*ORIGINAL ARTICLE*

Annals of Agricultural and Environmental Medicine 2012, Vol 19, No 1, 141-145
www.aaem.pl

# Social and family-related correlates of medical care utilization by asthmatic children in Upper Silesia, Poland

**Jan E. Zejda[1], Grzegorz M. Brożek[1], Małgorzata Farnik[2], Irena Smółka[1]**

[1] *Department of Epidemiology, Medical University of Silesia, Katowice, Poland*
[2] *Department of Pneumonology, Medical University of Silesia, Katowice, Poland*

Zejda J E, Brożek G M, Farnik M, Smółka I. Social and family-related correlates of medical care utilization by asthmatic children in Upper Silesia, Poland. Ann Agric Environ Med. 2012; 19(1): 141-145.

## Abstract

**Background:** Studies on childhood asthma demonstrate socioeconomic disparities in medical care utilization. A lack of information for Poland prompted our investigation into this question. Its goal was to discover if the utilization of medical services by asthmatic children depends on social and family factors.

**Methods:** Subjects were 186 children with physician-diagnosed asthma, identified through a questionnaire survey of 4,535 school children in Katowice District, Poland. Utilization of medical care was assessed by such past year events as medical visits (44.0%), any diagnostic test (35.4%) and spirometry (30.6%). Association of those events with socioeconomic variables was explored by means of logistic regression, according to the criterion $p \leq 0.1$.

**Results:** After adjustment for disease severity and gender medical visits were related to younger age (p=0.009), family history of respiratory diseases (p=0.08) and rural residence (p=0.09), any diagnostic tests to younger age (p=0.08), smaller number of siblings (p=0.01) and rural residence (p=0.004); spirometry to smaller number of siblings (p=0.09) and rural residence (p=0.006).

**Conclusion:** Clinical status and age are important determinants of utilization of medical services by asthmatic children. The effects of rural residence and family size may reflect a more attentive response to the needs of a sick child.

## Keywords

asthma, child, medical services, population-based study, questionnaire

## INTRODUCTION

The burden of childhood asthma is subject to many international and national initiatives including intervention and control measures aiming at reduction of disability and mortality [1, 2, 3, 4, 5]. Delivery and use of health services play important roles in the public health programmes, and appropriate utilization of medical services by asthmatic children is a necessary tool for control of this chronic disease [4]. A number of asthma studies have described socioeconomic disparities in medical care utilization, seen in terms of access, quality and affordability [6, 7, 8]. The findings show a consistent effect of ethnicity and economic standing of families in addition to severity of asthma and age of a child [9, 10, 11, 12]. Contribution of specific determinants depends on many local circumstances hampering generalizations of published evidence across populations. Social determinants are shaped by provision of health care services (organization, resources), with the important role of availability and accessibility, quality and cost of medical services. Accessibility, on the other hand, includes many components, such as predisposing determinants (demographic and social factors, beliefs), enabling determinants (family and community factors), as well as perceived and evaluated illness-related determinants [13]. Without recognition of the pattern of the medical care utilization on the local level, unequivocal identification of the needs and sound justification of the planned actions are not possible. Such information is not available for Poland, and that fact prompted our interest in the general pattern of the use of medical services by asthmatic children. Our recent population-based questionnaire survey of 4,535 children aged 5-15 years in Katowice District, Poland, yielded 186 cases of physician-diagnosed asthma. The goal of the study was to discover whether – in this group of children – hospitalizations, office medical visits and utilization of basic diagnostic tests were related to asthma severity and other than health-related factors. In particular, the analysis involved a potential contribution of social and family factors, assessed via questionnaire.

