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Government Report on the Antibiotic Barometer 2025

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From practice data to collective progress against antimicrobial resistance

4.1 Antimicrobial resistance calls for data-driven policy

Antimicrobial resistance represents a structural threat to public health, with consequences that extend well beyond individual patient care. The effectiveness of antibiotics is increasingly under pressure, highlighting the need for **coherent, evidence-based policy** that brings together prevention, rational use and monitoring. In Belgium, the majority of antibiotic use takes place in primary care, and particularly within general practice. This makes this setting crucial for effective policy interventions.

The Antibiotic Barometer provides policymakers with exactly what is needed in this context: a **systematic, repeatable and practice-oriented insight** into antibiotic prescribing behaviour. This NIHDI-supported audit and feedback instrument translates routinely collected electronic medical record (EMR) data into actionable insights, thereby building a bridge between everyday clinical practice and strategic health policy.

4.2 A solid foundation: reach, support and continuity

The strength of the Antibiotic Barometer lies in its scale and continuity. In the summer of 2025, **4,263 general practices and 11,399 general practitioners** contributed data, covering all provinces and regions. This broad participation ensures an **exceptionally representative picture** of antibiotic prescriptions in Belgian primary care.

Data are collected **quarterly**, in line with the seasonal nature of infectious diseases. This makes it possible to distinguish underlying trends from temporary fluctuations. The steady increase in participation since 2023 is an important signal of professional engagement. For policymakers, this means that the Barometer is not merely a measurement tool, but a **structurally embedded movement within general practice**.

4.3 Targeted measurements with high policy relevance

The Antibiotic Barometer focuses on seven common infections in general practice, including respiratory tract infections, urinary tract infections and pneumonia. These conditions were selected because they:

- occur frequently;
- are associated with a risk of unnecessary or inappropriate antibiotic use;
- and are highly relevant in the policy response to antimicrobial resistance.

For each condition and age group, three core aspects are monitored:

- whether antibiotics are prescribed;
- whether, when indicated, the recommended first-choice antibiotic is used;
- and to what extent quinolones are prescribed.

Together, these **38 indicators** form a detailed yet manageable framework to identify patterns, deviations and opportunities for improvement. For policymakers, the added value lies primarily in the fact that these indicators enable **targeted action**, without resorting to simplistic judgments.

4.4 Results that demonstrate progress and provide direction

Data up to the summer of 2025 show an evolution that is **clearly positive**. Across all indications, a substantial reduction in antibiotic prescriptions has been observed. Compared with the preceding two-year period, the proportion of patient contacts involving an antibiotic prescription decreased by **13.8%**. For respiratory and urinary tract infections, the reduction amounted to **8.4%**.

Notably, the largest decrease is seen among patients aged **2 to 65 years**. Among children and adolescents, quinolones are virtually not prescribed, indicating strong adherence to guidelines. Among adults, a gradual decline in quinolone use is also evident, particularly for indications such as cystitis and pneumonia.

These trends suggest that awareness-raising, guidelines and feedback are reinforcing each other. While direct causal relationships cannot be firmly established, the data show that improvement is not an abstract ideal, but a **measurable reality**.

4.5 Interpreting differences, not judging them

Regional variation in antibiotic prescribing persists. Brussels, for example, records lower prescribing rates for conditions where antibiotics are generally not indicated, while Flanders performs better in the use of first-choice antibiotics when treatment is warranted.

For policymakers, it is essential that these differences are interpreted in context. The Barometer shows a large variability in factors such as practice size, team-based working, availability of support staff and the EMR system in use that potentially play a significant role. In the near future multivariable analyses are planned to further investigate these associations.

The Antibiotic Barometer is therefore **explicitly not a performance rating tool**, but primarily a tool for general practitioners and, additionally, for policymakers, helping them to understand where and why differences arise — and where targeted support is likely to have the greatest impact.

4.6 Realistic ambitions through achievable benchmarks

To make improvement tangible and credible, the Antibiotic Barometer uses the **Achievable Benchmarks of Care (ABC™)** method. This approach takes the average performance of the top 10% of practices as a reference.

This approach offers clear policy value:

- it demonstrates what is already achievable within the current context;
- it avoids unrealistic targets;
- and it shifts the focus from “laggards” to **good practices that can be learned from**.

The gap between the regional average and this benchmark thus functions as a **compass for policy prioritisation**.

4.7 Policy value: from monitoring to strategic steering

The Antibiotic Barometer demonstrates that Belgium currently has:

- a **sustainable, federated data infrastructure** in primary care;
- a functional partnership between public authorities, healthcare providers, software vendors and knowledge centres;
- and an instrument that enables antibiotic policy to be shaped in an **evidence-informed and pragmatic** manner.

In the short term, the Barometer provides concrete entry points for targeted action in indications with high improvement potential. In the medium term, gains can be achieved through further harmonisation of EMR registration and refinement of analyses. Strategically, the Antibiotic Barometer can evolve into a **cornerstone of the national antimicrobial resistance (AMR) policy**, complementing guidelines and awareness-raising campaigns.

4.8 Conclusion: a collective investment with lasting returns

The Antibiotic Barometer convincingly demonstrates that large-scale quality monitoring in general practice is **feasible, accepted and effective**. The observed decline in antibiotic consumption shows that behavioural change is possible when healthcare providers are supported with relevant, clear and timely feedback.

For policymakers, the Barometer offers more than just figures: it acts as a **lever for sustainable health policy**, delivering long-term benefits for patients, professionals and the healthcare system as a whole. By further consolidating and refining this approach, Belgium is investing not only in better care today, but also in the **preservation of effective antibiotics for future generations**.\

5 Résumé exécutif: Le Baromètre des antibiotiques, un levier politique pour un usage responsable des antibiotiques

Des données de pratique vers un progrès collectif contre la résistance antimicrobienne

5.1 La résistance antimicrobienne appelle des politiques fondées sur les données

La résistance antimicrobienne constitue une menace structurelle pour la santé publique, dont les conséquences dépassent largement les soins prodigués au patient individuel. L'efficacité des antibiotiques est de plus en plus mise sous pression, ce qui souligne la nécessité de politiques cohérentes et fondées sur des données probantes, intégrant la prévention, l'usage rationnel et le suivi. En Belgique, la majorité de l'utilisation des antibiotiques a lieu en soins de première ligne, et plus particulièrement en médecine générale. Ce niveau de soins est dès lors crucial pour les interventions de politique publique.

Le Baromètre des antibiotiques offre aux décideurs exactement ce dont ils ont besoin dans ce contexte : une vision systématique, reproductible et ancrée dans la pratique des comportements de prescription des antibiotiques. Cet outil d'audit et de feedback soutenu par l'INAMI transforme des données issues des dossiers médicaux informatisés (DMI), collectées de manière routinière, en informations exploitables, établissant ainsi un pont entre la pratique quotidienne des soins et la politique de santé stratégique.

5.2 Un socle solide: portée, adhésion et continuité

La force du Baromètre des antibiotiques réside dans son ampleur et sa continuité. À l'été 2025, **4 263 cabinets de médecine générale et 11 399 médecins généralistes** ont fourni des données, couvrant l'ensemble des provinces et des régions. Cette large participation garantit une **représentativité exceptionnelle** des pratiques de prescription des antibiotiques en soins de première ligne en Belgique.

La collecte des données s'effectue **trimestriellement**, en cohérence avec le caractère saisonnier des maladies infectieuses. Cela permet de distinguer les tendances structurelles des fluctuations temporaires. L'augmentation constante de la participation depuis 2023 constitue un signal important d'adhésion professionnelle. Pour les décideurs, cela signifie que le Baromètre ne se limite pas à un instrument de mesure, mais représente une **dynamique durablement ancrée dans la médecine générale**.

5.3 Des mesures ciblées à forte valeur politique

Le Baromètre des antibiotiques se concentre sur **sept infections fréquentes en médecine générale**, notamment les infections respiratoires, les infections urinaires et la pneumonie. Ces affections ont été sélectionnées parce qu'elles :

- sont fréquentes ;
- comportent un risque d'usage excessif ou inapproprié des antibiotiques ;
- sont stratégiquement importantes dans la lutte contre la résistance antimicrobienne.

Pour chaque affection et chaque groupe d'âge, trois aspects clés sont suivis :

- la prescription ou non d'antibiotiques ;
- l'utilisation, lorsqu'une indication est présente, de l'antibiotique de premier choix recommandé ;
- le recours aux quinolones.

Ces **38 indicateurs** constituent un cadre à la fois détaillé et lisible permettant de rendre visibles les schémas, les écarts et les marges d'amélioration. Pour les décideurs, leur valeur ajoutée réside avant tout dans leur capacité à **soutenir des actions ciblées**, sans recourir à des jugements simplificateurs.

5.4 Des résultats qui montrent les progrès et orientent l'action

Les données disponibles jusqu'à l'été 2025 dessinent une évolution **clairement positive**. Toutes infections confondues, une réduction significative des prescriptions d'antibiotiques est observée. Par rapport aux deux années précédentes, la proportion de contacts patients associés à une prescription antibiotique a diminué de **13,8 %**. Pour les infections respiratoires et urinaires, la baisse atteint **8,4 %**.

La réduction la plus marquée concerne les patients âgés de **2 à 65 ans**. Chez les enfants et les adolescents, les quinolones sont quasiment absentes, ce qui témoigne d'un fort respect des recommandations cliniques. Chez les adultes, une diminution progressive de l'utilisation des quinolones est également observée, en particulier pour des indications telles que la cystite et la pneumonie.

Ces tendances suggèrent que la sensibilisation, les recommandations cliniques et le feedback se renforcent mutuellement. Bien que des relations de causalité directes ne puissent être établies, les données démontrent que l'amélioration n'est pas un idéal abstrait, mais bien une **réalité mesurable**.

5.5 Comprendre les différences, sans les juger

Des variations régionales dans les prescriptions d'antibiotiques persistent. Bruxelles, par exemple, présente des taux de prescription plus faibles pour les affections pour lesquelles les antibiotiques ne sont généralement pas indiqués, tandis que la Flandre affiche de meilleurs résultats en matière d'utilisation des antibiotiques de premier choix lorsque le traitement est justifié.

Il est essentiel que les décideurs interprètent ces différences dans leur contexte. Le Baromètre met en évidence une grande variabilité de facteurs tels que la taille des cabinets, le travail en équipe, la disponibilité du personnel de soutien et les logiciels de DMI utilisés, facteurs susceptibles de jouer un rôle significatif. Des analyses multivariées sont prévues à court terme afin d'examiner plus en profondeur ces associations.

Le Baromètre des antibiotiques n'est donc **pas un instrument d'évaluation ou de sanction**, mais avant tout un outil destiné aux médecins généralistes et, au-delà, aux décideurs, afin de comprendre où et pourquoi des écarts apparaissent — et où un soutien ciblé peut produire le plus d'impact.

5.6 Des ambitions réalistes grâce à des références atteignables

Afin de rendre les améliorations concrètes et crédibles, le Baromètre des antibiotiques recourt à la méthode des **Achievable Benchmarks of Care (ABC™)**, fondée sur la performance moyenne des 10 % de cabinets les plus performants.

Cette approche présente une réelle valeur politique :

- elle montre ce qui est déjà possible dans le contexte actuel ;
- elle évite de fixer des objectifs irréalistes ;
- elle déplace l'attention des « retards » vers **des bonnes pratiques pouvant servir de modèles**.

L'écart entre la moyenne régionale et ce benchmark sert ainsi de **boussole pour la priorisation des politiques publiques**.

5.7 Valeur politique : du suivi à la gouvernance stratégique

Le Baromètre des antibiotiques montre que la Belgique dispose aujourd'hui :

- d'une **infrastructure de données fédérée et durable** en soins de première ligne ;
- d'un **partenariat fonctionnel** entre pouvoirs publics, prestataires de soins, fournisseurs de logiciels et centres de connaissances ;
- d'un instrument permettant de concevoir une politique antibiotique **à la fois fondée sur les preuves et pragmatique**.

À court terme, le Baromètre offre des leviers pour des actions ciblées dans les indications présentant un fort potentiel d'amélioration. À moyen terme, les gains se situent dans une harmonisation accrue des enregistrements dans les DME et un approfondissement des analyses. Sur le plan stratégique, le Baromètre des antibiotiques peut devenir un **pilier du plan national de lutte contre la résistance antimicrobienne**, en complément des recommandations cliniques et des campagnes de sensibilisation.

5.8 Conclusion: un investissement collectif à rendement durable

Le Baromètre des antibiotiques démontre de manière convaincante que le suivi de la qualité à grande échelle en médecine générale est **réalisable, accepté et efficace**. La baisse observée de la consommation d'antibiotiques prouve que le changement de comportement est possible lorsque les professionnels de santé bénéficient d'un feedback pertinent, clair et fourni en temps opportun.

Pour les décideurs, le Baromètre est bien plus qu'un ensemble de chiffres : il constitue un **levier pour une politique de santé durable**, générant des bénéfices à long terme pour les patients, les professionnels et l'ensemble du système de santé. En consolidant et en affinant cette approche, la

Belgique investit non seulement dans de meilleurs soins aujourd'hui, mais aussi dans la **préservation de l'efficacité des antibiotiques pour les générations futures**.

6 Beleidssamenvatting: De Antibioticabarometer, een beleidshefboom voor verantwoord antibioticagebruik

Van praktijkdata naar collectieve vooruitgang tegen antimicrobiële resistentie

6.1 Antimicrobiële resistentie vraagt om data-gedreven beleid

Antimicrobiële resistentie vormt een structurele bedreiging voor de volksgezondheid, met gevolgen die verder reiken dan individuele patiëntenzorg. De doeltreffendheid van antibiotica staat onder druk, wat de noodzaak onderstreept van **samenhangend, evidence-based beleid** dat preventie, rationeel gebruik en monitoring met elkaar verbindt. In België vindt het grootste deel van het antibioticagebruik plaats in de eerstelijnszorg, en vooral binnen de huisartsenpraktijk. Dat maakt deze setting cruciaal voor beleidsinterventies.

De **Antibioticabarometer** biedt beleidsmakers precies wat in deze context nodig is: een systematisch, herhaalbaar en praktijkgericht zicht op antibioticavoorschrijfgedrag. Dit RIZIV ondersteunde audit- en feedbackinstrument vertaalt routinematig verzamelde EMD-gegevens naar bruikbare inzichten, en vormt zo een **brug tussen dagelijkse zorgpraktijk en strategisch gezondheidsbeleid**.

6.2 Een stevig fundament: bereik, draagvlak en continuïteit

De kracht van de Antibioticabarometer zit in haar schaal en continuïteit. In de zomer van 2025 leverden **4.263 huisartsenpraktijken en 11.399 huisartsen** gegevens aan, verspreid over alle provincies en gewesten. Deze brede participatie zorgt voor een **uitzonderlijk representatief beeld** van het antibiotica voorschrijfgedrag in de Belgische eerstelijnszorg.

De datacollectie gebeurt **per kwartaal**, in lijn met de seizoensgebonden aard van infectieziekten. Dit maakt het mogelijk om trends te onderscheiden van tijdelijke schommelingen. Dat de deelname sinds 2023 gestaag toeneemt, is een belangrijk signaal van professioneel draagvlak. Voor beleidsmakers betekent dit dat de barometer niet louter een meetinstrument is, maar een **structureel verankerde beweging** binnen de huisartsgeneeskunde.

6.3 Gerichte metingen met hoge beleidsrelevantie

De Antibioticabarometer focust op zeven frequente infecties in de huisartsenpraktijk, waaronder luchtweginfecties, urineweginfecties en longontsteking. Deze aandoeningen zijn geselecteerd omdat ze:

- vaak voorkomen,
- gepaard gaan met een risico op over- of foutief antibioticagebruik,
- en beleidsmatig relevant zijn in de strijd tegen resistentie.

Per aandoening en leeftijdsgroep worden drie kernaspecten opgevolgd:

- of antibiotica worden voorgeschreven,
- of bij indicatie het aanbevolen eerstekeuze-antibioticum wordt gebruikt,
- en in welke mate quinolonen worden ingezet.

Samen vormen deze **38 indicatoren** een fijnmazig maar overzichtelijk kader om patronen, afwijkingen en verbeterkansen zichtbaar te maken. Voor beleidsmakers ligt de meerwaarde vooral in het feit dat deze indicatoren **gericht actie mogelijk maken**, zonder te vervallen in simplistische oordelen.

6.4 Resultaten die vooruitgang tonen én richting geven

De data tot en met de zomer van 2025 schetsen een **evolutie die duidelijk positief is**. Over alle infecties heen is een **aanzienlijke daling van antibioticavoorschriften** vastgesteld. In vergelijking met de twee voorafgaande jaren ging het om een afname van **13,8%** van het aandeel patiëntcontacten met een antibioticum voorschrift. Voor luchtweg- en urineweginfecties bedroeg die daling **8,4%**.

Opvallend is dat de grootste reductie wordt gezien bij patiënten tussen **2 en 65 jaar**. Bij kinderen en jongeren worden quinolonen vrijwel niet voorgeschreven, wat wijst op sterke richtlijntrouw. Ook bij volwassenen is een geleidelijke afname van quinolonegebruik zichtbaar, met name bij indicaties zoals urineweginfecties en longontstekingen.

Deze trends suggereren dat **bewustwording, richtlijnen en feedback samen effect hebben**. Hoewel causale verbanden niet rechtstreeks kunnen worden gelegd, tonen de data aan dat verbetering geen abstract ideaal is, maar een **meetbare realiteit**.

6.5 Verschillen duiden, niet veroordelen

Regionale variatie in antibioticavoorschriften blijft bestaan. Zo noteert Brussel lagere voorschrijfpercentages bij aandoeningen waarvoor antibiotica doorgaans niet aangewezen zijn, terwijl Vlaanderen sterker scoort op het gebruik van eerstekeuze-antibiotica wanneer behandeling wel geïndiceerd is.

