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Children with asthma are being prescribed unnecessary antibiotics

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ABSTRACT

Objectives: To compare the rate, indications and type of antibiotic prescriptions in children with and without asthma.

Design: A retrospective cohort study

Setting: Two population-based primary care databases: IPCI (The Netherlands) and THIN (UK).

Participants: Children aged 5-18 years were included from January 2000 to December 2014. A child was categorized as having asthma if there were ≥2 prescriptions of respiratory drugs in the year following a code for asthma. Children were labelled as non-asthmatic if no asthma code was recorded in the patient file.

Main outcome measures: Rate of antibiotic prescriptions, related indications, and type of antibiotic drugs

Results: The cohorts in IPCI and THIN consisted of 946,143 and 7,241,271 person years (PY), respectively. In both cohorts, antibiotic use was significantly higher in asthmatic children (IPCI: 197 vs. 126 users / 1,000 PY, THIN: 374 vs. 250 users / 1,000 PY). In children with asthma, part of antibiotic prescriptions were for an asthma exacerbation only (IPCI: 12%, THIN: 4%) and prescriptions were more often due to lower respiratory tract infections then in non-asthmatic children (IPCI: 28% vs. 13%, THIN: 21% vs. 12%). Drug type and quality indicators depended more on age, gender and database than on asthma status.

Conclusions: Use of antibiotics was higher in asthmatic children compared to non-asthmatic children. This was mostly due to diseases for which antibiotics are normally not indicated according to guidelines. Further awareness amongst physicians and patients is needed to minimize antibiotic overuse and limit antibiotic resistance.

Strengths and limitations of this study

- This study investigates antibiotic prescriptions in two large population-based databases
- A major strength of this study is that the use of databases from different countries surpasses local prescription patterns
- Because of the design of the study misclassification of indications is possible
- Antibiotic use depends on country, sex and gender; therefore analyses were stratified

INTRODUCTION

Antibiotic resistance is one of the biggest threats to global health today, as recently stated by the World Health Organization.[1] Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality.[2] The world urgently needs to change the way it prescribes and uses antibiotics. The Netherlands has long been recognized as a role model in the restricted use of antibiotics. For example, due to restricted antibiotic use MRSA rates are much lower in the Netherlands than in surrounding countries.[3 4] Insights in antibiotic use for different patient groups and in different countries may help to develop best practices for optimal antibiotic use. Studies indicate that children with asthma receive more antibiotics than children without asthma.[5 6] However, national and international guidelines clearly state that antibiotics are not indicated for an asthma exacerbation.[7-9] Respiratory infections may trigger an asthma exacerbation, but these are mostly viral infections.[7] Insight in prescription patterns is a first step in detecting possible overuse and to initiate steps in reducing antibiotic use. Not only the prescription rate influences resistance patterns, also the type of antibiotic is important. Indeed, it is well known that broad spectrum antibiotics increase the risk of resistance more than narrow spectrum antibiotics.[10] The aim of this study was to investigate differences in antibiotic prescriptions rates, type of antibiotic being prescribed and related indications in children with and without asthma in a primary care setting in different countries. In addition we studied changes over time and associated quality indicators.

PATIENTS AND METHODS

Setting: A retrospective, population-based cohort study was conducted using data from 2 primary care databases: the Integrated Primary Care Information database (IPCI) from the Netherlands and The Health Improvement Network (THIN) from the UK. Both databases contain detailed information on drug prescription, diagnoses and comorbidities. Detailed descriptions of these databases have been published elsewhere.[11-13] The scientific review committee of IPCI and THIN approved this study (nr. 07/2016 and 16THIN046).

Patient involvement: No patients were involved in this study.

Study population: The study population comprised all children aged 5-18 years, with at least one year of valid database history and having at least one day of follow-up during the study period (1st January 2000 until 31st December 2014). Within this study population, we identified a cohort of children with asthma and a cohort of children without asthma. A child was diagnosed as having asthma if there were at least 2 prescriptions of respiratory drugs in the year following a code for asthma. These drugs consisted of bronchodilators, inhaled corticosteroids, LTRA or xanthines (ATC code R03 – BNF codes 3.1.1-3.1.4, 3.2, 3.3). If a patient was not diagnosed with a code for asthma, this child was labeled as non-asthmatic.

Exposure: Antibiotic (AB) prescriptions were identified from the patient files using prescription codes (ATC code J01 for IPCI and BNF code 5.1 for THIN). BNF codes were mapped to the corresponding ATC codes.

Indications: To assess the underlying indications, the indication of use as entered in the prescription records was used. As not all prescription records contained information

on the indication of use, diagnostic codes entered in the patient's file on the same date as the antibiotic prescription were also considered as indication of use. Indications were divided into the following categories: upper respiratory tract infections (URTI), skin infections (skin), urinary tract infections (UTI), asthma exacerbation (asthma), lower respiratory tract infections (LRTI) and a combination of upper and lower respiratory tract infections (URTI + LRTI) in case a patient had codes for both. Other indications and combinations of indications were categorized as 'other'. As we were especially interested in LRTI, we categorized subtypes of LRTI's into 'bronchitis', 'pneumonia', 'combination of asthma exacerbation and bronchitis', 'influenza', 'tracheitis' and 'other' (combinations of the previous or other LRTI).

Quality indicators: To investigate differences in quality of antibiotic prescriptions in children with and without asthma, quality indicators (QI's) were calculated as proposed by the European Surveillance of Antimicrobial Consumption (ESAC) and as described in literature.[14] First, the types of antibiotics that covered 90% of all antibiotic prescriptions (DU90%) were assessed.[15-17] Second, the ratio between broad and narrow spectrum antibiotics (B/N ratio) was calculated. Two additional QI's that are specific for outpatient pediatric use were also investigated namely the amoxicillin index (AI, the number of amoxicillin prescriptions as percentage of total antibiotic prescriptions) and the ratio between amoxicillin and broad spectrum antibiotics prescriptions (A/B ratio). Although amoxicillin is classified as an intermediate spectrum antibiotic and therefore not in the B/N ratio, it is considered the antibiotic of first choice for a large part of pediatric indications.[8 18 19] A high AI and A/B ratio are therefore indications of appropriate prescribing. Antibiotics considered as broad spectrum were: combinations of penicillins

(J01CR), 2nd and 3rd generation cephalosporins (J01DC, J01DD) and macrolides (J01F)(except erythromycin). Narrow spectrum antibiotics were: β-lactam sensitive antibiotics (J01CE), 1st generation cephalosporines (J01DB) and erythromycin (J01FA01).

Statistical analysis: Descriptive statistics were used to describe characteristics of children with or without asthma. The prevalence of antibiotic use was expressed as the number of users per 1,000 person years (PY) to be interpreted as the number of children per 1,000 who use antibiotics in one year. Antibiotic use was studied overall but also by type of antibiotic (ATC code pharmacological subgroup level). A Poisson regression model was applied to determine differences in antibiotic prescription rates. The effect of age, gender and calendar year was studied by means of a stratified analysis. Descriptive statistics were used to describe patient characteristics. Chi-square tests or Fisher's exact test were used to examine differences in indication of use between children with asthma and children without asthma.

A p-value <0.05 was considered statistically significant. Jerboa©, a custom-built software, was used to assess prevalence of antibiotic use and further analyses were conducted using SAS® version 9.4.[20]

RESULTS

The study population of IPCI consisted of 26,750 children with asthma and 330,916 children without asthma in total contributing to 946,143 PY. The median age for children with asthma at start of follow-up was 10.8 years (interquartile range (IQR) 6.4-14.6) and for children without asthma 10.3 years (IQR 6.1-13.9). The study population in THIN consisted of 152,957 children with asthma and 1,438,097 children without asthma, in total contributing to 7,241,271 PY. Median age at start of follow up was 7.9 years (IQR 5.0-11.4) for children with asthma and 6.0 years (inter quartile range, (IQR) 5.0-10.2) for children without asthma.

During the study period 186,195 prescriptions of antibiotics were retrieved from the IPCI database and 3,283,887 from the THIN database. The overall annual prevalence of AB use in the entire pediatric population was 131/1,000 PY for IPCI and twice as high, namely 263/1,000 PY for THIN ($p<0.001$). (figure 1) In both databases, children with asthma used significantly more antibiotics than children without asthma ($p<0.0001$). In IPCI, the prevalence rate ratio (PRR) of AB use in children with asthma versus use in non-asthmatic children was 1.65 (95% CI 1.53-1.78) (adjusted for age, gender and calendar year). The same trend was observed in THIN with a PRR of 1.60 (95% CI 1.54-1.66). The number of AB prescriptions was higher than the number of users and children who used antibiotics received on average two antibiotic prescriptions per year. In both databases the rate of antibiotic prescriptions decreased significantly with calendar time, both in children with or without asthma ($p<0.05$). (figure 2)

In IPCI, 29% of the antibiotic prescriptions could not be linked to an indication of use on the day of prescription; this was 50% for THIN. The most common indication for

antibiotic prescriptions in all children was upper respiratory tract infection (41% IPCI, 47% THIN), followed by lower respiratory tract infections with significantly higher proportions in children with asthma (18% IPCI, 21% THIN) than children without asthma (IPCI: 13%, THIN: 12%). (figure 3) The most common LRTI for AB prescriptions was acute bronchitis. (figure 4) In children with asthma, 14% (IPCI) to 4% (THIN) of antibiotics were prescribed for asthma exacerbation only.

The type of prescribed AB was different between databases. (Figure 5-6, table 1) In IPCI, the difference in type of antibiotic between children with and without asthma was most pronounced for macrolides (22.1% of all AB prescriptions in children with asthma vs. 15.9% in non-asthmatic children, p-value <0.0001). In THIN, this difference was less pronounced: macrolides were prescribed in 15.4% of prescriptions for children with asthma and 12.9% for children without asthma (p-value <0.0001).

Table 1 – DU90% in IPCI and THIN– NA: not part of DU90%

Drug		Percentage of DU90%	
Pharmacological subgroup	**Active component**	**asthma**	**no asthma**
IPCI			
Tetracyclines	doxycycline	7.0%	6.6%
	minocycline	N/A	3.6%
Penicillins	amoxicillin	37.5%	34.5%
	pheneticillin	5.2%	7.7%
	flucloxacillin	5.0%	6.3%
	amoxicillin with enzyme inhibitor	12.6%	14.2%
Sulfonamides and trimethoprim	sulfamethoxazole and trimethoprim	3.8%	N/A
Macroliden, lincosamides and strepto-gramins	clarithromycin	8.1%	5.6%
	azithromycin	13.8%	10.1%
Other antibacterials	nitrofurantoin	6.9%	11.5%
THIN			
Tetracyclines	lymecycline	4.1%	4.8%
	oxytetracycline	3.2%	3.5%
Penicillins	amoxicillin	38.8%	33.7%
	phenoxyme-thylpenicillin	13.9%	18.4%
	flucloxacillin	12.2%	14.0%
	amoxicillin with enzyme enhibitor	4.3%	4.4%
Other b-lactam antibacterials	cefalexin	3.2%	3.1%
Sulfonamides and trimethoprim	trimethoprim	5.2%	7.0%
Macroliden, lincosamides and streptogramins	erythromycin	12.1%	11.0%
	clarithromycin	3.2%	N/A

With regard to quality indicators, more appropriate antibiotic prescribing was observed for THIN (UK) compared to IPCI (NL), with a higher B/N ratio (IPCI: 3.4, THIN: 0.3) and a lower A/B ratio (IPCI: 1.1, THIN: 3.9) and AI (IPCI: 32.0, THIN: 36.1) in IPCI than in THIN. These findings remained when repeating the analysis for prescriptions for LRTI and asthma exacerbation only. Overall, based on quality indicators, AB prescribing in children with asthma appeared less appropriate than in children without asthma. (Table 2)

Table 2 – Quality indicators of all prescriptions and prescriptions for lower respiratory tract infections only

		All prescriptions			LRTI prescriptions		
		B/N ratio	**AI**	**A/B ratio**	**B/N ratio**	**AI**	**A/B ratio**
IPCI	**asthma**	4.7	34.7	1.1	23.3	48.6	1.2
	no asthma	3.2	31.5	1.1	20.6	50.3	1.3
THIN	**asthma**	0.4	38.8	3.8	0.6	72.8	7.6
	no asthma	0.3	33.7	4.0	0.5	73.2	8.6

Broad/Narrow (B/N) ratio: (J01CR J01DC, J01DD, J01F (except J01FA01))/(J01CE, J01DB, J01FA01)
Amoxicillin Index (AI): J01CA04/J01
Amoxicillin/Broad (A/B) ratio: J01CA04/ (J01CR, J01DC, J01DD, J01F (except J01FA01)
J01CA04: Amoxicillin, J01CE: Beta-lactamase sensitive penicillins, J01CR: combinations of penicillins
J01DB: 1st generation cephalosporins, J01DC: 2nd generation cephalosporins, JOIDD: 3rd generation cephalosporins
J01F: macrolides, lincosamides and streptogramins, J01FA01: erythromycin

The analyses of prescription rates, indications and quality indicators were repeated while stratifying for age and gender. After the age of 12, especially in girls the number of prescriptions increased due to urinary tract infections. Differences between children with and without asthma and between countries remained similar upon stratification. Details on stratified analysis are available in the online supplement 1.

DISCUSSION

In this international cohort study, we showed that children with asthma are more often prescribed antibiotics than children without asthma. This higher AB prescription rate in children with vs. children without asthma was strikingly similar in the UK and The Netherlands, while overall use of AB prescriptions was substantially higher in the UK compared to the Netherlands. High use of AB in children with asthma was already reported in literature but, to our knowledge, we are the first who investigated indication of use.[5 6]

The indications of use were often bronchitis and asthma exacerbations, conditions for which antibiotics are in general not recommended. Indeed, according to GINA, use of AB for the treatment of asthma exacerbations is not recommended unless there is strong evidence of lung infection.[7] Asthma is not a risk factor for complicated respiratory tract infections according to the British guidelines, and Dutch guidelines even emphasize that underlying asthma does not justify antibiotics in case of a LRTI.[8 9] One explanation could be that respiratory infectious syndromes in children with asthma present with various lower respiratory tract symptoms. This complicates the discrimination between a bacterial infection, a viral infection or an asthma exacerbation in primary care. Also, even though guidelines state that there is not enough evidence for treatment with antibiotics in case of an asthma exacerbation, it is being discussed that the supposedly anti-inflammatory effect of antibiotics (macrolides in particular) might be beneficial for patients with asthma.[21-24] This might explain the relatively higher rate of macrolides prescriptions for asthmatic children in the Netherlands. However, the

recommendation of macrolide use would only be beneficial for children with severe asthma whom are usually treated in secondary and tertiary care.

While important differences in prescription rates were observed in children with or without asthma, the type of drugs and quality of the prescriptions were comparable. Mainly country specific differences in quality indicators were observed which was already reported in other studies.[25] Although, children in the UK receive twice as often antibiotics compared with Dutch children, the choice of antibiotics seems to be more appropriate in the UK. These country specific differences in quality indicators might be explained by differences in availability of drugs, resistance patterns and national guidelines.

For the overall use of antibiotics in all children, it is remarkable that a large proportion was prescribed for upper respiratory tract infections. URTI's are notoriously caused by viruses for which antibiotics are not effective.[9] So in terms of reducing antibiotic use, a lot can be gained by not prescribing antibiotics anymore for this indication in both countries.

As for all observational research, this study has strengths and limitations: strengths of this study include the large number of patients that were followed over time and the fact that this is an international study. In addition, we present real life data. Indeed, we used the electronic patient records of GP practices spread over the UK and the Netherlands. In both countries the GP acts as a gatekeeper of the patient's medical care, minimizing selection and information bias. Also, in contrast to other studies, we had information on all different indications of use, although not for all AB prescriptions. With regard to

limitations, we might have underreported pneumonia as indication of AB use in THIN. In our study, pneumonia was defined based on pneumonia specific READ codes. This classification was stricter than in other studies where the READ code 'Acute lower respiratory infection (H062.00)' was also classified as 'pneumonia' while we classified that code as 'LRTI – unspecified'.[26] For both databases, indications were based on diagnose codes without use of free text. Finally, misclassification of asthma could be a concern as asthma was based on the presence of asthma disease codes in combination of use of respiratory drugs: Still the prevalence of asthma which we reported (IPCI (7.9%) and THIN (9.6%) is in line with literature suggesting that asthma misclassification is minimal.[27]

To conclude, this study shows possibilities for further reduction and more sensible choice of antibiotic use, even in countries as The Netherlands where antibiotic use is the lowest in the world. We showed that children with asthma are prescribed antibiotics often for self-limiting respiratory tract infections. Additionally, asthma treatment in primary care can be optimized by following (inter)national guidelines more strictly. This can be done by raising awareness amongst GP's, patients and their parents. Education of the patients should not be forgotten, as the patient's view on treatment influences the decision of physicians.[28-30] Further awareness can reduce unnecessary antibiotic use and limit antibiotic resistance.

FOOTNOTES

Author contributions: EB, TK, HJ and KV contributed to the conception and design, acquisition of data and analyses and interpretation of the data, drafted the article, revised it critically for important intellectual content and gave final approval of the version to be published. PB, JdJ and MS contributed to the conception and design and acquisition of data, interpretation of the data, revised the drafted manuscript critically for important intellectual content and gave final approval of the version to be published.

Ethics approval The scientific review committee of IPCI and THIN approved this study (nr. 07/2016 and 16THIN046)

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; KV works for a research group who in the past received unconditional research grants from Yamanouchi, Pfizer, Boehringer-Ingelheim, Novartis and GSK. None of these grants was related to the content of this work; no other relationships or activities that could appear to have influenced the submitted work.

Provenance and peer review: Not commissioned; externally peer reviewed.

Data sharing: statistical codes are available upon request from the corresponding author.

Patient consent: Not required.

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FIGURE LEGEND

Figure 1 – Age and asthma status specific annual prevalence rate of antibiotic use

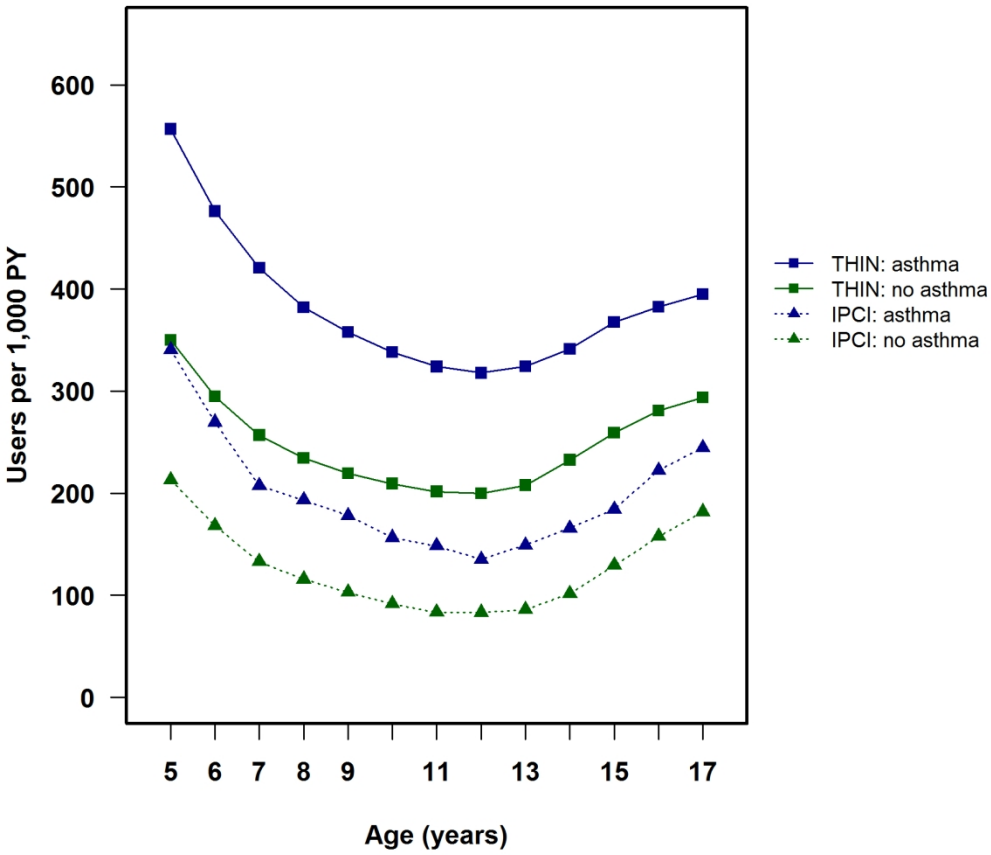
Figure 2 – Annual prevalence rate of antibiotic use by calendar year

Figure 3 – Indications of antibiotic use

Figure 4 – Indications of lower respiratory tract infections

Figure 5 – Age, gender and asthma specific antibiotic prescriptions in IPCI

Figure 6 – Age, gender and asthma specific antibiotic prescriptions in THIN



Age and asthma status specific annual prevalence rate of antibiotic use

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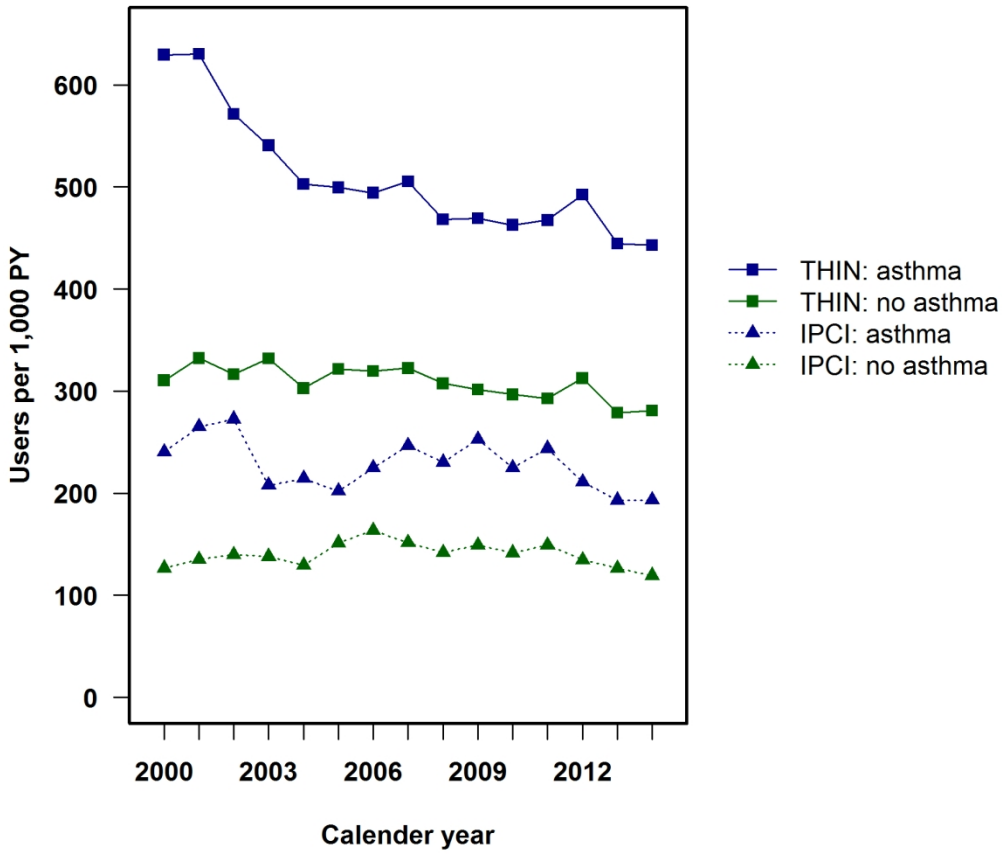

Annual prevalence rate of antibiotic use by calendar year

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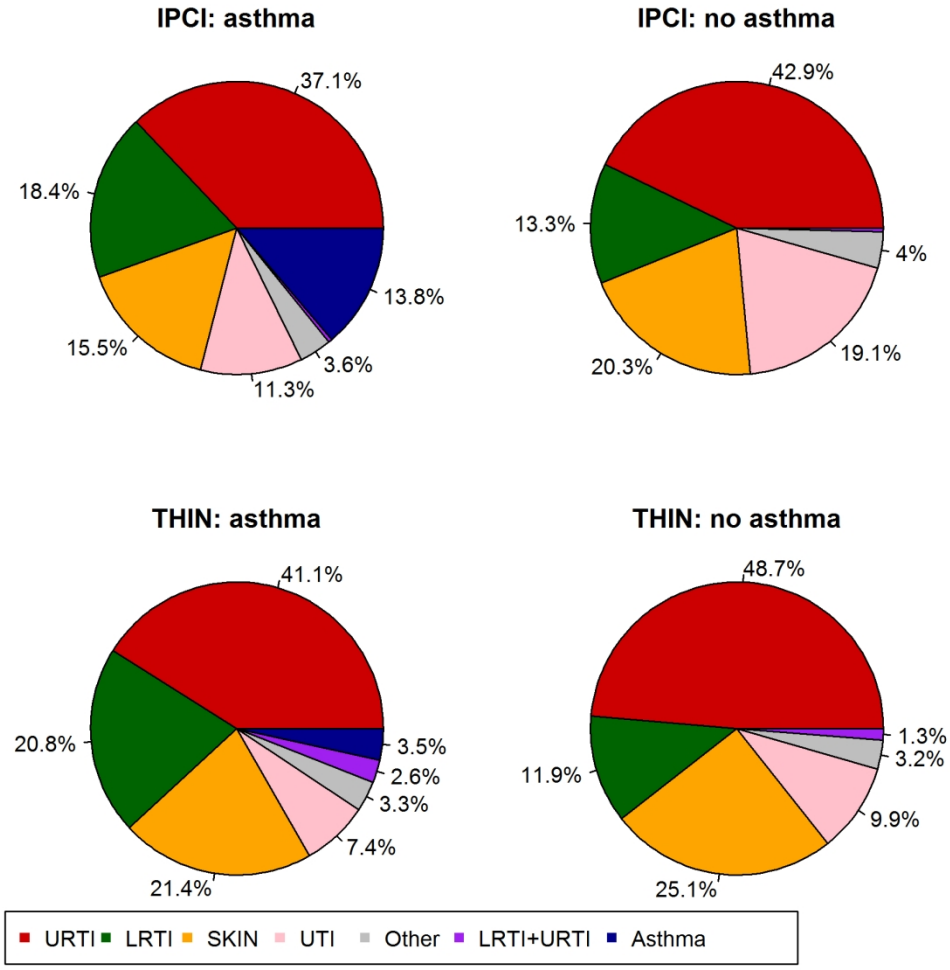

Indications of antibiotic use

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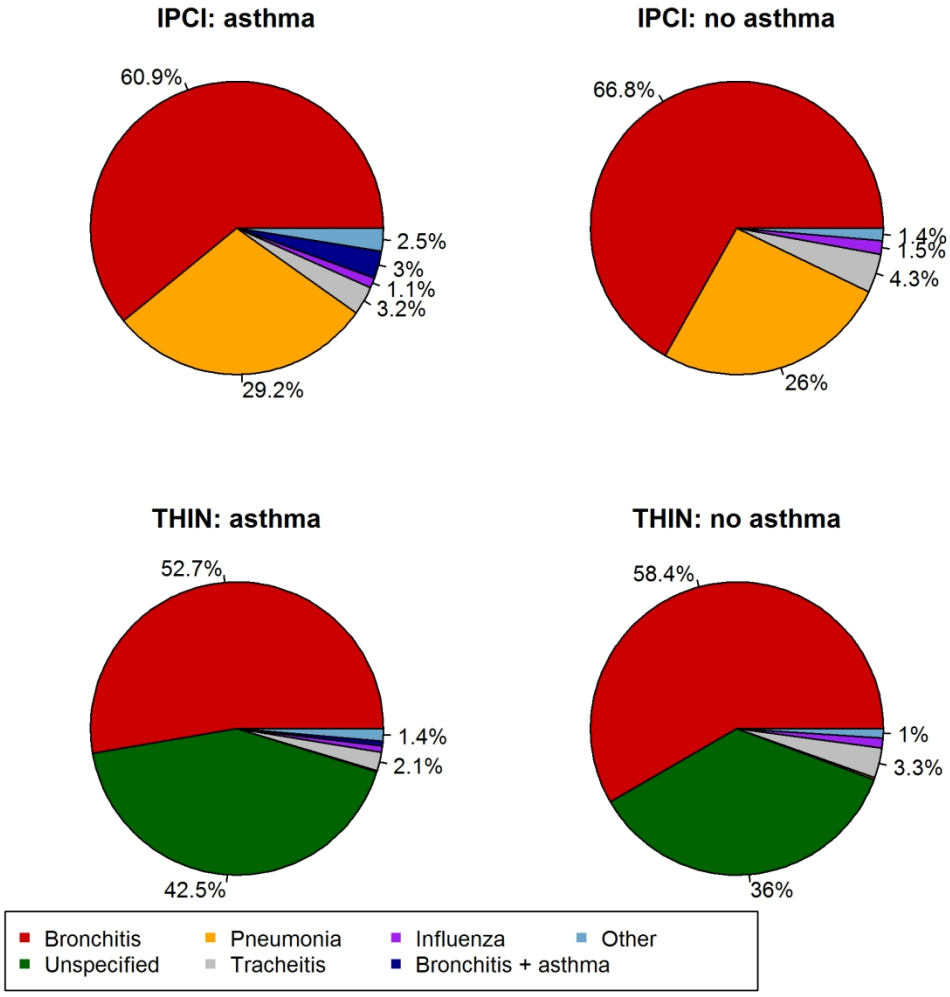

Indications of lower respiratory tract infections

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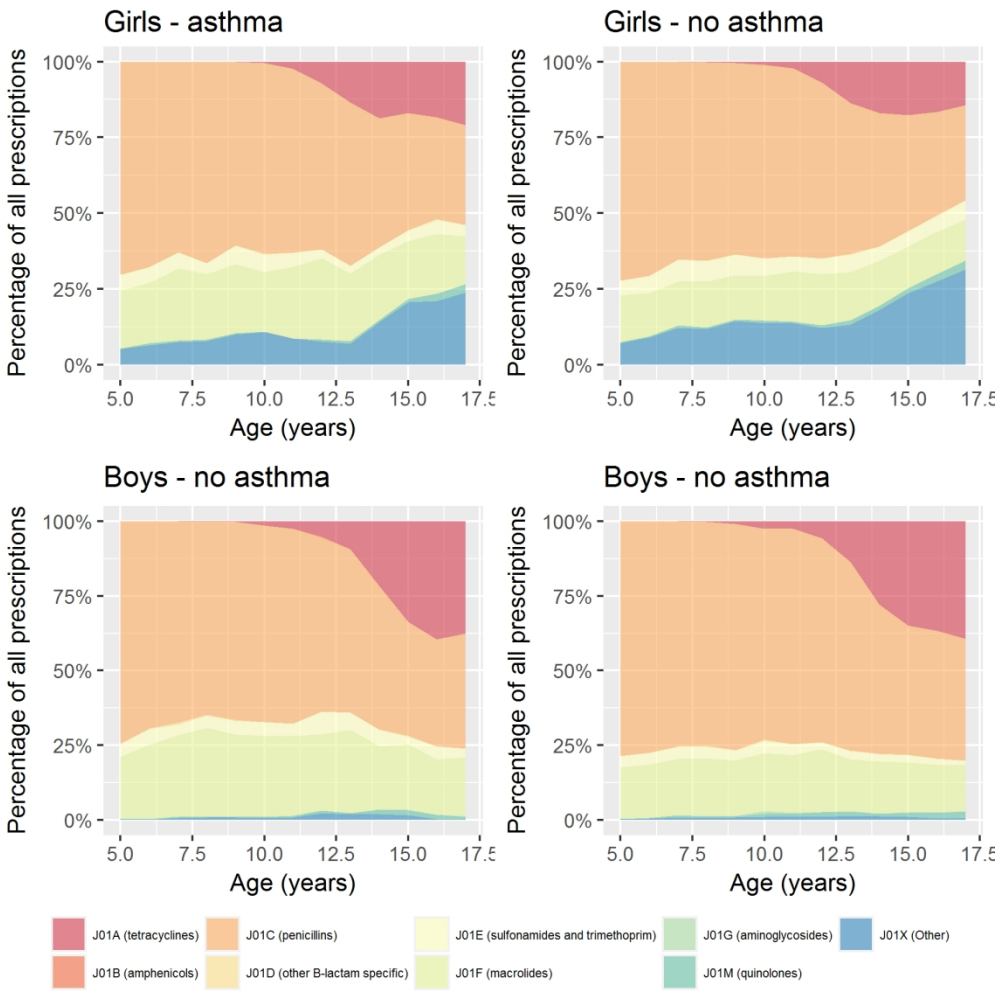
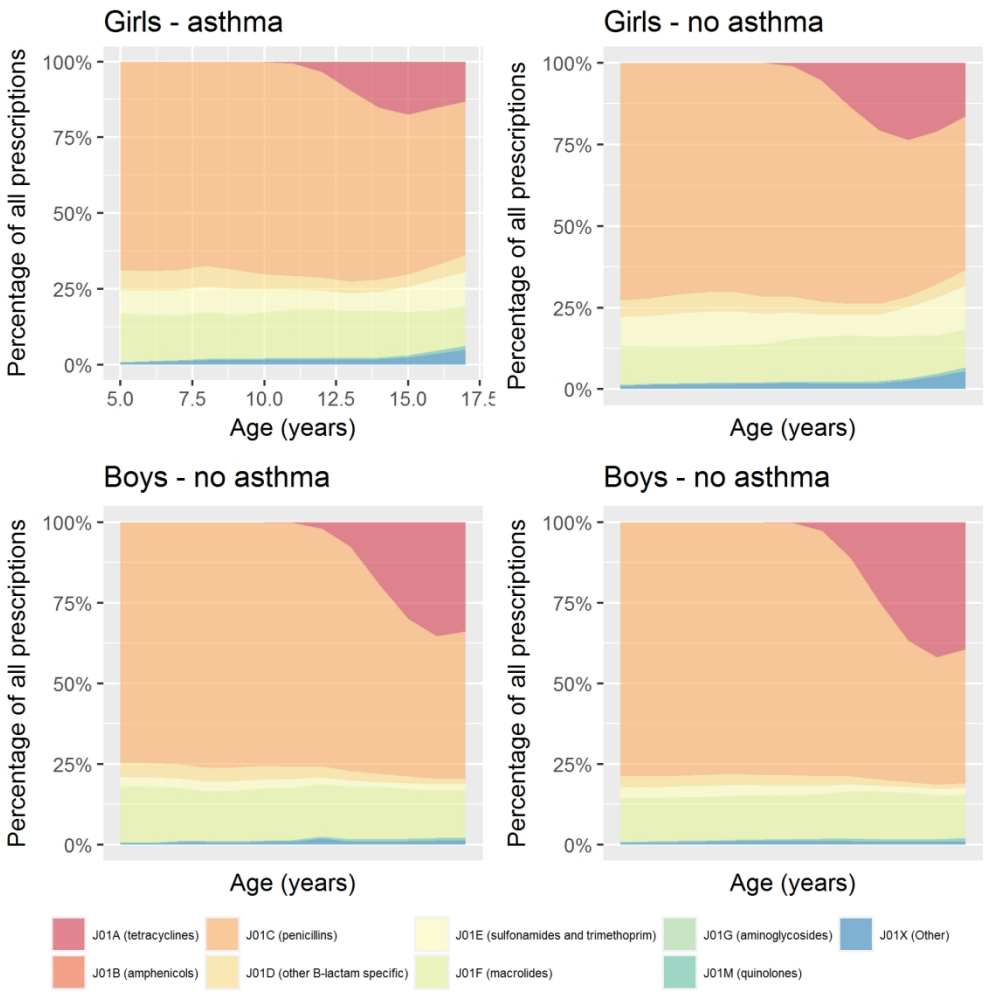


Age, gender and asthma specific antibiotic prescriptions in IPCI

160x160mm (300 x 300 DPI)



Age, gender and asthma specific antibiotic prescriptions in THIN

160x160mm (300 x 300 DPI)

Supplement 1

Table 1 – indications of prescriptions stratified for age and gender

IPCI								
	Girls <12 yr		Girls ≥12 yr		Boys <12 yr		Boys ≥12 yr	
Indication	asthma	no asthma	asthma	no asthma	asthma	no asthma	asthma	no asthma
URTI	39%	43%**	33%	37%**	40%	52%**	33%	39%**
LRTI	20%	14%**	12%	8%**	24%	19%**	16%	14%*
Skin	9%	14%**	13%	16%**	14%	20%**	28%	39%**
UTI	16%	23%**	26%	35%**	2%	3%**	3%	3%
Other/multiple indications	3%	4%*	2%	3%*	4%	5%	4%	4%
LRTI + URTI	1%	0%	0%	0%*	0%	1%	1%	0%
Asthma	12%	-	13%	-	15%	-	16%	-
THIN								
	Girls <12 yr		Girls ≥12 yr		Boys <12 yr		Boys ≥12 yr	
Indication	asthma	no asthma	asthma	no asthma	asthma	no asthma	asthma	no asthma
URTI	46%	56%**	40%	45%**	45%	56%**	35%	40%**
LRTI	22%	15%**	16%	9%**	26%	16%**	21%	12%**
Skin	13%	15%**	21%	26%**	15%	18%**	33%	41%**
UTI	10%	12%**	14%	16%**	4%	5%**	2%	3%**
Other/multiple indications	3%	3%*	4%	4%*	3%	3%	3%	3%*
LRTI + URTI	3%	2%**	2%	1%**	3%	2%**	2%	1%**
Asthma	3%		3%		5%		3%	

*p-value <0.05 (asthma as reference)
**p-value <0.0001 (asthma as reference)

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Supplement 2

Table 1- DU90% stratified for age and gender – NA: not part of DU90%

IPCI									
		girls <12		Girls ≥12		Boys <12		Boys ≥12	
Pharmacologi-cal subgroup	**Active component**	**asthma**	**No asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**
Tetracy-clines	Doxycycline	N/A	N/A	14.7%	10.8%	N/A	N/A	15.9%	18.0%
	Minocycline	N/A	N/A	3.4%	4.7%	N/A	N/A	9.8%	11.9%
Penicilins	amoxicillin	47.7%	44.5%	20.6%	17.2%	51.6%	51.7%	25.3%	23.2%
	Pheneticillin	3.9%	6.3%	7.7%	9.6%	N/A	6.6%	4.9%	8.1%
	Flucloxacillin	N/A	5.1%	5.0%	5.3%	5.1%	7.1%	6.2%	8.9%
	amoxicillin with enzyme enhibitor	14.9%	17.2%	9.4%	9.7%	13.9%	16.45	11.6%	13.6%
Sulfona-mides and trimethoprim	trimethoprim	N/A	N/A	N/A	3.8%	N/A	N/A	N/A	N/A
	Sulfamethoxazole and trimethoprim	4.6%	N/A	N/A	N/A	4.9%	N/A	4.3%	N/A
Macrolides, lincosamides and strepto-gramins	Clarithromycin	8.0%	5.2%	6.7%	4.7%	9.0%	6.7%	8.5%	6.1%
	Azithromycin	12.6%	9.8%	13.2%	9.2%	15.4%	11.5%	13.6%	10.2%
Other antibacterials	Nitrofurantoin	8.5%	11.9%	19.3%	25.0%	N/A	N/A	N/A	N/A

Table 2 - DU90% stratified for age and gender – NA: not part of DU90%

THIN									
		girls <12		**Girls ≥12**		**Boys <12**		**Boys ≥12**	
Pharmacologi-cal subgroup	**Active component**	**asthma**	**no asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**	**no asthma**	**no asthma**
Tetracyclines	doxycycline	N/A	N/A	2.7%	2.7%	N/A	N/A	3.0%	3.8%
	lymecycline	N/A	N/A	5.7%	8.3%	N/A	N/A	9.7%	12.6%
	oxytetra-cycline	N/A	N/A	3.9%	5.4%	N/A	N/A	8.2%	10.2%
	minocycline	N/A	N/A	N/A	2.5%	N/A	N/A	3.7%	4.8%
penicilins	amoxicillin	40.6%	45.7%	28.6%	20.6%	51.1%	52.6%	30.3%	22.0%
	phenoxy-methyl-penicillin	18.5%	14.2%	16.8%	20.0%	12.8%	20.4%	11.9%	14.9%
	flucloxacillin	12.2%	10.3%	11.6%	12.7%	12.2%	17.3%	14.1%	15.6%
	amoxicillin with enzyme enhibitor	4.8%	4.9%	3.8%	3.5%	5.0%	6.1%	3.5%	3.5%
other b-lactam antibacterials	cefalexin	4.4%	4.8%	3.7%	3.2%	2.8%	N/A	N/A	N/A
sulfonamides and trimethoprim	trimethoprim	10.1%	8.3%	9.0%	10.2%	12.8%	3.7%	N/A	N/A
Macroliden, lincosamides and streptogramins	erythromycin	9.5%	11.8%	11.0%	10.8%	3.3%	N/A	12.5%	12.5%
	clarithromycin	N/A	N/A	3.3%	N/A	N/A	N/A	3.1%	N/A

Table 3– Quality indicators for prescriptions for lower respiratory tract infections, stratified for gender and age

IPCI												
	Girls <12 yr			**Girls ≥12 yr**			**Boys <12 yr**			**Boys ≥12 yr**		
	B/N ratio	**AI**	**A/B ratio**	**B/N ratio**	**AI**	**A/B ratio**	**B/N ratio**	**AI**	**A/B ratio**	**B/N ratio**	**AI**	**A/B ratio**
asthma	16.8	56.8	1.5	31.1	33.5	0.8	18.5	56.3	1.5	75.8	37.2	0.9
no asthma	19.8	58.1	1.5	25.7	35.7	0.9	15.2	58.8	1.6	39.2	35.5	0.9
THIN												
	Girls <12 yr			**Girls ≥12 yr**			**Boys <12 yr**			**Boys ≥12 yr**		
	B/N ratio	**AI**	**A/B ratio**	**B/N ratio**	**AI**	**A/B ratio**	**B/N ratio**	**AI**	**A/B ratio**	**B/N ratio**	**AI**	**A/B ratio**
asthma	0.5	72.7	8.0	0.7	71.6	6.8	0.6	73.3	7.7	0.7	73.4	7.3
no asthma	0.5	73.3	9.0	0.6	72.0	7.7	0.5	74.4	8.5	0.6	73.1	7.9

Broad/Narrow (B/N) ratio: (j01CR j01DC, j01DD, j01F(except j01FA01))/(j01CE, J01DB, J01FA01)
Amoxicillin Index (AI): J01CA04/J01
Amoxicillin/Broad (A/B) ratio: J01CA04/ (J01CR, J01DC, J01DD, J01F (except j01FA01)

J01CA04: Amoxicillin
J01CE: Beta-lactamase sensitive penicillins
J01CR: combinations of penicillins
J01DB: 1st generation cephalosporins
J01DC: 2nd generation cephalosporins
JOIDD: 3rd generation cephalosporins
J01F: macrolides, lincosamides and streptogramins
J01FA01: erythromycin

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5/6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	5-7/12-14
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	5-7
		(*d*) If applicable, explain how loss to follow-up was addressed	5
		(*e*) Describe any sensitivity analyses	n.a.
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	8
		(c) Summarise follow-up time (eg, average and total amount)	8
Outcome data	15*	Report numbers of outcome events or summary measures over time	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
		(*b*) Report category boundaries when continuous variables were categorized	n.a.
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n.a.
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Antibiotic use in children with asthma: cohort study in UK and Dutch primary care databases

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Antibiotic use in children with asthma: cohort study in UK and Dutch primary care databases

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ABSTRACT

Objectives: To compare the rate, indications and type of antibiotic prescriptions in children with and without asthma.