## METHODS

Study subjects were 186 children who had diagnosis of asthma established by a physician in the past. They were identified according to the parental answer to the question 'has a doctor ever diagnosed asthma in your child', included in a Polish language version of children's respiratory health questionnaire, based on the ISSAC questionnaire and previously used in a number of studies in Poland [14, 15]. The survey was performed in 2010 in two regions of Katowice District, Poland (Pszczyna and Zywiec). All 6,655 children attending 87 primary and secondary schools in both regions

Address for correspondence: Jan E. Zejda, Department of Epidemiology, Medical University of Silesia, Medykow 18, 40-752 Katowice, Poland.
E-mail: jzejda@sum.edu.pl

Received: 20 April 2011; accepted: 10 March 2012

were invited to participate. Their parents or legal guardians received questionnaires together with explanatory letters. The response rate was 68% (4,535 returned questionnaires).

Data analysis included answers to questions about the following medical care events during the past 12 months: hospitalizations and office medical visits due to respiratory troubles, diagnostic procedures including spirometry, skin prick tests, blood tests for atopy, and chest x-ray. Analysis involved associations of those events with a number of demographic, health-related and social and family-related characteristics, also obtained by questionnaire. Univariate analysis included the assessment of between-group differences by means of chi-square test or Fisher exact test. Results of univariate analyses were verified by means of a multivariable logistic regression providing logistic odds ratios (logOR). Statistical inference was based on the criterion $p<0.05$ (univariate analyses) and $p\leq0.1$ (multivariate analyses). The study protocol was approved by the Ethics Committee of the Medical University of Silesia, and informed written consent was obtained from all subjects. All analyses were performed using SAS statistical package.

## RESULTS

All 186 asthmatic children included in our study were aged between 6-16 years (mean: 11.1 years, standard deviation: 2.2 years). Their mean age at diagnosis of asthma was 3.9±2.9 years, and mean duration of the disease 6.6±3.2 years. In the past 12 months, 10 asthmatic children (5.4%) underwent respiratory-related hospitalization and 82 (44.1%) were seen by a physician (office medical visits), 66 (35.5%) had at least one asthma-related diagnostic procedure in the past year, 56 (30.1%) had spirometry, and 46 (24.7%) skin prick tests. Blood testing for atopy was performed in 19 (10.2%) and chest x-ray in 7 (3.7%) children. Of the above-mentioned events, only hospitalizations, office medical visits, spirometry, and any diagnostic procedures were retained for analyses concerning utilization of health services (blood testing for atopy, skin prick tests and x-ray examination are not necessary procedures in the management of diagnosed asthma).

Table 1 shows the group distribution of social and family-related variables analyzed as potential correlates of medical services utilization in the past 12 months.

**Table 1.** Societal and family-related health characteristics analyzed as potential correlates of medical services utilization in the past 12 months in a group of 186 asthmatic children

| Characteristic | N | % |
|---|---|---|
| Age below 10 years | 50 | 26.8 |
| Male gender | 114 | 61.6 |
| Education of mother: high school + | 98 | 53.5 |
| Education of father: high school + | 66 | 37.9 |
| Number of siblings: 2 + | 63 | 34.0 |
| Rural residence | 145 | 78.8 |
| Asthma in mother | 11 | 5.9 |
| Asthma in father | 8 | 4.3 |
| Chronic lung disease or allergic disorders in mother | 76 | 40.8 |
| Chronic lung disease or allergic disorders in father | 52 | 27.9 |

The univariate effects of the variables included in Table 1 on hospitalization and medical visits are shown in Table 2. Both outcomes depended on age (more frequent in younger children ($p<0.05$), and were associated with attacks of asthma ($p<0.05$). Because of the statistically significant association between maternal and paternal education levels ($p<0.0001$) the Table includes a composed variable, named parental education (higher maternal or paternal education vs. otherwise). Similarly, a composed variable was used to describe a history of asthma in a parent. The small number of parental asthma cases (n=11) justified definition of another composed variable, parental history of lung diseases or allergies (diagnoses of chronic bronchitis or asthma or allergies).

