



26 **Change in viral bronchiolitis management in hospitals in the UK after the**  
27 **publication of NICE guideline**

28 **ABSTRACT**

29 **Background** Viral bronchiolitis is one of the most common causes of hospitalisation  
30 in young infants. It has previously been shown that many UK hospital Trusts were  
31 not compliant with many aspects of the NICE bronchiolitis guideline prior to its  
32 publication.

33 **Objectives** This study aimed to investigate changes in the management of  
34 bronchiolitis by hospital Trusts between 2015 (before NICE guideline publication)  
35 and 2017, after publication.

36 **Study design** We prospectively surveyed paediatricians at UK hospital Trusts on the  
37 management of bronchiolitis before (March to May 2015) and after (January to May  
38 2017) the NICE bronchiolitis guideline publication in June 2015, using an electronic,  
39 structured questionnaire.

40 **Results** In 2015 111 Trusts were represented and in 2017 100 Trusts. Significant  
41 improvements were seen in the use of nebulised bronchodilators and hypertonic  
42 saline and provision of parental written guidance. However, full compliance with the  
43 guideline did not change with 18% of Trusts compliant before publication of the  
44 guideline in 2015 and 19% fully compliant with the guideline in 2017.

45 **Conclusions** Overall there were modest but important improvements in the reported  
46 management of bronchiolitis after the publication of the NICE guideline.

47

48 **Keywords:** NICE, bronchiolitis, hospital trusts, viral testing, cohorting

49 **INTRODUCTION**

50 Viral bronchiolitis results in up to 25,000 hospital admissions per year in England  
51 with a 15-fold variation in hospital admission rates between different NHS Trusts  
52 across England [1]. Individual differences in hospital management have been  
53 suggested as a contributory factor to this variation [2]. The National Institute for  
54 Health and Care Excellence (NICE) published the first national (English) bronchiolitis  
55 guideline in June 2015 [3] to try to reduce this variation in management. We have  
56 previously shown that many Trusts were not compliant with the NICE guideline prior  
57 to its' publication [4], despite similar guidance already being available from the  
58 Scottish Intercollegiate Guideline Network (SIGN) [5]. This study investigates the  
59 changes in hospital Trust management after NICE guideline publication.

60

61 **OBJECTIVES**

62 The aim of this study was to investigate changes in the management of bronchiolitis  
63 by hospital Trusts between 2015 (before NICE guideline publication) and 2017, after  
64 publication. In our previous study we had also investigated the use of respiratory virus  
65 testing and isolation/cohorting of infants with viral bronchiolitis by Trusts and thus a  
66 secondary aim of this study was to assess any changes in these practices. The data  
67 from the 2015 survey have been published previously [4].

68

69 **STUDY DESIGN**

70 A structured electronic questionnaire was sent to paediatricians from all Trusts in the  
71 UK that provide paediatric care (n=170) between March to May 2015 and January to

72 May 2017 as previously described [4]. It was sent as a link via e-mail to paediatric  
73 consultants and trainees working at each Trust. We compared the responses from  
74 Trusts in 2015 and 2017. How many of the same clinicians completed the survey in  
75 both years is not known as the survey was completed anonymously but 42 Trusts  
76 had a participant complete the survey in both years.

## 77 **Statistical analysis**

78 Proportions were compared using the Chi squared or Fisher's exact test. Continuous  
79 variables were tested for normality using the Shapiro-Wilk test and data were analysed  
80 using either the independent T-test or the Mann-Whitney U test as appropriate.  
81 Statistical analysis was carried out with IBM SPSS Statistics (Version 24, New York,  
82 USA).

83 Ethical approval was not required for this study.

84

## 85 **RESULTS**

### 86 **Demographics**

87 Of 100 the Trusts included in 2017, 75% were district general hospitals and 25%  
88 university hospitals. 99% of Trusts had an emergency department and 15% a  
89 paediatric intensive care unit (PICU). 50% of Trusts reported most children are  
90 initially seen by emergency doctors and 46% by paediatric doctors. Responses  
91 were obtained from 87 (87%) general paediatric consultants, four (4%) respiratory  
92 consultants and nine (9%) junior doctors. All respondents were involved in the  
93 management of infants with acute bronchiolitis.

94 111 (65%) Trusts were represented by the responses in 2015 and 100 (59%) in  
95 2017. In 2015 100 (90%, 95% confidence interval [95% CI] 83-95%) Trusts had a  
96 guideline compared with 89 (89%, 95% CI 81-94%) in 2017, a difference of -1%  
97 (95% CI -9 to +7%, P=0.82). In 2017 58 (65%, 95% CI 55-74%) Trusts had updated  
98 their bronchiolitis guideline in light of the 2015 NICE guideline.

