

Dariusz Wiśniewski<sup>1</sup>, Maria Porzezińska<sup>2</sup>, Marta Gruchała-Niedoszytko<sup>3</sup>, Marek Niedoszytko<sup>1</sup>,  
Jan Marek Słomiński<sup>2</sup>, Ewa Jassem<sup>1</sup>

<sup>1</sup>Allergology Department, Medical University of Gdańsk, Poland  
Head: Prof. E. Jassem, MD, PhD

<sup>2</sup>Pneumology Department, Medical University of Gdańsk, Poland  
Head: Prof. J.M. Słomiński, MD, PhD

<sup>3</sup>Department of Clinical Nutrition, Medical University of Gdańsk, Poland  
Head: Prof. S. Małgorzewicz, MD, PhD

## Factors influencing adherence to treatment in COPD patients and its relationship with disease exacerbations

Czynniki wpływające na stosowanie się chorych na POChP do zaleceń lekarskich i ich związek z występowaniem zaostrzeń choroby

The authors declare no financial disclosure

### Abstract

**Introduction:** Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality in the world. Systematic treatment of COPD decreases symptoms and reduces the frequency of exacerbations and hospitalisations because of the disease. It is estimated that only 50% of patients use prescribed drugs systematically. The aim of this study was to identify the factors which can influence adherence to treatment of the patients who were treated due to exacerbation of COPD.

**Material and methods:** A questionnaire probe was conducted on 49 patients hospitalised at the Regional Lung and Tuberculosis Hospital in Olsztyn, Poland due to COPD exacerbation. The assessed variables were: quality of life and adherence to treatment 30 days after discharge from hospital in relationship with demographic factors, social status, disease and hospitalisation course, and relief after systematic treatment.

**Results:** Most of the patients assessed their health condition as poor and the disease as limiting their everyday social and occupational activity. 30 days after discharge from hospital the adherence rate to therapy was only 67%. There was an association between systematic treatment and the rate of exacerbations ( $P = 0.045$ ) and hospitalisations ( $P = 0.005$ ) but also clinical benefit after long-term treatment ( $P = 0.023$ ). There were no associations between adherence to treatment and sex, place of residence, education or occupation.

**Conclusions:** Lack of systematic treatment is the main risk factor for COPD exacerbations and hospitalisation rate. A subjective sense of relief after drugs is a factor improving patients' compliance.

**Key words:** COPD, adherence, demographic factors

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### Streszczenie

**Wstęp:** Przewlekła obturacyjna choroba płuc (POChP) jest jedną z najczęstszych przyczyn chorobowości i umieralności na świecie. Regularne leczenie pozwala na zmniejszenie nasilenia objawów, a także częstości zaostrzeń i hospitalizacji z powodu choroby. Jednak jedynie około 50% pacjentów przyjmuje regularnie przepisane leki. Celem pracy była ocena czynników wpływających na stosowanie się chorych na POChP, u których doszło do zaostrzenia choroby, do zaleceń lekarskich.

**Adres do korespondencji:** Maria Porzezińska MD, PhD, Pneumology Department, Medical University of Gdańsk, Poland, ul. Dębinki 7, 80–211 Gdańsk,

tel./fax: +48 58 349 26 25, e-mail: [porzen@gumed.edu.pl](mailto:porzen@gumed.edu.pl)

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**Materiał i metody:** Badaniem ankietowym objęto 49 pacjentów hospitalizowanych w Samodzielnym Publicznym Zespole Gruźlicy i Chorób Płuc w Olsztynie z powodu zaostrzenia POChP. Oceniano jakość życia, i stosowanie się do zaleceń lekarskich 30 dni po wypisie ze szpitala w zależności od czynników demograficznych, statusu społecznego, przebiegu choroby i hospitalizacji, a także poprawy odczuwanej po stosowanym leczeniu.

