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Association between guidelines and medical practitioners' perception of best management for patients attending with an apparently uncomplicated acute sore throat: a cross-sectional survey in five countries

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ABSTRACT

Objective To investigate the relationship between guidelines and the medical practitioners' perception of optimal care for patients attending with an apparently uncomplicated acute sore throat in five countries (Australia, Germany, Sweden, UK and USA).

Design International cross-sectional survey.

Setting Primary healthcare (PHC).

Participants Medical practitioners working in PHC.

Main outcome measures ORs for: (A) perception of throat swabs as important, (B) perception of blood tests (C reactive protein, B-ESR and B-leucocytes) as important and (C) antibiotic prescriptions if no pathogenic bacteria isolated on throat swab.

Results Guidelines differed significantly; those recommending throat swabs (Sweden and USA) were associated with practitioners perceiving them as important. The UK guideline was the only one actively discouraging the use of throat swabs. Hence, compared with the USA (reference), a throat swab showing no pathogenic bacteria increased the probability of antibiotic prescribing in the UK with OR 3.2 (95% CI 1.7 to 6.1) for adults, whereas it reduced the probability in Sweden for adults OR 0.35 (95% CI 0.13 to 0.96) and children 0.19 (95% CI 0.069 to 0.50).

Conclusions The differences between practitioners' perceptions of best management were associated with their guidelines. It remains unclear if guidelines influenced medical practitioners' perception or if guidelines merely reflect the consensus of current practice. A larger effort should be made to reach an international consensus in high-income countries about the best management of patients attending for an uncomplicated acute sore throat.

Strengths and limitations of this study

- ► This is the first study from several countries linking medical practitioners' perception of best management with their guidelines.
- ► The overall response rate was high (74%) despite the well-known difficulties in getting a high response rate in surveys handed out to medical practitioners.
- ► The cross-sectional design and the fact that perceptions of optimal management were used rather than actual performance are potential limitations.

BACKGROUND

An uncomplicated acute sore throat is a common reason for attending a primary healthcare setting (PHC). In most countries, 40%–86% of these patients are prescribed antibiotics.[1–6] Antibiotic treatment may reduce the risk of rheumatic fever in situations where this is common.[7–9] It has a modest effect on pain and a small effect on preventing suppurative complications.[10] These possible advantages must be weighed against the possible negative effects of antibiotic prescribing, such as antimicrobial resistance and side effects.

Factors influencing antibiotic prescribing

Some of the factors influencing antibiotic prescribing are: (A) the patient's propensity to visit a General Practitioner (GP) when ill, (B) the degree of access to an appointment with a GP, (C) the decision threshold for the GP to prescribe antibiotics and (D) the actual health of the patient based on their symptoms and signs.

The patient's propensity to visit a GP is partly a personality factor[11] combined with influences from government information campaigns as well as all other more or less accurate information available from friends,

relatives, the press, social media and various internet sources.

The number of medical practitioners is increasing both in absolute numbers and on a per capita basis in most high-income countries.[12] However, this is a double-edged sword when it comes to antibiotic prescribing being both potentially good and potentially bad. There is a direct association between attendance rates and antibiotic prescribing.[6 13] Therefore, lowering the threshold to see a GP is likely to increase antibiotic prescribing. The threshold to see a GP is also lowered by the expansion of telemedicine where the patient can chat with a GP using an app on their phone.[14 15]

The threshold for a GP to prescribe antibiotics is influenced by many factors, including their interpretation of the medical literature, experiences with previous patients, fear of litigation (in some settings), different perceptions of the degree of benefit versus harm of antibiotics, a desire to satisfy patient expectations and personal preference.[16–20] GPs prescribing habits may not primarily be guided by evidence-based medicine but rather by a number of other factors including what results in a prompt and pragmatic benefit.[21] Hence, guidelines may theoretically be good, but they have a tendency to work less well in clinical practice.[22] Varying personal preferences and the need for a prompt and pragmatic solution result in a large proportion of medical practitioners ignoring guidelines that describe the best management of patients with a sore throat and instead developing their own individual behaviours.[16 18 22–25] This individual behaviour manifests in differing prescribing habits with a variation between GPs regarding antibiotics for sore throat with a factor between 3 and 6.[16 18] This variation in individual practitioner behaviour seems to be more pronounced in countries with less emphasis on antibiotic stewardship, less surveillance of over-the-counter sale of antibiotics and with no access to point-of-care tests (POCTs) for group A Streptococci (GAS).[26] The actual health of the patient seem to be of some importance,[27] but these symptoms and signs are often misinterpreted by the physician leading to unnecessary antibiotic prescribing.[28]

