Hospital discharge using salbutamol as required after acute attacks of wheeze in children: a service evaluation

Gary Connett, Stephanie Harper, Bhagav Raut, David James

**ABSTRACT**

**Objective** Most UK hospitals discharge children after acute wheeze with advice to give regular salbutamol using a fixed dose weaning regime. We have introduced and evaluated the safety and efficacy of changing practice to using bronchodilators only as needed after 4 hourly assessments.

**Design** A multidisciplinary team of healthcare professionals worked with eight families of children who had needed hospital treatment with acute wheeze to develop guidance for the use of salbutamol on an as required basis after 4 hourly assessments. Data on salbutamol used with this approach were compared with a similar period in the previous year.

**Results** Data from 103 families showed a 73% reduction in salbutamol on day 1, 69% on day 2 and 50% on day 3 compared with what would have been used according to previous advice. Families found the advice easy to follow. There was a trend towards lower reattendance rates within 1 week compared with those recorded in the previous year. Those who had previously attended preferred this change in practice.

**Conclusions** These data suggest that with information to support the use of salbutamol on an as required basis after hospital attendance, children can be safely managed by their parents/guardians with much lower doses of salbutamol than those recommended in commonly used fixed dose weaning regimes.

**WHAT IS ALREADY KNOWN ON THIS TOPIC**

⇒ There is little evidence to guide recommendations for the use of bronchodilators during the recovery period after hospital presentation with acute attacks of wheezing.

**WHAT THIS STUDY ADDS**

⇒ This service evaluation provides reassuring data that children can be safely managed with salbutamol as needed without an increase in reattendance rates for the same episode of acute wheeze. This management strategy results in less salbutamol being used compared with amounts recommended in commonly used fixed dose weaning regimes.

**HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY**

⇒ Acute hospital services might usefully change their policies for treating acute wheeze as described. This approach is consistent with safe practice and patient preferences.

**INTRODUCTION**

While paediatric care plans for acute wheeze advise treating worsening symptoms with salbutamol every 4 hours as needed, discharge care plans typically advise reducing doses of bronchodilator according to predetermined, fixed dose regimes. There is no clear discharge advice for salbutamol use in national guidelines, but advice that patients can be discharged when stable on regular 3–4 hourly bronchodilators has resulted in many hospitals recommending continued use of regular bronchodilators after leaving hospital. There is no evidence to support this practice. We have recently changed our local care pathways and assessed the safety and efficacy of introducing written information to aid parents’ decision-making about the use of salbutamol as needed in children aged 1 to < 18 years.

**METHOD**

Our development group included eight families with children who had suffered from acute wheeze, and a multidisciplinary team of healthcare professionals attending to wheezy children across our locality who worked according to guidance for the development, implementation, and evaluation of safe asthma discharge care pathways.

Information included a colour-coded flowchart advising on 4 hourly assessments and the use of incremental doses of salbutamol as needed within safety netting margins (figure 1). Age-specific instructions for the use of a metered dose inhaler (MDI) and spacer were included with links to video recordings demonstrating inhaler techniques. A table to record salbutamol use and aerosol recycling advice were provided. This change in practice was signposted across Southampton Children’s Hospital with teaching sessions and champions with specific responsibilities for change management across our organisation.

Data were collected from parents whose children had presented to our hospital with an acute episode of wheeze and with a discharge diagnosis of acute wheeze or asthma. All children had presented with wheezing of a severity to have been treated with burst therapy or back-to-back nebulisers according to our regionally approved Wessex ‘Paediatric Viral Induced Wheeze and Acute Asthma Treatment Pathways’ as published in the guideline section of the PIER website (https://www.piernetwork.org/wheeze-asthma.html). Parents of children receiving
the new discharge plan after attending our paediatric emergency department or admission to hospital wards provided feedback at telephone follow-up by paediatric respiratory nurse specialists within 3–5 days. All changes in clinical practice were approved by the Clinical Governance Board of Southampton Children’s Hospital and the subsequent service evaluation of these changes was commissioned and approved by the Division of Respiratory Paediatrics. Parents who provided feedback at telephone follow-up appointments gave oral consent for the use of the information provided for evaluation purposes.

RESULTS
We obtained feedback from 103 families. Based on their reports, using salbutamol as required resulted in significant reductions in bronchodilator use. Compared with the expected use of salbutamol according to previous fixed dose 4 hourly weaning plans (day 1: 10 puffs, day 2: 5 puffs, day 3: 2 puffs), significantly lower doses were reported (figure 2). Mean estimated dose reductions were by 73% on day 1, 69% on day 2 and 50% on day 3. Only 13 children still required salbutamol after 3 days. Eight visited their General Practitioner over the next 2 weeks because of ongoing symptoms. In most cases, this was not because of concern about wheeze.

All parents/carers reported that written information was easy to follow. Only 23% used the table to record salbutamol use but all parents were able to recall the amounts used. All parents of children who had previously attended the hospital and been discharged on fixed dose weaning regimes said they preferred the new advice and confirmed that it had resulted in using less salbutamol. Those parents who had kept a written record of salbutamol use said they found this useful.