**Wyniki:** Większość chorych oceniła swój stan zdrowia jako zły, a chorobę jako ograniczającą codzienną aktywność społeczną i zawodową. Trzydzieści dni po hospitalizacji zalecenia lekarskie wypełniało ściśle jedynie 67% badanych. Wykazano związek pomiędzy systematycznością leczenia a częstością zaostrzeń POChP ( $p = 0.045$ ) i hospitalizacji ( $p = 0.005$ ) oraz odczuwaniem poprawy po stosowanym leczeniu ( $p = 0.023$ ). Płeć, miejsce zamieszkania, wykształcenie, a także rodzaj wykonywanej pracy nie miały związku ze stosowaniem się do zaleceń lekarskich.

**Wnioski:** Czynnikiem mającym największy wpływ na częstość zaostrzeń i hospitalizacji jest systematyczność leczenia. Odczuwanie przez chorych subiektywnej poprawy po lekach poprawia współpracę pomiędzy lekarzem i pacjentem.

**Słowa kluczowe:** POChP, stosowanie się do zaleceń, czynniki demograficzne

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## Introduction

Chronic obstructive pulmonary disease (COPD) is one of the most frequent causes of chronic morbidity and mortality in the world. It poses a serious problem to public health, and it is a frequent cause of hospitalisation and early disability of patients. It is estimated that currently in Poland about 2 million people suffer from COPD [1–4]. It is likely that in 2020 COPD will be the third cause of death worldwide [5].

COPD is a progressive disease which is distinguished by permanent limitations of airflow through the respiratory tract. Chronic symptoms deteriorate the quality of life and limit the occupational and social lives of patients [2, 6–9]. In a natural course of COPD there are periods of exacerbations that, additionally, deteriorate the quality of life, precipitate decrease in ventilation parameters, and increase mortality rate [2, 10–12].

Despite the irreversible nature of some changes, COPD is a disease which may be treated effectively. It has been proven that many therapeutic strategies not only allow the control of symptoms and improve patients' quality of life, but also decrease the intensity and duration of exacerbations and the frequency of hospitalisations due to the disease [2, 10, 13, 14]. However, it is necessary to undergo systematic and appropriate treatment. Meanwhile, the studies conducted in different countries have shown that although in clinical studies patients take 70–90% of prescribed drug doses [15–18], only 50% of patients adhere to medical recommendations in everyday practice [19–22].

The factors that influence adherence to recommended treatment in COPD patients are unknown. Knowledge about them could improve the cooperation between the patient and doctor, and consequently improve control of the disease.

The objective of the study was to evaluate factors that influence adherence to treatment in COPD patients who underwent exacerbations of the disease.

## Material and methods

A questionnaire probe included patients with previously diagnosed COPD, hospitalised due to exacerbation of the disease at the Regional Lung and Tuberculosis Hospital in Olsztyn in the period from November 2009 until March 2010. The SF-36 questionnaire [23] concerning physical, mental and social aspects enabled the assessment patients' quality of life, self-assessment of their health condition and impact of COPD on occupational and social activity. With the help of questionnaires created by the authors and information provided by the patients, we gathered demographic data and information concerning cigarette smoking. We also evaluated the influence of the disease on everyday life, the frequency of exacerbations and hospitalisations, and the impact of hospitalisation and applied drugs on improvement of patients' health condition. Furthermore, 30 days after discharge from hospital, based on telephone conversations, we assessed patients' adherence to recommended treatment in relation to the above-mentioned variables.

The study included 49 patients (26 male and 23 female) in the age range 47–83 years (mean age  $63.7 \pm 7.1$  years), inhabitants of villages, towns and cities. The majority of respondents lived with family or spouse; only 6% of patients declared living alone (Table 1). Most patients received elementary education (43%) or vocational secondary education (25%). 22% of patients acquired secondary education, and 10% — higher