Design: A retrospective cohort study

Setting: Two population-based primary care databases: IPCI (The Netherlands) and THIN (UK).

Participants: Children aged 5-18 years were included from January 2000 to December 2014. A child was categorized as having asthma if there were ≥2 prescriptions of respiratory drugs in the year following a code for asthma. Children were labelled as non-asthmatic if no asthma code was recorded in the patient file.

Main outcome measures: Rate of antibiotic prescriptions, related indications, and type of antibiotic drugs

Results: The cohorts in IPCI and THIN consisted of 946,143 and 7,241,271 person years (PY), respectively. In both cohorts, antibiotic use was significantly higher in asthmatic children (IPCI: 197 vs. 126 users / 1,000 PY, THIN: 374 vs. 250 users / 1,000 PY). In children with asthma, part of antibiotic prescriptions were for an asthma exacerbation only (IPCI: 12%, THIN: 4%) and prescriptions were more often due to lower respiratory tract infections then in non-asthmatic children (IPCI: 28% vs. 13%, THIN: 21% vs. 12%). Drug type and quality indicators depended more on age, gender and database than on asthma status.

Conclusions: Use of antibiotics was higher in asthmatic children compared to non-asthmatic children. This was mostly due to diseases for which antibiotics are normally not indicated according to guidelines. Further awareness amongst physicians and patients is needed to minimize antibiotic overuse and limit antibiotic resistance.

Strengths and limitations of this study

- This study investigates antibiotic prescriptions in two large population-based databases
- A major strength of this study is that the use of databases from different countries surpasses local prescription patterns
- Because of the design of the study misclassification of indications is possible
- Antibiotic use depends on country, sex and gender; therefore analyses were stratified

INTRODUCTION

Antibiotic resistance is one of the biggest threats to global health today, as recently stated by the World Health Organization.[1] Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality.[2] The world urgently needs to change the way it prescribes and uses antibiotics. The Netherlands has long been recognized as a role model in the restricted use of antibiotics. For example, due to restricted antibiotic use MRSA rates are much lower in the Netherlands than in surrounding countries.[3, 4] Insights in antibiotic use for different patient groups and in different countries may help to develop best practices for optimal antibiotic use.

Studies indicate that children with asthma receive more antibiotics than children without asthma.[5, 6] However, national and international guidelines clearly state that antibiotics are not indicated for an asthma exacerbation.[7-9] Respiratory infections may trigger an asthma exacerbation, but these are mostly viral infections.[7] Insight in prescription patterns is a first step in detecting possible overuse and to initiate steps in reducing antibiotic use. Not only the prescription rate influences resistance patterns, also the type of antibiotic is important. Indeed, it is well known that broad spectrum antibiotics increase the risk of resistance more than narrow spectrum antibiotics.[10]

The aim of this study was to investigate differences in antibiotic prescriptions rates, type of antibiotic being prescribed and related indications in children with and

without asthma in a primary care setting in different countries. In addition we studied changes over time and associated quality indicators.

PATIENTS AND METHODS

Setting: A retrospective, population-based cohort study was conducted using data from 2 primary care databases: the Integrated Primary Care Information database (IPCI) from the Netherlands and The Health Improvement Network (THIN) from the UK. Both databases contain detailed information on drug prescription, diagnoses and co morbidities. Detailed descriptions of these databases have been published elsewhere.[11-13] The scientific review committee of IPCI and THIN approved this study (nr. 07/2016 and 16THIN046).

Patient and public involvement: No patients and or public were involved in this study.

Study population: The study population comprised all children aged 5-18 years, with at least one year of valid database history and having at least one day of follow-up during the study period (1st January 2000 until 31st December 2014). Within this study population, we identified a cohort of children with asthma and a cohort of children without asthma. A child was diagnosed as having asthma if there were at least 2 prescriptions of respiratory drugs in the year following a code for asthma. These drugs consisted of bronchodilators, inhaled corticosteroids, leukotriene receptor antagonist or xanthines (ATC code R03 – BNF codes 3.1.1-3.1.4, 3.2, 3.3). If a patient was not diagnosed with a code for asthma, this child was labeled as non-asthmatic. Children with a diagnose code of asthma and less than 2 prescriptions of asthma drugs were excluded from analyses because of potential misclassification

Exposure: All antibiotic (AB) prescriptions during the study period were identified from the patient files by an automated search on antibiotic drug codes (ATC code J01 for IPCI and BNF code 5.1 for THIN). To enable comparison between countries, BNF codes were mapped to the corresponding ATC codes.

Indications: To assess the underlying indications, the main indication code (READ codes in the THIN database and ICPC codes in the IPCI database) linked to the prescription was used. Only if no indication code of an infection was linked to the prescription, diagnostic codes entered in the patient's file on the same date as the antibiotic prescription were also considered as indication of use. Indications were divided into the following categories: upper respiratory tract infections (URTI), skin infections (skin), urinary tract infections (UTI), asthma exacerbation (asthma), lower respiratory tract infections (LRTI) and a combination of upper and lower respiratory tract infections (URTI + LRTI) in case a patient had codes for both. Other indications were categorized as 'other', and since there were not many prescriptions with multiple indications we categorized those as 'other' as well. As we were especially interested in LRTI, we categorized subtypes of LRTI's into 'bronchitis', 'pneumonia', 'combination of asthma exacerbation and bronchitis', 'influenza', 'tracheitis', 'unspecified' if no further categorization was possible, and 'other' (other LRTI or combinations of the previous). Tables with all indication codes and corresponding categories are available in the online supplementary file 1.

Quality indicators: To investigate differences in quality of antibiotic prescriptions in children with and without asthma, quality indicators (QI's) were calculated as proposed by the European Surveillance of Antimicrobial Consumption (ESAC) and as described in

literature.[14] First, the types of antibiotics that covered 90% of all antibiotic prescriptions (DU90%) were assessed.[15-17] Second, the ratio between broad and narrow spectrum antibiotics (B/N ratio) was calculated. Two additional QI's that are specific for outpatient pediatric use were also investigated namely the amoxicillin index (AI, the number of amoxicillin prescriptions as percentage of total antibiotic prescriptions) and the ratio between amoxicillin and broad spectrum antibiotics prescriptions (A/B ratio). Although amoxicillin is classified as an intermediate spectrum antibiotic and therefore not in the B/N ratio, it is considered the antibiotic of first choice for a large part of pediatric indications.[8, 18, 19] A high AI and A/B ratio are therefore indications of appropriate prescribing. Antibiotics considered as broad spectrum were: combinations of penicillins (J01CR), 2nd and 3rd generation cephalosporins (J01DC, J01DD) and macrolides (J01F)(except erythromycin). Narrow spectrum antibiotics were: β-lactam sensitive antibiotics (J01CE), 1st generation cephalosporines (J01DB) and erythromycin (J01FA01).

Statistical analysis: Descriptive statistics were used to describe characteristics of children with or without asthma. The prevalence of antibiotic use was expressed as the number of users per 1,000 person years (PY) to be interpreted as the number of children per 1,000 who use antibiotics in one year. Antibiotic use was studied overall but also by type of antibiotic (ATC code pharmacological subgroup level). A Poisson regression model was applied to determine differences in antibiotic prescription rates. The effect of age, gender and calendar year was studied by means of a stratified analysis. Descriptive statistics were used to describe patient characteristics.

Chi-square tests or Fisher's exact test were used to examine differences in indication of use between children with asthma and children without asthma. Confidence intervals (CI) of proportions were derived using Wilson method for binomial proportions.

A p-value <0.05 was considered statistically significant. Jerboa©, a custom-built software, was used to assess prevalence of antibiotic use and further analyses were conducted using SAS® version 9.4.[20]

RESULTS

The study population of IPCI consisted of 26,750 children with asthma and 330,916 children without asthma in total contributing to 946,143 PY. The median age for children with asthma at start of follow-up was 10.8 years (interquartile range (IQR) 6.4-14.6) and for children without asthma 10.3 years (IQR 6.1-13.9). The study population in THIN consisted of 152,957 children with asthma and 1,438,097 children without asthma, in total contributing to 7,241,271 PY. Median age at start of follow up was 7.9 years (IQR 5.0-11.4) for children with asthma and 6.0 years (inter quartile range, (IQR) 5.0-10.2) for children without asthma.

During the study period 186,195 prescriptions of antibiotics were retrieved from the IPCI database and 3,283,887 from the THIN database. The overall annual prevalence of AB use in the entire pediatric population was 131/1,000 PY for IPCI and twice as high, namely 263/1,000 PY for THIN (p<0.001). (figure 1) In both databases, children with asthma used significantly more antibiotics than children without asthma (p<0.0001). In IPCI, the prevalence rate ratio (PRR) of AB use in children with asthma versus use in non-asthmatic children was 1.65 (95% CI 1.53-1.78) (adjusted for age, gender and calendar year). The same trend was observed in THIN with a PRR of 1.60 (95% CI 1.54-1.66). The number of AB prescriptions was higher than the number of users and children who used antibiotics received on average two antibiotic prescriptions per year. In both databases the rate of antibiotic prescriptions decreased significantly with calendar time, both in children with or without asthma (p<0.05). (figure 2)

In IPCI, 29% of the antibiotic prescriptions could not be linked to an indication of use on the day of prescription; this was 50% for THIN. Of those prescriptions with a known

indication, the most common indication in all children was upper respiratory tract infection (41% IPCI, 47% THIN), followed by lower respiratory tract infections with significantly higher proportions in children with asthma (18% IPCI, 21% THIN) than children without asthma (IPCI: 13%, THIN: 12%, p-value for both databases <0.001). (figure 3) The most common LRTI for which AB were prescribed was acute bronchitis. (figure 4)

In children with asthma, 14% (IPCI) to 4% (THIN) of antibiotics were prescribed for asthma exacerbation only. Compared to the THIN database, a smaller proportion of the prescriptions for asthmatics in IPCI were due to URTI, LRTI and skin infections, and a larger proportion in IPCI was due to UTI and asthma (p-value for all indications <0.001). Differences in prescriptions for non-asthmatic patients were mostly similar, except that in this cohorts more prescriptions were due to LRTI in IPCI than in THIN (13.3% vs 11.9%, p-value <0.001).

The type of prescribed AB was different between databases. (Figure 5-6, table 1) In IPCI, the difference in type of antibiotic between children with and without asthma was most pronounced for macrolides (22.1% of all AB prescriptions in children with asthma vs. 15.9% in non-asthmatic children, p-value <0.0001). In THIN, this difference was less pronounced: macrolides were prescribed in 15.4% of prescriptions for children with asthma and 12.9% for children without asthma (p-value <0.0001).

Table 1 – Drug utilization (DU) 90% of all prescriptions in IPCI and THIN

Drug		Percentage of DU90% (95% CI)		Asthma vs. no asthma
Pharmacological subgroup	**Active component**	**asthma**	**no asthma**	**p-value**
IPCI				
Tetracyclines	doxycycline	7.0% (6.6-7.4)	6.6% (6.5-6.7)	0.0092
	minocycline	N/A	3.6% (3.5-3.7)	N/A
Penicillins	amoxicillin	37.5% (37.0-38.4)	34.5% (34.3-34.8)	<0.0001
	pheneticillin	5.2% (4.9-5.5)	7.7% (7.6-7.8)	<0.0001
	flucloxacillin	5.0% (4.6-5.3)	6.3% (6.2-6.4)	<0.0001
	amoxicillin with enzyme inhibitor	12.6% (12.1-13.1)	14.2% (14.0-14.4)	<0.0001
Sulfonamides and trimethoprim	sulfamethoxazole and trimethoprim	3.8% (3.6-4.1)	N/A	N/A
Macroliden, lincosamides and strepto-gramins	clarithromycin	8.1% (7.7-8.5)	5.6% (5.5-5.7)	<0.0001
	azithromycin	13.8% (13.4-14.4)	10.1% (10.0-10.3)	<0.0001
Other antibacterials	nitrofurantoin	6.9% (6.5-7.2)	11.5% (11.3-11.6)	<0.0001
THIN				
Tetracyclines	lymecycline	4.1% (4.0-4.1)	4.8% (4.8-4.9)	<0.0001
	oxytetracycline	3.2% (3.1-3.2)	3.5% (3.5-3.5)	<0.0001
Penicillins	amoxicillin	38.8% (38.7-39)	33.7% (33.8-33.9)	<0.0001
	phenoxymethyl-penicillin	13.9% (13.7-14.0)	18.4% (18.3-18.4)	<0.0001
	flucloxacillin	12.2% (12.1-12.3)	14.0% (14.0-14.0)	<0.0001
	amoxicillin with enzyme enhibitor	4.3% (4.3-4.4)	4.4% (4.4-4.5)	0.0178
Other b-lactam antibacterials	cefalexin	3.2% (3.1-3.2)	3.1% (3.1-3.1)	<0.0001
Sulfonamides and trimethoprim	trimethoprim	5.2% (5.1-5.3)	7.0% (7.0-7.0)	<0.0001
Macroliden, lincosamides and streptogramins	erythromycin	12.1% (12.0-12.2)	11.0% (11.0-11.1)	<0.0001
	clarithromycin	3.2% (3.1-3.2)	N/A	N/A

N/A: not part of DU90%

With regard to quality indicators, less appropriate antibiotic prescribing was observed for IPCI (NL) compared to THIN (UK), with a higher B/N ratio (IPCI: 3.4, THIN: 0.3, p-value <0.001) and a lower A/B ratio (IPCI: 1.1, THIN: 3.9 p-value <0.001) and AI (IPCI: 32.0, THIN: 36.1 p-value <0.001) in IPCI than in THIN. These findings remained when repeating the analysis for prescriptions for LRTI only. Overall, based on quality indicators, AB prescribing in children with asthma appeared less appropriate than in children without asthma. (Table 2)

Table 2 – Quality indicators of all prescriptions and prescriptions for lower respiratory tract infections only

		All prescriptions						LRTI prescriptions					
		B/N ratio	p-value	AI	p-value	A/B ratio	p-value	B/N ratio	p-value	AI	p-value	A/B ratio	p-value
IPCI	asthma	4.7	ref.	34.7%	ref.	1.1	ref.	23.3	ref.	48.6%	ref.	1.2	ref.
	no asthma	3.2	<.0001	31.5%	<.0001	1.1	0.0054	20.6	0.5576	50.3%	0.3512	1.3	0.4074
THIN	asthma	0.4**	ref.	38.8%*	ref.	3.8**	ref.	0.6**	ref.	72.8%**	ref.	7.6**	ref.
	no asthma	0.3**	<.0001	33.7%**	<.0001	4.0**	<.0001	0.5**	<.0001	73.2%**	<.0001	8.6**	<.0001

** significant different from IPCI cohort, p-value <0.0001
* significant different from IPCI cohort, p-value <0.005
Broad/Narrow (B/N) ratio: (J01CR J01DC, J01DD, J01F (except J01FA01))/(J01CE, J01DB, J01FA01)
Amoxicillin Index (AI): J01CA04/J01
Amoxicillin/Broad (A/B) ratio: J01CA04/ (J01CR, J01DC, J01DD, J01F (except J01FA01)
J01CA04: Amoxicillin, J01CE: Beta-lactamase sensitive penicillins, J01CR: combinations of penicillins
J01DB: 1st generation cephalosporins, J01DC: 2nd generation cephalosporins, JOIDD: 3rd generation cephalosporins
J01F: macrolides, lincosamides and streptogramins, J01FA01: erythromycin

The analyses of prescription rates, indications and quality indicators were repeated while stratifying for age and gender. After the age of 12, especially in girls the number of prescriptions increased due to urinary tract infections. Differences between children with and without asthma and between countries remained similar upon stratification. Details on stratified analysis are available in the online supplementary file 2.

DISCUSSION

In this international cohort study, we showed that children with asthma are more often prescribed antibiotics than children without asthma. This higher AB prescription rate in children with vs. children without asthma was strikingly similar in the UK and The Netherlands, while overall use of AB prescriptions was substantially higher in the UK compared to the Netherlands. High use of AB in children with asthma was already reported in literature but, to our knowledge, we are the first who investigated indication of use.[5, 6]

The indications of use were often bronchitis and asthma exacerbations, conditions for which antibiotics are in general not recommended. Indeed, according to the guidelines of the Global Initiative of Asthma (GINA), use of AB for the treatment of asthma exacerbations is not recommended unless there is strong evidence of lung infection.[7] Asthma is not a risk factor for complicated respiratory tract infections according to the British guidelines, and Dutch guidelines even emphasize that underlying asthma does not justify antibiotics in case of a LRTI.[8, 9] Additionally it has been shown that asthma is not a risk factor for complications of influenza. [21] One explanation for increased antibiotic prescribing for children with asthma could be that respiratory infectious syndromes in children with asthma present with various lower respiratory tract symptoms. This complicates the discrimination between a bacterial infection, a viral infection or an asthma exacerbation in primary care. Also, even though guidelines state that there is not enough evidence for treatment with antibiotics in case of an asthma exacerbation, it is being discussed that the supposedly anti-inflammatory effect of antibiotics (macrolides in particular) might be beneficial for patients with asthma.[22-25]

This might explain the relatively higher rate of macrolides prescriptions for asthmatic children in the Netherlands. However, the recommendation of macrolide use would only be beneficial for children with severe asthma whom are usually treated in secondary and tertiary care.

For the overall use of antibiotics in all children, it is remarkable that a large proportion was prescribed for upper respiratory tract infections. URTI's are notoriously caused by viruses for which antibiotics are not effective.[9] This is supported by the observation that in IPCI, along with lower prescribing rates, less prescriptions were due to LRTI and URTI than in THIN. These findings suggest need for better guidelines on treatment of URTI and monitoring systems at the different points of care (GP, pharmacist, secondary care) for incorrect use of AB.

The majority of upper and lower respiratory tract infections are causes by viruses not requiring AB treatment. Early identification of bacteria as causal organism might be a tool for guided AB treatment. Reviews of randomised trials show that c-reactive protein (CRP) testing and procalcitonin-guided management can reduce antibiotic prescriptions, without negative impact on disease duration. [26] Similarly, delayed instead of immediate antibiotic prescribing which is already implemented in UK guidelines and shared decision making could benefit antibiotic rates.[26, 27] However, most studies on these tests have been done in adults. For this reason, Dutch guidelines advice the use of CRP testing in adults only with certain respiratory complaints while awaiting more evidence of safety of use in children. [8] Education of the patients should not be forgotten, as the patient's view on treatment influences the decision of physicians.[28-30] While important differences in prescription rates were observed in children with or

without asthma, the type of drugs and quality of the prescriptions were comparable. Although differences between asthmatics and non-asthmatics were statistically significant, compared to differences between countries they were almost negligible. Mainly country specific differences in quality indicators were observed which was already reported in other studies.[31] Although children in the UK receive twice as often antibiotics compared with Dutch children, the choice of antibiotics seems to be more appropriate in the UK. These country specific differences in quality indicators might be explained by differences in availability of drugs, resistance patterns and national guidelines.

As for all observational research, this study has strengths and limitations: strengths of this study include the large number of patients that were followed over time and the fact that this is an international study. In addition, we present real life data, by using the electronic patient records of GP practices spread over the UK and the Netherlands. In both countries the GP acts as a gatekeeper of the patient's medical care, minimizing selection and information bias. Also, in contrast to other studies, we had information on all different indications of use, although not for all AB prescriptions. With regard to limitations, we might have underreported pneumonia as indication of AB use in THIN. In our study, pneumonia was defined based on pneumonia specific READ codes. This classification was stricter than in other studies where the READ code 'Acute lower respiratory infection (H062.00)' was also classified as 'pneumonia' while we classified that code as 'LRTI – unspecified'.[32] For both databases, indications were based on diagnose codes without use of free text. In the UK, performing an asthma review is part of the quality and outcomes framework (QOF) which might lead to extra entries for

asthma if a patient presents with another disease. This would only be a problem if no indication was linked to the prescription directly. Finally, misclassification of asthma could be a concern as asthma was based on the presence of asthma disease codes in combination of use of respiratory drugs: Still the prevalence of asthma which we reported (IPCI 7.9% and THIN 9.6%) is in line with literature suggesting that asthma misclassification is minimal.[33]

To conclude, this study shows possibilities for further reduction and more sensible choice of antibiotic use, even in countries as The Netherlands where antibiotic use is the lowest in the world. We showed that children with asthma are prescribed antibiotics often for self-limiting respiratory tract infections. Additionally, asthma treatment in primary care can be optimized by following (inter)national guidelines more strictly in terms of prescription rates and type of drugs. This can be done by raising awareness amongst GP's, patients and their parents. Additionally, careful implementation of point-of care tests such as CRP testing and procalcitonin-guided management in guidelines will help in reducing antibiotic therapy rates. Further awareness can reduce unnecessary antibiotic use and limit antibiotic resistance.

FOOTNOTES

Author contributions: EB, TK, HJ and KV contributed to the conception and design, acquisition of data and analyses and interpretation of the data, drafted the article, revised it critically for important intellectual content and gave final approval of the version to be published. PB, JdJ and MS contributed to the conception and design and acquisition of data, interpretation of the data, revised the drafted manuscript critically for important intellectual content and gave final approval of the version to be published.

Ethics approval The scientific review committee of IPCI and THIN approved this study (nr. 07/2016 and 16THIN046)

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; KV works for a research group who in the past received unconditional research grants from Yamanouchi, Pfizer, Boehringer-Ingelheim, Novartis and GSK. None of these grants was related to the content of this work; no other relationships or activities that could appear to have influenced the submitted work.

Provenance and peer review: Not commissioned; externally peer reviewed.

Data sharing: statistical codes are available upon request from the corresponding author.

Patient consent: Not required.

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FIGURE LEGEND

Figure 1 – Age and asthma status specific annual prevalence rate of antibiotic use

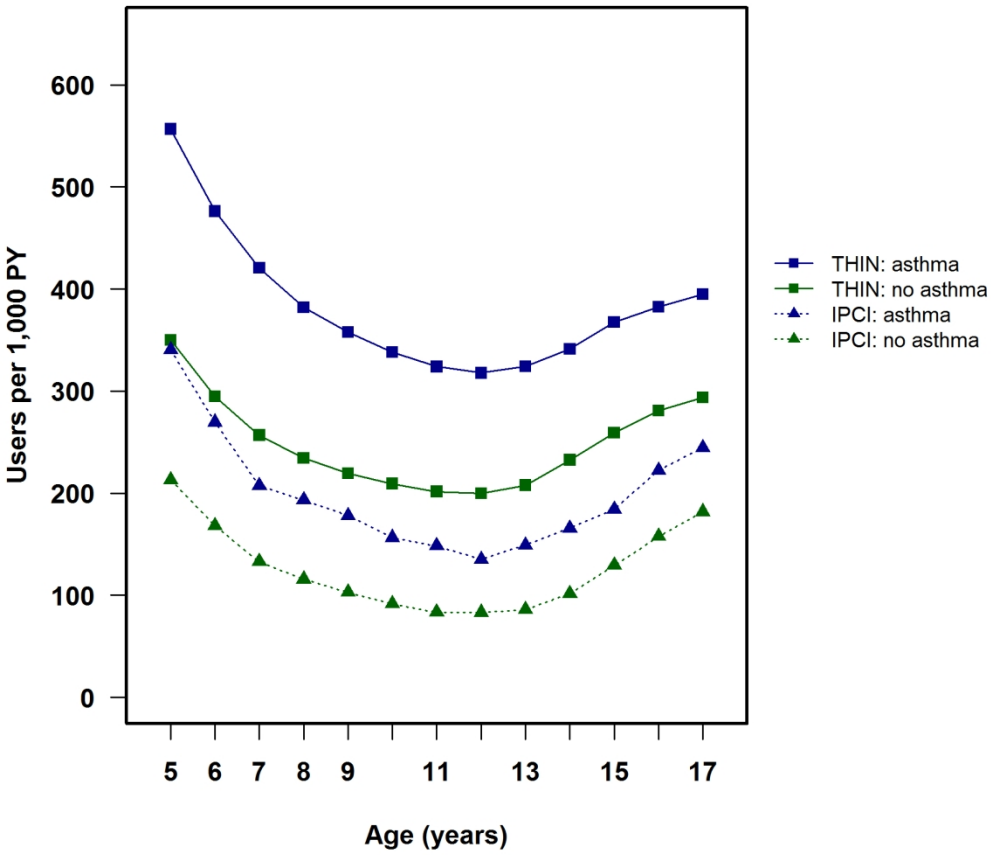
Figure 2 – Annual prevalence rate of antibiotic use by calendar year

Figure 3 – Indications of antibiotic use – proportion of known indications

Figure 4 – Indications of lower respiratory tract infections

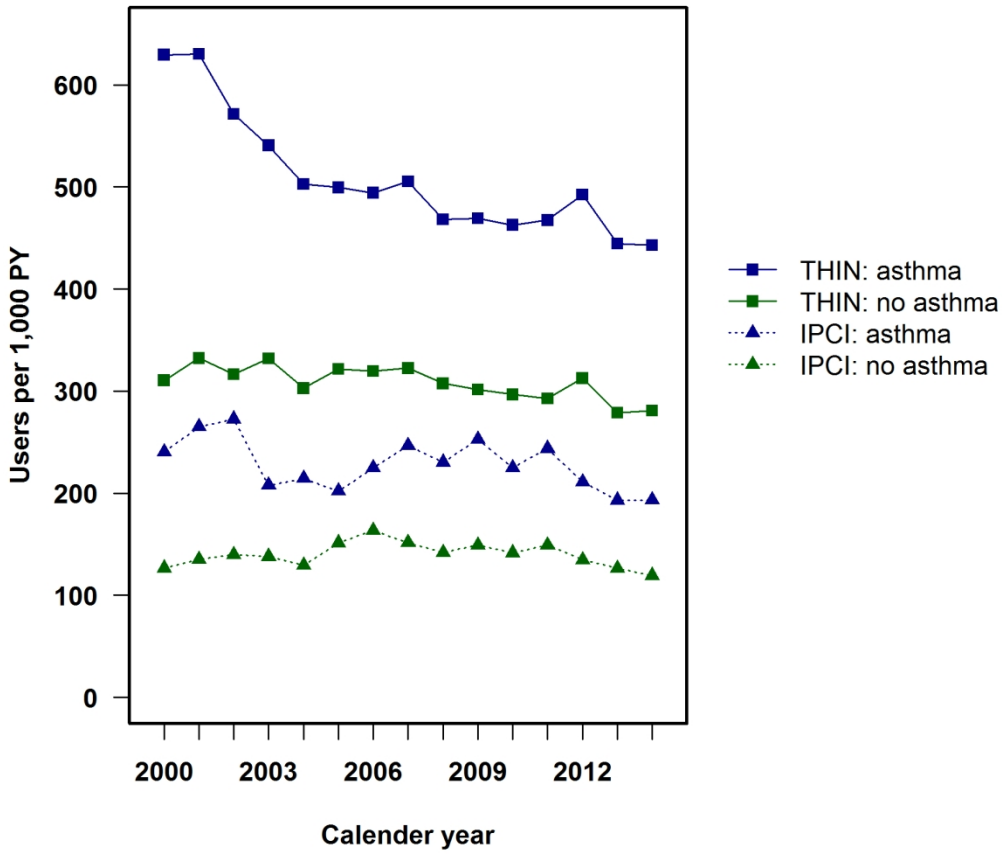
Figure 5 – Age, gender and asthma specific antibiotic prescriptions in IPCI

Figure 6 – Age, gender and asthma specific antibiotic prescriptions in THIN



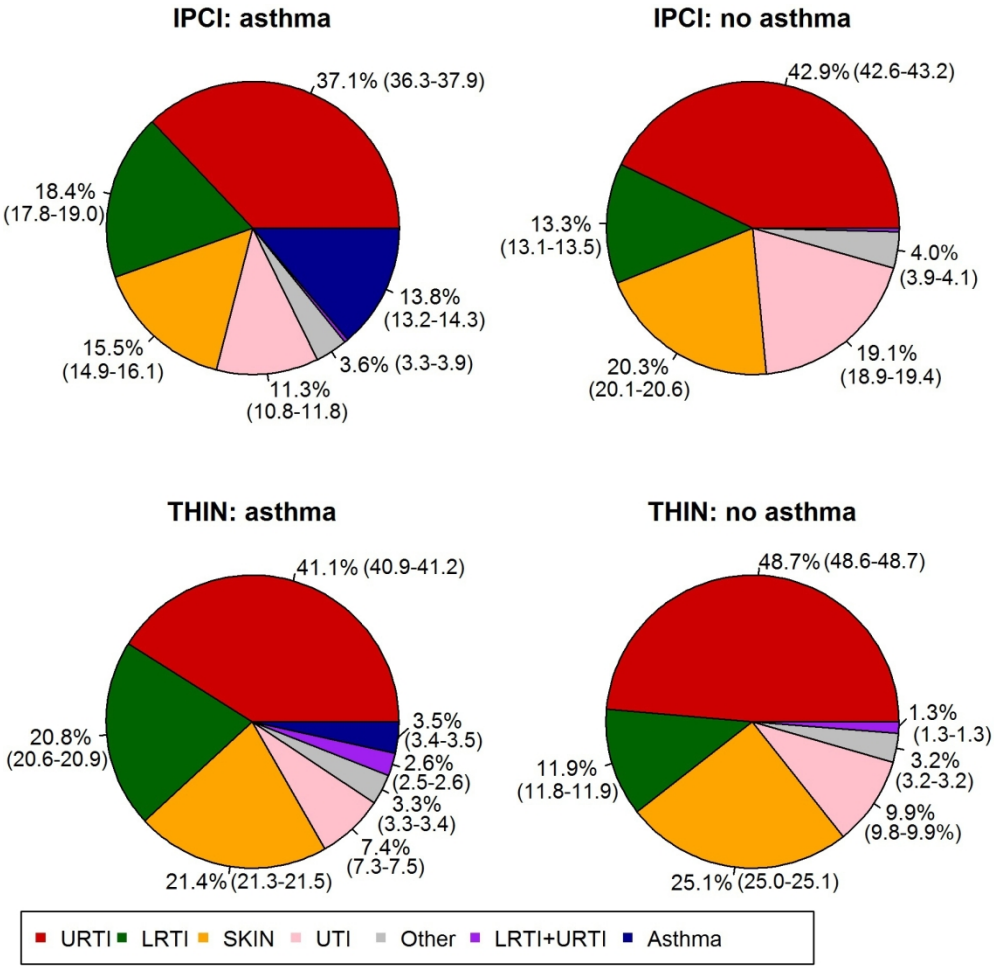
Age and asthma status specific annual prevalence rate of antibiotic use

160x160mm (300 x 300 DPI)



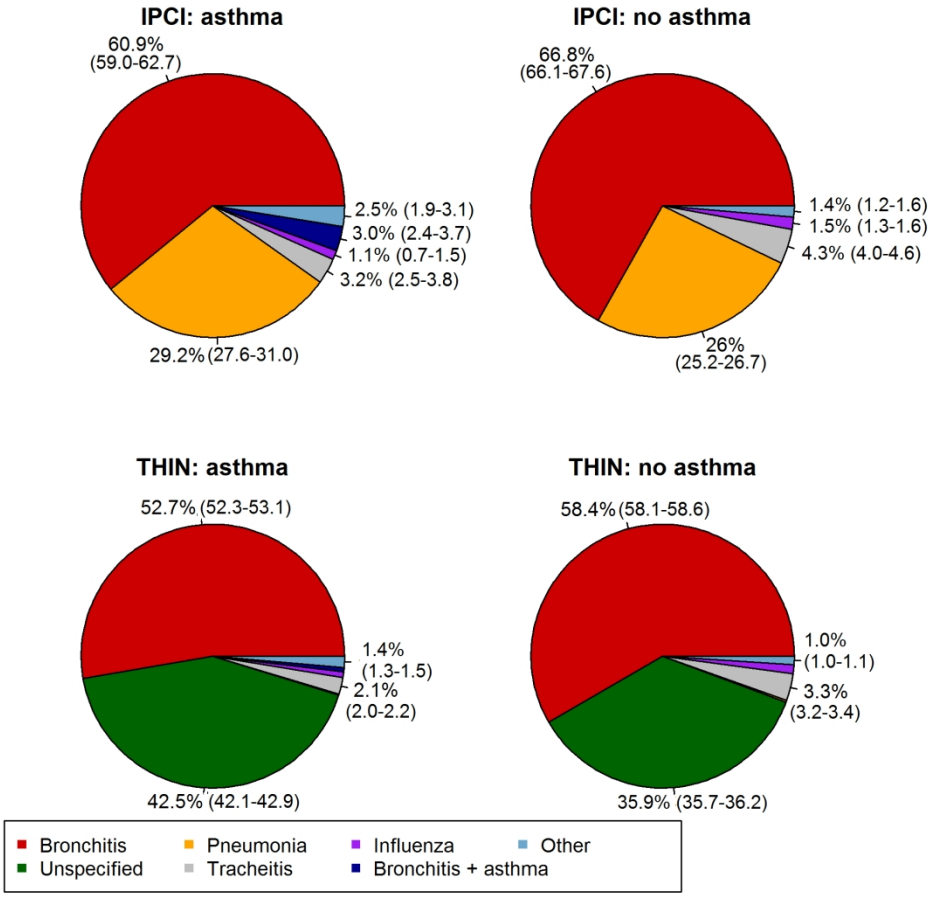
Annual prevalence rate of antibiotic use by calendar year

160x160mm (300 x 300 DPI)



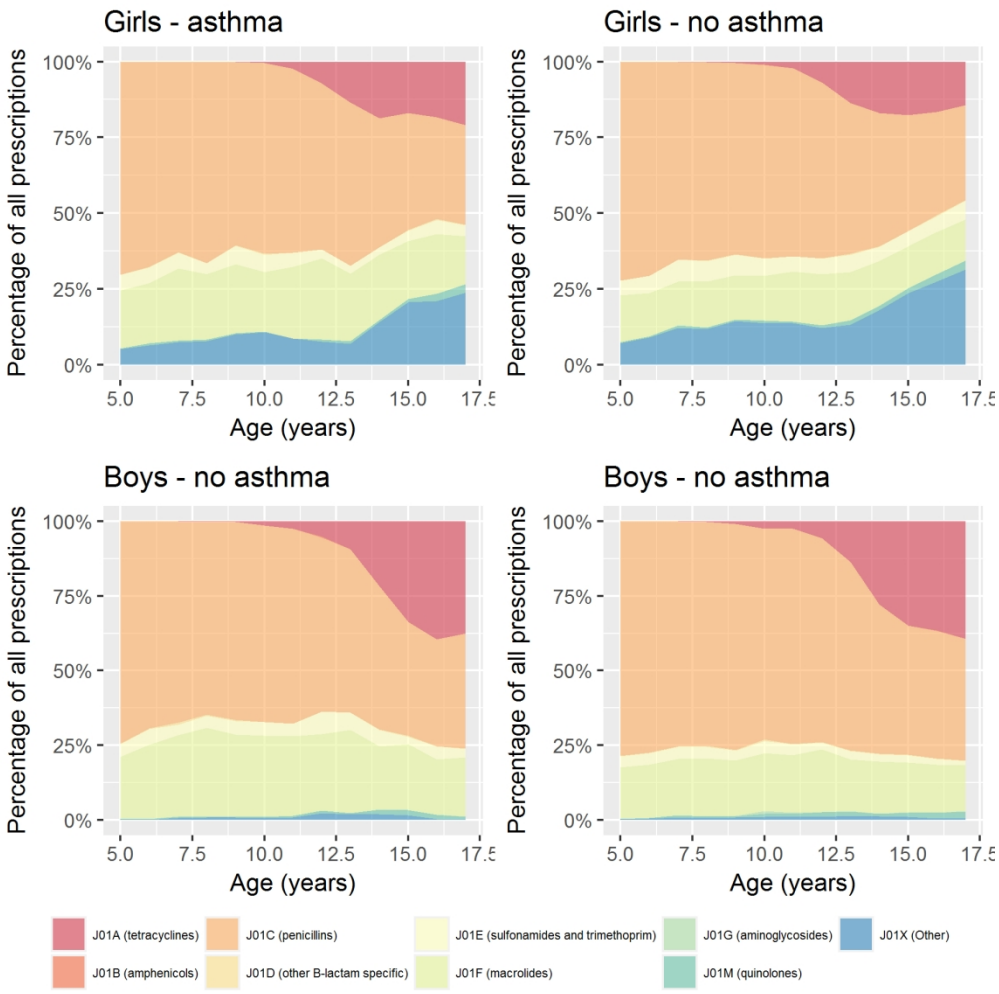
Indications of antibiotic use – proportion of known indications