**Table 2.** Respiratory hospitalizations and office medical visits in the past 12 months according to potential correlates of utilization of medical services in a group of 186 asthmatic children. The table shows frequencies (N, %) and statistical significance of differences (p values).

| | Hospitalization | | Office Medical Visits | |
|---|---|---|---|---|
| | N (%) | P value | N (%) | p value |
| Age | | | | |
| < 10 years | 9 (18.0) | <0.0001 | 31 (62.0) | 0.002 |
| 10+ years | 1 (0.7) | | 51 (37.5) | |
| Gender | | | | |
| Male | 4 (3.5) | 0.1 | 49 (42.9) | 0.7 |
| Female | 6 (8.4) | | 32 (45.0) | |
| Asthma attacks (past year) | | | | |
| Yes | 7 (11.2) | 0.01 | 51 (82.2) | <0.0001 |
| No | 3 (2.4) | | 31 (25.0) | |
| Parental asthma | | | | |
| Yes | 1 (5.5) | 0.9 | 10 (55.5) | 0.3 |
| No | 9 (5.3) | | 72 (42.8) | |
| Lung disease/allergy in parents | | | | |
| Yes | 4 (4.0) | 0.3 | 48 (48.4) | 0.1 |
| No | 6 (6.9) | | 34 (39.0) | |
| Parental education | | | | |
| High school + | 7 (6.0) | 0.5 | 54 (46.9) | 0.3 |
| < High school | 3 (4.2) | | 28 (39.4) | |
| Number of siblings | | | | |
| 2+ | 3 (4.7) | 0.8 | 27 (42.8) | 0.8 |
| < 2 | 7 (5.7) | | 54 (44.2) | |
| Residence | | | | |
| Rural | 7 (5.7) | 0.4 | 67 (46.2) | 0.3 |
| Urban | 3 (4.7) | | 15 (38.4) | |

As shown in Table 3, any diagnostic procedures were linked to attacks of asthma, rural residence, and were more frequent in children of smaller families ($p<0.05$). Spirometry was more frequent in children with attacks of asthma and with rural residence ($p<0.05$).

The results of univariate analyses were verified by logistic regression with the following set of independent variables: age group, gender, attacks of asthma, lung disease or allergy in parents, parental education, number of siblings and rural/urban residence (Table 4).

After adjustment for the statistically significant effect of severity of asthma (for all analyzed outcomes $p<0.1$), hospitalizations and office medical visits were associated with younger age and rural residence, and medical visits additionally with a history of lung diseases in parents ($p<0.1$). On the other hand, the utilization of any diagnostic procedures and of spirometry was mostly related to rural residence and smaller number of siblings in a family, in addition to the effect of child's age and male gender for diagnostic procedures.

**Table 3.** Any diagnostic tests and spirometry testing in the past 12 months according to potential correlates of utilization of medical services in a group of 186 asthmatic children. The table shows frequencies (N, %) and statistical significance of differences (p values)

| | Any Diagnostic Test | | Spirometry | |
|---|---|---|---|---|
| | N (%) | P value | N (%) | p value |
| Age | | | | |
| < 10 years | 23 (46.0) | 0.06 | 17 (34.0) | 0.4 |
| 10+ years | 43 (31.6) | | 39 (28.6) | |
| Gender | | | | |
| Male | 44 (38.6) | 0.2 | 37 (32.4) | 0.4 |
| Female | 22 (30.9) | | 19 (26.7) | |
| Asthma attacks (past year) | | | | |
| Yes | 31 (50.0) | 0.003 | 25 (40.3) | 0.03 |
| No | 35 (28.2) | | 31 (25.0) | |
| Parental asthma | | | | |
| Yes | 4 (22.2) | 0.2 | 2 (11.1) | 0.06 |
| No | 62 (36.9) | | 54 (32.1) | |
| Lung disease/allergy in parents | | | | |
| Yes | 37 (37.3) | 0.5 | 31 (31.3) | 0.7 |
| No | 29 (33.3) | | 25 (28.7) | |
| Parental education | | | | |
| High school + | 46 (40.0) | 0.1 | 38 (33.0) | 0.2 |
| < High school | 20 (28.1) | | 18 (25.3) | |
| Number of siblings | | | | |
| 2+ | 15 (23.8) | 0.01 | 14 (22.2) | 0.08 |
| < 2 | 51 (41.8) | | 42 (34.4) | |
| Residence | | | | |
| Rural | 59 (40.6) | 0.008 | 51 (35.1) | 0.007 |
| Urban | 7 (17.9) | | 5 (12.8) | |

