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A Cross-Sectional Study of Antibiotic Prescribing for Childhood UpperRespiratory Tract Infections in Irish General Practice

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Abstract

Introduction

This study aimed to analyse antibiotic prescribing in cases of upper respiratory tract infection (URTI) in children under 6 years attending Irish daytime and out-of-hours General Practice (GP) services. There have been large scale changes in entitlements for free GP care for this group in recent years.

Methods

A cross-sectional study of children under 6 years with URTI presentations was performed, over a two-week period for three years from 2015 to 2017. Factors associated with antibiotic prescription and preferred antibiotic compliance were examined using multivariate logistic regression.

Results

1,007 Under-6 patients presented with an URTI in our sample over the study period. Following introduction of free GP care, patients were 50% less likely to receive an antibiotic prescription. Overall antibiotic prescribing fell from 70% to 50% in daytime services and from 72% to 60% in the out-of-hours setting. Patients presenting to out-of-hours services were more likely to receive an antibiotic (OR: 1.42) and less likely to receive a deferred antibiotic (OR: 0.53). One quarter to one third of all prescriptions were for deferred antibiotics. Year-on-year trends showed a 13% decrease in prescriptions and 13% increase in preferred antibiotic use.

Conclusion

The introduction of free GP care led to significant reductions in antibiotic prescribing, which may be due to changes in health seeking behaviour by parents or other reasons. Antibiotic prescribing was more commonplace in the out-of-hours setting, and rates remains high by international standards. This study underlines the importance of ongoing work around GP antimicrobial stewardship, particularly in the out-of-hours setting.

Introduction

Antimicrobial resistance has been labelled a major threat to global public health by the World Health Organisation ¹. In Europe 80% of antibiotics are prescribed in the primary care setting, with similar trends seen in Ireland ². General Practices with lower rates of antibiotic prescription for upper respiratory tract infections (URTI) have not been shown to have higher rates of serious bacterial complications ³. Examining prescribing behaviour in GP services could be useful in reducing potentially inappropriate antibiotic use.

Influences on prescribing patterns in any healthcare setting are multi-factorial, but include setting, patient (or parental) factors and financial pressures ^[4-11].

Studies on GP antibiotic prescribing patterns in out-of-hours settings in Ireland compared to daytime settings are lacking. However, it has been demonstrated that Irish GPs are more likely to prescribe an antibiotic for urinary tract infections when approaching the weekend ⁴. A Dutch study has shown that children were more than twice as likely to receive an antibiotic prescription during out-of-hours consultation as compared to a daytime consultation ⁵.

Patient or parental factors relating to increased antibiotic prescribing include social background ⁶, lack of education about common viral illnesses ⁷, previous experience ⁸, perceived severity of illness ⁹ and economic considerations ¹⁰. Additionally, doctors may misinterpret parental concern or information-seeking as pressure for an antibiotic prescription ¹¹.

In Ireland, just over half the population are not eligible for state-funded care and thus must pay out-of-pocket for visits to their GP ¹². In July 2015, the “Under-6 contract” was introduced in an effort to address this inequality for young children ¹³. This contract granted Doctor Visit Cards (DVCs) to all children under the age of six years, regardless of parental financial means. These patients thus joined the 30% of the under-6 population who already had free access to GP services via their General Medical Services (GMS) card ¹⁴. Holders of DVC or GMS cards can attend daytime practices and the out-of-hours services free-of-charge. Reports suggest a 25% increase in visits when children receive free access to GP services ^{15,16}.

We aimed to quantify antibiotic prescription rates and compliance with preferred antibiotic guidelines for URTI presentations and to analyse any factors associated with antibiotic prescription in an Under-6 sample attending Irish daytime and out-of-hours GP services. The time period examined offers an opportunity to examine for changes which may be linked to eligibility for access to services free-of-charge.

