



Quality indicators of prescribed pediatrics medicines

Kazalniki kakovosti predpisovanja zdravil v pediatriji

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Abstract

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Background: Indicators of prescribed medicines represent selected data providing a partial insight into physicians' work in the field of drug prescribing. They are based on the data on drug prescriptions issued. The Health Insurance Institute of Slovenia (HIIS), in cooperation with the representatives of paediatric specialty, prepared an array of drug prescribing quality indicators for paediatrics. Indicators for the 5-year period between 2014 and 2018 were analysed.

Methods: The retrospective observational study analysed the data on the medicines prescribed to children aged up to 19 years. The data were obtained from the Primary Care Prescriptions Database at the HIIS and at the National Institute of Public Health. The consumption of medications is shown according to the anatomical therapeutic chemical (ATC) classification in DDD. Medication subgroups within the ATC groups were also reviewed. The data are shown in tabular format.

Results: The number of prescriptions issued for children in 2014–2018 in Slovenia is lower by 8%, while the number of DDD prescribed in the same period was higher by 4%. The highest percentage of persons receiving at least one prescription for systemic treatment of bacterial infections was observed in the Murska Sobota HIIS regional unit, i.e., 35%, followed by regional units Krško with 34.1%, Ravne with 33.2% and Novo mesto with 32%. The fewest persons received medications in the Nova Gorica regional unit. The KK1p indicator, which reflects the value of a defined daily dose (DDD) unit or the average price per unit of all medications prescribed in Slovenia, shows a downward trend for Slovenia as well as major differences between the HIIS regional units. Compared to the baseline year, there was a 16% reduction in the proportion of children having received a prescription for an antibiotic. The reduction observed for the Nova Gorica regional unit amounted to 33%.

Conclusion: The indicators presented show an improved quality of drug prescribing for children, notably regarding systemic antibiotics. We believe the indicators are useful both for individual physicians and for decision-making at national level. They also contribute to further control of antimicrobial use in children, which is their main purpose.

Izvleček

Izhodišče: Kazalniki predpisovanja zdravil so izbrani podatki, ki delno osvetljujejo zdravnikovo delo na področju predpisovanja zdravil. Temeljijo na podatkih o izdanih zdravilih na recept. Zavod za zdravstveno zavarovanje Slovenije (ZZZS) je v sodelovanju s predstavniki pediatrične stroke pripravil nabor kazalnikov kakovosti predpisovanja zdravil na področju pediatrije. Pripravljena je analiza kazalnikov za petletno obdobje od leta 2014–2018.

Metode: V retrospektivni, opazovalni raziskavi so bili analizirani podatki o predpisanih zdravilih otrokom do 19. leta starosti. Vir podatkov je baza ambulantno predpisanih zdravil na ZZZS in na

Nacionalnem inštitutu za javno zdravje (NIJZ). V analizo so bili vključeni podatki o številu ambulantno predpisanih zdravil na zelenih in belih receptih. Poraba zdravil je prikazana glede na razvrstitev po anatomsko-terapevtski-kemični (ATC) klasifikaciji v definiranih dnevni odmerkih (DDD). Pregledane so bile tudi podskupine zdravil znotraj skupin ATC. Podatki so prikazani v tabelah.

Rezultati: Število izdanih receptov v Sloveniji se je zmanjšalo za 8 %, vendar se je poraba zdravil v DDD povečala za 4 %. Najvišji delež oseb, ki so prejele vsaj en recept za zdravila za sistemsko zdravljenje bakterijskih okužb, je bil v območni enoti (OE) Murska Sobota 35 %, sledijo OE Krško s 34,1 %, OE Ravne s 33,2 % in OE Novo mesto z 32 %. Najmanj oseb je zdravila prejelo v OE Nova Gorica – 21,1 %. Kazalnik KK1p, ki kaže strošek predpisanih zdravil na enoto DDD, kaže padajoči trend za Slovenijo in velike razlike med območnimi enotami ZZZS. Glede na izhodiščno leto je v Sloveniji prišlo do zmanjšanja deleža otrok, ki so prejeli recept za antibiotik za sistemsko zdravljenje, za 16 %. V OE Nova Gorica je to zmanjšanje kar 33-odstotno.

Zaključek: Predstavljeni kazalniki kažejo izboljšanje kakovosti predpisovanja zdravil pri otrocih zlasti na področju sistemskih antibiotikov. Menimo, da so kazalniki koristni tako za posamezne zdravnike kot za odločanje na nacionalni ravni. Lahko prispevajo k nadaljnjemu obvladovanju porabe protimikrobnih zdravil pri otrocih, kar je njihov osnovni namen.

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1 Introduction

World Health Organization (WHO) defines rational use of medicines (RUM) as: “patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community.” RUM lowers risks, improves benefits, saves resources and contributes to fair availability (1,2,3).