160x160mm (300 x 300 DPI)



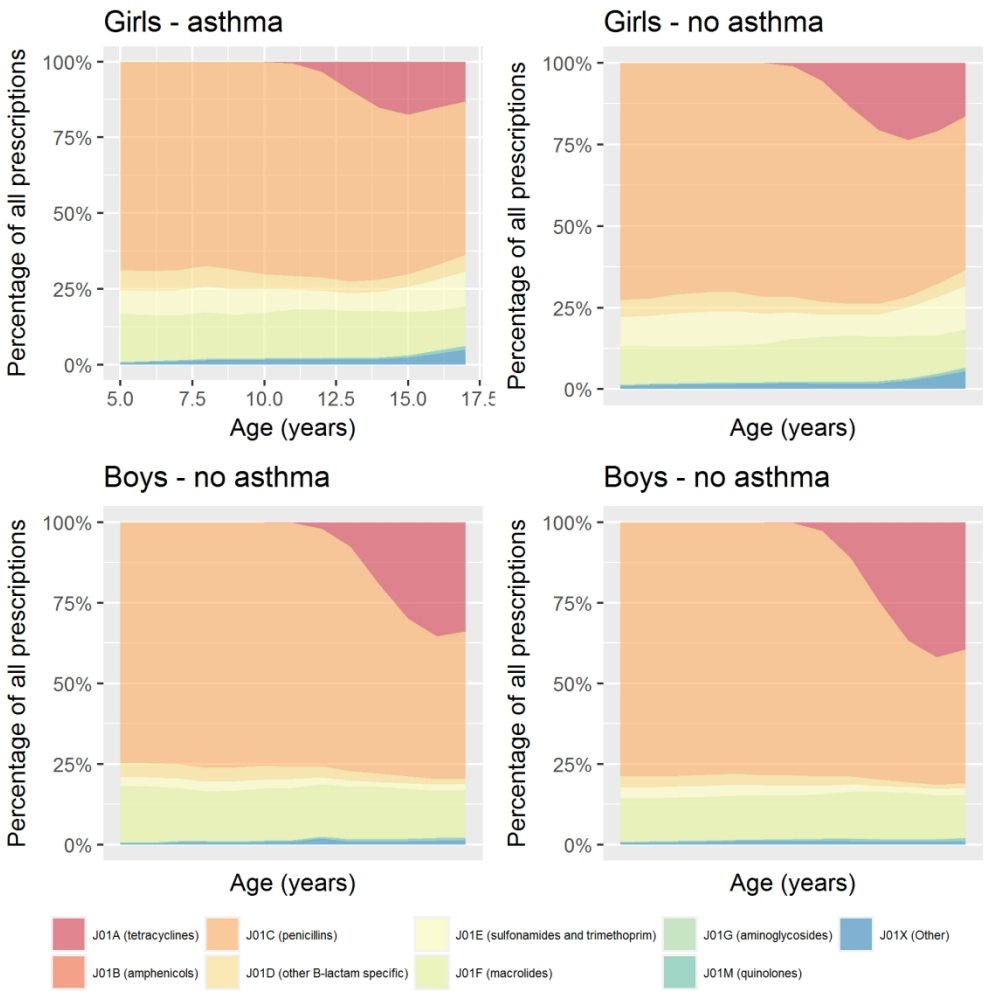
Indications of lower respiratory tract infections

178x160mm (300 x 300 DPI)



Age, gender and asthma specific antibiotic prescriptions in IPCI

160x160mm (300 x 300 DPI)



Age, gender and asthma specific antibiotic prescriptions in THIN

160x160mm (300 x 300 DPI)

Supplement 1

READ code	Description	Disease group	Disease further specified
1652	Feels hot/feverish	OTHER	OTHER
1653	Fever with sweating	OTHER	OTHER
1712	Dry cough	LRTI	LRTI - unspecified
1713	Productive cough -clear sputum	LRTI	LRTI - unspecified
1714	Productive cough -green sputum	LRTI	LRTI - unspecified
1715	Productive cough-yellow sputum	LRTI	LRTI - unspecified
1716	Productive cough NOS	LRTI	LRTI - unspecified
1716.11	Coughing up phlegm	LRTI	LRTI - unspecified
1717	Night cough present	LRTI	LRTI - unspecified
1719	Chesty cough	LRTI	LRTI - unspecified
1719.11	Bronchial cough	LRTI	LRTI - unspecified
165..11	Fever symptoms	OTHER	OTHER
165..12	Pyrexia symptoms	OTHER	OTHER
16L..00	Influenza-like symptoms	LRTI	INFLUENZA
17...00	Respiratory symptoms	LRTI	LRTI - unspecified
171..00	Cough	LRTI	LRTI - unspecified
171..11	C/O - cough	LRTI	LRTI - unspecified
171A.00	Chronic cough	LRTI	LRTI - unspecified
171B.00	Persistent cough	LRTI	LRTI - unspecified
171C.00	Morning cough	LRTI	LRTI - unspecified
171D.00	Evening cough	LRTI	LRTI - unspecified
171E.00	Unexplained cough	LRTI	LRTI - unspecified
171F.00	Cough with fever	LRTI	LRTI - unspecified
171G.00	Bovine cough	LRTI	LRTI - unspecified
171H.00	Difficulty in coughing up sputum	LRTI	LRTI - unspecified
171J.00	Reflux cough	LRTI	LRTI - unspecified
171K.00	Barking cough	LRTI	LRTI - unspecified
171L.00	Cough on exercise	LRTI	LRTI - unspecified
171Z.00	Cough symptom NOS	LRTI	LRTI - unspecified
173A.00	Exercise induced asthma	ASTHMA	ASTHMA
173c.00	Occupational asthma	ASTHMA	ASTHMA
173d.00	Work aggravated asthma	ASTHMA	ASTHMA
17Z..00	Respiratory symptoms NOS	URTI+LRTI	URTI+LRTI
17ZZ.00	Respiratory symptom NOS	URTI+LRTI	URTI+LRTI
19...00	Gastrointestinal symptoms	OTHER	GASTROENTERITIS
19...11	GIT symptoms	OTHER	GASTROENTERITIS
19...12	Intestinal symptoms	OTHER	GASTROENTERITIS
19F..00	Diarrhoea symptoms	OTHER	GASTROENTERITIS
19F..11	Diarrhoea	OTHER	GASTROENTERITIS
19F2.00	Diarrhoea	OTHER	GASTROENTERITIS

19F3.00	Spurious (overflow) diarrhoea	OTHER	GASTROENTERITIS
19FZ.00	Diarrhoea symptom NOS	OTHER	GASTROENTERITIS
19G..00	Diarrhoea and vomiting	OTHER	GASTROENTERITIS
19Z..00	Gastrointestinal symptoms NOS	OTHER	GASTROENTERITIS
1A...12	Urinary symptoms	UTI	CYSTITIS
1A1..00	Micturition frequency	UTI	CYSTITIS
1A1..11	Frequency of micturition	UTI	CYSTITIS
1A1..12	Polyuria	UTI	CYSTITIS
1A1..13	Urinary frequency	UTI	CYSTITIS
1A12.00	Frequency of micturition	UTI	CYSTITIS
1A55.00	Dysuria	UTI	CYSTITIS
1A7..00	Vaginal discharge symptom	UTI	FEMALE INFECTION
1AG..00	Recurrent urinary tract infections	UTI	CYSTITIS
1B8..00	Eye symptoms	OTHER	EYE INFECTION
1BA5.11	Pain in sinuses	URTI	SINUSITIS
1C...12	Ear symptoms	URTI	OTITIS
1C14.00	Blocked ear	URTI	OTITIS
1C3..00	Earache symptoms	URTI	OTITIS
1C32.00	Unilateral earache	URTI	OTITIS
1C33.00	Bilateral earache	URTI	OTITIS
1C3Z.00	Earache symptom NOS	URTI	OTITIS
1C4..00	Ear discharge symptoms	URTI	OTITIS
1C42.00	Ear discharge present	URTI	OTITIS
1C9..00	Sore throat symptom	URTI	TONSILLITIS
1C9..11	Throat soreness	URTI	TONSILLITIS
1C92.00	Has a sore throat	URTI	TONSILLITIS
1C93.00	Persistent sore throat	URTI	TONSILLITIS
1C9Z.00	Sore throat symptom NOS	URTI	TONSILLITIS
1CB..00	Throat symptom NOS	URTI	TONSILLITIS
1CB3.00	Throat pain	URTI	TONSILLITIS
1CB3.11	Pain in throat	URTI	TONSILLITIS
1CBZ.00	Throat symptom NOS	URTI	TONSILLITIS
1D14.00	C/O: a rash	SKIN	SKIN
1J4..00	Suspected UTI	UTI	CYSTITIS
1JN1.00	Suspected Lyme disease	OTHER	OTHER
1O2..00	Asthma confirmed	ASTHMA	ASTHMA
23...00	Examn. of respiratory system	URTI+LRTI	URTI+LRTI
2D...11	O/E - ear	URTI	OTITIS
2D6..00	O/E - discharge from ear	URTI	OTITIS
2D7..00	O/E - painful ear	URTI	OTITIS
2DC3.00	Inflamed throat	URTI	TONSILLITIS
2FD..00	O/E - skin cyst	SKIN	SKIN

2G64.00	O/E - infected toe	SKIN	SKIN
46...00	Urine examination	UTI	CYSTITIS
46...11	Urine tests	UTI	CYSTITIS
461..11	MSU - general	UTI	CYSTITIS
461..12	Urinalysis - general	UTI	CYSTITIS
46G4.11	Leucocytes in urine	UTI	CYSTITIS
46U..00	Urine culture	UTI	CYSTITIS
46Z1.00	Urine microscopy	UTI	CYSTITIS
4JJ..12	Mid-stream urine sample	UTI	CYSTITIS
81H..00	Dressing of wound	SKIN	SKIN
A0...00	Intestinal infectious diseases	OTHER	GASTROENTERITIS
A0...12	Food poisoning	OTHER	GASTROENTERITIS
A0...13	Vomiting - infective	OTHER	GASTROENTERITIS
A00..00	Cholera	OTHER	GASTROENTERITIS
A00..11	Vibrio cholerae	OTHER	GASTROENTERITIS
A000.00	Cholera - Vibrio cholerae	OTHER	GASTROENTERITIS
A001.00	Cholera - Vibrio cholerae El Tor	OTHER	GASTROENTERITIS
A01..00	Typhoid and paratyphoid fevers	OTHER	GASTROENTERITIS
A010.00	Typhoid fever	OTHER	GASTROENTERITIS
A010.11	Enteric fever	OTHER	GASTROENTERITIS
A01z.00	Paratyphoid fever NOS	OTHER	GASTROENTERITIS
A02..00	Other salmonella infections	OTHER	GASTROENTERITIS
A020.00	Salmonella gastroenteritiseritis	OTHER	GASTROENTERITIS
A020.11	Salmonellosis	OTHER	GASTROENTERITIS
A020.12	Salmonella food poisoning	OTHER	GASTROENTERITIS
A021.00	Salmonella septicaemia	OTHER	GASTROENTERITIS
A02z.00	Salmonella infection NOS	OTHER	GASTROENTERITIS
A03..00	Shigellosis	OTHER	GASTROENTERITIS
A030.11	Bacillary dysentery	OTHER	GASTROENTERITIS
A033.00	Shigella sonnei (group D)	OTHER	GASTROENTERITIS
A033.11	Bacillary dysentery Shigella sonnei	OTHER	GASTROENTERITIS
A03y.00	Other specified shigella infection	OTHER	GASTROENTERITIS
A03z.00	Shigellosis NOS	OTHER	GASTROENTERITIS
A04..00	Other bacterial food poisoning	OTHER	GASTROENTERITIS
A041.00	Botulism	OTHER	GASTROENTERITIS
A042.00	Clostridium perfringens food poisoning	OTHER	GASTROENTERITIS
A044.00	Vibrio parahaemolyticus food poisoning	OTHER	GASTROENTERITIS
A04y000	Foodborne Bacillus cereus intoxication	OTHER	GASTROENTERITIS
A04z.00	Food poisoning NOS	OTHER	GASTROENTERITIS
A05..00	Amoebiasis	OTHER	GASTROENTERITIS
A050.00	Acute amoebic dysentery	OTHER	GASTROENTERITIS
A056.00	Amoebic skin ulceration	SKIN	SKIN
A05y000	Amoebic appendicitis	OTHER	GASTROENTERITIS

A05y100	Amoebic balanitis	SKIN	SKIN
A061.00	Giardiasis - Lambliasis	OTHER	GASTROENTERITIS
A061.11	Colitis - giardial	OTHER	GASTROENTERITIS
A062.00	Coccidiosis	OTHER	GASTROENTERITIS
A063.00	Intestinal trichomoniasis	OTHER	GASTROENTERITIS
A064.00	Cryptosporidiosis	OTHER	GASTROENTERITIS
A07..00	Intestinal infection due to other organisms	OTHER	GASTROENTERITIS
A070.00	Escherichia coli gastrointestinal tract infection	OTHER	GASTROENTERITIS
A070000	Enteropathogenic Escherichia coli infection	OTHER	GASTROENTERITIS
A070100	Enterotoxigenic Escherichia coli infection	OTHER	GASTROENTERITIS
A070200	Enteroinvasive Escherichia coli infection	OTHER	GASTROENTERITIS
A070300	Enterohaemorrhagic Escherichia coli infection	OTHER	GASTROENTERITIS
A073.00	Proteus gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074.00	Other specified gastrointestinal tract bacterial infection	OTHER	GASTROENTERITIS
A074000	Staphylococcal gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074100	Pseudomonas gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074300	Campylobacter gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074311	Diarrhoea due to Campylobacter jejuni	OTHER	GASTROENTERITIS
A074312	Campylobacter enteritis	OTHER	GASTROENTERITIS
A074313	Helicobacter gastritis	OTHER	GASTROENTERITIS
A074400	Enteritis due to Yersinia enterocolitica	OTHER	GASTROENTERITIS
A074500	Helicobacter pylori gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074z00	Other specified gastrointestinal tract infections NOS	OTHER	GASTROENTERITIS
A075.00	Unspecified bacterial enteritis	OTHER	GASTROENTERITIS
A076.00	Enteritis due to specified virus	OTHER	GASTROENTERITIS
A076.11	Viral diarrhoea	OTHER	GASTROENTERITIS
A076.12	Viral vomiting	OTHER	GASTROENTERITIS
A076000	Enteritis due to adenovirus	OTHER	GASTROENTERITIS
A076100	Enteritis due to enterovirus	OTHER	GASTROENTERITIS
A076200	Enteritis due to rotavirus	OTHER	GASTROENTERITIS
A076300	Enteritis due to norovirus	OTHER	GASTROENTERITIS
A076z00	Enteritis due to specified virus NOS	OTHER	GASTROENTERITIS
A07y.00	Gastrointestinal tract infection specified organism NEC	OTHER	GASTROENTERITIS
A07y000	Viral gastroenteritiseritis	OTHER	GASTROENTERITIS
A07y100	Infantile viral gastroenteritiseritis	OTHER	GASTROENTERITIS
A07z.00	Gastrointestinal tract infection specified organism NOS	OTHER	GASTROENTERITIS
A08..00	Ill-defined intestinal tract infections	OTHER	GASTROENTERITIS
A08..11	Gastric flu	OTHER	GASTROENTERITIS
A080100	Infectious colitis	OTHER	GASTROENTERITIS
A080200	Infectious enteritis	OTHER	GASTROENTERITIS
A080300	Infectious gastroenteritiseritis	OTHER	GASTROENTERITIS
A080500	Haemorrhagic dysentery	OTHER	GASTROENTERITIS
A081000	Colitis - presumed infectious origin	OTHER	GASTROENTERITIS

A081100	Enteritis - presumed infectious origin	OTHER	GASTROENTERITIS
A081200	Gastroenteritiseritis - presumed infectious origin	OTHER	GASTROENTERITIS
A082.00	Infectious diarrhoea	OTHER	GASTROENTERITIS
A082.11	Travellers' diarrhoea	OTHER	GASTROENTERITIS
A082000	Dysenteric diarrhoea	OTHER	GASTROENTERITIS
A082100	Epidemic diarrhoea	OTHER	GASTROENTERITIS
A082111	Viral gastroenteritiseritis	OTHER	GASTROENTERITIS
A082z00	Infectious diarrhoea NOS	OTHER	GASTROENTERITIS
A083.00	Diarrhoea of presumed infectious origin	OTHER	GASTROENTERITIS
A083.11	Diarrhoea & vomiting -? infect	OTHER	GASTROENTERITIS
A083.12	Infantile gastroenteritiseritis	OTHER	GASTROENTERITIS
A08z.00	Ill defined gastrointestinal tract infections NOS	OTHER	GASTROENTERITIS
A0z..00	Intestinal tract infectious disease NOS	OTHER	GASTROENTERITIS
A10..00	Primary tuberculous infection	LRTI	LRTI OTHER
A100.00	Primary tuberculous complex	LRTI	LRTI OTHER
A10z.00	Primary tuberculous infection NOS	LRTI	LRTI OTHER
A11..00	Pulmonary tuberculosis	LRTI	LRTI OTHER
A11y.00	Other specified pulmonary tuberculosis	LRTI	LRTI OTHER
A11z.00	Pulmonary tuberculosis NOS	LRTI	LRTI OTHER
A124000	TB lung confirm sputum microscopy with or without culture	LRTI	LRTI OTHER
A12y.00	Other specified respiratory tuberculosis	LRTI	LRTI OTHER
A12yz00	Other specified respiratory tuberculosis NOS	LRTI	LRTI OTHER
A33..00	Whooping cough	LRTI	TRACHEITIS
A33yz00	Other whooping cough NOS	LRTI	TRACHEITIS
A33z.00	Whooping cough NOS	LRTI	TRACHEITIS
A34..00	Streptococcal sore throat and scarlatina	URTI	TONSILLITIS
A340.00	Streptococcal sore throat	URTI	TONSILLITIS
A340100	Streptococcal laryngitis	URTI	TONSILLITIS
A340200	Streptococcal pharyngitis	URTI	TONSILLITIS
A340300	Streptococcal tonsillitis	URTI	TONSILLITIS
A340z00	Streptococcal sore throat NOS	URTI	TONSILLITIS
A341.00	Scarlet fever - scarlatina	URTI	TONSILLITIS
A341.11	Scarlet fever	URTI	TONSILLITIS
A341.12	Scarlatina	URTI	TONSILLITIS
A34z.00	Streptococcal sore throat with scarlatina NOS	URTI	TONSILLITIS
A35..00	Erysipelas	SKIN	SKIN
A360.00	Meningococcal meningitis	OTHER	OTHER
A361.00	Meningococcal encephalitis	OTHER	OTHER
A365.00	Meningococcal meningitis with acute meningococcal septicaem	OTHER	OTHER
A366.00	Meningococcal meningitis with meningococcal septicaemia	OTHER	OTHER

A383000	Fusobacterial necrotising tonsillitis	URTI	TONSILLITIS
A3By.00	Other specified bacterial infection	OTHER	OTHER
A3By700	Gardnerella vaginalis	UTI	VAGINITIS
A3Byz00	Other specified bacterial infection NOS	OTHER	OTHER
A3Bz.00	Bacterial infection NOS	OTHER	OTHER
A3z..00	Other bacterial disease NOS	OTHER	OTHER
A42..00	Meningitis due to enterovirus	OTHER	OTHER
A42y.00	Other specified viral meningitis	OTHER	OTHER
A42z.00	Viral meningitis NOS	OTHER	OTHER
A42z.11	Aseptic meningitis	OTHER	OTHER
A4y0.00	Enteroviral encephalitis	OTHER	OTHER
A4z1.00	Adenoviral meningitis	OTHER	OTHER
A4zy300	Encephalitis lethargica	OTHER	OTHER
A4zy500	Adenoviral encephalitis	OTHER	OTHER
A521.00	Varicella pneumonitis	LRTI	PNEUMONIA
A661.00	Tick-borne fever	OTHER	OTHER
A661200	Colorado tick fever	OTHER	OTHER
A661z00	Tick-borne fever NOS	OTHER	OTHER
A770.12	Swimming pool conjunctivitis	OTHER	EYE INFECTION
A771.00	Epidemic keratoconjunctivitis	OTHER	EYE INFECTION
A772.00	Viral pharyngoconjunctivitis	OTHER	EYE INFECTION
A78A400	Chlamydial conjunctivitis	OTHER	EYE INFECTION
A79z.00	Viral infection NOS	OTHER	OTHER
A79z.11	Viral illness	OTHER	OTHER
A82..00	Tick-borne rickettsioses	OTHER	OTHER
A821400	Mediterranean tick fever	OTHER	OTHER
A82z.00	Tick-borne rickettsioses NOS	OTHER	OTHER
A83..00	Other rickettsioses	OTHER	OTHER
A871000	Lyme disease	OTHER	OTHER
A871011	Lyme borreliosis	OTHER	OTHER
A994.00	Nonspecific urethritis	UTI	URETHRITIS
AB24.11	Pneumonia - candidal	LRTI	PNEUMONIA
AB41500	Histoplasma duboisii with pneumonia	LRTI	PNEUMONIA
AyuL.00	[X]Other infectious diseases	OTHER	OTHER
Az...00	Infectious and parasitic diseases NOS	OTHER	OTHER
F00..00	Bacterial meningitis	OTHER	OTHER
F001.00	Pneumococcal meningitis	OTHER	OTHER
F002.00	Streptococcal meningitis	OTHER	OTHER
F004.00	Meningitis - tuberculous	OTHER	OTHER
F005.00	Meningitis - meningococcal	OTHER	OTHER
F00z.00	Bacterial meningitis NOS	OTHER	OTHER
F01..00	Meningitis due to other organisms	OTHER	OTHER
F01z.00	Meningitis due to organism NOS	OTHER	OTHER

F02z.00	Unspecified meningitis	OTHER	OTHER
F033.00	Encephalitis due to other infection EC	OTHER	OTHER
F03z.00	Encephalitis NOS	OTHER	OTHER
F4C0.00	Acute conjunctivitis	OTHER	EYE INFECTION
F4C0.11	Eye infection	OTHER	EYE INFECTION
F4C0.12	Conjunctivitis	OTHER	EYE INFECTION
F4C0000	Unspecified acute conjunctivitis	OTHER	EYE INFECTION
F4C0011	Conjunctivitis	OTHER	EYE INFECTION
F4C0100	Serous conjunctivitis	OTHER	EYE INFECTION
F4C0200	Acute follicular conjunctivitis	OTHER	EYE INFECTION
F4C0300	Acute mucopurulent conjunctivitis	OTHER	EYE INFECTION
F4C0311	Sticky eye	OTHER	EYE INFECTION
F4C0400	Catarrhal conjunctivitis	OTHER	EYE INFECTION
F4C0500	Pseudomembranous conjunctivitis	OTHER	EYE INFECTION
F4C0511	Membranous conjunctivitis	OTHER	EYE INFECTION
F4C1.00	Chronic conjunctivitis	OTHER	EYE INFECTION
F4C1000	Unspecified chronic conjunctivitis	OTHER	EYE INFECTION
F4D..00	Inflammation of eyelids	OTHER	EYE INFECTION
F4D0.00	Blepharitis	OTHER	EYE INFECTION
F4D0.11	Cellulitis of eyelids	OTHER	EYE INFECTION
F4D0z00	Blepharitis NOS	OTHER	EYE INFECTION
F4D1.00	Hordeolum and other deep inflammation of eyelid	OTHER	EYE INFECTION
F4D1000	Hordeolum externum (stye)	OTHER	EYE INFECTION
F4D1100	Hordeolum internum (infected meibomian cyst)	OTHER	EYE INFECTION
F4D1111	Meibomian cyst infected	OTHER	EYE INFECTION
F4D1200	Abscess of eyelid	OTHER	EYE INFECTION
F4D1211	Boil of eyelid	OTHER	EYE INFECTION
F4D1212	Furuncle of eyelid	OTHER	EYE INFECTION
F4D1300	Meibomianitis	OTHER	EYE INFECTION
F4D1400	Cellulitis of eyelid	OTHER	EYE INFECTION
F4D1z00	Hordeolum and other deep inflammation of eyelid NOS	OTHER	EYE INFECTION
F4D2.00	Chalazion (meibomian cyst)	OTHER	EYE INFECTION
F501.00	Infective otitis externa	URTI	OTITIS
F501000	Unspecified infective otitis externa	URTI	OTITIS
F501100	Acute infective otitis externa	URTI	OTITIS
F501300	Acute swimmers' ear	URTI	OTITIS
F501311	Beach ear	URTI	OTITIS
F501411	Erysipelas - otitis externa	URTI	OTITISEXT
F501500	Infective otitis externa due to herpes simplex	URTI	OTITISEXT
F501511	Herpes simplex- otitis externa	URTI	OTITISEXT
F501611	Herpes zoster - otitis externa	URTI	OTITISEXT
F501700	Infective otitis externa due to impetigo	URTI	OTITISEXT
F501711	Impetigo - otitis externa	URTI	OTITISEXT

F501800	Furunculosis of external auditory meatus	URTI	OTITISEXT
F501900	Other acute external ear infections	URTI	OTITISEXT
F501B00	Chronic otitis externa due to aspergillosis	URTI	OTITISEXT
F501D00	Chronic mycotic otitis externa NOS	URTI	OTITISEXT
F501E00	Other chronic infective otitis externa	URTI	OTITISEXT
F501F00	Chronic infective otitis externa NOS	URTI	OTITISEXT
F501G00	Haemorrhagic otitis externa	URTI	OTITISEXT
F501y00	Other specified infective otitis externa	URTI	OTITISEXT
F501z00	Infective otitis externa NOS	URTI	OTITISEXT
F502.00	Other otitis externa	URTI	OTITISEXT
F502000	External ear cholesteatoma	URTI	OTITISEXT
F502200	Acute chemical otitis externa	URTI	OTITISEXT
F502300	Other contact otitis externa	URTI	OTITISEXT
F502400	Acute eczematoid otitis extern	URTI	OTITISEXT
F502500	Other reactive otitis externa	URTI	OTITISEXT
F502z00	Otitis externa NOS	URTI	OTITISEXT
F502z11	Inflammation ear external	URTI	OTITISEXT
F505300	Stenosis of external ear canal due to inflammation	URTI	OTITISEXT
F51..00	Nonsuppurative otitis media + eustachian tube disorders	URTI	OTITIS
F510.00	Acute non suppurative otitis media	URTI	OTITIS
F510000	Acute otitis media with effusion	URTI	OTITIS
F510011	Acute secretory otitis media	URTI	OTITIS
F510100	Acute serous otitis media	URTI	OTITIS
F510200	Acute mucoid otitis media	URTI	OTITIS
F510300	Acute sanguinous otitis media	URTI	OTITIS
F510400	Acute allergic serous otitis media	URTI	OTITIS
F510500	Acute allergic mucoid otitis media	URTI	OTITIS
F510z00	Acute nonsuppurative otitis media NOS	URTI	OTITIS
F511100	Serosanguinous chronic otitis media	URTI	OTITIS
F511200	Bilateral chronic serous otitis	URTI	OTITIS
F511300	Unilateral chronic serous otitis	URTI	OTITIS
F511z00	Chronic serous otitis media NOS	URTI	OTITIS
F512.11	Glue ear	URTI	OTITIS
F512100	Mucosanguinous chronic otitis media	URTI	OTITIS
F512z00	Chronic mucoid otitis media NOS	URTI	OTITIS
F513000	Chronic allergic otitis media	URTI	OTITIS
F513z00	Other chronic nonsuppurative otitis media NOS	URTI	OTITIS
F514.00	Unspecified nonsuppurative otitis media	URTI	OTITIS
F514000	Allergic otitis media NOS	URTI	OTITIS
F514100	Serous otitis media NOS	URTI	OTITIS
F514200	Catarrhal otitis media NOS	URTI	OTITIS
F514300	Mucoid otitis media NOS	URTI	OTITIS

F514z00	Nonsuppurative otitis media NOS	URTI	OTITIS
F52..00	Suppurative and unspecified otitis media	URTI	OTITIS
F520.00	Acute suppurative otitis media	URTI	OTITIS
F520000	Acute suppurative otitis media tympanic membrane intact	URTI	OTITIS
F520100	Acute suppurative otitis media tympanic membrane ruptured	URTI	OTITIS
F520300	Acute suppurative otitis media due to disease EC	URTI	OTITIS
F520z00	Acute suppurative otitis media NOS	URTI	OTITIS
F523.00	Chronic suppurative otitis media NOS	URTI	OTITIS
F524.00	Purulent otitis media NOS	URTI	OTITIS
F524000	Bilateral suppurative otitis media	URTI	OTITIS
F525.00	Recurrent acute otitis media	URTI	OTITIS
F526.00	Acute left otitis media	URTI	OTITIS
F527.00	Acute right otitis media	URTI	OTITIS
F528.00	Acute bilateral otitis media	URTI	OTITIS
F52z.00	Otitis media NOS	URTI	OTITIS
F52z.11	Infection ear	URTI	OTITIS
F53..00	Mastoiditis and related conditions	URTI	MASTOIDITIS
F530.00	Acute mastoiditis	URTI	MASTOIDITIS
F530.11	Abscess of mastoid	URTI	MASTOIDITIS
F530.12	Empyema of mastoid	URTI	MASTOIDITIS
F530000	Acute mastoiditis without complications	URTI	MASTOIDITIS
F530100	Subperiosteal mastoid abscess	URTI	MASTOIDITIS
F530200	Gradenigo's syndrome	URTI	MASTOIDITIS
F530300	Acute mastoiditis with other complication	URTI	MASTOIDITIS
F530z00	Acute mastoiditis NOS	URTI	MASTOIDITIS
F531.00	Chronic mastoiditis	URTI	MASTOIDITIS
F531z00	Chronic mastoiditis NOS	URTI	MASTOIDITIS
F53z.00	Mastoiditis NOS	URTI	MASTOIDITIS
F586.00	Otorrhoea	URTI	OTITIS
F586000	Unspecified otorrhoea	URTI	OTITIS
F586011	Discharging ear NOS	URTI	OTITIS
F586200	Otorrhagia	URTI	OTITIS
F586z00	Otorrhoea NOS	URTI	OTITIS
F587.00	Otalgia	URTI	OTITIS
F587.11	Ear pain	URTI	OTITIS
F587000	Unspecified otalgia	URTI	OTITIS
F587100	Otogenic pain	URTI	OTITIS
F587200	Referred ear pain	URTI	OTITIS
F587z00	Otalgia NOS	URTI	OTITIS
H....00	Respiratory system diseases	URTI+LRTI	URTI+LRTI
H0...00	Acute respiratory infections	URTI+LRTI	URTI+LRTI

H00..00	Acute nasopharyngitis	URTI	URTI
H00..11	Common cold	URTI	URTI
H00..12	Coryza - acute	URTI	URTI
H00..13	Febrile cold	URTI	URTI
H00..14	Nasal catarrh - acute	URTI	URTI
H00..15	Pyrexial cold	URTI	URTI
H00..16	Rhinitis - acute	URTI	URTI
H01..00	Acute sinusitis	URTI	SINUSITIS
H01..11	Sinusitis	URTI	SINUSITIS
H010.00	Acute maxillary sinusitis	URTI	SINUSITIS
H011.00	Acute frontal sinusitis	URTI	SINUSITIS
H012.00	Acute ethmoidal sinusitis	URTI	SINUSITIS
H013.00	Acute sphenoidal sinusitis	URTI	SINUSITIS
H014.00	Acute rhinosinusitis	URTI	SINUSITIS
H01y.00	Other acute sinusitis	URTI	SINUSITIS
H01y000	Acute pansinusitis	URTI	SINUSITIS
H01yz00	Other acute sinusitis NOS	URTI	SINUSITIS
H01z.00	Acute sinusitis NOS	URTI	SINUSITIS
H02..00	Acute pharyngitis	URTI	TONSILLITIS
H02..11	Sore throat NOS	URTI	TONSILLITIS
H02..12	Viral sore throat NOS	URTI	TONSILLITIS
H02..13	Throat infection - pharyngitis	URTI	TONSILLITIS
H020.00	Acute gangrenous pharyngitis	URTI	TONSILLITIS
H021.00	Acute phlegmonous pharyngitis	URTI	TONSILLITIS
H022.00	Acute ulcerative pharyngitis	URTI	TONSILLITIS
H023.00	Acute bacterial pharyngitis	URTI	TONSILLITIS
H023000	Acute pneumococcal pharyngitis	URTI	TONSILLITIS
H023100	Acute staphylococcal pharyngitis	URTI	TONSILLITIS
H023z00	Acute bacterial pharyngitis NOS	URTI	TONSILLITIS
H024.00	Acute viral pharyngitis	URTI	TONSILLITIS
H025.00	Allergic pharyngitis	URTI	TONSILLITIS
H02z.00	Acute pharyngitis NOS	URTI	TONSILLITIS
H03..00	Acute tonsillitis	URTI	TONSILLITIS
H03..11	Throat infection - tonsillitis	URTI	TONSILLITIS
H03..12	Tonsillitis	URTI	TONSILLITIS
H030.00	Acute erythematous tonsillitis	URTI	TONSILLITIS
H031.00	Acute follicular tonsillitis	URTI	TONSILLITIS
H032.00	Acute ulcerative tonsillitis	URTI	TONSILLITIS
H033.00	Acute catarrhal tonsillitis	URTI	TONSILLITIS
H035.00	Acute bacterial tonsillitis	URTI	TONSILLITIS
H035000	Acute pneumococcal tonsillitis	URTI	TONSILLITIS
H035100	Acute staphylococcal tonsillitis	URTI	TONSILLITIS
H035z00	Acute bacterial tonsillitis NOS	URTI	TONSILLITIS

H036.00	Acute viral tonsillitis	URTI	TONSILLITIS
H037.00	Recurrent acute tonsillitis	URTI	TONSILLITIS
H03z.00	Acute tonsillitis NOS	URTI	TONSILLITIS
H04..00	Acute laryngitis and tracheitis	LRTI	TRACHEITIS
H040.00	Acute laryngitis	LRTI	TRACHEITIS
H040000	Acute oedematous laryngitis	LRTI	TRACHEITIS
H040100	Acute ulcerative laryngitis	LRTI	TRACHEITIS
H040200	Acute catarrhal laryngitis	LRTI	TRACHEITIS
H040300	Acute phlegmonous laryngitis	LRTI	TRACHEITIS
H040600	Acute suppurative laryngitis	LRTI	TRACHEITIS
H040w00	Acute viral laryngitis unspecified	LRTI	TRACHEITIS
H040x00	Acute bacterial laryngitis unspecified	LRTI	TRACHEITIS
H040z00	Acute laryngitis NOS	LRTI	TRACHEITIS
H041.00	Acute tracheitis	LRTI	TRACHEITIS
H041000	Acute tracheitis without obstruction	LRTI	TRACHEITIS
H041z00	Acute tracheitis NOS	LRTI	TRACHEITIS
H042.00	Acute laryngotracheitis	LRTI	TRACHEITIS
H042.11	Laryngotracheitis	LRTI	TRACHEITIS
H042000	Acute laryngotracheitis without obstruction	LRTI	TRACHEITIS
H042100	Acute laryngotracheitis with obstruction	LRTI	TRACHEITIS
H042z00	Acute laryngotracheitis NOS	LRTI	TRACHEITIS
H043.00	Acute epiglottitis (non strep)	LRTI	TRACHEITIS
H043.11	Viral epiglottitis	LRTI	TRACHEITIS
H043000	Acute epiglottitis without obstruction	LRTI	TRACHEITIS
H043200	Acute obstructive laryngitis	LRTI	TRACHEITIS
H043211	Croup	LRTI	TRACHEITIS
H043z00	Acute epiglottitis NOS	LRTI	TRACHEITIS
H044.00	Croup	LRTI	TRACHEITIS
H04z.00	Acute laryngitis and tracheitis NOS	LRTI	TRACHEITIS
H05..00	Other acute upper respiratory infections	URTI	URTI
H050.00	Acute laryngopharyngitis	URTI	URTI
H051.00	Acute upper respiratory tract infection	URTI	URTI
H052.00	Pharyngotracheitis	URTI	TONSILLITIS
H053.00	Tracheopharyngitis	URTI	TONSILLITIS
H054.00	Recurrent upper respiratory tract infection	URTI	URTI
H055.00	Pharyngolaryngitis	URTI	TONSILLITIS
H05y.00	Other upper respiratory infections of multiple sites	URTI	URTI
H05z.00	Upper respiratory infection NOS	URTI	URTI
H05z.11	Upper respiratory tract infection NOS	URTI	URTI
H05z.12	Viral upper respiratory tract infection NOS	URTI	URTI
H06..00	Acute bronchitis and bronchiolitis	LRTI	BRONCHITIS
H060.00	Acute bronchitis	LRTI	BRONCHITIS
H060.11	Acute wheezy bronchitis	LRTI	BRONCHITIS