Belangrijk voor beleidsmakers is dat deze verschillen **in context worden geplaatst**. De barometer maakt duidelijk dat er een grote variabiliteit is in factoren zoals praktijkgrootte, teamwerking, beschikbaarheid van ondersteunend personeel en gebruikte EMD-software en dat deze potentieel een wezenlijk rol spelen. In de nabije toekomst worden multivariate analyses gepland die deze associaties verder zullen onderzoeken.

De Antibioticabarometer is dan ook uitdrukkelijk **geen beoordelingsinstrument**, maar een hulpmiddel in eerste instantie voor huisartsen, maar daarnaast ook voor beleidsmakers dat hen helpt begrijpen *waar* en *waarom* verschillen ontstaan — en waar gerichte ondersteuning het meeste effect kan sorteren.

6.6 Realistische ambities dankzij haalbare referenties

Om verbetering concreet en geloofwaardig te maken, maakt de Antibioticabarometer gebruik van de **Achievable Benchmarks of Care (ABC™)**-methode. Hierbij wordt het gemiddelde van de 10% best presterende praktijken als referentie genomen.

Deze aanpak heeft een sterke beleidsmatige meerwaarde:

- ze toont wat **binnen de huidige context al mogelijk is**;
- ze vermijdt onrealistische doelstellingen;
- en ze verschuift de focus van “achterblijvers” naar **leerbare goede praktijken**.

De kloof tussen het regionale gemiddelde en deze benchmark fungeert zo als een **kompas voor beleidsprioritering**.

6.7 Beleidswaarde: van monitoring naar strategische sturing

De Antibioticabarometer toont dat België vandaag beschikt over:

- een **duurzame, gefedereerde data-infrastructuur** in de eerstelijnszorg,
- een **functioneel partnerschap** tussen overheid, zorgverleners, softwareleveranciers en kenniscentra,
- en een instrument dat toelaat om antibioticapolitiek **evidence-informed én pragmatisch** vorm te geven.

Op korte termijn biedt de barometer handvaten voor gerichte acties bij indicaties met hoog verbeterpotentieel. Op middellange termijn ligt de winst in verdere harmonisatie van EMD-registratie en verfijning van analyses. Strategisch kan de Antibioticabarometer uitgroeien tot een **anker binnen het nationale antimicrobiële resistentie (AMR) -beleid**, complementair aan richtlijnen en sensibiliseringscampagnes.

6.8 Slotbeschouwing: een collectieve investering met blijvend rendement

De Antibioticabarometer toont overtuigend aan dat grootschalige kwaliteitsopvolging in de huisartsgeneeskunde **haalbaar, aanvaard en effectief** is. De daling in antibioticaconsumptie bewijst dat gedragsverandering mogelijk is wanneer zorgverleners ondersteund worden met relevante, begrijpelijke en tijdige feedback.

Voor beleidsmakers biedt de barometer meer dan cijfers: zij vormt een **hefboom voor duurzaam gezondheidsbeleid**, met voordelen op lange termijn voor patiënten, zorgverleners én het zorgsysteem als geheel. Door deze aanpak verder te bestendigen en te verfijnen, investeert België niet alleen in betere zorg vandaag, maar ook in de **bescherming van antibiotica voor toekomstige generaties**.

7 Introduction

Antimicrobial resistance (AMR) is a significant and growing global health problem (1–3). It occurs when bacteria adapt to antimicrobial agents, rendering them less effective or completely ineffective (4,5). By 2050, approximately ten million people worldwide will no longer be able to be treated effectively, often resulting in death (4,6). One of the main causes of AMR is the excessive and inappropriate use of antibiotics. Belgium has one of the highest rates of antibiotic use in Europe (1). These findings underscore the need to implement systems that can improve antibiotic stewardship and make healthcare providers aware of their antibiotic prescribing behaviours (7–9).

Antibiotic stewardship is a coordinated approach to ensure that antibiotics are used appropriately and only when necessary. It focuses on selecting the appropriate drug, dose, and duration to effectively treat infections while minimising harm. The primary goals are to improve patient outcomes, reduce the development of antimicrobial resistance, and avoid unnecessary health care expenses. By promoting responsible prescribing practices, antibiotic stewardship helps preserve the effectiveness of these vital medicines for the future (7).

Earlier studies have identified respiratory (RTI) and urinary tract infections (UTI) as the most common indications for antibiotic prescriptions in primary care (10). Audit and feedback (A&F) is a well-studied intervention that can be used to improve antibiotic stewardship (11,12). The Antibiotic Barometer is an automated A&F intervention designed to help general practitioners (GPs) evaluate their prescribing behaviour and gain insight into their practice in a formative way. For these most common indications, it extracts information about the prescribing behaviour of GPs at the practice level by automatically collecting data four times a year from the electronic medical records (EMR) of GPs.

The feedback section of the Antibiotic Barometer allows healthcare providers to benchmark their performance against that of their peers, providing them with a clear picture of their position and identifying areas for improvement. In addition, the evolution of their prescribing behaviour can be monitored over time, making improvements effectively visible. Finally, to improve adherence to guidelines when initiating antibiotic treatment, feedback on the (correct) first-choice antibiotic prescription is provided. Visual feedback was presented interactively, as described in more detail below. The Antibiotic Barometer thus helps GPs to improve antibiotic stewardship.

This report aims to describe participation in the Antibiotic Barometer and elaborate on the antibiotic prescribing behaviour in general practice for different infections.

8 Methods

8.1 Feedback to general practitioners

Formative feedback is provided four times a year to GPs and incorporates features such as benchmarking, low cognitive load, and a link to the guidelines (13). A geographical benchmark is available to compare one's practice with the province, district (arrondissement/district), or first-line zone (eerstelijnszone/zone de première ligne). Furthermore, the Achievable Benchmark of Care (ABC^{TM}), which displays the average of the 10% best-performing practices, is used to provide a realistic target for improving practice performance (14–16). The colour codes highlight the practice performance compared to quartiles. The feedback can be consulted on the Healthstat platform. An example of visual feedback is presented in Figure 1.

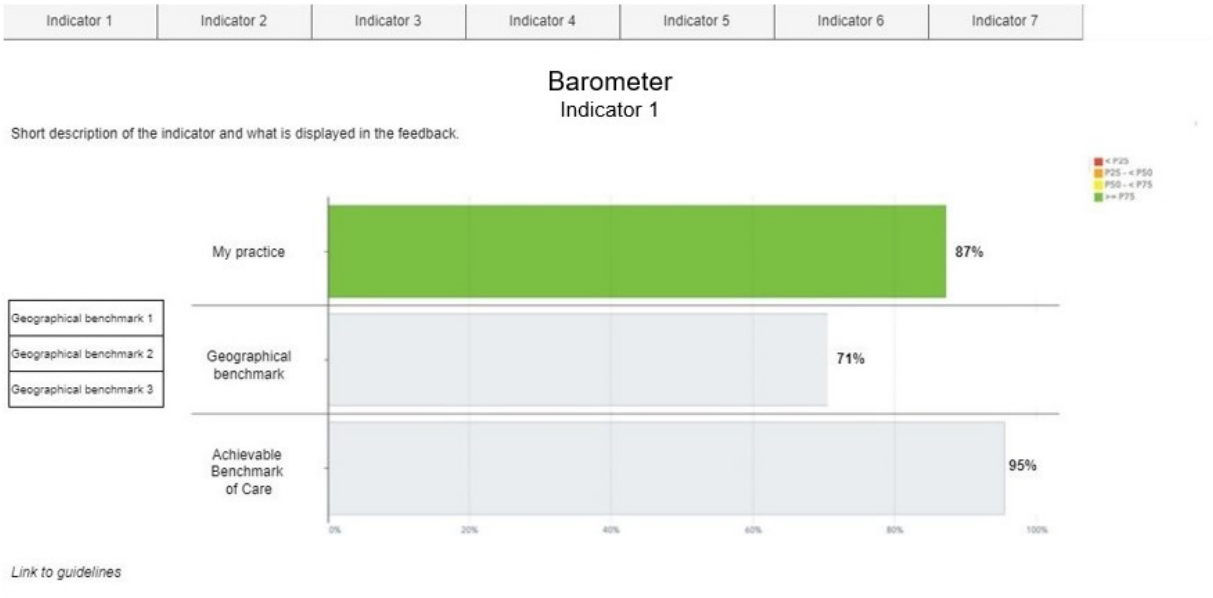


Figure 1 Example of colour-coded feedback visualisations and benchmarking for a given quality indicator.

8.2 Data collection

8.2.1 Quality indicators

The Antibiotic Barometer assesses different quality indicators that were previously published and validated in the Belgian context by Adriaenssens et al. (10). For seven indications (acute bronchitis/bronchiolitis, acute upper respiratory infection, cystitis/other urinary infection, acute tonsillitis, acute/chronic sinusitis, acute otitis media, and pneumonia) identified in the EMR by the ICPC-2 codes (R78, R74, U71, R76, R75, H71, and R81, respectively; see Table 1), three indicators were used: (a) the percentage of patients with age and/or gender limitation who were prescribed an antibiotic; (b) the percentage of patients with age and/or gender limitation who were prescribed an antibiotic and received the first-choice antibiotic; and (c) the percentage of patients with age and/or gender limitation who were prescribed an antibiotic and received quinolones (10). For diagnosis R76, an additional ICPC-2 code was added to improve the accuracy of the indicator. The Antibiotic Barometer uses a similar definition, as presented in Table 2. First-choice antibiotics were determined according to the BAPCOC guidelines (table 3) (17). As target for the different indicators the acceptable ranges for disease-specific antibiotic prescribing quality as described by Adriaenssens et al. were used (table 4) (10).

These indicators were validated by the Flemish Institute for Quality of Care (VIKZ) (6). These indicators are labelled as process indicators. Process indicators measure whether the recommended care processes are implemented, whereas outcome indicators measure the actual outcomes of care for patients (13).

In addition to the quality indicators for antibiotic prescribing behaviour, we also assessed the proportion of coded diagnoses for the ICPC-2 codes used in the Antibiotic Barometer. This measure reflects the number of cases for a specific diagnosis within a given age group, expressed as a percentage of the total patient contacts for that age group.

In addition to content-specific indicators, each barometer collects general practice information. These queries offer insights into the characteristics of the participating practices, such as their location, practice type, and number of GPs.

Table 1 ICPC-2 Codes, diagnoses, and age categories used in the Antibiotic Barometer.
ICPC-2 = The revised second edition of the International Classification of Primary Care (*) is combined in the antibiotic barometer with the ICPC-2 code R72 (bacterial throat infection). Grey shaded: These are the so-called disease-specific quality indicators for outpatient antibiotic use developed by and for general practitioners in the European Surveillance of Antimicrobial Consumption (ESAC) project.

ICPC-2 Code	Diagnosis	Age category (years)					
R74	acute upper respiratory infection	< 1	1-2	2-18	18-65	> 65	
R75	acute/chronic sinusitis	< 2		2-18	18-65	> 65	
R76 (*)	acute tonsillitis	< 1	1-2	2-18	18-65	> 65	
R78	acute bronchitis/bronchiolitis	< 2		2-18	18-65	65-75	> 75
R81	pneumonia	< 2		2-18	18-65	> 65	
H71	acute otitis media	< 2		2-18	18-65	> 65	
U71	cystitis/other urinary infection	< 2		2-18	18-65 (female)	> 65 (female)	

Table 2 Overview of indicators included in the Antibiotic Barometer.

Indicator	Description
Antibiotic prescriptions	Percentage of antibiotic prescriptions for patients with a diagnosis (based on ICPC-2 code) in a certain age category
First-choice antibiotic prescriptions	Percentage of first-choice antibiotics prescribed over the total number of patients with a diagnosis (based on ICPC-2 code) who were prescribed antibiotics in a certain age category
Quinolones prescriptions	Percentage of quinolones prescribed over the total number of patients with a diagnosis (based on ICPC-2 code) who were prescribed antibiotics in a certain age category

Table 3 Overview of the first-choice antibiotics included in the Antibiotic Barometer.

ICPC-2 Code	Diagnosis	First choice minors	First choice adults
R74	acute upper respiratory infection	Pheneticillin	Pheneticillin
R75	acute/chronic sinusitis	Amoxicillin	Amoxicillin
R76 (*)	acute tonsillitis	Pheneticillin	Pheneticillin

R78	acute bronchitis/bronchiolitis	Amoxicillin, Azithromycin	Amoxicillin, Amoxicillin/Clavulanic Acid
R81	pneumonia	Amoxicillin, Azithromycin	Amoxicillin, Amoxicillin/Clavulanic Acid
H71	acute otitis media	Amoxicillin	Amoxicillin
U71	cystitis/other urinary infection	Nitrofurantoin	Nitrofurantoin

Table 4 Overview of the acceptable range as presented by N. Adriaenssens et al. (2014).

ICPC-2 Code	Diagnosis	% Prescribed antibiotics	% First choice antibiotics	% Percentage prescribed quinolones
R74	acute upper respiratory infection	≤20	≥ 80	≤5
R75	acute/chronic sinusitis	≤20	≥ 80	≤5
R76 (*)	acute tonsillitis	≤20	≥ 80	≤5
R78	acute bronchitis/bronchiolitis	≤30	≥ 80	≤5
R81	pneumonia	≥ 90	≥ 80	≤5
H71	acute otitis media	≤20	≥ 80	≤5
U71	cystitis/other urinary infection	≥ 80	≥ 80	≤5

8.2.2 Intervention period and data flow

As part of the Antibiotic Barometer initiative, data are collected quarterly, with data cutoff dates at the end of each astronomical season (20 December, 20 March, 20 June and 20 September). Data extraction is performed by the software providers of the participating GP practices, who run predefined queries within the EMRs at the practice level for all three indicators for each diagnosis and for each age category (38 indicators) and sent between the 21st and 28th of the month of the cutoff date. They are given five working days to transmit the collected data to Healthdata.be via a secure method (eHealth boxes). Healthdata.be securely stores the data and provides access to Intego. The Intego team then further processes and analyses the data to generate a feedback report with suggestions for improvement for each practice. Through the Healthstat platform, these reports are made available to GPs by Healthdata.be (Figure 2).

In addition to traditional data collection, one EMR system (CareConnect) also collects retrospective data. This means that data from the previous five seasons are also collected from practices/general practitioners the first time they participate. When comparing classic data collections with those from the retrospective study, the number of practices and GPs may differ. If a GP registers for retrospective data collection, data are collected for the previous five seasons from the time of registration. Consequently, not all collections returned to the same moment in time. This indicates that the classic data collection is the most accurate method for practice and GP participation.

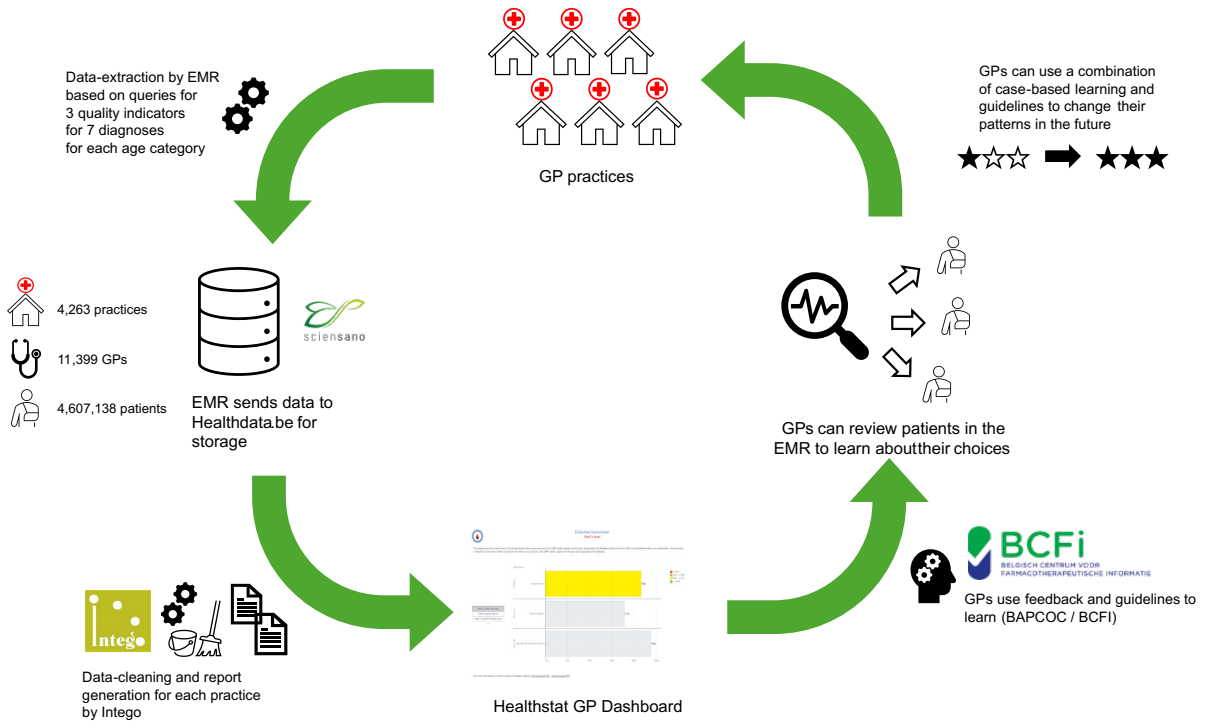


Figure 2 The diagram illustrates the cyclical process of the Antibiotic Barometer.
Data on quality indicators were extracted from electronic medical records (EMRs) in GP practices and sent to Healthdata.be for secure storage. Intego performs data cleaning and generates practice-level reports that are displayed on the Healthstat GP Dashboard. GPs review these dashboards and use evidence-based guidelines (BAPCOC) to enhance patient care. They can use queries in their EMR to identify patients and scan the EMR record to identify what influenced their choices for a certain patient to describe an antibiotic and the type of antibiotic prescribed. Using guidelines and case-based learning, the feedback loop is closed, stimulating GPs to alter their behavior in the future.