Total annual extent of antibiotic prescriptions in number of users per 100 patient-years was 18% in the Netherlands, 36.2% in the United Kingdom, and 52.0% in Italy. Their use was the highest in the first couple of years of life. The number of antibiotics that represent 90% of drugs for children was comparable. The index of amoxicillin was the highest in the Netherlands and the United Kingdom (50–60%), the lowest in Italy (30%), however, over

time it declined in the United Kingdom and Italy (4,5).

The indicators for prescribing medicines are select data that partially highlight the physician’s work in medication prescription. They are based on drugs issued on prescription. In cooperation with paediatric representatives, the Health Insurance Institute of Slovenia (HIIS) prepared a range of indicators of the quality of drug prescription in paediatrics. The analysis of indicators for the 2014–2018 period has been completed (6,7,8,9). The A/B indicator has been added, showing the proportion between number of people who received amoxicillin, and the number of people who received broad spectrum antibiotics. The analysis supports international comparison (4).

In this retrospective, observational, descriptive study, we analysed groups of

medicines prescribed between 2014 and 2018, which were the basis for determining the indicators of quality. The indicators were divided into three groups: the first defines the general indicators that include the size of the DDD unit, the number of prescriptions of a standardized receptor, the DDD number per standardized receptor and the share of prescription recipients among children. The second group includes indicators pertaining to the prescription of drugs for systemic infection treatment, and the third one includes indicators pertaining to prescribing antibiotics or chemotherapy drugs for local therapy.

2 Material and methods

The analysis included all the paediatricians and general/family medicine physicians, who treated 100 or more people, aged up to 19 years. All analyses include drugs that were issued at pharmacies in Slovenia and were prescribed on public and private prescriptions to persons aged up to 19 years. Even though an e-prescription also includes the data on prescribed drugs, all the indicators only take into account those issued in pharmacies in Slovenia. The data on the issued medicines comes from HIIS's prescription database, where all the data on paper and e-prescriptions are gathered, and the database of prescribed drugs in the Republic of Slovenia National Institute of Public Health (NIJZ) (9,11). The data on the doctor, provider and employments come from the database on providers – the Registry of Healthcare Providers and Workers (RIZDDZ) and the data on selected personal physicians. If a physician has more than one employment, all prescriptions are contributed to their basic employment. If their basic employment is not in clinical practice, the supplemental employment is counted in the analysis. The indicators are calculated on a yearly basis and take into account the drugs that were issued in pharmacies in a given year. Every indicator is displayed for

Slovenia and for all of HIIS's regional units (RU).

Some indicators take into account the age-standardised population. This number is a theoretical value at which we presuppose that the age structure of the participating population is the same as in standard population. It tells us what the value would be in an observed population, if the age structure of this population would be the same as in the standard population. The ponderers for defining standardised population change every year depending on the number of children and the value of prescribed drugs in an individual age group. The data for ponderers are calculated by yearly age intervals for recipients of drugs for ages from 0 to 19. The indicators are displayed by ages for the period of 5 years. A single methodology is used for all ages. This makes the data for every physician comparable by year, reflecting the changes in the physician's work. If the value of an indicator is 20% above the average, it is coloured green, while red marks indicators 20% below average. The methodology is described in more detail on HIIS's website, where all indicators and data on prescribed drugs can be accessed (6,7,8).

The usage of drugs is listed by their placement according to the anatomic-therapeutic-chemical (ATC) classification. Subgroups of drugs from the ATC groups, namely ATC group J01 (drugs for systemic treatment of bacterial infections), antibiotics, and chemotherapeutics for local treatment, which include drugs from ATC groups D06AX01, D06AX07, D06AX09, S01AA12, S01AA26, S01AD03, S01AE03, S01AE07 and S01CA01, were also reviewed. The use of antibiotics for systemic treatment was expressed in defined daily doses (DDD), and the use of antibiotics and chemotherapeutics for local treatment in the number of packs, because there is no DDD defined for them. DDD is the assumed average maintenance dose per day for a drug used for its main

Table 1: Basic data for calculating indicators.

	2014	2018	Index
No. of physicians	303	311	103
Number of defined children	34,854	35,826	103
Number of standardised defined children	26,431	27,040	102
Patient consultation rate	45,015	46,137	102
No. of prescriptions	87,031	80,333	92
No. of recipients of prescriptions	31,046	29,493	95
Number of defined prescription recipients	18,804	18,333	97
Total value of prescriptions with VAT (EUR)	931,418	915,089	98
Total use of prescription drugs in DDD	960,748	1,002,241	104

indication in adults. It is defined by the WHO Collaborating Centre for Drug Statistics Methodology in Oslo for drugs that have been assigned ATC labels. DDD is a fixed measurement unit, independent from the price and pharmaceutical form, which allows for an assessment of the need for using drugs and comparison between population groups (10,11).

3 Results

3.1 Primary data

Primary data shows that the number of physicians with 100 or more defined people, aged up to 19, has increased from 303 to 311 over five years, i.e., 3%, the same as the number of defined children. With increased total use of medicines in DDD by

Table 2: Indicator KK1p – the cost of prescribed drugs per DDD unit over the 2014–2018 period in Slovenia and RU HIIS.