### 99 **Use of supplemental oxygen**

100 There was no significant change in the proportion of Trusts advising supplemental  
101 oxygen at the NICE recommended threshold of <92% after the guideline was  
102 published (58% versus 66%, Difference +8% [95% CI -6% to +21%], P=0.25).

### 103 **Intravenous (IV) fluids**

104 Most Trusts reserved IV fluids for infants with severe disease or other specific issues  
105 in both years (2015 versus 2017; 86% versus 96%, Difference +10% [95% CI 2-  
106 19%], P=0.02).

### 107 **Chest physiotherapy and suctioning**

108 Similar proportions of Trusts in 2015 and 2017 (26% versus 31%, Difference +5%  
109 [95% CI -7 to +18%], P=0.45) recommended undertaking chest physiotherapy only in  
110 specific circumstances (e.g. patients with difficulty clearing secretions) in line with the  
111 NICE recommendations.

112 The proportion of Trusts recommending nasal suctioning for all hospitalised infants  
113 significantly decreased from 2015 to 2017 (39% versus 22%, Difference -17% [95%  
114 CI -4 to -29%], P=0.01) in line with the NICE recommendations.

### 115 **Investigations**

116 The majority of Trusts only undertook blood gas testing (84% and 86% in 2015 and  
 117 2017 respectively, Difference +2% [95% CI -8 to +12%], P=0.70) and chest x-rays  
 118 (65% and 74% in 2015 and 2017 respectively, Difference +9% [95% CI -4 to +22%],  
 119 P=0.18) in infants requiring high dependency unit (HDU) or paediatric intensive care  
 120 unit (PICU) admission.

121 **Medications**

122 Between 2015 and 2017 there were improvements in the reported use of almost all  
 123 medications not recommended by NICE (Table 1).

124 Table 1: The number of Trusts advising against routine use of various medications in  
 125 each year. Data presented as n (% , 95% confidence interval).

<b>Medication</b>	<b>2015</b>	<b>2017</b>	<b>% Difference</b>	<b>P Value</b>
Inhaled (via spacer) bronchodilator (NICE recommendation: Do not use salbutamol or ipratropium bromide)	69 (69%, 59-77%)	72 (81%, 72-88%)	+12% (-0.5 to +24%)	0.059
Nebulised bronchodilator (NICE recommendation: Do not use salbutamol or ipratropium bromide)	53 (53%, 43-63%)	62 (70%, 59-78%)	+17% (3-30%)	0.02
Nebulised adrenaline (NICE recommendation: Do not use nebulised adrenaline)	78 (78%, 69-85%)	78 (88%, 72-93%)	+10% (-1 to +20%)	0.07
Inhaled (via spacer) steroids (NICE recommendation: Do not use inhaled corticosteroids)	95 (95%, 89-98%)	85 (96%, 89-98%)	+1% (-6 to +8%)	0.74
Nebulised steroids (NICE recommendation: Do not use inhaled corticosteroids)	95 (95%, 89-98%)	87 (98%, 92-99%)	+3% (-3 to +9%)	0.27
Oral steroids (NICE recommendation: Do not use oral corticosteroids)	93 (93%, 86-97%)	87 (98%, 92-99%)	+5% (-2 to +12%)	0.10

Nebulised hypertonic saline (NICE recommendation: Do not use nebulised hypertonic saline)	45 (45%, 36-55%)	60 (67%, 57-76%)	+22% (8-35%)	0.003
Antibiotics (NICE recommendation: Do not use antibiotics)	69 (69%, 59-77%)	72 (81%, 72-88%)	+12% (-0.5 to +24%)	0.059
Montelukast (NICE recommendation: Do not use montelukast)	100 (100%, 96-100%)	87 (98%, 92-99%)	-2% (-7 to +2%)	0.16
Heliox (No NICE recommendation on Heliox)	99 (99%, 95-100%)	86 (97%, 91-99%)	-2% (-8 to +3%)	0.32
Ribavirin (No NICE recommendation on ribavirin)	96 (96%, 90-98%)	83 (93%, 86-97%)	-3% (-11 to +4%)	0.36

126

127 **Written advice**

128 Significantly more Trusts routinely gave written information to parents in 2017 than  
129 2015 (51% versus 87%, Difference +36% [95% CI 23-47%], P<0.0001).