**Table 1. Characteristics of the study group****Tabela 1. Charakterystyka badanej grupy**

Characteristic	Percentage (number)
Place of residence	
— village	33 (16)
— city < 20,000 inhabitants	37 (18)
— city > 20,000 inhabitants	30 (15)
Family status	
— living with family	37 (18)
— living with spouse	55 (27)
— living alone	6 (3)
— others	2 (1)
The sources of patients knowledge about chronic obstructive pulmonary disease	
— pulmonologist	74 (36)
— general practitioner	82 (40)
— nurse	10 (5)
— other patients	18 (9)
— brochure	10 (5)
— internet	10 (5)
Duration of present hospitalisation	
— ≥ 7 days	6 (3)
— 8–14 days	49 (24)
— 15–21 days	43 (21)
— > 21 days	2 (1)
The number of past hospitalisations	
— 1–4	57 (28)
— 5–8	31 (15)
— > 8	12 (6)

education. 20% of respondents were white-collar workers and 33% of them were manual workers. Unemployed patients constituted 47% of the study group.

29% of respondents were never-smokers, and 49% of them smoked cigarettes in the past. 22% of patients were current cigarette smokers, and 55% of them smoked more than 20 cigarettes per day. The majority of cigarette smokers (91%) had tried to give up smoking in the past, and 91% of them declared their readiness to give up smoking in the future.

74% of respondents have never participated in training in COPD. Their source of information about the disease was usually from attending physicians. 10% of them declared that they acquired their knowledge from the Internet (Table 1).

Most of the patients were hospitalised for longer than 7 days, and 43% of them were in hospital for 15–21 days. For many patients it was not their first stay in hospital; 43% of respondents were hospitalised due to COPD five or more times (Table 1).

The studies obtained the approval of the local ethics committee NKEBN/604/2001.

**Table 2. A self-assessment of patients' health status****Tabela 2. Samoocena stanu zdrowia chorych**

Characteristic	Percentage (number)
A health status	
— excellent	2 (1)
— good	10 (5)
— fairly good	29 (14)
— poor	59 (29)
Health status compared to that from the previous year	
— much better	4 (2)
— somewhat better	2 (1)
— about the same	31 (15)
— somewhat worse	31 (15)
— much worse	33 (16)
The influence of physical health or emotional problems on social activities	
— not at all	2 (1)
— slight	12 (6)
— moderate	31 (15)
— quite a big	25 (12)
— extreme	31 (15)
Improvement after hospitalisation	
— yes	88 (43)
— not	4 (2)
— I don't know	8 (4)
Improvement after treatment	
— yes	69 (34)
— not	12 (6)
— I don't know	18 (9)

## Statistical analysis

The collected data were statistically analysed with the help of statistical program SPSS vs. 14. To evaluate significance of differences between the variables, the chi-square test was used.  $P < 0.05$  was assumed as the level of statistical significance.

## Results

The vast majority of subjects evaluated their health condition as poor. Only 12% of respondents evaluated it as good or very good. Moreover, most of the patients believed that their health had deteriorated during the previous year (Table 2).

In the patients' opinion, the disease had hindered, to various degrees, typical activities of their everyday life. The most arduous for patients is ascending stairs up several storeys, as well as activities that require some effort or longer walks (Table 3). As much as 88% of respondents admitted that their health condition caused difficulties while doing their job or other activities, limited the type of such activities (90%), led to shortened time spent on them (82%) and prevented them from achieving their aspirations (90%). In the patients' opinion, although emotional health did not

**Table 3. The structure of the study group of chronic obstructive pulmonary disease symptoms patients according to difficulties in performing typical everyday activities**

**Tabela 3. Struktura badanej grupy pacjentów chorych na przewlekłą obturacyjną chorobę płuc według trudności w wykonywaniu typowych czynności dnia codziennego**

