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**DIFFERENCES IN THE DRUG PRESCRIPTIONS TO CHILDREN
BY ITALIAN PAEDIATRICIANS AND GENERAL
PRACTITIONERS.**

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5 **PAEDIATRICIANS AND GENERAL PRACTITIONERS.**
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Abstract

Purpose. To compare family paediatricians and general practitioners' habits on drug prescribing to children.

Methods. Prescriptions reimbursed by the Health Service and dispensed by the retail pharmacies of 15 local health units in the Lombardy Region, Italy, during 2005 were analysed. Only family paediatricians and general practitioners who were in charge of children of all the ages in the 6-13 year old age range were included.

Results. During 2005, 239,296 children (43.6% of the selected population) received at least one drug prescription.

The prevalence was higher in children treated by general practitioners (44.2 versus 43.4%), in particular in children 13 years old, with a prevalence of 38.7 versus 31.8% in children cared for by general practitioners and family paediatricians, respectively.

The prevalence of the most prescribed therapeutic classes was similar in the two groups. Some differences were found concerning the antibiotic classes, with family paediatricians prescribing penicillins more frequently and general practitioners prescribing macrolides and cephalosporins more frequently.

A total of 542 drugs were prescribed, 78% of which were prescribed by both the family paediatricians and the general practitioners. In all, only 4 drugs were prescribed by 75% or more physicians.

The chance of receiving a drug prescription, adjusted for age, gender, and local health unit of residence, was slightly higher in children cared for by general practitioners (OR 1.16; 95%CI 1.14-1.17)

Conclusions. Few differences were found between the prescribing patterns of family paediatricians and those of general practitioners. Differences exist in particular for older children and for some drug classes.

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Keywords: Child; Drug prescriptions; Family Practice; Pediatrics

For Peer Review

INTRODUCTION

Drug utilization studies performed in the Italian paediatric population found a prescription profile that appears to be specific to Italy, especially concerning antibiotics. [1-5] For these drugs, both quantitative and qualitative differences with respect to other European countries were found. [6] The antibiotic prescription prevalence was 3-4 fold higher in Italy than in the Netherlands or the UK, with a wide use of second choice antibiotics such as cephalosporins. [6] Moreover, a wide, irrational use of anti-asthmatics, in particular inhaled steroids, was observed. [7]

According to some international studies, drug prescriptions are influenced by the type of physician writing them. [8-13] In fact, differences in prescription profiles between family paediatricians and general practitioners were found, in particular concerning antibiotics. [9,10,12,13]

In Italy, children are assigned to a paediatrician until they are 6 years old; afterwards, the parents can choose to remain with that paediatrician until child is 14 years old or to register the child with a general practitioner. All adolescents over 14 years of age are assigned to a general practitioner. No studies were performed in Italy to compare the prescribing profile of the two kinds of physicians. Thus, an analysis of drugs prescribed to children 6-13 years old was performed in order to compare general practitioners' with family paediatricians' prescribing profiles.

METHODS

The data source was a database routinely updated for administrative and reimbursement reasons.

The database stores all community (i.e. out of hospital) prescriptions issued to individuals living in the Lombardy Region that are reimbursed by the National Health Service (NHS).

Data were managed and analysed using an anonymous patient code, after obtaining each local health unit director's authorisation.

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3 The analysis involved all paediatric prescriptions reimbursed by the Health Service and dispensed
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6 by the retail pharmacies of all the 15 local health units (LHU) in the Lombardy Region, in northern
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8 Italy, between 1 January and 31 December 2005.

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10 In order to obtain a comparable sample, only physicians who were in charge of children
11
12 representing all the ages in the 6-13 year old range were included. Moreover, physicians below the
13
14 5-centile of the distribution of physicians by number of treated children were excluded. Children
15
16 receiving six or more prescriptions were also excluded, since the percentage of chronically treated
17
18 patients may be different between physicians and may influence the prescribing profile.

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20 A total of 548,922 children 6-13 years of age was, therefore, selected (81% of the Lombardy
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22 Region's population 6-13 year old): 402,053 children were cared for by 1020 family paediatricians
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24 (88% of the total number of family paediatricians) and 146,869 children cared for by 2824 general
25
26 practitioners (42% of the total).

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28 Prescribed drugs were classified according to the International Anatomic-Therapeutical-Chemical
29
30 Classification system (ATC).

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32 Prevalence data by children's age and type of physician were calculated by dividing the number of
33
34 drug users by the total number of residents in each age group.

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36 Moreover, a Mantel-Haentzel χ^2 test was performed in order to compare the drug prescription
37
38 prevalence in children cared for by family paediatricians versus children cared for by general
39
40 practitioners.

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42 The area under the prevalence-time curve (AUC) from time 6 to 13 years (data plotted at mid-time
43
44 interval) were calculated according to the linear trapezoidal rule. The slopes of the prevalence vs
45
46 time curve were estimated by log-linear least square fit of the 6 and 13 year age points.

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48 Comparisons were made using the t test.

