Paediatric prescribing in New Zealand

Jason Hall BA, Junior Research Fellow, is the senior data analyst with the RNZCGP Research Unit. Interested in the use of the electronic medical record in general practice research, he is completing a Diploma in Public Health. Isobel Martin MPH PhD is Director of the RNZCGP Research Unit and a Lecturer in the Department of General Practice, Dunedin School of Medicine, University of Otago, Dunedin.

ABSTRACT

Aim

To describe patterns of prescribing for New Zealand children under the age of six.

Methods

The computerised records of 220 824 consulting patients from 49 general practices from around New Zealand were examined. A subset of 25 595 patients aged five years or less was selected and their prescribed medications examined. Medications prescribed were coded to therapeutic groups. Utilisation was described in terms of demographic characteristics.

Results

The mean prescription rate was 2.9 scripts per annum. Of all consulting children, 72.2% received one or more prescriptions in their first year of life. 28.6% of one-year-olds were prescribed five or more times per annum. The most frequently prescribed medications were antibiotics, anti-asthmatics, paracetamol, dermatological steroids, and anti-infective ophthalmologicals.

Conclusion

For children attending general practice there is a high rate of prescribing per GP contact and this rate is highest for one- and two-year-olds. This data reflects the more vulnerable health status of children, and identifies areas in which there is need for care when prescribing to children.

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Introduction

There are many potential difficulties involved with prescribing to children. There is a paucity of randomised clinical studies designed to test medication use in children. Prescribers need to take into account the way in which the disposition of drugs in children differs from adults both pharmacokinetically and pharmacodynamically.[1] There is a strong call for studies into how medicines are being prescribed to children in various settings and populations.[2] Studies that have investigated prescribing in paediatric populations have found high prescribing rates, although a limited formulary of medications is used.[3,4]

This study describes prescribed medication for a New Zealand paediatric population by demographic variables. It is important to identify at-risk populations and help target scarce health resources to the benefit of those most in need. These include resources needed for prevention strategies such as patient education and self-management programmes, which are increasingly recognised as an important part of disease management and cost containment. This retrospective, observational data based research involved a large population and recorded (without altering or influencing) actual general practitioner prescribing practice.

Methods

General practice data from 49 computerised practices from around New Zealand for the period from 1 July 1998 to 30 June 1999 were examined. These practices were selected on the basis of their recording full electronic clinical records. All transactions relating to each patient including their demographic details, government medical subsidy eligibility, consultation records and prescribed medications are recorded in various practice management software. Practices supply data to the RNZCGP Research Unit after running extraction programmes that expunge all patient names to preserve patient confidentiality. Each patient is allocated a unique code which is individuating but non-identifiable. Data is imported into a database (Microsoft Access 2000) at the Research Unit for further analysis. Age for each child was calculated as at 1 January 1999 and patients under the age of six were identified. Age groups were defined in yearly intervals.

Prescriptions were coded to the Anatomical Therapeutic Chemical (ATC) Classification System as used in the New Zealand pharmaceutical schedule. In the ATC system the drug substances are classified into groups at five different levels. The first level consists of 14 anatomical main groups. The two subsequent levels are therapeutic or pharmacological subgroups (second and third levels respectively). The fourth level is a therapeutic, pharmacological or chemical subgroup, and the fifth level represents the chemical substance. A therapeutic group is defined as a set of phar-

Table 1. Mean number of prescriptions per person per annum by sex and card status.

Age (yrs)	Males	Females	Males vs. Females	CSC card	No card	CSC vs. No CSC	All patients
<1	2.07	2.02	ns	2.39	1.83	p <0.001	2.05
1	3.68	3.66	ns	4.21	3.24	p <0.001	3.67
2	3.32	3.17	ns	3.58	2.96	p <0.001	3.24
3	2.86	2.83	ns	3.05	2.64	p =0.002	2.84
4	2.66	2.52	p =0.044	2.76	2.43	p =0.042	2.59
5	2.33	2.44	ns	2.56	2.21	p <0.001	2.38
Overall	**2.88**	**2.85**	**ns**	**3.16**	**2.61**	**p <0.001**	**2.86**

maceuticals that are used to treat the same or similar condition(s). A subgroup is defined as a set of pharmaceuticals that produce the same or similar therapeutic effect in treating the same or similar condition(s).