A multitude of interventions have attempted to change GPs' prescribing of antibiotics for acute respiratory tract infections, including the sore throat. Some of these studies show a modest short-term benefit,[29 30] but it seems difficult to prove that any of the attempts so far has any long-term benefit.[30]

Guidelines

An important goal of guidelines for managing patients with an apparently uncomplicated acute sore throat is to influence the medical practitioners' threshold to prescribe antibiotics, making prescriptions better targeted to those patients most likely to benefit from it. The throat is easily assessable for swabbing in a way that is not possible for other respiratory tract infections such as suspected sinusitis or pneumonia. Hence, the main divider between

Table 1 Applicable guidelines in participating countries

	Australia[34]*	Germany[35]*	Sweden[36]	UK[37]*	USA[38]*
Throat swabs	Not mentioned.	Throat swab can be used in cases of uncertainty.	Recommended if ≥3 Centor criteria and if antibiotics is considered.	Throat swabbing has no clear advantage.	Recommended if ≥3 Centor criteria.
B-CRP	Not mentioned.	CRP above a cut-off between 25–35 mg/L may add limited information suggesting bacterial aetiology.	Adds no useful information.	Not mentioned.	Not mentioned.
B-ESR	Not mentioned.	Adds no useful information.	Not mentioned.	Not mentioned.	Not mentioned.
B-leucocytes	Not mentioned.	Adds no useful information.	Adds no useful information.	Not mentioned.	Not mentioned.
Aetiology that may trigger antibiotics	GAS	GAS	GAS	Not mentioned.	GAS
Threshold to prescribe AB	It is reasonable to prescribe antibiotics if symptoms are severe (Centor scores are not mentioned but the described threshold corresponds well with ≥3 Centor criteria).	Consider antibiotics if ≥3 Centor criteria especially if prior contact to other GAS pharyngitis patients.	Only consider antibiotics if ≥3 Centor criteria and if a point-of-care test for GAS is positive.	Consider antibiotics if ≥3 Centor criteria or ≥4 FeverPAIN scores.	Prescribe antibiotics if ≥3 Centor criteria and if a point of care test for GAS is positive.

*Most countries have several, more or less partly conflicting, guidelines for managing patients with an acute sore throat. The ones referred to here are those most commonly used within primary healthcare in the area where the survey was done.
CRP, C reactive protein; ESR, erythrocyte sedimentation rate; GAS, group A Streptococci.

different sore throat guidelines is whether to rely solely on clinical scoring of symptoms and signs or to also rely on additional information obtained from a throat swab processed using culture or a POCT to detect the presence of GAS.[31] However, it seems the impact guidelines have on medical practitioners' perception of the best management strategy for these patients is limited.[32 33]

The primary aim of this study was to investigate difference between countries in the OR for (a) perception of throat swabs as important, (b) perception of blood tests (C reactive protein (CRP), B-ESR and B-leucocytes) as important and (C) antibiotic prescriptions if no pathogenic bacteria isolated on throat swab in patients with an apparently uncomplicated acute sore throat. The secondary aim was to explore other differences between countries in medical practitioners' perceptions. Findings will be related to what guidelines in their area recommend.

METHODS

Inclusion criteria

Medical practitioners working in a PHC setting were asked to participate by one of the authors. In most cases, this was done at meetings for continuing professional education except in Germany where most surveys were posted and later followed up by a telephone reminder. A few questionnaires were collected at personal visits to clinics during their lunch break.

Data collection

A one-page survey first asked about demographic information such as age, gender, year of graduation and experience as medical practitioner. The following questions asked about the perceived importance of different factors to guide antibiotic prescribing for patients attending with an apparently uncomplicated acute sore throat. The first question stated that 'My decision to start antibiotics would in most cases of patients with a sore throat be based on…

- History of comorbidities affecting immunity.
- History with indicative acute symptoms.
- Patient's wish to get antibiotics.
- Physical findings at examination (except fever).
- Fever >38 degrees Celsius/>100.4 Fahrenheit.
- Blood tests with high leucocyte count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP).
- Findings of bacteria from throat swab' (without specifying if the swab were to be analysed using culture or a POCT).