8.3 Statistical analysis

In this report, the practice data from general care practices participating in the Antibiotic Barometer were aggregated by arrondissement and province. Data cleaning and validation were conducted in a secure Healthdata.be processing environment before analysis. Descriptive statistics were employed to summarize the characteristics of the practices, such as size, type, and presence of nurses or assistants.

Continuous variables are reported as means, medians, interquartile ranges (p25–p75), and minimum/maximum values, whereas categorical variables are expressed as counts and percentages.

Indicator performance was assessed longitudinally across the fall, winter, spring, and summer seasons, commencing in fall 2023 and concluding in summer 2025, with stratification by province. For each indicator, the proportion of eligible patients meeting the criterion within each practice was calculated, and these proportions were aggregated using weighted means. Each indicator was compared to the total number of patients with the same diagnosis who received an antibiotic prescription. Five-point summaries (minimum, maximum, p25, p75, mean, and median) were generated for each indicator and time point.

The longitudinal analysis examined trends across all previous data collections up to the summer of 2025, enabling the capture of the evolution of participation, practice characteristics, and indicator performance over time. Temporal comparisons were visualized using line and box plots, and trends were evaluated descriptively.

All analyses were conducted using SAS (version 8.3) and R (version 4.4.2).

9 Results

9.1 Cross-sectional analysis

9.1.1 Practice participation

Table 3 displays the compiled data by province, detailing barometer participation (number of practices and total GPs) and practice characteristics (type, size, etc.).

Figure 3 and 4 illustrates the provincial involvement in the Antibiotic Barometer. In total, 4,263 general practices and 11,399 GPs provided data for the Antibiotic Barometer during the summer 2025 collection period. Participation levels varied across the regions. Flanders had the highest participation, with 2,284 practices (54.2%) and 6,839 GPs (60.0%). Wallonia contributed 1,422 practices (33.7%) and 3,229 GPs (28.3%), whereas the Brussels-Capital Region accounted for 505 practices (12.0%) and 1,331 GPs (11.7%). At the provincial level, Antwerp (590 practices, 1,944 GPs) and East Flanders (564 practices, 1,754 GPs) recorded the highest absolute numbers of practices and GPs, followed by West Flanders (439 practices, 1,333 GPs). Conversely, Luxembourg had the lowest absolute participation, with 97 practices and 224 GPs.

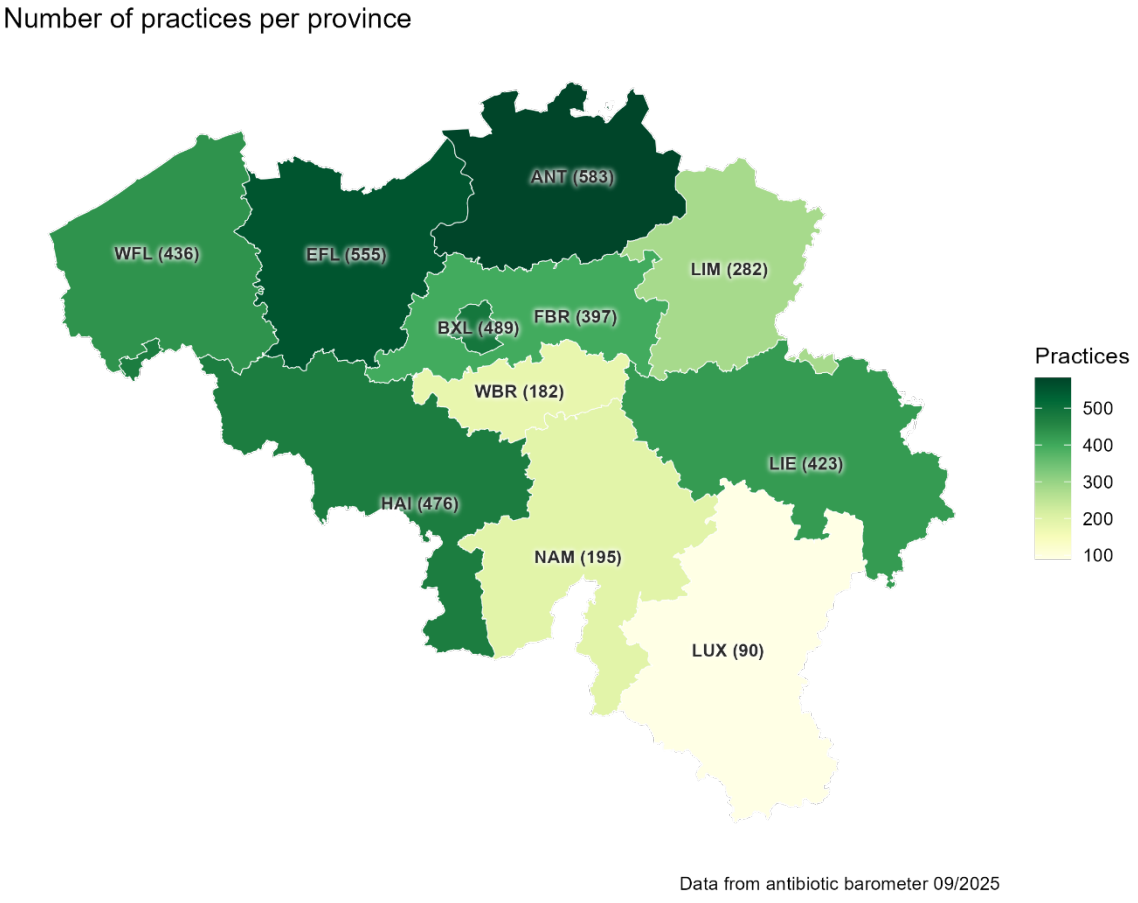


Figure 3 Number of participating general practices per province in the Antibiotic Barometer (summer 2025). Abbreviations: WFL = West Flanders; EFL = East Flanders; ANT = Antwerp; FBR = Flemish Brabant; LIM = Limburg; HAI = Hainaut; WBR = Walloon Brabant; NAM = Namur; LUX = Luxembourg; LIE = Liège; BXL = Brussels-Capital Region.

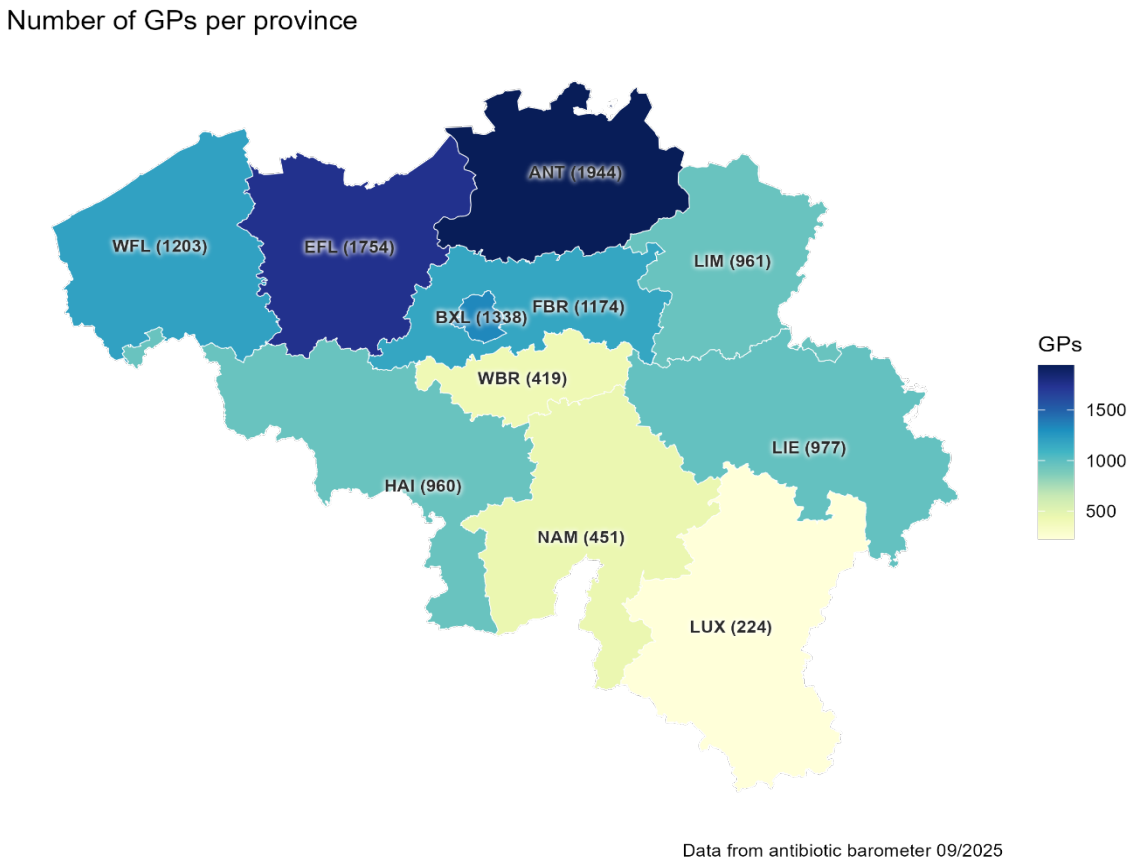


Figure 4 Number of participating general practitioners per province in the Antibiotic Barometer (summer 2025).
See earlier captions for province abbreviations.

9.1.2 Characteristics of participating practices

Figures 5, 6, and 7 present the distribution of selected practice characteristics, including practice type, practice size, and the age profile of participating GPs, by province and region. Figures 8 and 9 provide insight into the distribution of GP practice staff support and the use of different software packages. These characteristics may play an important role in both practice performance and the way in which feedback is perceived and interpreted. Furthermore, both the quality of data registration and the ability to extract data from information systems may substantially influence the results of this study. A detailed discussion of each of these characteristics is provided in the subsequent sections. Additionally we can already announce that there cannot be found any remarkable differences in participation between the antibiotics barometer and diabetes barometer.

For now we have only limited insight on the real usage of the different barometers but are intensively working together with Healthdata to log and analyse the visits of the GP dashboards. Furthermore we developed a self-efficacy questionnaire to follow-up the perceived ability of the GPs to perform population health management in their own practice.

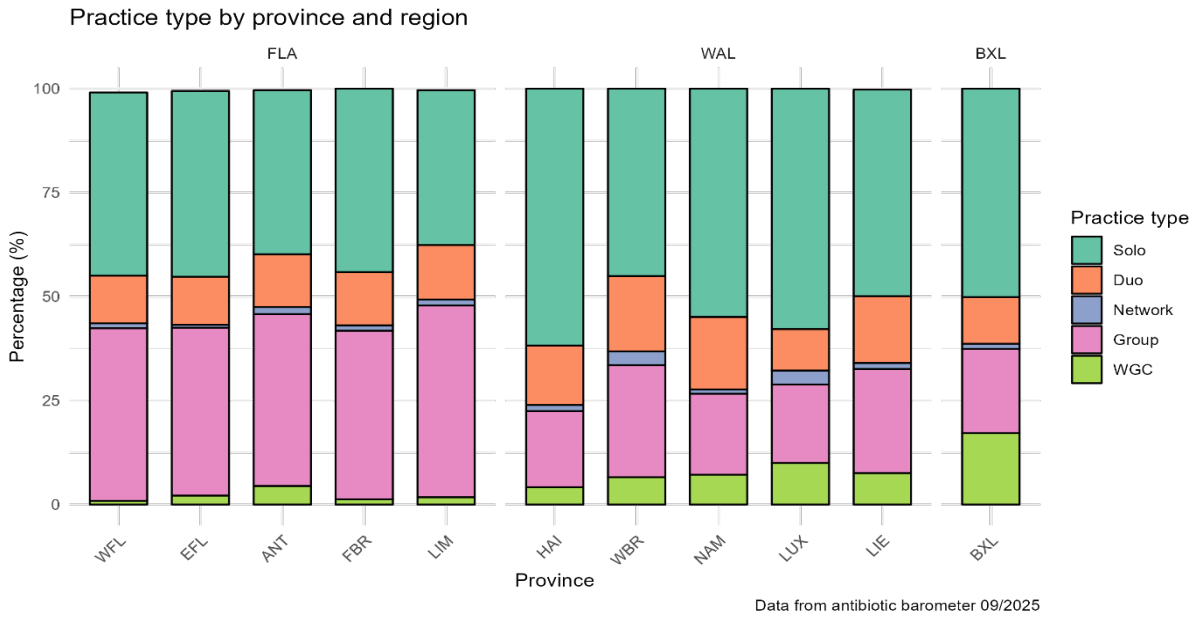


Figure 5 Distribution of practice types by province in the Antibiotic Barometer (summer 2025). The figure compares the proportions of solo, duo, network, group, and WGC (Wijkgezondheidscentrum/ maisons médicales/community health centers) practices across provinces. See earlier captions for province abbreviations

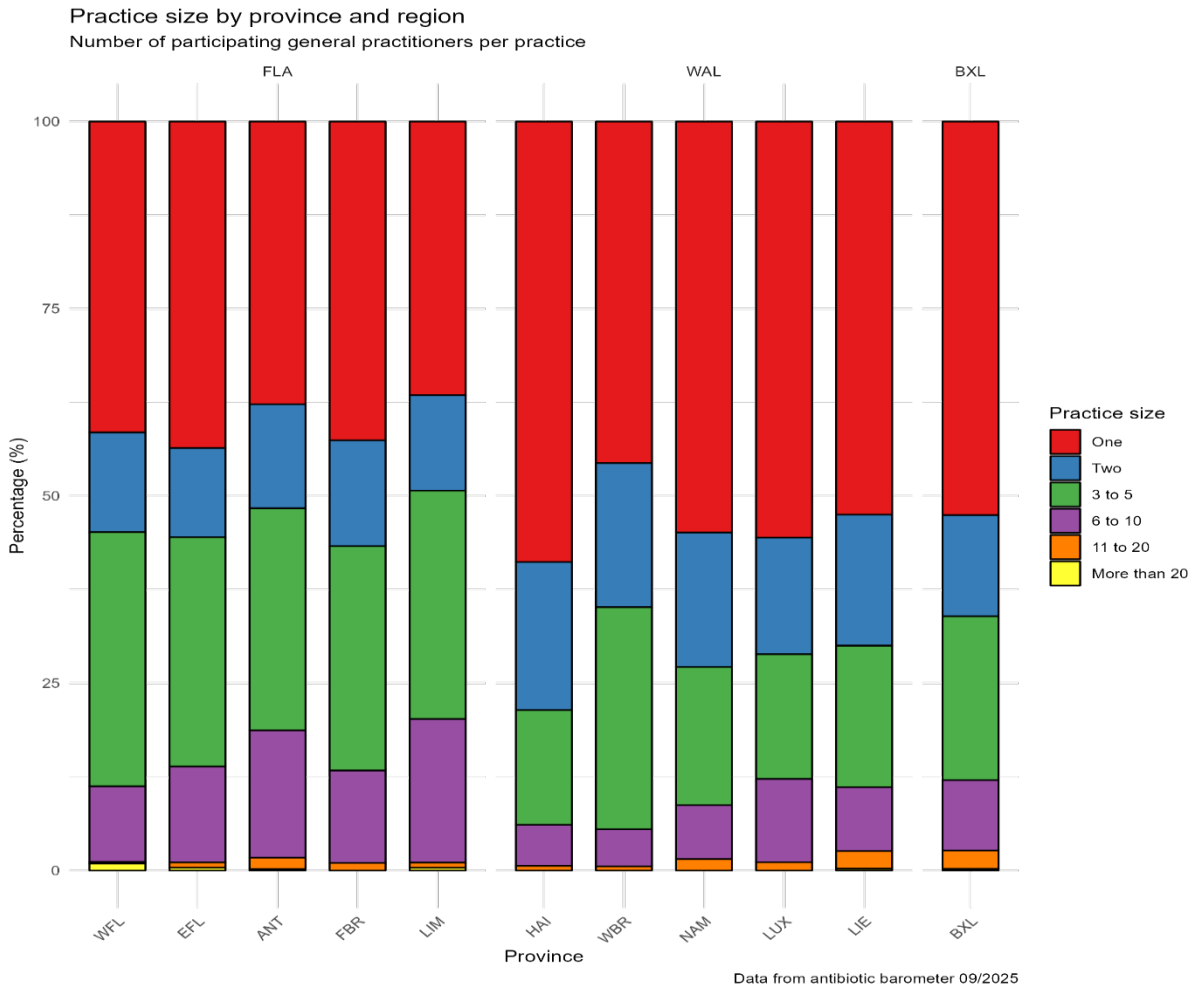


Figure 6 Distribution of practice size by province in the Antibiotic Barometer (summer 2025). See earlier captions for province abbreviations.

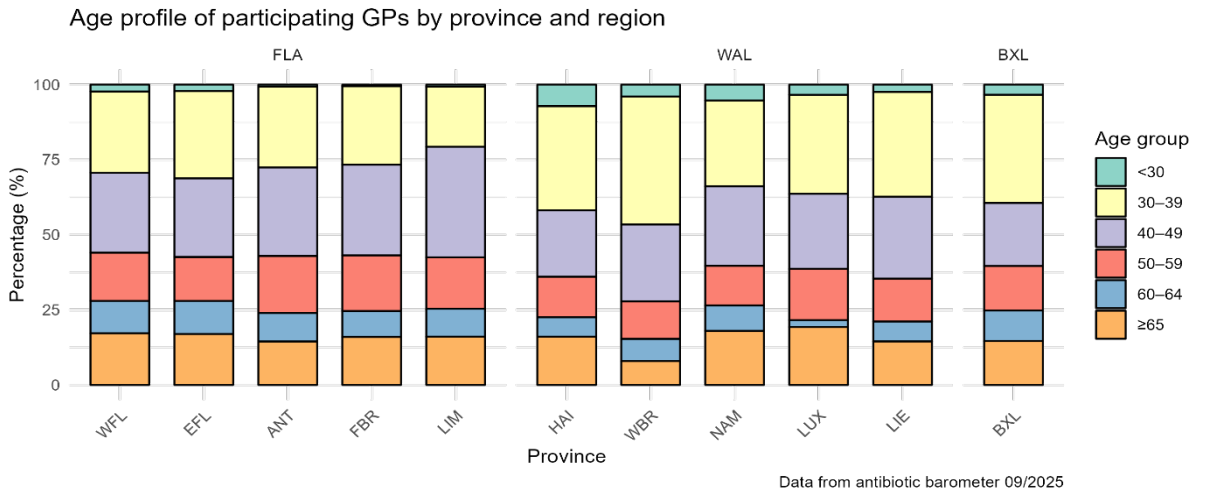


Figure 7 Mean age of participating GPs by province in the Antibiotic Barometer (summer 2025). The figure shows the proportion of GPs in six age categories: <30, 30–39, 40–49, 50–59, 60–64, and ≥65 years. See earlier captions for province abbreviations.

