

Management of acute bronchiolitis: can evidence based guidelines alter clinical practice?

J Barben,¹ C E Kuehni,² D Trachsel,³ J Hammer,³ on behalf of the Swiss Paediatric Respiratory Research Group

¹ Children's Hospital, St Gallen, Switzerland; ² Institute of Social and Preventive Medicine (ISPM), University of Bern, Switzerland; ³ University Children's Hospital Basel, Switzerland

Correspondence to:
Dr J Barben, Paediatric Pulmonology, Children's Hospital, CH-9006 St Gallen, Switzerland; juerg.barben@kispi.ch

J Barben and C E Kuehni contributed equally to this paper.

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ABSTRACT

Background: Acute bronchiolitis is the most common lower respiratory tract infection in infants and there is no evidence that drug treatment alters its natural course. Despite this, most Swiss paediatricians reported in 2001 prescribing bronchodilators and inhaled corticosteroids (ICS). This situation led to the creation of national guidelines followed by a tailored implementation programme. The aim of this study was to examine if treatment practices changed after the implementation of the new guidelines.

Methods: A questionnaire on treatment of bronchiolitis was sent to all Swiss paediatricians before (2001) and after (2006) creation and implementation of national guidelines (2003–2005). Guidelines were created in collaboration with all paediatric pulmonologists and implemented carefully using a multifaceted approach.

Results: Questionnaires were returned by 541 paediatricians (58%) in 2001 and by 639 (54%) in 2006. While both surveys showed a wide variation in the treatment of bronchiolitis between physicians, reported drug prescription decreased significantly between the two surveys. For outpatients, general use (for all patients) of bronchodilators dropped from 60% to 23%, and general use of ICS from 34% to 6%. For inpatients, general use of bronchodilators and ICS dropped from 55% to 18% and from 26% to 6%, respectively (all $p < 0.001$). The decrease was evident in all regions, among hospital and primary care physicians, and among general paediatricians and paediatric pulmonologists.

Conclusions: National guidelines together with a tailored implementation programme can have a major impact on medical management practices in a country.

Healthcare professionals are increasingly urged to base clinical practice on scientific evidence but implementation of research findings into routine daily practice is a major challenge.^{1–3} To date, most dissemination and implementation strategies have resulted in small to moderate improvements.⁴ Some strategies to change practices of health care professionals have been successful while others have not.^{5–6} Evidence based guidelines, published by many medical organisations, are often not very effective on their own.^{7–8} Instead, it has been suggested to design tailored interventions in order to implement these guidelines and change behaviour in daily practice.⁹

Acute bronchiolitis is the most common lower respiratory tract infection in infancy, with a typical clinical presentation of respiratory distress, crackles and wheezing.¹⁰ Its treatment is largely supportive, including oxygen therapy, fluid management, avoidance of unnecessary handling and

respiratory support.¹⁰ Systematic reviews suggest that available therapies will not shorten its natural course or provide clinically relevant improvements in symptoms. This is true for β_2 agonists, epinephrine, anticholinergics and both inhaled and oral corticosteroids.^{11–16} Nevertheless, all of these agents are used widely for the treatment of bronchiolitis.^{17–18} In Switzerland, a survey in 2001 showed that almost all paediatricians prescribed bronchodilators and inhaled corticosteroids (ICS) for outpatients and inpatients suffering from bronchiolitis.¹⁹ To change this situation, the Swiss Association of Paediatric Pulmonology (SAPP/SGPP) developed national guidelines for the management of acute bronchiolitis and viral induced wheeze in 2003 and 2004,²⁰ and took a range of measures to implement these. Both guidelines discouraged the use of any pharmaceutical agents or physiotherapy in previously healthy infants with bronchiolitis.

The aim of our study was to determine the effect of the new guidelines and their implementation by comparing self-reported management practices of all Swiss paediatricians before and after introduction of the new guidelines.

