the likelihood function, in particular, the ability to find an accurate confidence interval; as a rule, 95%CI is used for this, i.e. 0.025 and 0.975 percentiles of the posterior distribution.

Thus, it is immediately possible to state the absence of a reliable influence of such factors as age, gender, place of residence. The unreliability of the differences in the effects of the main therapy treatment regimens is also obvious. In fact, we compared the effects of regimens No. 2-5 with regimen No. 1 as the most common. In the absence of differences with regimen No. 1 of all others, we can state the absence of a reliable difference in effectiveness between them.

From the presented graphic images, it is obvious that of the accompanying therapy regimens, regimen No. 2 was the least effective.

In more detail, the reliable effects of the factors are analyzed according to Table 1, which presents the main centiles of the posterior distributions of the regression effects. It should be noted the appropriateness of using the relative risk (RR) as a visual measure of the epidemiological relationship. RR values exceeding 1 indicate an increase in the risk of exacerbation by a factor, less than 1, on the contrary, confirm the protective role of the factor. RR is obtained by exponentiating the regression effect, i.e. RR= e^{β}. RR allows us to estimate the impact of a factor in terms of percentage reduction and increase in risk. Unfortunately, epidemiologists have not been able to explain the combination of reduction or increase in risks. For example, how to explain a total risk reduction of 300%. The answer is simple, if we proceed from mathematical statistics, the impact of each factor is partial and therefore the regression coefficients are correctly called partial, that is, under the condition of the typical impacts of other factors. Based on this, we estimate the modification of the residual risk, the variance of which is taken as 100%. Thus, there is always some risk of the consequence, even if the total reduction is far from 100%, because the impacts are summed incorrectly as additive from one basis. Therefore, the analysis of variance is used to sum the variances, which is valid only for linear models with a normal distribution of variables. Using percentage changes in risk as variances is an absolutely gross error that confuses and embarrasses epidemiologists and specialists in experimental medicine and often occurs in professional publications and didactic materials of these disciplines. With this in mind, let us explain the modeling results.

Employment turns out to be an important social factor, namely, the employed population had a significantly lower risk of exacerbation, with a median effect of -0.122, 95%CI = (-0.19; -0.048). In terms of relative risk, it can be estimated that the employed population, based on the average values of all other studied factors, had a 12% lower risk of exacerbation, since RR=0.885.

The duration of inpatient treatment as a medical and organizational factor has an impact on the confidence limits. The median regression effect was 0.03 with 95%CI = (-0.014; -0.074). That is, each additional day of hospital stay is associated with a 3% increase in the risk of exacerbation, RR = 1.030.

Individuals diagnosed with asthma had a lower risk of exacerbations, median effect = -0.476, with a confidence interval of -0.802 to -0.169. Since RR = 0.621, the risk reduction was 48% compared to individuals with COPD, taking

