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MODERN APPROACHES TO PHARMACEUTICAL CARE FOR ACUTE COUGH OF VARIOUS ORIGINS: THEORETICAL ASPECTS AND PRACTICAL RECOMMENDATIONS FOR PHARMACIST (LITERATURE REVIEW)

Actuality. The importance of this article is determined by the widespread prevalence of cough among patients and the growing importance of the role of pharmacists in providing primary medical and pharmaceutical care. Systematising current knowledge and clinical recommendations will increase the level of professional awareness among pharmacists and optimise the quality of pharmaceutical care, reducing the risks of irrational pharmacotherapy and complications from self-medication.

The aim – systematisation of current understanding of the physiology, aetiology, characteristics, classification and principles of treatment of acute coughs of various origins to raise awareness among pharmacists/pharmacists about rational pharmaceutical care for acute coughs.

Material and methods. A search for scientific publications was conducted in the PubMed and Google Scholar medical data scientometric databases using the following search terms: cough, pharmaceutical care. In the PubMed database, the 'publication language' filter was additionally used, where, in addition to works in English, publications in Ukrainian were analysed separately. The electronic search was performed in PubMed and Google Scholar for the period 2016–2025.

Research results. The generalisation of the analysed data provides grounds for the formation of a clear and structured algorithm of actions for primary care pharmacists, aimed at improving the quality of counselling for patients with acute coughs, minimising cases of irrational use of medicines, and timely prevention of possible complications.

Conclusion. Based on an analysis of the literature, current ideas about the mechanisms and etiology of acute cough are summarized, the principles of rational pharmacotherapy are substantiated, the importance of non-drug measures is confirmed, and the functions of the pharmacist in providing primary care and pharmaceutical care to patients with acute coughs of various origins are systematized.

Key words: cough, pharmaceutical care, pharmacist, mucolytics, antitussives, algorithm.

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СУЧАСНІ ПІДХОДИ ДО ФАРМАЦЕВТИЧНОЇ ОПІКИ ПРИ ГОСТРОМУ КАШЛІ РІЗНОГО ГЕНЕЗУ: ТЕОРЕТИЧНІ АСПЕКТИ ТА ПРАКТИЧНІ РЕКОМЕНДАЦІЇ ДЛЯ ФАРМАЦЕВТІВ (ОГЛЯД ЛІТЕРАТУРИ)

Актуальність. Важливість цієї статті визначається великою поширеністю кашлю серед пацієнтів і зростаючим значенням ролі фармацевтів у забезпеченні первинної медико-фармацевтичної допомоги. Систематизація сучасних знань і клінічних рекомендацій дасть можливість підвищити рівень професійної обізнаності фармацевтів та оптимізувати якість фармацевтичної опіки, зменшуючи ризики нераціональної фармакотерапії та ускладнень самолікування.

Мета роботи – систематизація сучасних уявлень про фізіологію, етіологію, особливості, класифікацію та принципи лікування гострого кашлю різного генезу для підвищення рівня обізнаності фармацевтів щодо раціональної фармацевтичної опіки за наявності гострого кашлю.

Матеріали та методи. Здійснено пошук наукових публікацій у наукометричних базах медичних даних PubMed, Google Scholar за запитами: cough, pharmaceutical care. У базі даних PubMed додатково використовували фільтр «мова публікації», де, крім робіт англійською мовою, окремо аналізували публікації українською мовою. Електронний пошук виконано у PubMed і Google Scholar в часовому інтервалі 2016–2025 роки.

Результати дослідження. Узагальнення проаналізованих даних дає підстави для формування чіткого та структурованого алгоритму дій фармацевта первинної ланки, спрямованого на підвищення якості консультування пацієнтів із гострим кашлем, мінімізацію випадків нераціонального застосування лікарських засобів і своєчасну профілактику можливих ускладнень.

Висновки. На підставі аналізу літератури узагальнено сучасні уявлення про механізми й етіологію гострого кашлю, обґрунтовано принципи раціональної фармакотерапії, підтверджено значення немедикаментозних заходів та систематизовано функції фармацевта в наданні первинної допомоги та фармацевтичної опіки пацієнтам із гострим кашлем різного генезу.

Ключові слова: кашель, фармацевтична опіка, фармацевт, муколітики, протикашльові засоби, алгоритм.