METHODS

Study design and subjects

We performed two cross sectional questionnaire surveys of all Swiss paediatricians in 2001 and 2006. The names and addresses of all paediatricians were provided by the Swiss Society of Paediatrics. We received a complete list of all qualified paediatricians in Switzerland, irrespective of their place of work (primary paediatric practice, hospital). Paediatric trainees were not included in the list, but a small number of retired colleagues may have been. A subgroup of these paediatricians, organised in the SAPP/SGPP, had formal subspecialty training or a special interest in paediatric pulmonology. Depending on the region, questionnaires were sent in French or German. To improve response rate and minimise selection bias, the questionnaires were returned anonymously in a prepaid envelope, and did not include information on sex, age or position of the physicians. For the same reason it was impossible to send reminders to non-responders.

Questionnaires

For both surveys we used an identical standardised questionnaire on management practices of bronchiolitis in infants.^{19–21} All paediatricians were asked to complete at least the first question (Do you

treat children with bronchiolitis—yes or no?). For those currently treating patients, the questionnaire contained two further sections relating separately to the management of outpatients and inpatients. We asked if they used the following drugs: bronchodilators (salbutamol, ipratropium bromide, adrenaline), corticosteroids (systemic, inhaled), cromoglycates, antibiotics, nasal drops, theophylline, ribavirin and physiotherapy. Answer categories for all questions were: “always”, “sometimes”, “only for high risk children” (children with underlying diseases, including bronchopulmonary dysplasia, cystic fibrosis, heart diseases, immunodeficiency and neurological disorders) and “never”. In addition, we asked if they performed virological examinations of nose or throat swabs.

Development and implementation of national guidelines

In 2003 and 2004, SAPP/SGPP developed and published two guidelines. The first one focused on the distinct disease phenotype “bronchiolitis in infants”.²² The second one, published a year later, was more comprehensive and contained guidelines on the treatment of different phenotypes of obstructive airway disorders in infants and children, including bronchiolitis but also viral wheeze in older children and atopic asthma.²³ Both guidelines were based on available evidence, mainly systematic reviews and meta-analyses, and were developed in several steps involving a large group of interested paediatric pulmonologists in Switzerland. Efforts were made to involve both hospital physicians and those working in primary practice, and we made sure that representatives from all regions and languages were included in the guideline development group. Both guidelines recommend abandoning all pharmacological and non-pharmacological therapies of bronchiolitis for which scientific evidence is clearly missing. The only treatment recommended by the guidelines was the use of nasal drops to optimise nasal breathing, although it was admitted that the evidence to support this recommendation was insufficient.

A multifaceted implementation strategy was developed. The official guidelines and several commentaries were published between 2003 and 2005 in German and French in all major official journals for paediatricians and general practitioners in Switzerland, including official publications of the Swiss Medical Association and the Swiss Society of Paediatrics (SSP), but also a

number of other scientific and popular medical journals.^{20–22–26} Furthermore, the guidelines were presented by a number of dedicated speakers of the SAPP/SGPP at the main national meetings and annual conferences (SAPP/SGPP, SSP, Swiss Society of Pulmonology and Paediatric Forum, the organisation for paediatricians working in private practice) and at local teaching rounds in university hospitals and regional hospitals (advanced training and continuing education for practitioners) targeting registrars and paediatricians working in primary, secondary and tertiary care all over Switzerland. In addition, a parent information leaflet was created in German and French (<http://www.sgpp-schweiz.ch/go2/de/publikationen>) and sent to all Swiss paediatricians for distribution to parents. The leaflet explained the disease in a simple language, highlighted that drug treatment usually did not help and counselled parents how to treat their babies. Guidelines and information leaflets can be downloaded on the official website of the SAPP/SGPP (www.sgpp-schweiz.ch) and the SSP (www.swiss-paediatrics.org).

Statistical analysis

The data were analysed using Stata, V.9.2 (Stata Corporation, Austin, Texas). We tabulated the frequency of reported use for the different drugs, comparing the two surveys in 2001 and 2006. χ^2 tests, χ^2 tests for trend and Fisher's exact tests were performed as appropriate to assess statistical significance in comparison of proportions. Binary logistic regression and ordered logistic regression models were used to compare treatment frequency between the two surveys, adjusting for the covariates language, physician subspecialty, place of work (hospital, private practice) and number of patients treated annually. Results were expressed as odds ratios (OR) with 95% confidence intervals; likelihood ratio tests were performed to compare different models. Effect modification was tested by comparing models with and without inclusion of interaction terms.