9.1.2.1 Practice types

Figure 5 illustrates that the types of practice distribution differ significantly among provinces, highlighting regional variations in primary care organisation. In Flanders, solo practices are still prevalent, although they are slightly less dominant than in Wallonia. For instance, West Flanders, East Flanders, and Flemish Brabant report solo practice shares of approximately 44%, whereas Antwerp and Limburg have marginally lower percentages. All Flemish provinces feature a significant presence of group practices, exceeding 40%, with Limburg having the highest proportion (46 %). Conversely, the Walloon provinces show a much higher prevalence of solo practices. Hainaut leads with 62% solo practices, and both Namur and Luxembourg surpass 50%. Group practices are less common in the Walloon provinces, ranging from 18% to 27%, and WGCs (Wijkgezondheidscentra/maisons médicales/community health centers) are rare outside Brussels. The Brussels-Capital Region has a unique profile: solo practices make up about 50%, but WGCs account for 17%, which is notably higher than in any other province.

9.1.2.2 Practice sizes

Figure 6 illustrates the distribution of practice sizes, quantified by the total number of General Practitioners (GPs) and GPs in training, categorized by province and region. The size of the participating practices closely aligned with the patterns observed in the practice types. Provinces with a higher prevalence of group practices, such as Limburg, Antwerp, and East Flanders, reported larger teams, with many practices comprising 3-5 GPs and a notable proportion in the 6-10 GP category. Limburg is particularly notable for having the highest proportion of large practices. In contrast, provinces characterized by a predominance of solo practices, such as Hainaut, Namur, and Luxembourg, exhibit very small team sizes: over half of the practices consist of a single GP, and practices with more than three GPs are rare. Walloon Brabant follows a similar pattern, although less than half of the practices consist of a single GP, and there is a higher proportion of practices with three or more GPs. The Brussels-Capital Region reflects its unique urban context: while solo practices remain prevalent, Brussels includes a significant proportion of very large practices and WGCs, some accommodating 11-20 GPs, which is exceptional compared to other provinces.

Age profile of participating general practitioners

illustrates the age range of the GPs who participated in the Antibiotic Barometer. A key observation is that provinces with a prevalence of solo practices, like Hainaut, Namur, and Luxembourg, do not necessarily have a larger share of older GPs, contrary to common belief. Except for Walloon Brabant, most provinces exhibit a similar percentage of GPs who are 65 years or older. Overall, the GPs participating in the Antibiotic Barometer tended to be older in Flanders than in the Walloon region. The Brussels-Capital Region offers a varied scenario: although solo practices are still widespread, the existence of large multidisciplinary canters and WGCs draws in a younger group, thereby balancing the age distribution relative to other areas.

9.1.2.3 Supporting staff in participating practices

Figure 8 illustrates the distribution of supporting staff in the participating practices, which varies significantly across provinces and mirrors the organisational structures previously mentioned. Provinces such as Antwerp, West Flanders, and Limburg, characterised by larger group-based practices, reported the highest numbers of assistants and nurses. In these areas, over 50% of practices employ an (administrative) assistant, and up to 25% have a nurse practitioner, highlighting the shift towards multidisciplinary care in the Flemish region.

Conversely, Walloon provinces, where solo practices are more prevalent, exhibit much lower staff availability than Flemish provinces. In these areas, the proportion of practices with assistants or nurses is often below 35% for assistants and below 15% for nurses, reflecting the smaller team sizes noted earlier.

The Brussels-Capital Region falls in between: although solo practices are still common, the presence of WGCs and large multidisciplinary practices seems to enhance the presence of nurses compared to the Walloon provinces.

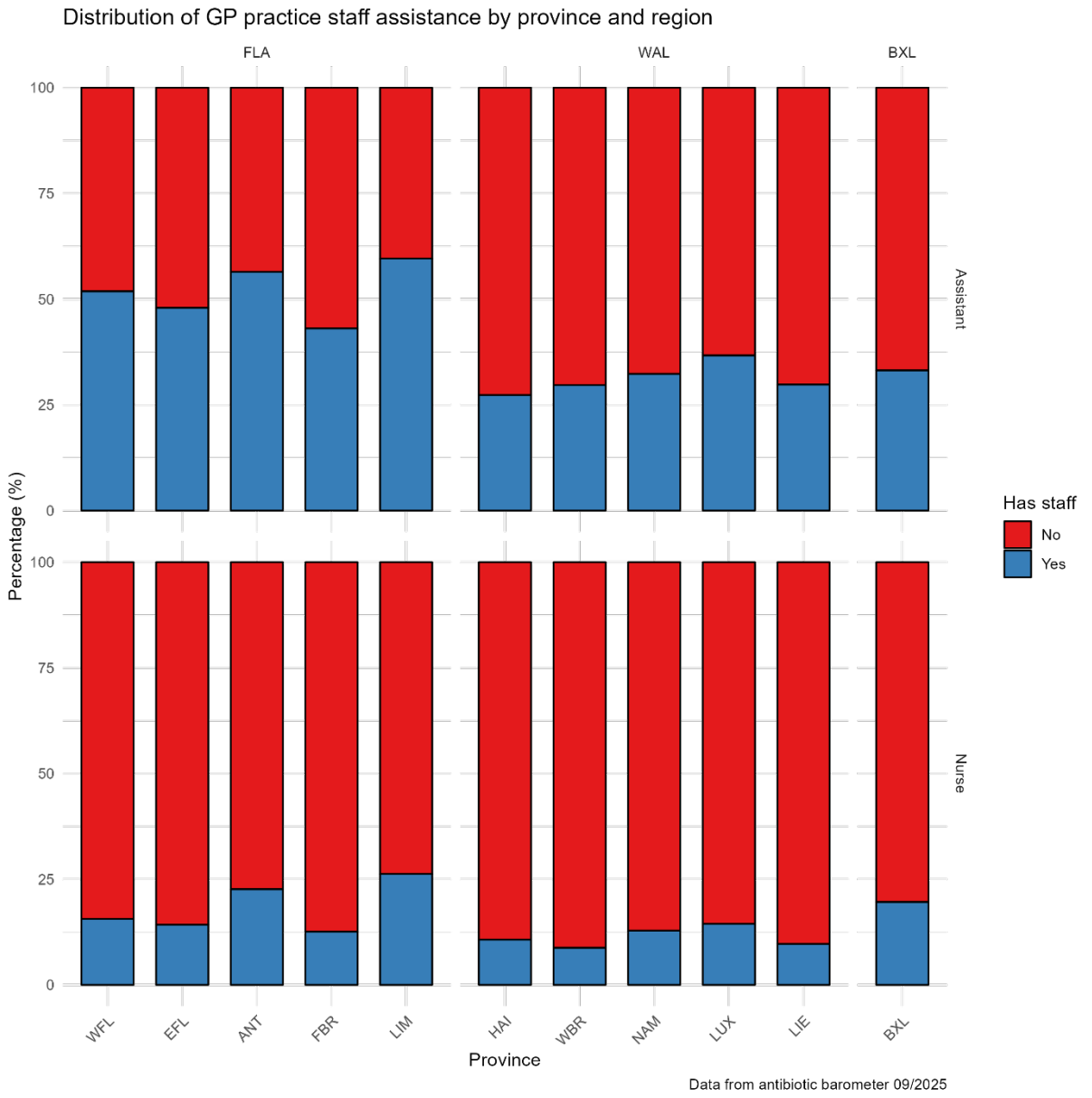


Figure 8 Distribution of supporting staff in participating practices by province in the Antibiotic Barometer (summer 2025).
See earlier captions for province abbreviations.

9.1.2.4 Electronic health record systems used in participating practices

Figure 9 illustrates that the distribution of EMR systems is heavily influenced by regional clustering, reflecting historical market penetration and practice organization. In Flanders, a single software provider (Software 1) dominates, capturing over 60% of practices in provinces such as West Flanders, East Flanders, and Antwerp. Meanwhile, Software 2 and Software 3 hold smaller portions in Flemish Brabant and Limburg, with Limburg exhibiting the most variety, including some use of Software 6. In Wallonia, the landscape is more varied, with no single provider taking the lead. Software 1 is still present but to a lesser extent, while Software 3 and Software 5 are prevalent in several provinces, especially in Walloon Brabant, Namur and Luxembourg.

The Brussels-Capital Region stands out for its diversity: while Software 1 retains a significant share, Software 3 and 5 are widely used, and smaller shares of other systems are observed. This diversity may

mirror the region's heterogeneous practice landscape, including solo and group practices, as well as WGCs.

Software 8 and 9 were utilised very infrequently. These software packages are designed for use outside regular office hours, which accounts for their limited use.

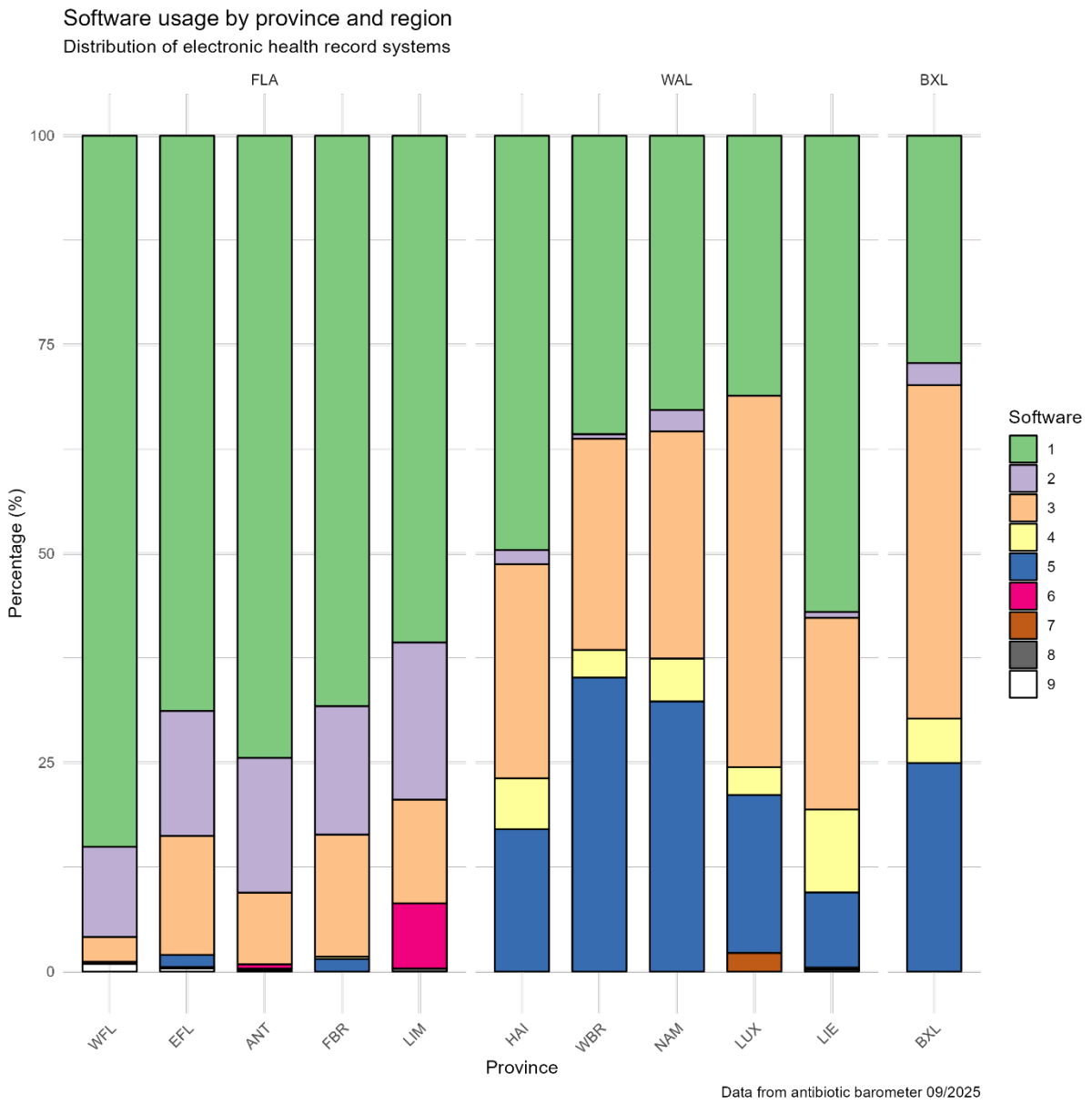


Figure 9 Distribution of electronic health record (EHR) systems by province in the Antibiotic Barometer (summer 2025).
See earlier captions for province abbreviations.

Table 3 Summary of practice characteristics and contextual factors for participating general practices in the Antibiotic Barometer (summer 2025).

Region	FLA					WAL					BXL
Province	**WFL**	**EFL**	**ANT**	**FBR**	**LIM**	**HAI**	**WBR**	**NAM**	**LUX**	**LIE**	**BXL**
Barometer participation											
Number of practices	439	564	590	403	288	489	191	205	97	440	505
Total number of GPs	1,404	1,636	1,717	1,068	1,014	1,017	380	487	221	1,124	1,331
Practice characteristics											
Practice type											
Solo	192 (44.0%)	248 (44.7%)	230 (39.5%)	175 (44.1%)	105 (37.2%)	294 (61.8%)	82 (45.1%)	107 (54.9%)	52 (57.8%)	210 (49.6%)	245 (50.1%)
Duo	50 (11.5%)	64 (11.5%)	74 (12.7%)	51 (12.8%)	37 (13.1%)	68 (14.3%)	33 (18.1%)	34 (17.4%)	9 (10.0%)	68 (16.1%)	55 (11.2%)
Network	5 (1.1%)	4 (0.7%)	10 (1.7%)	5 (1.3%)	4 (1.4%)	7 (1.5%)	6 (3.3%)	2 (1.0%)	3 (3.3%)	6 (1.4%)	6 (1.2%)
Group	181 (41.5%)	224 (40.4%)	241 (41.3%)	161 (40.6%)	130 (46.1%)	87 (18.3%)	49 (26.9%)	38 (19.5%)	17 (18.9%)	106 (25.1%)	99 (20.2%)
WGC	4 (0.9%)	12 (2.2%)	26 (4.5%)	5 (1.3%)	5 (1.8%)	20 (4.2%)	12 (6.6%)	14 (7.2%)	9 (10.0%)	32 (7.6%)	84 (17.2%)
Out-of-office hours	4 (0.9%)	3 (0.5%)	2 (0.3%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	0 (0.0%)
Practice size (n°GPs)											
One	181 (41.6%)	242 (43.6%)	220 (37.7%)	169 (42.6%)	103 (36.5%)	280 (58.8%)	83 (46.1%)	107 (54.9%)	50 (55.6%)	222 (52.5%)	257 (52.6%)
Two	58 (13.3%)	66 (11.9%)	81 (13.9%)	56 (14.1%)	36 (12.8%)	94 (19.7%)	35 (19.4%)	35 (17.9%)	14 (15.6%)	74 (17.5%)	66 (13.5%)

Region	FLA					WAL					BXL
Province	**WFL**	**EFL**	**ANT**	**FBR**	**LIM**	**HAI**	**WBR**	**NAM**	**LUX**	**LIE**	**BXL**
3-5	148 (34.0%)	170 (30.6%)	173 (29.7%)	119 (30.0%)	86 (30.5%)	73 (15.3%)	54 (30.0%)	36 (18.5%)	15 (16.7%)	80 (18.9%)	107 (21.9%)
6-10	44 (10.1%)	71 (12.8%)	99 (17.0%)	49 (12.3%)	54 (19.1%)	26 (5.5%)	7 (3.9%)	14 (7.2%)	10 (11.1%)	36 (8.5%)	46 (9.4%)
11-20	1 (0.2%)	4 (0.7%)	9 (1.5%)	4 (1.0%)	2 (0.7%)	3 (0.6%)	1 (0.6%)	3 (1.5%)	1 (1.1%)	10 (2.4%)	12 (2.5%)
>20	3 (0.7%)	2 (0.4%)	1 (0.2%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	1 (0.2%)
GPs' mean age profile											
<35	10 (2.3%)	12 (2.1%)	4 (0.7%)	2 (0.5%)	2 (0.7%)	33 (6.9%)	7 (3.8%)	10 (5.4%)	3 (3.3%)	10 (2.4%)	16 (3.3%)
35-44	118 (27.1%)	161 (28.2%)	156 (26.7%)	103 (25.9%)	56 (19.9%)	160 (33.6%)	75 (41.2%)	54 (29.2%)	29 (32.2%)	142 (33.6%)	170 (34.8%)
45-54	116 (26.6%)	145 (25.4%)	171 (29.3%)	119 (30.0%)	103 (36.5%)	102 (21.4%)	45 (24.7%)	40 (21.6%)	22 (24.4%)	111 (26.2%)	99 (20.2%)
55-64	70 (16.1%)	81 (14.2%)	110 (18.8%)	73 (18.4%)	48 (17.0%)	62 (13.0%)	22 (12.1%)	25 (13.5%)	15 (16.7%)	58 (13.7%)	70 (14.3%)
65-74	47 (10.8%)	61 (10.7%)	55 (9.4%)	34 (8.6%)	26 (9.2%)	30 (6.3%)	13 (7.1%)	16 (8.6%)	2 (2.2%)	27 (6.4%)	48 (9.8%)
≥75	75 (17.2%)	94 (16.5%)	84 (14.4%)	63 (15.9%)	45 (16.0%)	74 (15.5%)	14 (7.7%)	34 (18.4%)	17 (18.9%)	59 (13.9%)	69 (14.1%)
Missing	0 (0.0%)	17 (3.0%)	4 (0.7%)	3 (0.8%)	2 (0.7%)	15 (3.2%)	6 (3.3%)	6 (3.2%)	2 (2.2%)	16 (3.8%)	17 (3.5%)
GPs' staff											
Practice nurse practitioner	68 (23.1%)	79 (22.9%)	132 (28.6%)	50 (22.6%)	74 (30.6%)	51 (28.2%)	16 (22.9%)	25 (28.4%)	13 (28.3%)	41 (24.6%)	96 (37.2%)