	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	0.97 €	0.98 €	0.97 €	0.96 €	0.91 €	94
Celje	1.04 €	1.09 €	1.07 €	1.08 €	1.12 €	108
Koper	0.93 €	0.92 €	0.90 €	0.93 €	0.94 €	101
Krško	0.91 €	0.91 €	0.85 €	0.80 €	0.83 €	92
Kranj	1.04 €	1.02 €	1.06 €	1.11 €	1.05 €	101
Ljubljana	0.98 €	0.98 €	0.96 €	0.97 €	0.91 €	93
Maribor	0.96 €	1.02 €	1.02 €	0.94 €	0.85 €	89
Murska Sobota	1.04 €	1.06 €	1.11 €	1.08 €	1.01 €	98
Nova Gorica	0.84 €	0.81 €	0.75 €	0.72 €	0.66 €	78
Novo mesto	0.78 €	0.74 €	0.77 €	0.77 €	0.75 €	96
Ravne na Koroškem	1.08 €	1.11 €	1.07 €	1.05 €	1.01 €	93

4%, the number of prescription recipients has decreased by 5%, and the total value of prescriptions by 2%. The average physician included in the indicator had 1,156 defined children in 2018 (range of 105–2,768), 872 age standardised children (range of 101–2,109) and the patient consultation rate of 1,488 (range of 102–3,697), taken into account for the reviewed population of children (Table 1).

3.2 General indicators

We will present the 14 indicators of quality for prescribing drugs in paediatrics.

KK1p – the cost of prescribed medicines per DDD unit

The indicator shows the value of the DDD unit, i.e., the average price per unit for all prescribed drugs in EUR (Table 2). The indicator points to a declining trend

for Slovenia, and major differences between RU of HIIS. The index in Slovenia was 94. The highest growth was recorded in Celje (index of 108), followed by Koper and Kranj. The biggest decline of the DDD value was in Nova Gorica (index of 78) and in Maribor (index of 92).

KK2p – age-standardised number of prescriptions per recipient

The indicator shows the age-standardised number of prescriptions of all medicines prescribed at out-patient clinics of the selected prescriber per recipient. At the national level, a 3% decrease is visible, while at individual RUs, there was an increase. RU Krško recorded a growth of 6%, followed by Kranj and Ljubljana. All other RUs recorded a decrease in the number of issued prescriptions (Table 3). As no value is marked green, this means that there are no derogations from the Slovenian average that would be less than 20%. All deroga-

Table 3: Indicator KK2p – age-standardised number of prescriptions per recipient, and indicator KK3p – age-standardised DDD number per recipient over the 2014–2018 period in Slovenia and RU HIIS with corresponding indices.

	KK2p – age-standardised number of prescriptions per recipient						KK3p – age-standardised DDD number per recipient					
	2014	2015	2016	2017	2018	Index 2018/2014	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	3.6	3.4	3.7	3.7	3.5	97	40.2	36.7	42.3	42.6	43.9	109
Celje	3.7	3.4	3.9	3.7	3.5	94	40.4	35.6	41.4	39.9	38.5	95
Koper	3.7	3.3	3.7	3.7	3.5	93	43.6	38.6	43	42.8	40	92
Krško	5.1	4.9	5.3	5.4	5.4	106	53.4	50.4	57.6	59.2	61.6	115
Kranj	3.1	2.9	3.2	3.3	3.1	101	34.7	33.7	38.5	38.3	39	112
Ljubljana	3.2	3	3.3	3.3	3.2	100	36.3	33.9	39.1	39.6	41.9	115
Maribor	4	3.7	4	3.9	3.7	94	40.4	35.5	40.5	40.6	43.6	108
Murska Sobota	4.8	4.3	4.9	5	4.5	95	48.7	41.3	48.7	50.7	49.1	101
Nova Gorica	3.7	3.2	3.5	3.3	3.3	89	47.9	43.1	54.2	54.9	62.5	131
Novo mesto	3.8	3.4	3.6	3.6	3.4	90	48	44.1	48.4	48.9	49.6	103
Ravne na Koroškem	4.1	3.8	4.1	4	3.8	92	41.2	36.7	43.2	42.1	43.4	105

tions were higher, and are marked in red.
KK2p – age-standardised number of DDD medicines per recipient

The indicator shows the age-standardised number of DDD medicines per recipient. It shows fluctuating data with the lowest values for 2015. As the previous indicator shows, the number of issued prescriptions in Slovenia decreased by 3%; however, the use of medicines, as shown by this indicator, has increased, as there were 9% more DDDs prescribed (Table 3).

