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ORIGINAL ARTICLE

Antibiotics prescription and complementary tests based on frequency of use and loyalty in Primary Care☆,☆☆

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Medical overuse;
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Abstract
Objective: To assess whether there is a relationship between the prescription of antibiotics and the performance of complementary tests with frequency of use and loyalty in Primary Care.
Methods: Analytical descriptive study performed through a network of Primary Care sentinel paediatricians (PAPenRed). Each paediatrician reviewed the spontaneous visits (in Primary Care and in Emergency Departments) of 15 patients for 12 months, randomly chosen from their quota. The prescription of antibiotics and the complementary tests performed on these patients were also collected.
Results: A total of 212 paediatricians took part and reviewed 2,726 patients. It was found that 8.3% were moderate over-users (mean + 1–2 standard deviations) and 5.2% extreme over-users (mean + 2 standard deviations). Almost half (49.6%) were high-loyalty patients (more than 75% of visits with their doctor).

The incidence ratio of antibiotic prescriptions for moderate over-users was 2.13 (1.74–2.62) and 3.25 (2.55–4.13) for extreme over-users, compared to non-over-user children. The incidence ratio for the diagnostic tests were 2.25 (1.86–2.73) and 3.48 (2.78–4.35), respectively.

The incidence ratios for antibiotic prescription were 1.34 (1.16–1.55) in patients with medium-high loyalty, 1.45 (1.15–1.83) for medium-low loyalty, and 1.08 (0.81–1.44) for those with low loyalty, compared to patients with high loyalty. The incidence ratios to perform diagnostic tests were 1.46 (1.27–1.67); 1.60 (1.28–2.00), and 0.84 (0.63–1.12), respectively.

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Conclusions: Antibiotics prescription and complementary tests were significantly related to medical overuse. They were also related to loyalty, but less significantly.

PALABRAS CLAVE
Hiperfrecuentación;
Agentes antibacterianos;
Uso de medicamentos;
Técnicas diagnósticas;
Pediatría;
Atención Primaria

Prescripción de antibióticos y realización de pruebas complementarias en función de la frecuentación y de la fidelización en Atención Primaria

Resumen
Objetivo: Valorar si existe relación entre la prescripción de antibióticos y la realización de pruebas complementarias con la hiperfrecuentación y la fidelización de los pacientes.
Métodos: Estudio descriptivo que se realizó a través de una red de pediatras centinela de Atención Primaria (PAPenRed). Cada pediatra revisó las visitas espontáneas (en Atención Primaria y en centros de urgencias) durante 12 meses de 15 pacientes escogidos aleatoriamente de su cupo. También se recogió la prescripción de antibióticos y las pruebas complementarias realizadas a estos pacientes.
Resultados: Participaron 212 pediatras que revisaron a 2.726 pacientes. Un 8,3% fueron hiperfrecuentadores moderados (número de consultas entre +1 y +2 desviaciones estándar) y 5,2% hiperfrecuentadores extremos (número de consultas > 2 desviaciones estándar). Un 49,6% fueron pacientes de alta fidelización (más del 75% de visitas con su pediatra).

La razón de tasas de prescripción de antibióticos para hiperfrecuentadores moderados fue 2,13 (1,74-2,62) y la de hiperfrecuentadores extremos 3,25 (2,55-4,13) respecto a no hiperfrecuentadores. Las razones de tasas de realización de pruebas complementarias fueron 2,25 (1,86-2,73) y 3,48 (2,78-4,35), respectivamente.

Las razones de tasas de prescripción de antibióticos fueron 1,34 (1,16-1,55) en pacientes de fidelización media-alta, 1,45 (1,15-1,83) para fidelización media-baja y 1,08 (0,81-1,44) para los de baja fidelización respecto a los de alta fidelización. Para la realización de pruebas complementarias las razones de tasas fueron 1,46 (1,27-1,67); 1,60 (1,28-2,00) y 0,84 (0,63-1,12), respectivamente.
Conclusiones: La prescripción de antibióticos y la realización de pruebas complementarias se relacionaron significativamente con la hiperfrecuentación. También se relacionaron con la fidelización, pero de manera menos importante.