Methods

We conducted a cross-sectional study using 2 weeks of anonymised consultation data from January of each for the years 2015, 2016 and 2017. Data was obtained from four providers of daytime and two providers of out-of-hours General Practice services across the Greater Dublin Area.

URTIs were classified according to the ICD-10 criteria i.e. infectious process affecting the upper respiratory tract (nose, paranasal sinuses, pharynx, larynx, or trachea). A review of electronic medical records was completed for patients under 6 years of age presenting with an URTI over the third and fourth calendar weeks of the three included years. Consultation notes were reviewed individually to determine inclusion in this study. This was conducted for all children attending daytime services and a randomized sample (including approximately 50%) of out-of-hours presentations. Data were collected on patient age, gender, medical cover status, type of antibiotic prescription (immediate or deferred) and compliance with Ireland's national preferred antibiotic guidelines ³.

Trends over time were examined using univariate Poisson regression. Year of sampling was included as the independent variable and trend is reported as incident rate ratios (IRR), which are presented as percentage change per year. Antibiotic prescription, type of prescription and compliance with preferred antibiotic guidelines were considered as dependent variables. Factors associated with prescription were assessed using multivariate logistic regression. Independent variables included in the model were age (over 1 years of age), medical cover (GMS or DVC Cover versus Private Patients), Post 2015 (so as to compare before- and after- introduction of free GP care) and setting (out-of-hours versus daytime settings). Associations are reported as odds ratios (OR) with 95% confidence intervals estimated (95% CI). Analysis was conducted using Microsoft Excel 2007 and Stata 14 IC (Stata Corp, LLC, College Station, TX).

This study was approved by the TCD/HSE GP Training scheme internal ethics committee. Approval was also granted by the relevant out-of-hours service steering committees.

Results

Population Characteristics

Patients under 6 years of age presenting to a GP with an URTI were included (n = 1,007). The mean age of patients was 2.8 years (SD= 1.6) with females accounting for 46.0% (n = 463). Further details on practice mix and medical cover of patients are provided in *Table 1*. The large reduction in private patients post-2015 reflects the introduction of the free GP care for all Under-6s.

Table 1. Study Population (Children under 6 presenting with URTI) Characteristics (n=1,007)			
		Group Proportion	Patients
Gender	Male	54.0%	544
	Female	46.0%	463
Setting	Practice	38.2%	385
	Out-of-hours	61.8%	622
Patient Cover	Overall	GMS	43.2%
		DVC	40.1%
		Private	16.7%
	2015	GMS	46.6%
		DVC	12.1%
		Private	41.3%
	2016	GMS	45.0%
		DVC	50.0%
		Private	5.0%
	2017	GMS	36.8%
		DVC	60.1%
		Private	3.1%

Antibiotic Prescribing Rates

For the children under 6 who presented with an URTI to daytime services in the 2-week period of 2015, 69.6% were prescribed an antibiotic (*Table 2*). This fell in 2016 and 2017 to 46.2% and 49.5% respectively. For patients attending the out-of-hours service with an URTI, an antibiotic was prescribed in 72.3% of cases in 2015. In 2016 and 2017, this figure fell to 57.7% and 60.6% respectively.

Table 2. Antibiotics Prescribed to Children Under-6 Presenting with Upper Respiratory Tract Infections in Daytime and Out-of-hours services (n=608), Pre- and Post-Introduction of Free GP Care

		Pre- [2015] (%)	Post- [2016] (%)	Post- [2017] (%)	Total (%)	Total Patients
Daytime Services						
Antibiotic Prescribing	% URIs resulting in Antibiotic prescription	69.6	46.2	49.5	55.8	215
	% Immediate Antibiotics	67.3	64.2	59.6	64.7	139
	% Deferred Antibiotics	32.7	35.8	40.4	35.3	76
Preferred Antibiotic Compliance	1st line Immediate Antibiotics	60.3	53.5	85.7	63.3	88
	1st line Deferred Antibiotics	84.8	70.8	89.5	76.8	62
Out-of-hours Services						
Antibiotic Prescribing	% URIs resulting in Antibiotic prescription	72.3	57.7	60.6	63.1	393
	% Immediate Antibiotics	73.8	80.7	78.6	77.6	305
	% Deferred Antibiotics	26.2	19.3	21.4	22.4	88
Preferred Antibiotic Compliance	1st line Immediate Antibiotics	56.7	61.5	76.1	64.3	196
	1st line Deferred Antibiotics	59.5	80.8	76.0	70.5	62