3.3 Prescribing medicines for systemic infection treatment

KK4p – share of people who received the drugs for systemic treatment of bacterial infections

The indicator shows the ratio between the number of defined children whose physician prescribed at least one antibiotic (ATC: J01) and the number of all defined children of this physician (Table 4). On average, half of defined children receive at least one prescription for an antibiotic (in individual RUs the percentage is between 47% and 64%), with a clear shift towards decrease in most RUs. In Slovenia there is a

5% decrease in recipients of prescriptions. The growth of prescription recipients was recorded only in RU Kranj (index of 103).
KK5p – share of people who received medicines for systemic treatment of infections

The indicator shows the share of prescription recipients for antibiotics (ATC: J01) among all prescription recipients (Table 5). The difference compared to KK4p is that here all children who were prescribed an antibiotic are taken into account, not only those who were defined for it. With regard to the first year, all RUs recorded a decrease in the share of children who received a prescription for an antibiotic by 14%. At RU Nova Gorica, this decrease amounted to 33%. In 2014, the first year of the survey, the differences between the RUs were significantly lower than in 2018, which shows that over the past five years, physicians in certain RUs have approached management of antibiotic use more aggressively.

KK6p – age-standardised level of defined people (number/1000 people) who received medicines for systemic treatment of bacterial infections among all the defined people

Table 4: Indicator KK4p – share of defined people who received the medicines for systemic treatment of bacterial infections in the 2014–2018 period by RU with corresponding indices.

	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	54%	53%	52%	52%	51%	95
Celje	50%	51%	49%	51%	48%	96
Koper	61%	56%	54%	56%	53%	87
Krško	62%	64%	63%	62%	62%	100
Kranj	45%	47%	46%	47%	47%	103
Ljubljana	50%	49%	48%	49%	48%	96
Maribor	60%	58%	56%	56%	56%	93
Murska Sobota	68%	66%	66%	66%	64%	95
Nova Gorica	54%	50%	48%	47%	47%	86
Novo mesto	59%	57%	55%	56%	54%	91
Ravne na Koroškem	56%	56%	53%	51%	50%	90

The indicator shows the number of defined recipients of antibiotics (ATC: J01) per 1000 defined children (Table 5). When defining the population of the recipients, the age structure of recipients is taken into account (standardisation), just like with KK2p. In most RUs, there was a significant shift towards improvement over the past five years, with the differences between RUs in 2018 increasing compared to the first year. The index for Slovenia is 78.

KK7p – share of use (in DDD) of drugs for systemic treatment of bacterial infections among all prescribed drugs

The indicator shows the number of DDD units of prescribed antibiotics (ATC: J01) in the number of DDD units of all prescribed medicines (Table 6).

KK8p – share of people who received a second prescription for drugs for systemic treatment of bacterial infections

The indicator shows the share of children who were prescribed a second dose of an antibiotic (ATC: J01) within 14 days. It is not defined whether this is the same or a different antibiotic. The indicator has improved across all RUs. While in one RU a quarter of children receive a repeat dose of an antibiotic after the first prescription, in some RUs this share is at only one sixth. This points to significant differences in therapy (Table 6).

The highest share of people who received at least one prescription for medicines for systemic treatment of bacterial infections was in the Murska Sobota regional unit (RU HIIS), 35%. This was followed by RU Krško with 34.1%, RU Ravne na Koroškem with 33.2%, and RU Novo Mesto with 32%. The fewest people received drugs at RU Nova Gorica – 21.1% (Figure 1).

Table 5: Indicator KK5p – the share of people who received drugs for systemic treatment of infections, and indicator KK6p – age-standardised level of defined people (number/1000 people) who received medicines for systemic treatment of infections of all defined in the 2014–2018 period in Slovenia and by RU HIIS with corresponding indices.

	KK5p – share of people who received medicines for systemic treatment of bacterial infections						KK6p – age-standardised level of defined people (number/1000 people) who received medicines for systemic treatment of bacterial infections					
	2014	2015	2016	2017	2018	Index 2018/2014	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	42%	40%	39%	37%	35%	84	238	221	208	197	186	78
Celje	42%	39%	37%	36%	34%	80	230	223	198	206	179	78
Koper	44%	40%	40%	38%	36%	82	277	228	229	218	191	69
Krško	41%	42%	43%	39%	41%	98	281	292	300	265	272	97
Kranj	38%	37%	36%	34%	33%	89	180	177	172	162	159	88
Ljubljana	41%	38%	36%	34%	34%	82	208	187	175	165	159	76
Maribor	42%	42%	41%	38%	35%	84	266	257	239	219	206	78
Murska Sobota	43%	46%	43%	39%	37%	86	316	318	296	267	244	77
Nova Gorica	43%	39%	34%	33%	29%	67	242	198	170	159	144	59
Novo mesto	47%	45%	44%	43%	42%	89	297	266	259	251	237	80
Ravne na Koroškem	44%	44%	41%	40%	41%	93	273	265	236	222	228	84