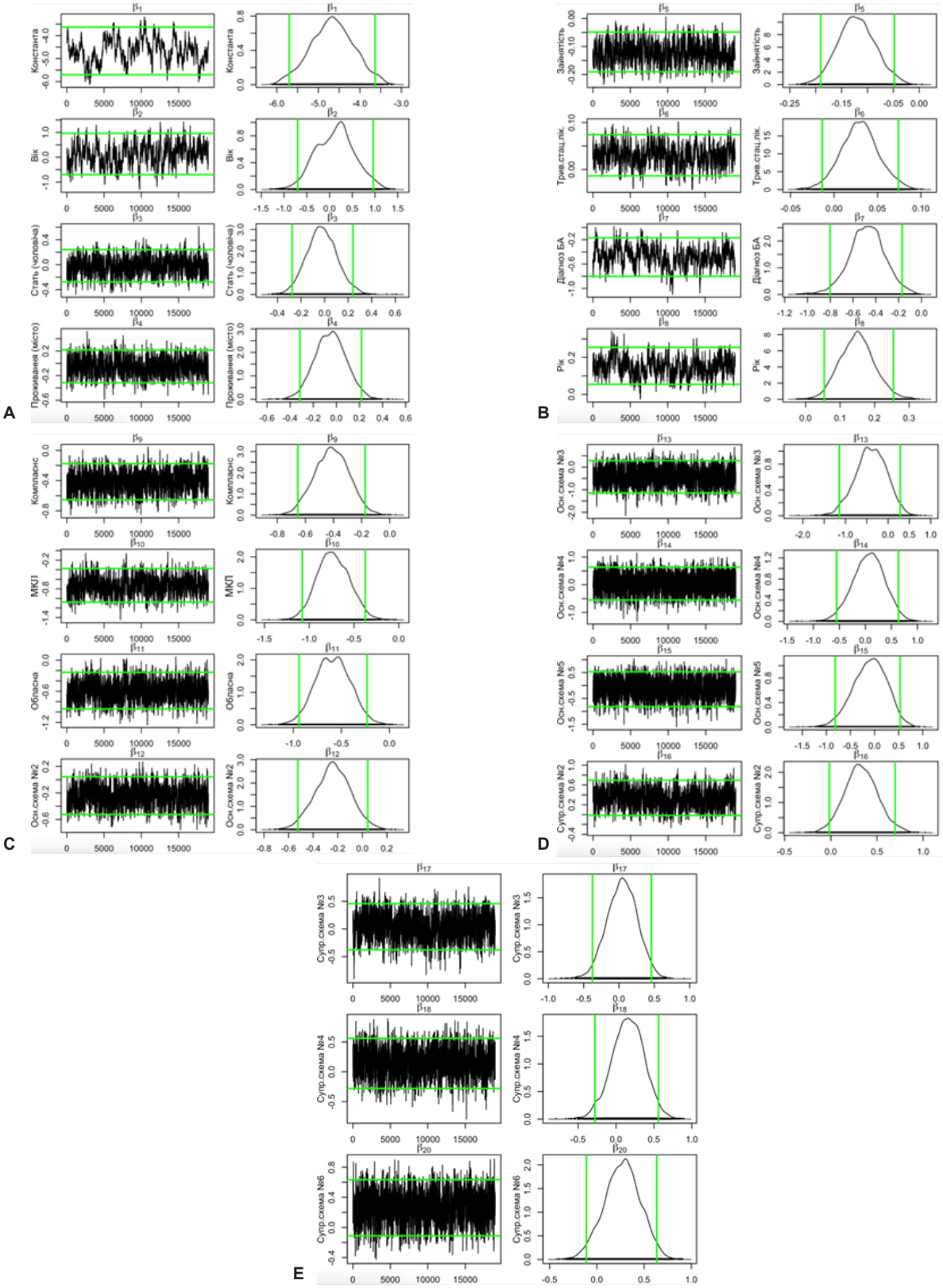

Fig. 1 Traceplots of the MSMS chains of model parameters and the corresponding densplots of the posterior distributions obtained from the script text. All posterior distributions (shown on the right of each pair) indicate a unimodal nature (jagging on several plots does not cancel unimodality), i.e. the possibility of using the median as a reliable estimator of the average or typical effect. On the traceplots and densplots, the confidence intervals are depicted as green lines. The occurrence of zero in the interval indicates the absence of reliability of the effect.

into account the average values of all other factors studied.

Each subsequent year of study increased the risk of exacerbation with a regression effect β = 0.15, 95%CI = (0.054; 0.254), that is, the annual increase in risk was 16% with RR = 1.162.

The presence of compliance significantly reduced the risk of exacerbation with an effect β = -0.411, 95%CI = (-0.654; -0.175), thus, compliance significantly provided a risk reduction of 34%, RR = 0.663.

Table 1. Principal centiles of posterior distributions of the effects of regression of factors on the risk of exacerbation after inpatient treatment.