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3 A logistic regression analysis was performed to evaluate the association between drug prescription,
4 type and gender of physician, and the age, gender, and LHU of residence of the child.
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8 The percentage of family paediatricians and general practitioners who prescribed each single drug
9
10 was calculated and a percentage $\geq 75\%$ was considered a high degree of concordance.
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12 Statistical analysis was performed using SAS software, version 9.1.
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15 A P value < 0.05 was considered statistically significant.
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17 RESULTS

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19 During 2005, 239,296 children (43.6% of the population) received at least one drug prescription
20 (table 1). The prevalence was highest at 6 years of age (53.9%), and decreased to 35% in children
21
22 13 years old (Figure 1).
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26
27 The prevalence was slightly higher in children treated by general practitioners (44.2 versus 43.4%;
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29 $\chi^2_{M-H} = 845$, $p < 0.001$). The greatest difference was observed in 13 year old children, with a
30
31 prevalence of 38.7 versus 31.8% in children cared for by general practitioners and family
32
33 paediatricians, respectively. A difference was found when comparing the slopes of the prevalence
34
35 versus age curve ($p < 0.001$).
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39 The AUC 6-14 general practitioners/paediatricians prevalence ratio was 1.1.
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42 The chance of receiving a drug prescription, adjusted for age, gender, and LHU of residence, was
43
44 slightly higher in children cared for by general practitioners (OR 1.16; 95%CI 1.14-1.17).
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46
47 Moreover, the chance was slightly higher for children in charge to female compared to male
48
49 physicians (OR 1.08; 95%CI 1.07-1.10).
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51
52 On average, each treated child received 2 prescriptions, without differences between the two
53
54 physician type groups, while the mean number of medication packages prescribed to children cared
55
56 for by family paediatricians was slightly higher (2.9 versus 2.6).
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59 Antibiotics, anti-asthmatics, and anti-histamines were the most prescribed therapeutic classes, and
60
covered 92.5% of the packages. The prevalence of antibiotics was nearly the same in the two groups

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3 (37%), while the prevalence of anti-asthmatics was slightly higher in children treated by family
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5 paediatricians (10.6 vs 9.9%) and, on the contrary, the prevalence of anti-histamines was higher in
6
7 the general practitioner treated group (4.2 vs 3.6%).
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9

10 Taking into account the ten most prescribed classes, the prevalence of antinflammatory and anti-
11
12 rheumatic drugs was 5-fold higher, and the prevalence of intestinal antidiarrheals/antifectives was
13
14 3.5 fold higher, in children treated by general practitioners.
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16

17 On the contrary, the prevalence rates of anti-parasitic drugs and antivirals were 1.4 fold higher in
18
19 the paediatrician treated group.
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22 An analysis of antibiotic prescriptions by class was also performed; the prevalence of penicillins
23
24 was higher in children cared for by family paediatricians (64.5 vs 54.2%), while the prevalence of
25
26 macrolides and cephalosporins was higher in children cared for by general practitioners (32.9 vs
27
28 28.3%, and 32.2 vs 26.6%, respectively).
29
30

31 Amoxicillin+clavulanic acid was the most frequently prescribed drug independently of the type of
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33 physician, followed by amoxicillin and beclometasone. Fourteen out of the 15 most frequently
34
35 prescribed drugs were the same in both groups (table 2).
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37

38 Budesonide was among the most prescribed drugs only in the family paediatrician treated group and
39
40 oxatomide only in the general practitioner group.
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42

43 A total of 542 drugs were prescribed, 78% of which were prescribed by both the family
44
45 paediatricians and the general practitioners. 74 drugs (14%) were prescribed only by the family
46
47 paediatricians and 42 (8%) only by the general practitioners. In particular, 7/74 and 4/42 were
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49 sexual hormones (mainly oral contraceptives). Furthermore, 48 out of 74 (64%) and 36 out of 42
50
51 (86%) drugs were prescribed by only one physician to one child.
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54 In all, 96% of the drugs were prescribed by less than 25% of the physicians, with a higher
55
56 percentage among general practitioners compared to family paediatricians (97% versus 92%,
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3 respectively, $\chi^2=11$; $p<0.001$). In all, 13 drugs were prescribed by 75% or more family
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5 paediatricians and only 4 drugs were prescribed by 75% or more general practitioners (table 2).
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7 The drug with the highest degree of concordance was amoxicillin+clavulanic acid, prescribed by
8
9 more than 96% of family paediatricians and general practitioners. The other common drugs were
10
11 amoxicillin, beclometasone and clarithromycin. These four drugs covered 68% of the treated
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13 children and the 54% of the packages. A total of 91 pharmaceutical preparations (identified by trade
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15 name, strength and formulation) containing the four leading drugs was prescribed, 87 of which
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17 (96%) were shared by family paediatricians and general practitioners.

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20 Only two pharmaceutical preparations were prescribed by 75% or more family paediatricians and
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22 general practitioners: Augmentin[®] (amoxicillin+clavulanic acid) 400/57 mg dry powder for oral
23
24 suspension and Clenil[®] (beclometasone) 0.8mg/2 ml nebulised suspension. No pharmaceutical
25
26 preparation containing amoxicillin or clarithromycin was prescribed by more than 50% of the
27
28 general practitioners. (table 3)

29
30
31 Among physicians prescribing amoxicillin, 91% of family paediatricians and 44% of the GPs
32
33 prescribed a generic specialty ($\chi^2=504$; $p<0.001$). The percentage of children receiving generic
34
35 amoxicillin was 41% in those cared for by family paediatricians and 22% in those cared for by
36
37 general practitioners ($\chi^2=1525$; $p<0.001$).

38 39 40 41 42 43 **DISCUSSION**

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46 The prevalence of drug prescriptions was slightly higher in children treated by general practitioners
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48 with an OR of 1.2. On the contrary, children cared for by paediatricians received a greater number
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50 of packages. Despite these differences, the prescription profiles of general practitioners and family
51
52 paediatricians were similar.

