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ESGAP inventory of target indicators assessing antibiotic prescriptions: a cross-sectional survey

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Background: A variety of indicators is commonly used to monitor antibiotic prescriptions as part of national antimicrobial stewardship (AMS) programmes.

Objectives: To make an inventory of indicators that assess antibiotic prescriptions and are linked to specific targets and incentives, at a national level.

Methods: A cross-sectional survey (three-item questionnaire) was conducted in 2017 among all ESGAP (ESCMID Study Group for Antimicrobial stewardshiP) members, coming from 23 European countries and 16 non-European countries.

Results: Almost all (20/23, 87%) European countries belonging to the ESGAP network participated, as well as one non-European country. Computerized systems routinely linking antibiotic prescriptions to clinical diagnoses were reported for only two countries (Turkey and Croatia). Only 6/21 (29%) countries had national indicators with both clear targets and incentives (Bulgaria, Croatia, France, the Netherlands, Norway and Portugal). We identified a total of 21 different indicators used in these countries, 16 concerning inpatients (9 quality indicators and 7 quantity metrics) and 8 concerning outpatients (all quantity metrics); some indicators were used in both settings. Three types of incentives were used: financing mechanism, hospitals' accreditation and public reporting. Some respondents reported that such indicators with both clear targets and incentives were used at a regional level in their country (e.g. Andalusia in Spain and England in the UK).

Conclusions: National indicators, with clear targets and incentives, are not commonly used in Europe and we observed wide variations between countries regarding the selected indicators, the units of measure and the chosen targets.

Introduction

Most countries in Europe use indicators to monitor antibiotic prescriptions as part of their national antimicrobial stewardship (AMS) programmes.[1] A number of international initiatives have recently attempted to validate indicators to monitor antibiotic prescriptions, such as the DRIVE-AB project and the Transatlantic Taskforce on Antimicrobial Resistance (TATFAR).[2,3]

In the UK, economist Jim O'Neill was commissioned in 2014 to analyse the global problem of rising drug resistance and propose concrete actions to tackle it internationally. One of the Government's objectives following the final 2016 O'Neill Review on Antimicrobial Resistance was to aim at reducing inappropriate antibiotic prescribing by 50%, with the aim of being a world leader in reducing prescribing by 2020.[4,5]

As part of identifying the level of inappropriate prescribing in the UK, the Government wanted to look at approaches taken by other countries.[5] Given the lack of published or easily accessible data on indicators that assess antibiotic prescriptions and are linked to specific targets and incentives, we conducted a national-level survey on this topic.

Methods

We conducted an exploratory cross-sectional survey among all ESGAP (ESCMID Study Group for Antimicrobial stewardshiP) members. At the time of the survey (February 2017), ESGAP included 137 members from 23 European countries (Albania, Austria, Belgium, Bulgaria, Croatia, the Czech Republic, France, Germany, Greece, Republic of Ireland, Italy, Malta, the Netherlands, Norway, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey and the UK) as well as 16 non-European countries (Australia, Bangladesh, Brunei, Dominican Republic, Egypt, Guatemala, Hong Kong, India, Iran, Japan, Lebanon, Pakistan, Singapore, South Africa, United Arab Emirates and the USA).

Each ESGAP member received a short questionnaire (three items, in Word format; see Document S1, available as Supplementary data at *JAC* Online) by e-mail, asking for: (i) availability of electronic medical records (EMRs) or any kind of computerized system that could easily produce indicators linking antibiotic prescriptions to clinical diagnoses at a national level; and (ii) the existence of indicators that assess antibiotic prescriptions with clear targets, used as prescribing incentives (e.g. payment-for-performance, accreditation, public reporting) to improve antibiotic prescribing in any setting (primary care, long-term care facilities and/or hospitals) at a national level. Only indicators linked to antibiotic prescriptions were included (not the overall antibiotic stewardship programme, or microbiology- or diagnostic-related indicators). We included public reporting only if the data were available and disclosed (with the names) at prescriber/practice level in the community or at the hospital level.

Each respondent was asked to provide links or documents detailing the indicators (Table S1), and the lead author (C. P.) double-checked the collected data (including any inconsistency in replies coming from the respondents of the same country); respondents were also recontacted if responses were unclear.

Indicators were then categorized as either quantity metrics or quality indicators by the authors, using the following definitions: a quality indicator reflects the degree to which an antibiotic prescription is appropriate or not (i.e. the outcome is valuable by itself; e.g. prescription compliant with guidelines), whereas a quantity metric reflects the volume or the costs of antibiotic use. While this distinction may be not always 100% clear-cut, we believe it to be of value for roughly categorizing indicators.

Results

Out of 137 ESGAP members, 37 (27%) replied, coming from 20/23 (87%) European countries belonging to the ESGAP network (Albania, Austria, Belgium, Bulgaria, Croatia, France, Germany, Greece, Italy, Malta, the Netherlands, Norway, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey and the UK) and one non-European country (India).