Introduction

Frequent attendance to health care facilities is a problem associated with a substantial consumption of resources. In Spain, it is estimated that 14%–15% of paediatric patients are high-frequency (HF) users of health care services and that this subpopulation consumes more than one third of the working time of health professionals.[1] For this reason, numerous studies have been investigating the factors that may lead to this excessive use with the aim of intervening and optimising health care quality.[2–6] Several factors have been described in relation to high-frequency use, such as age or the presence of certain disease patterns.[1–3,7,8]

High-frequency use of health care services raises concerns as to the pressure that these users exert on health professionals to prescribe treatments more frequently,[9,10] even in the absence of a disease that clearly indicates their use. There is also evidence that pressure from family members and recurrent visits may be associated with an increased use of diagnostic tests (DTs).[11] In addition to causing discomfort or potentially being hazardous to patients, these DTs do not appear to reassure users regarding the disease,[12] so they could be dispensed with in many instances. There is also evidence that the likelihood of DTs being ordered for any given condition varies depending on the level of care of the facility (hospital/primary care) or the type of professional managing the patient (general practitioner/paediatrician/resident physician).[11,13,14]

When it comes to pharmacological treatment, antibiotic prescription is particularly important in paediatrics, as these drugs are used frequently in the early years of life. It is well known that their indiscriminate use may pose a public health problem due to the development of antimicrobial resistance.[15,16] As is the case with DTs, the use of antibiotics varies widely between countries,[15] levels of care[14] and types of prescribing professionals.[17,18] There is also considerable variation in the antibiotics prescribed and the degree of adherence to clinical practice guidelines.[18,19] The current evidence suggests that despite the differences between countries, health care outcomes

are the same, which means that a sizable proportion of prescribed interventions could be avoided.[15,20]

Given the considerable variability evinced in studies on HF users between different types of health professionals and levels of care,[11,17,18] we wondered whether patients that seek services in various facilities may be more exposed to antibiotic prescription and undergo more DTs compared to those that routinely visit their usual paediatrician. Thus, patient loyalty (PL) to their main physician could be another significant factor in antibiotic prescription and the ordering of DTs, although we were unable to find any studies on this subject.

Thus, we hypothesised that high-frequency attendance by paediatric patients results in increased ordering of DTs and antibiotic prescription compared to the rest of the paediatric population, especially in patients with that are less loyal to their assigned paediatrician. The aim of this study was to explore this potential association.

Methods

Study design and setting

We conducted an observational study on antibiotic prescription and DT ordering in relation to frequency of health care use and PL to the assigned paediatrician.

We conducted the study through the sentinel paediatrician network of the Asociación Española de Pediatría de Atención Primaria (PAPenRed), which comprises 320 paediatricians employed in the Spanish public health system with representation of every autonomous community in the country. To participate in the study, paediatricians needed to have access to the records of emergency departments in their region's referral hospital and of urgent primary care services in their area.

Period under study

We collected data between July and October 2016.

Sample selection and data collection

During the period under study, the collaborating paediatricians reviewed the medical records of up to 15 patients in their caseloads.

Patients were selected based on a randomly generated matrix of 15 letter pairs. Paediatricians selected the first patient in their caseload whose paternal last name started with those two letters. If there were no matches, the second letter was changed following the order of the alphabet until a last name matched. If 2 or more patients had the same matching paternal last name, the one whose maternal last name was first in alphabetical order was selected. When two patients were a match and had the same two last names, the one whose given name was first in alphabetical order was selected.