J01 MEDICINES FOR SYSTEMIC TREATMENT OF BACTERIAL INFECTIONS

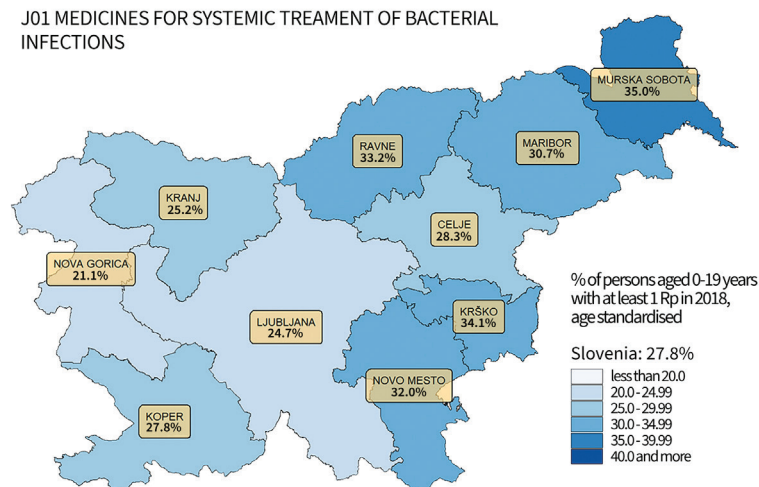


Figure 1: Share of people who received at least one prescription for medicines for systemic treatment of bacterial infections by individual RU HIIS in 2018.

The highest share of people aged between 0 and 19 with at least one prescription in the year was in the Lendava municipality (46.33%), followed by municipalities Turnišče (45.76%), Dobrovnik (43.55%), Muta (43.00%), Dobje (41.89%), Središče ob Dravi (41.27%), Kobilje (40.91%) and Trnovska vas (40.72%) (Figure 2).

KK9p – share of use (in DDD) of broad and narrow spectrum medicines for systemic treatment of bacterial infections

The indicator shows the share of use, expressed in the number of DDD broad and narrow spectrum antibiotics from ATC group J01. Broad spectrum antibiotics are defined as: amoxicillin with clavulanic acid, 2nd and 3rd generation cephalosporins, clarithromycin and azithromycin. Narrow spectrum antibiotics are:

Table 6: Indicator KK7p – share of use (in DDD) of medicines for systemic treatment of bacterial infections among all prescribed medicines, and indicator KK8p – share of people who were prescribed another dose of medicines for systemic treatment of bacterial infections in the 2014–2018 period in Slovenia and by RU HIIS with corresponding indices.

	Indicator KK7p – share of use (in DDD) of medicines for systemic treatment of bacterial infections among all prescribed drugs						Indicator KK8p – share of people who received a repeat prescription for medicines for systemic treatment of bacterial infections					
	2014	2015	2016	2017	2018	Index 2018/2014	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	12%	12%	12%	11%	10%	84	20%	20%	19%	18%	17%	88
Celje	12%	12%	11%	12%	11%	86	23%	22%	22%	21%	19%	84
Koper	12%	12%	12%	12%	11%	89	22%	20%	21%	19%	17%	76
Krško	9%	10%	11%	10%	10%	105	27%	27%	27%	25%	26%	98
Kranj	12%	11%	11%	11%	10%	87	15%	15%	16%	15%	15%	97
Ljubljana	13%	13%	12%	11%	10%	77	17%	16%	15%	15%	15%	90
Maribor	12%	13%	13%	12%	10%	84	20%	21%	20%	19%	18%	89
Murska Sobota	10%	13%	12%	11%	11%	102	24%	25%	24%	23%	19%	81
Nova Gorica	10%	9%	8%	7%	6%	56	22%	19%	17%	17%	16%	73
Novo mesto	12%	11%	12%	12%	11%	95	24%	23%	22%	23%	21%	86
Ravne na Koroškem	14%	15%	13%	13%	13%	92	26%	26%	23%	21%	21%	83

J01 MEDICINES FOR SYSTEMIC TREATMENT OF BACTERIAL INFECTIONS

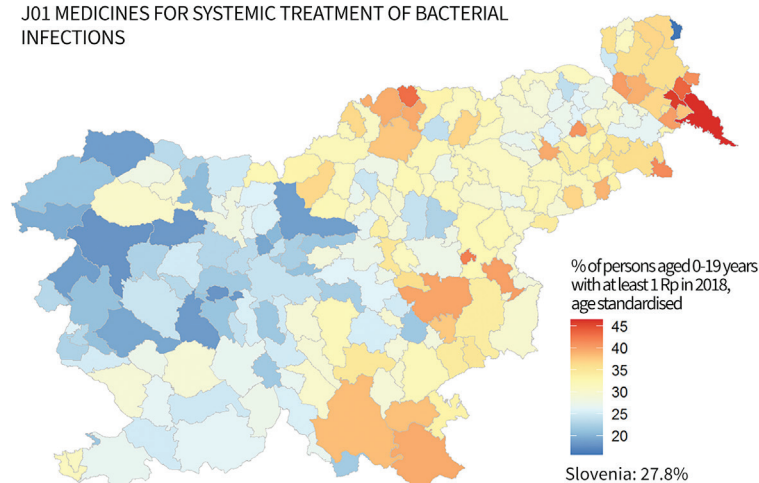


Figure 2: Share of people who received at least one prescription for medicines for systemic treatment of bacterial infections by Slovenian municipalities in 2018.

phenoxymethylpenicillin, 1st generation cephalosporins, erythromycin, midecamycin, and miocamycin.