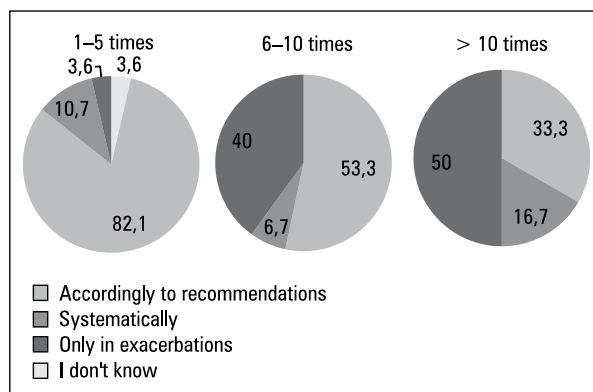
Activities	Yes, limits a lot	Yes, limits a little	No, doesn't limit at all
Vigorous activities	80%	18%	2%
Moderate activities	53%	41%	6%
Carrying groceries	45%	43%	12%
Climbing several flights of stairs	90	10%	0%
Climbing one flight of stairs	43%	47%	10%
Bending or kneeling	45	41%	14%
Walking more than 1 km	71%	22%	6%
Walking about 500 m	39%	39%	22%
Walking about 100 m	27%	27%	47%
Bathing or dressing yourself	39%	27%	35%

influence the accuracy of the performed work, it limited the amount of time spent on work or other activities (72%) and prevented the patients from achieving their aspirations (8%). The majority of respondents believed that their physical and emotional health had an adverse impact on their social activity with family, friends, neighbours and other people (Tables 2 and 3).

During discharge from hospital, 88% of patients admitted that hospitalisation resulted in an improvement in their health, and 69% of patients said that the applied treatment reduced the symptoms of the disease. However, 18% of respondents were not able to state whether the applied treatment resulted in an improvement in their health, and 12% of them claimed that alleviation of symptoms did not occur (Table 2).

During discharge from hospital, patients received guidelines on further use of drugs. All patients admitted that the guidelines were fully understandable.

During telephone conversations conducted 30 days after discharge from hospital, the vast majority (90%) of respondents still believed that hospitalisation improved their health. Most of the patients were under supervision of a pneumologist or allergist (69%) and 27% were under supervision of a general practitioner.



**Figure 1. The structure of the study group according to the use of prescribed drugs in relation to the number of chronic obstructive pulmonary disease symptoms exacerbations per year**

**Rycina 1. Struktura badanej grupy według stosowania zaleconych leków w zależności od liczby zaostrzeń przewlekłej obturacyjnej choroby płuc w ciągu roku**

The majority of respondents (96%) declared that they followed medical recommendations given during discharge from hospital. The remaining 4% of patients had prescribed drugs changed by an attending physician. 55% of the patients who had declared a desire to stop smoking during discharge from hospital achieved the objective after 30 days.

One month after discharge from hospital, 67% of respondents said that they were taking drugs in accordance with medical recommendations, and 10% admitted that they were taking drugs systematically but that they did not obey medical recommendations precisely. Every fifth respondent (20%) admitted taking drugs in case of exacerbation of the disease, and 2% of respondents could not declare that they adhered to treatment.

We have shown a significant correlation between patients' adherence to recommended treatment and number of exacerbations of the disease during the preceding year ( $P = 0.045$ ). The patients who underwent exacerbation of the disease from 1 to 5 times were taking drugs systematically. Among patients who underwent exacerbation more than 10 times, the majority were persons who took drugs only in case of exacerbations (Fig. 1).

We have also shown a correlation between the number of hospitalisations and the regularity of taking drugs ( $P < 0.005$ ). The patients who were more often hospitalised took drugs only during COPD exacerbations significantly more frequently. The patients who were taking drugs systematically and in accordance with medical

recommendations had undergone fewer hospitalisations in the past (Fig. 2).

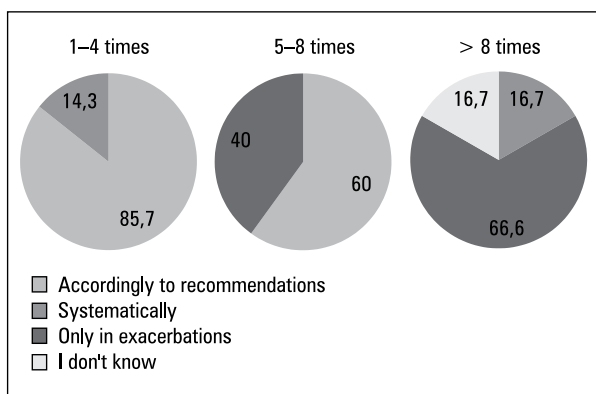
The regularity of taking drugs depended on the assessment of the positive impact of the drugs in alleviating symptoms of the disease ( $P = 0.023$ ). The patients who observed a positive impact of treatment on their health had adhered to medical recommendations more frequently. The persons who did not observe improvement, more frequently had taken prescribed drugs only in case of exacerbation of the disease (Fig. 3).