Introduction. Relevance. Cough is one of the most common symptoms for which patients seek medical and pharmaceutical help (Irwin, 2018; Morice, 2020). Its socio-economic significance is due to its high prevalence among all age groups, reduced quality of life, temporary incapacity for work, and significant treatment costs. Most cases of acute cough are associated with acute bronchitis in acute respiratory viral infections and have a viral aetiology, but the variety of its causes, including pulmonary (infectious, allergic, etc.) and extrapulmonary (gastroenterological, cardiological, haematological, oncological, etc.) factors, as well as the use of certain groups of drugs, makes the process of diagnosis and treatment a complex task (Kinkade, 2016; Smith, 2017).

The problem of irrational self-medication for coughs deserves special attention. One of the most common mistakes is the widespread and often unjustified use of antibiotics for viral infections, which is a key factor in the development of antibiotic resistance (WHO, 2021; Kim, 2023). Equally relevant is the problem of irrational use of drugs for symptomatic treatment: the simultaneous prescription of antitussives and expectorants, the use of outdated or ineffective methods of therapy, and the disregard of non-drug approaches (Rahman, 2021). This not only reduces the effectiveness of treatment and prolongs the recovery process, but also poses a potential threat to patients' health due to the development of side effects.

In these circumstances, the role of the pharmacist as the patient's first point of contact becomes extremely important. The modern paradigm of pharmaceutical practice has evolved from simply dispensing medicines to providing comprehensive pharmaceutical care, which includes assessing the patient's condition, providing informed recommendations on the rational choice of medicines, teaching non-drug methods and timely detection of symptoms that require mandatory referral to a doctor (Henman, 2024). The effectiveness of such care directly depends on the pharmacist's depth of understanding of the pathophysiological mechanisms of cough, its aetiology, classification, and the principles of modern pharmacotherapy.

The aim of the study is to systematise current knowledge about the physiology, aetiology, characteristics, classification and principles of treatment of coughs of various origins in order to raise awareness among pharmacists about rational pharmaceutical care for acute coughs.

Materials and methods. A search for scientific publications was conducted in the PubMed and Google Scholar medical databases using the keywords: cough, pharmaceutical care. In the PubMed database, the 'publication language' filter was additionally used, where, in addition to works in English, publications in Ukrainian were analysed separately. The electronic search was per-

formed in PubMed and Google Scholar for the period 2016–2025.

Research results and discussion. The relevance of cough treatment is due to its high prevalence among the population and a significant number of errors in pharmacotherapy. As the first link in medical care, pharmacists must have up-to-date knowledge to provide effective counselling and prevent irrational treatment. Therefore, in order to achieve the aim of the study, the following section presents summarised data on the theoretical aspects of treating acute coughs of various origins, grouped by relevant areas.

Physiology of coughing: mechanisms of occurrence, classification. Coughing is a reflex action aimed at clearing the airways; it usually occurs when the glottis is closed and has a characteristic sound. Coughing occurs when the receptors in the nose, ears, back of the throat, trachea, bronchi, pleura, diaphragm, pericardium, and oesophagus are mechanically irritated. The influence of external and internal factors, such as fluctuations in air temperature and humidity, air pollutants, tobacco smoke, nasal mucus, phlegm, inflammation of the mucous membranes of the respiratory tract, etc., leads to the formation of a reflex arc that ends in the cough centre of the medulla oblongata. Normally, coughing performs a protective function, promoting the removal of secretions, foreign bodies and irritants from the respiratory tract (Khimion, 2016) (Khits, 2021, Fig. 1).

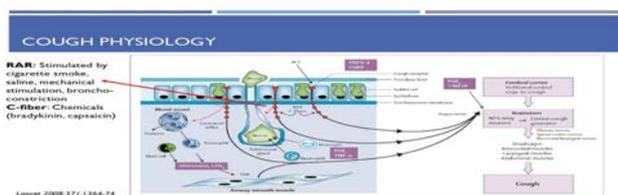


Fig. 1. Cough physiology

Coughing is directly related to the stimulation of sensory nerves in the mucous membrane of the pharynx, larynx, trachea and bronchi, and its occurrence is usually associated with the stimulation of receptors by factors such as hyperproduction of sputum, thermal/chemical/mechanical effects, and bronchospasm (Khits, 2021).

