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Article

Parental Self-Efficacy, Health Locus of Control, and Preventive Behaviors Against Respiratory Infections in Young Children: A Cross-Sectional Survey Study

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Abstract

Background: Respiratory infections in young children are a common health problem that is determined by some factors. This study aimed to learn the principles of respiratory infection prevention in young children in the context of parents' sense of self-efficacy and the level of health locus of control. **Materials and Methods:** A cross-sectional study was conducted among 150 parents of young children. The research tools used were an original questionnaire and a standardized scale of the Generalized Self-Efficacy Survey (GSES) and the Multidimensional Health Locus of Control Scale (MHLC - version A). The study material was collected online using Google Forms software. Data from 134 respondents were included in the statistical analysis. **Results:** A significant relationship was found between the frequency of respiratory infections in children aged 3-4 years and the parents' care for their hygiene, spending time outdoors, and dressing appropriately for the ambient temperature ($\chi^2=4.10$; $p=0.040$). Based on the sten scores for the GSES scale, it was found that most parents (66.42%; $n = 89$) had a high level of self-efficacy (scores of 7-10 sten). According to the MHLC scale - version A, health control was the highest in the internal dimension ($Me=26$), and chance had the least impact on health control ($Me=20$). **Conclusions:** Parents took various actions to prevent respiratory infections in their children. Most parents scored high on the GSES and MHLC – Version A, which may have translated into better health management skills and the implementation of appropriate health-promoting practices in their children.

Keywords: child; parents; infections; respiratory system; prevention; GSES scale; MHLC-A scale

Background

Respiratory infections are a common health problem in young children. They are usually mild upper respiratory tract infections [1]. However, lower respiratory tract infections can sometimes occur, which can cause complications and prolong the recovery period. Recurrent infections are particularly unfavorable, negatively affecting the child's general health and quality of life [2,3]. Additionally, they increase the number of outpatient consultations and can even result in hospitalization and secondary infections in siblings and family [4]. Respiratory infections are mainly of viral origin. Depending on the location, the causes may also be bacterial. The most common viral

pathogens include rhinoviruses, coronaviruses, adenoviruses, enteroviruses, and respiratory syncytial virus (RSV), as well as parainfluenza and influenza viruses. In the moderate, transitional climate of Europe, viral infections are observed especially in spring and autumn, with the peak incidence in winter. Infections are spread by droplets and by contact with the upper respiratory tract secretions of an infected person. The incubation period is 1-6 days, while the period of contagion in the case of infection caused by rhinoviruses can last up to 3 weeks. [5,6]. In the case of bacterial infections, the etiological factors are: *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, *Streptococcus pyogenes*, less frequently *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and anaerobic bacteria. Among the atypical bacteria responsible for respiratory tract infections, the following are of significant importance: *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, and *Legionella pneumophila* [7-9]. Respiratory tract infections in children (nose, sinuses, throat, and ears) most often cause nasal discharge and congestion, fever, sore throat or ear. They may be accompanied by a persistent cough [10]. Laryngeal and tracheal infections are characterized by a characteristic, persistent "barking" cough, hoarseness, and shortness of breath of varying intensity. In older children and adults, laryngitis may cause hoarseness [11]. Bronchitis and pneumonia in children mainly cause fever and cough [12]. Recurrent respiratory infections are a common problem in preschool and school-age children. The number of infections may reach up to 10 per year. Recurrent, chronic upper respiratory tract infections in children are considered to be at least 3 episodes of acute infections in a period of 6 months or from 6 to 8 per year. It is considered that the criteria for recurrent infections are met by an average of 15% of preschool children [8,13,14]. In children under 5 years of age, the frequency of hospitalization due to acute respiratory infections is 20%, and 90% of these cases are pneumonia [6,12]. The most common cause of this disease is RSV infection. Worldwide, every year, children under 5 years of age develop almost 34 million acute lower respiratory tract infections, due to RSV infection alone, with 1/10 children requiring hospitalization [14]. The annual number of deaths in early childhood due to acute respiratory infections is estimated at 1.9-2.2 million, with 70% of deaths occurring in developing countries [15]. In Poland, infant death rates due to respiratory infections have decreased from 46/100,000 to 1/100,000 in the last 40 years [16]. Epidemiological data also indicate that exposure to infection in early life is a significant factor determining the occurrence of immunological diseases in adults [17]. Respiratory infections in young children are caused by a number of factors, including genetic, anatomical, and physiological respiratory system, environmental, and family lifestyle factors [1,7,18]. Individual and environmental factors include: lack of breastfeeding and vitamin supplementation, poor housing conditions (damp, overcrowding), exposure to tobacco smoke (passive smoking impairs natural defense mechanisms and promotes respiratory infections), male gender, prematurity, immunodeficiencies (inborn errors of immunity), chronic lung diseases, and heart defects [19-23].