For each of these alternatives, the medical practitioner could answer in a 5-grade Likert scale with 'strongly agree', 'agree', 'neutral', 'disagree' and 'strongly disagree'.

The second question was a hypothetical case scenario describing 'a 25-year-old man presenting with a 3 day history of a sore throat and no cough. Physical examination shows red tonsils with a tonsillar exudate, tender anterior lymph nodes and temperature of 38.3 deg Celsius/100.94 Fahrenheit. Your colleague sent a throat swab yesterday and is now unable to review the results. I would prescribe antibiotics if the throat swab showed growth of…'. A separate response was requested for growth of GAS, group C Streptococci, group G Streptococci, *Fusobacterium necrophorum* (FN), *Haemophilus influenzae* and finally if none of the previously mentioned bacteria were found. The medical practitioner could answer in a 4-grade Likert scale with 'yes definitely', 'yes probably', 'probably not' and 'definitely not'. The practitioner could also state that they had not heard of the mentioned bacteria.

The third question was another hypothetical case scenario identical to the previous other than that the patient was a 10-year-old girl.

Statistical analysis

The 5-grade Likert scale was dichotomised so that 'strongly agree' and 'agree' were merged to 'agree' and coded as 1, while 'neutral', 'disagree' and 'strongly disagree' were merged to 'do not agree' and coded as 0. Two multivariable binary logistic regressions were performed to answer two of the primary aims, one with agreeing that throat swab is important as the dependent variable, and the other that blood tests are important as the dependent variable. Practitioner's age, gender, being senior versus being under training and country were independent variables.

The third primary aim focused on antibiotic prescribing despite no presence of bacteria in the throat. The 4-grade Likert scale was dichotomised so that 'yes definitely' and 'yes probably' were merged to 'yes' and coded as 1, while 'probably not' and 'definitely not' were merged to 'not' and coded as 0. Two multivariable binary logistic regressions were performed to explore factors associated with antibiotic prescribing despite a throat swab showing no presence of potentially pathogenic bacteria, one regression for each case scenario. Practitioner's age, gender, being senior versus under training and country were independent variables.

The findings in the four regression analyses were compared with statements in the corresponding guidelines (table 1). Adjusted ORs with 95% CIs are presented. The level of significance was set to 0.05. The statistics software package SPSS Windows V.25 was used.

Patient and public involvement

The target population for this study are medical practitioners. Medical practitioners were involved in the planning of this study, and the results will be d'isseminated to medical practitioners. Patients and the public were not involved.

RESULTS

In total 969 surveys were handed out with 713 (74%) returned and 680 (70%) had enough information to be analysed (table 2). The 33 returned surveys not included

Table 2 Response rate and demographic information of participating medical practitioners

	Australia	Germany	Sweden	UK	USA	Total
Data collection	May–November 2018	January–October 2018	September 2018–March 2019	January–July 2018	October 2018–April 2019	
Surveys handed out, n	156	273	134	110	296	969
Surveys returned, % (n)	96 (150)	66 (181)	79 (106)	83 (91)	63 (185)	74 (713)
Statement of exam/education, n						
Did not state exam/education	9	8	1	1	3	22
Statement ambiguous			1			1
Was not a medical practitioner			5		5	10
Surveys included in further analysis	141	173	99	90	177	680
Experience as medical practitioner, % (n)						
Senior: GP/consultant	71 (100)	88 (153)	41 (41)	72 (65)	80 (141)	74 (500)
Under training: resident/registrar	29 (41)	12 (20)	59 (58)	18 (25)	20 (36)	26 (180)
Practitioners' age						
Average age (SD)	42 (11)	52 (10)	41 (10)	40 (9.0)	47 (15)	45 (12)
Median age (IQR)	41 (32–50)	51 (45–60)	40 (33–48)	39 (32–48)	45 (34–59)	45 (34–55)
Practitioner of female gender, % (n)	44 (61)	44 (76)	58 (57)	67 (60)	51 (90)	51 (344)
Year of graduation						
25% percentile	1990	1987	2000	1995	1987	1990
50% percentile	2000	1994	2009	2004	2002	2000
75% percentile	2011	2000	2014	2010	2013	2011

in analysis did not clearly state that the respondent was a medical practitioner (table 2).

