

**Routine chest physiotherapy is not more effective than usual
supportive care in non-ventilated paediatric patients (0 to 24
months) with bronchiolitis:**

A systematic review

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Abstract

Purpose: To determine the effectiveness of chest physiotherapy (percussion, postural drainage and suctioning) in non-ventilated paediatric bronchiolitis patients aged 0 to 24 months.

Background: The field of paediatric cardiopulmonary physiotherapy has a limited evidence base and findings from this study may assist in choosing effective treatment options.

Methods: The following databases were reviewed by making use of a specified search strategy: African Health Line, CINAHL, Cochrane, Ebsco-Host, E-theses/dissertations, PEDro, Medline Ovid, Sabinet, Science Direct and Up-To-Date. Pre-set eligibility criteria were applied to the article title and/or abstract and full-text. Appraisal tools (CASP and PEDro scale) were used to evaluate and score the

included studies. A qualitative synthesis was done as a meta-analysis was not possible.

Results: Evidence does not support routine chest physiotherapy in uncomplicated viral bronchiolitis in non-ventilated paediatric patients. Chest physiotherapy does not have a significant influence on various outcomes measures.

Conclusion: Routine chest physiotherapy should not be prescribed for non-ventilated paediatric patients with bronchiolitis.

Keywords: *bronchiolitis, physiotherapy, respiratory infections, respiratory syncytial virus, systematic review*

Introduction

Airway infections are a common cause of illness and mortality in children, especially those younger than five years (Wainwright, 2010). Respiratory diseases such as bronchiolitis are prevalent in South Africa (SA), and their impact is exacerbated by other infectious diseases such as HIV/AIDS (World Health Organisation (WHO), 2012). The efficacy of many adjunct therapies, such as physiotherapy, needs to be established, especially in the field of respiratory therapy (Martín-Torres, Núñez & Sánchez, 2001).

Bronchiolitis – a lower airway infection mostly caused by an acute viral infection and leading to an acute inflammatory response in the bronchiole – is usually found in infants younger than two years (Kercsmar, 2003, p. 460). The disease is the leading cause of medical emergencies in winter in this age group (Piedra & Stark, 2009). In the United Kingdom, 10% of infants develop bronchiolitis each winter and 20% of these children are hospitalised (Couriel, 1999). In the United States of America (USA) and in SA, bronchiolitis related to respiratory syncytial virus (RSV) is the leading cause of hospitalisation in infants younger than 12 months (Jeena, 2004). RSV accounts for 50% of admissions and the hospitalisation rate seems to be increasing (Welliver, 2004). RSV contributes worldwide, directly or indirectly (as a result of complications), to the deaths of about 600 000 to 1 000 000 infants and children annually (Polak, 2004). Because of the acute effects of the disease, children

with bronchiolitis are also at a higher risk of developing future reactive airway disease, wheezing and asthma (Smyth & Openshaw, 2006).

Various studies have found that treatment in paediatric bronchiolitis is mostly supportive, including humidified oxygen therapy, fluid management (hydration), avoidance of unnecessary handling and respiratory support where necessary, as well as nasal suctioning, if indicated (Webb, Martin, Carlidge, Ng & Wright, 1985; Barben, Kuehni, Traschsel & Hammer, 2008). The following quotation describes the bronchiolitis dilemma accurately: “Currently there is no cure, no effective preventative measure, no vaccine, no effective treatment, and no consensus on how to apply supportive care” (Kercsmar, 2003, p. 460).

Despite the increasing incidence of bronchiolitis and bronchiolitis-related cases, little research in recent years could be found on the physiotherapy treatment of non-ventilated, acute paediatric patients with bronchiolitis. Therefore this research attempted, through a systematic review, to bridge this knowledge gap in physiotherapy management of paediatric bronchiolitis patients and to guide doctors in the referral of these patients. The aim of this systematic review was to determine the efficacy of chest physiotherapy, specifically percussion, postural drainage and suctioning, in non-ventilated bronchiolitis patients from newborn to 24 months of age.

Methods

The researcher therefore wanted to answer the following question:

What evidence exists to support the use of chest physiotherapy in non-ventilated patients with bronchiolitis, with reference to clinical outcomes measures in paediatric patients younger than 24 months, compared to supportive care?