In preventing respiratory infections, prophylaxis plays a key role, the aim of which is to maintain the child's good general condition, eliminate risk factors for respiratory infections and secondary infections and complications. First of all, attention should be paid to non-pharmacological methods of treatment that are elements of a healthy lifestyle, whose positive effect on the proper functioning of the immune system has been proven. These include: an adequate amount of sleep, regular and moderate physical exercise, breastfeeding for over 6 months, no exposure to tobacco smoke and air pollution, a rational diet and the associated correct body weight, appropriate housing conditions, complete vaccinations according to the national vaccination program. An important element of prevention is also ensuring that the child stays in an air free from pollution every day [24-26]. Immune errors that can promote recurrent upper respiratory tract infections include not only congenital disorders related to cellular and humoral mechanisms, but also, in some cases, acquired disorders, for example, those related to human immunodeficiency virus (HIV) infection in children of seropositive mothers [6,21]. Sometimes, morphological abnormalities are found in children with recurrent and chronic respiratory tract infections. Prevention in these cases involves surgery performed outside the period of infection [2,19].

Parents should make every effort to take care of their child's health and safety by eliminating risk factors for respiratory infections. The attitude of parents towards their own health and its promotion is also important [26-28].

Parents play a key role in shaping health-related behaviors in early childhood. Parental self-efficacy, which refers to beliefs and confidence in their ability to promote healthy functioning and support children's health needs through preventative care, providing healthy foods, and setting limits, is also an important factor in this process. Self-efficacy promotes rational actions of parents regarding their children's health [29-31]. Moreover, individuals who are confident in their self-efficacy are characterized by higher levels of positive emotions. Self-efficacy should be treated as a factor influencing the adoption of health-promoting behaviors. The stronger the sense of self-efficacy and the expectations associated with it, the greater the belief in the possibility of achieving good results, lasting effects, and consistent pursuit of a set goal despite encountered obstacles [32].

There are numerous studies that discuss the various determinants of respiratory infections in children and the possibilities of preventing these infections. These infections have a significant impact on the child and family life, and place an economic burden on the family and the healthcare system. Possible causes of respiratory infections in young children include primarily factors related to physiological and immunological differences in children, followed by environmental factors, including parental lifestyle, and sociodemographic factors. These factors likely contribute to the wide variation in infection rates and symptoms observed in early childhood [33]. However, to our knowledge, there are no reports that discuss the relationship between parental self-efficacy and health control and the prevention of respiratory infections in young children. This relationship seems to us to be important in supporting the principles of respiratory infection prevention used by parents in their children.

This study aimed to learn the principles of prevention of respiratory tract infections in young children in the context of parents' sense of self-efficacy and the level of health locus of control. The results of our study will fill a gap in the literature in terms of better understanding the role of psychosocial factors in determining parents' health behaviors toward their children. Preventive actions related to children's health should pay particular attention to parents' psychological resources that motivate them to engage in health-promoting activities, including generalized self-efficacy and locus of control over one's health [34].

Material and Methods

The study involved 150 parents of small children, aged from birth to 6 years. The inclusion criterion for the study was adult parents (women or men) with a small child (up to 6 years of age). The exclusion criterion for the study concerned minors and people who were not parents of small children.

A self-designed questionnaire and two standardized scales were used as the research tool. The questionnaire of the own survey consisted of 31 questions, including 7 questions about the sociodemographic data of the respondents, such as gender, age, place of residence, housing conditions, marital status, education, and financial status. The remaining 24 questions of the survey concerned obtaining information about the factors determining respiratory infections and their frequency, infection prevention, and family lifestyle. Information about the type of respiratory infection was obtained exclusively from the parents. Participants had this information from the primary care physician who examined the child.

The following scales were also used in the study:

- Generalized Self-Efficacy Scale (GSES) adapted by R. Schwarzer, M. Jerusalem, Z. Juczyński [35]. It presents 10 statements referring to various personal characteristics. After reading each statement, one should decide whether they are true or false concerning oneself. The Cronbach's alpha coefficient for the Polish version of the GSES is 0.85, which indicates its good internal consistency. This value was obtained based on a study conducted on 174 individuals aged 20–55 years [35].