**Table 4.** Statistical determinants of utilization of medical services in the past 12 months in a group of 186 asthmatic children. The table shows results of a multivariate logistic regression analysis: logistic odds ratios, their 95% confidence intervals (in the brackets) and p vales of regression coefficients

| Explanatory Variable | Hospitalization | Medical Visits | Diagnostic Test (any) | Spirometry |
|---|---|---|---|---|
| Age below 10 years | 29.59 (3.45-253.33) p = 0.002 | 3.00 (1.30-6.94) p = 0.009 | 1.93 (0.91-4.10) p = 0.08 | 1.27 (0.59-2.72) p = 0.5 |
| Male gender | 0.44 (0.09-2.04) p = 0.3 | 1.09 (0.51-2.35) p = 0.8 | 1.85 (0.92-3.74) p = 0.08 | 1.56 (0.77-3.15) p = 0.2 |
| Asthma attacks (past year) | 4.85 (0.95-24.55) p = 0.05 | 17.70 (7.59-41.28) p < 0.0001 | 2.63 (1.32-5.24) p = 0.005 | 2.06 (1.03-4.12) p = 0.03 |
| Lung disease or allergy in parents | 0.50 (0.11-2.22) p = 0.3 | 1.94 (0.92-4.10) p = 0.08 | 1.27 (0.66-2.47) p = 0.4 | 1.19 (0.61-2.32) p = 0.6 |
| Parental education: high school + | 0.92 (0.16-5.26) p = 0.9 | 1.33 (0.60-2.93) p = 0.4 | 1.44 (0.71-2.94) p = 0.3 | 1.30 (0.63-2.67) p = 0.4 |
| Number of siblings: below 2 | 0.64 (0.11-3.61) p = 0.6 | 0.73 (0.33-1.61) p = 0.4 | 2.40 (1.15-5.01) p = 0.01 | 1.88 (0.90-3.95) p = 0.09 |
| Rural residence | 0.63 (0.11-3.46) p = 0.05 | 2.26 (0.87-5.87) p = 0.09 | 4.05 (1.56-10.52) p = 0.004 | 4.22 (1.50-11.87) p = 0.006 |

## DISCUSSION

Our study found that the utilization of medical services by asthmatic children in Katowice District, Poland, depends on social and family-related factors, after adjustment for the severity of asthma. Among the explored characteristics, the age of a child and number of siblings, place of residence (rural/urban) and parental asthma showed statistically significant effects on the utilization of medical services. Age appeared to correlate mostly with hospitalization and medical visits. Younger asthmatic children have more hospitalizations [16]. In our study, hospitalizations were also more frequent among younger children and in children with advanced symptoms. Such a profile supports the view that the rate of hospitalizations of asthmatic children can serve as a general marker for control of the disease at the outpatient health care level [17]. Younger age could serve as a marker of shorter duration of the disease. It cannot be excluded that a recently established diagnosis of asthma stimulates more clinical and parental attention, thus explaining more medical visits and more diagnostic tests in that period. Of interest, however, is the lack of association between younger age and spirometric testing. That finding could be related to perceived technical difficulties of lung function testing in young children.