We collected data for the 12 months preceding the date when the medical records were reviewed. We only took into account visits scheduled on demand by the patient, thus excluding visits initiated by health professionals and routine checkups. The sources of data were the primary care medical records and the records of visits to public emergency care facilities in the area. If any of the pertinent data were missing from the records, the paediatrician contacted the family to obtain information. Paediatricians then filled out the form for each patient and submitted it through the network.

The inclusion criteria were age greater than 12 months and having been in the caseload of the collaborating paediatrician for more than 12 months.

Study sample

The population aged 14 years or younger in Spain as of January 2014 comprised 7 066 954 individuals according to data of the Instituto Nacional de Estadística (National Institute of Statistics, INE). Taking this into account, we sought to include a minimum of 1,500 patients, which would result in a margin of error of 2.5% for a 95% confidence level for the entire paediatric population residing in Spain. We made the calculations assuming the case of maximum uncertainty.

Variables

We collected data on the following variables:

Patient characteristics: date of birth, sex, origin (Spanish native or immigrant), private health insurance in addition to public health insurance, single-family household, parental employment, parental educational attainment, first-born status, usual carer of the child, attendance to child care facility (in children aged <3 years), presence of chronic disease and, if present, which disease. We defined *chronic disease* as any disease lasting at least 6 months that required pharmacological treatment for at least 1 month, or any significant congenital syndrome or malformation that could have an impact on morbidity.

Frequency of health care use and PL: number of visits to assigned paediatrician, number of visits to other paediatricians in the same facility, number of visits to any urgent care services at the primary care level, number of visits to hospital emergency department. We classified all the documented visits based on morbidity as benign acute illness that did not justify a visit, acute illness justifying a visit, exacerbation of chronic disease, psychosocial consultation, visit without disease (adapted from Starfield et al.[7]).

Antibiotic prescription (we recorded the number of prescriptions made at the primary care or emergency care level for each patient in the 12-month study period): number of prescribed courses of penicillins, penicillins with β-lactamase inhibitors, cephalosporins, macrolides and other antibiotics.

Diagnostic tests (we recorded the total number of DTs performed in each patient at the primary care or emergency care level during the 12-month study period): number of radiographs, ultrasound examinations, urine cultures, stool cultures or stool parasite exams, blood tests and other DTs.

Ethical considerations

The activity of the PAPenRed has been approved by the Board of Ethics and Scientific Research of Aragon (Resolution no. 19/2013; CP-cI PI13/00154).

Statistical analysis

We performed a descriptive analysis of the sample under study. We calculated the rate of antibiotic prescription and of performance of DTs per patient per year. We calculated rates for the overall sample and by age group (0–2 years, 3–6 years and 7–14 years).

To analyse frequency of use, we defined 3 groups: no HF use, moderate HF use (total number of visits greater than the mean number of visits +1 SD and lower than the mean number of visits +2 SD for the corresponding age group) and extreme HF use (total number of visits greater than the mean number of visits +2 SD for the corresponding age group).

To analyse loyalty, we defined 4 groups based on the percentage of visits that each patient had made to their paediatrician compared to the total visits made by the patient: high PL (>75%), medium-high PL (50%–75%), low-medium PL (25%–50%) and low PL (<25%).

We calculated rate ratios to compare HF users versus not HF users, and rate ratios to compare the medium and low PL groups with the high PL group. If we found statistically significant differences between groups in any of the variables in the bivariate analysis ($P < .05$), we performed a negative binomial regression analysis. The dependent variable was the count of antibiotic prescriptions or DTs performed, and the independent variable the frequency of use or PL, adjusting the regression model for those variables for which we had found statistically significant differences.

We performed the statistical analysis with the software SPSS version 20.0.

Results

We collected data for 2,859 patients, and the final sample included 2,726 patients for which the data were valid and included in the analysis. We excluded 133 patients because they did not meet the inclusion criteria or data were missing in their forms. A total of 212 paediatricians in the network participated in the study. We excluded the 11 network paediatricians from the Region of Murcia because they did not have access to emergency care records.