H060300	Acute purulent bronchitis	LRTI	BRONCHITIS
H060400	Acute croupous bronchitis	LRTI	BRONCHITIS
H060500	Acute tracheobronchitis	LRTI	BRONCHITIS
H060600	Acute pneumococcal bronchitis	LRTI	BRONCHITIS
H060700	Acute streptococcal bronchitis	LRTI	BRONCHITIS
H060800	Acute haemophilus influenzae bronchitis	LRTI	BRONCHITIS
H060A00	Acute bronchitis due to mycoplasma pneumoniae	LRTI	BRONCHITIS
H060C00	Acute bronchitis due to parainfluenza virus	LRTI	BRONCHITIS
H060E00	Acute bronchitis due to rhinovirus	LRTI	BRONCHITIS
H060v00	Subacute bronchitis unspecified	LRTI	BRONCHITIS
H060w00	Acute viral bronchitis unspecified	LRTI	BRONCHITIS
H060x00	Acute bacterial bronchitis unspecified	LRTI	BRONCHITIS
H060z00	Acute bronchitis NOS	LRTI	BRONCHITIS
H061.00	Acute bronchiolitis	LRTI	BRONCHITIS
H061100	Acute obliterating bronchiolitis	LRTI	BRONCHITIS
H061200	Acute bronchiolitis with bronchospasm	LRTI	BRONCHITIS
H061300	Acute exudative bronchiolitis	LRTI	BRONCHITIS
H061400	Obliterating fibrous bronchiolitis	LRTI	BRONCHITIS
H061500	Acute bronchiolitis due to respiratory syncytial virus	LRTI	BRONCHITIS
H061z00	Acute bronchiolitis NOS	LRTI	BRONCHITIS
H062.00	Acute lower respiratory tract infection	LRTI	LRTI - unspecified
H06z.00	Acute bronchitis or bronchiolitis NOS	LRTI	BRONCHITIS
H06z000	Chest infection NOS	LRTI	LRTI - unspecified
H06z011	Chest infection	LRTI	LRTI - unspecified
H06z100	Lower resp tract infection	LRTI	LRTI - unspecified
H06z111	Respiratory tract infection	URTI+LRTI	URTI+LRTI
H06z112	Acute lower respiratory tract infection	LRTI	LRTI - unspecified
H06z200	Recurrent chest infection	LRTI	LRTI - unspecified
H07..00	Chest cold	LRTI	LRTI - unspecified
H0y..00	Other specified acute respiratory infections	URTI+LRTI	URTI+LRTI
H0z..00	Acute respiratory infection NOS	URTI+LRTI	URTI+LRTI
H1...00	Other upper respiratory tract diseases	URTI	URTI
H13..00	Chronic sinusitis	URTI	SINUSITIS
H13..11	Chronic rhinosinusitis	URTI	SINUSITIS
H130.00	Chronic maxillary sinusitis	URTI	SINUSITIS
H130.12	Maxillary sinusitis	URTI	SINUSITIS
H131.00	Chronic frontal sinusitis	URTI	SINUSITIS
H131.11	Frontal sinusitis	URTI	SINUSITIS
H132.00	Chronic ethmoidal sinusitis	URTI	SINUSITIS
H135.00	Recurrent sinusitis	URTI	SINUSITIS
H13y.00	Other chronic sinusitis	URTI	SINUSITIS
H13y000	Chronic pansinusitis	URTI	SINUSITIS
H13y100	Pansinusitis	URTI	SINUSITIS

H13z.00	Chronic sinusitis NOS	URTI	SINUSITIS
H14..00	Chronic tonsil and adenoid disease	URTI	TONSILLITIS
H14..11	Adenoid disease - chronic	URTI	TONSILLITIS
H14..12	Tonsil disease - chronic	URTI	TONSILLITIS
H140.00	Chronic tonsillitis	URTI	TONSILLITIS
H140.11	Chronic adenoiditis	URTI	TONSILLITIS
H141.00	Tonsil and/or adenoid hypertrophy	URTI	TONSILLITIS
H141.11	Adenoid hypertrophy	URTI	TONSILLITIS
H141.12	Enlargement of tonsil or adenoid	URTI	TONSILLITIS
H141000	Hypertrophy of tonsils and adenoids	URTI	TONSILLITIS
H141100	Hypertrophy of tonsils alone	URTI	TONSILLITIS
H141200	Hypertrophy of adenoids alone	URTI	TONSILLITIS
H141z00	Hypertrophy of tonsils and adenoids NOS	URTI	TONSILLITIS
H142.00	Adenoid vegetations	URTI	TONSILLITIS
H143.00	Chronic adenotonsillitis	URTI	TONSILLITIS
H14y.00	Other chronic diseases of tonsils and adenoids	URTI	TONSILLITIS
H14y100	Cicatrix of tonsil	URTI	TONSILLITIS
H14y300	Tonsillar tag	URTI	TONSILLITIS
H14y400	Tonsil ulcer	URTI	TONSILLITIS
H14y500	Caseous tonsillitis	URTI	TONSILLITIS
H14y600	Lingular tonsillitis	URTI	TONSILLITIS
H14y700	Cyst of tonsil	URTI	TONSILLITIS
H14y711	Tonsillar cyst	URTI	TONSILLITIS
H14yz00	Other chronic diseases of tonsils and adenoids NOS	URTI	TONSILLITIS
H14z.00	Chronic tonsil and adenoid disease NOS	URTI	TONSILLITIS
H14z000	Chronic tonsil disease NOS	URTI	TONSILLITIS
H15..00	Peritonsillar abscess - quinsy	URTI	TONSILLITIS
H15..11	Quinsy	URTI	TONSILLITIS
H16..00	Chronic laryngitis and laryngotracheitis	LRTI	TRACHEITIS
H160.00	Chronic laryngitis	LRTI	TRACHEITIS
H160000	Chronic simple laryngitis	LRTI	TRACHEITIS
H160100	Chronic catarrhal laryngitis	LRTI	TRACHEITIS
H160500	Congested larynx	LRTI	TRACHEITIS
H161.00	Chronic laryngotracheitis	LRTI	TRACHEITIS
H17..12	Allergic rhinosinusitis	URTI	SINUSITIS
H1y2000	Pharyngeal disease unspecified	URTI	TONSILLITIS
H1y2100	Pharynx or nasopharynx cellulitis	URTI	TONSILLITIS
H1y2200	Parapharyngeal abscess	URTI	TONSILLITIS
H1y2300	Retropharyngeal abscess	URTI	TONSILLITIS
H1y2500	Pharynx or nasopharynx cyst	URTI	TONSILLITIS
H1y2600	Pharynx or nasopharynx abscess	URTI	TONSILLITIS
H1y2700	Vallecular cyst	URTI	TONSILLITIS
H1y7100	Cellulitis of larynx	URTI	TONSILLITIS

H2...00	Pneumonia and influenza	LRTI	PNEUMONIA
H20..00	Viral pneumonia	LRTI	PNEUMONIA
H20..11	Chest infection - viral pneumonia	LRTI	PNEUMONIA
H201.00	Pneumonia due to respiratory syncytial virus	LRTI	PNEUMONIA
H202.00	Pneumonia due to parainfluenza virus	LRTI	PNEUMONIA
H203.00	Pneumonia due to human metapneumovirus	LRTI	PNEUMONIA
H20y.00	Viral pneumonia NEC	LRTI	PNEUMONIA
H20z.00	Viral pneumonia NOS	LRTI	PNEUMONIA
H21..00	Lobar (pneumococcal) pneumonia	LRTI	PNEUMONIA
H21..11	Chest infection - pneumococcal pneumonia	LRTI	PNEUMONIA
H22..00	Other bacterial pneumonia	LRTI	PNEUMONIA
H22..11	Chest infection - other bacterial pneumonia	LRTI	PNEUMONIA
H220.00	Pneumonia due to klebsiella pneumoniae	LRTI	PNEUMONIA
H221.00	Pneumonia due to pseudomonas	LRTI	PNEUMONIA
H222.00	Pneumonia due to haemophilus influenzae	LRTI	PNEUMONIA
H223.00	Pneumonia due to streptococcus	LRTI	PNEUMONIA
H224.00	Pneumonia due to staphylococcus	LRTI	PNEUMONIA
H22y.00	Pneumonia due to other specified bacteria	LRTI	PNEUMONIA
H22y200	Pneumonia - Legionella	LRTI	PNEUMONIA
H22yz00	Pneumonia due to bacteria NOS	LRTI	PNEUMONIA
H22z.00	Bacterial pneumonia NOS	LRTI	PNEUMONIA
H23..00	Pneumonia due to other specified organisms	LRTI	PNEUMONIA
H23..11	Chest infection - pneumonia organism OS	LRTI	PNEUMONIA
H231.00	Pneumonia due to mycoplasma pneumoniae	LRTI	PNEUMONIA
H233.00	Chlamydial pneumonia	LRTI	PNEUMONIA
H23z.00	Pneumonia due to specified organism NOS	LRTI	PNEUMONIA
H241.00	Pneumonia with cytomegalic inclusion disease	LRTI	PNEUMONIA
H243.00	Pneumonia with whooping cough	LRTI	PNEUMONIA
H243.11	Pneumonia with pertussis	LRTI	PNEUMONIA
H246.00	Pneumonia with aspergillosis	LRTI	PNEUMONIA
H24y200	Pneumonia with pneumocystis carinii	LRTI	PNEUMONIA
H24y700	Pneumonia with varicella	LRTI	PNEUMONIA
H25..00	Bronchopneumonia due to unspecified organism	LRTI	PNEUMONIA
H25..11	Chest infection - unspecified bronchopneumonia	LRTI	PNEUMONIA
H26..00	Pneumonia due to unspecified organism	LRTI	PNEUMONIA
H26..11	Chest infection - pnemonia due to unspecified organism	LRTI	PNEUMONIA
H260.00	Lobar pneumonia due to unspecified organism	LRTI	PNEUMONIA
H261.00	Basal pneumonia due to unspecified organism	LRTI	PNEUMONIA
H262.00	Postoperative pneumonia	LRTI	PNEUMONIA
H27..00	Influenza	LRTI	INFLUENZA
H270.00	Influenza with pneumonia	LRTI	PNEUMONIA
H270.11	Chest infection - influenza with pneumonia	LRTI	PNEUMONIA

H270000	Influenza with bronchopneumonia	LRTI	PNEUMONIA
H270100	Influenza with pneumonia	LRTI	PNEUMONIA
H270z00	Influenza with pneumonia NOS	LRTI	PNEUMONIA
H271.00	Influenza with other respiratory manifestation	LRTI	INFLUENZA
H271000	Influenza with laryngitis	LRTI	TRACHEITIS
H271100	Influenza with pharyngitis	URTI	TONSILLITIS
H271z00	Influenza with respiratory manifestations NOS	URTI+LRTI	URTI+LRTI
H27y.00	Influenza with other manifestations	LRTI	INFLUENZA
H27y100	Influenza with gastrointestinal tract involvement	LRTI	INFLUENZA
H27yz00	Influenza with other manifestations NOS	LRTI	INFLUENZA
H27z.00	Influenza NOS	LRTI	INFLUENZA
H27z.11	Flu like illness	LRTI	INFLUENZA
H27z.12	Influenza like illness	LRTI	INFLUENZA
H28..00	Atypical pneumonia	LRTI	PNEUMONIA
H29..00	Avian influenza	LRTI	INFLUENZA
H2A..00	Influenza due to Influenza A virus subtype H1N1	LRTI	INFLUENZA
H2A..11	Influenza A (H1N1) swine flu	LRTI	INFLUENZA
H2B..00	Community acquired pneumonia	LRTI	PNEUMONIA
H2C..00	Hospital acquired pneumonia	LRTI	PNEUMONIA
H2y..00	Other specified pneumonia or influenza	LRTI	PNEUMONIA
H2z..00	Pneumonia or influenza NOS	LRTI	PNEUMONIA
H30..00	Bronchitis unspecified	LRTI	BRONCHITIS
H30..11	Chest infection - unspecified bronchitis	LRTI	BRONCHITIS
H30..12	Recurrent wheezy bronchitis	LRTI	BRONCHITIS
H300.00	Tracheobronchitis NOS	LRTI	BRONCHITIS
H301.00	Laryngotracheobronchitis	LRTI	BRONCHITIS
H302.00	Wheezy bronchitis	LRTI	BRONCHITIS
H30z.00	Bronchitis NOS	LRTI	BRONCHITIS
H31..00	Chronic bronchitis	LRTI	BRONCHITIS
H312000	Chronic asthmatic bronchitis	LRTI	BRONCHITIS
H312000	Chronic asthmatic bronchitis	ASTHMA	ASTHMA
H312011	Chronic wheezy bronchitis	LRTI	BRONCHITIS
H312011	Chronic wheezy bronchitis	ASTHMA	ASTHMA
H312300	Bronchiolitis obliterans	LRTI	BRONCHITIS
H31y000	Chronic tracheitis	LRTI	TRACHEITIS
H31y100	Chronic tracheobronchitis	LRTI	TRACHEITIS
H33..00	Asthma	ASTHMA	ASTHMA
H33..11	Bronchial asthma	ASTHMA	ASTHMA
H330.00	Extrinsic (atopic) asthma	ASTHMA	ASTHMA
H330.11	Allergic asthma	ASTHMA	ASTHMA
H330.12	Childhood asthma	ASTHMA	ASTHMA
H330.13	Hay fever with asthma	ASTHMA	ASTHMA
H330.14	Pollen asthma	ASTHMA	ASTHMA

H330000	Extrinsic asthma without status	ASTHMA	ASTHMA
H330011	Hay fever with asthma	ASTHMA	ASTHMA
H330100	Extrinsic asthma with status as	ASTHMA	ASTHMA
H330111	Extrinsic asthma with asthma at	ASTHMA	ASTHMA
H330z00	Extrinsic asthma NOS	ASTHMA	ASTHMA
H331.00	Intrinsic asthma	ASTHMA	ASTHMA
H331.11	Late onset asthma	ASTHMA	ASTHMA
H331000	Intrinsic asthma without status	ASTHMA	ASTHMA
H331100	Intrinsic asthma with status as	ASTHMA	ASTHMA
H331111	Intrinsic asthma with asthma at	ASTHMA	ASTHMA
H331z00	Intrinsic asthma NOS	ASTHMA	ASTHMA
H332.00	Mixed asthma	ASTHMA	ASTHMA
H333.00	Acute exacerbation of asthma	ASTHMA	ASTHMA
H334.00	Brittle asthma	ASTHMA	ASTHMA
H33z.00	Asthma unspecified	ASTHMA	ASTHMA
H33z.11	Hyperreactive airways disease	ASTHMA	ASTHMA
H33z000	Status asthmaticus NOS	ASTHMA	ASTHMA
H33z011	Severe asthma attack	ASTHMA	ASTHMA
H33z100	Asthma attack	ASTHMA	ASTHMA
H33z111	Asthma attack NOS	ASTHMA	ASTHMA
H33z200	Late-onset asthma	ASTHMA	ASTHMA
H33zz00	Asthma NOS	ASTHMA	ASTHMA
H33zz11	Exercise induced asthma	ASTHMA	ASTHMA
H33zz12	Allergic asthma NEC	ASTHMA	ASTHMA
H33zz13	Allergic bronchitis NEC	ASTHMA	ASTHMA
H47..11	Aspiration pneumonitis	LRTI	PNEUMONIA
H470.00	Pneumonitis due to inhalation of food or vomitus	LRTI	PNEUMONIA
H470.11	Aspiration pneumonia	LRTI	PNEUMONIA
H470100	Pneumonitis due to inhalation of gastric secretions	LRTI	PNEUMONIA
H470312	Aspiration pneumonia due to vomit	LRTI	PNEUMONIA
H470z00	Pneumonitis due to inhalation of food or vomitus NOS	LRTI	PNEUMONIA
H563300	Usual interstitial pneumonitis	LRTI	PNEUMONIA
H564.00	Bronchiolitis obliterans organising pneumonia	LRTI	PNEUMONIA
H5yy.11	Respiratory infection NOS	URTI+LRTI	URTI+LRTI
Hyu0.00	[X]Acute upper respiratory infections	URTI	URTI
Hyu0000	[X]Other acute sinusitis	URTI	SINUSITIS
Hyu0200	[X]Acute tonsillitis due to other specified organisms	URTI	TONSILLITIS
Hyu0800	[X]Other viral pneumonia	LRTI	PNEUMONIA
Hyu0H00	[X]Other pneumonia	LRTI	PNEUMONIA
Hyu1.00	[X]Other acute lower respiratory infections	LRTI	LRTI - unspecified
Hyu1000	[X]Acute bronchitis due to other specified organisms	LRTI	BRONCHITIS
Hyu2200	[X]Other chronic sinusitis	URTI	SINUSITIS
J025000	Dental abscess	SKIN	SKIN

J082.11	Mouth ulcer	SKIN	SKIN
J43..11	Gastroenteritiseritis	OTHER	GASTROENTERITIS
J43..12	Enterocolitis	OTHER	GASTROENTERITIS
Jyu1200	[X]Other acute gastritis	OTHER	GASTROENTERITIS
Jyu1300	[X]Other gastritis	OTHER	GASTROENTERITIS
K0y..00	Other specified nephritis	UTI	UTI
K0z..00	Nephritis	UTI	UTI
K10..00	Infections of kidney	UTI	UTI
K10..11	Renal infections	UTI	UTI
K100.00	Chronic pyelonephritis	UTI	PYELONEPHRITIS
K100200	Chronic pyelitis	UTI	PYELONEPHRITIS
K100300	Chronic pyonephrosis	UTI	PYELONEPHRITIS
K100400	Nonobstructive reflux-associated chronic pyelonephritis	UTI	PYELONEPHRITIS
K100600	Calculous pyelonephritis	UTI	PYELONEPHRITIS
K100z00	Chronic pyelonephritis NOS	UTI	PYELONEPHRITIS
K101.00	Acute pyelonephritis	UTI	PYELONEPHRITIS
K101200	Acute pyelitis	UTI	PYELONEPHRITIS
K101300	Acute pyonephrosis	UTI	PYELONEPHRITIS
K101z00	Acute pyelonephritis NOS	UTI	PYELONEPHRITIS
K10y.00	Pyelonephritis and pyonephrosis unspecified	UTI	PYELONEPHRITIS
K10y000	Pyelonephritis unspecified	UTI	PYELONEPHRITIS
K10y100	Pyelitis unspecified	UTI	PYELONEPHRITIS
K10y200	Pyonephrosis unspecified	UTI	PYELONEPHRITIS
K10yz00	Unspecified pyelonephritis NOS	UTI	PYELONEPHRITIS
K10z.00	Infection of kidney NOS	UTI	UTI
K15..00	Cystitis	UTI	CYSTITIS
K150.00	Acute cystitis	UTI	CYSTITIS
K151.00	Chronic interstitial cystitis	UTI	CYSTITIS
K152000	Subacute cystitis	UTI	CYSTITIS
K152y00	Chronic cystitis unspecified	UTI	CYSTITIS
K153.00	Trigonitis	UTI	UTI
K153.11	Follicular cystitis	UTI	CYSTITIS
K154000	Cystitis in actinomycosis	UTI	CYSTITIS
K155.00	Recurrent cystitis	UTI	CYSTITIS
K15y.00	Other specified cystitis	UTI	CYSTITIS
K15y000	Cystitis cystica	UTI	CYSTITIS
K15yz00	Other cystitis NOS	UTI	CYSTITIS
K15z.00	Cystitis NOS	UTI	CYSTITIS
K17..00	Urethritis due to non venereal causes	UTI	URETHRITIS
K17..11	Periurethritis	UTI	URETHRITIS
K170.00	Urethral and periurethral abscess	UTI	URETHRITIS
K170.11	Urethral abscess	UTI	URETHRITIS

K170200	Urethral gland abscess	UTI	URETHRITIS
K170300	Periurethral cellulitis	UTI	URETHRITIS
K172.00	Candidal urethritis	UTI	URETHRITIS
K17y.00	Other urethritis	UTI	URETHRITIS
K17y000	Urethritis unspecified	UTI	URETHRITIS
K17y100	Urethral syndrome NOS	UTI	URETHRITIS
K17y200	Skene's glands adenitis	UTI	URETHRITIS
K17y400	Urethral meatitis	UTI	URETHRITIS
K17y500	Urethral meatal ulcer	UTI	URETHRITIS
K17yz00	Other urethritis NOS	UTI	URETHRITIS
K190.00	Urinary tract infection	UTI	CYSTITIS
K190.11	Recurrent urinary tract infection	UTI	CYSTITIS
K190000	Bacteriuria	UTI	UTI
K190011	Asymptomatic bacteriuria	UTI	CYSTITIS
K190100	Pyuria	UTI	UTI
K190200	Post operative urinary tract infection	UTI	CYSTITIS
K190300	Recurrent urinary tract infection	UTI	CYSTITIS
K190311	Recurrent UTI	UTI	CYSTITIS
K190400	Chronic urinary tract infection	UTI	CYSTITIS
K190500	Urinary tract infection	UTI	CYSTITIS
K190600	Urosepsis	UTI	CYSTITIS
K190X00	Persistent proteinuria	UTI	UTI
K190z00	Urinary tract infection	UTI	UTI
K2...00	Male genital organ diseases	UTI	MALE INFECTION
K21..11	Prostatitis and other inflammatory diseases of prostate	UTI	MALE INFECTION
K210.00	Acute prostatitis	UTI	MALE INFECTION
K211.00	Chronic prostatitis	UTI	MALE INFECTION
K21z.00	Prostatitis NOS	UTI	MALE INFECTION
K24..00	Orchitis and epididymitis	UTI	MALE INFECTION
K240.00	Orchitis	UTI	MALE INFECTION
K240100	Orchitis with no abscess	UTI	MALE INFECTION
K240200	Orchitis unspecified	UTI	MALE INFECTION
K240z00	Orchitis NOS	UTI	MALE INFECTION
K241.00	Epididymitis	UTI	MALE INFECTION
K241100	Epididymitis with no abscess	UTI	MALE INFECTION
K241400	Acute epididymitis	UTI	MALE INFECTION
K241500	Chronic epididymitis	UTI	MALE INFECTION
K241600	Chlamydial epididymitis	UTI	MALE INFECTION
K241z00	Epididymitis NOS	UTI	MALE INFECTION
K242.00	Epididymo-orchitis	UTI	MALE INFECTION
K242100	Epididymo-orchitis with no abscess	UTI	MALE INFECTION
K242200	Epididymo-orchitis unspecified	UTI	MALE INFECTION
K242z00	Epididymo-orchitis NOS	UTI	MALE INFECTION

K24z.00	Orchitis and epididymitis NOS	UTI	MALE INFECTION
K271.00	Balanoposthitis	UTI	MALE INFECTION
K271.11	Balanitis	UTI	MALE INFECTION
K271000	Balanitis	UTI	MALE INFECTION
K271100	Posthitis	UTI	MALE INFECTION
K271z00	Balanoposthitis NOS	UTI	MALE INFECTION
K272.00	Other penile inflammatory disorders	UTI	MALE INFECTION
K272.11	Infection of penis	UTI	MALE INFECTION
K272000	Penile abscess	UTI	MALE INFECTION
K272100	Penile boil	UTI	MALE INFECTION
K272200	Penile carbuncle	UTI	MALE INFECTION
K272300	Cellulitis of penis	UTI	MALE INFECTION
K272z00	Other penile inflammatory disorder NOS	UTI	MALE INFECTION
K273.11	Erection - painful	UTI	MALE INFECTION
K274.11	Balanitis xerotica obliterans	UTI	MALE INFECTION
K28..00	Other male genital organ disorders	UTI	MALE INFECTION
K284.00	Other male genital inflammatory disorders	UTI	MALE INFECTION
K284000	Abscess of scrotum	UTI	MALE INFECTION
K284100	Boil of scrotum	UTI	MALE INFECTION
K284200	Carbuncle of scrotum	UTI	MALE INFECTION
K284300	Cellulitis of scrotum	UTI	MALE INFECTION
K284600	Fournier's gangrene of scrotum	UTI	MALE INFECTION
K284900	Inflammation of scrotum	UTI	MALE INFECTION
K284z00	Other male genital inflammatory disorders NOS	UTI	MALE INFECTION
K286w11	Haematospermia	UTI	MALE INFECTION
K28X.00	Inflammatory disorder of unspecified male genital organ	UTI	MALE INFECTION
K28y.00	Other male genital organ diseases OS	UTI	MALE INFECTION
K28y800	Pain in testis	UTI	MALE INFECTION
K28y811	Testicular pain	UTI	MALE INFECTION
K28yu00	Other testicular disease	UTI	MALE INFECTION
K28yv00	Other scrotal disease	UTI	MALE INFECTION
K28yz00	Other male genital organ diseases NOS	UTI	MALE INFECTION
K28z.00	Other male genital disorders NOS	UTI	MALE INFECTION
K28z.11	Pain in testis	UTI	MALE INFECTION
K2y..00	Other specified diseases of male genital organ	UTI	MALE INFECTION
K2z..00	Male genital organ disease NOS	UTI	MALE INFECTION
K4...00	Female pelvic inflammatory diseases	UTI	FEMALE INFECTION
K400.00	Acute salpingitis and oophoritis	UTI	FEMALE INFECTION
K400300	Acute salpingitis	UTI	FEMALE INFECTION
K402100	Ovarian abscess	UTI	FEMALE

			INFECTION
K402200	Tubo-ovarian abscess	UTI	FEMALE INFECTION
K402500	Salpingo-oophoritis unspecified	UTI	FEMALE INFECTION
K402600	Salpingitis unspecified	UTI	FEMALE INFECTION
K407.00	Female pelvic peritoneal adhesions	UTI	FEMALE INFECTION
K40y100	Female chlamydial pelvic inflammatory disease	UTI	FEMALE INFECTION
K40z.00	Female pelvic inflammatory diseases NOS	UTI	FEMALE INFECTION
K40z.11	PID	UTI	FEMALE INFECTION
K40z.12	Female pelvic infection	UTI	FEMALE INFECTION
K40z.13	PID - pelvic inflammatory disease	UTI	FEMALE INFECTION
K410.00	Acute uterine inflammatory disease	UTI	FEMALE INFECTION
K410000	Acute endometritis	UTI	FEMALE INFECTION
K410500	Subacute endometritis	UTI	FEMALE INFECTION
K41z000	Endometritis unspecified	UTI	FEMALE INFECTION
K41z300	Perimetritis unspecified	UTI	FEMALE INFECTION
K420.00	Cervicitis and endocervicitis	UTI	FEMALE INFECTION
K420000	Cervicitis unspecified	UTI	FEMALE INFECTION
K420300	Cervicitis with erosion	UTI	FEMALE INFECTION
K420400	Cervicitis with Nabothian cyst	UTI	FEMALE INFECTION
K420500	Cervicitis with ectropion	UTI	FEMALE INFECTION
K420900	Chlamydia cervicitis	UTI	FEMALE INFECTION
K420A00	Nabothian follicles	UTI	FEMALE INFECTION
K420A11	Nabothian cyst	UTI	FEMALE INFECTION
K420z11	Nabothian follicles NOS	UTI	FEMALE INFECTION
K421.00	Vaginitis and vulvovaginitis	UTI	VAGINITIS

K421000	Vaginitis unspecified	UTI	VAGINITIS
K421100	Vulvitis unspecified	UTI	FEMALE INFECTION
K421111	Vulval sores	UTI	FEMALE INFECTION
K421200	Vulvovaginitis unspecified	UTI	FEMALE INFECTION
K421400	Vaginitis in diseases EC	UTI	FEMALE INFECTION
K421500	Vulvitis in diseases EC	UTI	FEMALE INFECTION
K421600	Vulvovaginitis in diseases EC	UTI	VAGINITIS
K421700	Subacute and chronic vaginitis	UTI	VAGINITIS
K421800	Subacute and chronic vulvitis	UTI	VAGINITIS
K421900	Bacterial vaginitis	UTI	VAGINITIS
K421911	Bacterial vaginosis	UTI	VAGINITIS
K421A00	Acute vulvitis	UTI	FEMALE INFECTION
K421z00	Vaginitis and vulvovaginitis NOS	UTI	VAGINITIS
K422.00	Cyst of Bartholin's gland	UTI	FEMALE INFECTION
K423.00	Abscess of Bartholin's gland	UTI	FEMALE INFECTION
K423.11	Vulvovaginal gland abscess	UTI	VAGINITIS
K424.00	Other abscess of vulva	UTI	FEMALE INFECTION
K424000	Abscess of vulva	UTI	FEMALE INFECTION
K424011	Abscess of labia	UTI	FEMALE INFECTION
K424100	Carbuncle of vulva	UTI	FEMALE INFECTION
K424111	Boil of vulva	UTI	FEMALE INFECTION
K424200	Furuncle of vulva	UTI	FEMALE INFECTION
K425.00	Ulceration of vulva	UTI	FEMALE INFECTION
K425000	Ulceration of vulva unspecified	UTI	FEMALE INFECTION
K425200	Ulceration of vulva in Behcet's disease	UTI	FEMALE INFECTION
K425z00	Ulceration of vulva NOS	UTI	FEMALE INFECTION
K42y100	Carbuncle of labium	UTI	FEMALE INFECTION
K42y200	Ulcer of vagina	UTI	VAGINITIS

K42y300	Bartholinitis	UTI	FEMALE INFECTION
K42y400	Cyst of labium	UTI	FEMALE INFECTION
K42y500	Vulval vestibulitis	UTI	FEMALE INFECTION
K42y600	Vulvodynia	UTI	FEMALE INFECTION
K4z..00	Female pelvic inflammatory disease NOS	UTI	FEMALE INFECTION
K5...00	Other female genital tract disorders	UTI	FEMALE INFECTION
Kyu5500	[X]Other urethritis	UTI	URETHRITIS
Kyu6300	[X]Other inflammatory disorders of penis	UTI	MALE INFECTION
Kyu8300	[X]Other specified inflammation of vagina and vulva	UTI	FEMALE INFECTION
L166.00	Genitourinary tract infections in pregnancy	UTI	FEMALE INFECTION
L166.11	Cystitis of pregnancy	UTI	CYSTITIS
L166500	Infections of kidney in pregnancy	UTI	PYELONEPHRITIS
L166600	Urinary tract infection following delivery	UTI	FEMALE INFECTION
L166800	Urinary tract infection complicating pregnancy	UTI	FEMALE INFECTION
L166z00	Genitourinary tract infection in pregnancy NOS	UTI	FEMALE INFECTION
L166z11	UTI - urinary tract infection in pregnancy	UTI	FEMALE INFECTION
L178.00	Infections of urethra in pregnancy	UTI	URETHRITIS
L284.12	Chorioamnionitis	UTI	FEMALE INFECTION
L284.13	Membranitis	UTI	FEMALE INFECTION
Lyu6A00	[X]Infection of caesarean section wound following delivery	UTI	FEMALE INFECTION
Lyu6B00	[X]Vaginitis following delivery	UTI	VAGINITIS
M0...00	Skin and subcutaneous tissue infections	SKIN	SKIN
M00..00	Carbuncle	SKIN	SKIN
M000.00	Carbuncle of face	SKIN	SKIN
M000000	Carbuncle of ear	SKIN	SKIN
M000200	Carbuncle of nasal septum	SKIN	SKIN
M000z00	Carbuncle of face NOS	SKIN	SKIN
M001.00	Carbuncle of neck	SKIN	SKIN
M002300	Carbuncle of abdominal wall	SKIN	SKIN
M002400	Carbuncle of umbilicus	SKIN	SKIN
M002600	Carbuncle of groin	SKIN	SKIN

M003100	Carbuncle of axilla	SKIN	SKIN
M003200	Carbuncle of upper arm	SKIN	SKIN
M003400	Carbuncle of forearm	SKIN	SKIN
M003z00	Carbuncle of upper arm and forearm NOS	SKIN	SKIN
M004.00	Carbuncle of hand	SKIN	SKIN
M004000	Carbuncle of wrist	SKIN	SKIN
M004100	Carbuncle of thumb	SKIN	SKIN
M004200	Carbuncle of finger	SKIN	SKIN
M005.00	Carbuncle of buttock	SKIN	SKIN
M005100	Carbuncle of gluteal region	SKIN	SKIN
M006300	Carbuncle of lower leg	SKIN	SKIN
M007.00	Carbuncle of foot	SKIN	SKIN
M007100	Carbuncle of heel	SKIN	SKIN
M007200	Carbuncle of toe	SKIN	SKIN
M00z.00	Carbuncle NOS	SKIN	SKIN
M01..00	Furuncle - boil	SKIN	SKIN
M010.00	Boil of face	SKIN	SKIN
M010000	Boil of ear	SKIN	SKIN
M010100	Boil of face (excluding eye)	SKIN	SKIN
M010200	Boil of nasal septum	SKIN	SKIN
M010400	Boil of external nose	SKIN	SKIN
M010z00	Boil of face NOS	SKIN	SKIN
M011.00	Boil of neck	SKIN	SKIN
M012.00	Boil of trunk	SKIN	SKIN
M012000	Boil of chest wall	SKIN	SKIN
M012100	Boil of breast	SKIN	SKIN
M012200	Boil of back	SKIN	SKIN
M012300	Boil of abdominal wall	SKIN	SKIN
M012400	Boil of umbilicus	SKIN	SKIN
M012600	Boil of groin	SKIN	SKIN
M012700	Boil of perineum	SKIN	SKIN
M012z00	Boil of trunk NOS	SKIN	SKIN
M013.00	Boil of upper arm and forearm	SKIN	SKIN
M013100	Boil of axilla	SKIN	SKIN
M013200	Boil of upper arm	SKIN	SKIN
M013300	Boil of elbow	SKIN	SKIN
M013400	Boil of forearm	SKIN	SKIN
M013z00	Boil of upper arm and forearm NOS	SKIN	SKIN
M014.00	Boil of hand	SKIN	SKIN
M014000	Boil of wrist	SKIN	SKIN
M014100	Boil of thumb	SKIN	SKIN
M014200	Boil of finger	SKIN	SKIN
M014z00	Boil of hand NOS	SKIN	SKIN

M015.00	Boil of buttock	SKIN	SKIN
M015000	Boil of anus	SKIN	SKIN
M015100	Boil of gluteal region	SKIN	SKIN
M015z00	Boil of buttock NOS	SKIN	SKIN
M016.00	Boil of leg (excluding foot)	SKIN	SKIN
M016000	Boil of hip	SKIN	SKIN
M016100	Boil of thigh	SKIN	SKIN
M016200	Boil of knee	SKIN	SKIN
M016300	Boil of lower leg	SKIN	SKIN
M016z00	Boil of leg (excluding foot) NOS	SKIN	SKIN
M017.00	Boil of foot	SKIN	SKIN
M017000	Boil of foot unspecified	SKIN	SKIN
M017100	Boil of heel	SKIN	SKIN
M017200	Boil of toe	SKIN	SKIN
M017z00	Boil of foot NOS	SKIN	SKIN
M01y.00	Boil of other specified site	SKIN	SKIN
M01y000	Boil of head (excluding face)	SKIN	SKIN
M01yz00	Boil of other specified site NOS	SKIN	SKIN
M01z.00	Boil NOS	SKIN	SKIN
M01z.11	Recurrent boils	SKIN	SKIN
M01z.12	Boils of multiple sites	SKIN	SKIN
M01z000	Multiple boils	SKIN	SKIN
M02..00	Cellulitis and abscess of finger and toe	SKIN	SKIN
M020.00	Cellulitis and abscess of finger	SKIN	SKIN
M020000	Cellulitis and abscess of finger unspecified	SKIN	SKIN
M020100	Finger pulp abscess	SKIN	SKIN
M020111	Felon	SKIN	SKIN
M020112	Whitlow	SKIN	SKIN
M020200	Onychia of finger	SKIN	SKIN
M020300	Paronychia of finger	SKIN	SKIN
M020311	Perionychia of finger	SKIN	SKIN
M020400	Finger web space infection	SKIN	SKIN
M020500	Pulp space infection of finger/thumb	SKIN	SKIN
M020z00	Cellulitis and abscess of finger NOS	SKIN	SKIN
M021.00	Cellulitis and abscess of toe	SKIN	SKIN
M021000	Cellulitis and abscess of toe unspecified	SKIN	SKIN
M021100	Onychia of toe	SKIN	SKIN
M021200	Paronychia of toe	SKIN	SKIN
M021300	Pulp space infection of toe	SKIN	SKIN
M021z00	Cellulitis and abscess of toe NOS	SKIN	SKIN
M021z11	Perionychia of toe	SKIN	SKIN
M02z.00	Cellulitis and abscess of digit NOS	SKIN	SKIN
M02z.11	Nail infection NOS	SKIN	SKIN

M02z.12	Paronychia	SKIN	SKIN
M02z.13	Infected nailfold	SKIN	SKIN
M02z.14	Nailfold infected	SKIN	SKIN
M03..00	Other cellulitis and abscess	SKIN	SKIN
M03..11	Abscess of skin area excluding digits of hand or foot	SKIN	SKIN
M03..13	Cellulitis of skin area excluding digits of hand or foot	SKIN	SKIN
M030.00	Cellulitis and abscess of face	SKIN	SKIN
M030000	Cellulitis and abscess of cheek (external)	SKIN	SKIN
M030011	Cellulitis and abscess of cheek	SKIN	SKIN
M030100	Cellulitis and abscess of nose (external)	SKIN	SKIN
M030111	Cellulitis and abscess of nose	SKIN	SKIN
M030200	Cellulitis and abscess of chin	SKIN	SKIN
M030400	Cellulitis and abscess of forehead	SKIN	SKIN
M030500	Cellulitis and abscess of temple region	SKIN	SKIN
M030600	Cellulitis of face	SKIN	SKIN
M030z00	Cellulitis and abscess of face NOS	SKIN	SKIN
M031.00	Cellulitis and abscess of neck	SKIN	SKIN
M031.11	Cervical abscess	SKIN	SKIN
M032.00	Cellulitis and abscess of trunk	SKIN	SKIN
M032000	Cellulitis and abscess of chest wall	SKIN	SKIN
M032100	Cellulitis and abscess of breast	SKIN	SKIN
M032200	Cellulitis and abscess of back	SKIN	SKIN
M032300	Cellulitis and abscess of abdominal wall	SKIN	SKIN
M032400	Cellulitis and abscess of umbilicus	SKIN	SKIN
M032500	Cellulitis and abscess of flank	SKIN	SKIN
M032600	Cellulitis and abscess of groin	SKIN	SKIN
M032700	Cellulitis and abscess of perineum	SKIN	SKIN
M032800	Cellulitis of trunk	SKIN	SKIN
M032z00	Cellulitis and abscess of trunk NOS	SKIN	SKIN
M033.00	Cellulitis and abscess of arm	SKIN	SKIN
M033000	Cellulitis and abscess of shoulder	SKIN	SKIN
M033100	Cellulitis and abscess of axilla	SKIN	SKIN
M033200	Cellulitis and abscess of upper arm	SKIN	SKIN
M033300	Cellulitis and abscess of elbow	SKIN	SKIN
M033400	Cellulitis and abscess of forearm	SKIN	SKIN
M033z00	Cellulitis and abscess of arm NOS	SKIN	SKIN
M034.00	Cellulitis and abscess of hand excluding digits	SKIN	SKIN
M034.11	Cellulitis and abscess of hand	SKIN	SKIN
M034000	Cellulitis and abscess of hand unspecified	SKIN	SKIN
M034011	Abscess of dorsum of hand	SKIN	SKIN
M034012	Abscess of palm of hand	SKIN	SKIN
M034013	Cellulitis of dorsum of hand	SKIN	SKIN
M034014	Cellulitis of palm of hand	SKIN	SKIN