Results above 1 show a greater use of broad-spectrum antibiotics, and thereby a worse, less favourable share. The indicator has improved across most RUs, as well as at the country level (Table 7).

KK10p – share of use (in DDD) of amoxicillin and amoxicillin/clavulanic acid

The indicator shows the ratio between the DDD numbers of amoxicillin and amoxicillin with clavulanic acid. Higher results point to a better, i.e., more favourable ratio for amoxicillin. The indicator at the level of Slovenia has improved throughout this period (index 123) and has decreased only in two RUs (RU Nova Gorica and RU Ravne na Koroškem). This

Table 7: Indicator KK9p – share of use (in DDD) of broad and narrow spectrum medicines for systemic treatment of bacterial infections, and indicator KK10p – share of use (in DDD) of amoxicillin and amoxicillin/clavulanic acid in the 2014–2018 period in Slovenia and in RU HIIS with corresponding indices.

	KK9p – share of use (in DDD) of broad and narrow spectrum medicines for systemic treatment of bacterial infections						KK10p – share of use (in DDD) of amoxicillin and amoxicillin/clavulanic acid					
	2014	2015	2016	2017	2018	Index 2018/2014	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	0.9	0.8	0.7	0.7	0.7	76	2	2	2.1	2.3	2.4	123
Celje	0.9	0.7	0.6	0.6	0.6	61	2.3	2.2	2.6	3.9	3.8	166
Koper	1.2	1.4	1	1.5	1.2	99	1.1	1.1	1.3	1.3	1.3	124
Krško	1.2	1.4	0.9	1.1	1	85	1.7	1.7	1.9	2.4	2.6	157
Kranj	0.8	0.8	0.6	0.6	0.6	76	2.1	2.3	2.8	2.7	2.9	143
Ljubljana	0.8	0.8	0.6	0.6	0.6	75	2	1.8	2.1	2.1	2.2	114
Maribor	0.9	0.7	0.6	0.6	0.6	66	2	2	2.4	2.7	2.6	130
Murska Sobota	0.9	0.6	0.6	0.7	0.7	81	2.3	2.3	2.4	3.1	3.1	135
Nova Gorica	0.6	0.6	0.5	0.5	0.7	108	3.8	2.8	2.7	2.9	2.8	74
Novo mesto	1.2	1.1	0.9	0.9	0.7	58	1.6	1.8	1.6	1.7	2.3	146
Ravne na Koroškem	0.8	0.9	0.8	0.8	0.8	92	2.6	2.7	2.9	3.1	2.4	91

points to major differences between RU of HIIS. The best improvement is shown at RU Celje (index of 166), and RU Krško (index of 157) (Table 7).

3.4 Prescribing antibiotics or chemotherapy medicines for local therapy

KK11p – share of people who received an antibiotic or a chemotherapy drug for local therapy and the KK12p indicator.

The indicator shows the share of prescription recipients for antibiotics or chemotherapy drugs for local therapy among all prescription recipients and is comparable to KK5p. While 35% of children received prescriptions for a systemic antibiotic (Table 6), 23% of them received a local one (Table 8). As the indicator for system-

ic antibiotics has improved, the latter has worsened at the state-level by 2% over the past 5 years, while significantly improving in some RUs.

KK12p – age-standardised level of defined people (number/1000 people) who received antibiotic or chemotherapy medicines for local therapy, among all defined

The data shows the number of defined recipients of antibiotics or chemotherapy drugs for local therapy per 1000 defined children. When defining the population of recipients, we took into account the age structure of recipients, same as with the indicator KK6p. While 186 standardised children per 1000 defined received a systemic antibiotic (Table 6), 134 received a local one (Table 6). An improvement in the sense of reducing the number of re-

Table 8: Indicator KK11p – share of people who received an antibiotic or a chemotherapy medicines for local therapy, and indicator KK12p – age-standardised level of defined people (number/1000 people) who received medicines for systemic treatment for local therapy, among all defined in the 2014–2018 period in Slovenia and by RU HIIS with corresponding indices.

	Indicator KK11p – share of people who received an antibiotic or a chemotherapy medicines for local therapy and the KK12p indicator						Indicator KK12p – age-standardised level of defined people (number/1000 people) who received antibiotic or chemotherapy medicines for local therapy					
	2014	2015	2016	2017	2018	Index 2018/2014	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	22%	23%	22%	24%	23%	102	140	141	132	140	134	95
Celje	19%	19%	18%	19%	18%	96	110	111	103	109	98	89
Koper	28%	29%	28%	31%	32%	114	192	187	175	192	192	100
Krško	22%	26%	24%	26%	29%	132	157	188	177	185	201	128
Kranj	23%	23%	21%	24%	22%	95	122	123	113	126	120	98
Ljubljana	22%	23%	22%	24%	23%	103	132	131	124	133	129	97
Maribor	18%	20%	19%	20%	19%	108	127	135	127	128	128	100
Murska Sobota	28%	31%	30%	32%	28%	100	217	226	221	229	204	94
Nova Gorica	24%	24%	21%	20%	17%	70	140	124	107	100	86	61
Novo mesto	19%	19%	19%	20%	18%	96	143	138	131	136	120	84
Ravne na Koroškem	25%	26%	24%	26%	24%	93	162	158	137	145	135	84

ipients is significantly more expressed in systemic antibiotics, where the differences among RUs are also smaller.