Frequency of health care use

The mean number of visits was 11.4 ± 8.5 in the 0-to-2 years age group, 8.0 ± 6.8 in the 3-to-6 years age group and 4.4 ± 4.4 in the 7-to-14 years age group. In the total sample, the percentage of moderate HF users was 8.3% and the percentage of extreme HF users was 5.2%; these percentages were similar in every age group.

Table 1 compares the variables under study in patients with extreme HF use, moderate HF use and no HF use. Since there is previous published evidence of an association between the number of diseases present in individual patients and the frequency of use, we compared this variable between groups and found a clear difference.

Table 1 Comparison of extreme HF users, moderate HF users and non-HF users.

	Extreme HF use	Moderate HF use	No HF use	P[a]
Age in years (mean ± SD)	6.79 ± 3.74	7.02 ± 3.71	7.63 ± 3.98	.007
Male sex (%)	52.2	56.2	51.1	.485
Immigrant (%)	16.3	17.7	23.1	.039
Single-parent household (%)	13.5	13.8	8.3	.004
Private insurance (%)	6.1	7.2	14.3	.001
At least 1 parent employed (%)	94.6	91.1	94.8	.151
At least 1 parent with university education (%)	37.5	38.3	43.9	.094
Only child (%)	41.1	40.7	37.3	.422
Mother was not the usual caregiver (%)	14.9	16.0	18.1	.121
Attended child care (% of children aged <3 years)	60.6	63.6	54.4	.426
Chronic illness (%)	46.1	38.9	20.1	<.001
Number of types of morbidity (%)[b]				<.001
Only 1 type	1.4	1.8	30.5	
2 types	17.0	25.2	42.8	
3 types	36.9	45.1	22.1	
4 types	32.6	20.8	4.3	
5 types	12.1	7.1	0.3	

[a] Continuous variables compared by ANOVA and categorical variables compared using the χ^2 test.
[b] We calculated the percentage of patients with 1, 2, 3, 4 or 5 types of morbidity in the groups of total visits per patient defined in the study.

Table 2 Comparison of patient loyalty groups.

	Low PL	Low-medium-low PL	Medium-high PL	High PL	P[a]
Age in years (mean ± SD)	8.81 ± 3.81	7.03 ± 3.88	6.99 ± 3.92	7.42 ± 3.94	<.001
Male sex (%)	51.6	54.2	53.3	51.7	.838
Immigrant (%)	24.9	20.8	24.7	20.0	.051
Single-parent household (%)	8.0	9.1	10.1	8.4	.573
Private insurance (%)	14.2	10.1	9.6	14.4	.020
At least 1 parent employed (%)	91.3	93.4	94.7	95.0	.516
At least 1 parent with university education (%)	36.2	38.7	40.0	43.1	.135
Only child (%)	42.1	41.7	38.3	36.7	.288
Mother was not the usual caregiver (%)	17.1	15.5	13.3	12.8	.480
Attended child care (% of children aged <3 years)	45.2	59.5	58.4	54.4	.497
Chronic illness (%)	13.6	21.3	23.6	26.7	<.001
HF users (%)	97.31.41.3	83.8 11.6 4.6	81.4 10.4 8.2	86.68.74.7	<.001
Not HF users					
Moderate HF users					
Extreme HF users					

[a] Continuous variables compared by ANOVA and categorical variables compared using the χ^2 test.

Patient loyalty

Overall, the use of the different health care services by the patients was the following: visits to the assigned paediatrician (69%), visits to other paediatricians in the same clinic (9%), visits to urgent care services at the primary care level (11%) and visits to hospital emergency departments (11%).

The percent distribution of patients by PL group was the following: high PL, 49.6% of the sample; medium-high PL, 33.8%; low-medium PL, 7.9%; and low PL, 8.7%.

Table 2 compares the different groups. In this comparison, we also found an association between frequency of use and PL.