RESULTS

Response rates and characteristics of participating physicians

In 2001, 937 questionnaires were posted and 541 (58%) returned. In 2006, the response rate was 639/1188 (54%). Among these questionnaires, 119 (22%) in 2001 and 150 (23%) in 2006, respectively, came from physicians who did not treat children with acute bronchiolitis, leaving 422 (2001) and 498 (2006) for analysis.

In both years, about one-third of respondents were French and two-thirds were German speaking (table 1). Twenty-four per cent (2001) and 31% (2006) worked in hospitals, the others in private practice. About 9% in 2001 (6% in 2006) were qualified paediatric respiratory physicians or had a special interest in paediatric respiratory medicine.

The practice used to identify the causative viral agent remained stable over the observed period. In 2001, 44 (10%) physicians performed nose or throat swabs in all outpatients to identify respiratory viruses, 163 (39%) performed them sometimes, 90 (21%) only for high risk children and 197 (25%) never (with 18 (4%) missing answers). In 2006, the respective numbers were 28 (6%) always, 202 (41%) sometimes, 109 (22%) only for high risk children and 135 (37%) never (with 24 (5%) missing).

Reported drug prescription for acute bronchiolitis in 2001 and 2006

A wide variation in reported treatment of bronchiolitis was found in both surveys, for inpatients and outpatients. For

Table 1 Characteristics of participating physicians in 2001 and 2006

	2001 survey (n (%))	2006 survey (n (%))	p Value
Language			
German	279 (66.1)	331 (66.5)	0.90
French	143 (33.9)	167 (33.5)	
Physician specialty			
Paediatric pulmonologist (qualified)	16 (3.8)	18 (3.6)	0.34
Paediatric pulmonologist (interest)	21 (5.0)	13 (2.6)	
General paediatrician and other subspecialist	385 (91.2)	467 (93.8)	
Work place			
Hospital	102 (24.2)	153 (30.7)	0.05
Private practice	301 (71.3)	331 (66.5)	
Unclear	19 (4.5)	14 (2.8)	
No of bronchiolitis patients treated/year			
<10	133 (31.5)	125 (25.1)	0.15
10–50	241 (57.1)	306 (61.5)	
>50	37 (8.8)	55 (11.0)	
Missing	11 (2.6)	12 (2.4)	
Total	422 (100.0)	498 (100.0)	

Table 2 Reported management of outpatients with acute bronchiolitis in 2001 and 2006

	2001 survey (n = 422)					2006 survey (n = 498)					p Value
	Always	Sometimes	High risk	Never	Missing	Always	Sometimes	High risk	Never	Missing	
Salbutamol	254 60.2	149 35.3	1 0.2	2 0.5	16 3.8	117 23.5	314 63.1	8 1.6	32 6.4	27 5.4	<0.001
Ipratropium bromide	9 2.1	108 25.6	4 1.0	162 38.4	139 32.9	2 0.4	98 19.7	2 0.4	273 54.8	123 24.7	0.004
Cromoglycates	10 2.4	62 14.7	1 0.2	289 68.5	60 14.2	10 2.0	37 7.4	1 0.2	405 81.3	45 9.0	0.002
Steroids (any)	148 35.1	207 49.1	10 2.4	31 7.4	26 6.2	40 8.0	257 51.6	26 5.2	139 27.9	36 7.2	<0.001
Inhaled	143 33.9	197 46.7	9 2.1	35 8.3	38 9.0	32 6.4	205 31.2	24 4.8	171 34.3	66 13.3	<0.001
Systemic	14 3.3	142 33.7	13 3.1	137 32.5	116 27.5	12 2.4	163 32.7	19 3.8	238 47.8	66 13.3	0.769
Antibiotics	6 1.4	148 35.1	75 17.8	157 37.2	36 8.5	3 0.6	85 17.1	59 11.9	302 60.6	49 9.8	<0.001
Nasal drops (any)	189 44.8	204 48.3	0 0.0	10 2.0	19 5.0	298 59.8	169 34.0	1 0.0	8 2.0	22 4.4	<0.001
Xylometazoline	58 13.7	268 63.5	3 0.7	38 9.0	55 13.0	135 27.1	291 58.4	2 0.4	31 6.2	39 7.8	<0.001
NaCl 0.9%	176 41.7	169 40.1	0 0.0	12 2.8	65 15.4	278 55.8	159 31.9	1 0.2	10 2.0	50 10.0	0.001
Physiotherapy	— —	— —	— —	— —	— —	20 4.0	184 36.9	43 8.6	185 37.1	66 13.2	NA