Sources of data

This systematic review included 11 databases and applied a specified search strategy for each database (See Figure 1). Hand searching of prominent, peer-reviewed, special-interest physiotherapy journals was undertaken. The reference lists of all full text studies that were included were also examined.

Primary keywords used were (physiotherapy or physical therapy) and (bronchiolitis), and a combination of each of these terms with the following: Percussion/percuss*¹, Postural drainage/postural drain*, Suction/suction*. Bronchiolitis, the second main keyword, was also combined with paediatric/paediatric*/pediatric/pediatric*. All primary and secondary outcomes measures pertaining to bronchiolitis were considered, such as clinical scores, respiratory distress, vital signs, duration of oxygen use, intravenous or nasogastric feeding, as well as length of hospital stay. The truncation function was used to ensure that all language differentiations were accounted for, therefore ensuring a larger study frame.

A pilot study was performed for each database to determine which search strategy would render the greatest number of studies. Criteria for inclusion into the systematic review were all articles pertaining primarily to chest physiotherapy in paediatric bronchiolitis patients (0 to 24 months) in all settings (rural, urban, public and private hospitals, developed and developing countries), in all languages and all study types published between January 1993 and March 2009.

Search process

The search strategy and process of study selection followed is demonstrated in Figure 1. The first author and an external researcher conducted the searches according to the specific search strategy determined for that particular database, documented the results and saved all the citations for later comparison. Results were compared and, where differences occurred, the search was repeated by both the author and external researcher.