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55 Only a few differences were found concerning the most prescribed therapeutic classes, as expected
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57 since the two types of physicians face the same diseases. However, the differences were greater for
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3 some classes with a low prevalence rate, e.g. the prevalence of antinflammatory drugs was 5-fold
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5 higher in children treated by general practitioners, even if the most frequently prescribed drugs were
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7 the same in both the groups (ketoprofen, nimesulide, acetilsalicylic acid).
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10 A large number of drugs was prescribed, and most of them were prescribed by both family
11
12 paediatricians and general practitioners. Only a few drugs were specific of a type of physician, and
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14 nearly all of them were prescribed by one physician to one child.
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17 It is interesting to note that while 13 drugs were prescribed by 75% or more family paediatricians,
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19 only 4 drugs were prescribed by 75% or more general practitioners. A wide variability in the drugs
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21 was observed for both groups of physicians, even if a greater percentage of drugs prescribed by less
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23 than 25% of the physicians was found for general practitioners (97% versus 92%). A lower
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25 concordance was, therefore, observed between general practitioners, and very few drugs can be
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27 considered “essential” on the basis of their prescribing attitude.
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31 It is likely that this finding is influenced by the fact that general practitioners are in charge of a
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33 lower number of children compared to family paediatricians and that each general practitioner has
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35 to therefore deal with a narrower spectrum of diseases and therapeutic needs.
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38 A low level of agreement emerged also when looking at the pharmaceutical preparations of the 4
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40 drugs with a high degree of concordance among prescribers: 11 preparations were prescribed by
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42 75% or more family paediatricians and only 2 by 75% or more general practitioners. In the case of
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44 amoxicillin and clarithromycin there were no pharmaceutical preparations prescribed by more than
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46 50% of the general practitioners. However, this could indicate that many general practitioners prefer
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48 to prescribe only one trade name, while family paediatricians more commonly prescribe different
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50 trade names of the same drug, as was the case for clarithromycin, for which 3 different trade name
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52 oral suspensions were prescribed by more than 75% family paediatricians.
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57 General practitioner seems to have less of a tendency to prescribe generic drugs, at least taking into
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59 account amoxicillin prescriptions. In fact, nearly 6 out of 10 general practitioners never prescribed
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3 generic amoxicillin and children cared for by general practitioners had a 50% lower chance of
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5 receiving generic amoxicillin compared to children cared for by family paediatricians.
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8 The prescribing profile observed in this setting did not differ from that of other Italian contexts, in
9
10 particular concerning the antibiotic prescription profile, characterized by a wide use of second line
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12 agents (cephalosporins or macrolides), in which Italy differs from other European countries.[6]
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15 A more common inappropriate use of antibiotics was observed among general practitioners than
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17 family paediatricians in three international studies.[10,12,13] In this study, no differences were
18
19 observed regarding antibiotic prevalence rate; however, differences were found concerning
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21 antibiotic classes, with the family paediatricians prescribing penicillins more commonly and general
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23 practitioners prescribing macrolides and cephalosporins more frequently. This finding partly
24
25 reflects the profile observed in the Italian adult population. [14] Amoxi-clavulanic acid was the
26
27 most prescribed antibiotic and it was prescribed by more than 96% of physicians, despite the fact
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29 that amoxicillin is considered the antibiotic of choice for the most common infections in the
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31 paediatric age group [15-17] and is the most prescribed antibiotic in other countries [6]. Moreover,
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33 nearly 1 out of 10 general practitioners never prescribed amoxicillin.
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38 In Italy, amoxicillin+clavulanic acid was probably preferred due to its twice daily schedule regimen
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40 that is supposed to give a better compliance compared to the amoxicillin dosage schedule and to an
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42 unproved concern of beta-lactamase-producing bacteria. This study therefore seems to confirm that
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44 different attitudes towards antibiotic prescribing exist between family paediatricians and general
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46 practitioners.
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49 However, taking into account other drug classes, family paediatricians and general practitioners
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51 seem to share the same inappropriate prescriptions. In this regard, it is interesting to note that the
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53 prevalence of nebulised beclometasone, commonly prescribed without evidence of efficacy for the
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55 symptomatic treatment of upper respiratory tract infections (e.g. common cold, pharyngitis), as
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3 previously reported in a study performed with a group of Italian family paediatricians [18], was the
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5 same in the two groups.
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8 The main limit of this study is that only drugs reimbursed by the national health service were
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10 evaluated. It is therefore possible that there are some differences in the prescribing profile of drugs
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12 non reimbursed or over the counter (e.g. analgesics, antitussive medicines, and prokinetics).
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15 Moreover, this study was performed in a very homogeneous regional setting and the findings may
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17 not perfectly reflect the national situation. However, the study sample represents 12% of the 6-13
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19 year old Italian population and the profile of drug prescriptions is similar to that observed in other
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21 national settings.
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24 The findings from this study seem to document that there are few differences in the prescribing
25
26 pattern between general practitioners and family paediatricians. Differences exist in particular for
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28 older children and for some drug classes. The inappropriateness of drug prescription to children is
29
30 mostly independent from the type of physician. This should be taken into account in planning and
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32 performing educational interventions with the aim to improve the rational use of drugs in children.
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34 Such interventions should involve all the health care professionals and not only family
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36 paediatricians.
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For Peer Review

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Table 1 - Characteristics of the population.

	Family	General	
	paediatricians	Practitioners	Total
Physicians (N.)	1020	2824	3844
Children (N.)	402,053	146,869	548,922
M/F	1.04	1.06	1.05
Treated children (N.)	174,335	64,961	239,296
Prevalence (%)	43.4	44.2	43.6
Prescription/treated child	2.0	1.9	2.0
Packages/treated child	2.9	2.6	2.8
Drugs (N.)	499	467	542

Table 2 -The 15 most prescribed drugs in order of prevalence.

