Cough in children: definitions and clinical evaluation

Position statement of the Thoracic Society of Australia and New Zealand

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ABSTRACT

- The aetiology and management approach for cough in children differs greatly to that in adults, so the empirical approach commonly used in adults is unsuitable for children.
- Clinical evaluation of cough in children should include an assessment of environmental factors, particularly tobacco smoke, parental concerns and expectations.
- Most children with acute cough are likely to have an uncomplicated viral acute respiratory tract infection, but the possibility of a more serious problem, especially aspiration of foreign material, should always be considered.
- Isolated chronic cough in children is rarely asthma, and the term "cough variant asthma" should not be used.
- Over-the-counter and prescription medications are ineffective for the symptomatic relief of acute cough.
- Treatment for chronic cough should be based on aetiology. Because of the favourable natural history of cough, a "positive" response in medication trials should not be assumed to be due to the medication. Children should be reassessed within the expected timeframe of response to therapy.

MJA 2006; 184: 398–403

Cough is the most common presenting symptom to general practitioners,[1] and persistent cough is one of the most common problems referred to paediatricians and respiratory physicians. Cough in children causes significant anxiety to parents,[2] and use of inappropriate or unnecessary medications for a cough is associated with adverse events.[3] Different approaches have been published in the North American and European cough guidelines, and both have limited applicability in the Australasian context. This position statement is based on current but limited evidence for the management of cough in children in the Australasian context (Box 1).

Defining the spectrum of paediatric cough

Defining a symptom or disease facilitates consistent, effective and accurate communication in both clinical situations and in clinical epidemiological research. Until more research data are available, the following operational definitions are recommended. These definitions fall into three main categories, built on different constructs. It is possible for cough to be characterised:

- On duration of cough:
  - Acute cough: cough duration of < 2 weeks;
  - Protracted acute cough: cough duration between 2 and 4 weeks; and
  - Chronic cough: cough duration of > 4 weeks;
- On likelihood of an underlying disease or process (these descriptors overlap):
  - Expected cough;
  - Specific cough (Box 2); and
  - Nonspecific cough;
- On cough quality:
  - Classically recognised cough (see Box 3);
  - Wet/moist or productive cough v dry cough; and
  - Protracted bronchitis.

Classification based on cough duration

Acute cough

A systematic review on the natural history of acute cough in children aged 0–4 years in primary care found that, although most children's conditions improve with time, 5%–10% of children develop bronchitis and/or pneumonia.[7] However, some of the information used[7] was 35–50 years old, from a time when public health standards (eg, housing) were very different. A prospective study (1999–2001) of acute cough showed recovery by 50% of children within 10 days and 90% within 25 days.[8] However, it is not known if those with cough persisting for > 25 days had features consistent with protracted bronchitis or other identifiable complications (Dr Alistair Hay, Lecturer in Primary Healthcare, University of Bristol, personal communication). An Australian prospective community study recorded respiratory episodes of 2.2–5.3 per person-year for children aged ⩽ 10 years, with mean duration of episodes of 5.5–6.8 days.[9] Consequently, based on current data, we recommend that acute cough be defined as cough of < 14 days duration.

1 Objectives, consensus process, methodology and evidence of recommendations

Objectives are to recommend (a) definitions of paediatric cough for clinical and research purposes, and (b) key management statements, with the aim of improving the clinical management and research outcomes of cough in children. The target readers are physicians who treat children.

Following cough symposia held during the Thoracic Society of Australia and New Zealand (TSANZ) annual scientific meetings (2004 and 2005), the group of authors was formed. The group consists of an academic general practitioner (N G) and paediatric respiratory physicians, all with an interest in cough. MEDLINE and Cochrane databases were searched from January 1966 to June 2005 for subject headings (cough and children). Review of references and authors' expertise led to identification of additional relevant articles, including unpublished data. Drafts of the position statement were circulated among authors before submission to the TSANZ. Suggested revisions were incorporated into subsequent drafts, and the final draft represents all relevant evidence obtained by the literature search in conjunction with final recommendations, annotated to reflect level of evidence as used in the position statement and guidelines of TSANZ.[4] TSANZ statements are current for 5 years unless superseded.

E1: Systematic review of all relevant randomised controlled trials (RCTs).

E2: Well designed RCTs.

E3: Well designed cohort or case–control studies.