Region	FLA					WAL					BXL
Province	**WFL**	**EFL**	**ANT**	**FBR**	**LIM**	**HAI**	**WBR**	**NAM**	**LUX**	**LIE**	**BXL**
Practice assistant	226 (76.9%)	266 (77.1%)	329 (71.4%)	171 (77.4%)	168 (69.4%)	130 (71.8%)	54 (77.1%)	63 (71.6%)	33 (71.7%)	126 (75.4%)	162 (62.8%)
GPs' EMR system											
1	371 (85.1%)	382 (68.8%)	434 (74.4%)	271 (68.3%)	171 (60.6%)	236 (49.6%)	65 (35.7%)	64 (32.8%)	28 (31.1%)	241 (57.0%)	133 (27.2%)
2	47 (10.8%)	83 (15.0%)	94 (16.1%)	61 (15.4%)	53 (18.8%)	8 (1.7%)	1 (0.5%)	5 (2.6%)	0 (0.0%)	3 (0.7%)	13 (2.7%)
3	13 (3.0%)	79 (14.2%)	50 (8.6%)	58 (14.6%)	35 (12.4%)	122 (25.6%)	46 (25.3%)	53 (27.2%)	40 (44.4%)	97 (22.9%)	195 (39.9%)
4	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	29 (6.1%)	6 (3.3%)	10 (5.1%)	3 (3.3%)	42 (9.9%)	26 (5.3%)
5	0 (0.0%)	8 (1.4%)	0 (0.0%)	6 (1.5%)	0 (0.0%)	81 (17.0%)	64 (35.2%)	63 (32.3%)	17 (18.9%)	38 (9.0%)	122 (24.9%)
6	1 (0.2%)	0 (0.0%)	3 (0.5%)	0 (0.0%)	22 (7.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
7	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (2.2%)	1 (0.2%)	0 (0.0%)
8	0 (0.0%)	1 (0.2%)	1 (0.2%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
9	4 (0.9%)	2 (0.4%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	0 (0.0%)

9.1.3 Indicator performance

Figure 10 presents a summary of the prescribed antibiotics, first-choice antibiotics, and quinolones as outlined in the Antibiotic Barometer. Overall, the Brussels-Capital Region had the lowest antibiotic prescriptions, with antibiotics being prescribed in less than half of the cases for acute upper respiratory infections (R74). Quinolones are predominantly prescribed for cystitis and other urinary infections (U71). For conditions such as pneumonia (R81), acute bronchitis/bronchiolitis (R78), and acute otitis media (H71), over 75% of the antibiotic prescriptions were for the first-choice antibiotics.

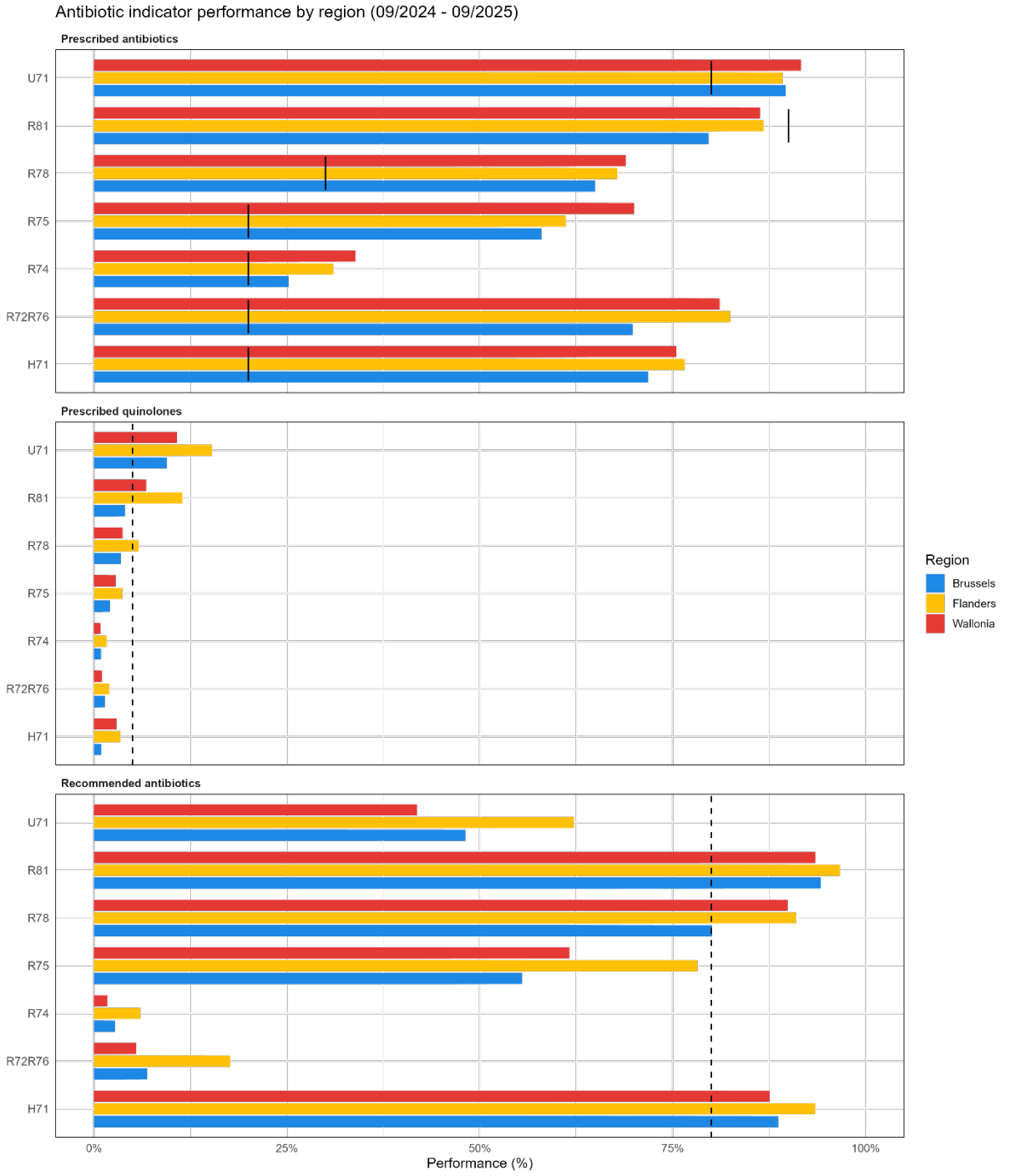


Figure 10 Weighted indicator performance for prescriptions for antibiotics, recommended (first-choice) antibiotics and quinolones in the Antibiotic Barometer (fall 2024 - summer 2025) for the seven indications per region.
Black vertical line and dotted line show the acceptable ranges (Table 4). See above for abbreviations.

9.1.3.1 *Antibiotic prescription by diagnosis*

Looking at antibiotic prescriptions at the provincial level (Figure 11), we see that for multiple diagnoses, antibiotics are more often prescribed in West Flanders and Limburg than in the other Flemish provinces. In Walloon Brabant, the province with the least antibiotic prescriptions for several diagnoses, this may be due to its proximity to the Brussels-Capital Region, where the same pattern is observed. Only for sinusitis (R75) there was a clear distinct pattern between Flanders and Wallonia, with antibiotics prescribed less often in the Flemish provinces than in the Walloon provinces.

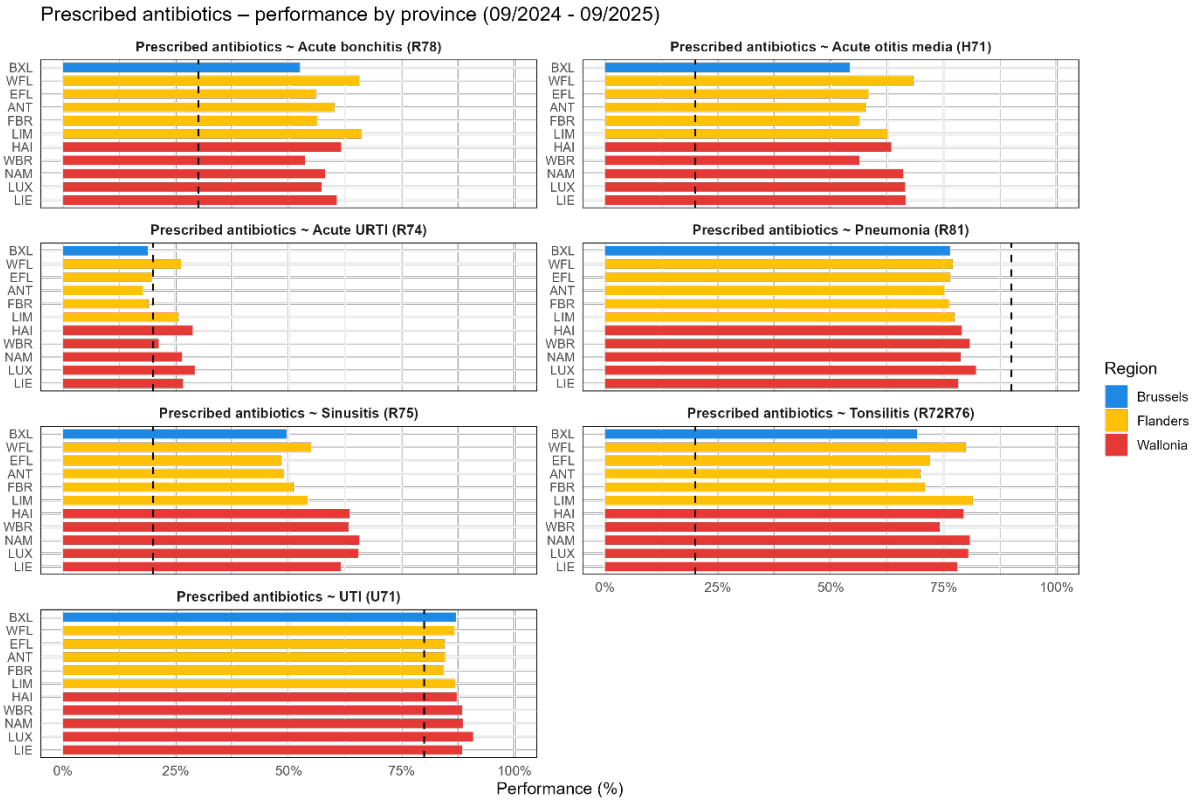


Figure 11 Weighted indicator performance for prescriptions for antibiotics in the Antibiotic Barometer (fall 2024 - summer 2025) for the seven indications per province.
Black vertical line and dotted line show the acceptable ranges (Table 4). See above for abbreviations.

Recommended antibiotic versus quinolones prescription per diagnosis

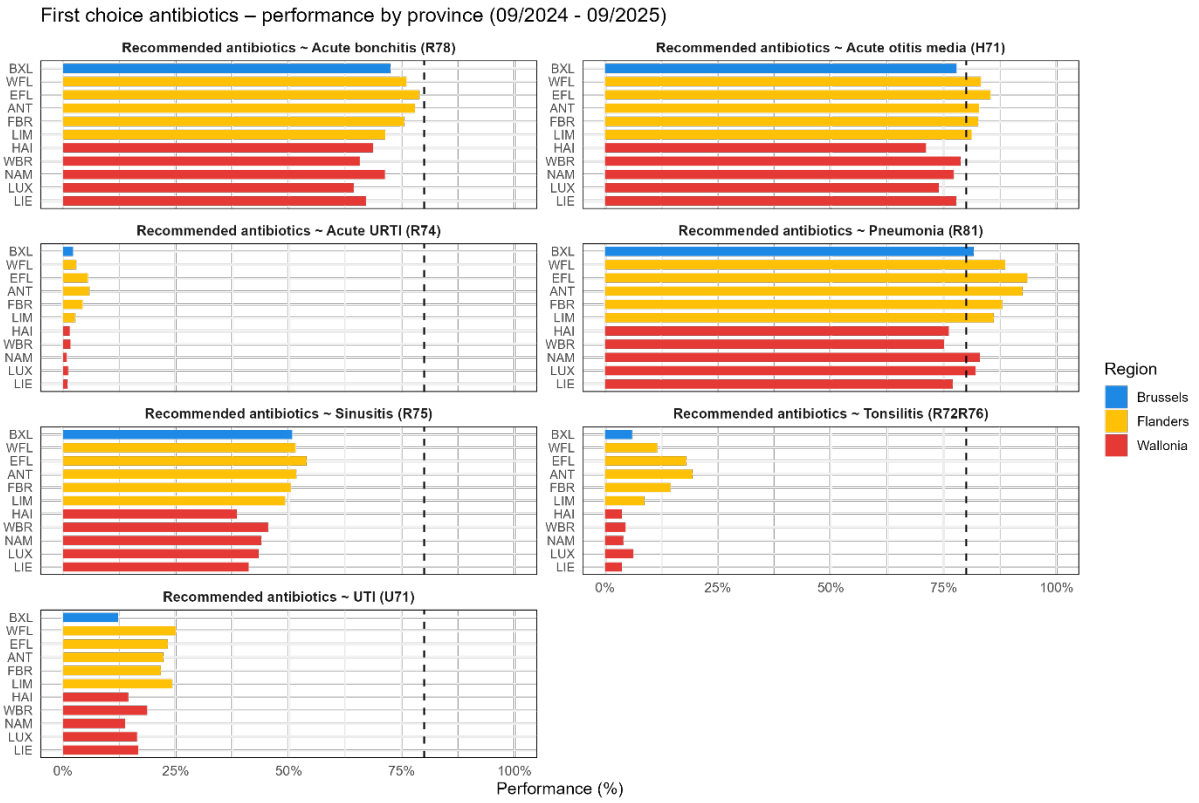


Figure 12 and Figure 13 show the proportion of patients receiving antibiotic prescriptions who were prescribed a first-choice antibiotic or quinolone. Generally, there were no significant differences at the provincial level for these indicators. The one exception were prescriptions for cystitis/other urinary infection (U71) in Brussels, where a low score for both first-choice antibiotics and quinolones was observed, indicating that many prescriptions for other types of antibiotics were made for this diagnosis in Brussels.

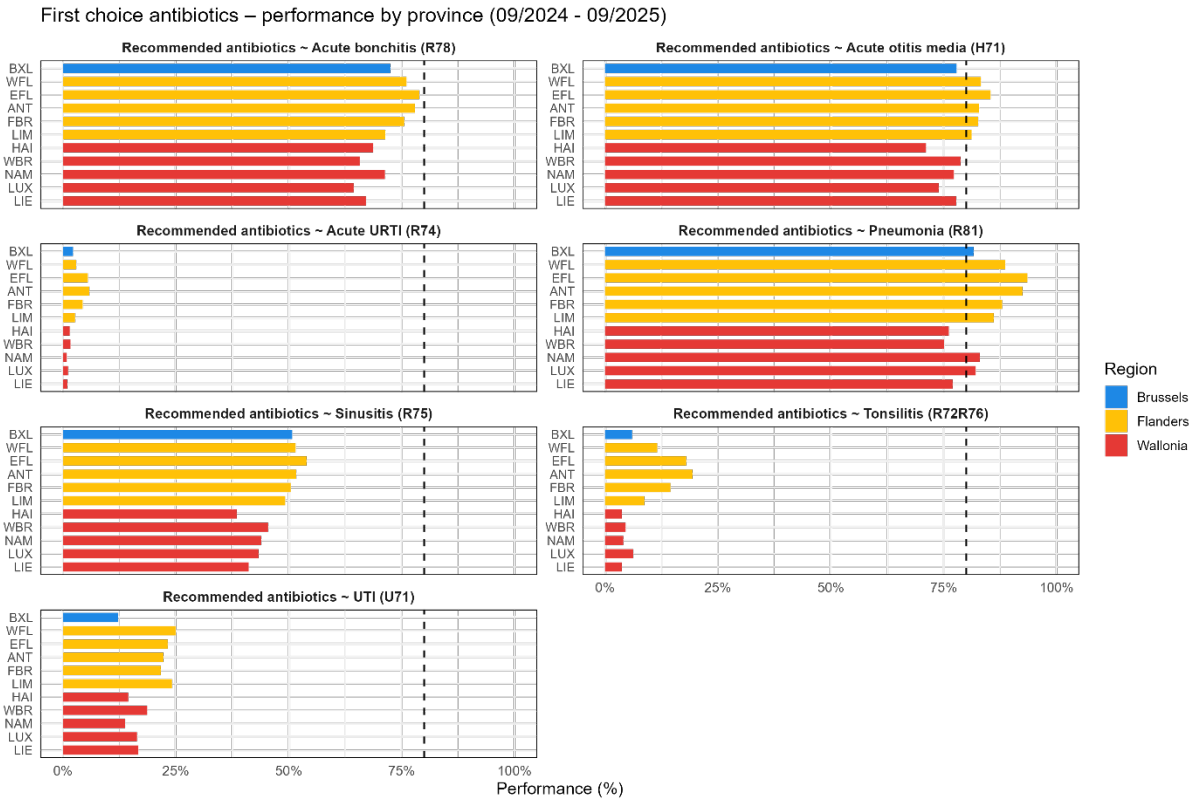


Figure 12 Weighted indicator performance for prescriptions for first-choice antibiotics in the Antibiotic Barometer (fall 2024 - summer 2025) for the seven indications per province.
Black vertical line and dotted line show the acceptable ranges (Table 4). See above for abbreviations