• Multidimensional Health Locus of Control Scale (MHCL – version A) adapted by Z. Juczyński, K.A Wallstion, B.S Wallston and R. DeVellis [36]. It presents 18 views of different people on certain important health-related issues. Each statement expresses a view that one can agree with or not. It is important to answer by one's own beliefs. The author, who adapted the standardized research tool, consented to the use of these scales. In the Polish version of the MHLC scale, Cronbach's alpha for individual dimensions in version A was 0.74 (internal control), 0.69 (chance), and 0.54 (other). These values indicate acceptable or low scale reliability, especially for the "other" dimension [33,34].

The participants were asked to respond to the statements on a four-point scale (ranging from "no" – scored as 1 point to "yes" – scored as 4 points). The sum of the points obtained (10-40) determines the overall self-efficacy index, which is then converted to standardized units – sten scores. Interpreting the GSES test results, the participants can be divided into three groups – individuals with high, average, and low self-efficacy. High self-efficacy is experienced by individuals scoring 30 points or higher, corresponding to the 7-10 sten scale; average self-efficacy is experienced by individuals scoring 25-29 points, corresponding to the 5-6 sten scale; and low self-efficacy is experienced by individuals scoring 24 points or lower, corresponding to the 1-4 sten scale [36].

The study material was collected online, using Google Forms software. The Authors assumed a survey period of approximately 4 months. The research tool was posted on the website at the link <https://forms.gle/gn4nEUgi3SvaGVeD8>, which was created and distributed from February 3 to May 31, 2025, on the Facebook platform, in groups for parents, such as: *Healthy children - Healthy Family, Mom for Mom, How to help a child in illness, Health and illnesses of children*.

Parents participating in the study expressed their conscious, voluntary, written consent to complete an anonymous survey after thoroughly familiarizing themselves with the purpose and scope of the study. The time to complete the questionnaire was approximately 45 minutes. Respondents could withdraw their consent and withdraw from the study at any stage of completing the online survey without giving a reason.

This study was conducted following the principles of the Declaration of Helsinki and reported to the Bioethics Committee at the Medical University of Lublin. After reviewing the documentation, the Committee issued a decision authorizing this type of study (KE/108/02/2024).

The database and statistical tests were conducted using STATISTICA 13.0 computer software (StatSoft, Poland). 134 fully completed questionnaires were qualified for the study and statistically analyzed. The reasons for not including 16 questionnaires in further analyses were: withdrawal of consent to the study (5) and incomplete data in the survey (11). The values of the analyzed measurable parameters were presented using the value, mean, and standard deviation, and for the non-measurable ones using the frequency and percentage. For measurable features, the normality of the distribution of the analyzed parameters was assessed using the Shapiro-Wilk W test. For unrelated qualitative features, the Chi² homogeneity test was used to detect the existence of differences between the compared groups. The Chi² independence test was used to examine the existence of relationships between the studied features, and the Mann-Whitney U test was used to compare two independent groups. The Kruskal-Wallis test was used to compare the age of the groups. The relationship between variables was assessed using the Spearman R correlation. The significance level of p<0.05 was adopted, indicating the presence of statistically significant differences or relationships.

Results

Data from 134 respondents were included in the research analysis. Table 1 characterizes the group of parents in terms of sociodemographic data.

Tble 1. Characteristics of respondents (n=134).

Category	N	%
Gender		
Women	115	85.82

Men	19	14.18
Age range in years		
18-25	30	22.39
26-35	57	42.54
36-45	47	35.07
Place of residence		
City	89	66.42
Rural area	45	33.58
Education		
Higher	82	61.19
Secondary	35	26.12
Vocational	15	11.19
Primary	2	1.49
Professional activity		
Both parents work	95	70.89
One parent works	39	29.10
Status of respondents		
Married	102	76.12
In a civil partnership	23	17.16
Single	8	5.97
Divorced	1	0.75
Family financial situation		
Very good	47	35.07
Good	70	52.24
Average	17	12.69
Family housing conditions		
Very good	78	58.21
Good	56	41.79

The study covered 134 parents, the vast majority of whom were women (85.82%; n=115). The largest group of respondents was people aged 26-35 (42.54%; n=57). The place of residence for most respondents was a city (66.42%; n=89). The respondents most often had higher education (61.19%; n=82) and were professionally active (70.89%; n=95). The majority of respondents were married (76.12%; n=102). The majority of respondents had a good financial status (52.24%; n=70), and (58.21%; n=78) assessed their housing conditions as very good. Children of parents aged 26-35 suffered from respiratory infections significantly more often ($\chi^2=5.910$; $Df=2$, $p=0.052$) than children of parents aged 18-25 or 36-45. The demonstrated relationship is not statistically significant, but shows a tendency towards it.