E4: Consensus opinion of authors. ◆

2 Pointers to specific cough (primarily for chronic cough)[5,6]

Symptom/sign	Possible underlying aetiology*
Auscultatory findings (wheeze, crepitations/crackles, differential breath sounds)	Asthma, bronchitis, congenital lung disease, foreign body aspiration, airway abnormality
Cough characteristics (eg, cough with choking, cough quality, cough starting from birth)	See text; congenital lung abnormalities
Cardiac abnormalities (including murmurs)	Any cardiac illness
Chest pain	Asthma, functional, pleuritis
Chest wall deformity	Any chronic lung disease
Daily moist or productive cough	Chronic bronchitis, suppurative lung disease
Digital clubbing	Suppurative lung disease
Dyspnoea (exertional or at rest)	Compromised lung function of any chronic lung or cardiac disease
Failure to thrive	Compromised lung function, immunodeficiency, cystic fibrosis
Feeding difficulties (including choking/vomiting)	Compromised lung function, primary aspiration
Haemoptysis	Bronchitis
Immune deficiency	Atypical and typical respiratory infections
Medications or drugs	Angiotensin-converting enzyme (ACE) inhibitors, puffers, illicit drug use
Neurodevelopmental abnormality	Primary or secondary aspiration
Recurrent pneumonia	Immunodeficiency, congenital lung problem, airway abnormality
Symptoms of upper respiratory tract infection	May coexist or be a trigger for an underlying problem

*This is a non-exhaustive list; only the more common respiratory diseases are mentioned. ◆

Chronic cough

It is unknown whether the primary stimulus for chronic cough in many children is identical to that for acute cough. Further, it is unknown why the cough associated with common acute viral upper respiratory tract infection (URTI) resolves in most, yet persists in some. Presumably, however, both the specific microbe (eg, cough is more likely to be prolonged after a potent respiratory infection such as pertussis) and host factors (eg, genetic predisposition to bronchitis) play a role.

No studies have clearly defined when cough should be defined as chronic. Cough related to URTI resolves within 1–3 weeks in at least 90% of children,[7,8] so it is logical to define chronic cough as daily cough lasting more than 4 weeks; published definitions of chronic cough in children have varied from 3 to 12 weeks.[10] In contrast, the current definition of chronic cough in adults is 8 weeks.

The paediatric definition is based on the natural history of acute URTIs in children,[7,8] and the knowledge that paediatric respiratory illness has important differences to that in adults.[10] For example, conditions such as a missed foreign body, which is more common in children (especially in those aged ⩽5 years), can lead to permanent lung damage.

3 Classically recognised cough[5,6]

Cough type	Suggested underlying process
Barking or brassy cough	Croup, tracheomalacia, habit cough
Honking	Psychogenic
Paroxysmal (with or without inspiratory "whoop")	Pertussis and parapertussis
Staccato	Chlamydia in infants
Cough productive of casts	Plastic bronchitis/asthma
Chronic wet cough in mornings only	Suppurative lung disease

◆

Classification based on suggested aetiology

Clinically, we find the terms "expected cough", "specific cough" and "nonspecific cough" useful; the scientific rationale has been described elsewhere.[11] In expected cough, the presence of cough is expected (eg, after an acute respiratory tract infection). In specific cough, the aetiology and necessity for further investigations is usually evident from the presence of coexisting symptoms or signs (Box 2). The presence of any of these symptoms or signs suggests that the cough is likely to be associated with an underlying disorder and that further complex investigations may be indicated. Nonspecific cough has been defined as usually dry cough in the absence of identifiable respiratory disease or known aetiology.

Classification based on cough quality

Classic recognisable cough types

Certain cough characteristics such as "croupy or brassy cough" (Box 3) are classically taught to point to specific aetiologies in children. Data on the sensitivity and specificity of each classic, recognisable cough type are limited; only that for brassy cough (for tracheomalacia diagnosed at bronchoscopy) is known.[12] Although a "pertussis-like" cough in children is generally due to *Bordetella pertussis* infection, it may also be caused by adenovirus, parainfluenza virus, respiratory syncytial virus or mycoplasma.

Wet/moist/productive cough v dry cough

Even when airway secretions are present, young children rarely expectorate sputum. Hence, wet/moist cough is the preferable term, rather than productive cough. The distinction of dry and wet/moist cough is both valid and reliable.[12] Minimal secretions may be present in children with dry cough,[12] and clinicians should be cognisant that a dry cough may become wet if airway secretions increase. Further, it should not be assumed that airway secretions are absent in children with dry cough; therefore, cough quality in these children should be reviewed regularly.[12]

Protracted bronchitis

Based on preliminary findings, we propose a clinical definition of "protracted bronchitis" as:

- the presence of isolated chronic moist cough;
- resolution of cough with appropriate antibiotics; and
- absence of pointers suggestive of alternative specific cough.