¹ truncation

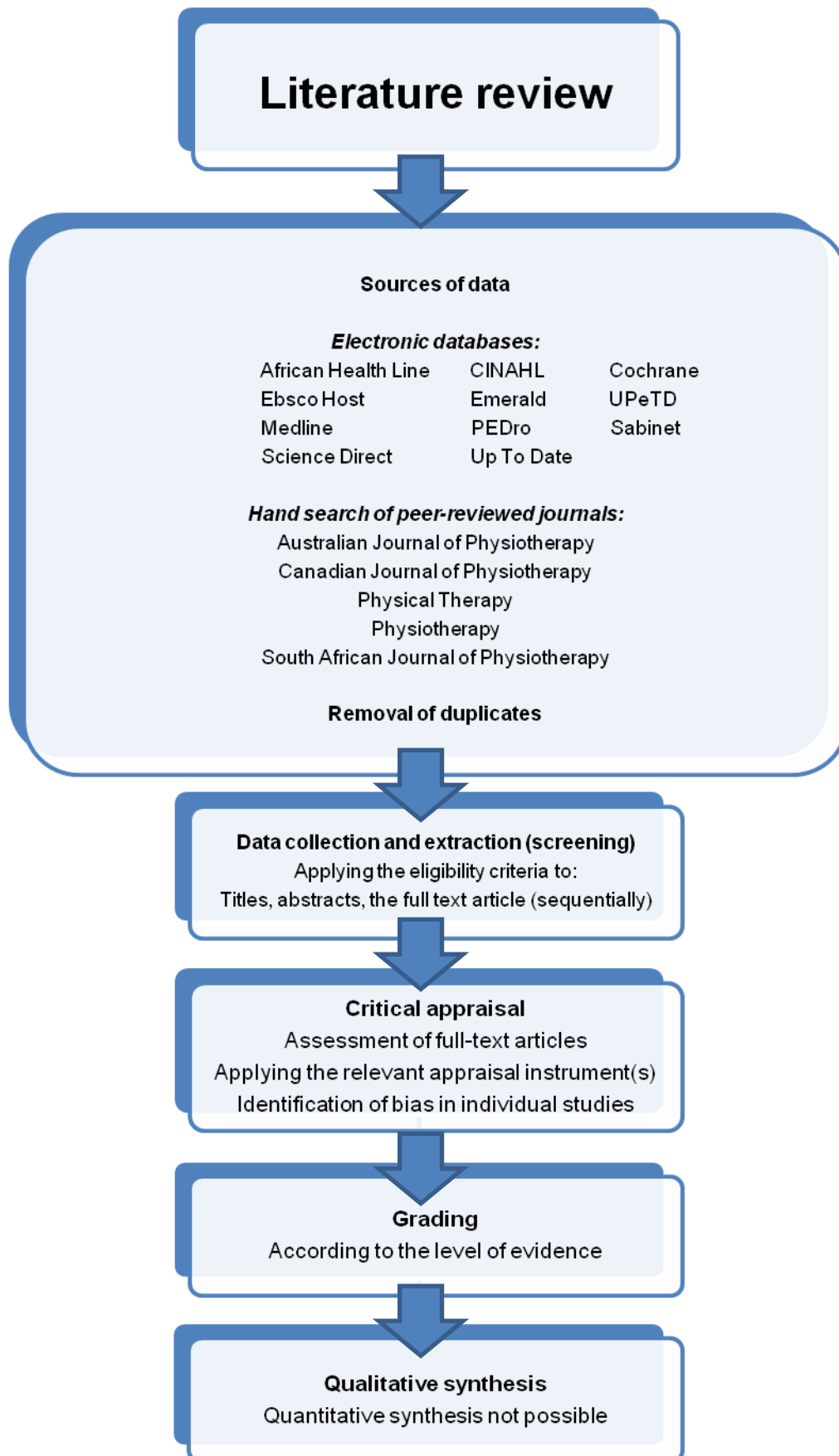


Figure 1: The research process

Firstly the list of citations from all databases was screened by applying the inclusion criteria drawn up by both the first author and another external researcher. If in doubt, the researchers included the citations for the next round of screening. When consensus was reached by the researchers the citations were included and when the researchers did not agree, a third rater arbitrated. Duplicate studies were excluded. Three research synthesis articles (Up-To-Date) were identified, and five articles were included for appraisal. This process is illustrated in Figure 2.