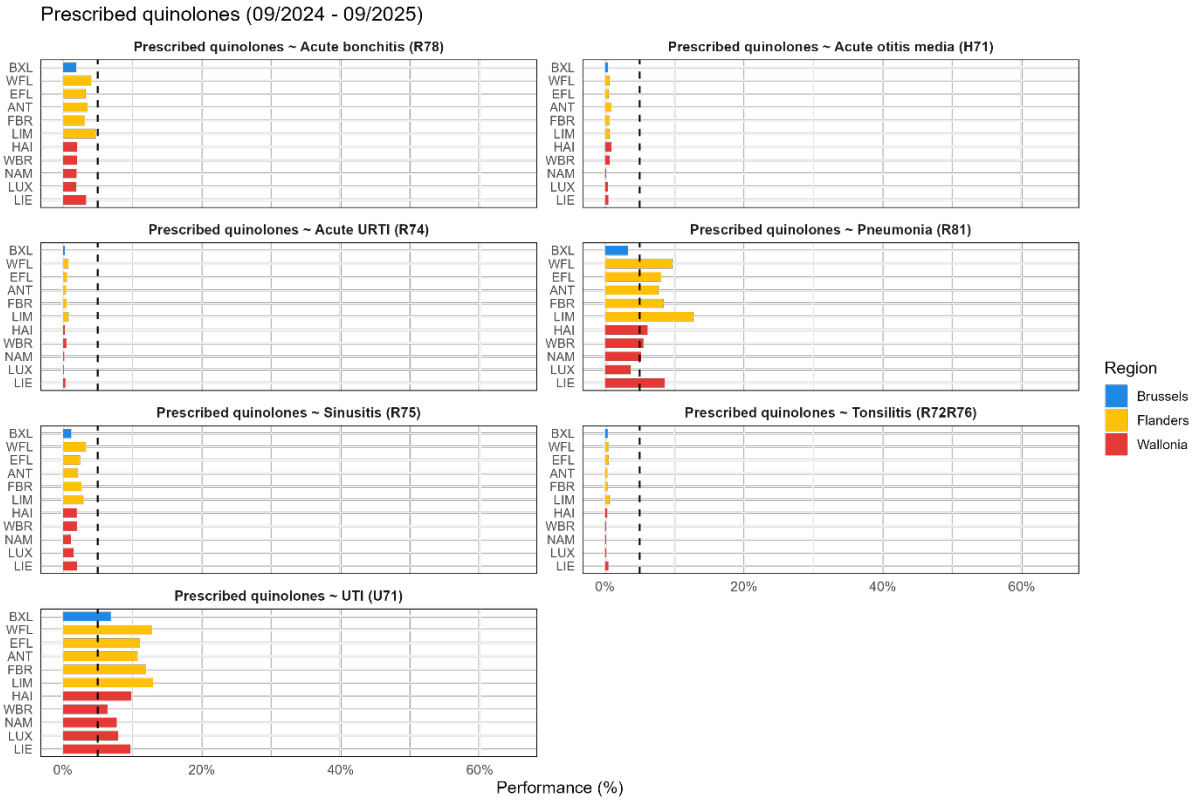


Figure 13 Weighted indicator performance for prescriptions of quinolones in the Antibiotic Barometer (fall 2024 - summer 2025) for the seven indications per province.
Black vertical line and dotted line show the acceptable ranges (Table 4). See above for abbreviations.

9.1.3.2 Age group differences

Figure 14 shows the differences in prescription behaviour for minors, adults, and overall for each indication in the Antibiotic Barometer. In general, quinolones are less often prescribed to minors than to adults. For pneumonia (R81), acute bronchitis/bronchiolitis (R78), and acute otitis media (H71), minors tended to receive the recommended antibiotics more often than adults.

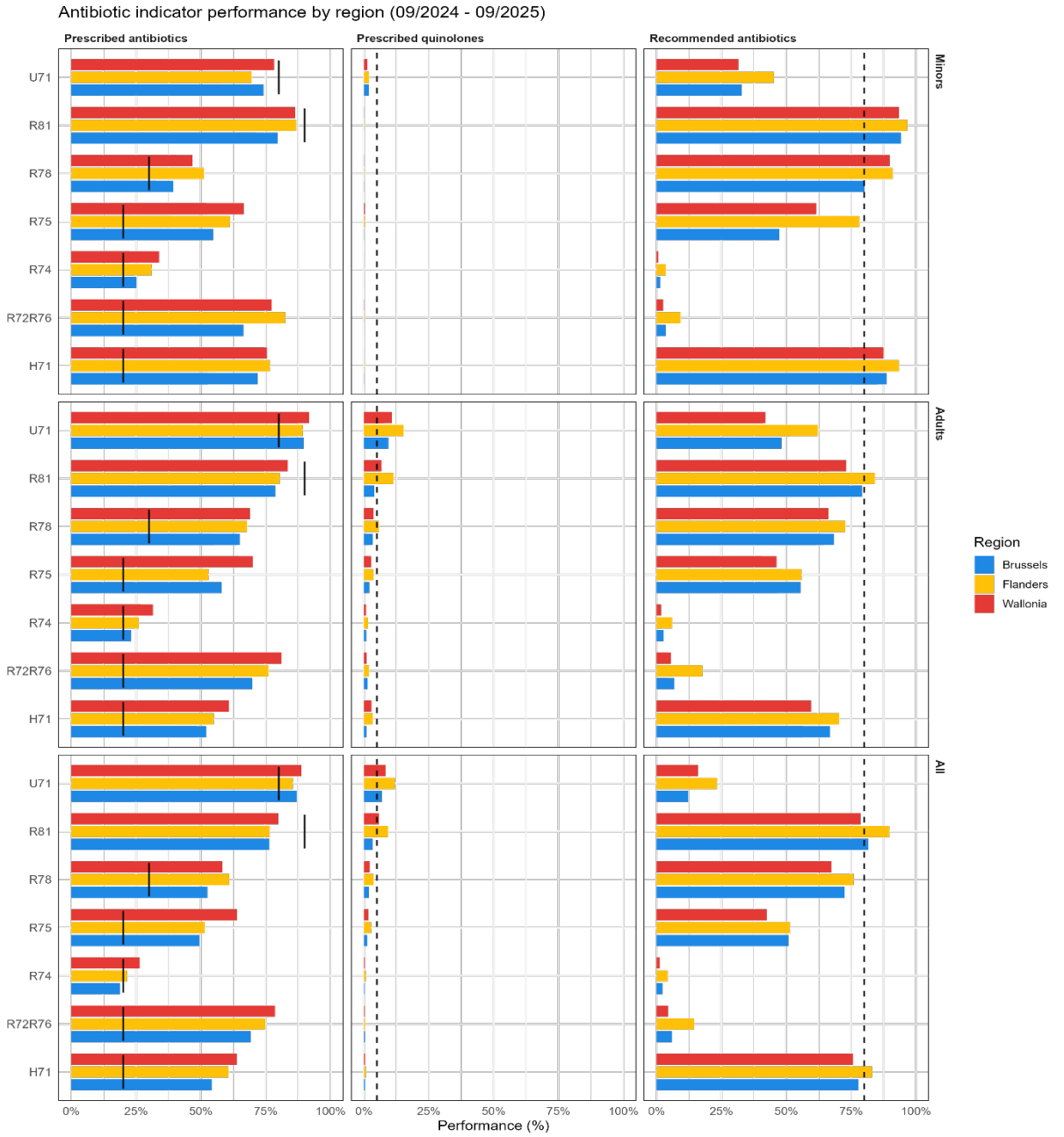


Figure 14 Weighted indicator performance for prescriptions for antibiotics, recommended (first-choice) antibiotics and quinolones in the Antibiotic Barometer (fall 2024 - summer 2025) for the seven indications for each region and for 3 age groups: minors (< 18 years), adults (≥ 18 years) and all.
Black vertical line and dotted line show the acceptable ranges (Table 4). See above for abbreviations.

9.2 Longitudinal analysis

9.2.1 Practice participation

The evolution of participation in the Antibiotic Barometer across different time points is shown in Figure 15 and 16. Participation increased between fall 2023 and summer 2025 in almost all provinces for both practices (Figure 15) and GPs (figure 16). In Flanders, the absolute counts were the highest throughout Antwerp, East Flanders, and West Flanders, peaking in winter 2024 (for example, Antwerp practices 483→611→590; GPs 1,572→1,752→1,717), followed by a slight decline in spring 2025 in most provinces. In Wallonia, participation steadily grew across the series, with Liège showing the largest increase (practices 333→440; GPs 920→1,124). In Wallonia, we also observe a slight decline in spring 2025 in some provinces, such as Hainaut, Walloon Brabant, and Namur. The Brussels-Capital Region also increased in winter 2024 (practices: 392→510→502; GPs: 1,095→1,312→1,310) with a small dip in spring 2025. Overall, regional differences are visible in the higher absolute participation in Flanders, intermediate and growing participation in the Walloon Region, and the Brussels-Capital Region trending upwards to late 2024, with a modest fallback in the spring 2025 timepoint.

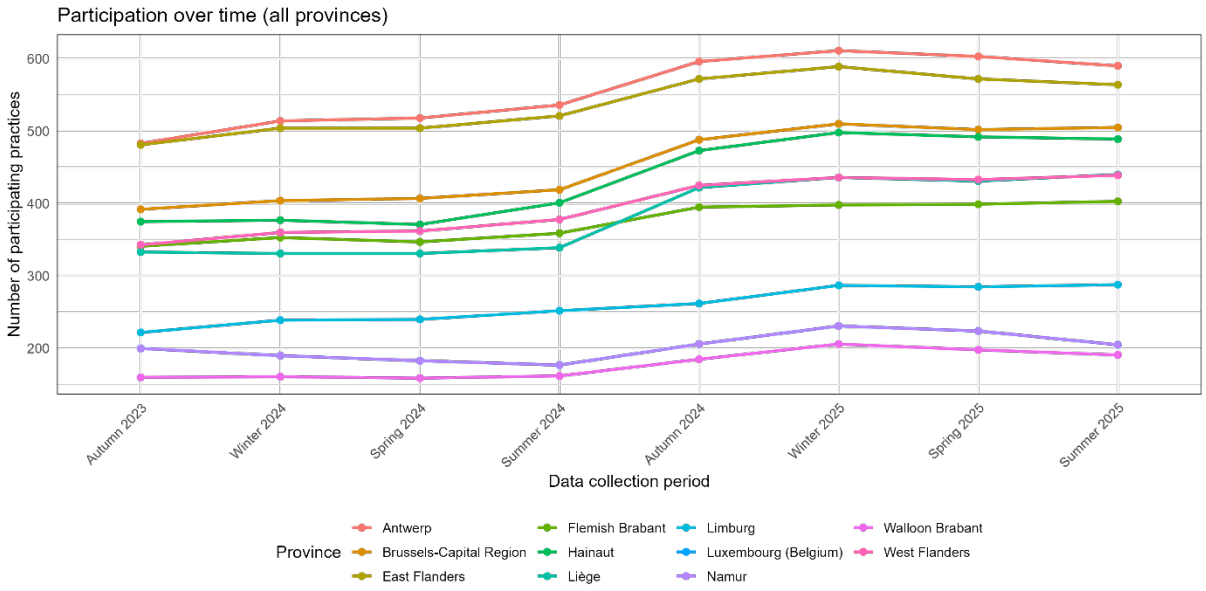


Figure 15 Evolution in Antibiotic Barometer participation across seasonal data collections from fall 2023 to summer 2025, for the number of practices. See earlier captions for province abbreviations.

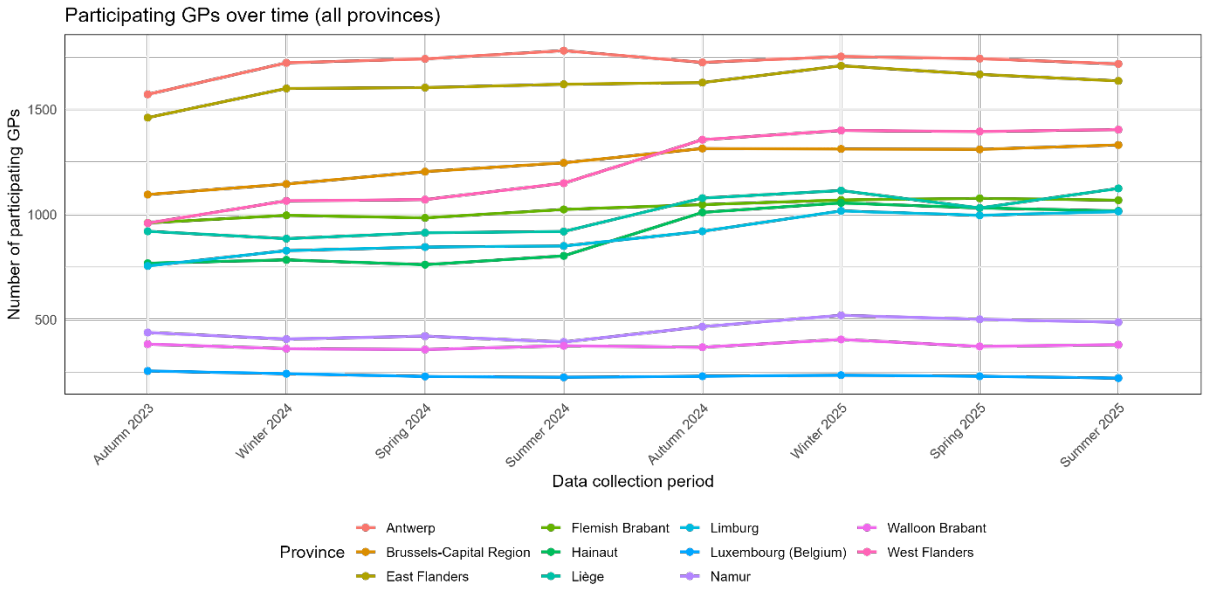


Figure 16 Evolution in Antibiotic Barometer participation across seasonal data collections from fall 2023 to summer 2025, for the number of general practitioners. See earlier captions for province abbreviations.

9.2.2 Registered diagnoses

Figure 16 shows the evolution of newly registered diagnoses during each season from fall 2023 to summer 2025 for the seven indications. The first noticeable finding were seasonal variations, with a clear peak registration of all respiratory diagnoses during winter, steadily decreasing during spring to a low level in summer. For example, for acute bronchitis/bronchiolitis (R78), the peak of registered diagnoses was 3,53% and the minimum was 1,14%. The exception was the registration of urinary tract infections (U71), where the seasonal pattern was completely different. Two minor peaks and dips were observed. The peaks were located in summer 2024 and summer 2025 (maximum 1,93%). The dips were located in winter 2024 and winter 2025 (minimum 1,51%).

There were also some regional differences in registered diagnoses, with pneumonia being more frequently diagnosed in Flanders and acute otitis media being most frequently diagnosed in the Brussels-Capital Region.

A more detailed analysis of the differences in registration for each age category shows clear differences in some diagnoses (Figure 17). Acute otitis media (H71) was more frequently diagnosed in minors, with a maximum of 6.75%, whereas pneumonia (R81) was most frequently diagnosed in the adults (maximum of 6.31%). Acute upper respiratory infections (R74) are most frequently diagnosed in minors but are also frequently diagnosed in adults.