The database also includes information about medications that do not receive Ministry of Health subsidies. We could not obtain information about drugs sold over the counter without a prescription for the study population.

Prescribed medication was calculated as a rate (number of prescriptions/child per annum) by age, sex and community services card status. The proportion of children who received at least one prescription and those that received five or more prescriptions was identified. We calculated the proportion of prescription items from the five most frequently prescribed medications from a therapeutic subgroup (ATC 2nd level) and the top twenty most frequently prescribed chemical substances.

> Patients with a community services card were prescribed to more frequently for all age groups compared to patients without a card

Results

The total consulting population for the 49 practices was 220 824 patients for the period 1/7/98 to 30/6/99. This is approximately 80% of the estimated population base that is serviced by these practices[6] (approximately 7.3% of New Zealand's population as at 31st December 1998). The data is geographically spread with 13.1% of the population coming from the Central region, 25.6% Midland, 24.5% Northern and 36.8% Southern.

There were 25 595 patients aged six years and under (52.1% were males) who consulted 143 021 times and were prescribed medication 73 319 times. These 73 319 prescriptions included 118 410 individual prescription items, of which there were 11 761 repeat medications. The mean prescription rate was 2.9 per child/year; there was little difference between rates of prescribing to males and females (see Table 1). Patients with a community services card were prescribed to more frequently for all

Table 2. Proportion of the study population who received >=1 prescription vs. those prescribed >=5 prescriptions

Age group (y)	<=1 prescription		>=5 prescriptions		Number of patients		
	Males	Females	Males	Females	Males	Females	Total
	%	%	%	%	n	n	n
< 1	73.2	71.0	13.4	13.7	1,874	1,618	3,492
1	81.6	84.3*	30.8	29.9	2,647	2,511	5,158
2	82.6	83.0	26.2	24.4	2,437	2,265	4,702
3	83.2	83.0	19.5	20.6	2,237	2,037	4,274
4	82.6	83.0	18.6	16.9	2,133	1,960	4,093
5	79.0	81.1	15.3	16.8	2,010	1,866	3,876
Total	**80.6**	**81.4**	**21.1**	**21.3**	**13,338**	**12,257**	**25,595**

* Significantly different p = 0.012, all others non-significant.

age groups compared to patients without a card.

Patients aged less than one were less likely to be prescribed medication than those aged one and over (72.4% versus 82.4%). The proportion of patients prescribed five or more prescriptions per annum peaked with 30.3% of one-year-olds, and then fell to 16.0% of five-year-olds (see Table 2.)

Overall 87.6% of all prescription items (including repeats) were prescribed from the five most frequently prescribed of the ATC level one therapeutic groups during the study period (see Table 3). Prescribing was from a relatively limited formulary. Only 330 chemical substances were used to prescribe to children out of approximately 1 100 listed at the time of the study. Of all prescriptions, 71.8% were from the twenty most frequently prescribed chemical substances.

Antibiotics were the most frequently prescribed medication item for all age groups, followed by drugs

Table 3. The most frequently prescribed main drug groups and therapeutic subgroups. Proportion of therapeutic group by therapeutic subgroup.