M034100	Cellulitis and abscess of wrist	SKIN	SKIN
M034z00	Cellulitis and abscess of hand NOS	SKIN	SKIN
M035.00	Cellulitis and abscess of buttock	SKIN	SKIN
M036.00	Cellulitis and abscess of leg excluding foot	SKIN	SKIN
M036.11	Cellulitis and abscess of leg	SKIN	SKIN
M036000	Cellulitis and abscess of hip	SKIN	SKIN
M036100	Cellulitis and abscess of thigh	SKIN	SKIN
M036200	Cellulitis and abscess of knee	SKIN	SKIN
M036300	Cellulitis and abscess of lower leg	SKIN	SKIN
M036400	Cellulitis and abscess of ankle	SKIN	SKIN
M036z00	Cellulitis and abscess of leg NOS	SKIN	SKIN
M037.00	Cellulitis and abscess of foot excluding toe	SKIN	SKIN
M037.11	Cellulitis and abscess of foot	SKIN	SKIN
M037000	Cellulitis and abscess of foot unspecified	SKIN	SKIN
M037100	Cellulitis and abscess of heel	SKIN	SKIN
M037z00	Cellulitis and abscess of foot NOS	SKIN	SKIN
M038.00	Cellulitis of external ear	SKIN	SKIN
M03y.00	Other specified cellulitis and abscess	SKIN	SKIN
M03y000	Cellulitis and abscess of head unspecified	SKIN	SKIN
M03y011	Abscess of scalp	SKIN	SKIN
M03z.00	Cellulitis and abscess NOS	SKIN	SKIN
M03z000	Cellulitis NOS	SKIN	SKIN
M03z100	Abscess NOS	SKIN	SKIN
M03zz00	Cellulitis and abscess NOS	SKIN	SKIN
M03zz11	Acute lymphangitis NOS	SKIN	SKIN
M04..00	Acute lymphadenitis	SKIN	SKIN
M04..11	Acute abscess lymph node	SKIN	SKIN
M04..12	Acute adenitis	SKIN	SKIN
M04..13	Acute cervical adenitis	SKIN	SKIN
M041.00	Acute lymphadenitis of upper limb	SKIN	SKIN
M042.00	Acute lymphadenitis of lower limb	SKIN	SKIN
M05..00	Impetigo	SKIN	SKIN
M050.00	Impetigo contagiosa unspecified	SKIN	SKIN
M051.00	Impetigo contagiosa bullosa	SKIN	SKIN
M053.00	Impetigo circinata	SKIN	SKIN
M055.00	Impetigo simplex	SKIN	SKIN
M056.00	Impetigo follicularis	SKIN	SKIN
M057.00	Chronic symmetrical impetigo	SKIN	SKIN
M05z.00	Impetigo NOS	SKIN	SKIN
M06..00	Pilonidal sinus/cyst	SKIN	SKIN
M060.00	Pilonidal cyst with abscess	SKIN	SKIN
M061.00	Pilonidal cyst with no abscess	SKIN	SKIN
M062.00	Pilonidal sinus with abscess	SKIN	SKIN

M063.00	Pilonidal sinus without abscess	SKIN	SKIN
M06z.00	Pilonidal sinus/cyst NOS	SKIN	SKIN
M07..00	Other local infections of skin and subcutaneous tissue	SKIN	SKIN
M070.00	Pyoderma	SKIN	SKIN
M070.11	Purulent dermatitis	SKIN	SKIN
M070100	Pyoderma faciale	SKIN	SKIN
M070200	Pyoderma gangrenosum	SKIN	SKIN
M071.00	Pyogenic granuloma	SKIN	SKIN
M071000	Pyogenic granuloma unspecified	SKIN	SKIN
M071200	Granuloma telangiectaticum	SKIN	SKIN
M071300	Umbilical granuloma	SKIN	SKIN
M071z00	Pyogenic granuloma NOS	SKIN	SKIN
M072.00	Erythrasma	SKIN	SKIN
M073.00	Scalp infection	SKIN	SKIN
M07y.00	Local infection of skin or subcutaneous tissue OS	SKIN	SKIN
M07y.11	Pustular eczema	SKIN	SKIN
M07y100	Ecthyma	SKIN	SKIN
M07y200	Dermatitis vegetans	SKIN	SKIN
M07y300	Perleche	SKIN	SKIN
M07y400	Pitted keratolysis	SKIN	SKIN
M07y500	Inflammation of scar	SKIN	SKIN
M07yz00	Other spec local skin/subc infection NOS	SKIN	SKIN
M07yz11	Infection toe	SKIN	SKIN
M07yz12	Infection foot	SKIN	SKIN
M07yz13	Infection finger	SKIN	SKIN
M07z.00	Local infection skin/subcut tissue NOS	SKIN	SKIN
M07z.11	Infected insect bite	SKIN	SKIN
M07z.12	Infected skin ulcer	SKIN	SKIN
M07z.13	Septic spots	SKIN	SKIN
M07z.14	Infected dermatitis	SKIN	SKIN
M07z.15	Sinus	SKIN	SKIN
M07z000	Infection foot	SKIN	SKIN
M07z100	Infection toe	SKIN	SKIN
M07z200	Infection finger	SKIN	SKIN
M08..00	Cutaneous cellulitis	SKIN	SKIN
M080.00	[X]Cellulitis of finger and toe	SKIN	SKIN
M080.11	[X]Nail bed infection	SKIN	SKIN
M080.12	[X]Septic thumb	SKIN	SKIN
M080.13	[X]Cellulitis of thumb	SKIN	SKIN
M081.00	[X]Cellulitis of other parts of limb	SKIN	SKIN
M082.00	Cellulitis of face	SKIN	SKIN
M083.00	Cellulitis of trunk	SKIN	SKIN
M084.00	[X]Cellulitis of breast	SKIN	SKIN

M085.00	Cellulitis of leg	SKIN	SKIN
M086.00	Cellulitis of ankle	SKIN	SKIN
M087.00	Chronic paronychia	SKIN	SKIN
M088.00	Cellulitis of arm	SKIN	SKIN
M089.00	Cellulitis of neck	SKIN	SKIN
M08A.00	Cellulitis of axilla	SKIN	SKIN
M08B.00	Cellulitis of foot	SKIN	SKIN
M08C.00	Cellulitis of toe	SKIN	SKIN
M08y.00	[X]Cellulitis of other sites	SKIN	SKIN
M09..00	Cutaneous abscess	SKIN	SKIN
M090.00	[X]Abscess of face	SKIN	SKIN
M091.00	[X]Abscess of neck	SKIN	SKIN
M092.00	[X]Abscess of trunk	SKIN	SKIN
M092000	[X]Abscess of buttock	SKIN	SKIN
M092100	[X]Abdominal wall abscess	SKIN	SKIN
M092200	[X]Perineal abscess	SKIN	SKIN
M093.00	[X]Abscess of buttock	SKIN	SKIN
M094.00	[X]Abscess of limb	SKIN	SKIN
M094000	[X]Abscess of axilla	SKIN	SKIN
M095.00	Skin abscess	SKIN	SKIN
M09y.00	[X]Abscess of other site	SKIN	SKIN
M0y..00	Other specified infections of skin or subcutaneous tissue	SKIN	SKIN
M0z..00	Skin and subcut tissue infection NOS	SKIN	SKIN
M0z..11	Infected sebaceous cyst	SKIN	SKIN
M1...00	Other skin and subcutaneous tissue inflammatory conditions	SKIN	SKIN
M1...11	Dermatitis/dermatoses	SKIN	SKIN
M10..00	Erythematosquamous dermatosis	SKIN	SKIN
M100.00	Pityriasis capitis - dandruff	SKIN	SKIN
M101.00	Seborrhoeic dermatitis	SKIN	SKIN
M101.11	Seborrhoeic dermatitis capitis	SKIN	SKIN
M101.12	Seborrhoeic eczema	SKIN	SKIN
M102.00	Infectious eczematoid dermatitis	SKIN	SKIN
M102.11	Pustular eczema	SKIN	SKIN
M103.00	Parakeratosis	SKIN	SKIN
M104.00	Pityriasis simplex	SKIN	SKIN
M10z.00	Erythematosquamous dermatosis NOS	SKIN	SKIN
M111.00	Atopic dermatitis/eczema	SKIN	SKIN
M12z000	Dermatitis NOS	SKIN	SKIN
M12z100	Eczema NOS	SKIN	SKIN
M12z111	Discoid eczema	SKIN	SKIN
M12z200	Infected eczema	SKIN	SKIN

M12z300	Hand eczema	SKIN	SKIN
M12z400	Erythrodermic eczema	SKIN	SKIN
M153.00	Rosacea	SKIN	SKIN
M153000	Acne rosacea	SKIN	SKIN
M230.00	Ingrowing nail	SKIN	SKIN
M230.11	Unguis incarnatus	SKIN	SKIN
M230000	Ingrowing great toe nail	SKIN	SKIN
M230100	Ingrowing toe nail (excluding great toe)	SKIN	SKIN
M230400	Ingrowing nail with infection	SKIN	SKIN
M230z00	Ingrowing nail NOS	SKIN	SKIN
M244.00	Folliculitis	SKIN	SKIN
M260.00	Acne varioliformis	SKIN	ACNE
M260000	Acne frontalis	SKIN	ACNE
M260z00	Acne varioliformis NOS	SKIN	ACNE
M260z11	Acne necrotica	SKIN	ACNE
M261.00	Other acne	SKIN	ACNE
M261000	Acne vulgaris	SKIN	ACNE
M261011	Blackhead	SKIN	ACNE
M261012	Comedo	SKIN	ACNE
M261100	Acne conglobata	SKIN	ACNE
M261500	Colloid acne	SKIN	ACNE
M261600	Cystic acne	SKIN	ACNE
M261700	Acne neonatorum	SKIN	ACNE
M261800	Infantile acne	SKIN	ACNE
M261900	Occupational acne	SKIN	ACNE
M261A00	Pustular acne	SKIN	ACNE
M261B00	Steroid acne	SKIN	ACNE
M261C00	Tropical acne	SKIN	ACNE
M261D00	Acne urticata	SKIN	ACNE
M261E00	Acne excoriee des jeunes filles	SKIN	ACNE
M261F00	Acne fulminans	SKIN	ACNE
M261H00	Acne keloid	SKIN	ACNE
M261J00	Acne necrotica	SKIN	ACNE
M261K00	Acne keloidalis	SKIN	ACNE
M261X00	Acne	SKIN	ACNE
M261z00	Other acne NOS	SKIN	ACNE
M2yz.11	Skin lesion	SKIN	SKIN
M2z0.00	Skin lesion	SKIN	SKIN
Myu0.00	[X]Infections of the skin and subcutaneous tissue	SKIN	SKIN
Myu0200	[X]Impetiginization of other dermatoses	SKIN	SKIN
Myu1.00	[X]Bullous disorders	SKIN	SKIN
Myu1300	[X]Other specified bullous disorders	SKIN	SKIN
Myu2C00	[X]Other specified dermatitis	SKIN	SKIN

Myu6800	[X]Other acne	SKIN	ACNE
Myu6A00	[X]Other follicular cysts of the skin+subcutaneous tissue	SKIN	SKIN
R021.00	[D]Rash and other nonspecific skin eruption	SKIN	SKIN
R062.00	[D]Cough	LRTI	LRTI - unspecified
SK03.00	Post-traumatic wound infection NEC	SKIN	SKIN
SP13100	Other aspiration pneumonia as a complication of care	LRTI	PNEUMONIA
SP25500	Postoperative wound infection	SKIN	SKIN
TE60.00	Dog bite	SKIN	SKIN

Table 1 – Indication and diagnose READ codes in THIN

ICPC code	Description	Disease group	Disease further specified
D70	Gastrointestinal infection	OTHER	GASTROENTERITIS
D73	Presumed GI infection	OTHER	GASTROENTERITIS
H71	Acute otitis media/myringitis	URTI	OTITIS
H72	Serous otitis media/glue ear	URTI	OTITIS
H74	Chronic otitis other infect ear	URTI	OTITIS
H04	Discharge from ear	URTI	OTITIS
H01	Ear pain/earache	URTI	OTITIS
H70	Otitis externa	URTI	EARINFECTION
H99	Other diseases of ear/mastoid	URTI	EARINFECTION
R74	URI (head cold)	URTI	URTI
R72	Strep throat/scarlet fever	URTI	TONSILLITIS
R76	Tonsillitis acute	URTI	TONSILLITIS
R90	Hypertrophy/chronic infect tonsils & adenoids	URTI	TONSILLITIS
R21	Sympt/complt throat	URTI	TONSILLITIS
R22	Sympt/complt tonsils	URTI	TONSILLITIS
R75	Sinusitis acute/chron	URTI	TONSILLITIS
R09	Sympt/complt sinus (incl pain)	URTI	TONSILLITIS
R83	Other infections of resp system	LRTI	OTHER
R71	Whooping cough	LRTI	TRACHEITIS
R77	Acute laryngitis/tracheitis	LRTI	TRACHEITIS
R78	Acute bronchitis/bronchiolitis	LRTI	BRONCHITIS
R02	Shortness of breath/dyspnoea	LRTI	BRONCHITIS
R03	Wheezing	LRTI	BRONCHITIS
R05	Cough	LRTI	BRONCHITIS
R81	Pneumonia	LRTI	PNEUMONIA
R96	Asthma	LRTI	ASTHMA

R80	Influenza (proven)wo pneumonia	LRTI	INFLUENZA
S09	Infected finger/toe/paronychia	SKIN	SKIN
S10	Boil/carbuncle/cellulitis local	SKIN	SKIN
S11	Other localized skin infection	SKIN	SKIN
S76	Other infectious skin dis	SKIN	SKIN
S84	Impetigo	SKIN	SKIN
D82	Disease of teeth/gums	SKIN	SKIN
D83	Disease of mouth/tongue/lips	SKIN	SKIN
S12	Insect bite	SKIN	SKIN
S13	Animal/human bite	SKIN	SKIN
S94	Ingrown toenail/other dis of nai S	SKIN	SKIN
S88	Contact dermatitis/other eczema	SKIN	SKIN
S87	Atopic dermatitis/eczema	SKIN	SKIN
S06	Local redness/erythema/rash	SKIN	SKIN
S18	Laceration/cut	SKIN	SKIN
S17	Abrasion/scratch/blister	SKIN	SKIN
S92	Pompholyx/dis sweat glands	SKIN	SKIN
S96	Acne	SKIN	ACNE
U70	Pyelonephritis/pyelitis acute	UTI	PYELONEPHRITIS
U71	Cystitis/other urin infect NOS	UTI	CYSTITIS
U02	Frequent/urgent urination	UTI	CYSTITIS
U05	Other urination problems	UTI	CYSTITIS
U01	Painful urination	UTI	CYSTITIS
U72	Urethritis non specific	UTI	URETHRITIS
U88	Glomerulonephritis/nephrosis	UTI	GLOMERULONEFR
X84	Vaginitis/vulvitis NOS	UTI	VAGINITIS
X99	Other diseases fem genital syste	UTI	FEMALE INFECTION
W94	Mastitis puerperalis	UTI	FEMALE INFECTION
Y74	Orchitis/epididymitis	UTI	MALE INFECTION
Y75	Balanitis	UTI	MALE INFECTION
F70	Infectious conjunctivitis	OTHER	EYE INFECTION
F72	Blepharitis/stye/chalazion	OTHER	EYE INFECTION
F73	Oth inf/inflam of eye (excl Herp	OTHER	EYE INFECTION
A99	Other general/unspec diseases	OTHER	OTHER
A03	Fever	OTHER	OTHER
B70	Acute lymphadenitis	OTHER	OTHER
A78	Other infectious diseases NOS	OTHER	OTHER
A77	Other viral diseases NOS	OTHER	OTHER

Table 2 - Indication and diagnose ICPC-codes in IPCI

Supplement 2

IPCI								
	Girls <12 yr		Girls ≥12 yr		Boys <12 yr		Boys ≥12 yr	
	asthma	no asthma	asthma	no asthma	asthma	no asthma	asthma	no asthma
URTI	39.3%**	43.6%	33.4%**	36.8%	40.6%**	52.2%	33.1%**	39.6%
Skin	9.1%**	13.9%	13.2%**	16.4%	14.3%**	19.6%	27.8%**	38.8%
UTI	16.0%**	23.5%	26.6%**	35.0%	1.8%**	3.5%	2.7%	3.0%
LRTI	31.9%**	14.3%	24.4%**	8.4%	38.5%**	19.4%	31.6%**	14.2%
Other /multiple indications	3.2%*	4.4%	2.3%*	3.0%	4.20%	4.7%	4.1%	3.9%
URTI+LRTI	0.5%	0.4%	0.2%*	0.3%	0.5%	0.6%	0.7%*	0.5%
THIN								
	Girls <12 yr		Girls ≥12 yr		Boys <12 yr		Boys ≥12 yr	
	asthma	no asthma	asthma	no asthma	asthma	no asthma	asthma	no asthma
URTI	46.0%**	55.6%	40.2%**	44.5%	45.0%**	55.9%	35.2%**	40.0%
Skin	13.3%**	15.5%	20.7%**	25.9%	15.2%**	18.3%	32.7%**	40.6%
UTI	9.7%**	12.3%	13.9%**	16.3%	3.8%**	5.2%	2.1%**	2.6%
LRTI	25.0%**	12.4%	19.4%**	8.8%	30.1%**	16.0%	24.2%**	12.3%
Other / multiple indications	3.1%**	2.9%	3.7%**	3.5%	2.90%	2.9%	3.5%*	3.3%
URTI+LRTI	2.9%**	1.4%	2.1%**	1.0%	3.0%**	1.7%	2.4%**	1.3%

Table 1 – indications stratified for age and gender
***p-value <0.05 (no asthma as reference)**
****p-value <0.0001 (no asthma as reference)**

IPCI									
		girls <12		Girls ≥12		Boys <12		Boys ≥12	
Pharmacologi-cal subgroup	**Active component**	**asthma**	**No asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**
Tetracy-clines	Doxycycline	N/A	N/A	14.7%	10.8%	N/A	N/A	15.9%	18.0%
	Minocycline	N/A	N/A	3.4%	4.7%	N/A	N/A	9.8%	11.9%
Penicilins	amoxicillin	47.7%	44.5%	20.6%	17.2%	51.6%	51.7%	25.3%	23.2%
	Pheneticillin	3.9%	6.3%	7.7%	9.6%	N/A	6.6%	4.9%	8.1%
	Flucloxacillin	N/A	5.1%	5.0%	5.3%	5.1%	7.1%	6.2%	8.9%
	amoxicillin with enzyme enhibitor	14.9%	17.2%	9.4%	9.7%	13.9%	16.45	11.6%	13.6%
Sulfona-mides and trimethoprim	trimethoprim	N/A	N/A	N/A	3.8%	N/A	N/A	N/A	N/A
	Sulfamethoxazole and trimethoprim	4.6%	N/A	N/A	N/A	4.9%	N/A	4.3%	N/A
Macrolides, lincosamides and strepto-gramins	Clarithromycin	8.0%	5.2%	6.7%	4.7%	9.0%	6.7%	8.5%	6.1%
	Azithromycin	12.6%	9.8%	13.2%	9.2%	15.4%	11.5%	13.6%	10.2%
Other antibacterials	Nitrofurantoin	8.5%	11.9%	19.3%	25.0%	N/A	N/A	N/A	N/A

Table 2- DU90% stratified for age and gender – NA: not part of DU90%

THIN									
		girls <12		Girls ≥12		Boys <12		Boys ≥12	
Pharmacologi-cal subgroup	**Active component**	**asthma**	**no asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**	**no asthma**	**no asthma**
Tetracyclines	doxycycline	N/A	N/A	2.7%	2.7%	N/A	N/A	3.0%	3.8%
	lymecycline	N/A	N/A	5.7%	8.3%	N/A	N/A	9.7%	12.6%
	oxytetra-cycline	N/A	N/A	3.9%	5.4%	N/A	N/A	8.2%	10.2%
	minocycline	N/A	N/A	N/A	2.5%	N/A	N/A	3.7%	4.8%
penicilins	amoxicillin	40.6%	45.7%	28.6%	20.6%	51.1%	52.6%	30.3%	22.0%
	phenoxy-methyl-penicillin	18.5%	14.2%	16.8%	20.0%	12.8%	20.4%	11.9%	14.9%
	flucloxacillin	12.2%	10.3%	11.6%	12.7%	12.2%	17.3%	14.1%	15.6%
	amoxicillin with enzyme enhibitor	4.8%	4.9%	3.8%	3.5%	5.0%	6.1%	3.5%	3.5%
other b-lactam antibacterials	cefalexin	4.4%	4.8%	3.7%	3.2%	2.8%	N/A	N/A	N/A
sulfonamides and trimethoprim	trimethoprim	10.1%	8.3%	9.0%	10.2%	12.8%	3.7%	N/A	N/A
Macroliden, lincosamides and streptogramins	erythromycin	9.5%	11.8%	11.0%	10.8%	3.3%	N/A	12.5%	12.5%
	clarithromycin	N/A	N/A	3.3%	N/A	N/A	N/A	3.1%	N/A

Table 3- DU90% stratified for age and gender – NA: not part of DU90%

IPCI												
	Girls <12 yr			Girls ≥12 yr			Boys <12 yr			Boys ≥12 yr		
	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio
asthma	16.8	56.8	1.5	31.1	33.5	0.8	18.5	56.3	1.5	75.8	37.2	0.9
no asthma	19.8	58.1	1.5	25.7	35.7	0.9	15.2	58.8	1.6	39.2	35.5	0.9
THIN												
	Girls <12 yr			Girls ≥12 yr			Boys <12 yr			Boys ≥12 yr		
	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio
asthma	0.5	72.7	8.0	0.7	71.6	6.8	0.6	73.3	7.7	0.7	73.4	7.3
no asthma	0.5	73.3	9.0	0.6	72.0	7.7	0.5	74.4	8.5	0.6	73.1	7.9

Table 4– Quality indicators for prescriptions for lower respiratory tract infections, stratified for age and gender

Broad/Narrow (B/N) ratio: (j01CR j01DC, j01DD, j01F(except j01FA01))/(j01CE, J01DB, J01FA01)
Amoxicillin Index (AI): J01CA04/J01
Amoxicillin/Broad (A/B) ratio: J01CA04/ (J01CR, J01DC, J01DD, J01F (except j01FA01)
J01CA04: Amoxicillin
J01CE: Beta-lactamase sensitive penicillins
J01CR: combinations of penicillins
J01DB: 1st generation cephalosporins
J01DC: 2nd generation cephalosporins
JOIDD: 3rd generation cephalosporins
J01F: macrolides, lincosamides and streptogramins
J01FA01: erythromycin

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5/6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	5-7/12-14
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	5-7
		(*d*) If applicable, explain how loss to follow-up was addressed	5
		(*e*) Describe any sensitivity analyses	n.a.
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	8
		(c) Summarise follow-up time (eg, average and total amount)	8
Outcome data	15*	Report numbers of outcome events or summary measures over time	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
		(*b*) Report category boundaries when continuous variables were categorized	n.a.
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n.a.
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Antibiotic use in children with asthma: cohort study in UK and Dutch primary care databases

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Antibiotic use in children with asthma: cohort study in UK and Dutch primary care databases

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ABSTRACT

Objectives: To compare the rate, indications and type of antibiotic prescriptions in children with and without asthma.

Design: A retrospective cohort study.

Setting: Two population-based primary care databases: IPCI (The Netherlands) and THIN (UK).

Participants: Children aged 5-18 years were included from January 2000 to December 2014. A child was categorized as having asthma if there were ≥2 prescriptions of respiratory drugs in the year following a code for asthma. Children were labelled as non-asthmatic if no asthma code was recorded in the patient file.

Main outcome measures: Rate of antibiotic prescriptions, related indications, and type of antibiotic drugs.

Results: The cohorts in IPCI and THIN consisted of 946,143 and 7,241,271 person years (PY), respectively. In both cohorts, antibiotic use was significantly higher in asthmatic children (IPCI: 197 vs. 126 users / 1,000 PY, THIN: 374 vs. 250 users / 1,000 PY). In children with asthma, part of antibiotic prescriptions were for an asthma exacerbation only (IPCI: 14%, THIN: 4%) and prescriptions were more often due to lower respiratory tract infections then in non-asthmatic children (IPCI: 18% vs. 13%, THIN: 21% vs. 12%). Drug type and quality indicators depended more on age, gender and database than on asthma status.

Conclusions: Use of antibiotics was higher in asthmatic children compared to non-asthmatic children. This was mostly due to diseases for which antibiotics are normally not indicated according to guidelines. Further awareness amongst physicians and patients is needed to minimize antibiotic overuse and limit antibiotic resistance.

Strengths and limitations of this study

- This study investigates antibiotic prescriptions in two large population-based databases
- A major strength of this study is that the use of databases from different countries surpasses local prescription patterns
- Because of the design of the study misclassification of indications is possible
- Antibiotic use depends on country, sex and gender; therefore analyses were stratified

INTRODUCTION

Antibiotic resistance is one of the biggest threats to global health today, as recently stated by the World Health Organization.[1] Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality.[2] The world urgently needs to change the way it prescribes and uses antibiotics. The Netherlands has long been recognized as a role model in the restricted use of antibiotics. For example, due to restricted antibiotic use MRSA rates are much lower in the Netherlands than in surrounding countries.[3, 4] Insights in antibiotic use for different patient groups and in different countries may help to develop best practices for optimal antibiotic use.

Studies indicate that children with asthma receive more antibiotics than children without asthma.[5, 6] However, national and international guidelines clearly state that antibiotics are not indicated for an asthma exacerbation.[7-9] Respiratory infections may trigger an asthma exacerbation, but these are mostly viral infections.[7] Insight in prescription patterns is a first step in detecting possible overuse and to initiate steps in reducing antibiotic use. Not only the prescription rate influences resistance patterns, also the type of antibiotic is important. Indeed, it is well known that broad spectrum antibiotics increase the risk of resistance more than narrow spectrum antibiotics.[10]

The aim of this study was to investigate differences in antibiotic prescriptions rates, type of antibiotic being prescribed and related indications in children with and

without asthma in a primary care setting in different countries. In addition we studied changes over time and associated quality indicators.

PATIENTS AND METHODS

Setting: A retrospective, population-based cohort study was conducted using data from 2 primary care databases: the Integrated Primary Care Information database (IPCI) from the Netherlands and The Health Improvement Network (THIN) from the UK. Both databases contain detailed information on drug prescription, diagnoses and co morbidities. Detailed descriptions of these databases have been published elsewhere.[11-13] The scientific review committee of IPCI and THIN approved this study (nr. 07/2016 and 16THIN046).

Patient and public involvement: No patients and or public were involved in this study.

Study population: The study population comprised all children aged 5-18 years, with at least one year of valid database history and having at least one day of follow-up during the study period (1st January 2000 until 31st December 2014). Within this study population, we identified a cohort of children with asthma and a cohort of children without asthma. A child was diagnosed as having asthma if there were at least 2 prescriptions of respiratory drugs in the year following a code for asthma. These drugs consisted of bronchodilators, inhaled corticosteroids, leukotriene receptor antagonist or xanthines (ATC code R03 – BNF codes 3.1.1-3.1.4, 3.2, 3.3). If a patient was not diagnosed with a code for asthma, this child was labeled as non-asthmatic. Children with a diagnose code of asthma and less than 2 prescriptions of asthma drugs were excluded from analyses because of potential misclassification

Exposure: All antibiotic (AB) prescriptions during the study period were identified from the patient files by an automated search on antibiotic drug codes (ATC code J01 for IPCI and BNF code 5.1 for THIN). To enable comparison between countries, BNF codes were mapped to the corresponding ATC codes.

Indications: To assess the underlying indications, the main indication code (READ codes in the THIN database and ICPC codes in the IPCI database) linked to the prescription was used. Only if no indication code of an infection was linked to the prescription, diagnostic codes entered in the patient's file on the same date as the antibiotic prescription were also considered as indication of use. Indications were divided into the following categories: upper respiratory tract infections (URTI), skin infections (skin), urinary tract infections (UTI), asthma exacerbation (asthma), lower respiratory tract infections (LRTI) and a combination of upper and lower respiratory tract infections (URTI + LRTI) in case a patient had codes for both. Other indications were categorized as 'other', and since there were not many prescriptions with multiple indications we categorized those as 'other' as well. As we were especially interested in LRTI, we categorized subtypes of LRTI's into 'bronchitis', 'pneumonia', 'combination of asthma exacerbation and bronchitis', 'influenza', 'tracheitis', 'unspecified' if no further categorization was possible, and 'other' (other LRTI or combinations of the previous). Tables with all indication codes and corresponding categories are available in the online supplementary file 1.

Quality indicators: To investigate differences in quality of antibiotic prescriptions in children with and without asthma, quality indicators (QI's) were calculated as proposed by the European Surveillance of Antimicrobial Consumption (ESAC) and as described in

literature.[14] First, the types of antibiotics that covered 90% of all antibiotic prescriptions (DU90%) were assessed.[15-17] Second, the ratio between broad and narrow spectrum antibiotics (B/N ratio) was calculated. Two additional QI's that are specific for outpatient pediatric use were also investigated namely the amoxicillin index (AI, the number of amoxicillin prescriptions as percentage of total antibiotic prescriptions) and the ratio between amoxicillin and broad spectrum antibiotics prescriptions (A/B ratio). Although amoxicillin is classified as an intermediate spectrum antibiotic and therefore not in the B/N ratio, it is considered the antibiotic of first choice for a large part of pediatric indications.[8, 18, 19] A high AI and A/B ratio are therefore indications of appropriate prescribing. Antibiotics considered as broad spectrum were: combinations of penicillins (J01CR), 2nd and 3rd generation cephalosporins (J01DC, J01DD) and macrolides (J01F)(except erythromycin). Narrow spectrum antibiotics were: β-lactam sensitive antibiotics (J01CE), 1st generation cephalosporines (J01DB) and erythromycin (J01FA01).

Statistical analysis: Descriptive statistics were used to describe characteristics of children with or without asthma. The prevalence of antibiotic use was expressed as the number of users per 1,000 person years (PY) to be interpreted as the number of children per 1,000 who use antibiotics in one year. Antibiotic use was studied overall but also by type of antibiotic (ATC code pharmacological subgroup level). A Poisson regression model was applied to determine differences in antibiotic prescription rates. The effect of age, gender and calendar year was studied by means of a stratified analysis. Descriptive statistics were used to describe patient characteristics.

Chi-square tests or Fisher's exact test were used to examine differences in indication of use between children with asthma and children without asthma. Confidence intervals (CI) of proportions were derived using Wilson method for binomial proportions.

A p-value <0.05 was considered statistically significant. Jerboa©, a custom-built software, was used to assess prevalence of antibiotic use and further analyses were conducted using SAS® version 9.4.[20]

RESULTS

The study population of IPCI consisted of 26,750 children with asthma and 330,916 children without asthma in total contributing to 946,143 PY. The median age for children with asthma at start of follow-up was 10.8 years (interquartile range (IQR) 6.4-14.6) and for children without asthma 10.3 years (IQR 6.1-13.9). The study population in THIN consisted of 152,957 children with asthma and 1,438,097 children without asthma, in total contributing to 7,241,271 PY. Median age at start of follow up was 7.9 years (IQR 5.0-11.4) for children with asthma and 6.0 years (inter quartile range, (IQR) 5.0-10.2) for children without asthma.

During the study period 186,195 prescriptions of antibiotics were retrieved from the IPCI database and 3,283,887 from the THIN database. The overall annual prevalence of AB use in the entire pediatric population was 131/1,000 PY for IPCI and twice as high, namely 263/1,000 PY for THIN (p<0.001). (figure 1) In both databases, children with asthma used significantly more antibiotics than children without asthma (p<0.0001). In IPCI, the prevalence rate ratio (PRR) of AB use in children with asthma versus use in non-asthmatic children was 1.65 (95% CI 1.53-1.78) (adjusted for age, gender and calendar year). The same trend was observed in THIN with a PRR of 1.60 (95% CI 1.54-1.66). The number of AB prescriptions was higher than the number of users and children who used antibiotics received on average two antibiotic prescriptions per year. In both databases the rate of antibiotic prescriptions decreased significantly with calendar time, both in children with or without asthma (p<0.05). (figure 2)

In IPCI, 29% of the antibiotic prescriptions could not be linked to an indication of use on the day of prescription; this was 50% for THIN. Of those prescriptions with a known

indication, the most common indication in all children was upper respiratory tract infection (41% IPCI, 47% THIN), followed by lower respiratory tract infections with significantly higher proportions in children with asthma (18% IPCI, 21% THIN) than children without asthma (IPCI: 13%, THIN: 12%, p-value for both databases <0.001). (figure 3) The most common LRTI for which AB were prescribed was acute bronchitis. (figure 4)

In children with asthma, 14% (IPCI) to 4% (THIN) of antibiotics were prescribed for asthma exacerbation only. Compared to the THIN database, a smaller proportion of the prescriptions for asthmatics in IPCI were due to URTI, LRTI and skin infections, and a larger proportion in IPCI was due to UTI and asthma (p-value for all indications <0.001). Differences in prescriptions for non-asthmatic patients were mostly similar, except that in these cohorts more prescriptions were due to LRTI in IPCI than in THIN (13% vs 12%, p-value <0.001).

The type of prescribed AB was different between databases. (Figure 5-6, table 1) In IPCI, the difference in type of antibiotic between children with and without asthma was most pronounced for macrolides (22.1% of all AB prescriptions in children with asthma vs. 15.9% in non-asthmatic children, p-value <0.0001). In THIN, this difference was less pronounced: macrolides were prescribed in 15.4% of prescriptions for children with asthma and 12.9% for children without asthma (p-value <0.0001).

Table 1 – Drug utilization (DU) 90% of all prescriptions in IPCI and THIN

Drug		Percentage of DU90% (95% CI)		Asthma vs. no asthma
Pharmacological subgroup	**Active component**	**asthma**	**no asthma**	**p-value**
IPCI				
Tetracyclines	doxycycline	7.0% (6.6-7.4)	6.6% (6.5-6.7)	0.0092
	minocycline	N/A	3.6% (3.5-3.7)	N/A
Penicillins	amoxicillin	37.5% (37.0-38.4)	34.5% (34.3-34.8)	<0.0001
	pheneticillin	5.2% (4.9-5.5)	7.7% (7.6-7.8)	<0.0001
	flucloxacillin	5.0% (4.6-5.3)	6.3% (6.2-6.4)	<0.0001
	amoxicillin with enzyme inhibitor	12.6% (12.1-13.1)	14.2% (14.0-14.4)	<0.0001
Sulfonamides and trimethoprim	sulfamethoxazole and trimethoprim	3.8% (3.6-4.1)	N/A	N/A
Macroliden, lincosamides and strepto-gramins	clarithromycin	8.1% (7.7-8.5)	5.6% (5.5-5.7)	<0.0001
	azithromycin	13.8% (13.4-14.4)	10.1% (10.0-10.3)	<0.0001
Other antibacterials	nitrofurantoin	6.9% (6.5-7.2)	11.5% (11.3-11.6)	<0.0001
THIN				
Tetracyclines	lymecycline	4.1% (4.0-4.1)	4.8% (4.8-4.9)	<0.0001
	oxytetracycline	3.2% (3.1-3.2)	3.5% (3.5-3.5)	<0.0001
Penicillins	amoxicillin	38.8% (38.7-39)	33.7% (33.8-33.9)	<0.0001
	phenoxymethyl-penicillin	13.9% (13.7-14.0)	18.4% (18.3-18.4)	<0.0001
	flucloxacillin	12.2% (12.1-12.3)	14.0% (14.0-14.0)	<0.0001
	amoxicillin with enzyme enhibitor	4.3% (4.3-4.4)	4.4% (4.4-4.5)	0.0178
Other b-lactam antibacterials	cefalexin	3.2% (3.1-3.2)	3.1% (3.1-3.1)	<0.0001
Sulfonamides and trimethoprim	trimethoprim	5.2% (5.1-5.3)	7.0% (7.0-7.0)	<0.0001
Macroliden, lincosamides and streptogramins	erythromycin	12.1% (12.0-12.2)	11.0% (11.0-11.1)	<0.0001
	clarithromycin	3.2% (3.1-3.2)	N/A	N/A

N/A: not part of DU90%

With regard to quality indicators, less appropriate antibiotic prescribing was observed for IPCI (NL) compared to THIN (UK), with a higher B/N ratio (IPCI: 3.4, THIN: 0.3, p-value <0.001) and a lower A/B ratio (IPCI: 1.1, THIN: 3.9 p-value <0.001) and AI (IPCI: 32.0, THIN: 36.1 p-value <0.001) in IPCI than in THIN. These findings remained when repeating the analysis for prescriptions for LRTI only. Overall, based on quality indicators, AB prescribing in children with asthma appeared less appropriate than in children without asthma. (Table 2)

Table 2 – Quality indicators of all prescriptions and prescriptions for lower respiratory tract infections only

		All prescriptions						LRTI prescriptions					
		B/N ratio	p-value	AI	p-value	A/B ratio	p-value	B/N ratio	p-value	AI	p-value	A/B ratio	p-value
IPCI	asthma	4.7	ref.	34.7%	ref.	1.1	ref.	23.3	ref.	48.6%	ref.	1.2	ref.
	no asthma	3.2	<.0001	31.5%	<.0001	1.1	0.0054	20.6	0.5576	50.3%	0.3512	1.3	0.4074
THIN	asthma	0.4**	ref.	38.8%*	ref.	3.8**	ref.	0.6**	ref.	72.8%**	ref.	7.6**	ref.
	no asthma	0.3**	<.0001	33.7%**	<.0001	4.0**	<.0001	0.5**	<.0001	73.2%**	<.0001	8.6**	<.0001

** significant different from IPCI cohort, p-value <0.0001
* significant different from IPCI cohort, p-value <0.005
Broad/Narrow (B/N) ratio: (J01CR J01DC, J01DD, J01F (except J01FA01))/(J01CE, J01DB, J01FA01)
Amoxicillin Index (AI): J01CA04/J01
Amoxicillin/Broad (A/B) ratio: J01CA04/ (J01CR, J01DC, J01DD, J01F (except J01FA01)
J01CA04: Amoxicillin, J01CE: Beta-lactamase sensitive penicillins, J01CR: combinations of penicillins
J01DB: 1st generation cephalosporins, J01DC: 2nd generation cephalosporins, JOIDD: 3rd generation cephalosporins
J01F: macrolides, lincosamides and streptogramins, J01FA01: erythromycin

The analyses of prescription rates, indications and quality indicators were repeated while stratifying for age and gender. After the age of 12, especially in girls the number of prescriptions increased due to urinary tract infections. Differences between children with and without asthma and between countries remained similar upon stratification. Details on stratified analysis are available in the online supplementary file 2.

DISCUSSION

In this international cohort study, we showed that children with asthma are more often prescribed antibiotics than children without asthma. This higher AB prescription rate in children with vs. children without asthma was strikingly similar in the UK and The Netherlands, while overall use of AB prescriptions was substantially higher in the UK compared to the Netherlands. High use of AB in children with asthma was already reported in literature but, to our knowledge, we are the first who investigated indication of use.[5, 6]

The indications of use were often bronchitis and asthma exacerbations, conditions for which antibiotics are in general not recommended. Indeed, according to the guidelines of the Global Initiative of Asthma (GINA), use of AB for the treatment of asthma exacerbations is not recommended unless there is strong evidence of lung infection.[7] Asthma is not a risk factor for complicated respiratory tract infections according to the British guidelines, and Dutch guidelines even emphasize that underlying asthma does not justify antibiotics in case of a LRTI.[8, 9] Additionally it has been shown that asthma is not a risk factor for complications of influenza. [21] One explanation for increased antibiotic prescribing for children with asthma could be that respiratory infectious syndromes in children with asthma present with various lower respiratory tract symptoms. This complicates the discrimination between a bacterial infection, a viral infection or an asthma exacerbation in primary care. Also, even though guidelines state that there is not enough evidence for treatment with antibiotics in case of an asthma exacerbation, it is being discussed that the supposedly anti-inflammatory effect of antibiotics (macrolides in particular) might be beneficial for patients with asthma.[22-25]

This might explain the relatively higher rate of macrolides prescriptions for asthmatic children in the Netherlands. However, the recommendation of macrolide use would only be beneficial for children with severe asthma whom are usually treated in secondary and tertiary care.

For the overall use of antibiotics in all children, it is remarkable that a large proportion was prescribed for upper respiratory tract infections. URTI's are notoriously caused by viruses for which antibiotics are not effective.[9] This is supported by the observation that in IPCI, along with lower prescribing rates, less prescriptions were due to LRTI and URTI than in THIN. These findings suggest need for better guidelines on treatment of URTI and monitoring systems at the different points of care (GP, pharmacist, secondary care) for incorrect use of AB.