No correlation was found between the studied demographic features and the regularity of

taking drugs. No correlation was found between degree of adherence to treatment and sex, place of residence, education or type of occupation. Demographic data are presented in Table 4.

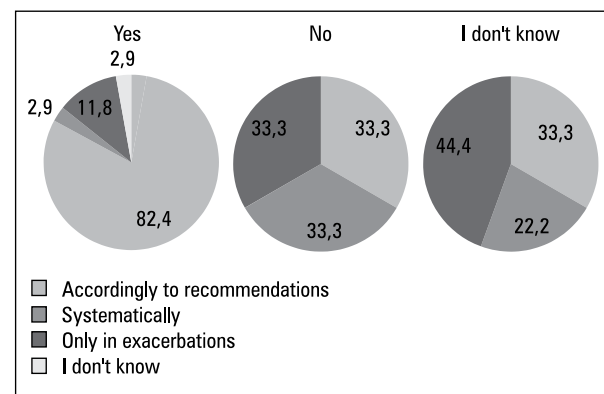
### Discussion

Chronic obstructive pulmonary disease is one of the most frequent causes of morbidity and mortality in the world, and its prevalence is constantly growing. Treatment of the disease is



**Figure 2.** The structure of the study group according to the use of prescribed drugs in relation to the number of past hospitalisations

**Rycina 2.** Struktura badanej grupy według stosowania zaleconych leków w zależności od liczby przebytych hospitalizacji



**Figure 3.** The structure of the study group according to the use of prescribed drugs in relation to reported release of chronic obstructive pulmonary disease symptoms after treatment

**Rycina 3.** Struktura badanej grupy według stosowania zaleconych leków w zależności od zgłaszanego złagodzenia objawów przewlekłej obturacyjnej choroby płuc po stosowaniu leczenia

**Table 4. Adherence to medical recommendations in chronic obstructive pulmonary disease patients in relation to demographic features**

**Tabela 4. Stosowanie się pacjentów z przewlekłą obturacyjną chorobą płuc do zaleceń lekarskich w zależności od cech demograficznych**

Characteristic	According to recommendations	Not according to recommendations, but systematically	Only in disease exacerbations	I don't know
Sex				
— females	74% (17)	9% (2)	17% (4)	0% (0)
— males	62% (16)	12% (3)	23% (6)	4% (1)
Education				
— primary	71% (15)	5% (1)	24% (5)	0% (0)
— vocational	50% (6)	17% (2)	25% (3)	8% (1)
— secondary	82% (9)	9% (1)	9% (1)	0% (0)
— higher	60% (3)	20% (1)	20% (1)	0% (0)
Place of residence				
— country	63% (10)	6% (1)	31% (5)	0% (0)
— city < 20,000 inhabitants	67% (12)	11% (2)	17% (3)	6% (1)
— city > 20,000 inhabitants	73% (11)	13% (2)	13% (2)	0% (0)
Type of occupation				
— manual work	56% (9)	0% (0)	38% (6)	6% (1)
— office work	70% (7)	10% (1)	20% (2)	0% (0)
— unemployed	74% (17)	17% (4)	9% (2)	0% (0)

a considerable burden to healthcare systems, and treatment of exacerbations of the disease is the most expensive, particularly if the patient needs to be hospitalised [2, 3, 5, 10, 24]. Exacerbations that are experienced by the patient from 0.5 to 3.5 times per year [25] worsen the quality of life and ventilation parameters, and increase mortality [11, 24, 26]. One factor associated with poor prognosis is unsatisfactory cooperation between the patient and doctor. The results of the study indicate that regularity of treatment is a factor that has a positive effect on reduction of frequency of exacerbations and hospitalisations. On the other hand, the patient's feeling that his/her health ameliorated is a factor that improves cooperation between the patient and doctor.