Analysis of own research based on the author’s survey questionnaire

Table 2. summarizes the respondents’ answers regarding the determinants and prevention of respiratory infections in young children.

Table 2. Respondents’ answers to the questions in the author’s survey questionnaire (n=134).

Analysis Category	N	%
Age of children		
3-4 weeks.	19	14.18
5 weeks-12 months	20	14.92
13 months-24 months	27	20.15
3-4 years	22	16.42

5-6 years	46	34.33
Biological gender of children		
Boys	74	55.22
Girls	60	44.78
Due date		
22-36 weeks of pregnancy	12	8.96
37-41 weeks of pregnancy	98	73.13
42 weeks pregnant	24	17.91
Breast-feeding		
Yes	107	79.85
No	27	20.15
The incidence of chronic diseases in children		
Asthma	15	11.19
Heart defect	4	2.98
Type 1 diabetes	1	0.75
Kidney defects	2	1.49
Child status in the family		
First child	48	35.83
He has siblings	86	64.18
Child care during the day		
Attends organized group activities/nursery/kindergarten	87	64.92
He remains under the care of his mother and/or family	47	35.07
Incidence of respiratory infections		
Rarely (1-4 times a year)	94	70.15
On average (5-6 times a year)	32	23.88
Often (7-10) times a year	5	3.73
Very often (more than 10 times a year)	3	2.32
Type of respiratory infection*		
Bronchitis	60	40.78
Cold (runny nose, cough, sore throat)	45	33.58
Pneumonia	40	29.85
Otitis media	25	18.66
Pharyngitis	23	17.16
Tonsillitis	18	13.43
Sinusitis	10	7.46
Flu	5	3.73
Whooping cough	3	2.24
Child exposure to second-hand smoke		
Yes	9	6.72
No	125	93.28
Carrying out compulsory vaccinations of children in accordance with the vaccination schedule		
Yes	116	86.57
No	18	13.43
Implementation of recommended vaccinations for children		
Yes	58	43.28
No	76	56.72
Giving your child vitamin D ₃		
Yes	110	82.09
No	24	17.91

Taking care of your child's hygiene, spending time outdoors and dressing appropriately for the ambient temperature		
Yes	103	76.86
No	31	23.13
Experiencing stressful situations by a child		
Yes	112	83.58
No	22	16.41

* Values do not add up to 100% due to the possibility of selecting multiple answers.

Most children were born on their due date (73.13%; n=98), and were breastfed (79.85%; n=107), mainly up to 6 months of age (32.84%; n=44). Less than 1/3 of children (16.41%; n=22) had a diagnosed chronic disease, most frequently asthma (11.19%; n=15). Children suffering from asthma had significantly more respiratory infections (41.46%) compared to children suffering from other chronic diseases (24.73; $\chi^2=3.801$; $p=0.05$).

The majority of children had siblings (64.18%; n=86) and were under institutional care for various periods of time during the day. Children attending a nursery or kindergarten had significantly more respiratory infections than children who did not attend these facilities ($\chi^2=14.670$; $p= 0.0001$).

The frequency of respiratory infections was assessed according to the point criterion depending on the number of infections per year (1-4 times per year, 1 point; 5-6 times per year-2 points; 7-10 times points; >10 times points). The mean score for the occurrence of infections was 1.35 ± 0.49 (Me=1.00; range from 1 to 4). It was shown that respiratory infections occurred in children 1-4 times per year (70.15%; n=94). Children aged 3-4 years had respiratory infections significantly more often ($\chi^2=26.670$; $p=0.00006$) compared to children in other age groups (neonates, infants, children aged 1-2 years, and 5-6 years).

The most common infections were bronchitis, colds, and pneumonia. Most infections in the child lasted from 6 to 10 days (44.03%; n=59). The respondents were most likely not smokers (73.88%; n=99) and did not expose their child to passive smoking (93.28%; n=125).