4 Key statements on general management

Key clinical issues of cough studies

A detailed clinical history is of key importance when evaluating a child with cough (E4).

While parental reporting of wet or dry cough has good reliability, parental reporting of nocturnal cough has poor reliability when compared with objective measures (E3).

As reporting of cough is prone to large placebo and time-period effects, observational studies (non-randomised controlled trials) on interventions for cough are of very limited value (E3).

Key recommendations for acute cough in children

Although most children with acute cough are likely to have an acute upper respiratory tract infection, all should be evaluated for the possibility of a more serious problem (E4):

- Is a characteristic recognisable cough present (eg, paroxysmal)?
- Are there symptoms or signs of a lower respiratory disease (tachypnoea, dyspnoea, wheeze or other chest auscultation abnormalities; eg, crackles, asymmetric breath sounds)?
- Is the child otherwise unwell (looks toxic, rigors, dehydrated, or vomiting)?
- Has the child aspirated (acute history of choking)?

Both over-the-counter (OTC) and prescription medications are generally ineffective for the symptomatic relief of acute cough and should be rarely used (E1). There are no (non-OTC) medications that have a registered indication in Australia for the relief of cough. Serious adverse events and accidental poisoning have been reported with use of OTC medications for cough (E3).

Key recommendations for chronic cough in children

Children with chronic cough should (E4):

- be carefully evaluated, especially for symptoms and signs of an underlying respiratory or systemic disease (noting "specific cough pointers", Box 2);
- have spirometry (if school age) and chest radiography performed; and
- be re-evaluated, as minimal airway secretions may be present in dry cough and hence wet cough may initially be perceived as dry cough.

The three most common causes of chronic cough in adults (gastro-oesphogeal reflux disease, asthma and postnasal drip) are relatively uncommon causes of chronic cough in children. Empirical treatment for these conditions is largely unsuitable in children (E3).

OTC or prescription medications are ineffective for chronic cough and should be rarely used for the symptomatic treatment of cough (E4).

Treatment for chronic cough should be based on aetiology. If medication trials are undertaken, a response should not be assumed to be due to the medication tried. This is especially true for asthma medications, where a diagnosis of asthma should not be made based on a single episode of cough (which "responds" to asthma medications) in the absence of other symptoms of asthma (E3).

An isolated chronic cough in children is unlikely to be asthma without other specific pointers to this disease. Asthma medication, especially high doses of inhaled corticosteroids, can have adverse effects.
If treatment is trialled, the child should be reviewed within 2–4 weeks. If there is no improvement, the treatment should be stopped rather then escalated (E2).

Common management approaches

A history of environmental exposures, particularly tobacco smoke exposure, should be sought and intervention initiated if appropriate (E3).

Exploration of parental concerns and expectations is beneficial, and specific education is more beneficial than nonspecific education (E3).

Psychological overlays/intervention should be considered when nonspecific cough is present (E4). ◆

In a study using a standardised protocol to evaluate children with chronic cough, protracted bronchitis was the most common (40%) aetiology.[13] When a wet cough only partially resolves after appropriate antibiotics, is very prolonged (more than 3 months) or there are recurrent (more than two per year) episodes of protracted bronchitis, the child requires additional treatment and investigations along the lines of that for chronic suppurative lung disease. Whether this represents a spectrum of, or leads to suppurative lung disease is unknown (E4).

Clinical evaluation of cough

Several issues pertaining to cough are highlighted (Box 4), as accuracy and reliability of symptoms are important in clinical and research settings. Parental reporting of wet or dry cough has good reliability,[12] in contrast to findings of wheeze and stridor, which are not accurately reported.[14] However, parental report of the presence or absence of nocturnal cough is unreliable compared with objective monitoring (E3).[15]

Another important clinical issue is the significant placebo and period-effect in studies that use cough as an outcome measure, rendering non-randomised controlled trials difficult to interpret (E2). The placebo effect on cough has been reported to be as large as 85% in adults, and one randomised controlled trial reported "parents who wanted medicine at the initial visit reported more improvement at follow-up, regardless of whether the child received drug, placebo, or no treatment".[16]

Acute cough: management issues

Most children with acute cough are likely to have an acute viral URTI. However, key questions to identify a more serious problem should be asked (Box 4). Usually, acute cough is self-limiting and treatment, if any, should be directed at the aetiology rather than the symptom of cough.