The majority of upper and lower respiratory tract infections are caused by viruses not requiring AB treatment. Early identification of bacteria as causal organism might be a tool for guided AB treatment. Reviews of randomised trials show that c-reactive protein (CRP) testing and procalcitonin-guided management can reduce antibiotic prescriptions, without negative impact on disease duration. [26] Similarly, delayed instead of immediate antibiotic prescribing which is already implemented in UK guidelines and shared decision making could benefit antibiotic rates.[26, 27] However, most studies on these tests have been done in adults. For this reason, Dutch guidelines advice the use of CRP testing in adults only with certain respiratory complaints while awaiting more evidence of safety of use in children. [8] Education of the patients should not be forgotten, as the patient's view on treatment influences the decision of physicians.[28-30] While important differences in prescription rates were observed in children with or

without asthma, the type of drugs and quality of the prescriptions were comparable. Although differences between asthmatics and non-asthmatics were statistically significant, compared to differences between countries they were almost negligible. Mainly country specific differences in quality indicators were observed which was already reported in other studies.[31] Although children in the UK receive twice as often antibiotics compared with Dutch children, the choice of antibiotics seems to be more appropriate in the UK. These country specific differences in quality indicators might be explained by differences in availability of drugs, resistance patterns and national guidelines.

As for all observational research, this study has strengths and limitations: strengths of this study include the large number of patients that were followed over time and the fact that this is an international study. In addition, we present real life data, by using the electronic patient records of GP practices spread over the UK and the Netherlands. In both countries the GP acts as a gatekeeper of the patient's medical care, minimizing selection and information bias. Also, in contrast to other studies, we had information on all different indications of use, although not for all AB prescriptions. With regard to limitations, we might have underreported pneumonia as indication of AB use in THIN. In our study, pneumonia was defined based on pneumonia specific READ codes. This classification was stricter than in other studies where the READ code 'Acute lower respiratory infection (H062.00)' was also classified as 'pneumonia' while we classified that code as 'LRTI – unspecified'.[32] For both databases, indications were based on diagnose codes without use of free text. The system automatically links a drug with the problem code it is prescribed within. In a busy consultation, all the prescriptions might

be issued under one problem code. In the UK, performing an asthma review is part of the quality and outcomes framework (QOF) which might lead to extra entries for asthma if a patient presents with another disease. For drugs with a single indication of use this problem can be identified. In the IPCI and THIN database in 98% and 94% of the minocycline prescriptions was linked to skin infections, and 98% and 96% of nitrofurantoin prescriptions was linked to urinary tract infections. This suggests limited bias. Still, the bias might be more likely to occur in indications from the same system organ class – such as LRTI and asthma, but this can only be identified through free text validation. Finally, misclassification of asthma could be a concern as asthma was based on the presence of asthma disease codes in combination of use of respiratory drugs: still the prevalence of asthma which we reported (IPCI 7.9% and THIN 9.6%) is in line with literature suggesting that asthma misclassification is minimal.[33]

To conclude, this study shows possibilities for further reduction and more sensible choice of antibiotic use, even in countries as The Netherlands where antibiotic use is the lowest in the world. We showed that children with asthma are prescribed antibiotics often for self-limiting respiratory tract infections. Additionally, asthma treatment in primary care can be optimized by following (inter)national guidelines more strictly in terms of prescription rates and type of drugs. This can be done by raising awareness amongst GP's, patients and their parents. Additionally, careful implementation of point-of care tests such as CRP testing and procalcitonin-guided management in guidelines will help in reducing antibiotic therapy rates. Further awareness can reduce unnecessary antibiotic use and limit antibiotic resistance.

FOOTNOTES

Author contributions: EB, TK, HJ and KV contributed to the conception and design, acquisition of data and analyses and interpretation of the data, drafted the article, revised it critically for important intellectual content and gave final approval of the version to be published. PB, JdJ and MS contributed to the conception and design and acquisition of data, interpretation of the data, revised the drafted manuscript critically for important intellectual content and gave final approval of the version to be published.

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; KV works for a research group who in the past received unconditional research grants from Yamanouchi, Pfizer, Boehringer-Ingelheim, Novartis and GSK. None of these grants was related to the content of this work; no other relationships or activities that could appear to have influenced the submitted work.

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Data sharing: statistical codes are available upon request from the corresponding author.

Patient consent: Not required.

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FIGURE LEGEND

Figure 1 – Age and asthma status specific annual prevalence rate of antibiotic use

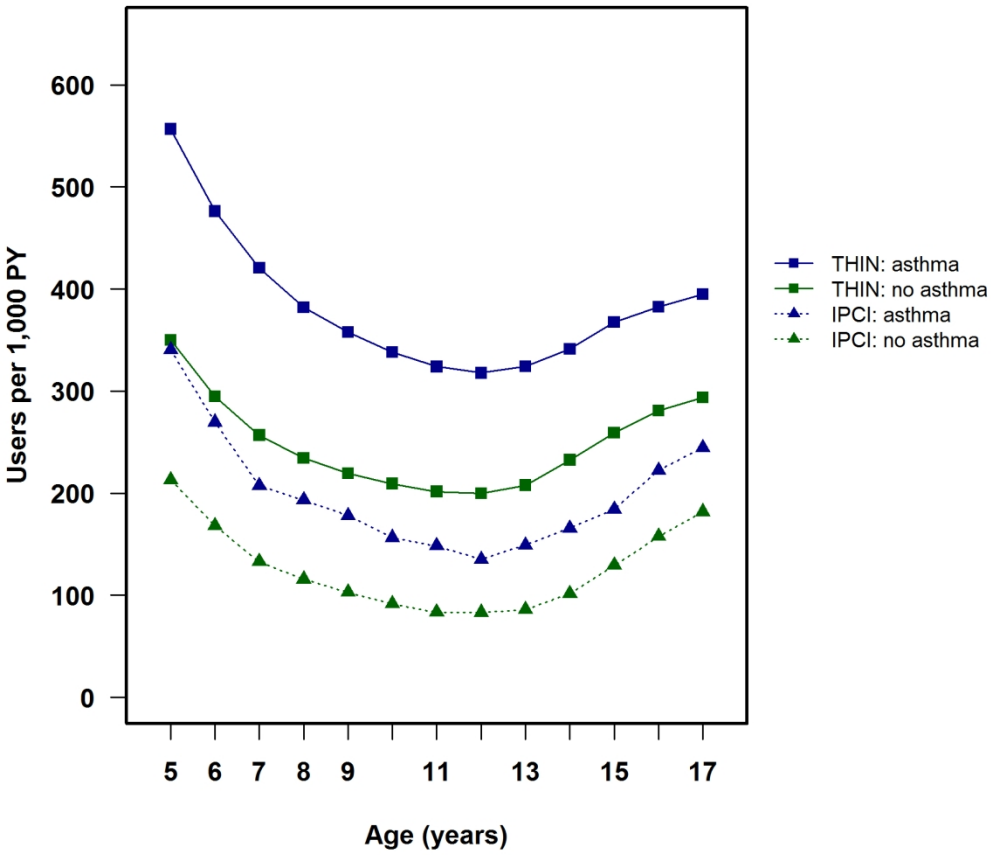
Figure 2 – Annual prevalence rate of antibiotic use by calendar year

Figure 3 – Indications of antibiotic use – proportion of known indications

Figure 4 – Indications of lower respiratory tract infections

Figure 5 – Age, gender and asthma specific antibiotic prescriptions in IPCI

Figure 6 – Age, gender and asthma specific antibiotic prescriptions in THIN



Age and asthma status specific annual prevalence rate of antibiotic use

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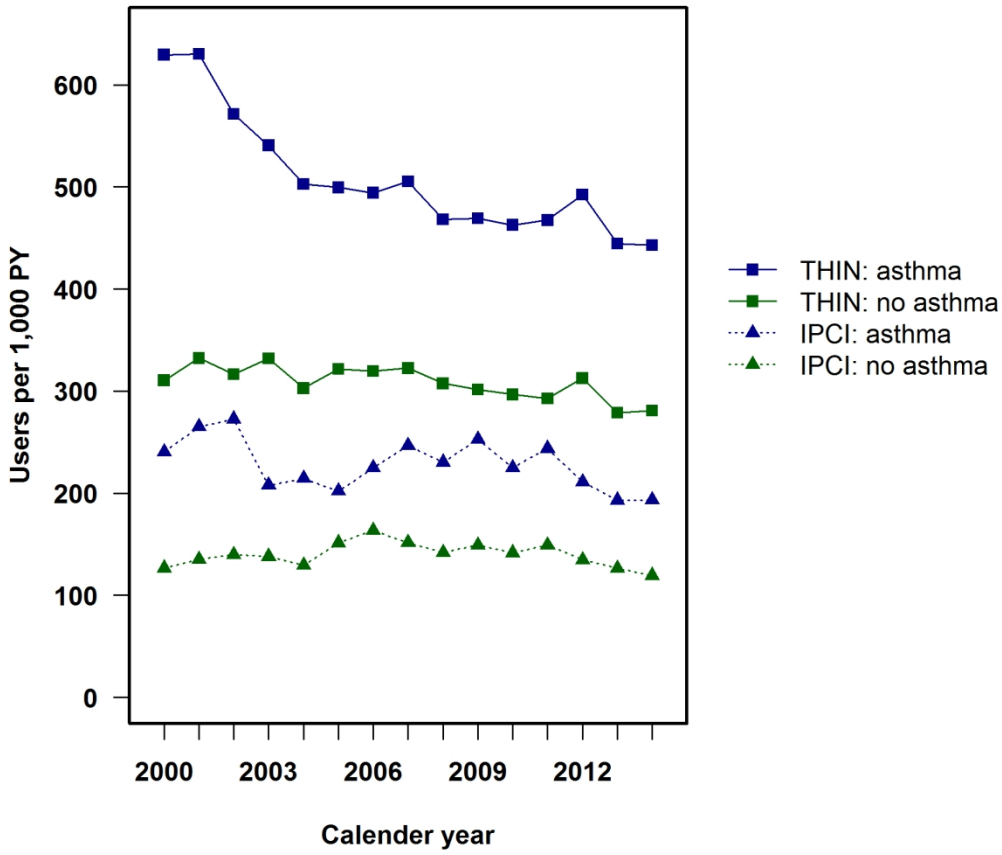
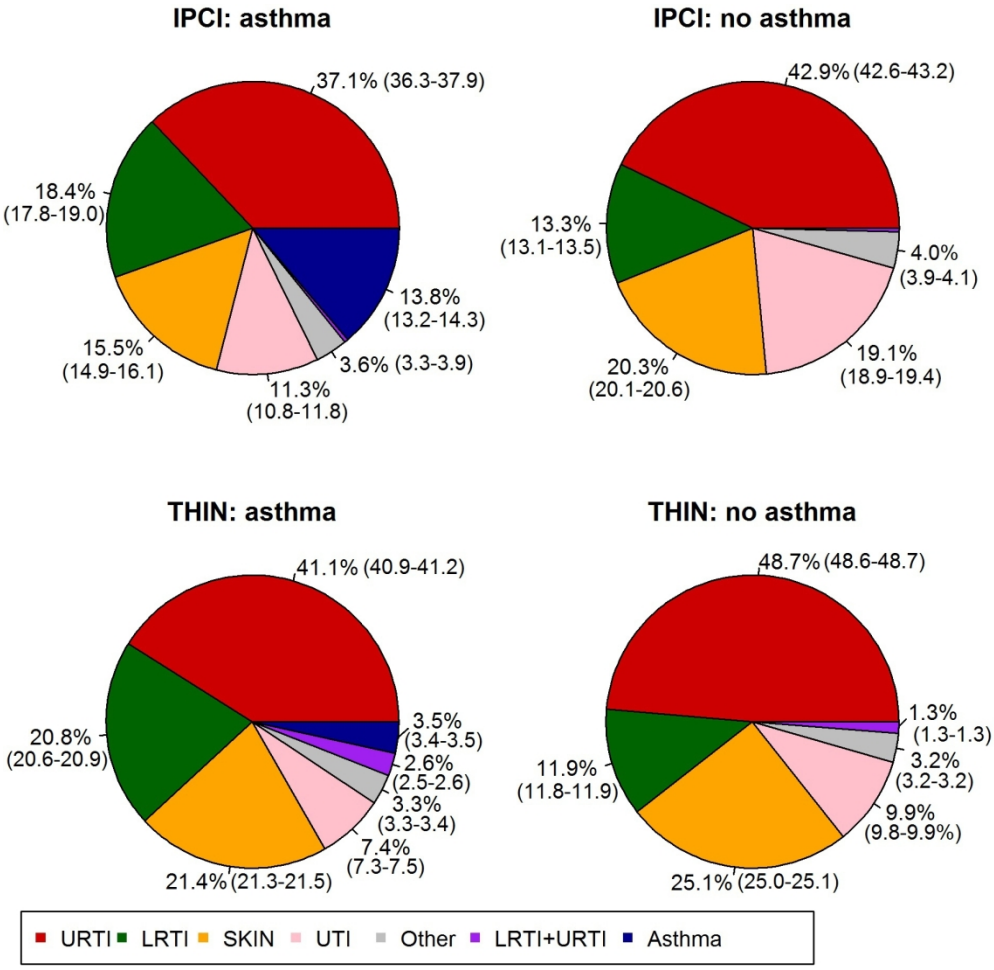


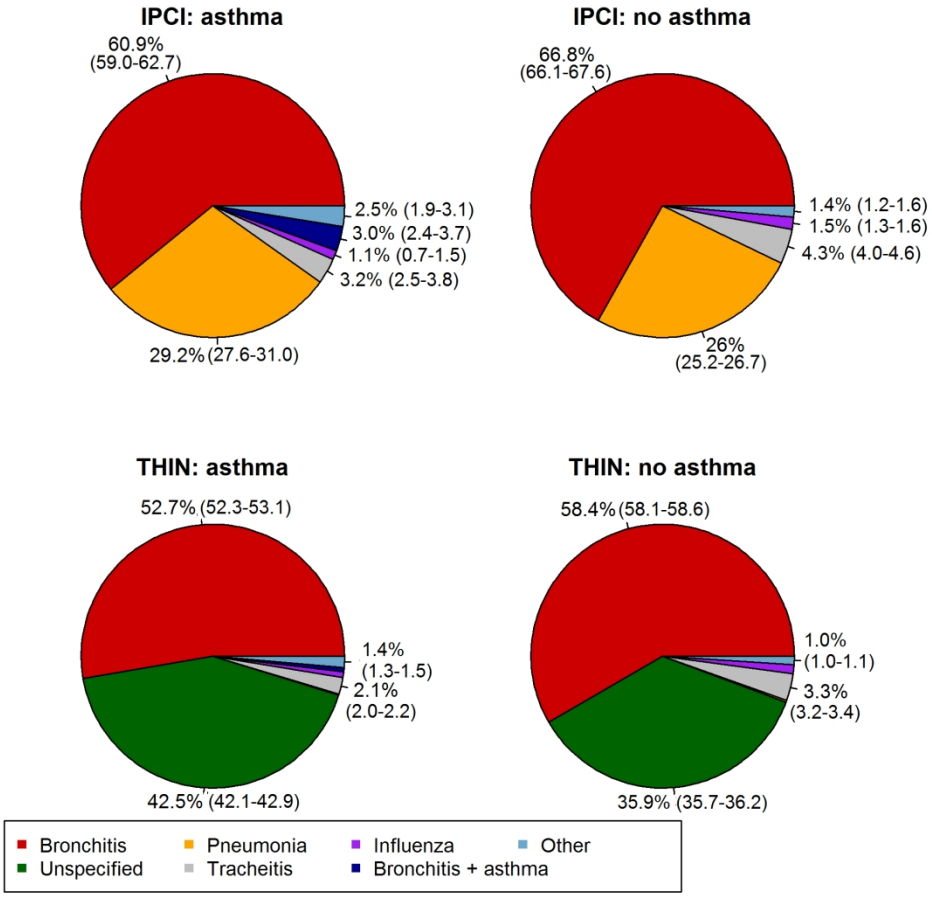
Annual prevalence rate of antibiotic use by calendar year

160x160mm (300 x 300 DPI)



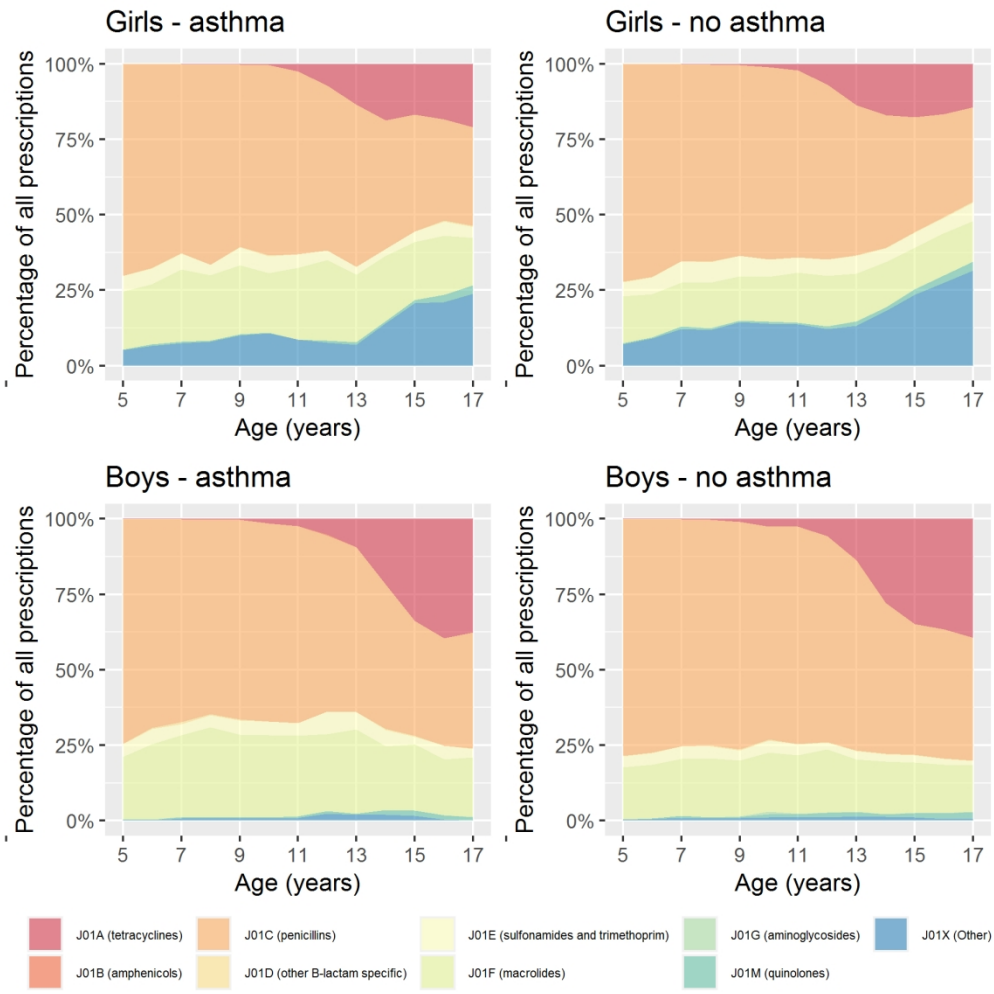
Indications of antibiotic use – proportion of known indications

160x160mm (300 x 300 DPI)



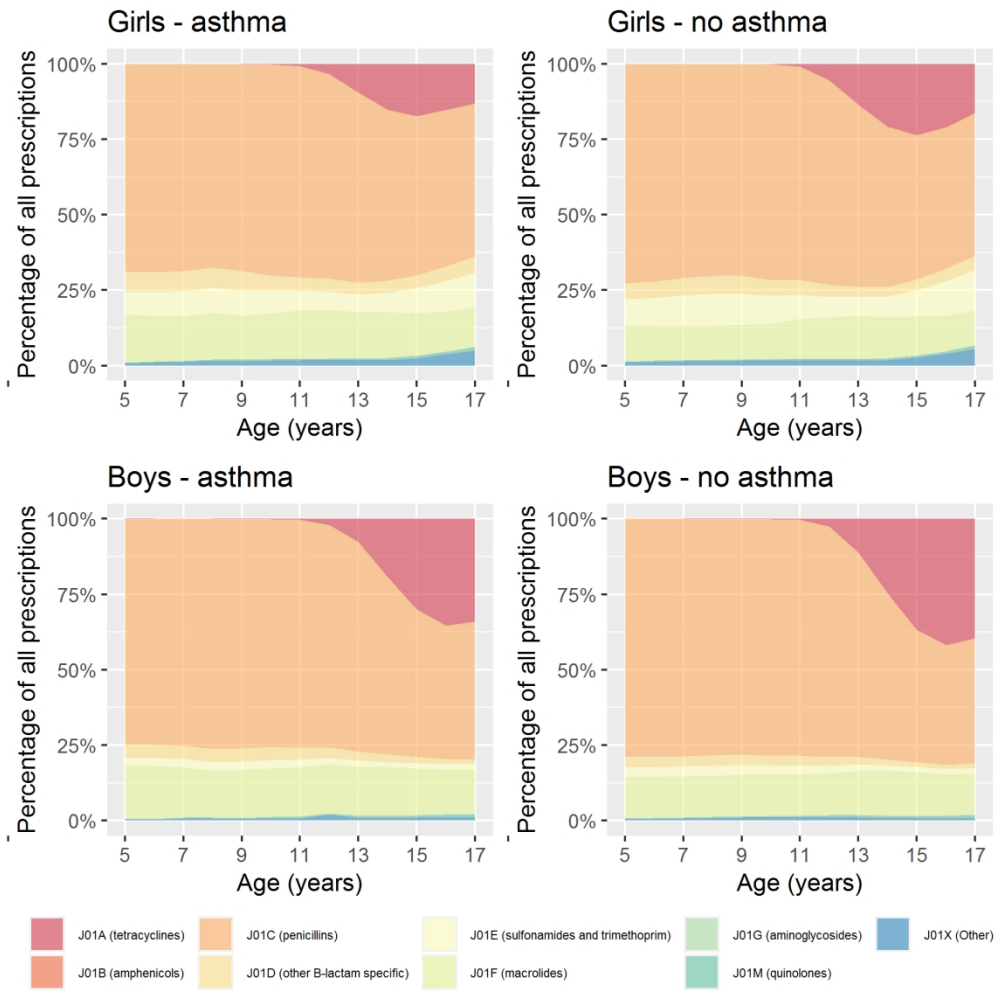
Indications of lower respiratory tract infections

178x160mm (300 x 300 DPI)



Age, gender and asthma specific antibiotic prescriptions in IPCI

160x160mm (300 x 300 DPI)



Age, gender and asthma specific antibiotic prescriptions in THIN

160x160mm (300 x 300 DPI)

Supplement 1

READ code	Description	Disease group	Disease further specified
1652	Feels hot/feverish	OTHER	OTHER
1653	Fever with sweating	OTHER	OTHER
1712	Dry cough	LRTI	LRTI - unspecified
1713	Productive cough -clear sputum	LRTI	LRTI - unspecified
1714	Productive cough -green sputum	LRTI	LRTI - unspecified
1715	Productive cough-yellow sputum	LRTI	LRTI - unspecified
1716	Productive cough NOS	LRTI	LRTI - unspecified
1716.11	Coughing up phlegm	LRTI	LRTI - unspecified
1717	Night cough present	LRTI	LRTI - unspecified
1719	Chesty cough	LRTI	LRTI - unspecified
1719.11	Bronchial cough	LRTI	LRTI - unspecified
165..11	Fever symptoms	OTHER	OTHER
165..12	Pyrexia symptoms	OTHER	OTHER
16L..00	Influenza-like symptoms	LRTI	INFLUENZA
17...00	Respiratory symptoms	LRTI	LRTI - unspecified
171..00	Cough	LRTI	LRTI - unspecified
171..11	C/O - cough	LRTI	LRTI - unspecified
171A.00	Chronic cough	LRTI	LRTI - unspecified
171B.00	Persistent cough	LRTI	LRTI - unspecified
171C.00	Morning cough	LRTI	LRTI - unspecified
171D.00	Evening cough	LRTI	LRTI - unspecified
171E.00	Unexplained cough	LRTI	LRTI - unspecified
171F.00	Cough with fever	LRTI	LRTI - unspecified
171G.00	Bovine cough	LRTI	LRTI - unspecified
171H.00	Difficulty in coughing up sputum	LRTI	LRTI - unspecified
171J.00	Reflux cough	LRTI	LRTI - unspecified
171K.00	Barking cough	LRTI	LRTI - unspecified
171L.00	Cough on exercise	LRTI	LRTI - unspecified
171Z.00	Cough symptom NOS	LRTI	LRTI - unspecified
173A.00	Exercise induced asthma	ASTHMA	ASTHMA
173c.00	Occupational asthma	ASTHMA	ASTHMA
173d.00	Work aggravated asthma	ASTHMA	ASTHMA
17Z..00	Respiratory symptoms NOS	URTI+LRTI	URTI+LRTI
17ZZ.00	Respiratory symptom NOS	URTI+LRTI	URTI+LRTI
19...00	Gastrointestinal symptoms	OTHER	GASTROENTERITIS
19...11	GIT symptoms	OTHER	GASTROENTERITIS
19...12	Intestinal symptoms	OTHER	GASTROENTERITIS
19F..00	Diarrhoea symptoms	OTHER	GASTROENTERITIS
19F..11	Diarrhoea	OTHER	GASTROENTERITIS
19F2.00	Diarrhoea	OTHER	GASTROENTERITIS

19F3.00	Spurious (overflow) diarrhoea	OTHER	GASTROENTERITIS
19FZ.00	Diarrhoea symptom NOS	OTHER	GASTROENTERITIS
19G..00	Diarrhoea and vomiting	OTHER	GASTROENTERITIS
19Z..00	Gastrointestinal symptoms NOS	OTHER	GASTROENTERITIS
1A...12	Urinary symptoms	UTI	CYSTITIS
1A1..00	Micturition frequency	UTI	CYSTITIS
1A1..11	Frequency of micturition	UTI	CYSTITIS
1A1..12	Polyuria	UTI	CYSTITIS
1A1..13	Urinary frequency	UTI	CYSTITIS
1A12.00	Frequency of micturition	UTI	CYSTITIS
1A55.00	Dysuria	UTI	CYSTITIS
1A7..00	Vaginal discharge symptom	UTI	FEMALE INFECTION
1AG..00	Recurrent urinary tract infections	UTI	CYSTITIS
1B8..00	Eye symptoms	OTHER	EYE INFECTION
1BA5.11	Pain in sinuses	URTI	SINUSITIS
1C...12	Ear symptoms	URTI	OTITIS
1C14.00	Blocked ear	URTI	OTITIS
1C3..00	Earache symptoms	URTI	OTITIS
1C32.00	Unilateral earache	URTI	OTITIS
1C33.00	Bilateral earache	URTI	OTITIS
1C3Z.00	Earache symptom NOS	URTI	OTITIS
1C4..00	Ear discharge symptoms	URTI	OTITIS
1C42.00	Ear discharge present	URTI	OTITIS
1C9..00	Sore throat symptom	URTI	TONSILLITIS
1C9..11	Throat soreness	URTI	TONSILLITIS
1C92.00	Has a sore throat	URTI	TONSILLITIS
1C93.00	Persistent sore throat	URTI	TONSILLITIS
1C9Z.00	Sore throat symptom NOS	URTI	TONSILLITIS
1CB..00	Throat symptom NOS	URTI	TONSILLITIS
1CB3.00	Throat pain	URTI	TONSILLITIS
1CB3.11	Pain in throat	URTI	TONSILLITIS
1CBZ.00	Throat symptom NOS	URTI	TONSILLITIS
1D14.00	C/O: a rash	SKIN	SKIN
1J4..00	Suspected UTI	UTI	CYSTITIS
1JN1.00	Suspected Lyme disease	OTHER	OTHER
1O2..00	Asthma confirmed	ASTHMA	ASTHMA
23...00	Examn. of respiratory system	URTI+LRTI	URTI+LRTI
2D...11	O/E - ear	URTI	OTITIS
2D6..00	O/E - discharge from ear	URTI	OTITIS
2D7..00	O/E - painful ear	URTI	OTITIS
2DC3.00	Inflamed throat	URTI	TONSILLITIS
2FD..00	O/E - skin cyst	SKIN	SKIN

2G64.00	O/E - infected toe	SKIN	SKIN
46...00	Urine examination	UTI	CYSTITIS
46...11	Urine tests	UTI	CYSTITIS
461..11	MSU - general	UTI	CYSTITIS
461..12	Urinalysis - general	UTI	CYSTITIS
46G4.11	Leucocytes in urine	UTI	CYSTITIS
46U..00	Urine culture	UTI	CYSTITIS
46Z1.00	Urine microscopy	UTI	CYSTITIS
4JJ..12	Mid-stream urine sample	UTI	CYSTITIS
81H..00	Dressing of wound	SKIN	SKIN
A0...00	Intestinal infectious diseases	OTHER	GASTROENTERITIS
A0...12	Food poisoning	OTHER	GASTROENTERITIS
A0...13	Vomiting - infective	OTHER	GASTROENTERITIS
A00..00	Cholera	OTHER	GASTROENTERITIS
A00..11	Vibrio cholerae	OTHER	GASTROENTERITIS
A000.00	Cholera - Vibrio cholerae	OTHER	GASTROENTERITIS
A001.00	Cholera - Vibrio cholerae El Tor	OTHER	GASTROENTERITIS
A01..00	Typhoid and paratyphoid fevers	OTHER	GASTROENTERITIS
A010.00	Typhoid fever	OTHER	GASTROENTERITIS
A010.11	Enteric fever	OTHER	GASTROENTERITIS
A01z.00	Paratyphoid fever NOS	OTHER	GASTROENTERITIS
A02..00	Other salmonella infections	OTHER	GASTROENTERITIS
A020.00	Salmonella gastroenteritiseritis	OTHER	GASTROENTERITIS
A020.11	Salmonellosis	OTHER	GASTROENTERITIS
A020.12	Salmonella food poisoning	OTHER	GASTROENTERITIS
A021.00	Salmonella septicaemia	OTHER	GASTROENTERITIS
A02z.00	Salmonella infection NOS	OTHER	GASTROENTERITIS
A03..00	Shigellosis	OTHER	GASTROENTERITIS
A030.11	Bacillary dysentery	OTHER	GASTROENTERITIS
A033.00	Shigella sonnei (group D)	OTHER	GASTROENTERITIS
A033.11	Bacillary dysentery Shigella sonnei	OTHER	GASTROENTERITIS
A03y.00	Other specified shigella infection	OTHER	GASTROENTERITIS
A03z.00	Shigellosis NOS	OTHER	GASTROENTERITIS
A04..00	Other bacterial food poisoning	OTHER	GASTROENTERITIS
A041.00	Botulism	OTHER	GASTROENTERITIS
A042.00	Clostridium perfringens food poisoning	OTHER	GASTROENTERITIS
A044.00	Vibrio parahaemolyticus food poisoning	OTHER	GASTROENTERITIS
A04y000	Foodborne Bacillus cereus intoxication	OTHER	GASTROENTERITIS
A04z.00	Food poisoning NOS	OTHER	GASTROENTERITIS
A05..00	Amoebiasis	OTHER	GASTROENTERITIS
A050.00	Acute amoebic dysentery	OTHER	GASTROENTERITIS
A056.00	Amoebic skin ulceration	SKIN	SKIN
A05y000	Amoebic appendicitis	OTHER	GASTROENTERITIS

A05y100	Amoebic balanitis	SKIN	SKIN
A061.00	Giardiasis - Lambliasis	OTHER	GASTROENTERITIS
A061.11	Colitis - giardial	OTHER	GASTROENTERITIS
A062.00	Coccidiosis	OTHER	GASTROENTERITIS
A063.00	Intestinal trichomoniasis	OTHER	GASTROENTERITIS
A064.00	Cryptosporidiosis	OTHER	GASTROENTERITIS
A07..00	Intestinal infection due to other organisms	OTHER	GASTROENTERITIS
A070.00	Escherichia coli gastrointestinal tract infection	OTHER	GASTROENTERITIS
A070000	Enteropathogenic Escherichia coli infection	OTHER	GASTROENTERITIS
A070100	Enterotoxigenic Escherichia coli infection	OTHER	GASTROENTERITIS
A070200	Enteroinvasive Escherichia coli infection	OTHER	GASTROENTERITIS
A070300	Enterohaemorrhagic Escherichia coli infection	OTHER	GASTROENTERITIS
A073.00	Proteus gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074.00	Other specified gastrointestinal tract bacterial infection	OTHER	GASTROENTERITIS
A074000	Staphylococcal gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074100	Pseudomonas gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074300	Campylobacter gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074311	Diarrhoea due to Campylobacter jejuni	OTHER	GASTROENTERITIS
A074312	Campylobacter enteritis	OTHER	GASTROENTERITIS
A074313	Helicobacter gastritis	OTHER	GASTROENTERITIS
A074400	Enteritis due to Yersinia enterocolitica	OTHER	GASTROENTERITIS
A074500	Helicobacter pylori gastrointestinal tract infection	OTHER	GASTROENTERITIS
A074z00	Other specified gastrointestinal tract infections NOS	OTHER	GASTROENTERITIS
A075.00	Unspecified bacterial enteritis	OTHER	GASTROENTERITIS
A076.00	Enteritis due to specified virus	OTHER	GASTROENTERITIS
A076.11	Viral diarrhoea	OTHER	GASTROENTERITIS
A076.12	Viral vomiting	OTHER	GASTROENTERITIS
A076000	Enteritis due to adenovirus	OTHER	GASTROENTERITIS
A076100	Enteritis due to enterovirus	OTHER	GASTROENTERITIS
A076200	Enteritis due to rotavirus	OTHER	GASTROENTERITIS
A076300	Enteritis due to norovirus	OTHER	GASTROENTERITIS
A076z00	Enteritis due to specified virus NOS	OTHER	GASTROENTERITIS
A07y.00	Gastrointestinal tract infection specified organism NEC	OTHER	GASTROENTERITIS
A07y000	Viral gastroenteritiseritis	OTHER	GASTROENTERITIS
A07y100	Infantile viral gastroenteritiseritis	OTHER	GASTROENTERITIS
A07z.00	Gastrointestinal tract infection specified organism NOS	OTHER	GASTROENTERITIS
A08..00	Ill-defined intestinal tract infections	OTHER	GASTROENTERITIS
A08..11	Gastric flu	OTHER	GASTROENTERITIS
A080100	Infectious colitis	OTHER	GASTROENTERITIS
A080200	Infectious enteritis	OTHER	GASTROENTERITIS
A080300	Infectious gastroenteritiseritis	OTHER	GASTROENTERITIS
A080500	Haemorrhagic dysentery	OTHER	GASTROENTERITIS
A081000	Colitis - presumed infectious origin	OTHER	GASTROENTERITIS

A081100	Enteritis - presumed infectious origin	OTHER	GASTROENTERITIS
A081200	Gastroenteritiseritis - presumed infectious origin	OTHER	GASTROENTERITIS
A082.00	Infectious diarrhoea	OTHER	GASTROENTERITIS
A082.11	Travellers' diarrhoea	OTHER	GASTROENTERITIS
A082000	Dysenteric diarrhoea	OTHER	GASTROENTERITIS
A082100	Epidemic diarrhoea	OTHER	GASTROENTERITIS
A082111	Viral gastroenteritiseritis	OTHER	GASTROENTERITIS
A082z00	Infectious diarrhoea NOS	OTHER	GASTROENTERITIS
A083.00	Diarrhoea of presumed infectious origin	OTHER	GASTROENTERITIS
A083.11	Diarrhoea & vomiting -? infect	OTHER	GASTROENTERITIS
A083.12	Infantile gastroenteritiseritis	OTHER	GASTROENTERITIS
A08z.00	Ill defined gastrointestinal tract infections NOS	OTHER	GASTROENTERITIS
A0z..00	Intestinal tract infectious disease NOS	OTHER	GASTROENTERITIS
A10..00	Primary tuberculous infection	LRTI	LRTI OTHER
A100.00	Primary tuberculous complex	LRTI	LRTI OTHER
A10z.00	Primary tuberculous infection NOS	LRTI	LRTI OTHER
A11..00	Pulmonary tuberculosis	LRTI	LRTI OTHER
A11y.00	Other specified pulmonary tuberculosis	LRTI	LRTI OTHER
A11z.00	Pulmonary tuberculosis NOS	LRTI	LRTI OTHER
A124000	TB lung confirm sputum microscopy with or without culture	LRTI	LRTI OTHER
A12y.00	Other specified respiratory tuberculosis	LRTI	LRTI OTHER
A12yz00	Other specified respiratory tuberculosis NOS	LRTI	LRTI OTHER
A33..00	Whooping cough	LRTI	TRACHEITIS
A33yz00	Other whooping cough NOS	LRTI	TRACHEITIS
A33z.00	Whooping cough NOS	LRTI	TRACHEITIS
A34..00	Streptococcal sore throat and scarlatina	URTI	TONSILLITIS
A340.00	Streptococcal sore throat	URTI	TONSILLITIS
A340100	Streptococcal laryngitis	URTI	TONSILLITIS
A340200	Streptococcal pharyngitis	URTI	TONSILLITIS
A340300	Streptococcal tonsillitis	URTI	TONSILLITIS
A340z00	Streptococcal sore throat NOS	URTI	TONSILLITIS
A341.00	Scarlet fever - scarlatina	URTI	TONSILLITIS
A341.11	Scarlet fever	URTI	TONSILLITIS
A341.12	Scarlatina	URTI	TONSILLITIS
A34z.00	Streptococcal sore throat with scarlatina NOS	URTI	TONSILLITIS
A35..00	Erysipelas	SKIN	SKIN
A360.00	Meningococcal meningitis	OTHER	OTHER
A361.00	Meningococcal encephalitis	OTHER	OTHER
A365.00	Meningococcal meningitis with acute meningococcal septicaem	OTHER	OTHER
A366.00	Meningococcal meningitis with meningococcal septicaemia	OTHER	OTHER

A383000	Fusobacterial necrotising tonsillitis	URTI	TONSILLITIS
A3By.00	Other specified bacterial infection	OTHER	OTHER
A3By700	Gardnerella vaginalis	UTI	VAGINITIS
A3Byz00	Other specified bacterial infection NOS	OTHER	OTHER
A3Bz.00	Bacterial infection NOS	OTHER	OTHER
A3z..00	Other bacterial disease NOS	OTHER	OTHER
A42..00	Meningitis due to enterovirus	OTHER	OTHER
A42y.00	Other specified viral meningitis	OTHER	OTHER
A42z.00	Viral meningitis NOS	OTHER	OTHER
A42z.11	Aseptic meningitis	OTHER	OTHER
A4y0.00	Enteroviral encephalitis	OTHER	OTHER
A4z1.00	Adenoviral meningitis	OTHER	OTHER
A4zy300	Encephalitis lethargica	OTHER	OTHER
A4zy500	Adenoviral encephalitis	OTHER	OTHER
A521.00	Varicella pneumonitis	LRTI	PNEUMONIA
A661.00	Tick-borne fever	OTHER	OTHER
A661200	Colorado tick fever	OTHER	OTHER
A661z00	Tick-borne fever NOS	OTHER	OTHER
A770.12	Swimming pool conjunctivitis	OTHER	EYE INFECTION
A771.00	Epidemic keratoconjunctivitis	OTHER	EYE INFECTION
A772.00	Viral pharyngoconjunctivitis	OTHER	EYE INFECTION
A78A400	Chlamydial conjunctivitis	OTHER	EYE INFECTION
A79z.00	Viral infection NOS	OTHER	OTHER
A79z.11	Viral illness	OTHER	OTHER
A82..00	Tick-borne rickettsioses	OTHER	OTHER
A821400	Mediterranean tick fever	OTHER	OTHER
A82z.00	Tick-borne rickettsioses NOS	OTHER	OTHER
A83..00	Other rickettsioses	OTHER	OTHER
A871000	Lyme disease	OTHER	OTHER
A871011	Lyme borreliosis	OTHER	OTHER
A994.00	Nonspecific urethritis	UTI	URETHRITIS
AB24.11	Pneumonia - candidal	LRTI	PNEUMONIA
AB41500	Histoplasma duboisii with pneumonia	LRTI	PNEUMONIA
AyuL.00	[X]Other infectious diseases	OTHER	OTHER
Az...00	Infectious and parasitic diseases NOS	OTHER	OTHER
F00..00	Bacterial meningitis	OTHER	OTHER
F001.00	Pneumococcal meningitis	OTHER	OTHER
F002.00	Streptococcal meningitis	OTHER	OTHER
F004.00	Meningitis - tuberculous	OTHER	OTHER
F005.00	Meningitis - meningococcal	OTHER	OTHER
F00z.00	Bacterial meningitis NOS	OTHER	OTHER
F01..00	Meningitis due to other organisms	OTHER	OTHER
F01z.00	Meningitis due to organism NOS	OTHER	OTHER

