

Analysis of the Respiratory Tract Morbidity in Children Living in Big Cities

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Abstract: Upper and lower respiratory tract pathology is an urgent problem of modern paediatrics since it is the most common paediatric disease. The aim was to conduct a retrospective analysis of the structure of respiratory diseases in children. Materials and methods: We conducted a retrospective analysis of 5,615 medical records of patients undergoing inpatient treatment at the non-profit municipal enterprise City Children's Clinical Hospital in 2018 for respiratory system pathology. Retrospective analysis is performed using the electronic program "Doctor Eleks", which allows us to search and form a group of case histories by keyword. The age characteristics and the structure of the respiratory tract morbidity were defined, seasonal prevalence and duration of treatment, and the medical conditions requiring the longest inpatient treatment were determined. A judicious approach is required to the question of hospitalisation of a patient with respiratory pathology - it must be timely and well-founded because the presence of a respiratory pathology does not always require hospitalisation. There is a necessity in studying the causes of hospitalisation of children for respiratory pathology and retrospectively study the history and causes of re-hospitalisations to develop recommendations for reducing the incidence of hospitalisation. It is also planned to study the structure of hospitalised patients according to other nosologies (pathology of the digestive tract, urinary system, etc.) in the nearest future in order to propose an algorithm for optimising the processes of hospitalisation by differentiating visitors who actually need hospitalisation and those who may be in outpatient treatment.

Keywords: Respiratory pathology, hospitalisation, children, bed-days, outpatient treatment.

INTRODUCTION

Children's health is an integral indicator of society's overall well-being and a subtle indicator of all social and environmental problems [1, 2].

Recently, the health situation of children has approached a critical point: the overall incidence and prevalence of diseases of individual organs and systems are increasing. This is facilitated by an increased intensity of environmental and social factors affecting the health of children and adolescents, deterioration of the nutrition structure, and reduced effectiveness of traditional preventive measures. An important feature of modern times is the rapid increase in the number and a change in the ratio of risk factors that affect homeostatic and immunological parameters, development and overall health of children [3-5].

Respiratory diseases are among the most important problems in modern paediatrics because, despite existing methods of prevention and treatment, they still rank first in the structure of morbidity and disease prevalence [6-11].

To a large extent, Respiratory pathology defines the level of childhood morbidity (and child mortality). Beginning in childhood, in many cases, it leads to disability in adulthood. All this determines the importance of paediatric pulmonology not just for paediatrics but also for clinical medicine.

Respiratory diseases remain the most common pathology in the structure of childhood morbidity [12-14].

Over the last ten years, the number of cases of bronchopulmonary disorders in children has increased by almost 3.6 times, mainly due to acute and recurrent inflammatory processes in the upper and lower respiratory tract. At the same time, the incidence rates of the respiratory tract decreases in children are 5-6 times higher than in adults [4, 8, 9, 15].

Thus, because the lower respiratory tract decreases are quite common among children, the district paediatricians and family doctors should remember that high rates of respiratory morbidity, including pneumonia, indicate the need for diagnostics and judicious therapy at the pre-hospital stage. This, in turn, requires appropriate conditions for supervision and treatment of patients in the ICU [16, 17].

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At present, it is impossible to separate the quality of a child's health from its social status and area of residence. Throughout the child's life, the impact of these factors changes. In some cases, the hereditary component prevails; in others - the environmental influence, which invariably affects the state of the bronchopulmonary system [17-19].

The high pace of life, modernisation of the educational process (transition of educational institutions to new content, structure and duration of the study), information overload pose high demands on a student's body. Prolonged exposure to adverse factors leads to functional disorders, including respiratory system conditions, which form a persistent pathology over time [20, 21].

Community-acquired respiratory tract infections (CARTIs) are the most common group of human infections [22]. The share of CARTIs among all infectious diseases is about 18% [23]. The enormous economic losses and the considerable loss of working capacity of the most productive members of society are mainly due to the high incidence of CARTIs. Nowadays, they occupy leading positions in the structure of morbidity and mortality of the population and cause huge damages incurred by the society. In the nosological structure of the CARTIs, the leading place in incidence rate is occupied by upper respiratory tract infections. However, by the severity of the disease, its load on the healthcare system and the level of threat to patient's life, the community-acquired lower respiratory infections are prevailing, the leading role being played by community-acquired pneumonia (CAP) [8, 18, 21].