There are no effective medications for the symptomatic relief of acute cough in children (E1),[17,18] and serious adverse events and accidental poisoning have been reported (E3).[19] In one analysis of 249 038 exposures to over-the-counter (OTC) medications, 72 "major events" and four deaths were reported, but this represents the tip of the iceberg.[19] In Australia, OTC medications are common unintentional ingestion medications in children under 5 years (29% of all calls in age group).[20]

There are no studies on herbal therapies or on simple measures such as chest rubs. Common measures for cough management outlined below are also relevant for acute cough.

Chronic cough: assessment and management

Children with chronic cough must:

- be carefully evaluated, especially for symptoms and signs of an underlying respiratory or systemic disease (as suggested by "specific cough pointers", Box 2);
- have spirometry (if school age) and chest x-ray performed; and
- be reassessed at regular intervals, as cough quality may change if airway secretions increase and specific points emerge (E4).

Furthermore, there is considerable overlap between specific and nonspecific cough. Except when classical asthma (presence of wheeze and/or dyspnoea that responds to β_2-agonist) is the aetiology, children with specific cough usually require additional tests (such as chest high-resolution computed tom-

5 Summary of therapies used for cough in children, as reported in the literature based on controlled trials[5]

Therapy	Time to response	Type of evidence	Level	Data limitation and considerations
Antihistamines				
Chronic cough	1 week	RCTs[23,24]	E2	Inconclusive, adverse events
Acute cough	Not relevant	Systematic review[17]	E1	Not beneficial
Antimicrobials	1–2 weeks	Systematic review[22]	E1	Some benefit, adverse events
Asthma-type therapy				
Cromones	2 weeks	Systematic review[25]	E3	Single open trial[26]
Anticholinergics	No data	Systematic review[27]		No trials in children
Inhaled corticosteroid	2–4 weeks	RCTs[28,29]	E2	Little benefit, adverse events
Oral corticosteroid		No data		No RCTs, adverse events
β_2-Agonist (oral or inhaled)	Not relevant	Systematic review;[30] RCT[28]	E1/E2	Not beneficial;[28] adverse events
Theophylline	1–2 weeks	Systematic review[31]	E3	Inconclusive, no RCTs
Leukotriene receptor antagonist	2–3 weeks	Observational studies[32]	E3	Inconclusive, no RCTs
Gastro-oesophageal reflux disease therapy				
Motility agents	Not relevant	Systematic review;[33] single controlled trial	E3	No benefit
Acid suppression		Systematic review[33]		No RCT on proton pump inhibitors, adverse events
Food thickening or antireflux formula	1 week	Systematic review[33]	E1	Inconclusive data
Head positioning	Not relevant	Systematic review[34]		No benefit, systematic review showed no benefit for gastro-oesphageal reflux, but cough was not an outcome measure
Fundoplication		Systematic review[33]		No RCT, adverse events
Herbal antitussive therapy		No data		No RCT, adverse events
Nasal therapy				
Nasal steroids	1–2 weeks	RCT[35]	E3	Mainly adults and older children (> 12 years) in RCT, beneficial when combined with antibiotics for sinusitis[36]
Other nasal sprays		No data		No RCT, adverse events
Over-the-counter cough medications	Not relevant	Systematic review;[17,18] RCT[37]	E1	Not beneficial, adverse events[19,20]
Other therapies				
Steam, vapour, rubs		No data		No RCTs, adverse events (eg, burns)
Physiotherapy		No data in cough that is not related to suppurative-like lung diseases		

RCT= randomised controlled trial. ◆

ography scan or bronchoscopy), and these are best performed in centres with the relevant expertise (E4). The role of these tests for evaluation of lung disease is beyond the scope of this position statement; suggested situations or conditions for referring the child are haemoptysis, suppurative lung disease, suspected foreign body aspiration, congenital lung lesions or disease, non-resolution of cough despite simple management, immunodeficiency states, recurrent pneumonia, and cardiac abnormalities. In some instances, particular characteristics of cough may be recognisable and suggestive of specific aetiology (Box 3).