Primary aims

The multivariable analysis showed that practitioners were less likely to agree that throat swabs are of importance in Australia (OR 0.40 (95% CI 0.15 to 0.55)), Germany (OR 0.20 (95% CI 0.11 to 0.35)) and UK (OR 0.15 (95% CI 0.077 to 0.29)) compared with practitioners from Sweden or the USA (table 3). Practitioners from Australia, and especially from Germany, perceived blood tests to be of some importance. UK practitioners were more likely than practitioners from other countries to prescribe antibiotics if a throat swab showed no growth of any potentially pathogenic bacteria. Practitioners from Germany, the USA and especially from Sweden would refrain from antibiotics if a throat swab was negative while practitioners from the UK would be more likely to prescribe antibiotics (table 3).

Secondary aims

The opinion that throat swabs are of importance was shared by 88% of participating practitioners in the USA, 87% in Sweden, 70% in Australia, 61% in Germany and 54% in the UK (table 4). Practitioners from the UK were largely unaware of the existence of FN, while practitioners from Australia and the UK were more likely to prescribe antibiotics to patients with growth of group C and group G Streptococci (table 5).

Other findings were that older practitioners perceived blood tests such as leucocyte counts, ESR or CRP as important (table 5). However, being a GP or specialist consultant made practitioners perceive blood tests or throat swabs less important compared with medical practitioners in training.

DISCUSSION

This study found that there were similarities in the perceived best antibiotic prescribing strategy for patients with an apparently uncomplicated acute sore throat between practitioners from countries with very different guidelines. However, the study also found a few significant differences between countries, largely reflecting corresponding differences in guidelines.

Strengths and limitations

This is the first multinational attempt to link specific differences in guidelines to medical practitioners' perception of best management. The high overall response rate is a strength of the study and indicates the generalisability of our findings.

Table 3 Perception of relevance of diagnostic tests to guide antibiotic prescribing

Independent variables (practitioner characteristics)↓	Dependent variables (one multivariable logistic regression for each column)			
	Perceived importance of 'objective' tests		Prescribing AB despite negative throat swab*	
	Throat swab important	Blood tests† important	Adult patient (25 years)	Child patient (10 years)
	aOR (95% CI), p value	aOR (95% CI), p value	aOR (95% CI), p value	aOR (95% CI), p value
Increasing age (one decade)	1.2 (0.97 to1.5), p=0.099	**1.3 (1.1 to 1.6), p=0.005**	0.89 (0.70 to 1.1), p=0.35	0.88 (0.70 to 1.1), p=0.25
Male gender	0.72 (0.49 to 1.1), p=0.093	0.77 (0.53 to 1.1), p=0.15	1.2 (0.73 to 1.8), p=0.54	1.3 (0.84 to 2.0), p=0.24
Senior experience‡	**0.49 (0.29 to 0.86), p=0.012**	**0.52 (0.32 to 0.86), p=0.010**	1.0 (0.55 to 1.9), p=0.98	0.93 (0.52 to 1.6), p=0.80
Country				
Australia	**0.30 (0.16 to 0.55), p<0.001**	**2.3 (1.4 to 3.8), p<0.001**	1.6 (0.86 to 3.0), p=0.14	1.2 (0.71 to 2.1), p=0.46
Germany	**0.20 (0.11 to 0.35), p<0.001**	**7.3 (4.4 to 12), p<0.001**	0.90 (0.47 to 1.7), p=0.74	**0.45 (0.24 to 0.83), p=0.011**
Sweden	0.73 (0.34 to 1.6), p=0.42	0.73 (0.41 to 1.3), p=0.28	**0.35 (0.13 to 0.96), p=0.042**	**0.19 (0.069 to 0.50), p<0.001**
UK	**0.15 (0.077 to 0.29), p<0.001**	1.2 (0.72 to 2.2), p=0.44	**3.2 (1.7 to 6.1), p<0.001**	1.7 (0.95 to 3.1), p=0.075
USA (reference)	(reference)	(reference)	(reference)	(reference)
Model evaluation and validation				
Included in analysis	640	632	631	621
Naegelkerke R^2	0.16	0.21	0.089	0.10
Hosmer & Lemeshow§	11, p=0.23	5.6, p=0.70	4.1, p=0.85	4.8, p=0.78
Area under curve¶	0.71 (0.66 to 0.75), p<0.001	0.72 (0.69 to 0.76), p<0.001	0.68 (0.62 to 0.73), p<0.001	0.68 (0.63 to 0.73), p=0.025