130 **Overall NICE guideline compliance**

131 There was no significant improvement in the proportion of Trusts that were fully  
132 compliant with the NICE guideline from 2015 to 2017 (18% versus 19%, Difference  
133 +1% [95% CI -10 to +12%], P=0.86). Compliance with individual aspects of the  
134 NICE guideline ranged from 43% to 100% in 2015 and 52% to 97% in 2017.

135 **Respiratory viral testing**

136 The proportion of Trusts routinely testing hospitalised infants for respiratory viruses  
137 significantly decreased between 2015 and 2017 (72% versus 44%, Difference -27%  
138 [95% CI -14 to -39%], P=0.0001).

139 There was an increase in those Trusts only undertaking respiratory virus testing in  
 140 infants with severe bronchiolitis (requiring HDU/PICU) (15% versus 40%, Difference  
 141 25% [95% CI 13-36%],  $P < 0.0001$ ).

142 Twenty-two (20%) Trusts in 2015 and 18 (18%) in 2017 (Difference -2% [95% CI -13  
 143 to +9%],  $P = 0.71$ ) used respiratory syncytial virus (RSV) point of care tests in the  
 144 emergency department (ED) to diagnose RSV infection as a cause of bronchiolitis.

145 In 2015, 74 (68%) Trusts tested respiratory samples for RSV, influenza and other  
 146 respiratory viruses, 28 (26%) for RSV only and four (4%) for RSV and influenza only  
 147 compared with 52 (52%), 21 (21%) and 10 (10%) in 2017 respectively ( $P = 0.10$ ,  
 148 comparing the mutually exclusive different options of testing between the years).

149 **Cohorting policies**

150 Cohorting policies remained similar across the two years ( $P = 0.46$ ) (Table 2).

151 Table 2: The number of Trusts using each of the different cohorting policies. Data  
 152 presented as n (% , 95% confidence interval). The options were mutually exclusive.

<b>Cohorting policy</b>	<b>2015</b>	<b>2017</b>	<b>Difference</b>	<b>P value*</b>
All infants to individual rooms/cubicles	39 (35%, 27-45%)	29 (29%, 21-39%)	-6% (-18 to +7%)	0.46
Cohort infants regardless of virus	18 (16%, 11-24%)	15 (15%, 9-23%)	-1% (-11 to +9%)	
Cohort infants with the same virus	18 (16%, 11-24%)	26 (26%, 18-35%)	+10% (-1 to 21%)	
Cohort infants testing positive for RSV separate to infants testing positive for other viruses	25 (23%, 16-31%)	19 (19%, 13-28%)	-4% (-15 to +7%)	
Other	10 (9%, 5-16%)	11 (11%, 6-19%)	+2% (-6 to +11%)	

153 \*The P value compares the five different cohorting options across the two years.

154

## 155 **DISCUSSION**

156 In this study we demonstrated modest but significant improvements in Trusts'  
157 reported management of viral bronchiolitis after the publication of the NICE  
158 guideline. We have previously shown the NICE guideline resulted in similar modest  
159 improvements in the primary care management of bronchiolitis [6].

160 That only modest improvements are seen is not surprising given the relatively short  
161 time between the surveys, that there was already very high compliance in several  
162 areas and resistance to change and difficulties translating guidelines into clinical  
163 practice being long-recognised problems. To try to overcome these problems NICE  
164 recommends using questionnaires to obtain a clear picture of current practice [7],  
165 which was the aim of this study. Widely distributed educational materials, regular  
166 national surveys and individual Trust audits are useful in helping adopt new  
167 guidelines into routine clinical practice [7]. We would welcome this for future updates  
168 of the NICE bronchiolitis guideline.

169 The American Academy of Paediatrics published their bronchiolitis guideline in 2006.  
170 A large study investigated adherence to the guideline in three time cohorts; pre-  
171 guideline, post-guideline early (one to two years post guideline) and post-guideline  
172 late (five to six years post guideline) [8]. There was minimal change between pre-  
173 guideline and post-guideline early but significant reductions in the use of steroids  
174 and bronchodilators and number of blood tests and chest X-rays performed between  
175 the pre-guideline and post-guideline late groups. This suggests significant changes

176 take time to be adopted into clinical practice. A Swiss study surveyed 1180  
177 paediatricians, and found that one to three years after publication of a bronchiolitis  
178 guideline with a national implementation strategy there were significant reductions in  
179 the use of bronchodilators and steroids [9], similar results to our study.