Antibiotic prescription

Out of the total prescriptions issued for antibiotic treatment, the percentages that corresponded to each type were the following: penicillins (51%), penicillins with β-lactamase inhibitors (22%), macrolides (14%), cephalosporins (3%) and other (10%).

Table 3 shows the rates of antibiotic prescription, overall and by type of antibiotic.

Diagnostic tests

The diagnostic test ordered most frequently was the plain radiograph (23% of all performed diagnostic tests). It was followed by decreasing order by blood tests (19%), urine strip tests (14%), rapid strep test (14%), urine culture (7%), stool culture/parasite testing (7%), ultrasound examination (5%), throat swab (2%). Other types of DTs amounted to 9% of the total.

Table 4 shows the rates of DT performance.

Association of high-frequency use and patient loyalty with antibiotic prescription and performance of diagnostic tests

Tables 5 and 6 present data on the association of HF use with antibiotic prescription and the performance of DTs, respectively. Tables 7 and 8 present data on the association of PL with antibiotic prescription and with the performance of DTs, respectively. These 4 tables evince a clear association between HF use and both antibiotic prescription and performance of DTs, and a weaker association of these variables with patient loyalty.

Table 3 Rate of antibiotic prescription in the total sample and by age group.

	Total sample	Age 0–2 years	Age 3–6 years	Age 7–14 years
Antibiotics overall	0.88	1.42	1.35	0.55
Penicillins	0.45	0.73	0.75	0.25
Penicillins with inhibitors	0.19	0.31	0.27	0.13
Cephalosporins	0.03	0.07	0.04	0.02
Macrolides	0.12	0.18	0.19	0.08
Other	0.09	0.13	0.09	0.08

Prescription rate expressed as number of prescriptions per patient per year.

Table 4 Diagnostic test performance rate for the total sample and by age group.

	Total sample	Age 0–2 years	Age 3–6 years	Age 7–14 years
Diagnostic tests overall	1.04	1.48	1.24	0.84
Radiographs	0.24	0.22	0.23	0.25
Ultrasounds	0.05	0.10	0.06	0.03
Urine strips	0.15	0.33	0.17	0.09
Rapid strep tests	0.14	0.11	0.24	0.11
Throat swabs	0.03	0.02	0.05	0.02
Urine cultures	0.08	0.16	0.10	0.04
Stool/parasites	0.07	0.17	0.09	0.04
Blood tests	0.20	0.26	0.22	0.17
Other	0.09	0.11	0.09	0.08

Diagnostic test performance rate expressed as number of DTs performed per patient per year.

Table 5 Association between high-frequency use and antibiotic prescription.

	Moderate HF use	Extreme HF use
Total sample	2.13 (1.74–2.62)	3.25 (2.55–4.13)
Age 0–2 years	2.06 (1.34–3.18)	2.11 (1.24–3.60)
Age 3–6 years	1.96 (1.32–2.90)	3.57 (2.23–5.69)
Age 7–14 years	2.43 (1.80–3.28)	3.66 (2.60–5.17)

The table shows the rate ratio of antibiotic prescription in moderate or extreme HF users versus low frequency users, with the corresponding 95% confidence intervals. We obtained the values using binomial regression adjusted for age, immigration status, number of parents in the household, private insurance, chronic illness and number of types of morbidity.

Table 6 Association between high-frequency use and performance of diagnostic tests.

	Moderate HF use	Extreme HF use
Total sample	2.25 (1.86–2.73)	3.48 (2.78–4.35)
Age 0–2 years	3.38 (2.23–5.14)	3.13 (1.83–5.36)
Age 3–6 years	2.66 (1.81–3.91)	3.91 (2.48–6.16)
Age 7–14 years	1.80 (1.37–2.38)	3.61 (2.66–4.91)

The table shows the rate ratio of DT performance in moderate or extreme HF users compared to low users with their 95% confidence intervals. We obtained the values using binomial regression adjusted for age, immigration status, number of parents in the household, private insurance, chronic illness and number of types of morbidity.