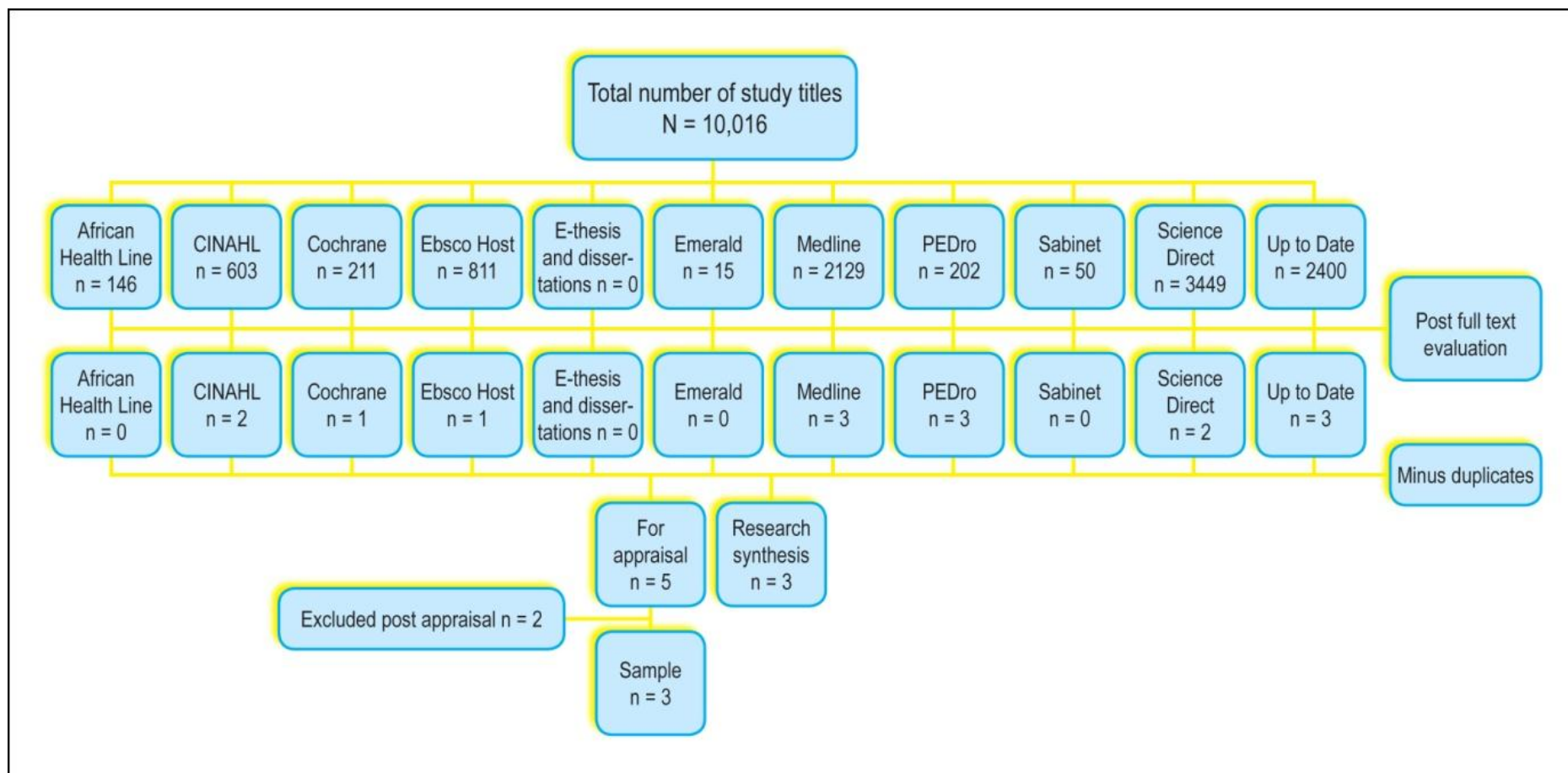


Figure 2: Records identified through database search

Furthermore, the reference lists of all included studies were searched to ensure saturation. Relevant study findings were recorded in an adapted data extraction table (Goldsmith, Bankhead & Austoker, 2007).

Quality appraisal

Two tools were used to appraise the studies: The Critical Appraisal Programme (CASP) and the Physiotherapy Evidence Database (PEDro) Scale are reliable, valid and widely used (Bhogal, Teasell, Foley & Speechley, 2005; Bleakley, 2008; Maher et al., 2003; Reilly, Barker & Shamley, 2006; Smith, Davies & Donell, 2009). Included studies were appraised by two reviewers, with collaborative discussion where doubt or differences in mark allocation occurred.

Following critical appraisal by making use of the CASP instruments and the PEDro Scale, two studies were excluded from the remaining studies based on their scores (< 45%). The two studies included in the final sample had the following appraisal results: Nicholas et al. (1999) scored 50% on the CASP instrument and 69% on the PEDro Scale. Bohe et al. (2004) scored well with a 63% on the CASP instrument and 81% on the PEDro Scale respectively. In light of the limited number of studies, findings from Webb et al. (1985) – although they were published before 1993 - were included in the final analysis, as they were cited in both the two included studies. Webb et al. (1985) had the highest score with 64% on the CASP instrument and 88% on the PEDro Scale.

The Cochrane Collaboration's tool for assessing risk of bias was used, comprising the items in Table 1 to evaluate the risk of bias in individual studies.

Table 1: Risk of bias in individual studies

Study	Concealment of randomisation	RCT stopped early	Patients blinded	Health care providers blinded	Data collectors blinded	Outcomes assessors blinded
Webb et al. 1985	Yes	No	Yes ²	Yes	No	No
Nicholas et al. 1999	Yes	No	Yes ²	No	No	No
Bohe et al. 2004	Yes	No	Yes ²	No ³	No	No

Data synthesis

All data is supposed to be synthesised and integrated by determining standard deviations (SD) and confidence intervals (CI) where possible, and doing a meta-analysis. No additional analyses were pre-specified. Outcomes measures of studies were investigated to identify potential for (1) sub-group analyses, e.g. between subjects' different levels of severity of bronchiolitis, (2) sensitivity analysis and meta-regression to identify predictors of outcomes.

Owing to the heterogeneousness of the studies, a quantitative synthesis was not appropriate and findings were qualitatively synthesised as a narrative.

Bias

Bias was minimised in numerous ways: By including randomised controlled trials, different external researchers for the various phases of the research process, and by including all types of studies, as well as grey literature and theses. Selection bias was minimised by searching according to a pre-set protocol, and language bias was minimised by including all languages.