Coughing as a protective reflex involves five components:

- peripheral cough receptors: nose, larynx, sinuses, trachea, Eustachian tube, bronchi, pleura, stomach, pericardium, diaphragm, etc.;
- afferent nerves;
- cough centre of the medulla oblongata;
- efferent nerves;
- effectors: respiratory muscles, laryngeal muscles and diaphragm (Khits, 2021).

The frequency and intensity of coughing depend not only on the strength of the irritant and its location in the respiratory organs, but also on the individual excitability of the cough receptors.

Classification of coughs. There are two types of cough: physiological and pathological (Roneel, 2022).

By nature, coughs are divided into:

- dry (non-productive) – without sputum discharge;
- wet (productive) – accompanied by expectoration of mucus.

The formation of bronchial secretions (phlegm) is one of the prerequisites for the normal functioning of the bronchial tree. It is a physiological component and consists of a mixture of mucous secretions from the respiratory tract with secretions from the nose, throat and saliva (normally, up to 100 ml/day of secretions are produced, most of which is swallowed) (Lorcan McGarvey, 2021). Bronchial secretions usually also contain pulmonary surfactant and cellular elements: alveolar macrophages and lymphocytes. Under normal conditions, sputum has bactericidal properties and contains immunoglobulins and non-specific defence factors (lysozyme, etc.) (Bansil, 2018). Sputum composition: in terms of its physical and chemical structure, it is a multicomponent colloidal solution consisting of two phases: a more liquid one (sol) and an insoluble one (gel). The sol covers the apical surfaces of mucociliary cells and contains electrolytes, proteins, enzymes, and biologically active components. The gel has a fibrillar structure and is formed from glycoprotein complexes of mucins connected by disulphide bridges. The coordinated action of all components of the ‘conveyor mechanism’ (ciliated epithelium, secretory components, and mucus) ensures the effectiveness of mucociliary transport (Khimion, 2016) (Khit, 2021, Fig. 2).

Inflammation of the respiratory organs is usually accompanied by a compensatory increase in mucus production. The composition of tracheobronchial secretions also changes: the water content decreases and the concentration of mucins increases, i.e., the viscosity of sputum increases.

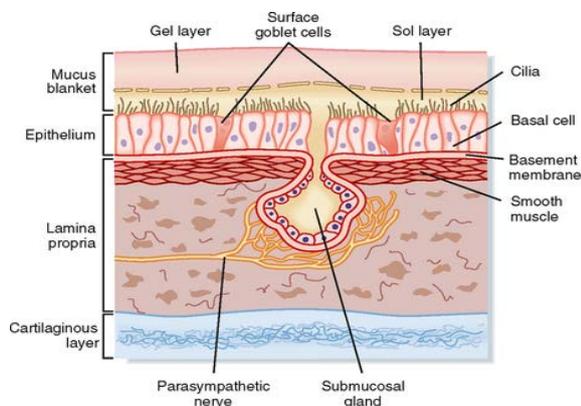


Fig. 2. Diagram of the mucociliary apparatus

Thus, excess viscous sputum in the respiratory tract is:

- a source of irritation to receptors – sensitive endings (=> expectoration, coughing, bronchial spasms);
- a factor of increased adhesion (sticking) of pathogenic microorganisms to the mucous membranes of the respiratory tract, as well as an optimal breeding ground for bacteria and viruses, creating favourable conditions for their reproduction;
- a factor that disrupts mucosal trophism, impairs mucociliary clearance, and reduces the bactericidal properties of bronchial secretions by decreasing the concentration of secretory IgA in them (Hill, 2022).

Such disturbances in the drainage function of the bronchial tree can lead not only to ventilation disorders, but also to a decrease in local immunological protection of the respiratory tract, with a high risk of a protracted course of the inflammatory process and its chronicity (Khimion, 2016).

Depending on its duration, nature of sputum and aetiology, cough can be:

acute (up to 3 weeks):

- productive: acute bronchitis, pneumonia;
- non-productive: acute respiratory viral infections (ARVI), allergic rhinitis, acute sinusitis, otitis externa, aspiration of a foreign body, drug-induced (e.g., ACE inhibitors, etc.).

chronic (more than 8 weeks):

- productive: chronic bronchitis, bronchial neoplasms, cystic fibrosis, heart failure;
- non-productive: bronchial asthma (cough variant), chronic inflammatory processes of the nasopharynx, interstitial lung diseases, whooping cough, neurotic conditions (Khits, 2021).