Data are presented as n (first line) and row per cent (second line) for each treatment. Data from hospital based and primary care physicians are included.
p Values are derived from Fisher's exact test.

outpatients (table 2), salbutamol, ICS and nasal drops were the most commonly prescribed drugs. The frequency of salbutamol and ICS use decreased steeply between the two surveys: general use (for all children) of salbutamol from 60% in 2001 to 23% in 2006 ($p<0.001$), and general use of ICS from 34% to 6% ($p<0.001$). Use of antibiotics ("sometimes") in outpatients decreased from 35% to 17% ($p<0.001$). Nasal drops was the only medication that was more frequently prescribed between

the two surveys, with 45% of physicians prescribing them for all children in 2001 and 60% in 2006 ($p<0.001$).

Changes in reported drug treatment of inpatients were similar (table 3). In 2001, 55% of paediatricians always used salbutamol and 26% ICS for inpatients. In 2006, these proportions decreased to 18% and 6%, respectively ($p<0.001$). The number of physicians always prescribing physiotherapy decreased from 42% in 2001 to 14% in 2006 ($p<0.001$).

Table 3 Reported management of inpatients with acute bronchiolitis in 2001 and 2006

	2001 survey (n = 102)					2006 survey (n = 153)					p Value
	Always	Sometimes	High risk	Never	Missing	Always	Sometimes	High risk	Never	Missing	
Salbutamol	56 54.9	43 42.2	1 1.0	2 2.0	0 0.0	27 17.7	110 71.9	5 3.3	11 7.2	0 0.0	<0.001
Ipratropium bromide	5 4.9	49 48.0	2 2.0	37 36.3	9 8.8	4 2.6	45 29.4	3 2.0	98 64.1	3 2.0	0.006
Adrenaline	1 1.0	35 34.3	3 2.9	51 50.0	12 11.8	1 0.7	33 21.6	4 2.6	107 69.9	8 5.2	0.100
Steroids (any)	28 27.5	53 52.0	6 5.9	15 14.7	0 0.0	11 7.2	69 45.1	12 7.8	61 39.9	0 0.0	<0.001
Inhaled	27 26.5	51 50.0	4 3.9	20 19.6	0 0.0	10 6.5	60 39.2	9 5.9	74 48.4	0 0.0	<0.001
Systemic	5 4.9	51 50.0	11 10.8	35 34.3	0 0.0	3 2.0	58 37.9	11 7.2	81 52.9	0 0.0	0.020
Theophylline	1 1.0	13 12.8	4 3.9	81 79.4	3 2.9	0 0.0	8 5.2	6 3.9	138 90.2	1 0.7	0.074
Ribavirin	0 0.0	2 2.0	6 5.9	92 90.2	2 2.0	0 0.0	1 0.7	12 7.8	139 90.9	1 0.7	0.599
Physiotherapy	43 42.2	48 47.1	4 3.9	6 5.9	1 1.0	22 14.4	90 58.8	10 6.5	30 19.6	1 0.7	<0.001

Data are presented as n (first line) and row per cent (second line) for each treatment. Only questionnaires from hospital based physicians are included and therefore numbers are lower than in table 2.
p Values are derived from Fisher's exact test.