A strong effect of rural living on the use of diagnostic procedures and medical visits could be discussed not only in terms of individual attitudes to the use of medical services, but also as the influence of specific health-oriented attributes of the community culture affecting health behavior of families [13]. In Poland, rural residents are known to cultivate a more traditional lifestyle than urban residents. That feature could shape the level of parental care of a sick child, perhaps predisposing to better parental attention to disease-related needs, and better compliance with medical advice regarding specific diagnostic measures. Such an interpretation could be supported by our finding that utilization of diagnostic procedures is more frequent among families with fewer children. A smaller number of children in a family could create a better environment to address and respond to the needs of a sick child.

Social and family-related correlates identified in our study, namely rural living and number of siblings, correspond with a conceptual model in which the demand for health services depends on individual and household factors, community factors and prices [18]. In Poland, the issue of fee/prices in paediatric health care is not a critical concern. All children have an equal access to the free of charge national health service, the mostly used primary health care sector in paediatrics in our country. Moreover, distribution and accessibility of paediatric primary health care resources in both settings, urban and rural, are comparable, at least in the region of our study. Family income and health insurance coverage are not important barriers to paediatric health care access in Poland.

Family size and parental education did not determine hospitalizations. Published data show that among the socioeconomic determinants of hospitalizations, poverty and ethnic differences are known to play an important role [6, 12]. Similar factors, as well as social insurance status and quality of primary health care, were found to affect the utilization of office medical visits [9, 10, 11]. In Poland, ethnic disparities virtually do not exist and – at least in our source population – income disparities are not large. Moreover, the access to hospital care and primary health care is equal for all sick children, in all regions. The effect of rural living on office medical visits could reflect the above-discussed role of traditional lifestyle. In general, the urban-rural differences found in our study could hardly be explained by the amount

of time spent by mothers outside the home – 76.3% of urban and 69.4% of rural mothers were professionally active.

Our study confirmed the dominant role of the severity of asthma among determinants of utilization of medical care services. The occurrence of attacks of asthma was the most convincing marker of disease severity available in our analysis of questionnaire-derived data. It might be intriguing that only 33.3% of asthmatic children were reported to have those symptoms in the past year. However, such an observation is not isolated – even some patients (in a clinical setting) do not report their symptoms during medical examination [19]. The finding could have reflected a mild course of the remaining cases, low readiness of parents to report mild symptoms or sufficient control of the disease. Attacks of asthma were also strongly associated with office medical visits and diagnostic procedures, and such links are not unexpected. The occurrence of symptoms is a leading indication for medical assessment, including lung function testing. A relatively weak statistical effect in relation to hospitalization could have resulted from the small number of hospitalizations. That finding is in line with a low admission rate to hospital for asthma-related problems [16].

Some other findings of our study deserve attention. First of all, a large proportion of asthmatic children did not report attacks of asthma (past year). That observation could suggest a satisfactory control of asthma, particularly if asthma was mild. The issue is difficult to resolve – current treatment of asthma was reported by 97% of children with asthma attacks and 43% of children without asthma attacks; past year medical visits were found in 82% of children with and in 24% of children without asthma attacks. On the other hand, it could be argued that some cases included in our study were false positive diagnoses, especially that even one-third of physician-diagnosed asthma could represent so called over-diagnosis [20, 21]. Our study protocol, however, precluded verification of that suspicion. Nevertheless, the low frequency of asthma in the examined population (4%), as well as the recognized problem of under-diagnosis of asthma in Poland (including the study region), do not seem to support such an explanation [22, 23].

Another important finding was an infrequent utilization of lung function testing. Our study showed that only one-third of asthmatic children had spirometric assessment in the past year. Although disturbing, this figure is not surprising. Lung function testing is a clearly underused procedure both in a primary and in secondary care settings, and not only in Poland [20]. The exact reasons for such a situation remain unknown. Every-day experience points to perceived technical difficulties, resulting in unsatisfactory collaboration of examined children. However, reliable forced exhalation maneuvers can be performed by most school-age children, at least during a symptom-free period [1].