Comparative effectiveness of the new intervention was assessed by comparing reattendance rates for a similar group of children with a discharge diagnosis of acute wheeze or asthma and who were treated for severe asthma in the same 6 months in the year before we introduced our new advice. The readmission rate for asthma in 2021 was 12.5 per 1000 and following the introduction of an ‘as required’ approach it fell to 8.3 per 1000. The OR for readmission following the intervention was 0.66 (0.37–1.14), p=0.12 (table 1). No children reattended more than once within a week of their initial attendance with acute wheeze. The number of children attending the hospital was less in 2022 among children aged >5 years (446 in 2021 vs 247 in

Table 1  Number of children with acute wheeze readverting within 1 week as a proportion of all wheezy children attending each month using salbutamol fixed dose (2021) and as needed (2022) treatment regimes

<table>
<thead>
<tr>
<th>Month</th>
<th>2021 (%)</th>
<th>2022 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>2/100 (2.0)</td>
<td>3/90 (3.3)</td>
</tr>
<tr>
<td>August</td>
<td>4/104 (3.8)</td>
<td>0/37 (0)</td>
</tr>
<tr>
<td>September</td>
<td>13/275 (4.7)</td>
<td>5/156 (3.2)</td>
</tr>
<tr>
<td>October</td>
<td>9/260 (3.5)</td>
<td>6/127 (4.7)</td>
</tr>
<tr>
<td>November</td>
<td>7/179 (3.9)</td>
<td>6/216 (2.8)</td>
</tr>
<tr>
<td>December</td>
<td>3/109 (2.7)</td>
<td>3/131 (2.3)</td>
</tr>
</tbody>
</table>
DISCUSSION

Advice for symptom management after acute wheezing attacks using as required doses of salbutamol has recently been published by one centre and has been recommended in a recent review, but objective evaluation of the safety and effectiveness of this approach has not been previously reported.3,6 The most recent Cochrane review of educational interventions for children with asthma recommends that education about managing wheezing attacks should be incorporated into routine asthma care but highlights the lack of evidence for specific components.7 Although we have not conducted a clinical trial, we believe this evaluation provides evidence that families can safely treat their children during the recovery period of acute wheeze without having to follow a predefined weaning regime. It is important to note that many of the children included in this study were preschool wheezers. Those with a history of recurrent wheezing and red flags for suspected asthma were commenced on regular inhaled corticosteroids and not treated with short acting bronchodilators alone.

Our data provide evidence that a more measured use of bronchodilators after hospital discharge results in less salbutamol being used. Empowering and supporting families with clear advice combined with respiratory nurse telephone follow up might also result in safely decreasing salbutamol use for subsequent wheezy episodes. Our readmission rates to the emergency department varied between 0% and 4.7% monthly and are comparable to those reported in a study of nurse-led interventions to reduce the use of hospital services after acute asthma admissions.8 We suspect that the trend towards lower short-term readmission rates did not reach statistical significance because of the relatively small numbers of children readmitting for the same acute episode. Those who did reattend were identified by our respiratory nurse specialists for follow-up care.

The number of school-aged children attending our hospital with wheeze was considerably less in 2022. This might in part have been a result of introducing NHS National bundle of care initiatives to improve asthma management in our locality.

As well as the reported benefits to patients, we also helped achieve important environmental benefits.9 MDIs contain powerful greenhouse gases, accounting for approximately 13% of the NHS’s carbon footprint.10 Guidelines to safely reduce the use of reliever medication might help reduce the UK’s per capita use of short-acting bronchodilators, which is currently treble that of many other European countries.11 Further studies might usefully confirm our clinical findings and explore how the information provided could be made available on handheld electronic devices for families who are familiar with using information in this format.12

An important limitation of this study is that much of the data for salbutamol use depended on parental recall with only 23% of families using the treatment log to record the treatment given. Reassuringly, however, the average doses used among those who did keep a written record were very similar to those who did not.

A potential problem with the use of MDIs is that they do not have a dose counter. There is a risk that families who have not kept records of the number of puffs of salbutamol used risk ‘running on empty’ with up to 100 additional actuations when using a 200 dose device.13 This was not an acute risk for our patients because the inhalers used for initial burst therapy were given to the families. These inhalers would have contained sufficient doses to continue treatment at home. Families were advised to count the doses given, but there was a risk that using devices for future episodes might result in them being used when empty.

In conclusion, these data provide good evidence to support a widespread change in practice in all UK centres to as required dosing regimes during the recovery phase of acute wheeze after hospital discharge. This approach is safe and results in lower doses of salbutamol than those recommended in common fixed dose weaning regimes.

Twitter Gary Connett @garyconnett

Contributors All authors made substantial contributions to the work described. GC led on the conception and design of the change in practice, the delivery of the project on hospital wards and the preparation of the manuscript. As guarantor for this study he accepts full responsibility for the work and conduct of the study, had access to all data and controlled the decision to publish. SH led on developing materials and the follow-up collection of data. BR collected ED data and worked on changing practice within the ED. DJ helped develop materials and led on the delivery of the project within the ED.

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Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants but University Hospital Southampton, Child Health clinical governance board approved the change in practice and service evaluation of this change in practice as stated in the manuscript. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Further data available at reasonable request.

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ORCID iD
Gary Connett http://orcid.org/0000-0003-1310-3239

REFERENCES

6 Dunant N. Salbutamol: hero or villain. Paediatrics and Child Health 2023;33:97–103.
8 Pinto JM, Navallo LI, Petrova A. Does participation in the community outreach for asthma care and healthy lifestyles (COACH) program alter subsequent use of hospital services for children discharged with asthma? J Asthma 2021;58:231–9.