Family paediatricians				General Practitioners			
Drug	Prevalence (%)	Packages (%)	Prescribers (%)	Drug	Prevalence (%)	Packages (%)	Prescribers (%)
Co-amoxiclav	15.1	25.8	100.0	Co-amoxiclav	12.5	19.0	96.4
Amoxicillin	10.4	17.7	100.0	Amoxicillin	8.8	12.5	87.9
Beclometasone	6.0	5.5	99.9	Beclometasone	6.0	6.2	83.1
Clarithromycin	5.9	7.5	99.7	Clarithromycin	6.0	7.7	82.3
Azithromycin	4.3	4.7	97.1	Azithromycin	5.1	6.1	71.4
Salbutamol	3.8	3.5	98.8	Cefixime	4.8	6.2	56.6
Cefaclor	3.6	5.9	98.3	Cefaclor	3.6	6.0	63.0
Cefixime	2.7	3.3	96.0	Salbutamol	2.2	2.3	65.4
Cetirizine	2.2	3.3	94.8	Ceftibuten	1.9	2.6	39.1
Cefpodoxime	1.5	2.3	76.9	Cetirizine	1.9	3.2	52.8
Ceftibuten	1.4	1.8	87.7	Cefpodoxime	0.9	1.3	24.6
Flunisolide	1.0	0.9	77.3	Flunisolide	0.9	0.9	27.8
Fluticasone	0.9	1.0	83.2	Oxatomide	0.9	0.9	29.5
Budesonide	0.7	0.7	70.7	Cefuroxime	0.8	1.1	19.0
Cefuroxime	0.7	1.0	52.9	Fluticasone	0.7	0.9	26.3
<i>% packages*</i>		84.9				76.9	

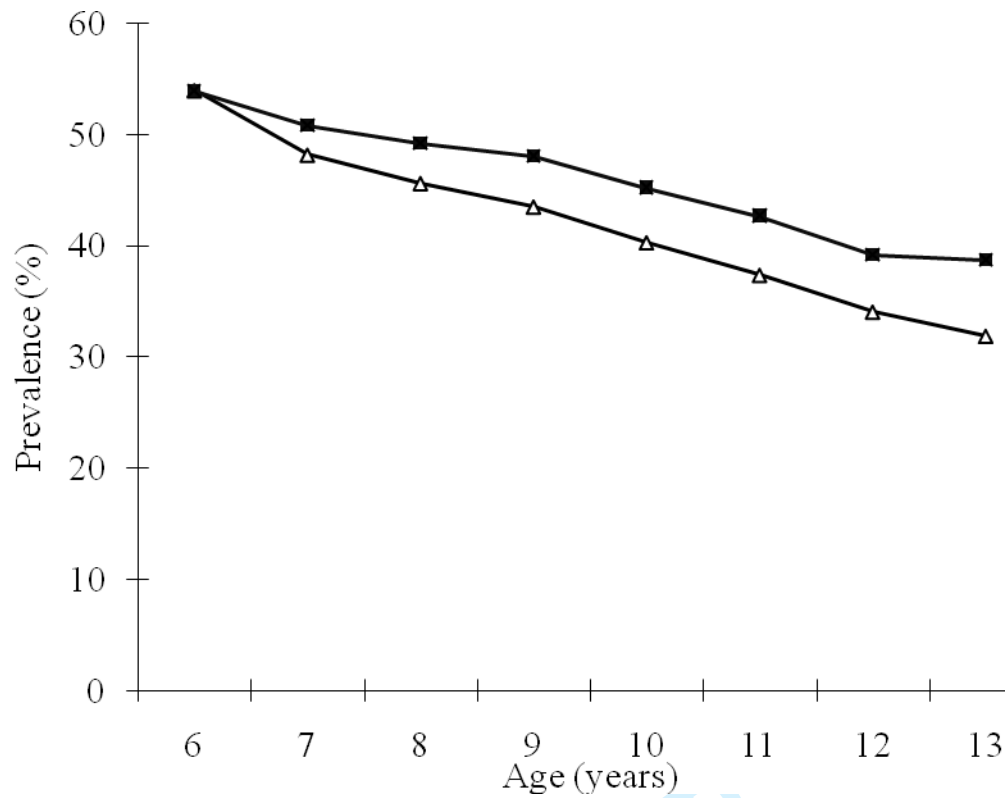
* % of packages covered by the 15 most prescribed drugs. The gray background highlights drugs prescribed by 75% or more physicians.

Table 3 – Most prescribed pharmaceutical preparations of the four shared drugs.

Drug	Trade Name	Formulation	treated children (%)	FP (%)	GP (%)
Co-amoxiclav (15)*	Augmentin[®]	400mg/5 ml + 57mg/5 dry powder for oral suspension	49.9	99.9	79.2
	Clavulin [®]	400mg/5 ml + 57mg/5 dry powder for oral suspension	18.3	90.8	10.8
	Augmentin [®]	875/125 mg tablets	10.9	89.6	15.3
	Augmentin [®]	875/125 mg sachets	10.9	88.1	14.6
Amoxicillin (42)	Zimox [®]	5 g/100 ml powder for oral suspension	24.1	91.3	49.9
	Zimox [®]	500 mg chewable tablets	12.2	71.1	31.5
	Amoxicillina [®]	5 g/100 ml powder for oral suspension	11.0	67.3	15.7
	Zimox [®]	1 g chewable tablets	10.7	65.4	31.6
	Velamox [®]	1 g chewable tablets	8.7	45.6	35.5
Beclometasone (13)	Clenil[®]	0.8/2 ml suspension for inhalation	76.5	99.8	91.3
	Prontinal	0.8/2 ml suspension for inhalation	22.8	83.4	40.0
Clarithromycin (18)	Klacid [®]	125 mg/5ml Granules for Oral Suspension	31.7	95.7	46.7
	Macladin [®]	125 mg/5ml Granules for Oral Suspension	20.7	86.9	37.2
	Veclam [®]	125 mg/5ml Granules for Oral Suspension	16.4	80.0	25.5
	Klacid [®]	250 mg tablets	8.1	58.5	27.1
	Macladin [®]	250 mg tablets	4.6	35.2	20.2

*() total number of preparations. Pharmaceutical preparations prescribed by 75% or more physicians are reported in bold. FP= family paediatricians; GP= general practitioners

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3 **Figure 1- Trend of prevalence by age and type of physician.**
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■ General practitioner ▲ Paediatricians

Review

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3 **DIFFERENCES IN THE DRUG PRESCRIPTIONS TO CHILDREN BY ITALIAN**
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5 **PAEDIATRICIANS AND GENERAL PRACTITIONERS.**
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10 Antonio Clavenna, Marco Sequi, and Maurizio Bonati.
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Abstract

Purpose. To compare family paediatricians and general practitioners' habits on drug prescribing to children.