	Centiles of posterior distributions				
Effect	0,025	0,250	0,500	0,750	0,975
Constant	-5,701	-5,020	-4,662	-4,312	-3,634
Age	-0,700	-0,185	0,148	0,406	0,962
Gender	-0,275	-0,110	-0,026	0,063	0,241
Residence in a village	-0,315	-0,144	-0,051	0,041	0,217
Employment	-0,190	-0,146	-0,122	-0,097	-0,048
Duration of inpatient treatment	-0,014	0,015	0,030	0,043	0,074
BA Diagnosis	-0,802	-0,576	-0,476	-0,376	-0,169
Year	0,054	0,115	0,150	0,182	0,254
Compliance	-0,654	-0,498	-0,411	-0,327	-0,175
Cluster-city	-1,078	-0,856	-0,737	-0,605	-0,375
Supracluster	-0,941	-0,713	-0,587	-0,463	-0,232
Main scheme #2	-0,524	-0,334	-0,237	-0,141	0,114
Main scheme No. 3	-1,143	-0,637	-0,394	-0,141	0,286
Main scheme No. 4	-0,553	-0,135	0,074	0,274	0,637
Main scheme No. 5	-0,817	-0,329	-0,077	0,151	0,532
Accompanying diagram #2	-0,016	0,208	0,324	0,447	0,697
Accompanying scheme No. 3	-0,377	-0,099	0,049	0,194	0,459
Accompanying scheme No. 4	-0,279	0,016	0,163	0,303	0,561
Accompanying scheme No. 5	-2,158	-0,934	-0,359	0,114	0,889
Accompanying scheme No. 6	-0,111	0,143	0,274	0,398	0,634

The level of justification of prescriptions was monitored by the level of the hospital where the patient was at the time of the previous exacerbation, the three options were: Cluster-interdistrict, Cluster-city and Supracluster hospitals. Accordingly, two regression effects (contrasts) are distinguished: Cluster-city and Supracluster hospitals compared to Cluster-interdistrict, marked as «Cluster-city» and «Supracluster» in the table. Both effects are reliable and indicate lower risks of exacerbation when justifying treatment in Cluster-city and Supracluster hospitals compared to Cluster-interdistrict. Thus, the median effect of «Cluster-city» was -0.737 with 95% CI from -1.078 to -0.375, the risk reduction was 52% against people with COPD based on the average values of all other studied factors (RR = 0.478). The median effect of «Supracluster» was -0.587 with 95% CI from -0.941 to -0.375, the risk reduction was 52% against people with COPD based on the average values of all other studied factors (RR = 0.478).

As already noted from the graphical analysis of traceplot and densplot, the least effective of the concomitant therapy regimens was regimen No. 2. From Table 2, the median con-

Table 2. Main centiles of posterior distr ibutions of the effects of factor regression on the time of exacerbation after inpatient treatment.

	Centiles of posterior distributions				
Effect	0,025	0,250	0,500	0,750	0,975
Constant	4,131	4,777	5,111	5,398	6,112
Age	-1,071	-0,449	-0,163	0,201	0,765
Gender	-0,266	-0,069	0,028	0,119	0,302
Residence in a village	-0,241	-0,044	0,056	0,157	0,348
Employment	0,053	0,105	0,133	0,160	0,210
Duration of inpatient treatment	-0,080	-0,048	-0,033	-0,017	0,015
BA Diagnosis	0,182	0,407	0,518	0,636	0,911
Year	-0,276	-0,198	-0,163	-0,127	-0,059
Compliance	0,192	0,358	0,450	0,543	0,718
Cluster-city	0,411	0,667	0,807	0,936	1,171
Supracluster	0,258	0,510	0,645	0,782	1,024
Main scheme #2	-0,049	0,156	0,260	0,365	0,567
Main scheme No. 3	-0,315	0,155	0,429	0,699	1,247
Main scheme No. 4	-0,699	-0,301	-0,080	0,149	0,604
Main scheme No. 5	-0,578	-0,165	0,085	0,359	0,890
Accompanying diagram #2	-0,764	-0,488	-0,354	-0,230	0,018
Accompanying scheme No. 3	-0,500	-0,210	-0,054	0,109	0,412
Accompanying scheme No. 4	-0,622	-0,333	-0,177	-0,018	0,307
Accompanying scheme No. 5	-0,968	-0,125	0,389	1,016	2,400
Accompanying scheme No. 6	-0,695	-0,434	-0,301	-0,157	0,122
Form parameters κ	0,824	0,888	0,915	0,943	0,995

trast effect with concomitant therapy regimen No. 1 was 0.324 with a 95% CI from -0.016 to 0.697, which corresponds to an increase in risk by 38.3%, RR=1.383 at the confidence limit.