In adults, the three most common causes of chronic cough are gastro-oesophageal reflux disease, asthma and postnasal drip; these are uncommon causes of cough in children (E3).[13] The use of isolated cough as a marker of asthma is controversial, with more recent evidence (clinical and community epidemiological studies) showing that, in most children, isolated cough (ie, without wheeze or dyspnoea) does *not* represent asthma (E2).[21] In contrast to adult data, published studies of airway cellularity in children with chronic cough all emphasise that isolated chronic cough is rarely due to asthma, and should not normally be treated as such.[5] The term "cough variant asthma" should not be used. In children with nonspecific cough, apart from a chest x-ray and spirometry, investigations are rarely required. Specifically, investigation for gastro-oesophageal reflux (in the absence of other symptoms), tests for airway hyper-responsiveness and radiological investigations for possible sinusitis, as a cause of isolated chronic cough, are largely unwarranted in children (E3).

Aetiologies of paediatric cough have been reviewed elsewhere.[10]

Treatment trials for chronic cough

Treatment for chronic cough should also be based on aetiology, and specific management of these is beyond the scope of this article. In nonspecific cough, the suggested management is a "watch, wait and review" approach (E4). Diagnoses with simple treatment options include asthma, and complications of URTIs (eg, protracted bronchitis, when antibiotics are appropriate: E1[22]).

Where medications have been shown to be possibly beneficial, the expected time to response is generally less than 2 weeks (Box 5). Thus, any child on a trial of medications must be reviewed, and if minimal or no response is seen, the dose or frequency of the medication should not be escalated; instead, the medication should be withdrawn (E3).

If asthma medications are trialled, and the cough resolves with inhaled corticosteroid (ICS) use, clinicians should not assume the child has asthma; rather, the child should be re-evaluated when off treatment. Resolution of cough may reflect the period effect or a transient state that is responsive to ICS (E3).[38] High doses of ICS can lead to adrenal suppression (E3).[39]

Common cough management points

Environmental exposures

The influence of prenatal and postnatal environmental influences, especially tobacco smoke, on cough and other respiratory symptoms and frequency of respiratory infections is undoubtedly significant. Thus, in the management of any child with cough, irrespective of the aetiology, attention to exacerbating factors, especially environmental tobacco smoke, is encouraged. However, there are no RCTs (and unlikely that there will ever be any) that have examined the effect of cessation of environmental tobacco smoke or other toxic environmental exposure on children's cough. A single report was found on cessation of parental smoking as a successful form of therapy for the children's cough.[40] In an open uncontrolled study, heating houses of children with asthma had the greatest effect on nocturnal cough,[41] but heating houses using materials which increase levels of minute particulate matter ($\leqslant 10\,\mu m$) may also increase respiratory symptoms.[42]

Parental concerns: communicating and counselling

In contrast to adult data, there are no quality-of-life studies for parents and children with chronic cough. However, parents presenting to US and UK doctors for their children's cough have significant concerns; fear of the child dying from choking, asthma attack or sudden infant death syndrome, and permanent chest damage, disturbed sleep and discomfort.[2,43] These concerns are often not appreciated by health professionals, and exploration of parental expectations and fears is often valuable in the management of cough.[2,43] Information available from the Internet often provides incorrect advice on the home management of paediatric cough.[44] Providing parents with information on the expected time for resolution may reduce anxiety in parents and the need for medications. Parental and professional expectations as well as doctors' perception of patients' expectations influence consulting rates and prescription of medications in URTIs.[7,45] Education is most effective when combined with a medical consultation about the child's specific condition; written information without consultation has only modest benefit in changing perceptions and behaviour (E3).[46]

Psychological influence and interventions

In adults (there are no data in children), anxiety is a known independent risk factor for chronic cough.[47] In older children, cough is subject to psychological influences; children are more likely to cough under certain settings.[48] Psychological overlays in children may occur in isolation (ranging from Tourette syndrome to a motor or vocal tic) or coexist with an organic aetiology.[49] In selected children, psychological approaches may be required.[50]

Conclusion

Despite the high prevalence of cough in children, the subject is relatively poorly researched. Children with cough should be managed according to child-specific guidelines, which differ greatly from adult guidelines, as the aetiological factors and treatments in children differ from adults. Treatment of cough in children should be based on aetiology, and there is little evidence for using medications for symptomatic relief of cough. If medications are used, it is imperative that the children are routinely followed up, and medications ceased if there is no effect on the cough within an expected timeframe.

Competing interests

Anne Chang has received an educational grant from GlaxoSmithKline. Peter Van Asperen is a member of Advisory Boards for GlaxoSmithKline, Merck Sharp & Dohme, and AstraZeneca, and has received travel assistance from GlaxoSmithKline and AstraZeneca. Craig Mellis has served on Advisory Boards for GlaxoSmithKline, Altana and Merck Sharp & Dohme.

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(Received 8 Nov 2005, accepted 26 Feb 2006) ❑