Aim

The purpose of the study was to conduct a retrospective analysis of the structure of respiratory diseases in children undergoing inpatient treatment at the non-profit municipal enterprise City Children's Clinical Hospital in Lviv, Ukraine, in 2018, based on the annual statistics report, age and seasonal prevalence. Objectives of the study: to determine the number of hospitalised with the pathology of the respiratory system; to divide into groups depending on the diagnosis, to define the duration of a bed-days depending on the diagnosis, to define the necessity of hospitalisation with the formulation of recommendations on a choice of outpatient treatment

MATERIALS AND METHODS

We conducted a retrospective analysis of 5,615 medical records of patients undergoing inpatient treatment at the City Children's Clinical Hospital in Lviv in 2018 regarding respiratory pathology. The data obtained were processed using mathematical statistics. Statistical analysis of the results was performed with Biostat, the Statistica software.

Retrospective analysis is performed using the electronic program "Doctor Eleks", which allows you to search and form a group of case histories by keyword. This program stores in electronic form all medical histories and information about the hospitalised patient. Numerical results were obtained for several people with specific diagnoses, the duration of the cast was made using a standard program on PC.

Data Source

We conducted a retrospective analysis using information extracted from the home page of medical records of City Children's Clinical Hospital in Lviv. All information was provided to the Medical Records Department of Lviv, with the following personally identifiable information disguised before the notification: patient name, ID, birth address, current address phone number, current address zip code, contact name, contact address, contact phone number, etc.

Classification of Diseases

National clinical coding database of the classification of diseases version 2.0 was used as the standard code for disease classification. Diseases were classified into categories using the tenth revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10), which identifies asthma, pneumonia, and chronic obstructive pulmonary disease. The codes are shown in Table 1.

We selected home records of medical records from January 1, 2018, to December 31, 2018, and removed information, including the characteristics of the medical institution (name, type and level), patient characteristics (name and code of the primary diagnosis, secondary name and diagnosis code, gender, age and length of stay), as well as information on cost (total cost, cost of material, cost of pharmacy and cost of feeding). Medical records were excluded if any of the following conditions were used: (a) the age at the time of diagnosis was over 18 years; (b) the

Table 1: ICD-10-CM Chapter 10, "Diseases of the Respiratory System (J00–J99)"

J00–J06	Acute upper respiratory infections
J10–J18	Influenza and pneumonia
J20–J22	Other acute lower respiratory infections
J30–J39,	Other diseases of upper respiratory infections
J40–J47,	Chronic lower respiratory diseases
J60–J70	Lung diseases due to external agents
J80–J84	Other respiratory diseases principally affecting the interstitium
J85–J86	Suppurative and necrotic conditions of the lower respiratory tract
J90–J94, J95	Other diseases of the pleura Intraoperative and postprocedural complications and disorders of the respiratory system, not elsewhere classified.

length of stay was zero; (c) some key variables are missing or unclear, including age, gender and primary diagnosis; (d) there were obvious errors, such as the date of admission after the date of release.

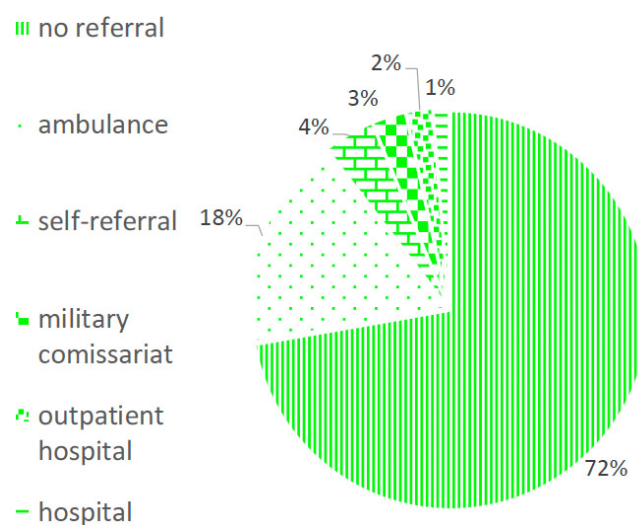
RESULTS AND DISCUSSION

Analysis of the nosological structure has shown that by the incidence rate, bronchitis occupies the first place (37.39%), pneumonia – the second (15.38%) and bronchial asthma – the third place (14.17%) (Table 2).