Almost two thirds (64.7%) of antibiotics from daytime services during the study were for immediate use, with 35.3% intended for deferred use. For all antibiotics prescribed in the out-of-hours setting, 77.6% were for immediate use and 22.4% were for deferred use.

Overall daytime compliance with preferred antibiotic guidelines was higher for deferred antibiotics (76.8%), compared to that for immediate antibiotics (63.3%). Compliance with antimicrobial guidelines in the out-of-hours services was 64.3% for immediate antibiotics and 70.5% for deferred antibiotics.

Overall preferred antibiotic guideline compliance increased by 13% ($p<0.05$) and antibiotic prescriptions decreased by 13% ($p<0.01$) year-on-year (*Table 3*). The use of immediate or deferred antibiotics did not change significantly over the three years examined.

Table 3. Trends Of Antibiotic Prescription, Use Of Deferred Prescriptions And Use Of Preferred Antibiotics For URTI In Patients Under-6 Years Over Time (n=608)				
Independent Predictor	Dependent Variable	% Change	95% Confidence Interval	p value
Years†	Antibiotic Prescription	-13	-21, -4	0.007
	Deferred Antibiotic Prescription	-3	-20, +17	0.722
	Preferred Antibiotic Compliance	+13	0, +27	0.045
Trends were examined using univariate Poisson regression, % change is reported in this table in lieu of Incident Rate Ratios provided by the statistical model. Significance is denoted by bold text at a level of $p < 0.016$ following Bonferroni correction for 3 comparisons.				
† Three years were examined in this study.				

Factors Associated with Antibiotic Prescribing

All patients presenting in the two years following the introduction of the free GP care (2016, 2017) were 50% less likely to receive an antibiotic prescription ($p < 0.001$). Patients with DVC or GMS cover were 49% less likely than private patients to receive an antibiotic for an URTI ($p = 0.03$), with no further significant associations.

The out-of-hours setting represented a 42% increased likelihood of antibiotic prescription ($p = 0.01$) (see *Table 4*). Patients over 1 year old were two and a half times more likely to be prescribed an antibiotic ($p < 0.001$). Patients presenting to the out-of-hours setting were more likely to receive an immediate antibiotic prescription ($p = 0.001$). In this analysis no other factors were significantly associated with deferred prescription type, nor with preferred antibiotic use (*Table 4*).

Table 4. Factors Associated with Antibiotic Prescription in Patients Under-6 Years of Age Presenting with Upper Respiratory Tract Infections (n=608)				
		Odds Ratio	95% Confidence Interval	p value
Antibiotic Prescription	Out-of-hours Setting	1.42	1.09, 1.86	0.010
	DVC or GMS Cover	0.51	0.33, 0.78	0.003
	Post-2015	0.50	0.36, 0.69	<0.001
	Age ≥ 1 years	2.48	1.74, 3.54	0.000
Deferred Antibiotic Prescription	Out-of-hours Setting†	0.53	0.37, 0.77	0.001
	DVC or GMS Cover	1.13	0.67, 1.87	0.649
	Post-2015	0.89	0.58, 1.37	0.604
	Age ≥ 1 years	1.03	0.59, 1.79	0.930
Preferred Antibiotic Compliance	Out-of-hours Setting	0.78	0.54, 1.12	0.179
	DVC or GMS Cover	1.49	0.93, 2.38	0.099
	Post-2015	1.34	0.89, 2.02	0.164
	Age ≥ 1 years	0.60	0.34, 1.06	0.077
Factors were examined using multivariate logistic regression, making adjustment for the variables shown. Significance is denoted by bold text at a level of $p < 0.0125$ following Bonferroni correction for 4 comparisons.				
† Favours prescription of an antibiotic for immediate fulfilment.				