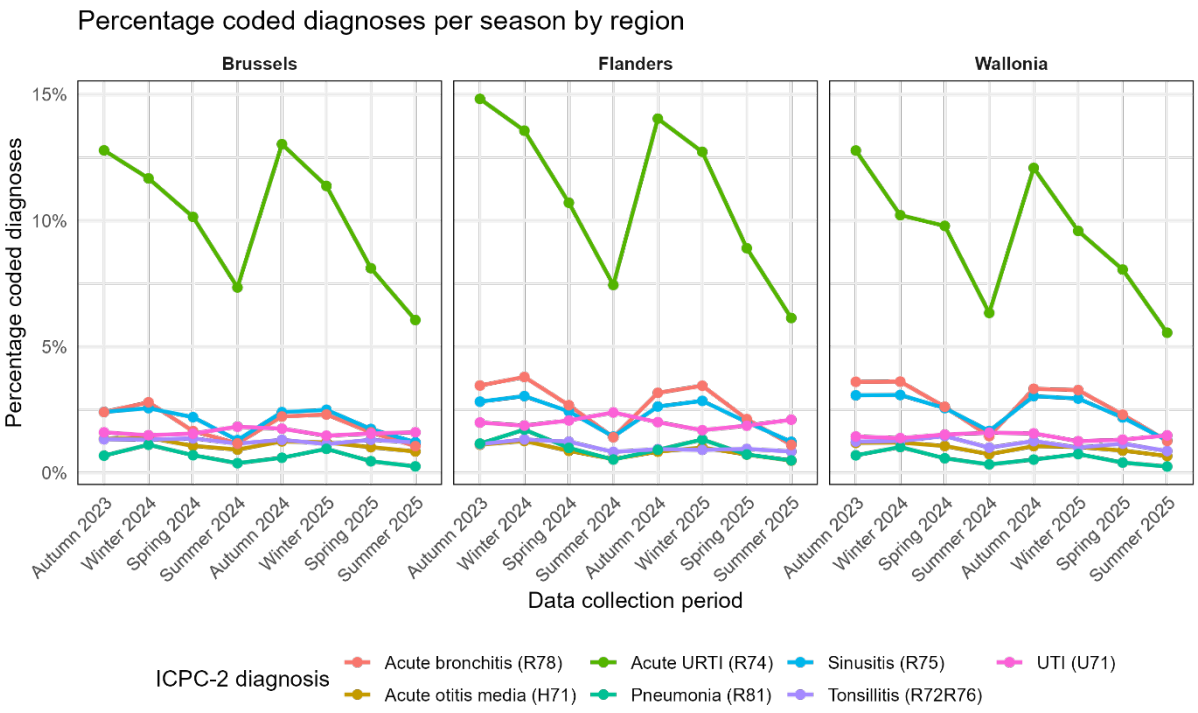
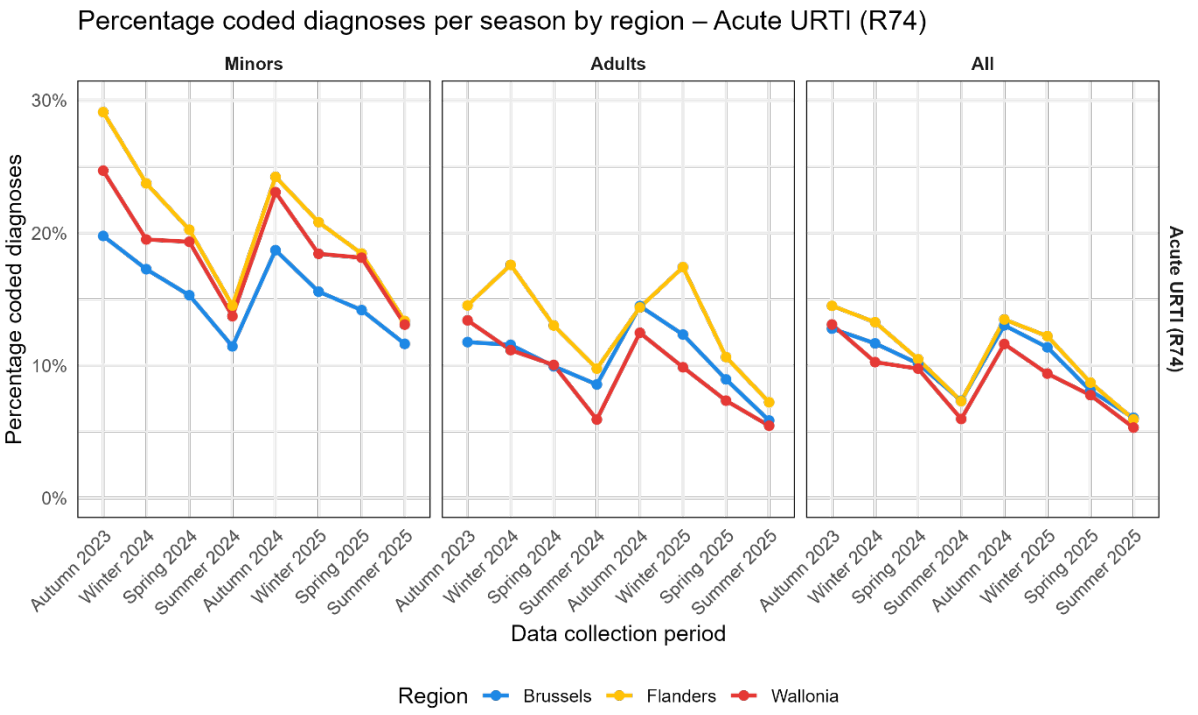


Figure 16 Newly registered diagnoses during each season from fall 2023 to summer 2025 for the seven indications for each region.



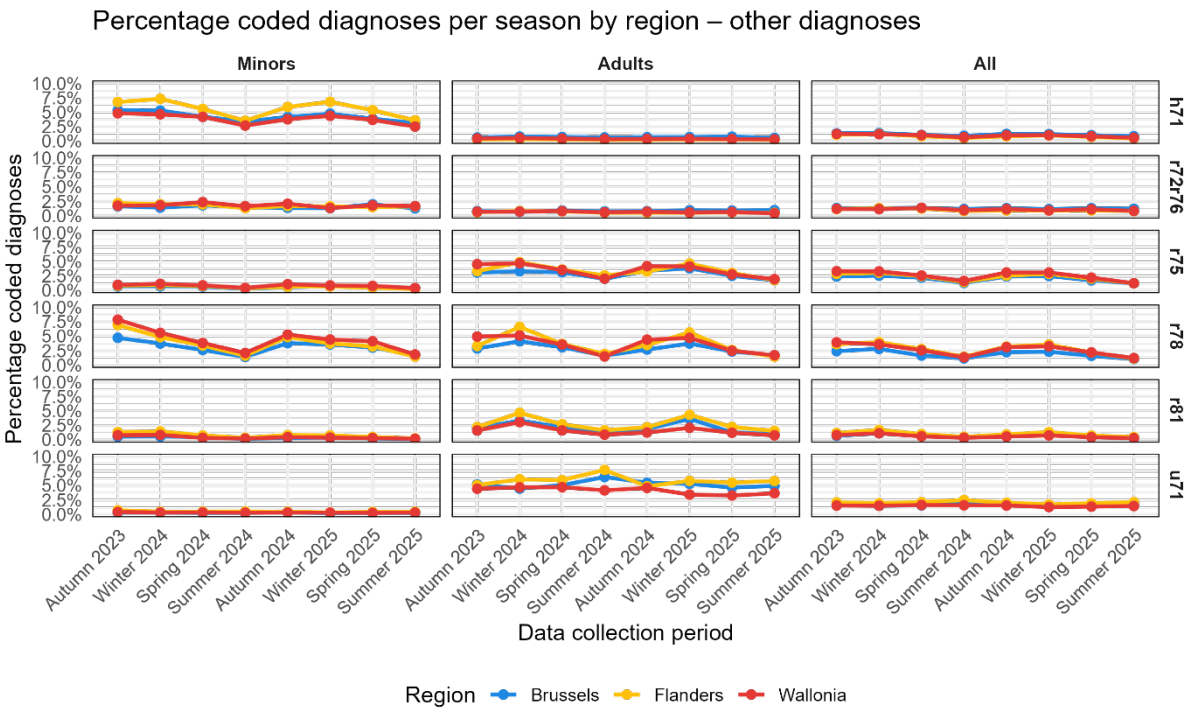


Figure 17 Newly registered diagnoses during each season from fall 2023 to summer 2025 for the seven indications for three age categories: minors (< 18 years), adults (18-65 years) and overall
Indications: R78 = acute bronchitis/bronchiolitis, R74 = acute upper respiratory infection, U71 = cystitis/other urinary infection, R76 = acute tonsillitis, R75 = acute/chronic sinusitis, H71 = acute otitis media, and R81 = pneumonia.

9.2.3 Indicator performance

Figure 18 shows that the overall percentage of patient contacts resulting in an antibiotic prescription decreased from 14.9% to 12.6% in just one year. The strongest decrease was observed in minors (0-18 years), while in adults the trend was similar but less pronounced. Figure 19 shows the longitudinal evolution per season in the percentage of patients contacts that resulted in an antibiotic prescription. In all provinces and the Brussels-Capital Region a decrease was observed when comparing the periods fall 2023 - summer 2024 and fall 2024 - summer 2025. In the Walloon provinces, the highest percentage of patient contacts resulted in an antibiotic prescription, but at the same time the strongest decrease was observed in this region when comparing both periods.

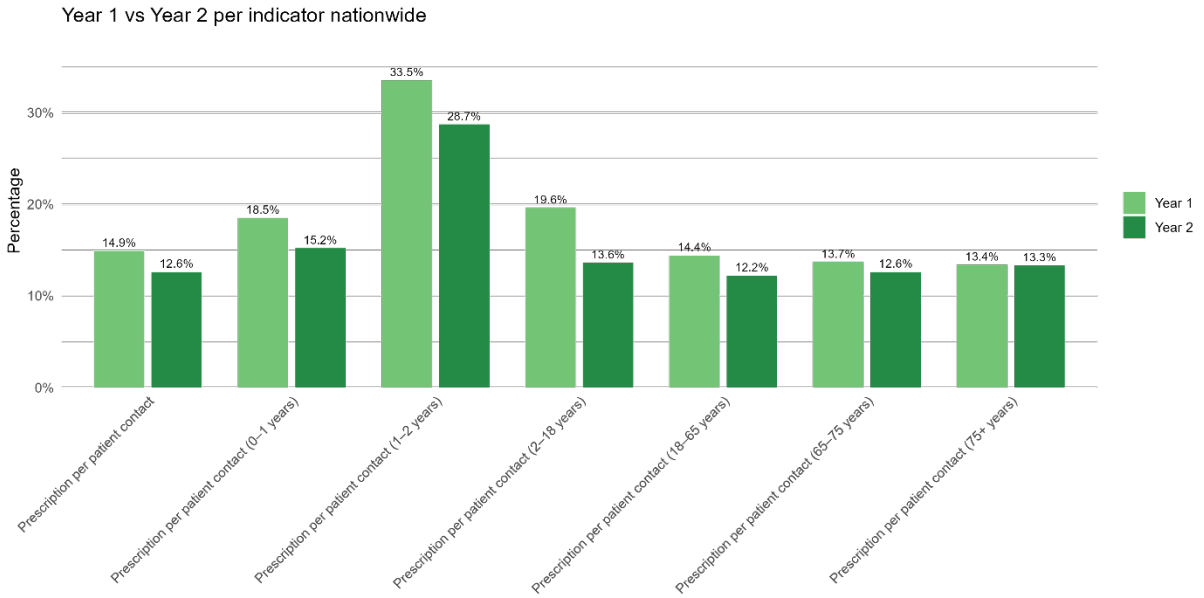


Figure 18 Bar charts comparing year 1 (fall 2023 - summer 2024) and year 2 (fall 2024 - summer 2025) for the percentage of patient contacts resulting in an antibiotic prescription (overall and by age group).

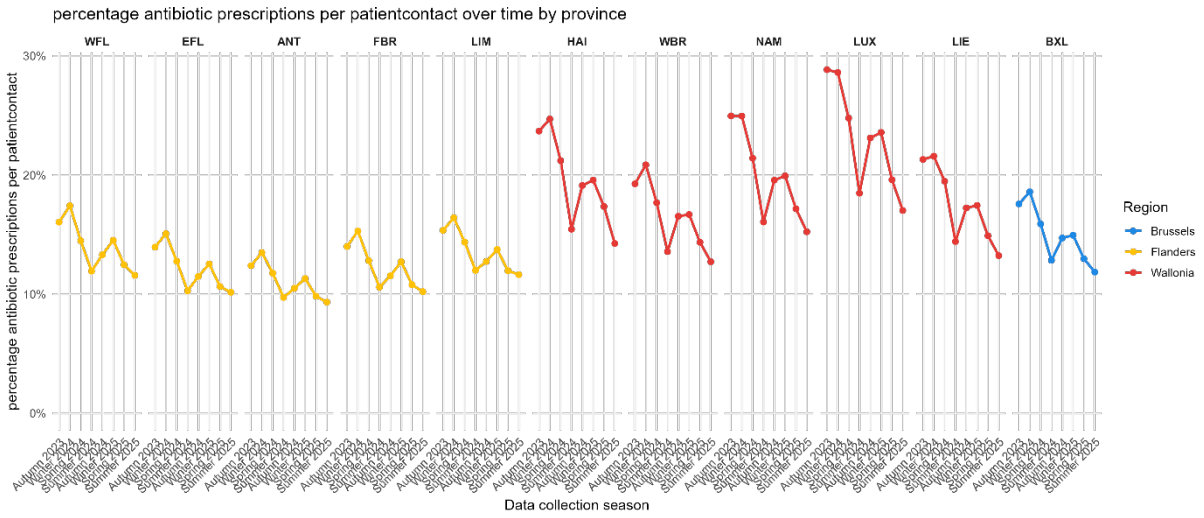


Figure 19 Longitudinal evolution (fall 2023 to summer 2025) by province of the percentage of patient contacts resulting in an antibiotic prescription. See earlier captions for province abbreviations.

Figure 20 shows the longitudinal evolution of the prescribed antibiotics during each season in the Antibiotic Barometer. Antibiotics were least prescribed for acute upper respiratory infections (R74) in all age categories. Antibiotics were less frequently prescribed for cystitis/other urinary infection (U71) and acute bronchitis/bronchiolitis (R78) in minors than in adults. For some diagnoses, a slight trend towards fewer antibiotic prescriptions was observed between fall 2023 and summer 2025, even considering seasonal fluctuations.

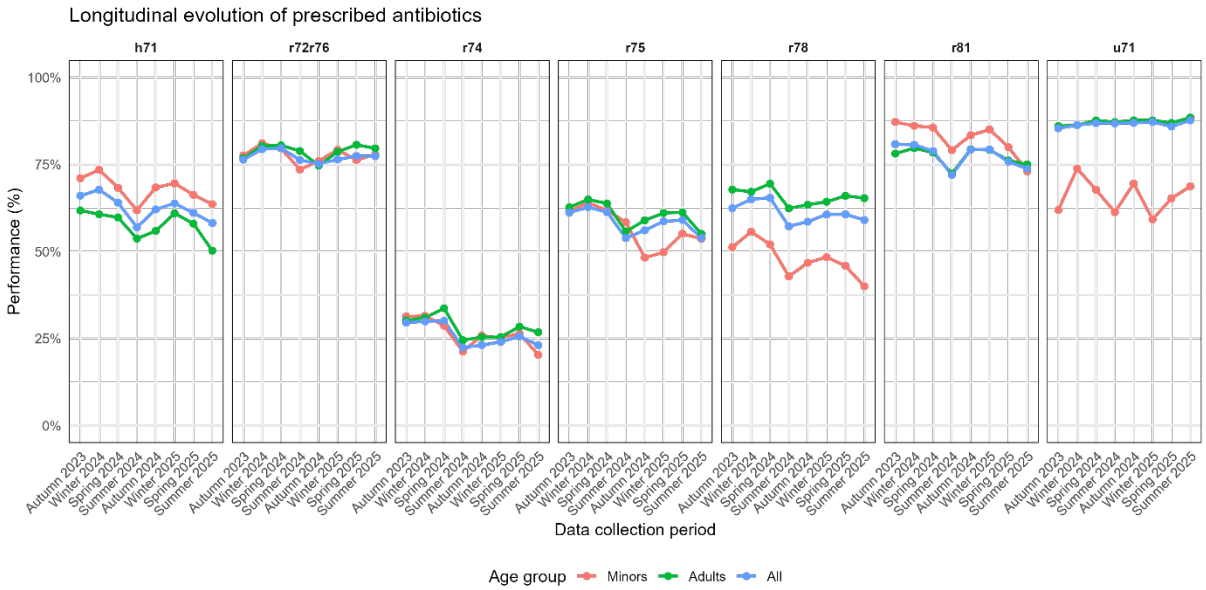


Figure 20 Longitudinal evolution of the total number of antibiotics prescribed during each season from fall 2023 to summer 2025 for the seven indications per age category: minors, adults and all ages.
Indications: R78 = acute bronchitis/bronchiolitis, R74 = acute upper respiratory infection, U71 = cystitis/other urinary infection, R72&R76 = acute tonsillitis, R75 = acute/chronic sinusitis, H71 = acute otitis media, and R81 = pneumonia.

Figure 21 shows the longitudinal evolution of the proportion of patients receiving an antibiotic prescription who were prescribed the first-choice antibiotic per diagnosis in the Antibiotic Barometer. The recommended antibiotic treatment was least often followed for acute tonsillitis (R76) and acute upper respiratory infection (R74) in all age categories. For cystitis/other urinary infection (U71), first-choice antibiotics were more often prescribed for adults than for minors, whereas for acute otitis media (H71), the opposite was observed, irrespective of the season. In general, there was no clear longitudinal trend towards higher proportions of first-choice antibiotic prescriptions.

For patients prescribed antibiotics, quinolone prescriptions were analysed in detail because of their importance in AMR (Figure 22). In adults, quinolones were most frequently prescribed for cystitis/other urinary infection (U71) and pneumonia (R81), but also for acute bronchitis/bronchiolitis (R78) and acute/chronic sinusitis (R75). However, a slight longitudinal trend towards lower proportions of quinolone prescriptions was observed for these diagnoses, irrespective of seasonal fluctuations. In minors, quinolones were exceptionally prescribed for the seven diagnoses during the entire study period.

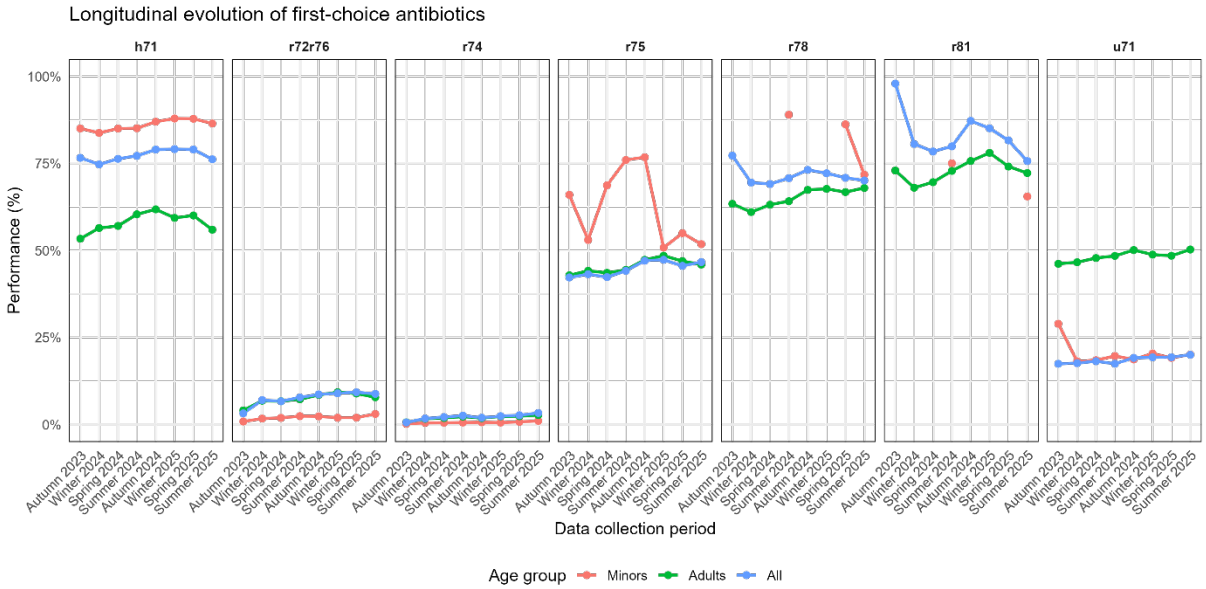


Figure 21 Longitudinal evolution of prescription for first-choice antibiotics during each season from fall 2023 to summer 2025 for the seven indications per age category: minors, adults and all ages.
Indications: R74 = acute upper respiratory infection, U71 = cystitis/other urinary infection, R72&R76 = acute tonsillitis, and R78 = acute bronchitis/bronchiolitis.