Computerized systems routinely linking antibiotic prescriptions to clinical diagnoses were reported for only two countries: Turkey (where such a computerized system exists in all settings) and Croatia (where it exists in primary care).

Only 6/21 (29%) countries had national indicators with both clear targets and incentives (Bulgaria, Croatia, France, the Netherlands, Norway and Portugal; Table 1 and Table S1). We identified a total of 21 different indicators used in these countries at the time of the study, 16 concerning inpatients (9 quality indicators and 7 quantity metrics) and 8 concerning outpatients (all quantity metrics); some indicators were used in both settings. Three types of incentives were used: financing mechanism (hospitals' financing, $n = 3$; or payment-for-performance in primary care, $n = 4$), hospitals' accreditation ($n = 5$) and public reporting ($n = 9$). Indicators targeted different aspects of antibiotic prescribing: total antibiotic use ($n = 5$), use of broad-spectrum antibiotics ($n = 8$), review of prescriptions ($n = 3$), compliance with guidelines ($n = 4$) and computerized prescribing ($n = 1$).

Even though it was not the purpose of the survey, some respondents reported that such indicators with both clear targets and incentives were used at a regional level in their country (e.g. Andalusia in Spain and England in the UK, where health policy is organized at a regional level); other respondents also mentioned national indicators with either a target or an incentive mechanism (e.g. Belgium and Greece; Tables S1 and S2).

Considering only quantity metrics assessing total antibiotic use, significant differences were observed regarding the different units of measurement and targets used (Table 2). Some countries used the number of prescriptions per 1000 inhabitants per year in primary care, but set very different targets: 140 prescriptions or fewer for France (but the indicator was restricted to adults aged 16–65 years without comorbidities), $\leq$250 by 2020 for Norway and $\leq$400 by 2025 for Belgium.

Discussion

To the best of our knowledge, this is the first inventory of indicators that assess antibiotic prescriptions and are linked to clear targets and incentives, at a national level. Only few (6/21) countries had such indicators and only two countries had computerized systems that were routinely linking antibiotic prescriptions to clinical diagnoses.

Coding infectious diagnoses (requiring an antibiotic or not) in EMRs and linking these codes to antibiotic prescriptions should be promoted in all settings, since it is a prerequisite for any kind of automated measurement of quality indicators, which can measure appropriateness of prescriptions. Periodic assessment of the accuracy of the diagnostic codes is of course needed since misdiagnosis is a frequent driver of unnecessary antibiotic prescriptions,[6] and since diagnostic shift might be used by some prescribers to justify inappropriate prescriptions.

We observed wide variations between countries regarding the selected indicators, the units of measure and the chosen targets. Number of prescriptions per 1000 patients per year is possibly a better unit of measure to compare countries, as DDDs have significant shortcomings.[7]

Our exploratory work includes, however, a limited number of countries (21, almost all European) and further investigation is deserved. However, we consider that sharing experiences at European level by means of a database hosted by a public agency, such as the ECDC or WHO-Europe, would be of great value. A thorough evaluation of target attainment, impact on bacterial resistance and efficacy of different incentives would be extremely informative.[8] Possible unintended consequences of decreased antibiotic prescribing should also be monitored and reported. All the above could add evidence and help setting relevant future targets.

Table 1. List of indicators assessing antibiotic prescriptions at a national level, with both clear targets and incentives

Country	Type of indicator	Definition of the indicator	Setting/prescriber/patient population	Target	Related incentive
Bulgaria	IQI	antibiotic prescriptions (including surgical prophylaxis) should be compliant with guidelines	hospitals/any prescriber/any patient receiving antibiotics	100% compliance	mandatory and required for hospital accreditation
Croatia	IQM	proportion of patients being prescribed a restricted antibiotic	hospitals/any prescriber/any patient receiving restricted antibiotics	below median value for all hospitals for previous year	monthly financial incentive for the hospital
France	OQM	number of antibiotic prescriptions for 100 patients per year	primary care/general practitioners/patients aged 16–65 years without comorbidity	≤14	payment-for-performance
France	OQM	proportion of patients treated with broad-spectrum antibiotics over the year (co-amoxiclav, third-generation cephalosporins and quinolones), out of patients receiving antibiotics	primary care/general practitioners/any patient	≤27%	payment-for-performance
France	OQM	proportion of children treated with third-generation cephalosporins over the year, out of children receiving antibiotics	primary care/general practitioners or paediatricians/any child aged <4 years	≤3%	payment-for-performance
France	OQM	proportion of children treated with third-generation cephalosporins over the year, out of children receiving antibiotics	primary care/general practitioners or paediatricians/any child aged ≥4 years	≤2%	payment-for-performance
France	IQI	a reminder is in place for the clinician to reassess antibiotic prescriptions in selected situations (certain antibiotics, bacteria and/or positive culture results)	hospitals/any antibiotic/any patient	100% compliance	mandatory certification of hospitals
France	IQI	a computerized prescription system is in place for antibiotics	hospitals/any antibiotic/any patient	100% compliance	mandatory certification of hospitals
France	IQI	a procedure is in place for the clinician to document reassessment of all antibiotic prescriptions at day 7 in the medical record	hospitals/any antibiotic/any patient	100% compliance	mandatory certification of hospitals
France	IQI	a procedure is in place to ensure that restricted antibiotics are reviewed at day 3	hospitals/any restricted antibiotic/any patient	100% compliance	mandatory certification of hospitals
The Netherlands	IQI	timely administration of intravenous antibiotic in patients with severe community-acquired pneumonia (CAP)	hospitals/any prescriber/patient with severe CAP admitted to ICU	time to administration within 4 h in > 90% of patients	public reporting (every year, Healthcare Inspectorate)
The Netherlands	IQI	appropriate (timely) preoperative antibiotic prophylaxis	hospitals/any prescriber/patients undergoing surgery	percentage timely prophylaxis > 90%	public reporting (every year, Healthcare Inspectorate)
The Netherlands	IQI	system to control restricted antibiotics present (e.g. pre-authorization; restricted drug list)	hospitals/any restricted antibiotic/any patient	present in every hospital	public reporting (every year, Healthcare Inspectorate)