Acute cough is usually the result of a viral infection of the upper respiratory tract and resolves within the above-mentioned time frame. A cough caused by an upper respiratory tract infection that lasts longer than 3 weeks is usually referred to as a ‘post-viral cough’ (Kevin Liang, 2024). In most cases, acute cough is caused by viruses that are tropic to the epithelium of the upper respiratory tract, but other aetiological factors are also possible, such as bacterial pneumonia or aspiration of a foreign body. The duration of a cough caused by an upper respiratory tract infection usually does not exceed two weeks, while longer episodes may indicate a subacute or chronic course of the process. The American College of Chest Physicians proposes a classification of cough based on its duration: up to 3 weeks – acute, 3 to 8 weeks – subacute, more than 8 weeks – chronic (Shields, 2024).

Thus, coughing is a protective reaction of the respiratory system aimed at clearing the airways of mucus,

dust, foreign particles and pathogenic microorganisms. It occurs as a result of irritation of the cough reflex receptors located in the airways, pleura, diaphragm and stomach. However, coughing can only perform its protective function under certain rheological properties of sputum.

The main causes and clinical features of coughs of various origins. Each form of cough has its own causes and specific course. A dry (non-productive) cough more often occurs with inflammation of the upper respiratory tract, with bronchial mucosal oedema, bronchospasm, and irritation of the cough receptors involved in its pathogenesis (Gülden Bilgin, 2023). A wet (productive) cough is more common in cases of inflammation of the lower respiratory tract, with the pathogenesis involving inflammation of the bronchial mucosa, impaired mucociliary clearance, and exudate/transudate of bronchial secretions (Seliuk, 2018).

- In viral infections, a dry cough prevails at the onset (1–3 days), which later turns into a wet cough.

- In allergic conditions and bronchial asthma, a spastic, dry, nocturnal cough is observed, or after exposure to cold or physical exertion, sometimes with scanty, glassy sputum.

- In gastroesophageal reflux disease, a reflex cough is associated with eating.

- In heart failure, a wet cough with ‘foamy’ sputum occurs, especially at night.

- When taking antihypertensive drugs, angiotensin-converting enzyme inhibitors – dry cough, hacking (due to a pharmacodynamic increase in bradykinin levels).

In most cases of coughing, it is necessary to consult a doctor for additional examination and treatment or to change the antihypertensive medication.

Cough therapy primarily consists of eliminating its cause, i.e., treating the disease that caused the cough. The most effective is etiotropic pharmacotherapy of cough, which involves either eliminating the cause of the cough (discontinuing medications that cause coughing, eliminating contact with the allergen, quitting smoking), or eliminating the pathological process that caused the cough (antibacterial therapy for pneumonia and other respiratory infections, therapy for gastroesophageal reflux disease, compensation for chronic heart failure, etc.) (Savelieva-Kulik, 2019).

In addition, there is symptomatic treatment, which consists either in suppressing the cough reflex (using antitussive drugs for excessive exhausting cough) or stimulating mucociliary cells for better expectoration of sputum and reduction of inflammation in the respiratory tract (Khimion, 2016).

Modern approaches to cough pharmacotherapy.

The most common cause of coughing when visiting a

pharmacist is acute bronchitis. The term ‘acute bronchitis’ usually refers to an acute respiratory tract infection, which is mainly characterised by a cough with or without phlegm (in some cases, self-limiting bronchial hyperreactivity) (Singh, 2024).

More than 90% of cases of acute bronchitis have a non-bacterial cause (Singh, 2024). The cause is usually viruses, among which influenza A and B viruses stand out, but also parainfluenza, coronavirus, rhinovirus, respiratory syncytial virus and metapneumovirus, depending on the nature of the epidemic and the season. In a minority of patients, bacteria are identified as responsible for the disease. Atypical bacteria play an important role in the onset of acute bronchitis, among which *Bordetella pertussis*, *Mycoplasma pneumoniae* and *Chlamydia pneumoniae* stand out. The causative agent of the disease can be detected in only 16–40% of cases (Nguyen, 2025). There are also non-infectious causes of acute bronchitis: smoking (including cannabis), airborne allergens, pollutants, etc (National Academies Press, 2017, Tanner, 2018).