Appropriate treatment of COPD may reduce clinical symptoms, frequency and severity of exacerbations and hospitalisations. It also improves the exercise tolerance and general health condition of patients [13, 14, 18, 25, 27–29]. Therefore, it seems obvious that failure to regularly treat COPD deteriorates the course of the disease and increases mortality rate, which has also been shown in the research [12, 16, 18, 22, 30].

Unfortunately, applicable standards are often forgotten during treatment [20, 31–35]. Furthermore, many patients do not adhere to medical recommendations concerning taking drugs or non-pharmacological treatment [19, 34, 36]. In the present study, 67% of patients adhered to treatment, and next 10% of patients were taking drugs systematically, whereas in numerous examined populations drugs were taken regularly only by approximately 50% of subjects [20–22, 36, 37]. The relatively high proportion of cooperating patients in the study population, compared to other research projects, may be caused by the short period of time (30 days) between discharge from hospital and evaluation in the questionnaire. It is known that adherence to treatment is at its best shortly after a doctor's appointment, and it becomes weaker as time goes by [15, 30, 38].

There are various reasons why patients do not adhere to treatment. Some patients omit drug doses unintentionally, because they forget, especially when they feel well or they are distracted by other activities, or when they misunderstood medical recommendations. Others do it intentionally, e.g. due to high costs of the therapy or when they have achieved certain clinical improvement. Some patients stop the therapy when the drug prescribed during a doctor's appointment finishes. However, patients rarely omit drug doses due to its adverse effects [16, 19, 33, 39, 40].

Attempts to assess whether adherence to treatment is influenced by demographic factors brought divergent results. Whereas in one study women followed medical recommendations better [41], in others, similarly as in the present study, such differences were not found [16, 22, 40]. Patient age was not a factor that allowed prediction of adherence to treatment either. It has been shown that in some populations the elderly demonstrated better cooperation [15, 16, 21]; however, it has not been confirmed by other analyses [22, 42].

It could be expected that better adherence to treatment would be presented by educated patients who understand the need for regular treatment of the disease. However, we did not find any relation with education or occupation. There was no relation with place of residence or family situation either. Other studies have not shown unambiguous results. Some authors have proved that better adherence to treatment is observed in more educated patients [21] and those who are married [15, 21], and others did not find dependence between the level of cooperation of the patient and his/her social status, marital status or employment [22].

Divergences noted in particular studies might depend on different affluence of patients. However, the price of a drug is not always decisive in relation to the patient's adherence to recommended treatment. Agh et al. showed that patients adhered to treatment poorly when they had several drugs prescribed, but the price of the drugs did not influence their attitude to treatment [16].

It seems that patients with more severe forms of COPD and a larger number of clinical symptoms should adhere to treatment more precisely. Such dependence has been confirmed by J. Turner [21]. According to her, in a study group of COPD patients, those with lower FEV<sub>1</sub> and larger dyspnoea intensification followed medical recommendations more precisely. However, in other groups of patients these dependences were not so indisputable. Although in the study conducted by Rand, patients with lower FEV<sub>1</sub> values cooperated better, they suffered from smaller dyspnoea intensification [15]. In research by other authors, no dependence was found between adherence to treatment and severity of the disease [16, 40]; even patients with more severe forms of the disease, lower FEV<sub>1</sub> values and bigger dyspnoea intensification adhered to treatment to a lesser degree [18, 30]. In the research by Corden, no dependence was shown between adherence to treatment and quality of life, although the latter deteriorated

significantly during 4 weeks of observation in patients who followed recommendations only to some degree [22].

In the present study, patients with more frequent exacerbations of COPD and past hospitalisations, so probably with the most severe forms of the disease, adhered to treatment less accurately. Simultaneously, according to the results of the study by Rand et al., the patients who followed medical recommendations best were more rarely hospitalised [15]. The researches by other authors have also shown that the patients who followed recommendations more precisely had fewer exacerbations of COPD and hospitalisations per year [18, 30]. On the other hand, it is known that chronic, regular treatment of COPD reduces the number of exacerbations and hospitalisations [13, 14]. Therefore, it may be presumed that the reason for poor cooperation of patients was not the severity of the disease, but irregular taking of drugs, which favoured a greater number of exacerbations and hospitalisations.