Statistically significant findings are presented as bold

*Scenario with a patient presenting with a 3-day history of a sore throat and no cough. Physical examination shows red tonsils with a tonsillar exudate, tender anterior lymph nodes and temperature of 38.3°C (100.94°F). A throat swab was taken the day before showing no growth of any potentially pathogenic bacteria.
†Blood tests with elevated inflammatory markers such as leucocytes, erythrocyte sedimentation rate or CRP.
‡Senior experience such as general practitioner/consultant versus practitioner under training (registrar/resident).
§X^2, p value.
¶Area under curve (95% CI) and p value obtained at a receiver operating curve analysis.
aOR, adjusted OR; CRP, C reactive protein.

The main limitation is that this study measured perceptions and not actual behaviour. Furthermore, being of a cross-sectional design, this study cannot clarify if the association between guidelines and medical practitioners' perception should be interpreted so that guidelines directly caused the perceptions of the medical practitioners to change. Although this is a possible interpretation, given that observed differences in perceptions correspond well with differences in guidelines, it could not be directly proven by this study. It is also possible that guidelines reflect usual practice and availability of rapid tests in a country, and in effect the guideline is influenced by (rather than influences) usual practice.

Sweden and Germany have guidelines that can be considered as nationwide guidelines for PHC in these countries. The situation is somewhat less clear in other countries where different guidelines exist. However, we believe most Australian GPs would rely on the therapeutic guidelines.[34] The different US guidelines for management of patients with a sore throat are very similar. Most UK guidelines would not encourage throat swabbing. We have chosen to include the guidelines most likely to be used by the practitioners responding to the survey.

The propensity of patients in different countries to visit the medical practitioners with a sore throat is likely to be an interplay between guidelines, organisation of PHC and

Table 4 Practitioner's perception of the importance of different types of information to trigger antibiotics

	Australia	Germany	Sweden	UK	USA	Total	P value*
History of comorbidities affecting immunity							
Strongly disagree	0.0% (0/140)	1.8% (3/169)	5.1% (5/98)	0.0% (0/90)	0.6% (1/176)	1.3% (9/673)	<0.001
Disagree	2.1% (3/140)	4.7% (8/169)	15% (15/98)	8.9% (8/90)	10% (18/176)	7.7% (52/673)	
Neutral	10% (14/140)	17% (28/169)	30% (29/98)	11% (10/90)	26% (45/176)	19% (126/673)	
Agree	60% (84/140)	45% (76/169)	39% (38/98)	58% (52/90)	44% (77/176)	49% (327/673)	
Strongly agree	28% (39/140)	32% (54/169)	11% (11/98)	22% (20/90)	20% (35/176)	24% (159/673)	
History with indicative acute symptoms							
Strongly disagree	2.9% (4/139)	6.0% (10/167)	5.4% (5/93)	1.1% (1/89)	3.5% (6/173)	3.9% (26/661)	<0.001
Disagree	21% (29/139)	17% (29/167)	5.4% (5/93)	11% (10/89)	9.2% (16/173)	14% (89/661)	
Neutral	20% (28/139)	20% (33/167)	16% (15/93)	12% (11/89)	23% (39/173)	19% (126/661)	
Agree	45% (63/139)	37% (61/167)	38% (35/93)	49% (44/89)	45% (78/173	43% (281/661)	
Strongly agree	11% (15/139)	20% (34/167)	36% (33/93)	26% (23/89)	20% (34/173)	21% (139/661)	
Patient's wish to get antibiotics							
Strongly disagree	25% (35/140)	48% (82/171)	57% (54/94)	20% (18/90)	37% (65/174)	38% (254/669)	<0.001
Disagree	51% (72/140)	36% (61/171)	31% (29/94)	49% (44/90)	39% (68/174)	41% (274/669)	
Neutral	18% (25(140)	14% (23/171)	11% (10/94)	27% (24/90)	17% (29/174)	17% (111/669)	
Agree	5.0% (7/140)	2.9% (5/171)	4.4% (4/94)	4.4% (4/90)	6.3% (11/174)	4.2% (28/669)	
Strongly agree	0.71% (1/140)	0.0% (0/171)	0.0% (0/94)	0.0% (0/90)	0.57% (1/174)	0.30% (2/669)	
Physical findings at examination (except fever)							
Strongly disagree	0.75% (1/134)	0.60% (1/167)	5.3% (5/94)	0.0% (0/88)	0.57% (1/175)	1.2% (8/658)	0.18
Disagree	3.7% (5/134)	4.2% (7/167)	3.2% (3/94)	2.3% (2/88)	4.0% (7/175)	3.6% (24/658)	
Neutral	7.5% (10/134)	11% (18/167)	12% (11/94)	11% (10/88)	12% (21/175)	11% (70/658)	
Agree	65% (87/134)	53% (89/167)	33% (31/94)	48% (42/88)	54% (95/175)	52% (344/658)	
Strongly agree	23% (31/134)	31% (52/167)	47% (44/94)	39% (34/88)	29% (51(175)	32% (212/658)	
Fever>38°C (more than 100.4°F)							
Strongly disagree	5.1% (7/138)	13% (21/167)	5.3% (5/94)	0.0% (0/90)	1.2% (2/173)	5.3% (35/662)	<0.001
Disagree	16% (22/138)	25% (42/167)	9.6% (9/94)	8.9% (8/90)	9.8% (17/173)	15% (98/662)	
Neutral	29% (40/138)	27% (45/167)	19% (18/94)	21% (19/90)	24% (41/173)	25% (163/662)	
Agree	40% (55/138)	26% (43/167)	37% (35/94)	48% (43/90)	46% (80/173)	39% (256/662)	
Strongly agree	10% (14/138)	9.6% (16/167)	29% (27/94)	22% (20/90)	19% (33/173)	17% (110/662)	
Bloods with high leucocyte count, ESR and CRP							