Table 7 Association between patient loyalty and antibiotic prescription.

	High-medium PL	Low-medium PL	Low PL
Total sample	1.34 (1.16–1.55)	1.45 (1.15–1.83)	1.08 (0.81–1.44)
Age 0–2 years	1.31 (0.96–1.75)	1.49 (0.93–2.39)	0.93 (0.42–2.06)
Age 3–6 years	1.15 (0.88–1.50)	1.35 (0.90–2.03)	1.13 (0.63–2.01)
Age 7–14 years	1.48 (1.19–1.84)	1.47 (1.03–2.09)	1.12 (0.77–1.62)

The table shows the rate ratio of antibiotic prescription in patients with low or medium loyalty compared to patients with high PL with the corresponding 95% confidence intervals. We obtained the values using binomial regression adjusted for age, private insurance, chronic illness and frequency of health care use.

Discussion

There is no clear definition of HF use and the criteria used for its definition in different studies vary widely. The mean number of visits in a given period of time plus 1 or 2 standard deviations are commonly used thresholds. Since these are the definition criteria applied most frequently, we chose to create 2 HF groups, which also allowed us to assess whether there were any differences between what we labelled moderate HF users and extreme HF users. This seemed to be the case, as we generally found higher values in the variables under study in extreme HF users compared to moderate HF users. The proportion of HF users was consistent with the proportion reported in previous studies conducted in Spain:

Table 8 Association between patient loyalty and performance of diagnostic tests.

	High-medium PL	Low-medium PL	Low PL
Total sample	1.46 (1.27–1.67)	1.60 (1.28–2.00)	0.84 (0.63–1.12)
Age 0–2 years	1.83 (1.36–2.45)	2.20 (1.36–3.56)	1.70 (0.80–3.61)
Age 3–6 years	1.10 (0.83–1.45)	1.29 (0.85–1.96)	0.96 (0.52–1.78)
Age 7–14 years	1.52 (1.26–1.85)	1.57 (1.14–2.15)	0.69 (0.48–1.00)

The table shows the rate ratio of diagnostic test performance in patients with low or medium loyalty compared to patients with high PL with the corresponding 95% confidence intervals. We obtained the values using binomial regression adjusted for age, private insurance, chronic illness and frequency of health care use.

approximately 14% when calculated using the mean + 1SD[1] and 4%–5% when using the mean + 2SDs.[4,6]

We collected data on the variables that we believed may have the most impact on the frequency of use by patients. An important aspect to take into account in the investigation of HF users is whether children that use services often are justified in doing so. In this regard, there appear to be different patterns of illness that have an impact on frequency of use.[6] In fact, there is evidence that the number of types of morbidity present in a patient is associated with the extent of health care utilisation.[7] For this reason, our study included an analysis of the number of morbidities using the categories defined by Starfield, and our results were consistent with those of the original study. This variable and the presence of chronic illness seemed to have the greatest impact on HF use, and therefore both should be taken into account in future research.

We did not find any studies that analysed the association with patient loyalty. Thus, we believe that the descriptive data presented here may be of interest. We ought to highlight that out of every 3 visits scheduled on patient demand, 1 was not with the assigned primary care paediatrician. Approximately half of the patients exhibited high PL. This was the case in all age groups, while the proportion of patients with chronic disease was greater in the high PL group compared to the low PL group. High-frequency users mainly belonged to the two medium-loyalty groups. The characteristic profile of patients in the low PL group was a child aged 7–14 years without chronic disease who used health care services infrequently.

As for antibiotic prescription, there is recent evidence of the considerable variability that exists between European countries.[15] Since health indicators do not differ significantly between these countries, there must be somewhere antibiotic utilisation is excessive in the paediatric population. Although this was not the aim of our study, we ought to mention that the antibiotic prescription rate that we found was similar to those reported for the countries with the highest rates of prescription, which are far above those of the countries with the lowest rates.