The predominance of cough and accompanying clinical signs indicative of acute upper respiratory tract infection, such as sore throat or rhinorrhoea, is commonly used to differentiate bronchitis from other acute upper respiratory tract infections. First and foremost, pneumonia must be ruled out. Many patients, doctors, and pharmacists believe that purulent sputum indicates a bacterial infection and is an indication for antibiotic therapy. The inflammatory process usually occurs as a result of infiltration by inflammatory cells or desquamation of the mucosal epithelium, which may be associated with both viral and bacterial infections (Serhan, 2020).

Rational approaches to managing patients with cough in acute bronchitis:

- adequate hydration (1.5–2.0 litres of physiological fluid volume) to reduce intoxication and facilitate sputum discharge;

- frequent ventilation and humidification of the air in the room (use a humidifier, do not use air conditioning!);

- refrain from smoking, including passive smoking;

- rest and diet;

- hand hygiene;

- provide realistic expectations regarding the duration of the patient's cough (usually lasts 10 to 14 days);

- consult a doctor (if necessary).

Taking into account current international recommendations (Morice, 2020) for the treatment of cough, it should be emphasised that the primary task of the physician is to determine the cause of the cough and rule out serious diseases that may cause coughing. Most cases of acute cough are associated with respiratory infections of

the upper respiratory tract and require only supportive measures.

Etiotropic pharmacotherapy. Etiotropic pharmacotherapy for acute cough involves the use of agents aimed at eliminating the causative factor of the disease:

Antibiotics. Routine use of antibiotics is not recommended for uncomplicated acute bronchitis, regardless of the duration of the cough. Their use is justified only if pertussis infection (*Bordetella pertussis*) or parapertussis infection is suspected. Treatment with macrolides or, if this is not possible, trimethoprim/sulfamethoxazole is indicated.

Antiviral agents. In cases of severe acute bronchitis, in which influenza A or B viruses are identified, it is important to start treatment within the first 48 hours to increase the effectiveness of neuraminidase inhibitors: in inhaled (zanamivir) and oral (oseltamivir) forms, which reduces the duration of symptoms.

Symptomatic therapy. Symptomatic therapy includes:

Beta-2 agonists. Systematic use is not recommended for acute bronchitis. The use of inhaled beta-2 adrenomimetics may be beneficial for patients with chronic airway obstruction and wheezing. Bronchodilators are also effective in patients with uncomplicated acute bronchitis and bronchial hyperreactivity (Budniak, 2025).

Antitussives. The use of antitussive drugs such as codeine or dextromethorphan is useful as a short-term symptomatic treatment to relieve cough in patients with chronic cough (lasting > 3 weeks). Acute or early cough caused by colds or other viral infections of the upper respiratory tract does not seem to respond to antitussives.

Mucolytics. Systematic use is not recommended in acute bronchitis (Serhan, 2020, Nguyen, 2025).

According to current data, the problem of irrational treatment is relevant, including: polypharmacy, the practice of prescribing off-label drugs, the simultaneous prescription of drugs with antitussive and mucolytic mechanisms of action, early unjustified antibiotic therapy and irrational use of nebuliser therapy, the use of compresses, mustard plasters, rubbing with aromatic balms, and steam inhalations. All of the above is incorrect and should be eradicated from modern practice (Rechkina, 2022).

For coughs of allergic aetiology during the pollen season, it is advisable to use third-generation antihistamines and intranasal corticosteroids or third-generation antihistamines with antitussive drugs (Abdullah, 2022).

Herbal remedies. Phytotherapy has a long history of use and is regulated in many countries by legislative norms that determine the procedure for registering herbal medicines, their standardisation, certification and quality control. Particular attention is paid to confirming

the efficacy, safety and appropriateness of clinical use in patients of different age groups (Garnik, 2018, p. 19).

Self-treatment of cough is possible in cases of acute respiratory diseases, laryngitis, tracheitis, in the early stages of acute bronchitis, when inhaling irritating substances (provided that the patient's general condition is satisfactory)!

When monitoring a patient with a cough, the pharmacist must:

- find out information about the duration of the cough, previous treatment;
- provide general recommendations for treating the cough;
- rule out or identify threatening symptoms (requiring immediate medical attention);
- in the absence of threatening symptoms, dispense over-the-counter medicines for symptomatic treatment of cough.