Methods. Prescriptions reimbursed by the Health Service and dispensed by the retail pharmacies of 15 local health units in the Lombardy Region, Italy, during 2005 were analysed. Only family paediatricians and general practitioners who were in charge of children of all the ages in the 6-13 year old age range were included.

Results. During 2005, 239,296 children (43.6% of the selected population) received at least one drug prescription.

The prevalence was higher in children treated by general practitioners (44.2 versus 43.4%), in particular in children 13 years old, with a prevalence of 38.7 versus 31.8% in children cared for by general practitioners and family paediatricians, respectively.

The prevalence of the most prescribed therapeutic classes was similar in the two groups. Some differences were found concerning the antibiotic classes, with family paediatricians prescribing penicillins more frequently and general practitioners prescribing macrolides and cephalosporins more frequently.

A total of 542 drugs were prescribed, 78% of which were prescribed by both the family paediatricians and the general practitioners. In all, only 4 drugs were prescribed by 75% or more physicians.

The **chance risk** of receiving a drug prescription, adjusted for age, gender, and local health unit of residence, was slightly higher in children cared for by general practitioners (OR 1.16; 95%CI 1.14-1.17)

Conclusions. Few differences were found between the prescribing patterns of family paediatricians and those of general practitioners. Differences exist in particular for older children and for some drug classes.

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Keywords: Child; Drug prescriptions; Family Practice; Pediatrics

For Peer Review

INTRODUCTION

Drug utilization studies performed in the Italian paediatric population found a prescription profile that appears to be specific to Italy, especially concerning antibiotics. [1-5] For these drugs, both quantitative and qualitative differences with respect to other European countries were found. [6] The antibiotic prescription prevalence was 3-4 fold higher in Italy than in the Netherlands or the UK, with a wide use of second choice antibiotics such as cephalosporins. [6] Moreover, a wide, irrational use of anti-asthmatics, in particular inhaled steroids, was observed. [7]

According to some international studies, drug prescriptions are influenced by the type of physician writing them. [8-13] In fact, differences in prescription profiles between family paediatricians and general practitioners were found, in particular concerning antibiotics. [9,10,12,13]

In Italy, children are assigned to a paediatrician until they are 6 years old; afterwards, the parents can choose to remain with that paediatrician until child is 14 years old or to register the child with a general practitioner. All adolescents over 14 years of age are assigned to a general practitioner. No studies were performed in Italy to compare the prescribing profile of the two kinds of physicians. Thus, an analysis of drugs prescribed to children 6-13 years old was performed in order to compare general practitioners' with family paediatricians' prescribing profiles.

METHODS

The data source was a database routinely updated for administrative and reimbursement reasons.

The database stores all community (i.e. out of hospital) prescriptions issued to individuals living in the Lombardy Region that are reimbursed by the National Health Service (NHS).

Data were managed and analysed using an anonymous patient code, after obtaining each local health unit director's authorisation.

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3 The analysis involved all paediatric prescriptions reimbursed by the Health Service and dispensed
4 by the retail pharmacies of all the 15 local health units (LHU) in the Lombardy Region, in northern
5 Italy, between 1 January and 31 December 2005.
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10 In order to obtain a comparable sample, only physicians who were in charge of children
11 representing all the ages in the 6-13 year old range were included. Moreover, physicians below the
12 5-centile of the distribution of physicians by number of treated children were excluded. Children
13 receiving six or more prescriptions were also excluded, since the percentage of chronically treated
14 patients may be different between physicians and may influence the prescribing profile.
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22 A total of 548,922 children 6-13 years of age was, therefore, selected (81% of the Lombardy
23 Region's population 6-13 year old): 402,053 children were cared for by 1020 family paediatricians
24 (88% of the total number of family paediatricians) and 146,869 children cared for by 2824 general
25 practitioners (42% of the total).
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31 Prescribed drugs were classified according to the International Anatomic-Therapeutical-Chemical
32 Classification system (ATC).
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36 Prevalence data by children's age and type of physician were calculated by dividing the number of
37 drug users by the total number of residents in each age group.
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41 Moreover, a Mantel-Haentzel χ^2 test was performed in order to compare the drug prescription
42 prevalence in children cared for by family paediatricians versus children cared for by general
43 practitioners.
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48 The area under the prevalence-time curve (AUC) from time 6 to 13 years (data plotted at mid-time
49 interval) were calculated according to the linear trapezoidal rule. The slopes of the prevalence vs
50 time curve were estimated by log-linear least square fit of the 6 and 13 year age points.
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55 Comparisons were made using the t test.
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3 A logistic regression analysis was performed to evaluate the association between drug prescription,
4 type and gender of physician, and the age, gender, and LHU of residence of the child.
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8 The percentage of family paediatricians and general practitioners who prescribed each single drug
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10 was calculated and a percentage $\geq 75\%$ was considered a high degree of concordance.
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12 Statistical analysis was performed using SAS software, version 9.1.
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15 A P value < 0.05 was considered statistically significant.
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17 RESULTS

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19 During 2005, 239,296 children (43.6% of the population) received at least one drug prescription
20 (table 1). The prevalence was highest at 6 years of age (53.9%), and decreased to 35% in children
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26 13 years old (Figure 1).

27 The prevalence was slightly higher in children treated by general practitioners (44.2 versus 43.4%;
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29 $\chi^2_{M-H} = 845$, $p < 0.001$). The greatest difference was observed in 13 year old children, with a
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31 prevalence of 38.7 versus 31.8% in children cared for by general practitioners and family
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38 paediatricians, respectively. A difference was found when comparing the slopes of the prevalence
39
40 versus age curve ($p < 0.001$).