Table 2: Structure of Respiratory Tract Pathology of the Hospitalized Patients

Diagnosis	Number	%
Bronchitis	2029	37.39
Pneumonia	835	15.38
Bronchial asthma	769	14.17
Tonsillar hypertrophy	687	12.66
Upper respiratory tract infection	514	9.47
Tracheitis	243	4.48
Tonsillitis	184	3.39
Pharyngitis	56	1.04
Laryngitis	39	0.72
Lung abscess	22	0.41
Other	237	4.22

Analysis of the hospital's referral structure shows that patients with respiratory system pathology go to the hospital without referrals - 72% of cases, 18% were referred by outpatient hospitals (Figure 1).

**Figure 1: Hospital referral structure.**

The number and duration of bed-days of patients undergoing treatment with respiratory disease are typical. There were 4,526 (80.6%) paediatric profile diagnoses and 1,089 (19.4%) surgical profile diagnoses.

During data analysis, it was found that the average number of bed-days of patients of the paediatric profile was 8.44, and of the surgical profile - 5.54. However, in this structure, the patients with thoracic profile (8 children) were the longest hospitalised among all patients - the average hospital stay was 40.12 days (Table 3).

Upper respiratory tract diseases were found in 1,707 cases (30.4%), lower respiratory tract diseases in 3,908 cases (69.4%).

Comparing the incidence rate of hospitalisation of children by season, it can be stated that, as expected, more patients with respiratory tract pathology went to

Table 3: Length of Hospitalization in Bed-Days

	Number of children	Bed-days	Average length of hospitalization in bed-days
Pediatric profile	4,526	38,234	8.44
Surgical profile,	1,089	6,143	5.64
including thoracic surgery	8	321	40.12

Table 4: Hospitalization and Average Bed-Days by Season

Season	Number of children	Bed-days	Average bed-days
Winter	1,643	12,945	7.87 *
Spring	1,227	9,894	8.06 *
Summer	1,136	8,410	7.40 *
Autumn	1,609	13,127	8.15 *

* - difference with control group ($p < 0.05$).

the hospital during the cold season - in autumn and winter. However, no statistically significant difference in the length of hospitalisation due to various respiratory pathologies in different seasons was detected ($p \leq 0.05$) (Table 4).

According to a clear algorithm, the child's hospitalisation determines the specific indications (diagnosis, the degree of dysfunction of organs and systems, changes in the results of laboratory and instrumental examinations). Cases, where a child may be in outpatient treatment and does not require hospitalisation should be clearly regulated. Unnecessary inpatient treatment should be avoided. It has negative consequences for both the child and the doctor. For a child, it is unnecessary antibiotic therapy, parenteral intervention, risks of additional infection and psychological problems associated with isolation from parents and friends, the stress of being in an unfamiliar dangerous environment. For the hospital - this is extra material and intangible costs: accommodation, food, medicine, staff work, doctor's time, examination. Analysis of the causes of hospitalisation can streamline the work of the admissions department [17, 20, 21].

Respiratory pathology ranks first due to disability, skipping days of training and hospitalisation. An important problem that needs to be addressed is preventive measures to reduce the incidence of respiratory pathology among children [8, 15, 24].

There are several directions: as a primary prevention the healthy lifestyle, sufficient exposure to fresh air, nutrition appropriate to the age and needs of

the child, sufficient physical activity, no pollutants in the air (industrial, domestic) are usually recommended [2,3,18,19].

Then, after conducting an individual retrospective study of the anamnesis, it is possible to develop specific recommendations for preventing recurrent diseases of the respiratory tract and, accordingly, re-hospitalisations. It is necessary to determine concomitant aggravating factors (damp room, passive smoking, length of stay in the fresh air, method of space heating) and diseases, including respiratory allergies [1 10,13,14].