Therapeutic group				Age (years)			
Subgroup	< 1	1	2	3	4	5	Overall
n = number of prescription items	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Infections – Agents for systemic use*	n = 2,304	n = 10,375	n = 9,141	n = 7,426	n = 6,275	n = 5,511	n = 41,032
Penicillins	67.2	57.1	55.8	56.0	58.7	59.4	57.7
Other Antibiotics	16.2	22.2	21.9	20.3	19.9	18.5	20.6
Cephalosporins and Cephamycins	10.7	14.2	14.5	14.1	11.2	11.8	13.3
Macrolides and Aminoglycosides	5.3	5.7	6.6	7.5	8.4	8.4	7.0
All Others	0.6	0.8	1.2	2.1	1.8	1.9	1.4
Respiratory system and allergies*	n = 862	n = 3,640	n = 3,854	n = 3,745	n = 4,001	n = 3,871	n = 19,973
Antihistamines	14.8	27.0	26.8	22.8	19.1	15.3	21.8
Beta-adrenoceptor agonists – MDIs	10.3	17.1	22.0	26.9	26.1	28.4	23.6
Decongestants	44.9	21.6	13.5	9.5	7.9	6.3	13.1
Inhaled Corticosteroids – MDIs	3.8	7.7	12.4	16.6	22.0	23.8	16.1
Beta-adrenoceptor agonists oral liquids	6.0	10.4	7.9	5.5	3.8	3.5	6.2
All Others	20.2	16.2	17.4	18.7	21.1	22.7	19.2
Dermatologicals*	n = 2,170	n = 5,455	n = 4,184	n = 3,073	n = 2,629	n = 2,151	n = 19,662
Corticosteroids – Plain	24.7	27.9	31.4	32.1	29.6	28.6	29.3
Corticosteroids – Combination	30.6	28.2	19.8	15.1	13.1	13.2	21.0
Antibacterials Topical	9.3	7.0	10.8	14.0	15.4	15.9	11.3
Emollients	16.7	14.3	14.6	13.8	13.1	12.2	14.2
Antifungals Topical	11.8	11.3	6.7	5.4	4.9	6.1	8.0
All Others	6.9	11.3	16.7	19.6	23.9	24.0	16.2
Nervous System*	n = 1,936	n = 4,703	n = 3,804	n = 2,705	n = 2,245	n = 1,823	n = 17,216
Antipyretics & Non-Opioid Analgesics	99.0	98.0	95.6	93.0	93.1	92.8	95.6
All Others	1.0	2.0	4.4	7.0	6.9	7.2	4.4
Sensory organs*	n = 772	n = 1,504	n = 1,196	n = 936	n = 752	n = 632	n = 5,792
Anti-Infective Preparations	82.9	76.1	67.1	59.3	52.5	50.6	66.5
Ear Preparations	16.3	22.6	30.5	37.0	39.6	43.5	30.2
Corticosteroids & Other Anti-Inflam's	0.6	1.1	2.1	3.3	6.4	5.4	2.7
All others	0.1	0.3	0.3	0.4	1.5	1.3	0.5

*Note: The medications that constitute these ATC categories are listed in the New Zealand Pharmaceutical schedule.

prescribed for asthma, paracetamol, dermatological corticosteroids and anti-infective ophthalmologicals (see Table 3).

Discussion

This study examined general practice prescribing for patients aged less than six years, and provides important insights into prescribing patterns in New Zealand.

The results of this study indicate high rates of exposure to medication when consulting at general practice are present at an early age. This was especially evident for one-year-old children, with a mean prescription rate of 3.7 per consulting child/year. Prescribing was a frequent outcome of a general practice contact with 81.0% of patients aged less than six prescribed some form of medication during a consultation, which closely approximates results from the 1996/97 New Zealand Health Survey.[6] This high rate of prescribing may be a reflection of increased vulnerability of children to various illnesses. Prescribing for children was from a limited formulary of medications, which is consistent with evidence found in other countries.[2]

Although there were clear differences in rates of prescribing between community services cardholders and non-cardholders, the difference on average was not as pronounced for these data as has been found previously.[5] There were no significant sex differences in prescribing, which differs from previously published research, but the reasons for this are unclear.

There was a high rate of paracetamol prescribing with 14.8% of all prescription items for patients aged less than one being for some form of paracetamol. Although paracetamol is seen as a safe drug for children, there are the potential dangers of hepatotoxicity and the inhibition of the immune response if dosage is excessive.[6]

Antibiotics are frequently prescribed to young children; 60.6% of children under the age of six were prescribed some form of antibiotic, although it can be anticipated that a proportion of these prescriptions were not dispensed, for example due to the use of as needed prescriptions by general practitioners.[7] There are three main factors to take into account when prescribing antibiotics, the potential of allergic reactions, antibiotic resistance,[8] and more recently researchers have drawn attention to the possibility that paediatric prescribing of antibiotics could be related to later asthma.[9,10,11] Some potential drivers of excessive antibiotic prescribing are parental pressure and diagnostic uncertainty.[12]

The major strength of this database is its size, covering a large (albeit self-selected) sample of New Zealand's consulting population. Another strength is the completeness of the data available with every prescription recorded on the database, including prescriptions for medications that do not receive government subsidies and general practitioner prescribed over-the-counter medications. Importantly, the database provides individuation of data while maintaining patient confidentiality.