No significant differences in effectiveness were observed for the main therapy regimens.

Exacerbations of diseases with bronchoobstructive syndrome, in particular chronic obstructive pulmonary disease (COPD) and bronchial asthma (BA), are the main reasons for seeking medical care, hospitalizations and repeated hospitalizations, which significantly burdens the health care system and reduces the quality of life of patients [5, 7, 8, 17]. Analysis of the characteristics of these exacerbations, especially in the hospital setting, is critical for the development of effective prevention and treatment strategies. Exacerbations of chronic obstructive pulmonary disease (COPD) are common and significantly affect the course of the disease. Patients with frequent exacerbations (two or more per year) have a significantly higher risk of rehospitalization and increased mortality [14]. A study by H. Müllerova et al. (2015) in the ECLIPSE cohort showed that patients with a history of hospitalization for COPD had a significantly higher risk of rehospitalization within 3 years (odds ratio 1.51; $p < 0.001$) and death (odds ratio 1.60; $p < 0.001$) compared with those without hospitalizations [14]. Risk factors for recurrent COPD include older age, low body mass index, smoking, comorbidities (especially cardiovascular disease and depression), and previous exacerbations [11, 14]. For example, in a study by H. Müllerova et al. (2015), 35.5% of COPD patients had one or more hospitalizations during a 3-year follow-up [14].

The frequency of COPD exacerbations is directly correlated with healthcare costs. A. D. Dhamane et al. (2015) found that COPD patients who had frequent exacerbations had significantly higher healthcare costs and higher rates of emergency department visits and hospitalizations [5]. Specifically, the average annual increase in healthcare costs per COPD patient who had two or more exacerbations per year was 21,789 compared with those who had no exacerbations [5].

Pneumonia accompanying COPD is a separate important aspect affecting prognosis. M. Søgaard et al. (2016) showed that patients hospitalized with COPD and concomitant pneumonia had higher 30-day mortality (8.3% vs. 3.2%, $p < 0.001$) and 90-day mortality (14.4% vs. 5.8%, $p < 0.001$) compared with patients without pneumonia [18]. This emphasizes the need for careful screening and treatment of infectious complications during COPD exacerbations.

Exacerbations of asthma are acute or subacute episodes of progressive worsening of asthma symptoms (dyspnea, cough, wheezing) and decreased lung function [8]. Hospitalizations for asthma exacerbations represent a significant burden. M. Ekström et al. (2021) studied the risk of readmission and death in patients hospitalized for asthma. They found that the risk of readmission within 1 year was 15.9% and the risk of death was 1.1% [7]. However, almost 75% of readmissions for asthma occurred within the first 90 days after discharge [7].

Risk factors for readmissions for asthma include a history of previous hospitalizations, uncontrolled asthma, comorbid conditions (especially cardiovascular disease, depression, and obesity), and low socioeconomic status [8, 9, 17]. Gonzalez-Barcala et al. (2018) found that the most significant risk factors for readmission were: lack of inhaled corticosteroid treatment (OR 2.83; $p < 0.001$), treatment non-adherence (OR 2.11; $p < 0.001$), and previous hospitalizations (OR 1.94; $p < 0.001$) [8].

Readmissions for asthma are a serious problem. Patel et al. (2022) examined 30-day unplanned readmissions in hospitalized asthma patients in the United States. They found that the overall 30-day readmission rate was 7.41% [17]. The median time to readmission was 14 days [17]. S. P. Veeranki et al. (2016) also confirmed a high rate of 30-day readmissions (10.9%) in patients with asthma who were discharged from hospital [20]. However, men had a higher risk of 30-day readmissions compared to women (11.8% vs. 10.3%) [20].