KK13p – share of people who received a second dose of an antibiotic or a chemotherapy medicine for local therapy

The indicator shows the share of children who were prescribed a repeated dose of an antibiotic or a chemotherapy medicine for local therapy (Table 9). The share in 2018 is on average the same as with systemic antibiotics (Table 9). This indicator also shows major differences between RUs.

KK14p – share of use (in packs) of antibiotics or chemotherapy medicine for local therapy among all antibiotics

The indicator shows the use of antibiotics or chemotherapy drugs for local therapy among all antibiotics; use was measured in packs (Table 9). The share has increased in most RUs in the past years, pointing to an effective decrease of systemic and local

antibiotics.

4 Discussion

The 14 indicators described provide a broad insight into drug prescribing to children. While standardisation by age structure of children is not as important for comparisons between RUs, it is very important for comparisons between populations of defined children of individual physicians. A comparison of a physician working at a preschool outpatient clinic with one who only treats school-going children would not make sense without a standardisation.

The index of the number of issued prescriptions to children in the years 2014–2018 in Slovenia was lower by 3%, while in the same period there were 9% more DDD prescribed. The highest share of persons who received at least one pre-

Table 9: Indicator KK13p – share of people who received a prescribed antibiotic or chemotherapy medicine for local therapy, and indicator KK14p – share of use (in packs) of antibiotics or chemotherapy medicine for local therapy among all antibiotics in the 2014–2018 period in Slovenia and by RU HIIS with corresponding indices.

	KKp13 – share of children with repeat prescriptions of local antibiotics						KKp14 – share of use (in packs) of local antibiotics among all antibiotics					
	2014	2015	2016	2017	2018	Index 2018/2014	2014	2015	2016	2017	2018	Index 2018/2014
Slovenija	19%	18%	18%	18%	17%	90	36%	38%	38%	41%	41%	113
Celje	15%	15%	15%	15%	13%	88	31%	34%	35%	36%	38%	121
Koper	22%	20%	21%	20%	22%	99	40%	44%	41%	47%	50%	125
Krško	22%	24%	25%	26%	25%	112	36%	40%	38%	44%	45%	123
Kranj	15%	15%	15%	14%	13%	83	40%	40%	38%	42%	40%	100
Ljubljana	17%	16%	16%	16%	15%	90	37%	39%	39%	42%	42%	113
Maribor	20%	20%	19%	18%	17%	86	34%	36%	36%	39%	40%	117
Murska Sobota	23%	24%	26%	26%	23%	101	40%	41%	43%	48%	45%	112
Nova Gorica	19%	14%	14%	12%	12%	61	36%	38%	39%	39%	38%	107
Novo mesto	20%	22%	18%	18%	15%	72	28%	30%	29%	29%	28%	101
Ravne na Koroškem	21%	20%	19%	19%	17%	84	37%	37%	38%	41%	38%	104

scription for drugs for systemic treatment of bacterial infections was at RU Murska Sobota, namely 35%. This was followed by RU Krško with 34.1%, RU Ravne na Koroškem with 33.2%, and RU Novo Mesto with 32%. The fewest people received drugs at RU Nova Gorica – 21.1%.

The five-year period provides an insight into the dynamics of changes at the level of Slovenia, any by individual RUs. At the level of Slovenia, three out of four general indicators were improved, with only decline in KK3p – the age-standardised DDD number of prescribed medicines per standardised recipient. All six antibiotic indicators for systemic therapy have improved, which is a very significant result. The results of indicators of antibiotics or chemotherapy drugs for local therapy show that two decreased, namely the share of people who received an antibiotic or a chemotherapy drug for local therapy (KK11p) and the age-standardised level of defined people (number/1000 people) who received antibiotic or chemotherapy drugs for local therapy, among all defined (KK12p). Two indicators, the share of people who received a prescribed antibiot-

ic or chemotherapy drug for local therapy (KK13p), and the share of use (in packs) of antibiotics or chemotherapy drugs for local therapy among all antibiotics (KK14p) have improved. The share of children who were prescribed a second dose of a local antibiotic within 14 days in 2018 is on average the same as with systemic antibiotics (Table 9), with major differences between RUs. The share has decreased in most RUs in the past years, pointing to an effective decrease of prescribing both systemic and local antibiotics.

Comparisons between RUs paint a very diverse picture. A highly simplified approach for assessing the success of an individual RU is by looking at the number of derogations of individual RUs in indicators from the average by more or less than 20% in 2018, we can see that the derogations below 20%, which are marked green, and the derogations above 20%, which are marked red, for the RUs listed below. The data has been collected from all indicators (Table 10).