Although we found no published evidence on diagnostic tests, it is likely that the same is the case with them, and that many could be avoided.[11,12] We ought to highlight that the most frequently ordered DT was the plain radiograph, which is an invasive test.

The association between antibiotic prescription and high frequency utilisation has already been described in the literature.[6,9] Our findings are conclusive in this regard, as HF use was strongly and significantly associated with antibiotic prescription. As we expected, this association became stronger the greater the frequency of use, so that antibiotic prescription was double in moderate HF users and triple in extreme HF users compared to patients that were not HF users. The results were similar for the performance of DTs. It may be that the pressure exerted by the family on health care professionals and the desire of paediatricians to alleviate the anxiety of the family are significant factors at play.[9–11] Specific strategies for the management of HF users should be developed to redirect this overutilisation of health care resources, which also seems to lead to these patients being overmedicated and undergoing a greater number of tests.

We expected to find a strong association of low PL with antibiotic prescription and performance of DTs. Our rationale was that these patients receive care from different providers that are not acquainted with the family and are unable to follow up the case, which could influence the approach of providers to their management. We did in fact detect an association, but it was weaker than the one observed in relation with HF use and was not statistically significant in most of the groups under study. We mainly observed this association in patients with low-medium and medium-high PL. The low PL group, which constituted a minority of the sample and was characterised by infrequent use of health care, had antibiotic prescription and DT performance rates that were similar and even lower than those observed in the high PL group, which made sense, as patients in the low PL group were older and less likely to have chronic disease.

There is an intrinsic limitation in studies on health care utilisation and antibiotic prescription, which is that it is all but impossible to get an accurate account of all the services and prescriptions generated in settings outside the public health system.[10,16] It is also very difficult to accurately track the dispensation in pharmacies of antibiotics without a prescription. However, only 13.2% of patients in our sample were covered by private insurance (and all of them had access to the public health system, too). Therefore, and considering the large size of the sample, we believe that our study provides an adequate representation of the phenomenon under study, as it analysed data that could be retrieved from the public system, which is used by a vast majority of patients.

Another possible limitation is that there may be disease-related factors that have yet to be identified that influence

the frequency of use. In any case, we included the factors currently known, and our study is the first on the subject that includes and adjusts results based on patterns of morbidity.

Thus, we conclude that high-frequency use is strongly associated with antibiotic prescription, and that high-frequency users undergo more DTs. In contrast, patient loyalty had a significantly lesser impact on antibiotic prescription and the ordering of DTs.

Conflicts of interest

The authors have no conflicts of interest to declare.

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Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.anpede.2017.11.009.