Most of the children were breastfed (n=107; 79.85%). Non-breastfed children were more likely to have respiratory infections (40.74%) compared to breastfed children (27.10%). However, these differences were not statistically significant, $\chi^2= 1.910$; $p = 0.17$.

Most frequently, surveyed parents (86.57%; n=116) carried out mandatory vaccinations for children according to the national vaccination program, i.e., against hepatitis B, tuberculosis, pneumococci, tetanus, diphtheria, pertussis, poliomyelitis, HIB, mumps, measles, rubella, rotaviruses, and HPV. On the other hand, more than half of parents (56.72%; n=76) did not use recommended vaccinations, i.e., against meningococci, chickenpox, influenza, and COVID-19.

The majority of the respondents gave vitamin D₃ to their children (82.09%; n=110), usually in a dose of 400 to 600 IU/day, and 17.91% did not supplement vitamin D₃.

The respondents most often assessed the level of personal hygiene of children as very good (76.86%; n=103) and claimed that children regularly spend time outdoors in air free from pollution and are dressed appropriately for the conditions outside (73.88%; n=99). In addition, they claimed that children are not exposed to stressful situations, regularly sleep through the night, and do not show signs of fatigue (83.58%; n=112). Statistical analysis also showed a significant relationship between the frequency of respiratory infections in children aged 3-4 and the parents' care for their hygiene, spending time outdoors, and dressing appropriately for the ambient temperature ($\chi^2= 4.100$; $p=0.040$). It was shown that children whose parents paid less attention to hygiene and dressing appropriately to the ambient temperature and spent less time outdoors with their children were more likely to suffer from respiratory infections.

Analysis of own research based on the Generalized Self-Efficacy Scale (GSES)

The GSES tool, adapted by R. Schwarzer et al. [35], was used to assess self-efficacy. The scale score ranges from 10 to 40 points. The higher the score, the greater the sense of self-efficacy. The average self-efficacy score was 31.43 ± 4.73 (Me=30.50; range from 21-40). The ranked results were converted to sten scores. Table 3 presents the obtained frequencies of occurrence for individual sten scores. The most common scores were within the range of 7 sten scores (30.60 %).

Table 3. Sten scores for the GSES scale.

Sten	n	%	Level of self-efficacy parents	n	%
1	0	0.00	Low	6	4,48
2	0	0.00			
3	4	2.99			
4	2	1.49			
5	20	14.93	Average	39	29,10
6	19	14.18			
7	41	30.60	High	89	66,42
8	22	16.42			
9	7	5.22			
10	19	14.17			
Total	134	100.00	Total	134	100.00

The obtained sten scores showed that the majority of parents (66.42%; n=89) had a high level of self-efficacy (7-10 sten), 29.10% (n=39) had an average level (5-6 sten), and 4.48% (n=6) had a low level (1-4 sten).

In the group of parents who had a high level of self-efficacy, respiratory infections in children occurred with a slightly lower frequency (74.16%) than in the group with an average level of self-efficacy (61.54%) and a low level (66.67%). However, the differences shown were not statistically significant ($p=0.350$). At the same time, respondents with a low sense of self-efficacy more often did not vaccinate their children with mandatory vaccines according to the vaccination schedule (33.33%) compared to respondents with an average level of self-efficacy (12.82%) or a high level (12.36%). The differences shown were not statistically significant ($p=0.34$). On the other hand, respondents with a high sense of self-efficacy more often assessed that they took very good care of their children's hygiene (77.53%) than those with an average (69.23%) and low (50%) sense of self-efficacy. The differences shown were not statistically significant ($p=0.240$).

Analysis of own research based on the Multidimensional Health Locus of Control Scale (MHLC-version A)

MHLC-A scale adapted by Z. Juczyński [36] was used to assess the health locus of control. The scale consists of 18 statements, which are rated from 1 to 6 points. The scale includes three areas of the health locus of control: Internal (In), Influence of others (I) and Case (C). In the study group (Table 4), health control was the highest in the Internal dimension (Me=26), lower in the dimension – Influence of others (Me=21), and Case had the least impact on health control (Me=20).

Table 4. Health locus of control assessment.

Dimension-control	M	Me	Q1	Q3	SD
Internal (In)	25.91	26.00	22.00	30.0	5.01
Influence of others (I)	20.37	21.00	16.00	25.00	6.68
Case (C)	19.30	20.00	14.00	25.00	6.79

Tables 5 and 6 show only those MHLC-A scale results that were statistically significant with the analyzed factors influencing respiratory infections in children.