Table 4 Determinants of reported frequency of use of salbutamol, inhaled steroids and antibiotics in outpatients with acute bronchiolitis

	2001 survey (n = 422‡)				2006 survey (n = 498‡)			
	Unadjusted		Adjusted*		Unadjusted		Adjusted*	
	OR (95% CI)	p Value	OR (95% CI)	p Value	OR (95% CI)	p Value	OR (95% CI)	p Value
Salbutamol								
French (vs German)	2.00 (1.28 to 3.10)	0.002	2.55 (1.54 to 4.22)	<0.001	0.87 (0.59 to 1.30)	0.508	0.90 (0.60 to 1.36)	0.626
Paediatric pulmonologists	0.37 (0.18 to 0.76)	0.007	0.69 (0.32 to 1.52)	0.360	0.31 (0.13 to 0.75)	0.009	0.43 (0.18 to 1.03)	0.060
Hospital based vs practice	0.46 (0.29 to 0.74)	0.001	0.41 (0.25 to 0.70)	0.001	0.44 (0.28 to 0.69)	<0.001	0.54 (0.34 to 0.87)	0.010
>50 patients vs less	0.43 (0.22 to 0.87)	0.019	0.53 (0.25 to 1.13)	0.101	0.41 (0.22 to 0.77)	0.006	0.60 (0.31 to 1.15)	0.125
Inhaled steroids								
French (vs German)	2.15 (1.43 to 3.24)	<0.001	2.14 (1.37 to 3.34)	0.001	1.36 (0.94 to 1.97)	0.107	1.40 (0.95 to 2.07)	0.092
Paediatric pulmonologists†	0.17 (0.08 to 0.36)	<0.001	0.24 (0.11 to 0.55)	0.001	0.34 (0.15 to 0.77)	0.010	0.46 (0.20 to 1.08)	0.076
Hospital based vs practice	0.29 (0.18 to 0.47)	<0.001	0.25 (0.15 to 0.42)	<0.001	0.44 (0.30 to 0.65)	<0.001	0.46 (0.30 to 0.70)	<0.001
>50 patients vs less	0.81 (0.42 to 1.59)	0.548	1.60 (0.78 to 3.30)	0.203	0.62 (0.36 to 1.08)	0.091	0.86 (0.47 to 1.57)	0.632
Antibiotics								
French (vs German)	2.62 (1.76 to 3.90)	<0.001	2.83 (1.84 to 4.35)	<0.001	1.41 (0.95 to 2.11)	0.090	1.41 (0.94 to 2.13)	0.100
Paediatric pulmonologists	0.36 (0.18 to 0.74)	0.006	0.63 (0.29 to 1.36)	0.242	0.50 (0.19 to 1.35)	0.173	0.53 (0.19 to 1.47)	0.225
Hospital based vs practice	0.71 (0.46 to 1.10)	0.125	0.67 (0.42 to 1.07)	0.094	1.33 (0.88 to 2.02)	0.181	1.48 (0.95 to 2.30)	0.084
>50 patients vs less	0.68 (0.35 to 1.30)	0.246	0.76 (0.38 to 1.50)	0.426	0.82 (0.44 to 1.53)	0.530	0.73 (0.38 to 1.41)	0.347

Unadjusted and adjusted odds ratios were derived from ordered logistic regression.

*Adjusted for all variables in the list; †vs general paediatricians and other paediatric subspecialists; ‡regressions are based on 406 (2001) and 471 questionnaires (2006) for salbutamol, on 384 (2001) and 449 questionnaires (2006) for inhaled corticosteroids and on 386 (2001) and 449 questionnaires (2006) for antibiotics.

Theophylline and ribavirin were prescribed for very few patients in both surveys.

Determinants of reported drug use in 2001 and 2006

In 2001, salbutamol, ICS and antibiotics for outpatients were prescribed more often by physicians living in the French speaking part of Switzerland (table 4). The same was true for the other drugs not shown in table 4. This difference had narrowed or disappeared by 2006. In both surveys, all drugs tended to be prescribed less often by paediatric pulmonologists compared with general paediatricians, by hospital physicians compared with those working in private practice and by doctors treating more than 50 children per year compared with those treating fewer cases.