41 The AUC 6-14 general practitioners/paediatricians prevalence ratio was 1.1.

42 The risk chance of receiving a drug prescription, adjusted for age, gender, and LHU of residence,
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44 was slightly higher in children cared for by general practitioners (OR 1.16; 95%CI 1.14-1.17).

45 Moreover, the risk chance was slightly higher for children in charge to female compared to male
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50 physicians (OR 1.08; 95%CI 1.07-1.10).

51 On average, each treated child received 2 prescriptions, without differences between the two
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58 physician type groups, while the mean number of medication packages prescribed to children cared
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60 for by family paediatricians was slightly higher (2.9 versus 2.6).

Antibiotics, anti-asthmatics, and anti-histamines were the most prescribed therapeutic classes, and
covered 92.5% of the packages. The prevalence of antibiotics was nearly the same in the two groups

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3 (37%), while the prevalence of anti-asthmatics was slightly higher in children treated by family
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5 paediatricians (10.6 vs 9.9%) and, on the contrary, the prevalence of anti-histamines was higher in
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7 the general practitioner treated group (4.2 vs 3.6%).
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10 Taking into account the ten most prescribed classes, the prevalence of antinflammatory and anti-
11
12 rheumatic drugs was 5-fold higher, and the prevalence of intestinal antidiarrheals/antifectives was
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14 3.5 fold higher, in children treated by general practitioners.
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17 On the contrary, the prevalence rates of anti-parasitic drugs and antivirals were 1.4 fold higher in
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19 the paediatrician treated group.
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22 An analysis of antibiotic prescriptions by class was also performed; the prevalence of penicillins
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24 was higher in children cared for by family paediatricians (64.5 vs 54.2%), while the prevalence of
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26 macrolides and cephalosporins was higher in children cared for by general practitioners (32.9 vs
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28 28.3%, and 32.2 vs 26.6%, respectively).
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31 Amoxicillin+clavulanic acid was the most frequently prescribed drug independently of the type of
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33 physician, followed by amoxicillin and beclometasone. Fourteen out of the 15 most frequently
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35 prescribed drugs were the same in both groups (table 2).
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38 Budesonide was among the most prescribed drugs only in the family paediatrician treated group and
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40 oxatomide only in the general practitioner group.
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43 A total of 542 drugs were prescribed, 78% of which were prescribed by both the family
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45 paediatricians and the general practitioners. 74 drugs (14%) were prescribed only by the family
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47 paediatricians and 42 (8%) only by the general practitioners. In particular, 7/74 and 4/42 were
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49 sexual hormones (mainly oral contraceptives). Furthermore, 48 out of 74 (64%) and 36 out of 42
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51 (86%) drugs were prescribed by only one physician to one child.
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54 In all, 96% of the drugs were prescribed by less than 25% of the physicians, with a higher
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56 percentage among general practitioners compared to family paediatricians (97% versus 92%,
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3 respectively, $\chi^2=11$; $p<0.001$). In all, 13 drugs were prescribed by 75% or more family
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5 paediatricians and only 4 drugs were prescribed by 75% or more general practitioners (table 2).
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7 The drug with the highest degree of concordance was amoxicillin+clavulanic acid, prescribed by
8
9 more than 96% of family paediatricians and general practitioners. The other common drugs were
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11 amoxicillin, beclometasone and clarithromycin. These four drugs covered 68% of the treated
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13 children and the 54% of the packages. A total of 91 pharmaceutical preparations (identified by trade
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15 name, strength and formulation) containing the four leading drugs was prescribed, 87 of which
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17 (96%) were shared by family paediatricians and general practitioners.

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22 Only two pharmaceutical preparations were prescribed by 75% or more family paediatricians and
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24 general practitioners: Augmentin[®] (amoxicillin+clavulanic acid) 400/57 mg dry powder for oral
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26 suspension and Clenil[®] (beclometasone) 0.8mg/2 ml nebulised suspension. No pharmaceutical
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28 preparation containing amoxicillin or clarithromycin was prescribed by more than 50% of the
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30 general practitioners. (table 3)

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34 Among physicians prescribing amoxicillin, 91% of family paediatricians and 44% of the GPs
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36 prescribed a generic specialty ($\chi^2=504$; $p<0.001$). The percentage of children receiving generic
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38 amoxicillin was 41% in those cared for by family paediatricians and 22% in those cared for by
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40 general practitioners ($\chi^2=1525$; $p<0.001$).

41 42 43 **DISCUSSION**

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46 The prevalence of drug prescriptions was slightly higher in children treated by general practitioners
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48 with an OR of 1.2. On the contrary, children cared for by paediatricians received a greater number
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50 of packages. Despite these differences, the prescription profiles of general practitioners and family
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52 paediatricians were similar.