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The validity of research based on database records has been questioned for a variety of reasons:

(i) One central concern is that there are biases in selected data collections. This question has been addressed in a study that compared data from a group of randomly selected doctors that found no significant differences between the two groups.[13]

(ii) The lack of a clear population from which data is drawn. The design of medical software packages requires active management of patient registers – that is patients who had moved away, died or ceased to be patients of the practice must be removed from the system by the practice staff. It is therefore difficult to make inferences about patients who did not consult.

(iii) Some patients may see more than one general practitioner over the study period and so some prescriptions may not appear on the database.

(iv) The study is cross-sectional.

(v) Prescription data comes from general practice prescribing records not pharmacy dispensing records, and therefore failure to present or pick up a prescription was not measured. There are many different estimates for non-dispensing and the rate differs between different medication types, different age groups, sex, general practitioner, and day of the week.[14,15,16]

Despite these limitations in our study design, clinical databases are increasingly used to examine utilisation and are a valuable tool for general practice research.

Key points

- For children attending general practice there is a high rate of prescribing per GP contact and this rate is highest for one- and two-year-olds.
- Prescribing for children was from a limited formulary of medications, which is consistent with evidence found in other countries.
- 60.6% of children under the age of six were prescribed some form of antibiotic.
- The most frequently prescribed medications were antibiotics, anti-asthmatics, paracetamol, dermatological steroids, and anti-infective ophthalmologicals.

In summary, there is a high level of exposure to medication in paediatric populations. The most frequently prescribed medications were antibiotics, anti-asthmatics, paracetamol, dermatological steroids, and anti-infective ophthalmologicals. This is a reflection of the high frequency of infections and respiratory diseases in paediatric populations. This data can provide the justification and direction for future research and can become the baseline data set for future studies examining trends in disease occurrence, prescription patterns and therapeutic strategies for selected populations.

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References

1. Sutcliffe AG. Prescribing medicines for children. BMJ 1999; 319:70–1.
2. Sanz E. Drug prescribing for children in general practice. Acta Paediatr 1998; 87:489–90.
3. Sanz E, Boada J. Drug utilization in pediatric outpatients in Tenerife Island. Eur J Clin Pharmacol 1988; 34:495–9.
4. Straand J, Rokstad K, Heggedal U. Drug prescribing in general practice. A report from the More & Romsdal Prescription Study. Acta Paediatr 1998; 87:218–24.
5. Sutton F, Crampton P. The community services card: does it make a difference to pharmaceutical utilisation? NZ Med J 2001; 114(1131):206–8.
6. Dawson K, McIlvenny S, Quinn S, Harron D. Paracetamol prescribing – an epidemic? Fam Pract 1996; 13(2):179-81.
7. Arrol B, Goodyear-Smith F. General practitioner management of upper respiratory tract infections: when are antibiotics prescribed? N Z Med J 2000; 113(1122):493–6.
8. Tenover FC, Hughes JM. The challenge of emerging infectious diseases. JAMA. 1996; 275:300–304.
9. Droste J, Wieringa M, Weyler J, Nelen V, Vermeire P, Van Bever H. Does the use of antibiotics in early childhood increase the risk of asthma and allergic disease? Clin Exp Allergy 2000; 30(11):1547–53.
10. Wickens K, Pearce N, Crane J, Beasley R. Antibiotic use in early childhood and the development of asthma. Clin Exp Allergy 1999; 29(6):766–71.
11. Wjst M, Hoelscher B, Frye C, Wichmann H, Dold S, Heinrich J. Early antibiotic treatment and later asthma. Eur J Med Res 2001; 6(6):263–71.
12. Pichichero ME. Understanding Antibiotic Overuse for Respiratory Tract Infections in Children. Pediatrics 1999; 104(6):1384–8.
13. Tilyard MW, Dovey SM, Spears GFS. Biases in estimates from the RNZCGP Computer Research Group. NZ Med J 1995; 108:18–21.
14. Gardner TL, Dovey SM, Tilyard MW. Differences between prescribed and dispensed medications. NZ Med J 1996; 109:69–72.
15. MoH.1999. Taking the Pulse – the 1996/97 New Zealand Health Survey. Wellington: Ministry of Health.
16. Beardon PHG, McGilchrist MM, McKendrick AD, et al. Primary non-compliance with prescribed medication in primary care. BMJ 1993; 307:846–8.