Table 5. Assessment of health locus of control concerning the scope of personal hygiene care in children.

Dimension-control	Very good			On average			Z	p
	M	Me	SD	M	Me	SD		
Internal (In)	26.44	27.00	4.33	24.40	25.00	6.41	-1.83	0.070
Influence of others (I)	21.85	23.00	5.99	16.17	16.00	6.85	-4.35	0.00001*
Case (C)	20.81	22.00	6.48	15.03	15.00	5.84	-4.36	0.00001*

Parents who took very good care of their children's personal hygiene had significantly higher health control locus in the dimension Influence of Others ($p=0.00001$) and Case ($p=0.00001$) compared to parents who took average care of their children's personal hygiene (Table 5). The Internal health control dimension was also slightly higher in the group of respondents who took very good care of their children's hygiene, compared to parents who took average care of their children's hygiene. However, the differences shown were not statistically significant ($p=0.070$).

Table 6. Assessment of health locus of control concerning the implementation of compulsory vaccinations in children.

Dimension-control	Yes			NO			Z	p
	M	Me	SD	M	Me	SD		
Internal (In)	24.52	24.00	5.34	26.97	27.00	4.50	-2.55	0.010*
Influence of others (I)	20.90	21.00	6.63	19.96	21.00	6.74	0.67	0.500
Case (C)	18.14	18.00	6.65	20.18	22.00	6.81	-1.71	0.091

The respondents who did not vaccinate their children (Table 6) had a statistically significantly higher dimension of Internal health control compared to the respondents who vaccinated their children ($p=0.010$). The respondents who did not vaccinate their children had a slightly higher level of health control in the dimension of Case, and in the vaccinators in the dimension of Influence of others. However, no significant differences were found in the assessment of the level of these health dimensions between the groups ($p>0.050$).

Discussion

Respiratory infections are common in young children, and their pathogenesis is complex and involves many factors [23]. These include the anatomy and physiology of the respiratory system, vitamin or trace element deficiencies, genetic and environmental factors, and impaired immunity [24]. Both the upper and lower respiratory tracts can become infected, and recurrent lower respiratory tract infections, such as pneumonia, remain the leading cause of infection in children under 5 years of age [18].

Respiratory infections can lead to serious health complications, especially in children whose immune system is still underdeveloped [31]. Identification of risk factors and methods of preventing infections is important in maintaining the health of the child, therefore, this study aimed to learn the principles of prevention of respiratory infections in young children in the context of the assessment of self-efficacy and the level of health locus of control by parents. The final statistical analysis of the study results included responses obtained from 134 parents, the majority of whom were women (85.82%) and parents aged 26-35 (42.54%), with higher education (61.19%).

Due to the cross-sectional nature of our study, in the detailed analyses and summaries, we focused on the general connections between our results and reports in the medical literature without delving into the underlying causes of our data.

One of the most common pathogens causing acute respiratory infections in young children, which are the cause of hospitalization, is RSV. Worldwide, this virus is responsible for 33 million infections and over 3.5 million hospitalizations [37-39]. Recurrent respiratory infections in developed countries occur in 25% of children under one year of age and 18% of children aged 1-4 years [18]. In a study conducted by Kurt et al. [31], it was shown that more than half of the parents of children who attended a nursery (61.7%) indicated frequent respiratory infections, also in the last two weeks. In addition, the vast majority of children (91.5%) received antibiotics. During the study conducted by the authors, the number of COVID-19 cases was high worldwide, but the fact that parents did not report COVID-19 cases in children could be related to the rarely observed and mild symptoms of this disease in children [39,40].

Our studies have shown that respiratory tract infections were most common in children aged 1 to 4 (36.57%) and 5-6 years (34.33%), while newborns (14.18%) and infants (14.92%) suffered from them rarely.

Factors such as parental smoking and asthma may contribute to the development of recurrent respiratory infections in children, but no consensus has been reached [41,42]. Studies by Vardabas et al. [43] have shown significant associations between parental smoking and respiratory infections. In turn, Zhuge et al. [44] found that parental smoking was not associated with respiratory infections in children, while the smell of indoor smoke was a more direct indicator of exposure to respiratory infections. Observations by Qian et al. [45] showed an association between dry cough and the feeling of stuffy, unpleasant odor, moist or dry air, and mold. Parental smoking is one of the identified risk factors for childhood pneumonia, while passive smoking increases the risk of asthma exacerbation in children [41,43]. Very often, parents do not smoke in the presence of children, but smoking on the balcony or near a window when children are not present may also cause smoke to enter the room, which affects the exposure of children to toxic substances resulting from smoking [43].