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56 Only a few differences were found concerning the most prescribed therapeutic classes, as expected
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58 since the two types of physicians face the same diseases. However, the differences were greater for
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3 some classes with a low prevalence rate, e.g. the prevalence of antinflammatory drugs was 5-fold
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5 higher in children treated by general practitioners, even if the most frequently prescribed drugs were
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7 the same in both the groups (ketoprofen, nimesulide, acetilsalicylic acid).
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10 A large number of drugs was prescribed, and most of them were prescribed by both family
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12 paediatricians and general practitioners. Only a few drugs were specific of a type of physician, and
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14 nearly all of them were prescribed by one physician to one child.
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17 It is interesting to note that while 13 drugs were prescribed by 75% or more family paediatricians,
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19 only 4 drugs were prescribed by 75% or more general practitioners. A wide variability in the drugs
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21 was observed for both groups of physicians, even if a greater percentage of drugs prescribed by less
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23 than 25% of the physicians was found for general practitioners (97% versus 92%). A lower
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25 concordance was, therefore, observed between general practitioners, and very few drugs can be
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27 considered “essential” on the basis of their prescribing attitude.
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31 It is likely that this finding is influenced by the fact that general practitioners are in charge of a
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33 lower number of children compared to family paediatricians and that each general practitioner has
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35 to therefore deal with a narrower spectrum of diseases and therapeutic needs.
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38 A low level of agreement emerged also when looking at the pharmaceutical preparations of the 4
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40 drugs with a high degree of concordance among prescribers: 11 preparations were prescribed by
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42 75% or more family paediatricians and only 2 by 75% or more general practitioners. In the case of
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44 amoxicillin and clarithromycin there were no pharmaceutical preparations prescribed by more than
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46 50% of the general practitioners. However, this could indicate that many general practitioners prefer
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48 to prescribe only one trade name, while family paediatricians more commonly prescribe different
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50 trade names of the same drug, as was the case for clarithromycin, for which 3 different trade name
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52 oral suspensions were prescribed by more than 75% family paediatricians.
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56 General practitioner seems to have less of a tendency to prescribe generic drugs, at least taking into
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58 account amoxicillin prescriptions. In fact, nearly 6 out of 10 general practitioners never prescribed
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3 generic amoxicillin and children cared for by general practitioners had a 50% lower chance of
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5 receiving generic amoxicillin compared to children cared for by family paediatricians.
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8 The prescribing profile observed in this setting did not differ from that of other Italian contexts, in
9
10 particular concerning the antibiotic prescription profile, characterized by a wide use of second line
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12 agents (cephalosporins or macrolides), in which Italy differs from other European countries.[6]
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15 A more common inappropriate use of antibiotics was observed among general practitioners than
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17 family paediatricians in three international studies.[10,12,13] In this study, no differences were
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19 observed regarding antibiotic prevalence rate; however, differences were found concerning
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21 antibiotic classes, with the family paediatricians prescribing penicillins more commonly and general
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23 practitioners prescribing macrolides and cephalosporins more frequently. This finding partly
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25 reflects the profile observed in the Italian adult population. [14] Amoxi-clavulanic acid was the
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27 most prescribed antibiotic and it was prescribed by more than 96% of physicians, despite the fact
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29 that amoxicillin is considered the antibiotic of choice for the most common infections in the
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31 paediatric age group [15-17] and is the most prescribed antibiotic in other countries [6]. Moreover,
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33 nearly 1 out of 10 general practitioners never prescribed amoxicillin
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38 In Italy, amoxicillin+clavulanic acid was probably preferred due to its twice daily schedule regimen
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40 that is supposed to give a better compliance compared to the amoxicillin dosage schedule and to an
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42 unproved concern of beta-lactamase-producing bacteria. Moreover, nearly 1 out of 10 general
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44 practitioners never prescribed amoxicillin, which is the first line antibiotic for the most common
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46 infections in children. [15-17] This study therefore seems to confirm that different attitudes towards
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48 antibiotic prescribing exist between family paediatricians and general practitioners.
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53 However, taking into account other drug classes, family paediatricians and general practitioners
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55 seem to share the same inappropriate prescriptions. In this regard, it is interesting to note that the
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57 prevalence of nebulised beclometasone, commonly prescribed without evidence of efficacy for the
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3 symptomatic treatment of upper respiratory tract infections (e.g. common cold, pharyngitis), as
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6 previously reported in a study performed with a group of Italian family paediatricians [18], was the
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8 same in the two groups.

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10 The main limit of this study is that only drugs reimbursed by the national health service were
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12 evaluated. It is therefore possible that there are some differences in the prescribing profile of drugs
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14 non reimbursed or over the counter (e.g. analgesics, antitussive medicines, and prokinetics).

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17 Moreover, this study was performed in a very homogeneous regional setting and the findings may
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19 not perfectly reflect the national situation. However, the study sample represents 12% of the 6-13
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21 year old Italian population and the profile of drug prescriptions is similar to that observed in other
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23 national settings.

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26 The findings from this study seem to document that there are few differences in the prescribing
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28 pattern between general practitioners and family paediatricians. Differences exist in particular for
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30 older children and for some drug classes. The inappropriateness of drug prescription to children is
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32 mostly independent from the type of physician. This should be taken into account in planning and
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34 performing educational interventions with the aim to improve the rational use of drugs in children.
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36 Such interventions should involve all the health care professionals and not only family
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39 paediatricians.
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58 “Epidemiologia dei farmaci - EPIFARM”)
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Table 1 - Characteristics of the population.

	Family	General	
	paediatricians	Practitioners	Total
Physicians (N.)	1020	2824	3844
Children (N.)	402,053	146,869	548,922
M/F	1.04	1.06	1.05
Treated children (N.)	174,335	64,961	239,296
Prevalence (%)	43.4	44.2	43.6
Prescription/treated child	2.0	1.9	2.0
Packages/treated child	2.9	2.6	2.8
Drugs (N.)	499	467	542

Table 2 -The 15 most prescribed drugs in order of prevalence.