The presented study has some limitations. First of all, analysis involved data obtained via a standard respiratory health questionnaire. As a consequence, the spectrum of explored correlates of health care utilization and of medical services was limited, and the precision of the information was defined by the wording of the questions. However, the wording of the questions helped the responders to provide clear answers, and the answers allowed the identification of biologically plausible associations, such as apparent impact of disease severity on the utilization of medical services. From that perspective, the findings should not be ignored as they highlight areas that deserve further, more specific research. Another limitation stems from the fact that potential determinants and modes of medical services analyzed in our study reflected the current status in the past year. It remains unknown to what extent the picture is representative for earlier experiences. However, even if the presented study did address events that occurred prior to the past year, the quality of evidence could still be open to discussion because of its cross-sectional design. Our study did not analyze the contribution from the specialized care of asthmatic children. In Poland, almost all childhood asthma is diagnosed and managed by primary care paediatricians who have access to diagnostic and therapeutic guidelines for asthma management. Moreover, given the organization of the national health service and its infrastructure, specialized care is similarly accessible to urban and rural children. Hence, the decisive factor is rather on demand than on a supply, and such a conclusion seems to be supported by the results of the presented study.

## CONCLUSIONS

In conclusion, studies on health care utilization by children with asthma offer an insight into potential ways for improving the management and control of the disease. Convincing published evidence on disparities in this respect comes from analyses of existing large data sets, run within health care registries. Population-based questionnaire surveys offer more insight into barriers to optimal utilization of medical services. Despite study limitations, the findings of the presented study confirm that the utilization of medical services by asthmatic children depends on their health status. The utilization of diagnostic procedures that are essential in regular monitoring and management of the disease appeared to depend on such family-related factors as parental history of asthma, and number of children. These associations probably reflect parental awareness of disease-related needs, and the level of parental care for a sick child. The role of family factors, such as attitudes and preferences in relation to the needs of a sick child, is also suggested by the consistent effect of rural living, favouring a traditional lifestyle with its family-oriented norms and behaviours. In addition to the evidence concerning correlates of the utilization of medical services, the presented study shows that only half of the children with diagnosed asthma have an annual medical check-up, and that only one-third of the asthmatic children have current spirometric assessment. Both findings indicate a need for improvement in the primary care management of childhood asthma in the study region.

### Acknowledgements

This work was supported by the university intramural research grant 'Epidemiology of childhood asthma in the Silesia Voivodship, Poland' (Medical University of Silesia, Katowice, Poland).

## REFERENCES

1. Bacharier LB, Boner A, Carlsen KH, Eigenmann PA, Frischer T, Gotz M, et al. Diagnosis and treatment of asthma in childhood: a PRACTALL consensus report. Allergy. 2008; 63: 5-34.