F02z.00	Unspecified meningitis	OTHER	OTHER
F033.00	Encephalitis due to other infection EC	OTHER	OTHER
F03z.00	Encephalitis NOS	OTHER	OTHER
F4C0.00	Acute conjunctivitis	OTHER	EYE INFECTION
F4C0.11	Eye infection	OTHER	EYE INFECTION
F4C0.12	Conjunctivitis	OTHER	EYE INFECTION
F4C0000	Unspecified acute conjunctivitis	OTHER	EYE INFECTION
F4C0011	Conjunctivitis	OTHER	EYE INFECTION
F4C0100	Serous conjunctivitis	OTHER	EYE INFECTION
F4C0200	Acute follicular conjunctivitis	OTHER	EYE INFECTION
F4C0300	Acute mucopurulent conjunctivitis	OTHER	EYE INFECTION
F4C0311	Sticky eye	OTHER	EYE INFECTION
F4C0400	Catarrhal conjunctivitis	OTHER	EYE INFECTION
F4C0500	Pseudomembranous conjunctivitis	OTHER	EYE INFECTION
F4C0511	Membranous conjunctivitis	OTHER	EYE INFECTION
F4C1.00	Chronic conjunctivitis	OTHER	EYE INFECTION
F4C1000	Unspecified chronic conjunctivitis	OTHER	EYE INFECTION
F4D..00	Inflammation of eyelids	OTHER	EYE INFECTION
F4D0.00	Blepharitis	OTHER	EYE INFECTION
F4D0.11	Cellulitis of eyelids	OTHER	EYE INFECTION
F4D0z00	Blepharitis NOS	OTHER	EYE INFECTION
F4D1.00	Hordeolum and other deep inflammation of eyelid	OTHER	EYE INFECTION
F4D1000	Hordeolum externum (stye)	OTHER	EYE INFECTION
F4D1100	Hordeolum internum (infected meibomian cyst)	OTHER	EYE INFECTION
F4D1111	Meibomian cyst infected	OTHER	EYE INFECTION
F4D1200	Abscess of eyelid	OTHER	EYE INFECTION
F4D1211	Boil of eyelid	OTHER	EYE INFECTION
F4D1212	Furuncle of eyelid	OTHER	EYE INFECTION
F4D1300	Meibomianitis	OTHER	EYE INFECTION
F4D1400	Cellulitis of eyelid	OTHER	EYE INFECTION
F4D1z00	Hordeolum and other deep inflammation of eyelid NOS	OTHER	EYE INFECTION
F4D2.00	Chalazion (meibomian cyst)	OTHER	EYE INFECTION
F501.00	Infective otitis externa	URTI	OTITIS
F501000	Unspecified infective otitis externa	URTI	OTITIS
F501100	Acute infective otitis externa	URTI	OTITIS
F501300	Acute swimmers' ear	URTI	OTITIS
F501311	Beach ear	URTI	OTITIS
F501411	Erysipelas - otitis externa	URTI	OTITISEXT
F501500	Infective otitis externa due to herpes simplex	URTI	OTITISEXT
F501511	Herpes simplex- otitis externa	URTI	OTITISEXT
F501611	Herpes zoster - otitis externa	URTI	OTITISEXT
F501700	Infective otitis externa due to impetigo	URTI	OTITISEXT
F501711	Impetigo - otitis externa	URTI	OTITISEXT

F501800	Furunculosis of external auditory meatus	URTI	OTITISEXT
F501900	Other acute external ear infections	URTI	OTITISEXT
F501B00	Chronic otitis externa due to aspergillosis	URTI	OTITISEXT
F501D00	Chronic mycotic otitis externa NOS	URTI	OTITISEXT
F501E00	Other chronic infective otitis externa	URTI	OTITISEXT
F501F00	Chronic infective otitis externa NOS	URTI	OTITISEXT
F501G00	Haemorrhagic otitis externa	URTI	OTITISEXT
F501y00	Other specified infective otitis externa	URTI	OTITISEXT
F501z00	Infective otitis externa NOS	URTI	OTITISEXT
F502.00	Other otitis externa	URTI	OTITISEXT
F502000	External ear cholesteatoma	URTI	OTITISEXT
F502200	Acute chemical otitis externa	URTI	OTITISEXT
F502300	Other contact otitis externa	URTI	OTITISEXT
F502400	Acute eczematoid otitis extern	URTI	OTITISEXT
F502500	Other reactive otitis externa	URTI	OTITISEXT
F502z00	Otitis externa NOS	URTI	OTITISEXT
F502z11	Inflammation ear external	URTI	OTITISEXT
F505300	Stenosis of external ear canal due to inflammation	URTI	OTITISEXT
F51..00	Nonsuppurative otitis media + eustachian tube disorders	URTI	OTITIS
F510.00	Acute non suppurative otitis media	URTI	OTITIS
F510000	Acute otitis media with effusion	URTI	OTITIS
F510011	Acute secretory otitis media	URTI	OTITIS
F510100	Acute serous otitis media	URTI	OTITIS
F510200	Acute mucoid otitis media	URTI	OTITIS
F510300	Acute sanguinous otitis media	URTI	OTITIS
F510400	Acute allergic serous otitis media	URTI	OTITIS
F510500	Acute allergic mucoid otitis media	URTI	OTITIS
F510z00	Acute nonsuppurative otitis media NOS	URTI	OTITIS
F511100	Serosanguinous chronic otitis media	URTI	OTITIS
F511200	Bilateral chronic serous otitis	URTI	OTITIS
F511300	Unilateral chronic serous otitis	URTI	OTITIS
F511z00	Chronic serous otitis media NOS	URTI	OTITIS
F512.11	Glue ear	URTI	OTITIS
F512100	Mucosanguinous chronic otitis media	URTI	OTITIS
F512z00	Chronic mucoid otitis media NOS	URTI	OTITIS
F513000	Chronic allergic otitis media	URTI	OTITIS
F513z00	Other chronic nonsuppurative otitis media NOS	URTI	OTITIS
F514.00	Unspecified nonsuppurative otitis media	URTI	OTITIS
F514000	Allergic otitis media NOS	URTI	OTITIS
F514100	Serous otitis media NOS	URTI	OTITIS
F514200	Catarrhal otitis media NOS	URTI	OTITIS
F514300	Mucoid otitis media NOS	URTI	OTITIS

F514z00	Nonsuppurative otitis media NOS	URTI	OTITIS
F52..00	Suppurative and unspecified otitis media	URTI	OTITIS
F520.00	Acute suppurative otitis media	URTI	OTITIS
F520000	Acute suppurative otitis media tympanic membrane intact	URTI	OTITIS
F520100	Acute suppurative otitis media tympanic membrane ruptured	URTI	OTITIS
F520300	Acute suppurative otitis media due to disease EC	URTI	OTITIS
F520z00	Acute suppurative otitis media NOS	URTI	OTITIS
F523.00	Chronic suppurative otitis media NOS	URTI	OTITIS
F524.00	Purulent otitis media NOS	URTI	OTITIS
F524000	Bilateral suppurative otitis media	URTI	OTITIS
F525.00	Recurrent acute otitis media	URTI	OTITIS
F526.00	Acute left otitis media	URTI	OTITIS
F527.00	Acute right otitis media	URTI	OTITIS
F528.00	Acute bilateral otitis media	URTI	OTITIS
F52z.00	Otitis media NOS	URTI	OTITIS
F52z.11	Infection ear	URTI	OTITIS
F53..00	Mastoiditis and related conditions	URTI	MASTOIDITIS
F530.00	Acute mastoiditis	URTI	MASTOIDITIS
F530.11	Abscess of mastoid	URTI	MASTOIDITIS
F530.12	Empyema of mastoid	URTI	MASTOIDITIS
F530000	Acute mastoiditis without complications	URTI	MASTOIDITIS
F530100	Subperiosteal mastoid abscess	URTI	MASTOIDITIS
F530200	Gradenigo's syndrome	URTI	MASTOIDITIS
F530300	Acute mastoiditis with other complication	URTI	MASTOIDITIS
F530z00	Acute mastoiditis NOS	URTI	MASTOIDITIS
F531.00	Chronic mastoiditis	URTI	MASTOIDITIS
F531z00	Chronic mastoiditis NOS	URTI	MASTOIDITIS
F53z.00	Mastoiditis NOS	URTI	MASTOIDITIS
F586.00	Otorrhoea	URTI	OTITIS
F586000	Unspecified otorrhoea	URTI	OTITIS
F586011	Discharging ear NOS	URTI	OTITIS
F586200	Otorrhagia	URTI	OTITIS
F586z00	Otorrhoea NOS	URTI	OTITIS
F587.00	Otalgia	URTI	OTITIS
F587.11	Ear pain	URTI	OTITIS
F587000	Unspecified otalgia	URTI	OTITIS
F587100	Otogenic pain	URTI	OTITIS
F587200	Referred ear pain	URTI	OTITIS
F587z00	Otalgia NOS	URTI	OTITIS
H....00	Respiratory system diseases	URTI+LRTI	URTI+LRTI
H0...00	Acute respiratory infections	URTI+LRTI	URTI+LRTI

H00..00	Acute nasopharyngitis	URTI	URTI
H00..11	Common cold	URTI	URTI
H00..12	Coryza - acute	URTI	URTI
H00..13	Febrile cold	URTI	URTI
H00..14	Nasal catarrh - acute	URTI	URTI
H00..15	Pyrexial cold	URTI	URTI
H00..16	Rhinitis - acute	URTI	URTI
H01..00	Acute sinusitis	URTI	SINUSITIS
H01..11	Sinusitis	URTI	SINUSITIS
H010.00	Acute maxillary sinusitis	URTI	SINUSITIS
H011.00	Acute frontal sinusitis	URTI	SINUSITIS
H012.00	Acute ethmoidal sinusitis	URTI	SINUSITIS
H013.00	Acute sphenoidal sinusitis	URTI	SINUSITIS
H014.00	Acute rhinosinusitis	URTI	SINUSITIS
H01y.00	Other acute sinusitis	URTI	SINUSITIS
H01y000	Acute pansinusitis	URTI	SINUSITIS
H01yz00	Other acute sinusitis NOS	URTI	SINUSITIS
H01z.00	Acute sinusitis NOS	URTI	SINUSITIS
H02..00	Acute pharyngitis	URTI	TONSILLITIS
H02..11	Sore throat NOS	URTI	TONSILLITIS
H02..12	Viral sore throat NOS	URTI	TONSILLITIS
H02..13	Throat infection - pharyngitis	URTI	TONSILLITIS
H020.00	Acute gangrenous pharyngitis	URTI	TONSILLITIS
H021.00	Acute phlegmonous pharyngitis	URTI	TONSILLITIS
H022.00	Acute ulcerative pharyngitis	URTI	TONSILLITIS
H023.00	Acute bacterial pharyngitis	URTI	TONSILLITIS
H023000	Acute pneumococcal pharyngitis	URTI	TONSILLITIS
H023100	Acute staphylococcal pharyngitis	URTI	TONSILLITIS
H023z00	Acute bacterial pharyngitis NOS	URTI	TONSILLITIS
H024.00	Acute viral pharyngitis	URTI	TONSILLITIS
H025.00	Allergic pharyngitis	URTI	TONSILLITIS
H02z.00	Acute pharyngitis NOS	URTI	TONSILLITIS
H03..00	Acute tonsillitis	URTI	TONSILLITIS
H03..11	Throat infection - tonsillitis	URTI	TONSILLITIS
H03..12	Tonsillitis	URTI	TONSILLITIS
H030.00	Acute erythematous tonsillitis	URTI	TONSILLITIS
H031.00	Acute follicular tonsillitis	URTI	TONSILLITIS
H032.00	Acute ulcerative tonsillitis	URTI	TONSILLITIS
H033.00	Acute catarrhal tonsillitis	URTI	TONSILLITIS
H035.00	Acute bacterial tonsillitis	URTI	TONSILLITIS
H035000	Acute pneumococcal tonsillitis	URTI	TONSILLITIS
H035100	Acute staphylococcal tonsillitis	URTI	TONSILLITIS
H035z00	Acute bacterial tonsillitis NOS	URTI	TONSILLITIS

H036.00	Acute viral tonsillitis	URTI	TONSILLITIS
H037.00	Recurrent acute tonsillitis	URTI	TONSILLITIS
H03z.00	Acute tonsillitis NOS	URTI	TONSILLITIS
H04..00	Acute laryngitis and tracheitis	LRTI	TRACHEITIS
H040.00	Acute laryngitis	LRTI	TRACHEITIS
H040000	Acute oedematous laryngitis	LRTI	TRACHEITIS
H040100	Acute ulcerative laryngitis	LRTI	TRACHEITIS
H040200	Acute catarrhal laryngitis	LRTI	TRACHEITIS
H040300	Acute phlegmonous laryngitis	LRTI	TRACHEITIS
H040600	Acute suppurative laryngitis	LRTI	TRACHEITIS
H040w00	Acute viral laryngitis unspecified	LRTI	TRACHEITIS
H040x00	Acute bacterial laryngitis unspecified	LRTI	TRACHEITIS
H040z00	Acute laryngitis NOS	LRTI	TRACHEITIS
H041.00	Acute tracheitis	LRTI	TRACHEITIS
H041000	Acute tracheitis without obstruction	LRTI	TRACHEITIS
H041z00	Acute tracheitis NOS	LRTI	TRACHEITIS
H042.00	Acute laryngotracheitis	LRTI	TRACHEITIS
H042.11	Laryngotracheitis	LRTI	TRACHEITIS
H042000	Acute laryngotracheitis without obstruction	LRTI	TRACHEITIS
H042100	Acute laryngotracheitis with obstruction	LRTI	TRACHEITIS
H042z00	Acute laryngotracheitis NOS	LRTI	TRACHEITIS
H043.00	Acute epiglottitis (non strep)	LRTI	TRACHEITIS
H043.11	Viral epiglottitis	LRTI	TRACHEITIS
H043000	Acute epiglottitis without obstruction	LRTI	TRACHEITIS
H043200	Acute obstructive laryngitis	LRTI	TRACHEITIS
H043211	Croup	LRTI	TRACHEITIS
H043z00	Acute epiglottitis NOS	LRTI	TRACHEITIS
H044.00	Croup	LRTI	TRACHEITIS
H04z.00	Acute laryngitis and tracheitis NOS	LRTI	TRACHEITIS
H05..00	Other acute upper respiratory infections	URTI	URTI
H050.00	Acute laryngopharyngitis	URTI	URTI
H051.00	Acute upper respiratory tract infection	URTI	URTI
H052.00	Pharyngotracheitis	URTI	TONSILLITIS
H053.00	Tracheopharyngitis	URTI	TONSILLITIS
H054.00	Recurrent upper respiratory tract infection	URTI	URTI
H055.00	Pharyngolaryngitis	URTI	TONSILLITIS
H05y.00	Other upper respiratory infections of multiple sites	URTI	URTI
H05z.00	Upper respiratory infection NOS	URTI	URTI
H05z.11	Upper respiratory tract infection NOS	URTI	URTI
H05z.12	Viral upper respiratory tract infection NOS	URTI	URTI
H06..00	Acute bronchitis and bronchiolitis	LRTI	BRONCHITIS
H060.00	Acute bronchitis	LRTI	BRONCHITIS
H060.11	Acute wheezy bronchitis	LRTI	BRONCHITIS

H060300	Acute purulent bronchitis	LRTI	BRONCHITIS
H060400	Acute croupous bronchitis	LRTI	BRONCHITIS
H060500	Acute tracheobronchitis	LRTI	BRONCHITIS
H060600	Acute pneumococcal bronchitis	LRTI	BRONCHITIS
H060700	Acute streptococcal bronchitis	LRTI	BRONCHITIS
H060800	Acute haemophilus influenzae bronchitis	LRTI	BRONCHITIS
H060A00	Acute bronchitis due to mycoplasma pneumoniae	LRTI	BRONCHITIS
H060C00	Acute bronchitis due to parainfluenza virus	LRTI	BRONCHITIS
H060E00	Acute bronchitis due to rhinovirus	LRTI	BRONCHITIS
H060v00	Subacute bronchitis unspecified	LRTI	BRONCHITIS
H060w00	Acute viral bronchitis unspecified	LRTI	BRONCHITIS
H060x00	Acute bacterial bronchitis unspecified	LRTI	BRONCHITIS
H060z00	Acute bronchitis NOS	LRTI	BRONCHITIS
H061.00	Acute bronchiolitis	LRTI	BRONCHITIS
H061100	Acute obliterating bronchiolitis	LRTI	BRONCHITIS
H061200	Acute bronchiolitis with bronchospasm	LRTI	BRONCHITIS
H061300	Acute exudative bronchiolitis	LRTI	BRONCHITIS
H061400	Obliterating fibrous bronchiolitis	LRTI	BRONCHITIS
H061500	Acute bronchiolitis due to respiratory syncytial virus	LRTI	BRONCHITIS
H061z00	Acute bronchiolitis NOS	LRTI	BRONCHITIS
H062.00	Acute lower respiratory tract infection	LRTI	LRTI - unspecified
H06z.00	Acute bronchitis or bronchiolitis NOS	LRTI	BRONCHITIS
H06z000	Chest infection NOS	LRTI	LRTI - unspecified
H06z011	Chest infection	LRTI	LRTI - unspecified
H06z100	Lower resp tract infection	LRTI	LRTI - unspecified
H06z111	Respiratory tract infection	URTI+LRTI	URTI+LRTI
H06z112	Acute lower respiratory tract infection	LRTI	LRTI - unspecified
H06z200	Recurrent chest infection	LRTI	LRTI - unspecified
H07..00	Chest cold	LRTI	LRTI - unspecified
H0y..00	Other specified acute respiratory infections	URTI+LRTI	URTI+LRTI
H0z..00	Acute respiratory infection NOS	URTI+LRTI	URTI+LRTI
H1...00	Other upper respiratory tract diseases	URTI	URTI
H13..00	Chronic sinusitis	URTI	SINUSITIS
H13..11	Chronic rhinosinusitis	URTI	SINUSITIS
H130.00	Chronic maxillary sinusitis	URTI	SINUSITIS
H130.12	Maxillary sinusitis	URTI	SINUSITIS
H131.00	Chronic frontal sinusitis	URTI	SINUSITIS
H131.11	Frontal sinusitis	URTI	SINUSITIS
H132.00	Chronic ethmoidal sinusitis	URTI	SINUSITIS
H135.00	Recurrent sinusitis	URTI	SINUSITIS
H13y.00	Other chronic sinusitis	URTI	SINUSITIS
H13y000	Chronic pansinusitis	URTI	SINUSITIS
H13y100	Pansinusitis	URTI	SINUSITIS

H13z.00	Chronic sinusitis NOS	URTI	SINUSITIS
H14..00	Chronic tonsil and adenoid disease	URTI	TONSILLITIS
H14..11	Adenoid disease - chronic	URTI	TONSILLITIS
H14..12	Tonsil disease - chronic	URTI	TONSILLITIS
H140.00	Chronic tonsillitis	URTI	TONSILLITIS
H140.11	Chronic adenoiditis	URTI	TONSILLITIS
H141.00	Tonsil and/or adenoid hypertrophy	URTI	TONSILLITIS
H141.11	Adenoid hypertrophy	URTI	TONSILLITIS
H141.12	Enlargement of tonsil or adenoid	URTI	TONSILLITIS
H141000	Hypertrophy of tonsils and adenoids	URTI	TONSILLITIS
H141100	Hypertrophy of tonsils alone	URTI	TONSILLITIS
H141200	Hypertrophy of adenoids alone	URTI	TONSILLITIS
H141z00	Hypertrophy of tonsils and adenoids NOS	URTI	TONSILLITIS
H142.00	Adenoid vegetations	URTI	TONSILLITIS
H143.00	Chronic adenotonsillitis	URTI	TONSILLITIS
H14y.00	Other chronic diseases of tonsils and adenoids	URTI	TONSILLITIS
H14y100	Cicatrix of tonsil	URTI	TONSILLITIS
H14y300	Tonsillar tag	URTI	TONSILLITIS
H14y400	Tonsil ulcer	URTI	TONSILLITIS
H14y500	Caseous tonsillitis	URTI	TONSILLITIS
H14y600	Lingular tonsillitis	URTI	TONSILLITIS
H14y700	Cyst of tonsil	URTI	TONSILLITIS
H14y711	Tonsillar cyst	URTI	TONSILLITIS
H14yz00	Other chronic diseases of tonsils and adenoids NOS	URTI	TONSILLITIS
H14z.00	Chronic tonsil and adenoid disease NOS	URTI	TONSILLITIS
H14z000	Chronic tonsil disease NOS	URTI	TONSILLITIS
H15..00	Peritonsillar abscess - quinsy	URTI	TONSILLITIS
H15..11	Quinsy	URTI	TONSILLITIS
H16..00	Chronic laryngitis and laryngotracheitis	LRTI	TRACHEITIS
H160.00	Chronic laryngitis	LRTI	TRACHEITIS
H160000	Chronic simple laryngitis	LRTI	TRACHEITIS
H160100	Chronic catarrhal laryngitis	LRTI	TRACHEITIS
H160500	Congested larynx	LRTI	TRACHEITIS
H161.00	Chronic laryngotracheitis	LRTI	TRACHEITIS
H17..12	Allergic rhinosinusitis	URTI	SINUSITIS
H1y2000	Pharyngeal disease unspecified	URTI	TONSILLITIS
H1y2100	Pharynx or nasopharynx cellulitis	URTI	TONSILLITIS
H1y2200	Parapharyngeal abscess	URTI	TONSILLITIS
H1y2300	Retropharyngeal abscess	URTI	TONSILLITIS
H1y2500	Pharynx or nasopharynx cyst	URTI	TONSILLITIS
H1y2600	Pharynx or nasopharynx abscess	URTI	TONSILLITIS
H1y2700	Vallecular cyst	URTI	TONSILLITIS
H1y7100	Cellulitis of larynx	URTI	TONSILLITIS

H2...00	Pneumonia and influenza	LRTI	PNEUMONIA
H20..00	Viral pneumonia	LRTI	PNEUMONIA
H20..11	Chest infection - viral pneumonia	LRTI	PNEUMONIA
H201.00	Pneumonia due to respiratory syncytial virus	LRTI	PNEUMONIA
H202.00	Pneumonia due to parainfluenza virus	LRTI	PNEUMONIA
H203.00	Pneumonia due to human metapneumovirus	LRTI	PNEUMONIA
H20y.00	Viral pneumonia NEC	LRTI	PNEUMONIA
H20z.00	Viral pneumonia NOS	LRTI	PNEUMONIA
H21..00	Lobar (pneumococcal) pneumonia	LRTI	PNEUMONIA
H21..11	Chest infection - pneumococcal pneumonia	LRTI	PNEUMONIA
H22..00	Other bacterial pneumonia	LRTI	PNEUMONIA
H22..11	Chest infection - other bacterial pneumonia	LRTI	PNEUMONIA
H220.00	Pneumonia due to klebsiella pneumoniae	LRTI	PNEUMONIA
H221.00	Pneumonia due to pseudomonas	LRTI	PNEUMONIA
H222.00	Pneumonia due to haemophilus influenzae	LRTI	PNEUMONIA
H223.00	Pneumonia due to streptococcus	LRTI	PNEUMONIA
H224.00	Pneumonia due to staphylococcus	LRTI	PNEUMONIA
H22y.00	Pneumonia due to other specified bacteria	LRTI	PNEUMONIA
H22y200	Pneumonia - Legionella	LRTI	PNEUMONIA
H22yz00	Pneumonia due to bacteria NOS	LRTI	PNEUMONIA
H22z.00	Bacterial pneumonia NOS	LRTI	PNEUMONIA
H23..00	Pneumonia due to other specified organisms	LRTI	PNEUMONIA
H23..11	Chest infection - pneumonia organism OS	LRTI	PNEUMONIA
H231.00	Pneumonia due to mycoplasma pneumoniae	LRTI	PNEUMONIA
H233.00	Chlamydial pneumonia	LRTI	PNEUMONIA
H23z.00	Pneumonia due to specified organism NOS	LRTI	PNEUMONIA
H241.00	Pneumonia with cytomegalic inclusion disease	LRTI	PNEUMONIA
H243.00	Pneumonia with whooping cough	LRTI	PNEUMONIA
H243.11	Pneumonia with pertussis	LRTI	PNEUMONIA
H246.00	Pneumonia with aspergillosis	LRTI	PNEUMONIA
H24y200	Pneumonia with pneumocystis carinii	LRTI	PNEUMONIA
H24y700	Pneumonia with varicella	LRTI	PNEUMONIA
H25..00	Bronchopneumonia due to unspecified organism	LRTI	PNEUMONIA
H25..11	Chest infection - unspecified bronchopneumonia	LRTI	PNEUMONIA
H26..00	Pneumonia due to unspecified organism	LRTI	PNEUMONIA
H26..11	Chest infection - pnemonia due to unspecified organism	LRTI	PNEUMONIA
H260.00	Lobar pneumonia due to unspecified organism	LRTI	PNEUMONIA
H261.00	Basal pneumonia due to unspecified organism	LRTI	PNEUMONIA
H262.00	Postoperative pneumonia	LRTI	PNEUMONIA
H27..00	Influenza	LRTI	INFLUENZA
H270.00	Influenza with pneumonia	LRTI	PNEUMONIA
H270.11	Chest infection - influenza with pneumonia	LRTI	PNEUMONIA

H270000	Influenza with bronchopneumonia	LRTI	PNEUMONIA
H270100	Influenza with pneumonia	LRTI	PNEUMONIA
H270z00	Influenza with pneumonia NOS	LRTI	PNEUMONIA
H271.00	Influenza with other respiratory manifestation	LRTI	INFLUENZA
H271000	Influenza with laryngitis	LRTI	TRACHEITIS
H271100	Influenza with pharyngitis	URTI	TONSILLITIS
H271z00	Influenza with respiratory manifestations NOS	URTI+LRTI	URTI+LRTI
H27y.00	Influenza with other manifestations	LRTI	INFLUENZA
H27y100	Influenza with gastrointestinal tract involvement	LRTI	INFLUENZA
H27yz00	Influenza with other manifestations NOS	LRTI	INFLUENZA
H27z.00	Influenza NOS	LRTI	INFLUENZA
H27z.11	Flu like illness	LRTI	INFLUENZA
H27z.12	Influenza like illness	LRTI	INFLUENZA
H28..00	Atypical pneumonia	LRTI	PNEUMONIA
H29..00	Avian influenza	LRTI	INFLUENZA
H2A..00	Influenza due to Influenza A virus subtype H1N1	LRTI	INFLUENZA
H2A..11	Influenza A (H1N1) swine flu	LRTI	INFLUENZA
H2B..00	Community acquired pneumonia	LRTI	PNEUMONIA
H2C..00	Hospital acquired pneumonia	LRTI	PNEUMONIA
H2y..00	Other specified pneumonia or influenza	LRTI	PNEUMONIA
H2z..00	Pneumonia or influenza NOS	LRTI	PNEUMONIA
H30..00	Bronchitis unspecified	LRTI	BRONCHITIS
H30..11	Chest infection - unspecified bronchitis	LRTI	BRONCHITIS
H30..12	Recurrent wheezy bronchitis	LRTI	BRONCHITIS
H300.00	Tracheobronchitis NOS	LRTI	BRONCHITIS
H301.00	Laryngotracheobronchitis	LRTI	BRONCHITIS
H302.00	Wheezy bronchitis	LRTI	BRONCHITIS
H30z.00	Bronchitis NOS	LRTI	BRONCHITIS
H31..00	Chronic bronchitis	LRTI	BRONCHITIS
H312000	Chronic asthmatic bronchitis	LRTI	BRONCHITIS
H312000	Chronic asthmatic bronchitis	ASTHMA	ASTHMA
H312011	Chronic wheezy bronchitis	LRTI	BRONCHITIS
H312011	Chronic wheezy bronchitis	ASTHMA	ASTHMA
H312300	Bronchiolitis obliterans	LRTI	BRONCHITIS
H31y000	Chronic tracheitis	LRTI	TRACHEITIS
H31y100	Chronic tracheobronchitis	LRTI	TRACHEITIS
H33..00	Asthma	ASTHMA	ASTHMA
H33..11	Bronchial asthma	ASTHMA	ASTHMA
H330.00	Extrinsic (atopic) asthma	ASTHMA	ASTHMA
H330.11	Allergic asthma	ASTHMA	ASTHMA
H330.12	Childhood asthma	ASTHMA	ASTHMA
H330.13	Hay fever with asthma	ASTHMA	ASTHMA
H330.14	Pollen asthma	ASTHMA	ASTHMA

H330000	Extrinsic asthma without status	ASTHMA	ASTHMA
H330011	Hay fever with asthma	ASTHMA	ASTHMA
H330100	Extrinsic asthma with status as	ASTHMA	ASTHMA
H330111	Extrinsic asthma with asthma at	ASTHMA	ASTHMA
H330z00	Extrinsic asthma NOS	ASTHMA	ASTHMA
H331.00	Intrinsic asthma	ASTHMA	ASTHMA
H331.11	Late onset asthma	ASTHMA	ASTHMA
H331000	Intrinsic asthma without status	ASTHMA	ASTHMA
H331100	Intrinsic asthma with status as	ASTHMA	ASTHMA
H331111	Intrinsic asthma with asthma at	ASTHMA	ASTHMA
H331z00	Intrinsic asthma NOS	ASTHMA	ASTHMA
H332.00	Mixed asthma	ASTHMA	ASTHMA
H333.00	Acute exacerbation of asthma	ASTHMA	ASTHMA
H334.00	Brittle asthma	ASTHMA	ASTHMA
H33z.00	Asthma unspecified	ASTHMA	ASTHMA
H33z.11	Hyperreactive airways disease	ASTHMA	ASTHMA
H33z000	Status asthmaticus NOS	ASTHMA	ASTHMA
H33z011	Severe asthma attack	ASTHMA	ASTHMA
H33z100	Asthma attack	ASTHMA	ASTHMA
H33z111	Asthma attack NOS	ASTHMA	ASTHMA
H33z200	Late-onset asthma	ASTHMA	ASTHMA
H33zz00	Asthma NOS	ASTHMA	ASTHMA
H33zz11	Exercise induced asthma	ASTHMA	ASTHMA
H33zz12	Allergic asthma NEC	ASTHMA	ASTHMA
H33zz13	Allergic bronchitis NEC	ASTHMA	ASTHMA
H47..11	Aspiration pneumonitis	LRTI	PNEUMONIA
H470.00	Pneumonitis due to inhalation of food or vomitus	LRTI	PNEUMONIA
H470.11	Aspiration pneumonia	LRTI	PNEUMONIA
H470100	Pneumonitis due to inhalation of gastric secretions	LRTI	PNEUMONIA
H470312	Aspiration pneumonia due to vomit	LRTI	PNEUMONIA
H470z00	Pneumonitis due to inhalation of food or vomitus NOS	LRTI	PNEUMONIA
H563300	Usual interstitial pneumonitis	LRTI	PNEUMONIA
H564.00	Bronchiolitis obliterans organising pneumonia	LRTI	PNEUMONIA
H5yy.11	Respiratory infection NOS	URTI+LRTI	URTI+LRTI
Hyu0.00	[X]Acute upper respiratory infections	URTI	URTI
Hyu0000	[X]Other acute sinusitis	URTI	SINUSITIS
Hyu0200	[X]Acute tonsillitis due to other specified organisms	URTI	TONSILLITIS
Hyu0800	[X]Other viral pneumonia	LRTI	PNEUMONIA
Hyu0H00	[X]Other pneumonia	LRTI	PNEUMONIA
Hyu1.00	[X]Other acute lower respiratory infections	LRTI	LRTI - unspecified
Hyu1000	[X]Acute bronchitis due to other specified organisms	LRTI	BRONCHITIS
Hyu2200	[X]Other chronic sinusitis	URTI	SINUSITIS
J025000	Dental abscess	SKIN	SKIN

J082.11	Mouth ulcer	SKIN	SKIN
J43..11	Gastroenteritiseritis	OTHER	GASTROENTERITIS
J43..12	Enterocolitis	OTHER	GASTROENTERITIS
Jyu1200	[X]Other acute gastritis	OTHER	GASTROENTERITIS
Jyu1300	[X]Other gastritis	OTHER	GASTROENTERITIS
K0y..00	Other specified nephritis	UTI	UTI
K0z..00	Nephritis	UTI	UTI
K10..00	Infections of kidney	UTI	UTI
K10..11	Renal infections	UTI	UTI
K100.00	Chronic pyelonephritis	UTI	PYELONEPHRITIS
K100200	Chronic pyelitis	UTI	PYELONEPHRITIS
K100300	Chronic pyonephrosis	UTI	PYELONEPHRITIS
K100400	Nonobstructive reflux-associated chronic pyelonephritis	UTI	PYELONEPHRITIS
K100600	Calculous pyelonephritis	UTI	PYELONEPHRITIS
K100z00	Chronic pyelonephritis NOS	UTI	PYELONEPHRITIS
K101.00	Acute pyelonephritis	UTI	PYELONEPHRITIS
K101200	Acute pyelitis	UTI	PYELONEPHRITIS
K101300	Acute pyonephrosis	UTI	PYELONEPHRITIS
K101z00	Acute pyelonephritis NOS	UTI	PYELONEPHRITIS
K10y.00	Pyelonephritis and pyonephrosis unspecified	UTI	PYELONEPHRITIS
K10y000	Pyelonephritis unspecified	UTI	PYELONEPHRITIS
K10y100	Pyelitis unspecified	UTI	PYELONEPHRITIS
K10y200	Pyonephrosis unspecified	UTI	PYELONEPHRITIS
K10yz00	Unspecified pyelonephritis NOS	UTI	PYELONEPHRITIS
K10z.00	Infection of kidney NOS	UTI	UTI
K15..00	Cystitis	UTI	CYSTITIS
K150.00	Acute cystitis	UTI	CYSTITIS
K151.00	Chronic interstitial cystitis	UTI	CYSTITIS
K152000	Subacute cystitis	UTI	CYSTITIS
K152y00	Chronic cystitis unspecified	UTI	CYSTITIS
K153.00	Trigonitis	UTI	UTI
K153.11	Follicular cystitis	UTI	CYSTITIS
K154000	Cystitis in actinomycosis	UTI	CYSTITIS
K155.00	Recurrent cystitis	UTI	CYSTITIS
K15y.00	Other specified cystitis	UTI	CYSTITIS
K15y000	Cystitis cystica	UTI	CYSTITIS
K15yz00	Other cystitis NOS	UTI	CYSTITIS
K15z.00	Cystitis NOS	UTI	CYSTITIS
K17..00	Urethritis due to non venereal causes	UTI	URETHRITIS
K17..11	Periurethritis	UTI	URETHRITIS
K170.00	Urethral and periurethral abscess	UTI	URETHRITIS
K170.11	Urethral abscess	UTI	URETHRITIS

K170200	Urethral gland abscess	UTI	URETHRITIS
K170300	Periurethral cellulitis	UTI	URETHRITIS
K172.00	Candidal urethritis	UTI	URETHRITIS
K17y.00	Other urethritis	UTI	URETHRITIS
K17y000	Urethritis unspecified	UTI	URETHRITIS
K17y100	Urethral syndrome NOS	UTI	URETHRITIS
K17y200	Skene's glands adenitis	UTI	URETHRITIS
K17y400	Urethral meatitis	UTI	URETHRITIS
K17y500	Urethral meatal ulcer	UTI	URETHRITIS
K17yz00	Other urethritis NOS	UTI	URETHRITIS
K190.00	Urinary tract infection	UTI	CYSTITIS
K190.11	Recurrent urinary tract infection	UTI	CYSTITIS
K190000	Bacteriuria	UTI	UTI
K190011	Asymptomatic bacteriuria	UTI	CYSTITIS
K190100	Pyuria	UTI	UTI
K190200	Post operative urinary tract infection	UTI	CYSTITIS
K190300	Recurrent urinary tract infection	UTI	CYSTITIS
K190311	Recurrent UTI	UTI	CYSTITIS
K190400	Chronic urinary tract infection	UTI	CYSTITIS
K190500	Urinary tract infection	UTI	CYSTITIS
K190600	Urosepsis	UTI	CYSTITIS
K190X00	Persistent proteinuria	UTI	UTI
K190z00	Urinary tract infection	UTI	UTI
K2...00	Male genital organ diseases	UTI	MALE INFECTION
K21..11	Prostatitis and other inflammatory diseases of prostate	UTI	MALE INFECTION
K210.00	Acute prostatitis	UTI	MALE INFECTION
K211.00	Chronic prostatitis	UTI	MALE INFECTION
K21z.00	Prostatitis NOS	UTI	MALE INFECTION
K24..00	Orchitis and epididymitis	UTI	MALE INFECTION
K240.00	Orchitis	UTI	MALE INFECTION
K240100	Orchitis with no abscess	UTI	MALE INFECTION
K240200	Orchitis unspecified	UTI	MALE INFECTION
K240z00	Orchitis NOS	UTI	MALE INFECTION
K241.00	Epididymitis	UTI	MALE INFECTION
K241100	Epididymitis with no abscess	UTI	MALE INFECTION
K241400	Acute epididymitis	UTI	MALE INFECTION
K241500	Chronic epididymitis	UTI	MALE INFECTION
K241600	Chlamydial epididymitis	UTI	MALE INFECTION
K241z00	Epididymitis NOS	UTI	MALE INFECTION
K242.00	Epididymo-orchitis	UTI	MALE INFECTION
K242100	Epididymo-orchitis with no abscess	UTI	MALE INFECTION
K242200	Epididymo-orchitis unspecified	UTI	MALE INFECTION
K242z00	Epididymo-orchitis NOS	UTI	MALE INFECTION