Continued

Table 1. *Continued*

Country	Type of indicator	Definition of the indicator	Setting/prescriber/patient population	Target	Related incentive
The Netherlands	IQI	intravenous–oral switch programme present	hospitals/any antibiotic/any patient	present in every hospital	public reporting (every year, Healthcare Inspectorate)
Norway	OQM and IQM	Norway is among the three countries in Europe that have the lowest antibiotic use in humans (DDDs/1000 inhabitants/day)	hospitals and primary care/any prescriber/any patient	among the top three lowest users in Europe	public reporting; follow-up by a national steering group
Norway	OQM and IQM	total use of antibiotics (DDDs/1000 inhabitants/day)	hospitals and primary care/any prescriber/any patient	30% reduction from 2012 to 2020	public reporting on a national level; follow-up by a national steering group
Norway	OQM	average number of antibiotic prescriptions per 1000 inhabitants/year	primary care/any general practitioner/any patient receiving antibiotics	250 prescriptions per 1000 inhabitants per year by 2020 (compared with 450/1000 inhabitants per year now)	public reporting (and benchmarking: comparison between counties and municipalities); follow-up by a national steering group
Norway	OQM and IQM	prescription of certain antibiotics for respiratory infections (DDDs/1000 inhabitants/day)	hospitals and primary care/any prescriber/any patient with a respiratory infection	20% reduction by 2020 compared with 2012	public reporting on a national level; follow-up by a national steering group
Norway	IQM	total use of broad-spectrum antibiotics (second- and third-generation cephalosporins, quinolones, carbapenems and β-lactams/β-lactamase inhibitors) (DDDs/100 bed-days)	hospitals/any prescriber/any patient	30% reduction from 2012 to 2020	public reporting (and benchmarking: comparison between hospitals); follow-up by a national steering group
Portugal	IQM	total antibiotic use (DDDs/1000 hospital discharges/day)	hospitals/any prescriber/any patient receiving antibiotics	10% reduction compared with the year before	result affects the hospital financing negotiation
Portugal	IQM	total carbapenem use (DDDs/1000 hospital discharges/day)	hospitals/any prescriber/any patient receiving carbapenems	10% reduction compared with the year before	result affects the hospital financing negotiation

OQI, outpatient quality indicator; OQM, outpatient quantity metric; IQI, inpatient quality indicator; IQM, inpatient quantity metric.

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Transparency declarations

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Supplementary data

Document S1 and Tables S1 and S2 are available as Supplementary data at *JAC* Online.

Table 2. Total antibiotic use indicators: comparison of units of measure and targets

Country	Unit of measure	Setting	Target
Belgium	number of prescriptions per 1000 inhabitants per year	primary care	decrease from >800 prescriptions today to 600 by 2020 and 400 by 2025
England	number of prescriptions per 1000 inhabitants per year (adjusted for age and sex)	primary care	equal to or below England 2013/14 mean performance value of 1161
France	number of prescriptions for 100 patients per year	primary care	≤14 (for general practitioners and patients aged 16–65 years without comorbidity)
Norway	number of prescriptions per 1000 inhabitants per year	primary care	250 prescriptions by 2020 (compared with 450 now)
Norway	DDDs/1000 inhabitants/day	primary care and hospitals	Norway is among the three countries in Europe that have the lowest antibiotic use in humans
Norway	DDDs/1000 inhabitants/day	primary care and hospitals	30% reduction from 2012 to 2020
England	DDDs per 1000 admissions (including day-cases) per year	hospitals	1% reduction for those trusts with 2016 consumption indicators below 2013/14 median value or 2% reduction for those trusts with 2016 consumption indicators above 2013/14 median value
Portugal	DDDs/1000 hospital discharges/day	hospitals	10% reduction compared with the year before

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