In our studies, no relationship was found between the frequency of respiratory infections in children and parental smoking and exposure to passive smoking. Most respondents did not smoke cigarettes (73.88%). In addition, 93.28% of respondents stated that they did not expose their children to passive inhalation of tobacco.

The influence of asthma on the development of recurrent respiratory infections is a subject of much discussion. Asthma or other chronic diseases may cause recurrent respiratory infections, e.g. sinusitis, rhinitis, otitis media [21,22,43]. Population studies show that in children with asthma, upper and lower respiratory tract infections occur more often and last longer than in children without allergies and asthma [38,44]. Our own studies have shown that children with asthma had significantly more respiratory infections (41.46%) compared to children who suffered from other chronic diseases (24.73; $\chi^2=3.80$; $p=0.050$).

Breast milk contains many protective factors, such as immunoglobulins, lactoferrin and lymphocytes, which may contribute to reducing infections in infants. Breastfeeding also plays a protective role in respiratory infections, and this role becomes more dominant with increasing breastfeeding duration [46]. Our studies have shown that non-breastfed children were more likely to be exposed to respiratory infections (40.74%) compared to breastfed children (27.10%).

In recent years, there has been growing interest in the potential role of vitamin D₃ in preventing respiratory infections [46]. Vitamin D has immunomodulatory and anti-inflammatory effects, hence some reports confirm a significant decrease in the number of respiratory infections in children receiving vitamin D₃ supplementation. However, the results of some studies in this area are inconclusive. Furthermore, the dosage and duration of vitamin D₃ supplementation varied across studies [47,48]. In a systematic review, Martineau et al. [49] demonstrated that in observational studies, individuals with severe vitamin D deficiency who received daily or weekly supplementation without additional bolus doses experienced greater health benefits.

Statistical analysis of our study did not confirm a significant association between the incidence of respiratory infections and vitamin D₃ supplementation, although the majority of respondents gave their children vitamin D₃ (82.09%; n=110), typically at a dose of 400 to 600 IU/day. However, we found that children who did not receive vitamin D₃ supplementation (17.91%; n=24) had slightly more respiratory infections (36%) compared to children who received vitamin D₃ supplementation (28.44%). However, our study group of parents was relatively small, and it is possible that children received lower doses of vitamin D₃ than recommended for their age. The influence of other environmental factors, including nutrition, on the risk of respiratory infections cannot be ruled out.

Preschool facilities that provide care for children, where they have close contact and social interactions, may be the cause of an increased risk of respiratory infections in children. In addition, greater exposure to infectious agents results from the immaturity of the immune system at this stage of life and insufficient hygiene [11,12,13,50]. Therefore, one of the important preventive measures is to improve the environmental conditions in which children live, ensuring good hygiene, proper nutrition, and physical activity [1,15,22]. It is also necessary to prevent infections through the use of protective vaccinations, which can reduce the burden of infection with some pathogens, the number of prescribed antibiotics, and hospitalizations due to complications in children and adolescents [5,6,8,9,49]. Our studies confirm that children attending kindergarten or nursery had respiratory infections more often (46.67%) than children who did not attend these facilities (16.22%). At the same time, in children whose parents took average care of their hygiene, respiratory infections occurred slightly more often (40%) than in children who had very good personal hygiene (26.26%). However, a significant relationship was found between the frequency of respiratory infections in children and their lifestyle. Children who led an active lifestyle suffered from respiratory infections more often (36.84%) than children who were not active (20.69%). This can be justified by the fact that physically active children have more contact with other peers, which increases the risk of infection. In addition, the respiratory system of young children is more susceptible to infections due to its immaturity.

Our research has shown that most parents vaccinated their children according to the vaccination schedule (86.57%), and 43.28% of surveyed parents also used recommended vaccinations. Children who were not vaccinated with mandatory vaccines had respiratory infections slightly more often (44.44%) than children vaccinated according to the vaccination schedule (27.59%). Also, children who were not vaccinated with recommended vaccines had respiratory infections slightly more often (75%) than vaccinated children (63.79%).