However, it is very important to consider the presence of concomitant pathology and aggravating factors, which even in upper respiratory tract infection or bronchitis may require hospitalisation. These include the following categories of patients—children with developmental disabilities (Down syndrome, autism spectrum disorders, cerebral palsy, etc). Congenital and acquired malformations of the cardiovascular system (open oval window, septal defects, stenosis or insufficiency of valves, myocarditis, cardiomyopathy, myocardial infarction, etc.) can aggravate the course of respiratory pathology and require hospitalisation. The presence of multiple malformations may involve the later detection of as yet undiagnosed significant organic disorders of the urinary, digestive or respiratory systems [1,7,8].

Concomitant allergic diseases or anamnesis of respiratory allergic reactions may also complicate the course of respiratory pathology [13].

The child's age (up to 6 months) and social factors (unfavourable living conditions, inability of the family to provide effective treatment at home) should also be an indication for hospitalisation [9, 17].

To date, there are a large number of studies examining the effects of tobacco smoke on the incidence of respiratory pathology in children [19]. Exposure to tobacco smoke has been linked to frequent colds, prolonged dry cough, stenotic laryngotracheitis, pneumonia, and more. The data on the effect of tobacco smoke on the development of respiratory pathology in children were obtained in particular due to conducting in 2010-2011 in China a study of 41,176 children aged 3-8 years. In this sample, a clear relationship was found between exposure to tobacco smoke and respiratory failure in children with adjusted odds of 1.06 to 1.95, with the detrimental effects of exposure to tobacco smoke being more harmful in children of the first year of life. Tobacco smoke has been shown to increase the risk of respiratory pathology in children by 6.0% for croup, 9.5% for colds, 17.1% for dry night coughs and 32.3% for pneumonia. Therefore, it is extremely important in terms of primary and secondary prevention of respiratory pathology in children to widely inform the public about the harmful effects of tobacco smoke [2, 3, 19, 25-27].

CONCLUSIONS

The health analysis of the paediatric population indicates the need for constant attention to the emergence and prevalence of respiratory diseases by medical professionals and increasing awareness of educational professionals to improve the effectiveness of medical-preventive measures aimed at prophylaxis of morbidity and disability of children.

Respiratory diseases rank first among all causes of hospitalisation in 2018 to non-profit municipal enterprise City Children's Clinical Hospital. A significant number of hospitalised (72%) non-referral patients may indicate poor primary care (family medicine) performance or distrust of patients. Patients with acute upper respiratory tract diseases can be managed in an outpatient hospital, thus relieving the secondary (specialised) health care load (by 30.4%) and reducing the number of bed-days. Patients with bronchitis (37.39%) and upper respiratory tract infections (30.4%) should be treated on an outpatient basis. Therefore, it is necessary to develop and implement clear algorithms for the management of patients with this pathology for general practitioners and doctors of the

admission department. This will reduce the burden on hospitals and reduce the misuse of funds.

Thus, due to studying the structure of hospitalisation of children with diseases of the respiratory system, we obtained information that allows us to distinguish two areas of further research.

First, it is the optimisation of primary care (general practitioners), which provides for compliance with clear criteria for outpatient management of patients or determines the need for hospitalisation.

Development of recommendations for secondary prevention in children with a history of frequent episodes of acute respiratory diseases. The permissible frequency of acute respiratory diseases for children of the first year of life is up to 4 times, aged 1 to 3 years - up to 6 times a year; for children aged 4-5 years - up to 5 times a year, and for children older than 5 years - up to 4 episodes of acute respiratory diseases per year. For children with frequent episodes of acute respiratory diseases, a clear and effective algorithm for detailed instrumental and laboratory examination to identify possible causes (congenital malformations, hereditary metabolic disorders, comorbid somatic diseases, social factors, etc.) should be developed.

Secondly, the optimisation of the admission department of the hospital - the exclusion of self-treatment (hospitalisation only under the direction of a general practitioner, except for emergencies).

Third, compliance with the recommendations for the appointment of antibiotics in all areas of the medical structure in order to reduce the risk of polyresistance of microorganisms to antibacterial drugs and the formation of a group of reserve antibiotics, which should not be first-line drugs and form a reserve for hospital use.

Theoretically, there are protocols for hospitalisations, but it is important to monitor the effectiveness of their implementation and improve depending on the results of research, namely the assessment of the appropriateness of hospitalisation of children with respiratory diseases if there is an upper respiratory infection or bronchitis and in the absence of comorbidities. Mandatory aggravating factors, both medical and social, should also be taken into account.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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