‘Serious symptoms (‘red flags’) that require immediate medical attention. Serious symptoms that require immediate medical attention include:

- 1) the cough lasts more than a week and its intensity increases;
- 2) the cough is accompanied by a persistent (lasting 2 weeks); increase in temperature to 37.5–38.0 °C;
- 3) the cough is accompanied by a high (above 38.0–39.0 °C) temperature for 2 or more days;
- 4) the cough is accompanied by shortness of breath, chest pain when breathing;
- 5) the cough is accompanied by thick greenish sputum or sputum streaked with blood;
- 6) the cough is accompanied by attacks of suffocation, weakness, weight loss;
- 7) cough accompanied by profuse sweating (especially at night), fever;
- 8) sudden onset of severe coughing;
- 9) intense coughing for an hour without interruption;
- 10) profuse sputum production;
- 11) change in voice;
- 12) if the cough persists for 2 days after symptomatic treatment, it is necessary to consult a doctor (Order of the Ministry of Health №. 7, 2022).

Summarising current international recommendations for the treatment of cough, it should be emphasised that the primary task is to determine the cause of the cough and rule out serious diseases. Most cases of acute cough are associated with respiratory infections of the upper respiratory tract, therefore, given the viral nature of ARVI and acute bronchitis, the use of antibiotics is not recommended. Antiviral drugs may be prescribed in cases of severe acute bronchitis (e.g., influenza A or B with

virus identification), but it is important to start treatment within the first 48 hours to increase effectiveness and reduce the duration of symptoms. Given that acute bronchitis resolves spontaneously in most patients, in some cases only symptomatic treatment of cough is required. Cough suppressants, antihistamines and decongestants should not be routinely prescribed, as they are no more effective than placebo in acute cough and may cause side effects. Specific causes of cough (bronchial asthma, croup, pneumonia, etc.) should be treated according to the relevant guidelines (Morice, 2020).

Medicines for symptomatic treatment of cough.

Usually, the choice of symptomatic treatment is based on the characteristics of the cough, namely the presence or absence of phlegm (dry or productive cough, respectively).

A dry, persistent, painful cough that disrupts sleep and reduces the patient's quality of life requires symptomatic treatment with the prescription of antitussive medicines:

1) central action:

– Narcotic: codeine phosphate, dextromethorphan hydrobromide, morphine chloride, ethylmorphine hydrochloride): available by prescription, therefore require consultation with a doctor!

– non-narcotic: butamirate citrate, glaucine hydrochloride, oxeladine citrate, pentoxyverine, etc.): available without a prescription!

2) peripheral action (prenoxdiazine, levodropropizine etc.): available without a prescription!

3) drugs with an indirect antitussive effect;

4) combination drugs.

The use of antitussive drugs is justified in cases where the cough is caused not so much by impaired mucociliary clearance as by irritation of reflexogenic zones. When managing patients with cough, it is important to remember that treatment is indicated only in cases of dry, irritating cough that worsens well-being and affects overall health and quality of life.

Warnings regarding the use of over-the-counter cough medicines:

– Glaucine and butamirate may lower blood pressure.

– Butamirate and oxeladine depress the central nervous system (decrease attention and reaction time), therefore they are not prescribed to drivers and persons in other professions that require increased attention.

– Butamirate and oxeladine should not be combined with alcohol.

Mucolytics are used to ease coughing or for wet coughs accompanied by thick, sticky phlegm that is difficult to expel. Modern drugs have both mucoregulatory and mucolytic effects, which often determines their uni-

versal indications for use in acute and chronic diseases of the upper and lower respiratory tract, and are available *without a prescription*.

1. Mucolytics: direct thiols (acetylcysteine, carbocysteine); indirect thiols (erdosteine).

2. Surfactant synthesis stimulants (ambroxol, bromhexine).

3. Mucokinetics/expectorants: marshmallow, guaifenesin, eucalyptus leaves, plantain, liquorice root, ivy leaves, thyme herb; combined herbal medicinal products (Order of the Ministry of Health № 7, 2022).