References

1. Tapia Collados C, Gil Guillén V, Orozco Beltrán D, Bernáldez Torralba C, Ortuño Adán E. Hiperfrecuentación en las consultas de pediatría de Atención Primaria. Rev Pediatr Aten Primaria. 2004;6:547–57.
2. Soriano Faura J, Lázaro Armengol C, Gómez Gil A. Determinantes del uso de las consultas de pediatría: estudio de morbilidad infantil y variables maternas. Aten Primaria. 1999;23:132–6.
3. Prado S, Esquerda M, Anguera R, Capdevila R, Agustí MJ, Bringué X, et al. Factors associats a la hiperfreqüentació en pediatría d'atenció primària. Pediatr Catalana. 2006;66:47–52.
4. Gorrotxategui Gorrotxategui P, Jauregui Garasa A, Iturrioz Rosell P. Relación entre la frecuentación de los niños y la de sus padres en una consulta de atención primaria. Acta Pediatr Esp. 2006;64:219–22.
5. Igual Rosado R, Castro Nicolau E, Alonso Martínez I, Terradas Corominas M, de Frutos Gallego E, Cebrià Andreu J. Hiperfrecuentación en las consultas: ¿hay relación con la personalidad de la madre? An Pediatr. 2003;58:29–33.
6. Ordóñez Alonso MA, Domínguez Aurrecoechea B, Pérez Candás JI, López Vilar P, Fernández Francés M, Coto Fuente M, et al. Influencia de la asistencia a guarderías en la frecuentación en Urgencias y Atención Primaria. Rev Pediatr Aten Primaria. 2016;18:243–52.
7. Starfield B, Hankin J, Steinwachs D, Horn S, Benson P, Katz H, et al. Utilization and morbidity: random or tandem? Pediatrics. 1985;75:241–7.
8. Maeng DD, Hao J, Bulger JB. Patterns of multiple emergency department visits: do Primary Care physicians matter? Perm J. 2017:21, http://dx.doi.org/10.7812/TPP/16-063. Epub 2017 Mar 15.
9. Rodríguez García A, Díez Domingo J, Ballester Sanz A, Albert Rue A. Prescripción farmacológica en los niños hiperfrecuentadores de un centro de salud. Acta Pediatr Esp. 2001;59:214–8.
10. Serna MC, Real J, Ribes E, Marsal JR, Godoy P, Galván L. Determinantes de la prescripción de antibióticos en atención primaria. Enferm Infecc Microbiol Clin. 2011;29:193–200.
11. Macarthur C, Wright JG, Srivastava R, Rosser W, Feldman W. Variability in physicians reported ordering and perceived reassurance value of diagnostic tests in children with 'growing pains'. Arch Pediatr Adolesc Med. 1996;150:1072–6.
12. Van Ravesteijn H, van Dijk I, Darmon D, van de Laar F, Lucassen P, Hartman TO, et al. The reassuring value of diagnostic tests: a systematic review. Patient Educ Couns. 2012;86:3–8.
13. Bettinelli A, Provero MC, Cogliati F, Villella A, Marinoni M, Saettini F, et al. Symptomatic fever management among 3 different groups of pediatricians in Northern Lombardy (Italy): results of an explorative cross-sectional survey. Ital J Pediatr. 2013;39:51.
14. Conway PH, Edwards S, Stucky ER, Chiang VW, Ottolini MC, Landrigan CP. Variations in management of common inpatient pediatric illnesses: hospitalists and community pediatricians. Pediatrics. 2006;118:441–7.
15. Holstiege J, Schink T, Molokhia M, Mazzaglia G, Innocenti F, Oteri A, et al. Systemic antibiotic prescribing to paediatric outpatients in 5 European countries: a population-based cohort study. BMC Pediatr. 2014;14:174.
16. Vázquez Fernández ME, Bachiller Luque MR, Vázquez Fernández MJ, Pastor García E, Eiros Bouza JM. Variabilidad de la prescripción de antibióticos en la población pediátrica de Castilla y León durante los años 2001 a 2005 en el medio urbano o rural. An Pediatr. 2007;67:139–44.
17. Mainous AG 3rd, Hueston WJ, Love MM. Antibiotics for colds in children: who are the high prescribers? Arch Pediatr Adolesc Med. 1998;152:349–52.
18. Cars H, Håkansson A. Prescriptions of antibiotics for children. Prescribing habits of district, hospital, and private physicians. Scand J Prim Health Care. 1997;15:22–5.
19. Fossum GH, Lindbæk M, Gjelstad S, Dalen I, Kværner KJ. Are children carrying the burden of broad-spectrum antibiotics in general practice? Prescription pattern for paediatric outpatients with respiratory tract infections in Norway. BMJ Open. 2013;3.
20. Elshout G, van Ierland Y, Bohnen AM, de Wilde M, Oostenbrink R, Moll HA, et al. Alarm signs and antibiotic prescription in febrile children in primary care: an observational cohort study. Br J Gen Pract. 2013;63:e437–44.