Age also plays a role in the incidence and diagnosis of readmissions in asthma. K. Hasegawa et al. (2016) showed that older patients (65 years and older) had a higher rate of 30-day readmissions (13.1%) compared to young adults (18–39 years; 8.5%) and middle-aged patients (40–64 years; 9.8%) [10]. However, readmissions for non-respiratory reasons were more common in older patients [10].

For both COPD and asthma, hospitalization for exacerbations is a significant risk factor for subsequent exacerbations and adverse outcomes. For example, R. Y. Suruki et al. (2017) showed that asthma patients who had at least one exacerbation in a 12-month period had significantly higher healthcare costs and more frequent emergency room visits compared with those who had no exacerbations [19]. Organizational factors and treatment regimens play a key role in preventing relapse. Poor disease control, lack of treatment consistency, poor adherence to therapy, and inadequate patient education on self-management are common issues that contribute to exacerbations [8]. Optimizing discharge from hospital, including clear patient instructions, medication agreement, and early follow-up, can reduce the risk of repeat hospitalizations [16]. The specificities of institutions at different levels of health care provision must be taken into account, as access to specialized care, diagnostic capabilities and educational programs may differ, affecting the effectiveness of treatment and the prevention of exacerbations.

Thus, understanding the complex interrelationship between biological, social and organizational factors, as well as the impact of treatment regimens on the risk of exacerbations of asthma and COPD, especially in the hospital setting, is critical for the development of targeted interventions aimed at improving treatment outcomes, reducing the burden of disease and improving the quality of life of patients.

Conclusion and prospects for further developments

1. The study found that social and organizational factors, rather than specific pharmacological regimens of primary treatment, have the greatest impact on the risk of exacerbation of diseases with bronchoobstructive syndrome. Patient compliance, employment, level of medical institution and nosological form (BA vs. COPD) demonstrated a significant association with the risk of exacerbation, indicating the need for a more individualized approach to the management of such patients. At the same time, despite the fact that some accompanying treatment regimens showed differences in the impact on the risk of exacerbation, none of the main therapy regimens showed a statistically significant advantage.

This confirms the importance of a systemic approach to the patient, including organizational and behavioral aspects, which should be taken into account in clinical protocols and medical practice.

References

[1] Achakulwisut, P., Brauer, M., Hystad, P., & Anenberg, S. C. (2019). Global, national, and urban burdens of paediatric asthma incidence attributable to ambient NO2 pollution: estimates from global datasets. *The Lancet Planetary Health*, *3*(4), e166-e178. 10.1016/S2542-5196(19)30046-4

[2] Adeloye, D., Chua, S., Lee, C., Basquill, C., Papana, A., Theodoratou, E., ... & Global Health Epidemiology Reference Group (GHERG. (2015). Global and regional estimates of COPD prevalence: Systematic review and meta–analysis. *Journal of global health, 5*(2), 020415. https://doi.org/10.7189/