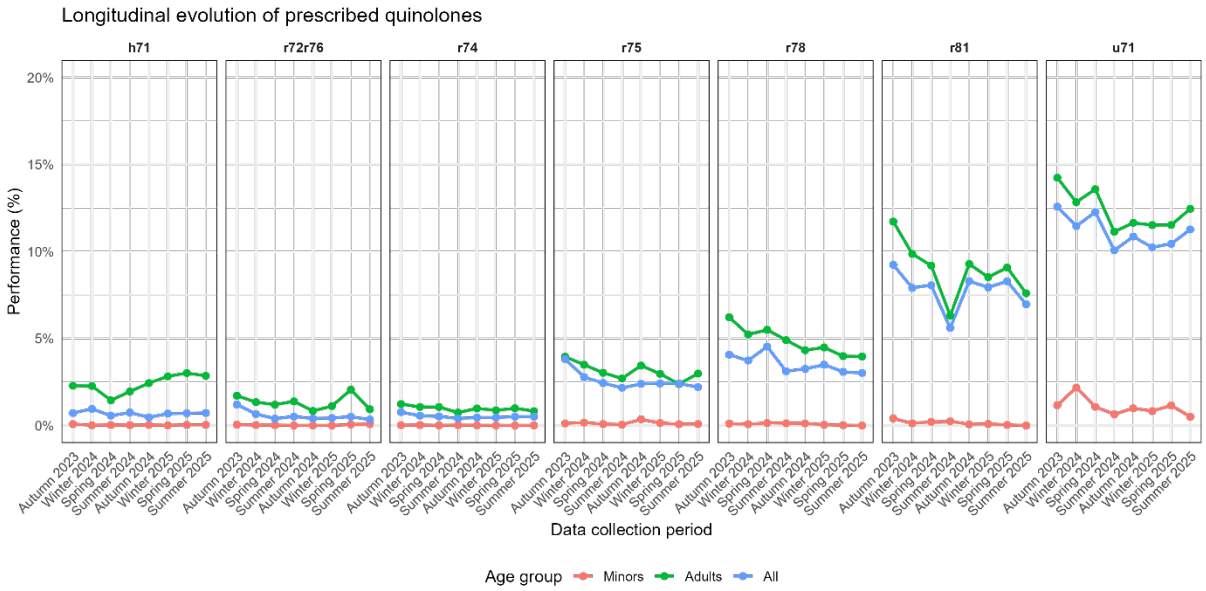


Figure 22 Longitudinal evolution of prescriptions for quinolones during each season from fall 2023 to summer 2025 for the seven indications per age category: minors, adults and all ages.
Indications: R78 = acute bronchitis/bronchiolitis, R74 = acute upper respiratory infection, U71 = cystitis/other urinary infection, R72&R76 = acute tonsillitis, R75 = acute/chronic sinusitis, H71 = acute otitis media, and R81 = pneumonia.

Figure 23 shows the longitudinal evolution of prescribed antibiotics per season and per region for all seven selected infections. Box-plots are presented to give an idea of the variability. In general, the variability becomes smaller when the numbers increase. Regardless of age, robust results were observed for all infections with little variability for cystitis (U71), pneumonia (R81) and upper respiratory tract infections (R74). Most differences between regions were observed for sinusitis (R75) and otitis (H71).

Figure 24 describes the variability of the evolution of prescribed first-choice antibiotics per season and per region for all seven infections in different age groups. The same trends were seen as in Figure 21, showing large variability for sinusitis (R75), bronchitis (R78), otitis (H71) and pneumonia (R81).

Figure 25 shows the variability of prescribed quinolones per season and per region for all seven infections in different age groups. Except for outliers, the variability was low.

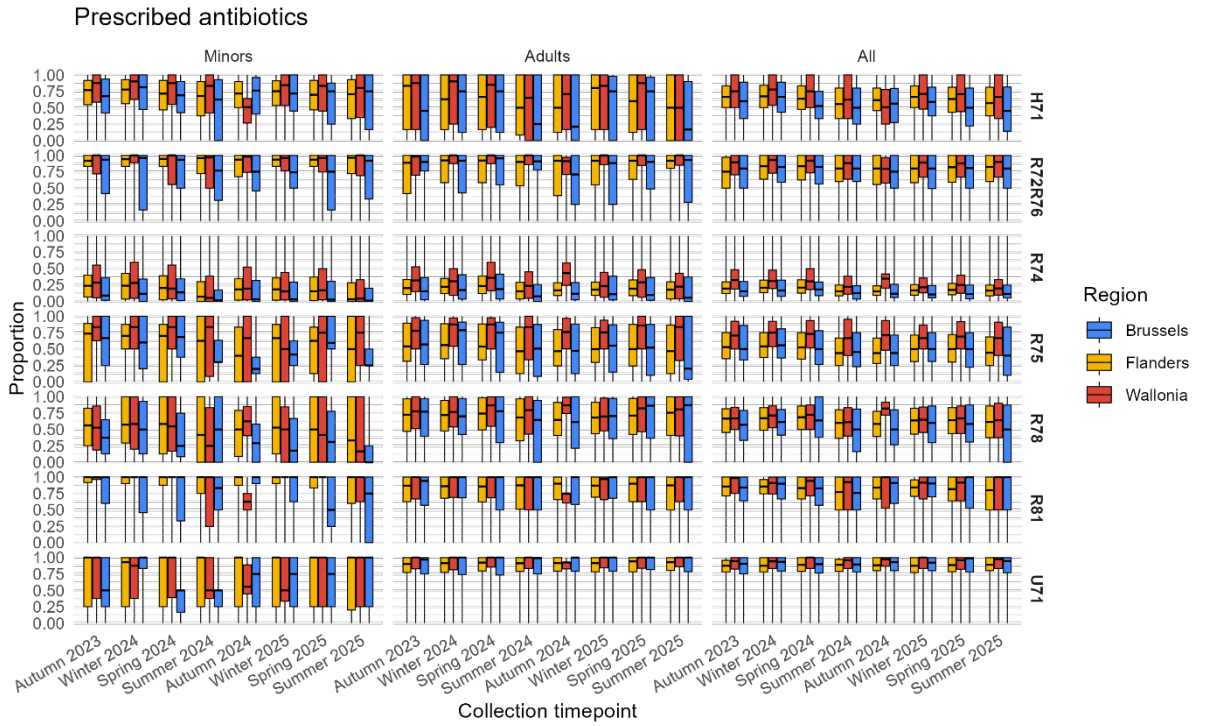


Figure 23 Longitudinal evolution of prescribed antibiotics per season and per region from fall 2023 to summer 2025 for the seven indications per age category: minors, adults and all ages. Box-plots represent medians and p25 and p75 intervals. Indications: R78 = acute bronchitis/bronchiolitis, R74 = acute upper respiratory infection, U71 = cystitis/other urinary infection, R72&R76 = acute tonsillitis, R75 = acute/chronic sinusitis, H71 = acute otitis media, and R81 = pneumonia.

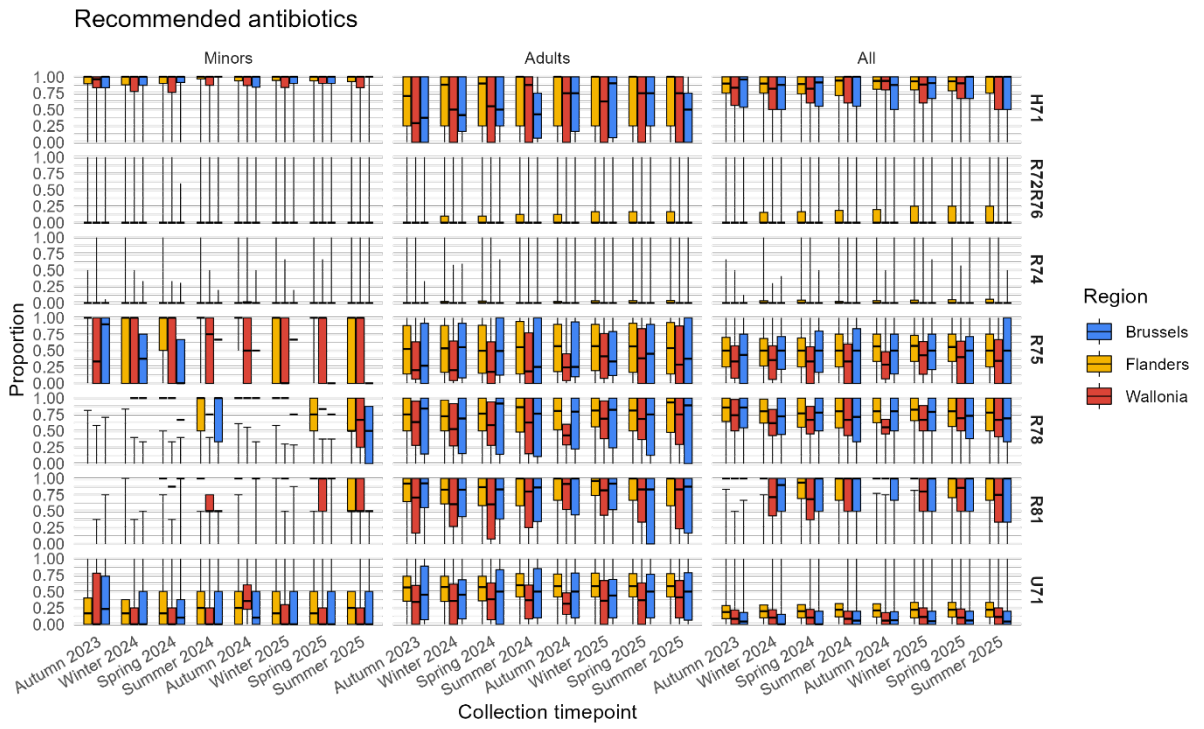


Figure 24 Longitudinal evolution of recommended (first-choice) antibiotics per season and per region from fall 2023 to summer 2025 for the seven indications per age category: minors, adults and all ages. Box-plots represent medians and p25 and p75 intervals. Indications: R78 = acute bronchitis/bronchiolitis, R74 = acute upper respiratory infection, U71 = cystitis/other urinary infection, R72&R76 = acute tonsillitis, R75 = acute/chronic sinusitis, H71 = acute otitis media, and R81 = pneumonia.

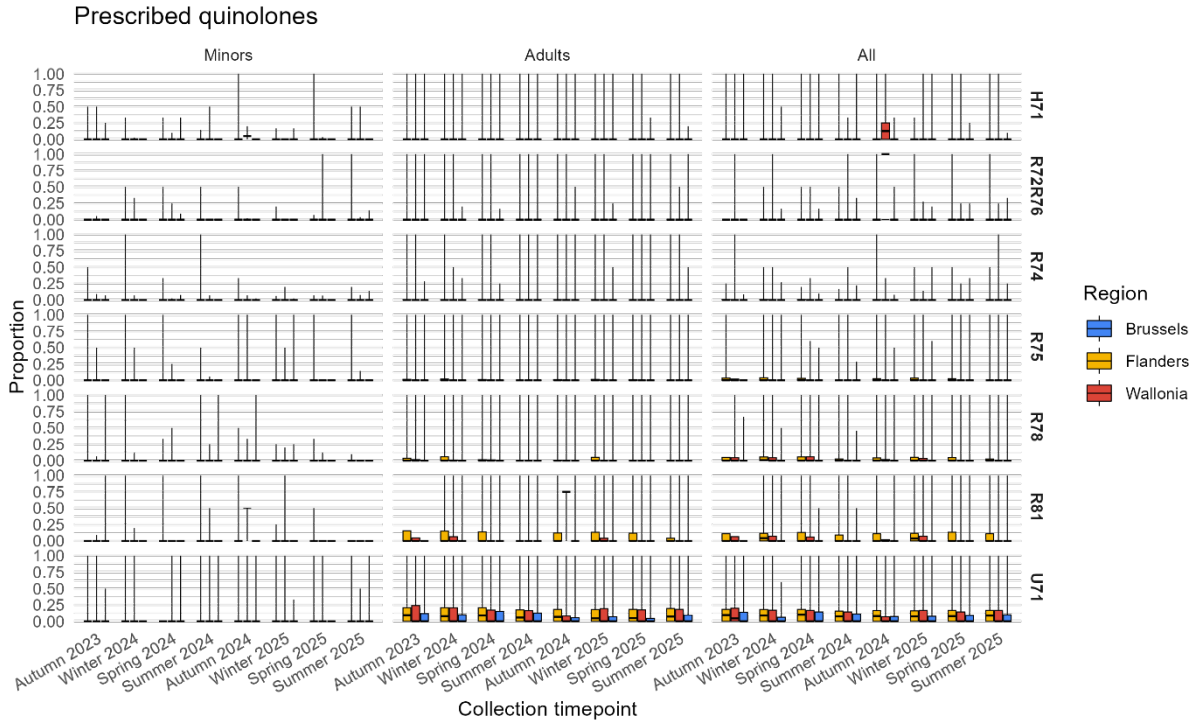


Figure 25 Longitudinal evolution of quinolone prescriptions per season and per region from fall 2023 to summer 2025 for the seven indications per age category: minors, adults and all ages. Box-plots represent medians and p25 and p75 intervals. Indications: R78 = acute bronchitis/bronchiolitis, R74 = acute upper respiratory infection, U71 = cystitis/other urinary infection, R72&R76 = acute tonsillitis, R75 = acute/chronic sinusitis, H71 = acute otitis media, and R81 = pneumonia.

10 Discussion

The September 2025 data collection of the Antibiotic Barometer represents one of the most comprehensive snapshots of antibiotic prescribing practices in Belgian primary care. In this round, 4,263 practices and 11,399 general practitioners contributed data, covering 4,607,138 patient contacts over the summer months and 19,817,651 contacts in the past year.

Overall, there was a 13.8% decrease in antibiotic prescriptions when comparing the periods of fall 2023 - summer 2024 and fall 2024 - summer 2025. When considering only RTI and UTI, this reduction was 8.4%. This decrease in antibiotic prescriptions was the most evident in the age category between 2 and 65 years. In addition, clear regional differences emerged in prescribing patterns and indicator performance. Over the past year, Flemish practices prescribed slightly more quinolones than practices in Brussels and Wallonia; however, they also demonstrated higher adherence to first-choice antibiotics when antibiotics were indicated. Brussels stands out for its overall lower antibiotic prescribing rates, particularly for acute upper respiratory tract infection (R74), for which antibiotics are not indicated, and performs well for conditions such as cystitis/other urinary infection (U71) and pneumonia (R81), where antibiotic use is clinically appropriate. These variations coincide with the heterogeneity in practice organization (solo vs. group), staffing, and EMR systems, all of which likely influence the prescribing decisions and data completeness. Encouragingly, longitudinal trends suggest a cautious but positive shift toward guideline-based prescribing, although substantial opportunities for further improvement remain. This may signal growing awareness, targeted stewardship efforts, and technical refinements within the practices.

Several lessons can be drawn from this report. First, beyond its scale, the Antibiotic Barometer demonstrates that it is possible to implement and operate a federated, trimester-based quality-monitoring infrastructure across highly heterogeneous general practices and nine different EMR systems. This achievement reflects the sustained engagement of government and industry stakeholders. By aligning these partners around a shared indicator set and a secure data pipeline, the Antibiotic Barometer delivers standardized, practice-level extracts with minimal cognitive load for participating practices. A notable strength of this initiative is its ability to incorporate data from out-of-hours practices, owing to the involvement of two EMR systems dedicated to these services. This broadens the representativeness of the dataset and provides a more complete picture of the antibiotic prescribing patterns across the continuum of primary care.

Because the Antibiotic Barometer was immediately implemented on a nationwide scale, and not tested with a randomized trial design, no causal relationship between the use of the Antibiotic Barometer and the indicators could be investigated. Furthermore, other confounders could explain a decrease in the total percentage of prescribed antibiotics in the past two years (NRKP/CNPQ indicators, antibiotic stewardship program, antibiotic sensitization campaigns, ...)

By combining prescribing indicators with practice characteristics (type, size, staffing, EMR software) and contextual factors (seasonal variation, patient contact volume), the Barometer is positioned as a valuable policy instrument. This can inform stewardship strategies, incentive design, and interoperability priorities for EMR systems (e.g. FHIR (Fast Healthcare Interoperability Resources) and SNOMED-CT (Systematized Nomenclature of Medicine – Clinical Terms) adoption) while identifying the type of practice or certain practice characteristics that may require targeted support to improve prescription

quality. Ultimately, the Barometer offers a repeatable, granular snapshot of antibiotic prescribing quality that is comparable across diverse administrative sectors and care settings, including out-of-hours care, which is a unique feature in the Belgian context.

11 Conclusion

The September 2025 Antibiotic Barometer provides one of the most detailed insights into antibiotic prescribing in Belgian primary care, revealing a 13.8% reduction in antibiotic prescriptions over the past two years. Although regional differences persist, longitudinal trends indicate progress toward guideline-based practices. The Barometer's success in integrating data from diverse practices and EHR systems, including out-of-hours care, underscores its value as a scalable and federated monitoring tool. By linking prescribing indicators with contextual factors, it offers a robust foundation for policy development, targeted stewardship, and interoperability improvements, positioning it as a key instrument for enhancing the quality of antibiotic prescribing nationwide.

12 List of abbreviations

GP	General Practitioner
AMR	Antimicrobial resistance
UTI	Urinary tract infections
RTI	Respiratory tract infections
A&F	Audit and feedback
VIKZ	Flemish Institute for Quality of Care
URTI	upper respiratory tract infection

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