180 Our study has several strengths and limitations. We have prospective, longitudinal  
181 data from a large number of Trusts representative of different size hospitals and  
182 geographic locations throughout the UK. Responses were only obtained from  
183 approximately 60% of relevant Trusts and thus it is possible that clinicians in higher  
184 performing Trusts may have been more likely to respond. Individual patient notes  
185 were not examined and so we cannot comment on how these reported results  
186 translate to actual patient care. In addition, as some Trusts had replies from multiple  
187 clinicians which were not always identical, there may have been some individual  
188 clinician bias which may have resulted in either an under or over estimation of the  
189 use of investigations or non-recommended medications. Forty-two Trusts completed  
190 the survey in both years, thus some differences may be due to variation in the others  
191 completing the survey in each year.

192 Although it is recognised that guidelines are not always followed by individual  
193 clinicians, it remains important to establish Trusts' recommendations as best  
194 practice. Many departments have high turnover of staff, particularly of junior doctors,  
195 and thus guidelines are an important tool in maintaining good clinical practice.

196 In conclusion, modest but significant improvements in reported care have been  
197 made since the publication of NICE guideline. Given the high-volume nature of this  
198 condition, even small improvements may affect the care of large numbers of  
199 children.

200 **Acknowledgements/Funding**

201 Funding: This study was funded by the Medical Sciences Division Medical Research  
202 Fund and the Jenner Institute of the University of Oxford. The funders had no role in  
203 the design, data collection or analysis, interpretation, write up or decision for article  
204 submission of the project.

205 Competing interests: AJP has previously conducted studies on behalf of Oxford  
206 University funded by vaccine manufacturers, but currently does not undertake  
207 industry funded clinical trials. AJP chairs the UK Department of Health's (DH) Joint  
208 Committee on Vaccination and Immunisation (JCVI) and is a member of the World  
209 Health Organization's (WHO) Strategic Advisory Group of Experts. The views  
210 expressed in this manuscript are those of the authors and do not necessarily reflect  
211 the views of the JCVI, the DH, or the WHO.

212 SBD, EJC and RB have no conflicts of interest to declare.

213 Ethical approval: Not required.

214 Acknowledgements: The authors acknowledge the support of the National Institute  
215 for Health Research (NIHR) Oxford Biomedical Research Centre and the NIHR  
216 Thames Valley and South Midlands Clinical Research Network. AJP is a NIHR  
217 Senior Investigator. The views expressed in this article are those of the author(s) and  
218 not necessarily those of the NHS, the NIHR, or the Department of Health. We thank  
219 all the doctors who completed the survey.

220

221

222 **REFERENCES**

- 223 1 Cheung CR, Smith H, Thurland K, *et al.* Population variation in admission rates  
224 and duration of inpatient stay for bronchiolitis in England. *Arch Dis Child*  
225 2013;**98**:57–9. doi:10.1136/archdischild-2012-302277
- 226 2 Murray J, Bottle A, Sharland M, *et al.* Risk factors for hospital admission with  
227 RSV bronchiolitis in England: a population-based birth cohort study. *PLoS One*  
228 2014;**9**:e89186. doi:10.1371/journal.pone.0089186
- 229 3 National Institute for Health and Care Excellence. Bronchiolitis: diagnosis and  
230 management of bronchiolitis in children. Clinical Guideline NG 9. 2015.
- 231 4 Carande EJ, Galiza EP, Nickless A, *et al.* Viral bronchiolitis management in  
232 hospitals in the UK. *J Clin Virol* 2018;**104**:29–33.  
233 doi:10.1016/j.jcv.2018.04.010.
- 234 5 SIGN. Bronchiolitis in Children- Sign Guideline 91 (2006). 2006.
- 235 6 Carande EJ, Cheung CR, Pollard AJ, *et al.* Change in viral bronchiolitis  
236 management in primary care in the UK after the publication of NICE guideline.  
237 *Thorax* 2018;;thoraxjnl-2017-211180. doi: 10.1136/thoraxjnl-2017.  
238 doi:10.1136/thoraxjnl-2017-211180
- 239 7 NICE. How to change practice- Understand, identify and overcome barriers to  
240 change. 2007.
- 241 8 Parikh K, Hall M, Teach SJ. Bronchiolitis management before and after the  
242 AAP guidelines. *Pediatrics* 2014;**133**:e1-7. doi:10.1542/peds.2013-2005
- 243 9 Barben J, Kuehni CE, Trachsel D, *et al.* Management of acute bronchiolitis:

244 can evidence based guidelines alter clinical practice? *Thorax* 2008;**63**:1103–9.

245 doi:10.1136/thx.2007.094706

246

247