Continued

Table 4 Continued

	Australia	Germany	Sweden	UK	USA	Total	P value*
Strongly disagree	3.0% (4/135)	2.3% (4/171)	13% (12/91)	14% (12/88)	15% (26/173)	8.8% (58/658)	<0.001
Disagree	12% (16/135)	5.3% (9/171)	30% (27/91)	25% (22/88)	20% (35/173)	17% (109/658)	
Neutral	8% (38/135)	9.4% (16/171)	23% (21/91)	18% (16/88)	26% (45/173)	21% (136/658)	
Agree	47% (63/135)	46% (79/171)	20% (18/91)	24% (21/88)	25% (44/173)	34% (225/658)	
Strongly agree	10% (14/135)	37% (63/171)	14% (13/91)	19% (17/88)	13% (23/173)	20% (130/658)	
Findings of bacteria from throat swab							
Strongly disagree	3.7% (5/136)	10% (17/169)	1.0% (1/98)	10% (9/90)	1.7% (3/174)	5.2% (35/667)	<0.001
Disagree	8.8% (12/136)	13% (22/169)	5.1% (5/98)	16% (14/90)	3.4% (6/174)	8.8% (59/667)	
Neutral	18% (24/136)	17% (28/169)	7.1% (7/98)	22% (20/90)	6.9% (12/174)	14% (91/667)	
Agree	43% (58/136)	27% (45/169)	42% (41/98)	36% (32/90)	28% (48/174)	34% (224/667)	
Strongly agree	27% (37/136)	34% (57/169)	45% (44/98)	17% (15/90)	60% (105/174)	39% (258/667)	

*Kruskal Wallis one-way analysis of variance comparing countries.
CRP, C reactive protein; ESR, erythrocyte sedimentation rate.

patient behaviour. This may influence the sorts of sore throats that are presented in each country. It was deemed very difficult to show exactly how this phenomenon varied between countries and possibly influenced the result.

Perception of the value of history, physical examination, throat swabs or blood tests may refer either to the importance of doing/obtaining/ordering these yourself or to the importance of the outcome of them. When the practitioner perceives that ordering swabs or blood tests is important, it would obviously mean to look at the results and consider them in management decisions. Hence, for this particular scenario these two aspects of perception are likely to overlap significantly and represent the same perception.

The perception of the clinical value of throat swabbing might be influenced by reimbursement to the doctor for using POCT to detect GAS. POCTs to detect GAS are not reimbursed in Australia, Sweden or the UK. POCTs are reimbursed in the USA and in Germany for patients <16 years.