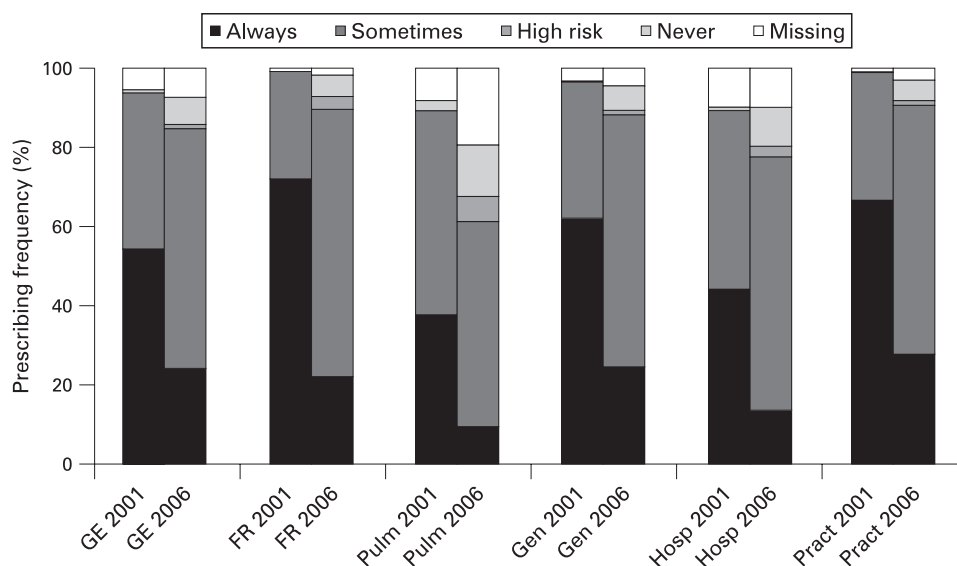
The decrease in the prescription of salbutamol for outpatients between the two surveys was seen in all subgroups: French and German speaking, hospital based and primary care

physicians, paediatric pulmonologists and generalists (p value (for trend) ≤ 0.002 for all subgroups) (fig 1). The same was true for the decrease in reported use of other drugs (data not shown).

DISCUSSION

This is, to our knowledge, the first study that has demonstrated a clinically relevant change in the management of acute bronchiolitis before and after introduction of national guidelines. We found a large reduction in the reported prescription for most drugs, most prominently for bronchodilators, inhaled steroids and antibiotics, and among all paediatricians (hospital and practicing paediatricians, paediatric pulmonologists and generalists/other subspecialists). The simple but labour intensive interventions taken to implement these new guidelines, tailored to the needs of hospital based and primary care paediatricians, have proved highly effective.

Figure 1 Frequency of reported prescription of salbutamol in outpatients with acute bronchiolitis in 2001 and 2006, by groups of participating physicians. Frequency was reported as always, sometimes, high risk and never. Missing values are also indicated. FR, French speaking; GE, German speaking; Gen, general paediatricians and other subspecialists; Hosp, hospital based physicians; Pract, physicians working in primary care practices; Pulm, paediatric pulmonologists. p Values (from trend tests) for differences between the two surveys were ≤ 0.002 in all subgroups.



Methodological considerations

The effect of the new guidelines was assessed by nationwide surveys of all qualified paediatricians in Switzerland before and after their introduction, using the same methodology. The questionnaire, although not formally validated, had been used in previous surveys.²¹ The response rates of 58% and 54% are relatively good for a survey among physicians using only a single mailing. Also, the group of non-responders is likely to include colleagues not treating children with bronchiolitis at the time of the survey (eg, retired colleagues, physicians temporarily out of work and subspecialists working in other fields). It is likely that non-responders differed from responders (for instance by age, gender and awareness of new medical literature) but it seems unlikely that the characteristics of non-responders had changed substantially between the two surveys. Given the similar response rates and similar characteristics of respondents in the two surveys, we do not think that the change between the two surveys could be explained by response bias. Also, the differences were so large that only a very strong bias could have reversed our results.

Our strategy to implement the new guidelines targeted paediatricians, and only these were included in the survey. We do not know if treatment practices also changed among general practitioners. Although general practitioners treat a significant proportion of older children in Switzerland, they see only a minority of infants. We are therefore confident that these surveys reached the majority of physicians treating infants with bronchiolitis in Switzerland.