Family paediatricians				General Practitioners			
Drug	Prevalence (%)	Packages (%)	Prescribers (%)	Drug	Prevalence (%)	Packages (%)	Prescribers (%)
Co-amoxiclav	15.1	25.8	100.0	Co-amoxiclav	12.5	19.0	96.4
Amoxicillin	10.4	17.7	100.0	Amoxicillin	8.8	12.5	87.9
Beclometasone	6.0	5.5	99.9	Beclometasone	6.0	6.2	83.1
Clarithromycin	5.9	7.5	99.7	Clarithromycin	6.0	7.7	82.3
Azithromycin	4.3	4.7	97.1	Azithromycin	5.1	6.1	71.4
Salbutamol	3.8	3.5	98.8	Cefixime	4.8	6.2	56.6
Cefaclor	3.6	5.9	98.3	Cefaclor	3.6	6.0	63.0
Cefixime	2.7	3.3	96.0	Salbutamol	2.2	2.3	65.4
Cetirizine	2.2	3.3	94.8	Ceftibuten	1.9	2.6	39.1
Cefpodoxime	1.5	2.3	76.9	Cetirizine	1.9	3.2	52.8
Ceftibuten	1.4	1.8	87.7	Cefpodoxime	0.9	1.3	24.6
Flunisolide	1.0	0.9	77.3	Flunisolide	0.9	0.9	27.8
Fluticasone	0.9	1.0	83.2	Oxatomide	0.9	0.9	29.5
Budesonide	0.7	0.7	70.7	Cefuroxime	0.8	1.1	19.0
Cefuroxime	0.7	1.0	52.9	Fluticasone	0.7	0.9	26.3
<i>% packages*</i>		<i>84.9</i>				<i>76.9</i>	

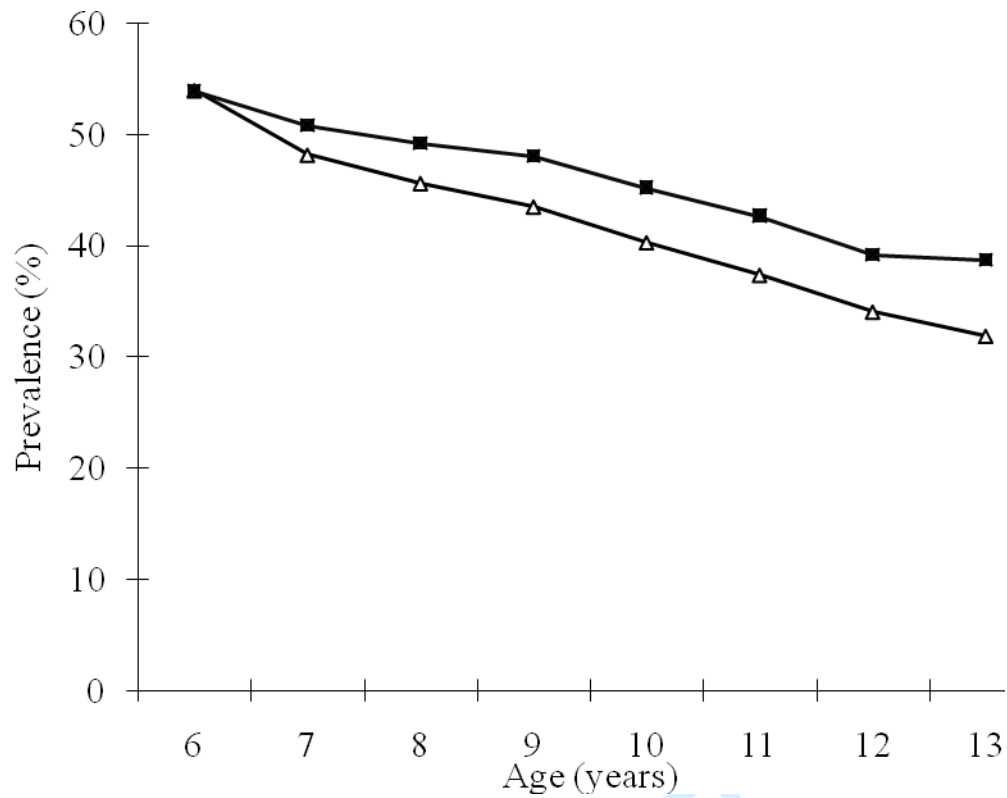
* % of packages covered by the 15 most prescribed drugs. The gray background highlights drugs prescribed by 75% or more physicians.

Table 3 – Most prescribed pharmaceutical preparations of the four shared drugs.

Drug	Trade Name	Formulation	treated children (%)	FP (%)	GP (%)
Co-amoxiclav (15)*	Augmentin[®]	400mg/5 ml + 57mg/5 dry powder for oral suspension	49.9	99.9	79.2
	Clavulin [®]	400mg/5 ml + 57mg/5 dry powder for oral suspension	18.3	90.8	10.8
	Augmentin [®]	875/125 mg tablets	10.9	89.6	15.3
	Augmentin [®]	875/125 mg sachets	10.9	88.1	14.6
Amoxicillin (42)	Zimox [®]	5 g/100 ml powder for oral suspension	24.1	91.3	49.9
	Zimox [®]	500 mg chewable tablets	12.2	71.1	31.5
	Amoxicillina [®]	5 g/100 ml powder for oral suspension	11.0	67.3	15.7
	Zimox [®]	1 g chewable tablets	10.7	65.4	31.6
	Velamox [®]	1 g chewable tablets	8.7	45.6	35.5
Beclometasone (13)	Clenil[®]	0.8/2 ml suspension for inhalation	76.5	99.8	91.3
	Prontinal	0.8/2 ml suspension for inhalation	22.8	83.4	40.0
Clarithromycin (18)	Klacid [®]	125 mg/5ml Granules for Oral Suspension	31.7	95.7	46.7
	Macladin [®]	125 mg/5ml Granules for Oral Suspension	20.7	86.9	37.2
	Veclam [®]	125 mg/5ml Granules for Oral Suspension	16.4	80.0	25.5
	Klacid [®]	250 mg tablets	8.1	58.5	27.1
	Macladin [®]	250 mg tablets	4.6	35.2	20.2

*() total number of preparations. Pharmaceutical preparations prescribed by 75% or more physicians are reported in bold. FP= family paediatricians; GP= general practitioners

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4 **Figure 1- Trend of prevalence by age and type of physician.**
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■ General practitioner ▲ Paediatricians

Review