The selection of medical practitioners is a convenience sample and not a random sample. However, practitioners were not approached based on their interest of the topic, only by the fact that they happened to attend a formal meeting held for other reasons. In most high-income countries, medical practitioners are expected to participate in continuous professional education. This is formally checked and followed up in some countries, while in other countries, it is more of a strong encouragement without a formal follow-up. Participation in continuous professional education is likely to be higher now compared with 20 years ago. Hence, practitioners attending an educational meeting is likely a smaller selection bias today compared with 20 years ago.

The perceived importance of a throat swab

The Swedish and the USA guidelines put a strong emphasis on the importance of a throat swab, while the Australian and UK guidelines are of the opposite opinion. The German guidelines are somewhere in between. These differences in guidelines were clearly reflected where practitioners from Australia, Germany and the UK would be much less inclined to consider a throat swab being of any clinical importance (table 3). The lowest clinical value of a throat swab (OR of 0.15) was stated by medical practitioners from the UK, and their guideline was the only one that actively discouraged clinicians from using a throat swab.

The guidelines clearly reflect the practitioner's perception of the clinical value of a throat swab, but it is hard to tell which one is the chicken or the egg, if either. A possible alternative explanation is that throat swabs were more commonly used, and therefore valued, where it was reimbursed by national or private health insurance programmes. Throat swabs were to a larger extent perceived as clinically important in Sweden and the USA compared with the other countries. However, throat swabs are reimbursed in the USA but not in Sweden making this interpretation less likely.

Table 5 Practitioner's perception of the importance of potential findings in a throat swab to guide antibiotic prescribing

	Australia	Germany	Sweden	UK	USA	Total	P value*
Practitioner has ever heard of the following bacteria† (asked once for each of the two case scenarios)							
GAS – adult patient	100% (138/138)	100% (171/173)	100% (98/98)	100% (88/88)	100% (177/177)	100% (674/674)	–
GAS – child patient	100% (137/137)	100% (173/173)	100% (94/94)	100% (88/88)	100% (177/177)	100% (669/669)	–
GCS – adult patient	93% (125/135)	94% (160/170)	94% (86/92)	87% (75/86)	86% (152/176)	91% (598/659)	0.062
GCS – child patient	93% (125/134)	94% (161/171)	93% (82/88)	88% (76/86)	86% (152/176)	91% (596/655)	0.067
GGS – adult patient	87% (116/134)	89% (152/170)	96% (90/94)	63% (54/86)	82% (144/176)	84% (556/660)	<0.001
GGS – child patient	88% (118/134)	90% (152/169)	96% (86/90)	64% (55/86)	82% (145/176)	85% (556/655)	<0.001
FN – adult patient	42% (57/137)	60% (100/167)	63% (58/92)	18% (16/89)	39% (68/174)	45% (299/659)	<0.001
FN – child patient	40% (54/135)	61% (102/168)	66% (59/90)	20% (18/89)	39% (68/174)	46% (301/656)	<0.001
HI – adult patient	99% (134/135)	99% (169/171)	100% (92/92)	99% (85/86)	99% (174/175)	99% (654/659)	0.85
HI – child patient	100% (134/134)	99% (168/169)	100% (88/88)	100% (87/87)	98% (172/175)	99% (649/653)	0.25
Would prescribe AB to a patient attending for a sore throat‡ if a throat swab showed growth of§ …							
GAS – adult patient	96% (132/138)	95% (165/173)	99% (97/98)	97% (85/88)	99% (176/177)	97% (655/674)	0.1
GAS – child patient	94% (130/137)	98% (169/173)	98% (92/94)	99% (87/88)	100% (177/177)	98% (655/669)	0.036
GCS – adult patient	74% (93/125)	59% (95/160)	55% (47/86)	71% (53/75)	55% (84/152)	62% (372/598)	0.0031
GCS – child patient	81% (101/125)	68% (109/161)	56% (46/82)	74% (56/76)	61% (92/152)	68% (404/596)	<0.001
GGS – adult patient	73% (85/116)	51% (77/152)	53% (48/90)	69% (37/54)	51% (73/144)	58% (320/556)	<0.001
GGS – child patient	79% (93/118)	59% (90/152)	56% (48/86)	71% (39/55)	56% (81/145)	63% (351/556)	<0.001
FN – adult patient	70% (40/57)	33% (33/100)	79% (46/58)	81% (13/16)	60% (41/68)	58% (173/299)	<0.001
FN – child patient	82% (44/54)	38% (39/102)	81% (48/59)	89% (16/18)	57% (39/68)	62% (186/301)	<0.001
HI – adult patient	60% (80/134)	60% (101/169)	40% (37/92)	57% (48/85)	60% (104/174)	57% (370/654)	0.018
HI – child patient	66% (89/134)	70% (118/168)	44% (39/88)	59% (51/87)	67% (116/172)	64% (413/649)	<0.001
No growth – adult patient	24% (32/136)	12% (20/168)	5.6% (5/89)	35% (31/88)	15% (26/176)	17% (114/657)	<0.001
No growth – child patient	29% (38/132)	11% (18/166)	5.6% (5/89)	33% (29/88)	23% (39/172)	20% (129/647	<0.001