The main limitation of our study is that we assessed self-reported prescription of drugs and not the actual behaviour of physicians in daily practice. Data of actual drug sales would be helpful to support our findings. Unfortunately, in Switzerland, available data on drug sales are not broken down by age. The use of inhaled corticosteroids via nebulisers in the paediatric hospital setting has certainly decreased dramatically over the past years (personal communication of hospital based pharmacists and drug company salespersons). Therefore, although it is likely that the new guidelines have reduced costs in the treatment of bronchiolitis in infants and preschool children, which together with other wheezing disorders account for a considerable proportion of total health care costs,²⁷ the current study is not designed to prove this assumption.

It could be argued that the time trends in drug prescription were not a response to the new Swiss guidelines but rather a consequence of the accumulating evidence on this topic in general, including other reviews and guidelines. There are three arguments against this. Firstly, the scientific evidence that no drug changes the natural course of acute bronchiolitis had been available for decades, and was reflected in the scarce use of drugs in Australian paediatricians nearly 10 years ago (table 5), perhaps because of their published guidelines in 1993.²¹ Because the Swiss had not implemented this evidence by 2001, it is unlikely that such a large change would have occurred without an intervention within the short period of 5 years. Secondly, at the time of our first survey, Australia was the only country with published guidelines,²¹ and the American Academy of Pediatrics did not publish their recommendations until October 2006,¹⁰ shortly after our second survey had taken place. Thirdly, the decrease was seen for all drugs except for nasal drops which were the only medications recommended in the new guidelines. However, we cannot definitely exclude the fact that other publications have contributed to the observed change in behaviour of Swiss paediatricians.

Comparison with other studies

There are only a few published reports on management practices of acute bronchiolitis in other countries (table 5).^{17 18 21 28} Compared with the survey among the European Society for Paediatric Infectious Disease¹⁷ and the Canadian retrospective study in nine tertiary hospitals,¹⁸ the Swiss paediatricians have improved their management towards a more evidence based treatment. However, they still prescribe more drugs than their colleagues in Australia.²¹ The Irish study²⁹ presenting a clinical scenario of a 3-month-old infant with severe respiratory syncytial virus infection is not directly comparable.

The findings that hospital physicians prescribed less drugs than practitioners and paediatric pulmonologists less than general paediatricians is not surprising. In a study on determinants of health costs and patterns of care in patients with asthma in Switzerland,³⁰ Szucs and colleagues found that total direct costs were higher among general practitioners compared with specialists. They also showed that French

Table 5 International comparison of inpatient management for infants with acute bronchiolitis

	Canada 1994*	Europe 1995†	Australia 1998‡	Switzerland		Belgium 2003¶
				2001§	2006§	
Salbutamol (%)						
All patients	85	61	7	55	18	NA
Sometimes	NA	NA	69	42	72	NA
Only high risk patients	NA	34	12	1	3	NA
Never	NA	5	9	2	7	11
Steroids (%)						
All patients	28	11	1	27	7	2
Sometimes	NA	NA	35	52	45	32
Only high risk patients	NA	69	22	6	8	20
Never	NA	19	38	15	40	46
Ribavirin (%)						
All patients	6	0	0	0	0	NA
Sometimes	NA	NA	1	2	1	NA
Only high risk patients	NA	57	11	6	8	NA
Never	NA	43	83	90	91	NA

*Retrospective study in hospitals.¹⁸ †Questionnaire survey with specialised paediatric infectious disease physicians.¹⁷

‡Questionnaire survey with paediatricians—response rate 62%.²¹ §Current study. ¶Questionnaire survey with paediatricians—response rate 40%. NA, not available.²⁸

speaking physicians prescribed more drugs than doctors in the German speaking part of the country, resulting in a higher economic burden. This is true for other disorders and is reflected by higher premiums for medical insurance in the French speaking part of Switzerland. In addition, the French speaking part of Switzerland is strongly influenced by French language scientific literature. For instance, publications on chest physiotherapy in children with bronchiolitis from a Belgian kinesiologist, published in French,³¹ seem to have had a large impact on French speaking paediatricians in Switzerland (personal communication with French speaking colleagues). It is important to note that this gap between the French and German speaking part of Switzerland narrowed or disappeared after implementation of the new guidelines (fig 1).