K24z.00	Orchitis and epididymitis NOS	UTI	MALE INFECTION
K271.00	Balanoposthitis	UTI	MALE INFECTION
K271.11	Balanitis	UTI	MALE INFECTION
K271000	Balanitis	UTI	MALE INFECTION
K271100	Posthitis	UTI	MALE INFECTION
K271z00	Balanoposthitis NOS	UTI	MALE INFECTION
K272.00	Other penile inflammatory disorders	UTI	MALE INFECTION
K272.11	Infection of penis	UTI	MALE INFECTION
K272000	Penile abscess	UTI	MALE INFECTION
K272100	Penile boil	UTI	MALE INFECTION
K272200	Penile carbuncle	UTI	MALE INFECTION
K272300	Cellulitis of penis	UTI	MALE INFECTION
K272z00	Other penile inflammatory disorder NOS	UTI	MALE INFECTION
K273.11	Erection - painful	UTI	MALE INFECTION
K274.11	Balanitis xerotica obliterans	UTI	MALE INFECTION
K28..00	Other male genital organ disorders	UTI	MALE INFECTION
K284.00	Other male genital inflammatory disorders	UTI	MALE INFECTION
K284000	Abscess of scrotum	UTI	MALE INFECTION
K284100	Boil of scrotum	UTI	MALE INFECTION
K284200	Carbuncle of scrotum	UTI	MALE INFECTION
K284300	Cellulitis of scrotum	UTI	MALE INFECTION
K284600	Fournier's gangrene of scrotum	UTI	MALE INFECTION
K284900	Inflammation of scrotum	UTI	MALE INFECTION
K284z00	Other male genital inflammatory disorders NOS	UTI	MALE INFECTION
K286w11	Haematospermia	UTI	MALE INFECTION
K28X.00	Inflammatory disorder of unspecified male genital organ	UTI	MALE INFECTION
K28y.00	Other male genital organ diseases OS	UTI	MALE INFECTION
K28y800	Pain in testis	UTI	MALE INFECTION
K28y811	Testicular pain	UTI	MALE INFECTION
K28yu00	Other testicular disease	UTI	MALE INFECTION
K28yv00	Other scrotal disease	UTI	MALE INFECTION
K28yz00	Other male genital organ diseases NOS	UTI	MALE INFECTION
K28z.00	Other male genital disorders NOS	UTI	MALE INFECTION
K28z.11	Pain in testis	UTI	MALE INFECTION
K2y..00	Other specified diseases of male genital organ	UTI	MALE INFECTION
K2z..00	Male genital organ disease NOS	UTI	MALE INFECTION
K4...00	Female pelvic inflammatory diseases	UTI	FEMALE INFECTION
K400.00	Acute salpingitis and oophoritis	UTI	FEMALE INFECTION
K400300	Acute salpingitis	UTI	FEMALE INFECTION
K402100	Ovarian abscess	UTI	FEMALE

			INFECTION
K402200	Tubo-ovarian abscess	UTI	FEMALE INFECTION
K402500	Salpingo-oophoritis unspecified	UTI	FEMALE INFECTION
K402600	Salpingitis unspecified	UTI	FEMALE INFECTION
K407.00	Female pelvic peritoneal adhesions	UTI	FEMALE INFECTION
K40y100	Female chlamydial pelvic inflammatory disease	UTI	FEMALE INFECTION
K40z.00	Female pelvic inflammatory diseases NOS	UTI	FEMALE INFECTION
K40z.11	PID	UTI	FEMALE INFECTION
K40z.12	Female pelvic infection	UTI	FEMALE INFECTION
K40z.13	PID - pelvic inflammatory disease	UTI	FEMALE INFECTION
K410.00	Acute uterine inflammatory disease	UTI	FEMALE INFECTION
K410000	Acute endometritis	UTI	FEMALE INFECTION
K410500	Subacute endometritis	UTI	FEMALE INFECTION
K41z000	Endometritis unspecified	UTI	FEMALE INFECTION
K41z300	Perimetritis unspecified	UTI	FEMALE INFECTION
K420.00	Cervicitis and endocervicitis	UTI	FEMALE INFECTION
K420000	Cervicitis unspecified	UTI	FEMALE INFECTION
K420300	Cervicitis with erosion	UTI	FEMALE INFECTION
K420400	Cervicitis with Nabothian cyst	UTI	FEMALE INFECTION
K420500	Cervicitis with ectropion	UTI	FEMALE INFECTION
K420900	Chlamydia cervicitis	UTI	FEMALE INFECTION
K420A00	Nabothian follicles	UTI	FEMALE INFECTION
K420A11	Nabothian cyst	UTI	FEMALE INFECTION
K420z11	Nabothian follicles NOS	UTI	FEMALE INFECTION
K421.00	Vaginitis and vulvovaginitis	UTI	VAGINITIS

K421000	Vaginitis unspecified	UTI	VAGINITIS
K421100	Vulvitis unspecified	UTI	FEMALE INFECTION
K421111	Vulval sores	UTI	FEMALE INFECTION
K421200	Vulvovaginitis unspecified	UTI	FEMALE INFECTION
K421400	Vaginitis in diseases EC	UTI	FEMALE INFECTION
K421500	Vulvitis in diseases EC	UTI	FEMALE INFECTION
K421600	Vulvovaginitis in diseases EC	UTI	VAGINITIS
K421700	Subacute and chronic vaginitis	UTI	VAGINITIS
K421800	Subacute and chronic vulvitis	UTI	VAGINITIS
K421900	Bacterial vaginitis	UTI	VAGINITIS
K421911	Bacterial vaginosis	UTI	VAGINITIS
K421A00	Acute vulvitis	UTI	FEMALE INFECTION
K421z00	Vaginitis and vulvovaginitis NOS	UTI	VAGINITIS
K422.00	Cyst of Bartholin's gland	UTI	FEMALE INFECTION
K423.00	Abscess of Bartholin's gland	UTI	FEMALE INFECTION
K423.11	Vulvovaginal gland abscess	UTI	VAGINITIS
K424.00	Other abscess of vulva	UTI	FEMALE INFECTION
K424000	Abscess of vulva	UTI	FEMALE INFECTION
K424011	Abscess of labia	UTI	FEMALE INFECTION
K424100	Carbuncle of vulva	UTI	FEMALE INFECTION
K424111	Boil of vulva	UTI	FEMALE INFECTION
K424200	Furuncle of vulva	UTI	FEMALE INFECTION
K425.00	Ulceration of vulva	UTI	FEMALE INFECTION
K425000	Ulceration of vulva unspecified	UTI	FEMALE INFECTION
K425200	Ulceration of vulva in Behcet's disease	UTI	FEMALE INFECTION
K425z00	Ulceration of vulva NOS	UTI	FEMALE INFECTION
K42y100	Carbuncle of labium	UTI	FEMALE INFECTION
K42y200	Ulcer of vagina	UTI	VAGINITIS

K42y300	Bartholinitis	UTI	FEMALE INFECTION
K42y400	Cyst of labium	UTI	FEMALE INFECTION
K42y500	Vulval vestibulitis	UTI	FEMALE INFECTION
K42y600	Vulvodynia	UTI	FEMALE INFECTION
K4z..00	Female pelvic inflammatory disease NOS	UTI	FEMALE INFECTION
K5...00	Other female genital tract disorders	UTI	FEMALE INFECTION
Kyu5500	[X]Other urethritis	UTI	URETHRITIS
Kyu6300	[X]Other inflammatory disorders of penis	UTI	MALE INFECTION
Kyu8300	[X]Other specified inflammation of vagina and vulva	UTI	FEMALE INFECTION
L166.00	Genitourinary tract infections in pregnancy	UTI	FEMALE INFECTION
L166.11	Cystitis of pregnancy	UTI	CYSTITIS
L166500	Infections of kidney in pregnancy	UTI	PYELONEPHRITIS
L166600	Urinary tract infection following delivery	UTI	FEMALE INFECTION
L166800	Urinary tract infection complicating pregnancy	UTI	FEMALE INFECTION
L166z00	Genitourinary tract infection in pregnancy NOS	UTI	FEMALE INFECTION
L166z11	UTI - urinary tract infection in pregnancy	UTI	FEMALE INFECTION
L178.00	Infections of urethra in pregnancy	UTI	URETHRITIS
L284.12	Chorioamnionitis	UTI	FEMALE INFECTION
L284.13	Membranitis	UTI	FEMALE INFECTION
Lyu6A00	[X]Infection of caesarean section wound following delivery	UTI	FEMALE INFECTION
Lyu6B00	[X]Vaginitis following delivery	UTI	VAGINITIS
M0...00	Skin and subcutaneous tissue infections	SKIN	SKIN
M00..00	Carbuncle	SKIN	SKIN
M000.00	Carbuncle of face	SKIN	SKIN
M000000	Carbuncle of ear	SKIN	SKIN
M000200	Carbuncle of nasal septum	SKIN	SKIN
M000z00	Carbuncle of face NOS	SKIN	SKIN
M001.00	Carbuncle of neck	SKIN	SKIN
M002300	Carbuncle of abdominal wall	SKIN	SKIN
M002400	Carbuncle of umbilicus	SKIN	SKIN
M002600	Carbuncle of groin	SKIN	SKIN

M003100	Carbuncle of axilla	SKIN	SKIN
M003200	Carbuncle of upper arm	SKIN	SKIN
M003400	Carbuncle of forearm	SKIN	SKIN
M003z00	Carbuncle of upper arm and forearm NOS	SKIN	SKIN
M004.00	Carbuncle of hand	SKIN	SKIN
M004000	Carbuncle of wrist	SKIN	SKIN
M004100	Carbuncle of thumb	SKIN	SKIN
M004200	Carbuncle of finger	SKIN	SKIN
M005.00	Carbuncle of buttock	SKIN	SKIN
M005100	Carbuncle of gluteal region	SKIN	SKIN
M006300	Carbuncle of lower leg	SKIN	SKIN
M007.00	Carbuncle of foot	SKIN	SKIN
M007100	Carbuncle of heel	SKIN	SKIN
M007200	Carbuncle of toe	SKIN	SKIN
M00z.00	Carbuncle NOS	SKIN	SKIN
M01..00	Furuncle - boil	SKIN	SKIN
M010.00	Boil of face	SKIN	SKIN
M010000	Boil of ear	SKIN	SKIN
M010100	Boil of face (excluding eye)	SKIN	SKIN
M010200	Boil of nasal septum	SKIN	SKIN
M010400	Boil of external nose	SKIN	SKIN
M010z00	Boil of face NOS	SKIN	SKIN
M011.00	Boil of neck	SKIN	SKIN
M012.00	Boil of trunk	SKIN	SKIN
M012000	Boil of chest wall	SKIN	SKIN
M012100	Boil of breast	SKIN	SKIN
M012200	Boil of back	SKIN	SKIN
M012300	Boil of abdominal wall	SKIN	SKIN
M012400	Boil of umbilicus	SKIN	SKIN
M012600	Boil of groin	SKIN	SKIN
M012700	Boil of perineum	SKIN	SKIN
M012z00	Boil of trunk NOS	SKIN	SKIN
M013.00	Boil of upper arm and forearm	SKIN	SKIN
M013100	Boil of axilla	SKIN	SKIN
M013200	Boil of upper arm	SKIN	SKIN
M013300	Boil of elbow	SKIN	SKIN
M013400	Boil of forearm	SKIN	SKIN
M013z00	Boil of upper arm and forearm NOS	SKIN	SKIN
M014.00	Boil of hand	SKIN	SKIN
M014000	Boil of wrist	SKIN	SKIN
M014100	Boil of thumb	SKIN	SKIN
M014200	Boil of finger	SKIN	SKIN
M014z00	Boil of hand NOS	SKIN	SKIN

M015.00	Boil of buttock	SKIN	SKIN
M015000	Boil of anus	SKIN	SKIN
M015100	Boil of gluteal region	SKIN	SKIN
M015z00	Boil of buttock NOS	SKIN	SKIN
M016.00	Boil of leg (excluding foot)	SKIN	SKIN
M016000	Boil of hip	SKIN	SKIN
M016100	Boil of thigh	SKIN	SKIN
M016200	Boil of knee	SKIN	SKIN
M016300	Boil of lower leg	SKIN	SKIN
M016z00	Boil of leg (excluding foot) NOS	SKIN	SKIN
M017.00	Boil of foot	SKIN	SKIN
M017000	Boil of foot unspecified	SKIN	SKIN
M017100	Boil of heel	SKIN	SKIN
M017200	Boil of toe	SKIN	SKIN
M017z00	Boil of foot NOS	SKIN	SKIN
M01y.00	Boil of other specified site	SKIN	SKIN
M01y000	Boil of head (excluding face)	SKIN	SKIN
M01yz00	Boil of other specified site NOS	SKIN	SKIN
M01z.00	Boil NOS	SKIN	SKIN
M01z.11	Recurrent boils	SKIN	SKIN
M01z.12	Boils of multiple sites	SKIN	SKIN
M01z000	Multiple boils	SKIN	SKIN
M02..00	Cellulitis and abscess of finger and toe	SKIN	SKIN
M020.00	Cellulitis and abscess of finger	SKIN	SKIN
M020000	Cellulitis and abscess of finger unspecified	SKIN	SKIN
M020100	Finger pulp abscess	SKIN	SKIN
M020111	Felon	SKIN	SKIN
M020112	Whitlow	SKIN	SKIN
M020200	Onychia of finger	SKIN	SKIN
M020300	Paronychia of finger	SKIN	SKIN
M020311	Perionychia of finger	SKIN	SKIN
M020400	Finger web space infection	SKIN	SKIN
M020500	Pulp space infection of finger/thumb	SKIN	SKIN
M020z00	Cellulitis and abscess of finger NOS	SKIN	SKIN
M021.00	Cellulitis and abscess of toe	SKIN	SKIN
M021000	Cellulitis and abscess of toe unspecified	SKIN	SKIN
M021100	Onychia of toe	SKIN	SKIN
M021200	Paronychia of toe	SKIN	SKIN
M021300	Pulp space infection of toe	SKIN	SKIN
M021z00	Cellulitis and abscess of toe NOS	SKIN	SKIN
M021z11	Perionychia of toe	SKIN	SKIN
M02z.00	Cellulitis and abscess of digit NOS	SKIN	SKIN
M02z.11	Nail infection NOS	SKIN	SKIN

M02z.12	Paronychia	SKIN	SKIN
M02z.13	Infected nailfold	SKIN	SKIN
M02z.14	Nailfold infected	SKIN	SKIN
M03..00	Other cellulitis and abscess	SKIN	SKIN
M03..11	Abscess of skin area excluding digits of hand or foot	SKIN	SKIN
M03..13	Cellulitis of skin area excluding digits of hand or foot	SKIN	SKIN
M030.00	Cellulitis and abscess of face	SKIN	SKIN
M030000	Cellulitis and abscess of cheek (external)	SKIN	SKIN
M030011	Cellulitis and abscess of cheek	SKIN	SKIN
M030100	Cellulitis and abscess of nose (external)	SKIN	SKIN
M030111	Cellulitis and abscess of nose	SKIN	SKIN
M030200	Cellulitis and abscess of chin	SKIN	SKIN
M030400	Cellulitis and abscess of forehead	SKIN	SKIN
M030500	Cellulitis and abscess of temple region	SKIN	SKIN
M030600	Cellulitis of face	SKIN	SKIN
M030z00	Cellulitis and abscess of face NOS	SKIN	SKIN
M031.00	Cellulitis and abscess of neck	SKIN	SKIN
M031.11	Cervical abscess	SKIN	SKIN
M032.00	Cellulitis and abscess of trunk	SKIN	SKIN
M032000	Cellulitis and abscess of chest wall	SKIN	SKIN
M032100	Cellulitis and abscess of breast	SKIN	SKIN
M032200	Cellulitis and abscess of back	SKIN	SKIN
M032300	Cellulitis and abscess of abdominal wall	SKIN	SKIN
M032400	Cellulitis and abscess of umbilicus	SKIN	SKIN
M032500	Cellulitis and abscess of flank	SKIN	SKIN
M032600	Cellulitis and abscess of groin	SKIN	SKIN
M032700	Cellulitis and abscess of perineum	SKIN	SKIN
M032800	Cellulitis of trunk	SKIN	SKIN
M032z00	Cellulitis and abscess of trunk NOS	SKIN	SKIN
M033.00	Cellulitis and abscess of arm	SKIN	SKIN
M033000	Cellulitis and abscess of shoulder	SKIN	SKIN
M033100	Cellulitis and abscess of axilla	SKIN	SKIN
M033200	Cellulitis and abscess of upper arm	SKIN	SKIN
M033300	Cellulitis and abscess of elbow	SKIN	SKIN
M033400	Cellulitis and abscess of forearm	SKIN	SKIN
M033z00	Cellulitis and abscess of arm NOS	SKIN	SKIN
M034.00	Cellulitis and abscess of hand excluding digits	SKIN	SKIN
M034.11	Cellulitis and abscess of hand	SKIN	SKIN
M034000	Cellulitis and abscess of hand unspecified	SKIN	SKIN
M034011	Abscess of dorsum of hand	SKIN	SKIN
M034012	Abscess of palm of hand	SKIN	SKIN
M034013	Cellulitis of dorsum of hand	SKIN	SKIN
M034014	Cellulitis of palm of hand	SKIN	SKIN

M034100	Cellulitis and abscess of wrist	SKIN	SKIN
M034z00	Cellulitis and abscess of hand NOS	SKIN	SKIN
M035.00	Cellulitis and abscess of buttock	SKIN	SKIN
M036.00	Cellulitis and abscess of leg excluding foot	SKIN	SKIN
M036.11	Cellulitis and abscess of leg	SKIN	SKIN
M036000	Cellulitis and abscess of hip	SKIN	SKIN
M036100	Cellulitis and abscess of thigh	SKIN	SKIN
M036200	Cellulitis and abscess of knee	SKIN	SKIN
M036300	Cellulitis and abscess of lower leg	SKIN	SKIN
M036400	Cellulitis and abscess of ankle	SKIN	SKIN
M036z00	Cellulitis and abscess of leg NOS	SKIN	SKIN
M037.00	Cellulitis and abscess of foot excluding toe	SKIN	SKIN
M037.11	Cellulitis and abscess of foot	SKIN	SKIN
M037000	Cellulitis and abscess of foot unspecified	SKIN	SKIN
M037100	Cellulitis and abscess of heel	SKIN	SKIN
M037z00	Cellulitis and abscess of foot NOS	SKIN	SKIN
M038.00	Cellulitis of external ear	SKIN	SKIN
M03y.00	Other specified cellulitis and abscess	SKIN	SKIN
M03y000	Cellulitis and abscess of head unspecified	SKIN	SKIN
M03y011	Abscess of scalp	SKIN	SKIN
M03z.00	Cellulitis and abscess NOS	SKIN	SKIN
M03z000	Cellulitis NOS	SKIN	SKIN
M03z100	Abscess NOS	SKIN	SKIN
M03zz00	Cellulitis and abscess NOS	SKIN	SKIN
M03zz11	Acute lymphangitis NOS	SKIN	SKIN
M04..00	Acute lymphadenitis	SKIN	SKIN
M04..11	Acute abscess lymph node	SKIN	SKIN
M04..12	Acute adenitis	SKIN	SKIN
M04..13	Acute cervical adenitis	SKIN	SKIN
M041.00	Acute lymphadenitis of upper limb	SKIN	SKIN
M042.00	Acute lymphadenitis of lower limb	SKIN	SKIN
M05..00	Impetigo	SKIN	SKIN
M050.00	Impetigo contagiosa unspecified	SKIN	SKIN
M051.00	Impetigo contagiosa bullosa	SKIN	SKIN
M053.00	Impetigo circinata	SKIN	SKIN
M055.00	Impetigo simplex	SKIN	SKIN
M056.00	Impetigo follicularis	SKIN	SKIN
M057.00	Chronic symmetrical impetigo	SKIN	SKIN
M05z.00	Impetigo NOS	SKIN	SKIN
M06..00	Pilonidal sinus/cyst	SKIN	SKIN
M060.00	Pilonidal cyst with abscess	SKIN	SKIN
M061.00	Pilonidal cyst with no abscess	SKIN	SKIN
M062.00	Pilonidal sinus with abscess	SKIN	SKIN

M063.00	Pilonidal sinus without abscess	SKIN	SKIN
M06z.00	Pilonidal sinus/cyst NOS	SKIN	SKIN
M07..00	Other local infections of skin and subcutaneous tissue	SKIN	SKIN
M070.00	Pyoderma	SKIN	SKIN
M070.11	Purulent dermatitis	SKIN	SKIN
M070100	Pyoderma faciale	SKIN	SKIN
M070200	Pyoderma gangrenosum	SKIN	SKIN
M071.00	Pyogenic granuloma	SKIN	SKIN
M071000	Pyogenic granuloma unspecified	SKIN	SKIN
M071200	Granuloma telangiectaticum	SKIN	SKIN
M071300	Umbilical granuloma	SKIN	SKIN
M071z00	Pyogenic granuloma NOS	SKIN	SKIN
M072.00	Erythrasma	SKIN	SKIN
M073.00	Scalp infection	SKIN	SKIN
M07y.00	Local infection of skin or subcutaneous tissue OS	SKIN	SKIN
M07y.11	Pustular eczema	SKIN	SKIN
M07y100	Ecthyma	SKIN	SKIN
M07y200	Dermatitis vegetans	SKIN	SKIN
M07y300	Perleche	SKIN	SKIN
M07y400	Pitted keratolysis	SKIN	SKIN
M07y500	Inflammation of scar	SKIN	SKIN
M07yz00	Other spec local skin/subc infection NOS	SKIN	SKIN
M07yz11	Infection toe	SKIN	SKIN
M07yz12	Infection foot	SKIN	SKIN
M07yz13	Infection finger	SKIN	SKIN
M07z.00	Local infection skin/subcut tissue NOS	SKIN	SKIN
M07z.11	Infected insect bite	SKIN	SKIN
M07z.12	Infected skin ulcer	SKIN	SKIN
M07z.13	Septic spots	SKIN	SKIN
M07z.14	Infected dermatitis	SKIN	SKIN
M07z.15	Sinus	SKIN	SKIN
M07z000	Infection foot	SKIN	SKIN
M07z100	Infection toe	SKIN	SKIN
M07z200	Infection finger	SKIN	SKIN
M08..00	Cutaneous cellulitis	SKIN	SKIN
M080.00	[X]Cellulitis of finger and toe	SKIN	SKIN
M080.11	[X]Nail bed infection	SKIN	SKIN
M080.12	[X]Septic thumb	SKIN	SKIN
M080.13	[X]Cellulitis of thumb	SKIN	SKIN
M081.00	[X]Cellulitis of other parts of limb	SKIN	SKIN
M082.00	Cellulitis of face	SKIN	SKIN
M083.00	Cellulitis of trunk	SKIN	SKIN
M084.00	[X]Cellulitis of breast	SKIN	SKIN

M085.00	Cellulitis of leg	SKIN	SKIN
M086.00	Cellulitis of ankle	SKIN	SKIN
M087.00	Chronic paronychia	SKIN	SKIN
M088.00	Cellulitis of arm	SKIN	SKIN
M089.00	Cellulitis of neck	SKIN	SKIN
M08A.00	Cellulitis of axilla	SKIN	SKIN
M08B.00	Cellulitis of foot	SKIN	SKIN
M08C.00	Cellulitis of toe	SKIN	SKIN
M08y.00	[X]Cellulitis of other sites	SKIN	SKIN
M09..00	Cutaneous abscess	SKIN	SKIN
M090.00	[X]Abscess of face	SKIN	SKIN
M091.00	[X]Abscess of neck	SKIN	SKIN
M092.00	[X]Abscess of trunk	SKIN	SKIN
M092000	[X]Abscess of buttock	SKIN	SKIN
M092100	[X]Abdominal wall abscess	SKIN	SKIN
M092200	[X]Perineal abscess	SKIN	SKIN
M093.00	[X]Abscess of buttock	SKIN	SKIN
M094.00	[X]Abscess of limb	SKIN	SKIN
M094000	[X]Abscess of axilla	SKIN	SKIN
M095.00	Skin abscess	SKIN	SKIN
M09y.00	[X]Abscess of other site	SKIN	SKIN
M0y..00	Other specified infections of skin or subcutaneous tissue	SKIN	SKIN
M0z..00	Skin and subcut tissue infection NOS	SKIN	SKIN
M0z..11	Infected sebaceous cyst	SKIN	SKIN
M1...00	Other skin and subcutaneous tissue inflammatory conditions	SKIN	SKIN
M1...11	Dermatitis/dermatoses	SKIN	SKIN
M10..00	Erythematosquamous dermatosis	SKIN	SKIN
M100.00	Pityriasis capitis - dandruff	SKIN	SKIN
M101.00	Seborrhoeic dermatitis	SKIN	SKIN
M101.11	Seborrhoeic dermatitis capitis	SKIN	SKIN
M101.12	Seborrhoeic eczema	SKIN	SKIN
M102.00	Infectious eczematoid dermatitis	SKIN	SKIN
M102.11	Pustular eczema	SKIN	SKIN
M103.00	Parakeratosis	SKIN	SKIN
M104.00	Pityriasis simplex	SKIN	SKIN
M10z.00	Erythematosquamous dermatosis NOS	SKIN	SKIN
M111.00	Atopic dermatitis/eczema	SKIN	SKIN
M12z000	Dermatitis NOS	SKIN	SKIN
M12z100	Eczema NOS	SKIN	SKIN
M12z111	Discoid eczema	SKIN	SKIN
M12z200	Infected eczema	SKIN	SKIN

M12z300	Hand eczema	SKIN	SKIN
M12z400	Erythrodermic eczema	SKIN	SKIN
M153.00	Rosacea	SKIN	SKIN
M153000	Acne rosacea	SKIN	SKIN
M230.00	Ingrowing nail	SKIN	SKIN
M230.11	Unguis incarnatus	SKIN	SKIN
M230000	Ingrowing great toe nail	SKIN	SKIN
M230100	Ingrowing toe nail (excluding great toe)	SKIN	SKIN
M230400	Ingrowing nail with infection	SKIN	SKIN
M230z00	Ingrowing nail NOS	SKIN	SKIN
M244.00	Folliculitis	SKIN	SKIN
M260.00	Acne varioliformis	SKIN	ACNE
M260000	Acne frontalis	SKIN	ACNE
M260z00	Acne varioliformis NOS	SKIN	ACNE
M260z11	Acne necrotica	SKIN	ACNE
M261.00	Other acne	SKIN	ACNE
M261000	Acne vulgaris	SKIN	ACNE
M261011	Blackhead	SKIN	ACNE
M261012	Comedo	SKIN	ACNE
M261100	Acne conglobata	SKIN	ACNE
M261500	Colloid acne	SKIN	ACNE
M261600	Cystic acne	SKIN	ACNE
M261700	Acne neonatorum	SKIN	ACNE
M261800	Infantile acne	SKIN	ACNE
M261900	Occupational acne	SKIN	ACNE
M261A00	Pustular acne	SKIN	ACNE
M261B00	Steroid acne	SKIN	ACNE
M261C00	Tropical acne	SKIN	ACNE
M261D00	Acne urticata	SKIN	ACNE
M261E00	Acne excoriee des jeunes filles	SKIN	ACNE
M261F00	Acne fulminans	SKIN	ACNE
M261H00	Acne keloid	SKIN	ACNE
M261J00	Acne necrotica	SKIN	ACNE
M261K00	Acne keloidalis	SKIN	ACNE
M261X00	Acne	SKIN	ACNE
M261z00	Other acne NOS	SKIN	ACNE
M2yz.11	Skin lesion	SKIN	SKIN
M2z0.00	Skin lesion	SKIN	SKIN
Myu0.00	[X]Infections of the skin and subcutaneous tissue	SKIN	SKIN
Myu0200	[X]Impetiginization of other dermatoses	SKIN	SKIN
Myu1.00	[X]Bullous disorders	SKIN	SKIN
Myu1300	[X]Other specified bullous disorders	SKIN	SKIN
Myu2C00	[X]Other specified dermatitis	SKIN	SKIN

Myu6800	[X]Other acne	SKIN	ACNE
Myu6A00	[X]Other follicular cysts of the skin+subcutaneous tissue	SKIN	SKIN
R021.00	[D]Rash and other nonspecific skin eruption	SKIN	SKIN
R062.00	[D]Cough	LRTI	LRTI - unspecified
SK03.00	Post-traumatic wound infection NEC	SKIN	SKIN
SP13100	Other aspiration pneumonia as a complication of care	LRTI	PNEUMONIA
SP25500	Postoperative wound infection	SKIN	SKIN
TE60.00	Dog bite	SKIN	SKIN

Table 1 – Indication and diagnose READ codes in THIN

ICPC code	Description	Disease group	Disease further specified
D70	Gastrointestinal infection	OTHER	GASTROENTERITIS
D73	Presumed GI infection	OTHER	GASTROENTERITIS
H71	Acute otitis media/myringitis	URTI	OTITIS
H72	Serous otitis media/glue ear	URTI	OTITIS
H74	Chronic otitis other infect ear	URTI	OTITIS
H04	Discharge from ear	URTI	OTITIS
H01	Ear pain/earache	URTI	OTITIS
H70	Otitis externa	URTI	EARINFECTION
H99	Other diseases of ear/mastoid	URTI	EARINFECTION
R74	URI (head cold)	URTI	URTI
R72	Strep throat/scarlet fever	URTI	TONSILLITIS
R76	Tonsillitis acute	URTI	TONSILLITIS
R90	Hypertrophy/chronic infect tonsils & adenoids	URTI	TONSILLITIS
R21	Sympt/complt throat	URTI	TONSILLITIS
R22	Sympt/complt tonsils	URTI	TONSILLITIS
R75	Sinusitis acute/chron	URTI	TONSILLITIS
R09	Sympt/complt sinus (incl pain)	URTI	TONSILLITIS
R83	Other infections of resp system	LRTI	OTHER
R71	Whooping cough	LRTI	TRACHEITIS
R77	Acute laryngitis/tracheitis	LRTI	TRACHEITIS
R78	Acute bronchitis/bronchiolitis	LRTI	BRONCHITIS
R02	Shortness of breath/dyspnoea	LRTI	BRONCHITIS
R03	Wheezing	LRTI	BRONCHITIS
R05	Cough	LRTI	BRONCHITIS
R81	Pneumonia	LRTI	PNEUMONIA
R96	Asthma	LRTI	ASTHMA

R80	Influenza (proven)wo pneumonia	LRTI	INFLUENZA
S09	Infected finger/toe/paronychia	SKIN	SKIN
S10	Boil/carbuncle/cellulitis local	SKIN	SKIN
S11	Other localized skin infection	SKIN	SKIN
S76	Other infectious skin dis	SKIN	SKIN
S84	Impetigo	SKIN	SKIN
D82	Disease of teeth/gums	SKIN	SKIN
D83	Disease of mouth/tongue/lips	SKIN	SKIN
S12	Insect bite	SKIN	SKIN
S13	Animal/human bite	SKIN	SKIN
S94	Ingrown toenail/other dis of nai S	SKIN	SKIN
S88	Contact dermatitis/other eczema	SKIN	SKIN
S87	Atopic dermatitis/eczema	SKIN	SKIN
S06	Local redness/erythema/rash	SKIN	SKIN
S18	Laceration/cut	SKIN	SKIN
S17	Abrasion/scratch/blister	SKIN	SKIN
S92	Pompholyx/dis sweat glands	SKIN	SKIN
S96	Acne	SKIN	ACNE
U70	Pyelonephritis/pyelitis acute	UTI	PYELONEPHRITIS
U71	Cystitis/other urin infect NOS	UTI	CYSTITIS
U02	Frequent/urgent urination	UTI	CYSTITIS
U05	Other urination problems	UTI	CYSTITIS
U01	Painful urination	UTI	CYSTITIS
U72	Urethritis non specific	UTI	URETHRITIS
U88	Glomerulonephritis/nephrosis	UTI	GLOMERULONEFR
X84	Vaginitis/vulvitis NOS	UTI	VAGINITIS
X99	Other diseases fem genital syste	UTI	FEMALE INFECTION
W94	Mastitis puerperalis	UTI	FEMALE INFECTION
Y74	Orchitis/epididymitis	UTI	MALE INFECTION
Y75	Balanitis	UTI	MALE INFECTION
F70	Infectious conjunctivitis	OTHER	EYE INFECTION
F72	Blepharitis/stye/chalazion	OTHER	EYE INFECTION
F73	Oth inf/inflam of eye (excl Herp	OTHER	EYE INFECTION
A99	Other general/unspec diseases	OTHER	OTHER
A03	Fever	OTHER	OTHER
B70	Acute lymphadenitis	OTHER	OTHER
A78	Other infectious diseases NOS	OTHER	OTHER
A77	Other viral diseases NOS	OTHER	OTHER

Table 2 - Indication and diagnose ICPC-codes in IPCI

Supplement 2

IPCI								
	Girls <12 yr		Girls ≥12 yr		Boys <12 yr		Boys ≥12 yr	
	asthma	no asthma	asthma	no asthma	asthma	no asthma	asthma	no asthma
URTI	39.3%**	43.6%	33.4%**	36.8%	40.6%**	52.2%	33.1%**	39.6%
Skin	9.1%**	13.9%	13.2%**	16.4%	14.3%**	19.6%	27.8%**	38.8%
UTI	16.0%**	23.5%	26.6%**	35.0%	1.8%**	3.5%	2.7%	3.0%
LRTI	31.9%**	14.3%	24.4%**	8.4%	38.5%**	19.4%	31.6%**	14.2%
Other /multiple indications	3.2%*	4.4%	2.3%*	3.0%	4.20%	4.7%	4.1%	3.9%
URTI+LRTI	0.5%	0.4%	0.2%*	0.3%	0.5%	0.6%	0.7%*	0.5%
THIN								
	Girls <12 yr		Girls ≥12 yr		Boys <12 yr		Boys ≥12 yr	
	asthma	no asthma	asthma	no asthma	asthma	no asthma	asthma	no asthma
URTI	46.0%**	55.6%	40.2%**	44.5%	45.0%**	55.9%	35.2%**	40.0%
Skin	13.3%**	15.5%	20.7%**	25.9%	15.2%**	18.3%	32.7%**	40.6%
UTI	9.7%**	12.3%	13.9%**	16.3%	3.8%**	5.2%	2.1%**	2.6%
LRTI	25.0%**	12.4%	19.4%**	8.8%	30.1%**	16.0%	24.2%**	12.3%
Other / multiple indications	3.1%**	2.9%	3.7%**	3.5%	2.90%	2.9%	3.5%*	3.3%
URTI+LRTI	2.9%**	1.4%	2.1%**	1.0%	3.0%**	1.7%	2.4%**	1.3%

Table 1 – indications stratified for age and gender
***p-value <0.05 (no asthma as reference)**
****p-value <0.0001 (no asthma as reference)**

IPCI									
		girls <12		Girls ≥12		Boys <12		Boys ≥12	
Pharmacologi-cal subgroup	**Active component**	**asthma**	**No asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**
Tetracy-clines	Doxycycline	N/A	N/A	14.7%	10.8%	N/A	N/A	15.9%	18.0%
	Minocycline	N/A	N/A	3.4%	4.7%	N/A	N/A	9.8%	11.9%
Penicilins	amoxicillin	47.7%	44.5%	20.6%	17.2%	51.6%	51.7%	25.3%	23.2%
	Pheneticillin	3.9%	6.3%	7.7%	9.6%	N/A	6.6%	4.9%	8.1%
	Flucloxacillin	N/A	5.1%	5.0%	5.3%	5.1%	7.1%	6.2%	8.9%
	amoxicillin with enzyme enhibitor	14.9%	17.2%	9.4%	9.7%	13.9%	16.45	11.6%	13.6%
Sulfona-mides and trimethoprim	trimethoprim	N/A	N/A	N/A	3.8%	N/A	N/A	N/A	N/A
	Sulfamethoxazole and trimethoprim	4.6%	N/A	N/A	N/A	4.9%	N/A	4.3%	N/A
Macrolides, lincosamides and strepto-gramins	Clarithromycin	8.0%	5.2%	6.7%	4.7%	9.0%	6.7%	8.5%	6.1%
	Azithromycin	12.6%	9.8%	13.2%	9.2%	15.4%	11.5%	13.6%	10.2%
Other antibacterials	Nitrofurantoin	8.5%	11.9%	19.3%	25.0%	N/A	N/A	N/A	N/A

Table 2- DU90% stratified for age and gender – NA: not part of DU90%

THIN									
		girls <12		Girls ≥12		Boys <12		Boys ≥12	
Pharmacologi-cal subgroup	**Active component**	**asthma**	**no asthma**	**asthma**	**no asthma**	**asthma**	**no asthma**	**no asthma**	**no asthma**
Tetracyclines	doxycycline	N/A	N/A	2.7%	2.7%	N/A	N/A	3.0%	3.8%
	lymecycline	N/A	N/A	5.7%	8.3%	N/A	N/A	9.7%	12.6%
	oxytetra-cycline	N/A	N/A	3.9%	5.4%	N/A	N/A	8.2%	10.2%
	minocycline	N/A	N/A	N/A	2.5%	N/A	N/A	3.7%	4.8%
penicilins	amoxicillin	40.6%	45.7%	28.6%	20.6%	51.1%	52.6%	30.3%	22.0%
	phenoxy-methyl-penicillin	18.5%	14.2%	16.8%	20.0%	12.8%	20.4%	11.9%	14.9%
	flucloxacillin	12.2%	10.3%	11.6%	12.7%	12.2%	17.3%	14.1%	15.6%
	amoxicillin with enzyme enhibitor	4.8%	4.9%	3.8%	3.5%	5.0%	6.1%	3.5%	3.5%
other b-lactam antibacterials	cefalexin	4.4%	4.8%	3.7%	3.2%	2.8%	N/A	N/A	N/A
sulfonamides and trimethoprim	trimethoprim	10.1%	8.3%	9.0%	10.2%	12.8%	3.7%	N/A	N/A
Macroliden, lincosamides and streptogramins	erythromycin	9.5%	11.8%	11.0%	10.8%	3.3%	N/A	12.5%	12.5%
	clarithromycin	N/A	N/A	3.3%	N/A	N/A	N/A	3.1%	N/A

Table 3- DU90% stratified for age and gender – NA: not part of DU90%

IPCI												
	Girls <12 yr			Girls ≥12 yr			Boys <12 yr			Boys ≥12 yr		
	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio
asthma	16.8	56.8	1.5	31.1	33.5	0.8	18.5	56.3	1.5	75.8	37.2	0.9
no asthma	19.8	58.1	1.5	25.7	35.7	0.9	15.2	58.8	1.6	39.2	35.5	0.9
THIN												
	Girls <12 yr			Girls ≥12 yr			Boys <12 yr			Boys ≥12 yr		
	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio	B/N ratio	AI	A/B ratio
asthma	0.5	72.7	8.0	0.7	71.6	6.8	0.6	73.3	7.7	0.7	73.4	7.3
no asthma	0.5	73.3	9.0	0.6	72.0	7.7	0.5	74.4	8.5	0.6	73.1	7.9

Table 4– Quality indicators for prescriptions for lower respiratory tract infections, stratified for age and gender

Broad/Narrow (B/N) ratio: (j01CR j01DC, j01DD, j01F(except j01FA01))/(j01CE, J01DB, J01FA01)
Amoxicillin Index (AI): J01CA04/J01
Amoxicillin/Broad (A/B) ratio: J01CA04/ (J01CR, J01DC, J01DD, J01F (except j01FA01)
J01CA04: Amoxicillin
J01CE: Beta-lactamase sensitive penicillins
J01CR: combinations of penicillins
J01DB: 1st generation cephalosporins
J01DC: 2nd generation cephalosporins
JOIDD: 3rd generation cephalosporins
J01F: macrolides, lincosamides and streptogramins
J01FA01: erythromycin

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5/6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	5-7/12-14
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	5-7
		(*d*) If applicable, explain how loss to follow-up was addressed	5
		(*e*) Describe any sensitivity analyses	n.a.
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	8
		(c) Summarise follow-up time (eg, average and total amount)	8
Outcome data	15*	Report numbers of outcome events or summary measures over time	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
		(*b*) Report category boundaries when continuous variables were categorized	n.a.
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n.a.
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.