Discussion

This cross-sectional study, repeated over three years in the Irish GP setting, showed predictable changes in GP care entitlements of children under-6 following introduction of free GP care. Free GP care was associated with lower antibiotic prescribing rates, with the odds of DVC or GMS patients being prescribed an antibiotic being half that of private patients. As more children gained access to free visits over the study, this in turn led to a clear reduction in antibiotic prescribing rates in both settings. While these prescribing trends are likely multifactorial, we postulate that increased attendance as a result of gaining access to free GP care ^{4,5} has led to increased presentation of undifferentiated or more minor illness, thereby facilitating lower prescribing rates. Parental pressure to prescribe may also have been lessened now that care is free at point of use. In any event, GPs are improving standards of antimicrobial stewardship despite increased workload.

Patients attending an out-of-hours setting were more likely to be prescribed an antibiotic, which was expected ^{17,18}. Notably, the only factor clearly associated with immediate antibiotic prescription use was the out-of-hours setting. This may be linked to increased workload pressures, lack of opportunity for follow-up, GPs not knowing the patients and the fact that those who present out-of-hours may be sicker than their daytime counterparts.

Use of deferred antibiotics was a popular strategy amongst GPs in both settings, and compliance with antimicrobial guidelines was generally higher for deferred antibiotics. Compliance with antimicrobial guidelines for preferred first-line agents fluctuated somewhat over the study but comprised a majority of antibiotics at all times. Overall compliance was two-thirds for immediate antibiotics and three-quarters for deferred antibiotics.

Patients over one year-of-age in our sample were more likely to receive an antibiotic prescription. Parents with younger infants may be presenting more readily for review but are less likely to receive antibiotic treatment. Viral bronchiolitis is also a common illness for younger infants. However, this is a novel finding and warrants further exploration.

While overall rates of antibiotic prescribing for URTIs fell over the study, antibiotic prescribing rates remain relatively high ⁶, with 49.5% of daytime and 60.6% of out-of-hours URTI presentations receiving an antibiotic prescription in the most recent year examined (2017).

This study was strengthened by sampling a large population over a number of different practices in both the daytime and out-of-hours settings. The study was unique in being able to quantify antibiotic prescribing before and after the introduction of free GP care for all children under 6 years. A weakness of our study was that URTI presentation data was only collected for a 14-day period in January for each year, and this may not accurately reflect general antibiotic prescribing trends. However, Ireland is known to be above average in terms of overall antibiotic prescribing in the OECD ⁷. It was also not possible to determine severity of illness or rationalise individual prescribing decisions from chart

review. A number of findings on univariate logistic regression are attenuated by wide confidence intervals.

Antibiotic use fell over the course of the study and overall use of preferred antibiotics seems to be rising. Much progress has been made to date in developing specific public health awareness programmes (e.g. 'Under The Weather' campaign ⁸) and preferred Irish primary care antibiotic guidelines to assist in appropriate use of antibiotics. The most successful interventions to reduce antibiotic prescribing rates in children with URTIs are indeed those which targets both parents and clinicians ⁷. Continued educational interventions around antimicrobial stewardship, for both patients and GPs, will be critical in years to come if antibiotic consumption, and consequent antimicrobial resistance ⁷, is to be reduced. The effect of same will likely be attenuated in the out-of-hours setting. Factors affecting prescribing rates here are less likely to be influenced by GP prescribing habits and potentially more dependent on patient factors. Future work in this area should assess factors driving differences in prescribing patterns between settings. It is reasonable to consider that both patient and practice characteristics have differing but related contributions to the data described within this study.

Conflicts of Interest

The authors have no conflicts of interest to declare

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