Even though drug use decreased enormously between the two surveys, we need to say that a large number of Swiss paediatricians continued to use supplementary drugs for both outpatients and inpatients. More than 90% of the paediatricians still indicated that they used bronchodilators, but mainly for the purpose of a treatment trial ("sometimes" users) because of the clinical difficulties of differentiating acute bronchiolitis from viral induced obstructive bronchitis (wheezing) and the first episode of asthma in older infants, respectively.³²

How to implement change in clinical practice?

Difficulties in implementing evidence based medicine into clinical practice are well recognised.^{1 6 8} The barriers to the adoption of research findings in clinical practice are complex and many theories and a multitude of factors that may affect a successful implementation of evidence have been described.^{5 7 21 33} Relying on the passive diffusion of information is doomed to failure in a global environment with about 10 000 new randomised trials published annually.¹ A common approach is to summarise research findings in guidelines and consensus views in medical journals. Evidence based guidelines can contribute to improved care only if they succeed in changing actual practice.³ However, many physicians are unaware of the guidelines or, at least, not influenced by them because improving knowledge does not necessarily alter behaviour.^{6 34} In particular, one has to bear in mind that health professionals have their own experiences, beliefs and perceptions about appropriate practice; attempts to change practice which ignore these factors are unlikely to succeed. Circulation of guidelines without a tailored implementation strategy may have little impact on the behaviour of health professionals.^{6 9}

A systematic review of 235 studies of guideline dissemination and implementation strategies found a small to moderate improvement in care, with an average of 10% improvement across the studies.⁴ Most of these studies investigated change in clinical practice in the hospital setting, not daily behaviour of practitioners. For example, in a hospital setting in Cincinnati (USA), an evidence based clinical practice guideline for managing bronchiolitis was highly successful in its first year of implementation, with significant reductions in the use of all respiratory therapies.³⁵ The use of β_2 agonists decreased by 30%, and the mean cost for respiratory care services by 77%. Subsequently, Kotagal and colleagues introduced the same guidelines in seven hospitals but with varying success.³⁶

To achieve a change in clinical practice we believe that the following points need to be considered. Firstly, there must be a few individuals who are motivated to facilitate the change. Secondly, national or local guidelines, reflecting the needs of the local population, should be developed from existing international guidelines and the current available literature by a process

of consultation with all of the relevant medical staff. This process will encourage a sense of "ownership" of the local guidelines. Thirdly, having developed local guidelines, implementation must include interactive educational sessions with all relevant practitioners. Finally, implementation activities should be evaluated to examine their effectiveness and the results disseminated to all relevant practitioners.²¹

Why was the present strategy successful?

We therefore believe that the following components of our strategy were crucial to its success. (1) The guidelines were developed in a working group which included representatives from all regions and all languages in Switzerland, hospital physicians as well as respiratory physicians working in private practice. Therefore, a broad consensus was reached. (2) The new guidelines were broadly presented by a number of dedicated paediatric respiratory physicians in various national and local meetings, at university hospitals and regional hospitals in advanced training programmes for registrars and continuing education for practitioners, and in all relevant medical publications, not only in scientific ones, but also in popular medical tabloids. (3) The implementation package included an information leaflet for distribution to parents which was supported by the Swiss Society of Paediatrics. Under the pressure of demanding or overanxious parents and overcrowded medical practices it is easier for a clinician to prescribe a drug instead of trying to explain to parents that no medication will help. This fact is well known by paediatricians who are confronted daily with viral and other self-limiting diseases such as coughs or painful middle ear infections. This parental pressure might perhaps explain the increased use of nose drops, which we found in parallel to the decreased use of other medications. The information leaflet might also have helped to signal to parents that there is a national consensus for treatment of this condition and there is no evidence to support the use of drugs in the management of bronchiolitis. In addition, Switzerland is a small country with only 7 million inhabitants with a very active and collaborative group of paediatric pulmonologists who have built up a good care and information network.

In summary, we showed that the creation and tailored implementation of new bronchiolitis guidelines in Switzerland was followed by a clinically significant change in the management of acute bronchiolitis in all paediatricians. The relatively simple but labour intensive measures taken to implement the new guidelines, tailored to the respective needs of hospital based and primary care based paediatricians, specialists and generalists, have thus proven to be highly effective.

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