2. Bousquet J., Ansotegui IJ, van Ree R, Burney PG, Zuberbier T, van Cauwenberge P. European Union meets the challenge of the growing importance of allergy and asthma in Europe. Allergy. 2004; 59: 1-4.
3. Dahl R, Bjermer L. Nordic consensus report on asthma management. Nordic Asthma Consensus Group. Respir Med. 2000; 94: 299-327.
4. Global Strategy for Asthma Management and Prevention. The Global Initiative for Asthma 2006. www.ginasthma.org. (access: 25.01.2011).
5. National Asthma Education and Prevention Program: The Expert Panel Report 3 (EPR–3) Full Report 2007: Guidelines for the Diagnosis and Management of Asthma. National Institutes of Health publication No. 07-4051. www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm (access: 25.01.2011).
6. Akinbami LJ, Schoendorf KC. Trends in childhood asthma: prevalence, health care utilization, and mortality. Pediatrics. 2002; 110: 315-322.
7. Finkelstein JA, Brown RW, Schneider LC, Weiss ST, Quintana JM, Goldmann DA, et al. Quality of care for preschool children with asthma: the role of social factors and practice setting. Pediatrics. 1995; 95: 389-394.
8. Kattan M, Mitchell H, Eggleston P, Gergen P, Crain E, Redline S, et al. Characteristics of inner-city children with asthma: the National Cooperative Inner-City Asthma Study. Pediatr Pulmonol. 1997; 24: 253-262.
9. Kim H, Kieckhefer GM, Greek AA, Joesh JM, Baydar N. Health care utilization by children with asthma. Prev Chron Dis. 2009; 6: A12. www.ncbi.nlm.nih.gov/pmc/articles/PMC2644592/?tool=pubmed. (access: 25.01.2011).
10. Piper CN, Glover S, Elder K, Baek JD, Wilkinson L. Disparities in access to care among asthmatic children in relation to race and socioeconomic status. J Child Health Care. 2010; 14: 271-279.
11. Seid M, Opipari-Arrigan L, Gelhard LR, Varni JW, Driscoll K. Barriers to care questionnaire: reliability, validity, and responsiveness to change among parents of children with asthma. Acad Pediatr. 2009; 9: 106-113.
12. Smith MJ, Rascati KL, Barner JC. A descriptive analysis of asthma-related medical services and prescription utilizing among recipients in a Medicaid program. J Asthma. 2005; 42: 447-453.
13. Andersen R, Newman JF. Societal and individual determinants of medical care utilization in the United States. The Milbank Quarterly. 2005; 83: 1-28.
14. Brożek M, Zejda JE, Kowalska M, Gębuś M, Kępa K, Igielski M. Opposite trends of allergic disorders and respiratory symptoms in children over a period of large-scale ambient air pollution decline. Pol J Environ Stud. 2010; 19: 1133-1138.
15. Leonardi GS, Houthuijs D, Nikiforov B, Volf J, Rudnai P, Zejda J, et al. Respiratory symptoms, bronchitis and asthma in children of Central and Eastern Europe. Eur Respir J. 2002; 20: 890-898.
16. Uijen JH, Schellevis FG, Bindels PJE, Willemsen SP, van der Wouden JC. Low hospital admission rates for respiratory diseases in children. BMC Family Practice. 2010; 11: 76. www.ncbi.nlm.nih.gov/pmc/articles/PMC2958964/?tool=pubmed. (access: 25.01.2011).
17. Homer CJ, Szilagyi P, Rodewald L, Bloom SR, Greenspan P, Yazdgerdi S, et al. Does quality of care affect rates of hospitalization for childhood asthma? Pediatrics. 1996; 98: 18-23.
18. Ensor T, Cooper S. Overcoming barriers to health service access: influencing the demand side. Health Policy Plann. 2004; 19: 69-79.
19. Siersted HC, Boldsen J, Hansen HS, Mostgaard G, Hyldebrandt N. Population based study of risk factors for underdiagnosis of asthma in adolescence: Odense schoolchild study. BMJ. 1998; 316: 651-657.
20. Contoli M, Papi A. When asthma diagnosis becomes a challenge. Eur Respir J. 2010; 36: 231-233.
21. Luks VP, Vandemheen KL, Aaron SD. Confirmation of asthma in an era of overdiagnosis. Eur Respir J. 2010; 36: 255-260.
22. Doniec Z, Wroński M, Willim G, Pisiewicz K, Kurzawa R. Czy astma oskrzelowa u dzieci jest nadal chorobą „niedodiagnozowaną"? [Is bronchial asthma In children still „underdiagnosed" disease?]. Acta Pneumonol Allergol Pediatr. 2001; 4: 56-60.
23. Kuprys-Lipińska I, Elgalal A, Kuna P. Niedodiagnozowanie i brak właściwej terapii astmy – badanie populacji ogólnej mieszkańcow województwa łódzkiego (Polska) [The underdiagnosis and undertreatment of asthma in general population of the Lodz Province (Poland)]. Pneumonol Alergol Pol. 2010; 78: 21-27.