*X^2 test comparing countries.
†GAS, GCS, GGS, FN and HI.
‡Scenario with a patient presenting with a 3-day history of a sore throat and no cough. Physical examination shows red tonsils with a tonsillar exudate, tender anterior lymph nodes and temperature of 38.3°C (100.94°F). A throat swab was taken the day before and the result has arrived.
§Figures below only include practitioners who have heard about the bacterium.
FN, *Fusobacterium necrophorum*; GAS, group A Streptococci; GCS, group C Streptococci; GGS, group G Streptococci; HI, *Haemophilus influenzae*.

The perceived importance of blood tests

The German guidelines discussed the potential value of CRP, while other guidelines mostly disregarded the subject of blood tests or briefly stated blood tests were of no value. Hence, the finding that German practitioners put more emphasis on the clinical value of blood tests (OR 7.3) (table 3) is not surprising.

The finding that increasing age of the practitioner is associated with relying more on blood tests and that being senior (specialists in general practice/family medicine) is associated with relying less on blood tests may at first seem contradictory. However, it could be explained that older practitioners rely more on blood tests because that was more common in the past. During registrar/resident training, medical practitioners are taught to not rely on blood tests for sore throat patients. So, after completing the training and becoming a specialist, they should know blood tests add very little information in patients with a sore throat. There was likely a substantial proportion of practitioners being specialists and still also being quite young.

Antibiotic prescribing to patients with no growth of potentially pathogenic bacteria

Practitioners in countries with guidelines discouraging the use of throat swabs, such as in Australia and the UK, are more prone to ignore a throat swab showing no growth of any potentially pathogenic bacteria (table 3). Countries with a strong emphasis on the clinical importance of throat swabs, such as Sweden and the USA, are much less prone to prescribe antibiotics if a throat swab shows no pathogens. Practitioners from Germany did not perceive a throat swab as important, but they had a tendency to respect a negative throat swab (table 5). Hence, the guidelines seem to reflect the practitioner's perceptions.

Generalisability

More than one country represented each of the two major types of guidelines recommending or discouraging the use of throat swabs. The perceived value of taking a throat swab was consistent with the corresponding guideline in each country. The subsequent perceived importance of not prescribing antibiotics in case of a negative throat swab also followed the corresponding guideline although these findings were not statistically significant for Australia. The main finding that guidelines seem to reflect medical practitioners' perception is likely to be generalisable to high-income countries.

Differences in populations propensity to attend healthcare, culture among practitioners as well as organisation of funding for PHC make the consumption of antibiotics significantly different between many high-income countries. The main purpose with this manuscript is to make a brief attempt to quantify these differences and identify some factors related to them using the sore throat as a straight forward example. However, the uncomplicated sore throat is just one of many conditions involved. More importantly, this publication aim to stress the importance of a structured international dialogue to sort out these differences that are astonishing given that we all have access to the same evidence.

CONCLUSIONS

Guidelines describing the optimal management of patients with an apparently uncomplicated acute sore throat differ significantly between countries. The guidelines studied are based on the same scientific studies yet being interpreted very differently. It also seems that medical practitioners in different countries have different perceptions on how to best manage these patients reflecting these differences in guidelines. It would be important to try to agree on a best practice for patients at low risk for rheumatic fever attending for an apparently uncomplicated acute sore throat that can be recommended across many high-income countries. This international guideline should address the use of throat swabs as well as defining etiologic agents where it may be relevant to consider antibiotics.

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