jogh.05-020415
[3] Asher, M. I., García-Marcos, L., Pearce, N. E., & Strachan, D. P. (2020). Trends in worldwide asthma prevalence. *European Respiratory Journal, 56*(6), 2002094. https://doi.org/10.1183/13993003.02094-2020
[4] Chowdhury, N. U., Guntur, V. P., Newcomb, D. C., & Wechsler, M. E. (2021). Sex and gender in asthma. *European Respiratory Review, 30*(162), 210067. https://doi.org/10.1183/16000617.0067-2021
[5] Dhamane, A. D., Moretz, C., Zhou, Y., Burslem, K., Saverno, K., Jain, G., ... & Kaila, S. (2015). COPD exacerbation frequency and its association with health care resource utilization and costs. *International Journal of Chronic Obstructive Pulmonary Disease, 10*, 2609-2618. https://doi.org/10.2147/COPD.S90148
[6] Dharmage, S. C., Perret, J. L., & Custovic, A. (2019). Epidemiology of asthma in children and adults. *Frontiers in pediatrics*, (*7)*, 246. https://doi.org/10.3389/fped.2019.00246
[7] Ekström, M., Nwaru, B. I., Wiklund, F., Telg, G., & Janson, C. (2021). Risk of rehospitalization and death in patients hospitalized due to asthma. *The Journal of Allergy and Clinical Immunology: In Practice, 9*(5), 1960-1968. https://doi.org/10.1016/j.jaip.2020.12.030
[8] Gonzalez-Barcala, F. J., Calvo-Alvarez, U., Garcia-Sanz, M. T., Garcia-Couceiro, N., Martin-Lancharro, P., Pose, A., ... & Muñoz, X. (2018). Asthma exacerbations: risk factors for hospital readmissions*. Irish Journal of Medical Science (1971-), (187)*, 155-161. https://doi.org/10.1007/s11845-017-1633-9
[9] Grant, T., Croce, E., & Matsui, E. C. (2022). Asthma and the social determinants of health. *Annals of Allergy, Asthma & Immunology, 128*(1), 5-11. https://doi.org/10.1016/j.anai.2021.10.002
[10] Hasegawa, K., Gibo, K., Tsugawa, Y., Shimada, Y. J., & Camargo Jr, C. A. (2016). Age-related differences in the rate, timing, and diagnosis of 30-day readmissions in hospitalized adults with asthma exacerbation. *Chest, 149*(4), 1021-1029. https://doi.org/10.1016/j.chest.2015.12.039
[11] Hogea, S. P., Tudorache, E., Fildan, A. P., Fira-Mladinescu, O., Marc, M., & Oancea, C. (2020). Risk factors of chronic obstructive pulmonary disease exacerbations. *The clinical respiratory journal, 14*(3), 183-197. https://doi.org/10.1111/crj.13129
[12] Kuruvilla, M. E., Vanijcharoenkarn, K., Shih, J. A., & Lee, F. E. H. (2019). Epidemiology and risk factors for asthma. *Respiratory medicine, (149)*, 16-22. https://doi.org/10.1016/j.rmed.2019.01.014
[13] Mattiuzzi, C., & Lippi, G. (2020, January). Worldwide asthma epidemiology: insights from the Global Health Data Exchange database. *International forum of allergy & rhinology, 10*(1), 75-80. https://doi.org/10.1002/alr.22464
[14] Müllerova, H., Maselli, D. J., Locantore, N., Vestbo, J., Hurst, J. R., Wedzicha, J. A., ... & Anzueto, A. (2015). Hospitalized exacerbations of COPD: risk factors and outcomes in the ECLIPSE cohort. *Chest, 147*(4), 999-1007. https://doi.org/10.1378/chest.14-0655
[15] Nunes, C., Pereira, A. M., & Morais-Almeida, M. (2017). Asthma costs and social impact. *Asthma research and practice*, (*3)*, 1-11. https://doi.org/10.1186/s40733-016-0029-3
[16] Obaidat, B., Alkhatib, A., Garcia, M., & Tabba, M. (2016). Trends of asthma exacerbation readmission rates: a review of a national database. *Chest, 150*(4), 842A. https://doi.org/10.1016/j.chest.2016.08.942
[17] Patel, N., Singh, S., Desai, R., Desai, A., Nabeel, M., Parikh, N., ... & Mahajan, S. (2022). Thirty-day unplanned readmission in hospitalised asthma patients in the USA. *Postgraduate medical journal, 98*(1165), 830-836. https://doi.org/10.1136/postgradmedj-2021-140735
[18] Søgaard, M., Madsen, M., Løkke, A., Hilberg, O., Sørensen, H. T., & Thomsen, R. W. (2016). Incidence and outcomes of patients hospitalized with COPD exacerbation with and without pneumonia. *International journal of chronic obstructive pulmonary disease, (11),* 455-465. https://doi.org/10.2147/COPD.S96179
[19] Suruki, R. Y., Daugherty, J. B., Boudiaf, N., & Albers, F. C. (2017). The frequency of asthma exacerbations and healthcare utilization in patients with asthma from the UK and USA. *BMC pulmonary medicine, (17)*, 74. https://doi.org/10.1186/s12890-017-0409-3
[20] Veeranki, S. P., Sharma, K., Ohabughiro, M. U., Mehta, H. B., Adhikari, D., Kuo, Y. F., & Calhoun, W. J. (2016). 30-Day readmissions in hospitalized adults with asthma exacerbations: insights from the Nationwide Readmission Database. *Chest, 150*(5), 1162-1165. https://doi.org/10.1016/j.chest.2016.07.043
[21] Xie, M., Liu, X., Cao, X., Guo, M., & Li, X. (2020). Trends in prevalence and incidence of chronic respiratory diseases from 1990 to 2017. *Respiratory research, (21)*, 1-13. https://doi.org/10.1186/s12931-020-1291-8
[22] Zheng, Y., Lan, L., Lu, G., & Gao, Y. D. (2024). Patterns and trends in asthma incidence rates in main Asian and Western countries and their prediction to 2030. *Chinese Medical Journal Pulmonary and Critical Care Medicine, 2*(3), 188-196. doi:

ОЦІНКА ЕФЕКТІВ БІОЛОГІЧНИХ, СОЦІАЛЬНИХ, ОРГАНІЗАЦІЙНИХ ФАКТОРІВ І СХЕМ ЛІКУВАННЯ ЩОДО РИЗИКУ ВИНИКНЕННЯ ЗАГОСТРЕННЯ ЗАХВОРЮВАНЬ З БРОНХООБСТРУКТИВНИМ СИНДРОМОМ НА ПРИКЛАДІ ЗАКЛАДІВ РІЗНОГО РІВНЯ НАДАННЯ МЕДИЧНОЇ ДОПОМОГИ

Кохан Б. І.

Анотація. *Актуальність дослідження зумовлена високою поширеністю захворювань із бронхообструктивним синдромом та значними соціальними й економічними втратами, які вони спричиняють. Особливої ваги набуває необхідність розуміння впливу як лікувальних схем, так і соціальних, біологічних та організаційних факторів на ризик загострень, що дозволить підвищити ефективність медичної допомоги на всіх рівнях. Врахування таких чинників є важливим як для клінічного прогнозування, так і для розробки політик охорони здоров'я. Мета роботи – оцінити вплив біологічних, соціальних, організаційних факторів та схем лікування на ризик загострення захворювань із бронхообструктивним синдромом, використовуючи дані медичних закладів різного рівня. У дослідженні проаналізовано 731 архівну карту стаціонарних пацієнтів трьох лікувальних закладів Вінницької області за 2019-2024 роки. Оцінено ефективність десяти основних та шести супроводжувальних схем лікування. Для моделювання ризиків загострень та часових проміжків до них використано модель Вейбула з Bayesian MCMC-аналізом на базі програмного середовища R із застосуванням бібліотек «nimble», «coda», «survival» та ін. За результатами аналізу, не було виявлено достовірних відмінностей ефективності між основними схемами лікування. Серед супроводжувальних терапій схема №2 виявилася найменш ефективною з граничною статистичною достовірністю. Важливими виявилися соціальні та організаційні чинники: зайнятість достовірно знижувала ризик загострення на 12% (RR=0.885), наявність комплайєнсу – на 34% (RR=0.663), а лікування у закладах кластерного та надкластерного рівня було пов'язане з достовірно нижчим ризиком загострення порівняно з міжрайонним рівнем (RR≈0.48). Діагноз БА також асоціювався зі зниженням ризику на 38% порівняно з ХОЗЛ.*

Натомість кожен рік дослідження асоціювався зі щорічним підвищенням ризику на 16%. Індивідуальний ризик загострення хвороб із бронхообструктивним синдромом залежить переважно не від застосованої схеми лікування, а від соціальних, організаційних факторів та дотримання пацієнтом лікувального режиму. Оптимізація маршруту пацієнта і забезпечення комплайєнсу є ключовими напрямами зниження ризику загострень.
Ключові слова: *бронхообструктивний синдром, загострення, лікувальні схеми, соціальні фактори, рівень медичної допомоги, організація охорони здоров'я, хронічні неінфекційні захворювання, громадське здоров'я.*