However, the present study has shown that patients who observed positive effects of the therapy cooperated better, which has also been confirmed by other researches [19, 43].

Restrepo has proven that non-adherence to treatment may be caused by a large number of prescribed drugs, often with different dosage schedules [19]. It should be emphasised that COPD patients often suffer from numerous concomitant diseases that also need to be treated pharmacologically. A complicated dosage schedule of a large number of drugs creates favourable conditions to omit drug doses or intentionally modify medical recommendations. Although in some research projects, dependence between the number of prescribed drugs and adherence to treatment was not shown [22, 37, 41], other studies found that such a dependence may exist [16]. Dosage form is also of crucial importance. Some patients find the use of drugs via inhaler problematic [19, 43]. Therefore, it seems to be necessary to discuss with the patient the symptoms that are his/her most problematic ailment caused by COPD. Working out a treatment plan together directed at reduction of the patient's subjective ailments may be the solution to improve cooperation between the patient and the doctor.

The majority of the examined patients observed a reduction of symptoms after hospitalisation, but also as the result of chronic use of prescribed drugs. Nevertheless, 30 days after discharge from hospital many of them ceased following medical recommendations. It is pos-

sible that such an attitude is connected with poor awareness or knowledge about the disease [16, 19]. It has been repeatedly proven that COPD patients cooperate better when they know the pathogenesis of the disease and the available therapeutic modalities. Confidence in the doctor and in the efficacy of prescribed drugs are also of great importance [19, 37, 42, 44]. In the past it has also been shown that some problems with adherence to treatment are encountered with patients who smoke cigarettes, despite the fact that this addiction has a negative effect on the clinical course of the disease [16, 21]. It may also be connected with poor awareness and knowledge about COPD in this group of patients [16].

Only 27% of patients in the present paper participated in training in COPD in the past. Better knowledge may significantly improve patients' adherence to treatment, reduce the number of exacerbations of the disease and ameliorate the quality of life. In particular, understanding the objectives of treatment, the mechanisms of drugs' activity and repeated training in inhalation techniques may be of vital importance [17, 19, 45, 46].

Appropriately systematised educational material could be spread via the Internet. By visiting websites and educational platforms, patients can take advantage of easily accessible information that is often in a multimedia form, and they can share their experience with other patients. Every tenth patient from the present study had used the Internet to find information about the disease, and in the future this proportion will probably be higher.

In the past it has been proven that patients who have some knowledge about the disease cooperate well with their doctor, even if they have many prescribed drugs [37]. Furthermore, when the patient learns how to manage on his/her own in the case of COPD exacerbations, it results in a reduction in their number and duration, and improves control of the disease [10, 17, 46].

The disadvantage of the present paper is the relatively small number of patients included in the study. This was due to the short duration of the study and the fact that it included only patients whose available medical documentation confirmed COPD diagnosed in the past by a pulmonologist or allergist, or during the patient's stay at the lung diseases ward. Due to the fact that the reason for current hospitalisation was exacerbation of COPD, spirometry was not performed. Unfortunately, most patients did not have in their documentation on spirometry results from the past; therefore, determination of the stage of

the disease based on obstruction intensification was not possible. But based on past exacerbations and hospitalisations reported by patients, and according to currently applicable classification, the majority of patients could be classified as class C and D of obstructive pulmonary disease [7].

### Conclusions

Non-adherence to treatment in patients with COPD results in more frequent exacerbations of the disease and hospitalisations. However, clinical improvement after applied treatment improves cooperation between the patient and doctor. Nevertheless, only 67% of patients take prescribed drugs regularly. Sex, place of residence, education or kind of occupation do not influence adherence to treatment.

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### Conflict of interest

The authors declare no conflict of interest.

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