Characteristics of modern mucolytics. *Acetylcysteine* (a derivative of the amino acid cysteine, containing an acetyl group) is a mucolytic drug that acts directly on the molecular structure of mucus. The acetylcysteine molecule contains sulphhydryl groups that break the disulphide bonds of acidic mucopolysaccharides in sputum, which reduces the viscosity of mucus, making it easier to cough up. Acetylcysteine remains active in the presence of purulent sputum and destroys bacterial biofilms (Kochuieva, 2019). It is important to remember that the thiol group of acetylcysteine can interact with certain antibiotics (e.g. tetracyclines (except doxycycline), amphotericin B, ampicillin, cephalosporin, aminoglycosides), leading to a reduction in the activity of both drugs (Zaichenko, 2019) and detoxifying effects (is an antidote for paracetamol overdose). Acetylcysteine can provoke bronchospasm, especially in patients with bronchial asthma, and also causes dyspepsia and irritation of the gastrointestinal mucosa. In addition to oral forms, acetylcysteine is often used by inhalation or intravenously (Tenório, 2021).

Carbocysteine (also a derivative of the amino acid cysteine, but with a carboxymethyl group) has both mucolytic and mucoregulatory effects (i.e., it not only thins but also normalises the composition of sputum). It can exacerbate bronchospasm, so it is contraindicated for coughs with a bronchial obstructive component. It is not very effective when used as an aerosol and is usually taken orally (Bianco, 2022). Carbocysteine has no antidotal effect, but is better tolerated by the gastrointestinal tract than acetylcysteine.

Erdosteine is an inactive prodrug that is rapidly metabolised in the liver. Due to the absence of free thiol groups, erdostein (unlike acetylcysteine and its combinations) does not irritate the gastric mucosa, and there is no risk of antibiotic inactivation, so, unlike the above-mentioned drugs, there is no need to take a 2-hour break (Ostrovskyi, 2020). The second important advantage of the drug is its anti-inflammatory effect. It has been proven that erdostein affects not only bacterial but also allergic inflammation. In addition, erdostein poten-

tiates the action of antibiotics, significantly increasing their concentration in sputum (Rechkina, 2022).

Ambroxol is the gold standard of mucolytic therapy, belongs to a new generation of mucolytic drugs, is a metabolite of bromhexine and provides a more pronounced expectorant effect, promoting the production of qualitatively altered secretions. It also has anti-inflammatory and immunomodulatory effects, antioxidant properties, and does not cause bronchial obstruction (Shen, 2023). An important feature of ambroxol is its ability to increase the content of surfactant in the lungs (in viral infections, it increases surfactant production by 1.5–1.7 times, and surfactant protein A directly interacts with the virus haemagglutinin and neutralises it). It also has synergism with antibiotics, increasing their bioavailability (penicillins, macrolides) (Sattar Taheri-Araghi, 2024).

Combined mucolytic agents are represented by a wide variety of drugs. In addition to combinations of several mucoactive components, they may contain bronchodilators, decongestants, antihistamines, antitussives, antipyretics, and antiseptic components of plant, mineral, or chemical origin. Other agents that regulate bronchial secretion are represented by various homeopathic and phytotherapeutic preparations (Khimion, 2016).

N.B.! Expectorants/mucolytics should not be combined simultaneously with:

- 1) central and peripheral antitussives (as these inhibit the cough reflex and lead to greater accumulation of phlegm in the bronchi, with possible subsequent development of inflammation);

- 2) first-generation antihistamines, which thicken phlegm and thus impair its removal;

- 3) drugs that further dehydrate the patient's body (diuretics, laxatives, etc.), as this also impairs sputum expectoration (Order of the Ministry of Health № 7, 2022).

Discussion. An analysis of current scientific literature on approaches to the pharmaceutical care of patients with coughs of various origins allows us to identify a number of key aspects that are crucial for the development of rational pharmacotherapy. The data obtained require in-depth scientific consideration in the context of the current challenges of pharmaceutical practice, in particular with regard to combating antibiotic resistance and improving the quality of pharmaceutical services.

First of all, it should be emphasised that cough as a symptom remains one of the most common reasons for patients to visit pharmacies (Morice, 2017). This makes the issue of its rational treatment extremely relevant and places increased demands on the professional competence of pharmacists. As research data show, most cases of acute cough have a viral aetiology, which makes the

routine prescription of antibiotics completely unjustified (Smith, 2017). This problem is particularly important in the context of the global threat of antibiotic resistance, as evidenced by the position of the World Health Organisation (Holmes, 2018). Cochrane systematic reviews, in particular the work of Smith et al. (Smith, 2017), clearly demonstrate the lack of evidence for the effectiveness of antibiotic therapy in uncomplicated acute bronchitis, which should become a fundamental principle in the work of a pharmacist.