The presented indicators cannot be put directly into international context. The ration between broad and narrow spectrum antibiotics is one of the indicators of the European Centre for Disease Prevention and Control (ESAC-net), published on its website for whole populations of included countries (12). Sandra de Bie et al. has published the data of this indicator for the paediatric population for the 2001–2010 period (4). In 2010, the ratio for the Netherlands stood at 3.2, for the United Kingdom at 0.3 and for Italy at 217.9. For Slovenia, this ratio stood at 0.9 in 2014, and in 2018, it improved to 0.7 (Table 7, indicator KK9p). The comparison shows that according to this indicator, Slovenia is very far behind the United Kingdom, but still better than the Netherlands and Italy. It naturally has to be taken into account that there is a 4-year difference between the data.

We also calculated the A/B indicator for the Slovenian paediatric population, developed by the same working group. It

Table 10: RU HIIS, listed by number of derogations from the Slovenian average by less (green) or more (red) than 20% per individual indicator.

	Green	Red
Nova Gorica	6	1
Celje	3	1
Kranj	2	0
Novo mesto	1	1
Murska Sobota	1	6
Ljubljana	0	0
Maribor	0	0
Ravne na Koroškem	0	3
Koper	0	6
Krško	0	9

shows the ratio between number of people who received amoxicillin, and the number of people who received broad spectrum antibiotics from the groups ATC J01CR (penicillin combined with β -lactamase inhibitors), J01DC (2nd generation cephalosporins), J01DD (3rd generation cephalosporins) and J01F (macrolides, lincosamides and streptogramins without erythromycin, miocamycin and midecamycin) (4). The value of the indicator in 2014 was 0.93, and in 2018, it was 0.75, which is a 19% decrease (Table 11). In 2010, this ratio in Italy stood at 0.3, in the Netherlands at 1.6, and in the United Kingdom at 5.4. For this indicator, it also applies that because of the 4-year difference, the comparison can only serve as an orientation; however, it does point to a significantly poorer ratio in Slovenia than in the United Kingdom and the Netherlands.

For a comprehensive assessment of indicators, their shortcomings also have to be known. Indicators do not differentiate physicians by their specialisation. The only measure for including a physician is the number of defined children. The data shows that the defined paediatric populations of physicians are very different. The range in the number of standardised children is between 101 and 2,019, and the range of consultation rate is between 102 and 3,697. Younger physicians do not yet have all the defined children, even though they are perhaps already their patients, data from job changes are delayed. The

Table 11: The number of people aged 19 years or less in Slovenia who received prescriptions for medications from the listed ATC groups of drugs between 2014 and 2018 and the A/B indicator.

ATC Group	2014	2018
J01CA04	62.705	52.661
J01CR+DC+DD+F	58.157	39.733
A/B indicator	0,93	0,75

indicators do not take into account the social aspect. Despite its small size, Slovenia is a socially very diverse country, which is also reflected in children morbidity. Comparisons between RUs and the derogations from the average does not take into account that RUs have very different population numbers. Positive derogation in a small RU may be the result of a high quality of the work of a smaller group of physicians, while change in a large RU requires the engagement of a significantly bigger number of physicians.

A more detailed monitoring of different aspects of antibiotic use with children was the most important reason for introducing indicators, as physicians often prescribe antibiotic especially for infections of the upper respiratory tract. Excessive use and inappropriate prescription of antibiotics results in resistance to them (13,14). In Italy, nearly a half of paediatricians (44.5%) demonstrated insufficient quality in prescribing antibiotics (15).

Presented indicators point to an improvement in the quality of prescribing drugs to children, especially in the field of antibiotics for systemic therapy. We believe that the indicators are useful both for individual physicians and for decision-making at the national level. They can contribute to continued management of the use of antimicrobial drugs, which is their core purpose (16).

In November 2017, HIIS sent the guidelines for treating the most frequent infections to all physicians together with the Recept (Prescription) publication. The objective of this review is not a statistical analysis of their impact to prescriptions or indicators. This would be difficult to evaluate. The dynamics of antibiotic indicators shows that in 2018 the positive trend from the previous years has continued. This has achieved the purpose of these guidelines. The group of authors who described the approaches to managing antibiotics in Slovenia has discovered that successful management requires a comprehensive

approach from several perspectives (16). Guidelines and indicators certainly contribute towards better management of antimicrobial drugs use.

5 Conclusion

Slovenia is one of the few countries to establish indicators for prescribing medicines in paediatrics in primary healthcare. A review of the 2014–2018 period shows an improvement in indicators, especially in the prescribing of antibiotics for sys-

temic treatment of bacterial infections. The improvement is less expressed in the field of prescribing antibiotics or chemotherapy drugs for local therapy. Orientation comparison with the published data for the United Kingdom, the Netherlands and Italy shows that especially United Kingdom has significantly better indicators than Slovenia. All of this shows that we should strive towards improvement – continued reduction of the use of antibiotics and the change in the structure towards narrow spectrum antibiotics.

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