According to the assumptions of the social cognitive theory, the sense of self-efficacy is an element of control over personal action. The higher it is, the more strongly an individual is involved in the intended behavior, even in situations when they encounter obstacles and experience failures. The sense of self-efficacy allows for predicting intentions and actions in various areas of human activity, especially in the field of health behaviors [32,33].

In our studies, it was shown that the majority of parents had a high level of self-efficacy (66.42%). Moreover, in parents who had a high level of self-efficacy, respiratory infections in their children occurred less frequently (74.16%) than in the group with an average (61.54%) or low (66.67%) level of self-efficacy. It was also shown that parents with a high sense of self-efficacy more often vaccinated their child with recommended vaccines (43.82%), gave vitamin D₃ (85.39%), took care of the child's active lifestyle (59.55%), and took very good care of their hygiene (77.53%).

A sense of health locus of control means believing in the impact of health-promoting behaviors on an individual's health and taking actions to protect or improve it.

There are external and internal loci of control. The first assumes that events are determined by factors beyond our control, such as the actions of other people, fate, or chance, while the second involves perceiving the situation as the result of one's actions. People with an internal locus of control take responsibility for their actions, seek information, and make autonomous decisions [32,37]. Conscious health control is directly related to the sense of responsibility for one's health [51].

Our research has shown that in the studied group, health control was the highest in the internal dimension, while lower in the dimension – influence of others, and chance had the smallest influence

on health control. It was also found that parents who took very good care of their child's hygiene had health control located in the external dimension to a higher degree.

Limitations

The largest limitation of our study is the small sample size. The study included only a small group of parents of young children, meaning the results cannot be generalized. Furthermore, our study was limited to a European population. At the same time, validation of research tools for the study group, which should be carried out in the future, was not performed. Our study sample, although conveniently selected through online parenting groups, resulted in only self-assessment data without clinical verification and no confirmation of the family's financial status and housing conditions. The study was based solely on an online survey. Significant information on the prevention of respiratory infections in children could be obtained through in-person interviews with parents, which was not conducted in this study. The study involved parents of young children, who typically have limited time to complete surveys due to childcare requirements. Another limitation of our survey study may have been "memory bias," as some of the information obtained from parents required recall of past events related to their children's health. Furthermore, our study was cross-sectional in nature, meaning that its results only allow for inferences about the co-occurrence of certain phenomena but do not allow for a causal analysis of the relationships between them. Therefore, further research with a larger sample and in-depth analyses using qualitative data are necessary to better understand the prevention of respiratory infections in young children and identify interventions that support parental education. Despite these limitations, the results of our study provide important information on how parents take care of the prevention of respiratory infections in children, taking into account their level of self-efficacy and control over their own health.

Conclusions

When presenting the results of our study, it is important to note that the study group of parents was small, and the data obtained were derived solely from information obtained from respondents and did not include clinical data or verified sociodemographic data. Furthermore, most of the results we obtained were not statistically significant, although they indicated trends in this direction. Parents most frequently took actions to prevent respiratory infections in their children, including vaccinations according to the vaccination schedule and recommended vaccinations, vitamin D₃ supplementation, maintaining their child's personal hygiene, spending regular time outdoors, and avoiding exposure to tobacco smoke. Respiratory infections in our study occurred primarily in children aged 1-4 years, and children attending preschool or daycare were more likely to develop respiratory infections. Higher levels of parental self-efficacy and health control influenced some of their actions to prevent respiratory infections in young children.

Our results may have implications for health promotion and health education through the development of counseling networks to more effectively reach parents who struggle to take preventive measures for their children. The parents should be continuously educated on how to prevent respiratory infections in children and how to take care of their own health. A key role in this education should be played by all members of the therapeutic team, especially doctors, nurses, and midwives, as they interact with parents and their children on various occasions.

Therefore, further comprehensive research with other representative samples is necessary.

Abbreviations

WHO – World Health Organization.

HIV – *Human immunodeficiency virus*.

RSV – Respiratory Syncytial Virus.

WZW B – Hepatitis B.

HIB – Haemophilus influenzae type b.

GSES – Generalized Self-Efficacy Scale.

MHCL: version A – Multidimensional Health Locus of Control Scale.

Chi² – Pearson chi-square test.

Me – Median.

IQR – Interquartile range.

rS – The Spearman rank correlation coefficient.

M – Mean.

SD – Standard deviation.

Q1 – Lower quartile.

Q3 – Upper quartile.

Z – Z-test result for the normal distribution.

P – Level of significance.

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