An important aspect that requires special attention is the differentiation (distinction) of coughs by nature (productive/non-productive) and duration (acute/chronic). In addition, current clinical guidelines, such as the ERS guidelines (Morice, 2020, Birring, 2018, Lai, 2018), CHEST Guideline (Birring, 2018) and Gowan T. M. (Gowan, 2021) emphasise the need for a differentiated approach to the treatment of different types of cough. Leading experts in the field of respiratory medicine, in particular Morice et al. (Morice, 2020) and Birring S. S. (Birring, 2018), emphasise that misinterpretation of the nature of a cough can lead to serious therapeutic errors. The most dangerous of these is the simultaneous prescription of antitussives and mucolytics, which poses a real threat to the patient's health due to the possibility of bronchial secretion accumulation and the development of pneumonia (Thomas, 2023).

The effectiveness of different groups of drugs for the symptomatic treatment of cough deserves special discussion. Recent studies, including those by Thomas P. (Thomas, 2023), demonstrate the limited effectiveness of centrally acting antitussives in acute viral cough. At the same time, mucolytic drugs, in particular ambroxol and acetylcysteine, demonstrate good efficacy in productive coughs with difficult-to-remove secretions. It is important to note that, in addition to its mucolytic action, ambroxol has the ability to increase the bioavailability of certain antibiotics, which may be of additional benefit in bacterial complications (Holmes, 2018).

Considerable attention in the current literature is devoted to non-pharmacological methods of treating cough. Recent studies confirm the high effectiveness of adequate hydration and maintaining optimal air humidity (Kinkade, 2016, Anumeha, 2024). These simple measures are often more effective than many medications, especially in acute respiratory viral infections. Family medicine specialists (Kinkade, 2016) emphasise that non-medicinal methods should form the basis of treatment for uncomplicated coughs in acute respiratory viral infections.

A critically important aspect of pharmaceutical care is the pharmacist's ability to identify so-called 'red flags' –

symptoms that require immediate referral of the patient to a doctor. These symptoms include coughing up blood, shortness of breath, prolonged fever, night sweats, and unwanted rapid and significant weight loss (NICE guideline, 2021). Delayed detection of these symptoms can lead to late diagnosis of serious diseases such as tuberculosis, pulmonary embolism, lung cancer, and others.

In the context of pharmaceutical care, the concept of (Henman, 2024) is of particular importance, which involves a comprehensive approach to the patient, including assessment of their condition, provision of evidence-based recommendations, and training in non-pharmacological methods. Modern pharmacists must go beyond simply dispensing medicines and become active participants in the process of providing medical care (Brazeau, 2024).

Thus, to summarise the above, it should be noted that rational pharmaceutical care for patients with cough requires a comprehensive approach based on the principles of evidence-based medicine and taking into account the individual characteristics of each patient. Only such an approach can ensure effective and safe treatment, minimise the risk of complications and contribute to reducing antibiotic resistance.

Conclusions. Based on a review of the literature aimed at systematising current ideas for rational pharmaceutical care for acute coughs of various origins, the following key conclusions have been formulated:

1. Modern ideas about the pathophysiological mechanisms, classification, nature, and aetiological causes of acute cough are summarized. This creates a theoretical foundation for therapy.

2. Rational symptomatic pharmacotherapy is justified, which consists in adhering to the principle of ‘matching the drug to the type of cough’ and the irrationality of simultaneously prescribing certain groups of drugs.

3. The leading role of non-drug approaches as the basis for effective treatment has been confirmed. Adequate hydration, air humidification, and smoking cessation significantly contribute to the thinning of sputum and relief of acute cough, both as a standalone measure and in combination with symptomatic pharmacotherapy.

4. The functions of a pharmacist in providing primary care in a pharmacy setting have been systematized. Pharmaceutical care includes taking a brief medical history, identifying ‘red flags’ with subsequent referral to a doctor, providing informed recommendations on over-the-counter medicines and informing patients about the rules for their use.

Therefore, this literature review aims to raise awareness among pharmacists/pharmacists about the importance of providing quality care to patients with coughs of various origins, preventing the irrational use of medicines, and preventing potential complications of the disease.

Practical significance. The results of the literature review can be used to improve the effectiveness of pharmaceutical counselling, improve training programmes for pharmacists, and introduce algorithms for selecting cough medicines in pharmacy practice.

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