² Under 24 months

³We're not stated as such

Hierarchy of evidence

The hierarchy of Sackett, Straus, Richardson, Rosenberg and Haynes (2000) was used to describe the level of evidence for findings because it contains a detailed description of categories (A to E), and is commonly used in medical, and specifically in physiotherapy, literature. The included studies were appraised and categorised according to the hierarchy of evidence, as illustrated in Table 2.

Table 2: Grading system according to Sackett et al. (2000)⁴

Grade of recommendation	Level of evidence	Treatment/therapy/intervention/harm
A	1a	Systematic review (with homogeneity) of RCTs
	1b	Individual RCT (with narrow confidence interval)
	1c	All or no treatment
B	2a	Systematic review (with homogeneity) of cohort studies
	2b	Individual cohort study including low quality RCT e.g. < 80% F/U
	2c	"Outcomes" research
	3a	Systematic review with homogeneity of case control studies
	3b	Individual case control studies
C	4	Case series and poor quality cohort and case control studies
D	5	Expert opinion without explicit appraisal, or based on physiology, "bench" research and "1 st principles"

⁴Only the subsection of studies about intervention/treatment included

Results

Of the total of 10 016 citations identified from the databases reflected in Figure 2, eight studies complied with the eligibility criteria and were included for in-depth review. The initial sample comprised randomised controlled trials (n=2), systematic reviews (n=3), and research syntheses (n=3). The systematic reviews and research syntheses were excluded from the final sample. The three studies included in the final sample (Table 1) scored moderately to fair on the CASP instrument, with scores ranging from 50% to 64%. The compilation of the samples of these studies comprised 175 subjects. Interventions from these studies included: standard vibration, postural drainage techniques and percussion, postural drainage with modifications to suit the subject, as well as standard percussion in modified postural drainage positions (in response to the clinical picture of patients), followed by assisted coughing or gentle oropharyngeal suctioning. Outcomes measures used were clinical scores, respiratory distress, oxygen use, duration of nasogastric or intravenous feeding, oxygen saturation and the length of hospital stay. No significant improvement in any of the outcomes measures was found post-physiotherapy.

A meta-analysis of the data used in the studies was not possible. For example, effect sizes could not be calculated as Bohe et al. (2004) did not report standard deviations (SD). In addition the studies included were heterogeneous regarding methods applied and outcomes measures used, as well as other variables.

Table 3 reports on the characteristics of the three studies.

Table 3: Characteristics of the included studies

Author and date	Study title and design	Sample and setting	Outcome measures	Findings	Conclusion	Level of evidence
Webb et al. 1985	Chest physiotherapy in acute bronchiolitis. Clinical trial (RCT)	N=90 44 treatment, 46 control group City Hospital, Nottingham.	Clinical score/daily score (illness severity). Length of acute illness.	No difference in daily scores or length of illness.	CPT has no positive effect on the natural cause of the disease. CPT involves a lot of handling, which causes distress in the patients during the acute stage. CPT should not be used routinely in the management of acute bronchiolitis.	Recommendation A Level of evidence (1a)
Nicholas et al. 1999	An evaluation of chest physiotherapy in the management of acute bronchiolitis: changing clinical practice. Clinical trial (RCT).	N=50 27 females Mean age: 2.8 months Royal Hospital for Sick Children, Edinburgh.	Clinical score: Clinical status Length of hospital stay Inspired O ₂ Nasogastric feeding SaO ₂ .	Clinical scores over five days (improvement in treatment group not statistically significant). No statistically significant effect on: Length of hospital stay, requirement for supplemental O ₂ and nasogastric feeding. Less severely ill infants (clinical score <9.5) recovered at slower rate than control group (statistically significant). Saturation decrease between baseline and intervention (not statistically significant).	Patients with bronchiolitis should not be routinely referred for chest physiotherapy (CPT). CPT does not decrease the intensity of the acute illness in these patients, and can even slow recovery in moderately ill patients. CPT does not affect the progress of any infant with uncomplicated bronchiolitis. CPT does not cause distress in patients treated, because responsive CPT was applied.	Recommendation A Level of evidence (1b)

Bohe et al. 2004	Indications of conventional chest physiotherapy in acute bronchiolitis (Spanish). Clinical trial (RCT)	N=32 <24 months 16 treatment, 16 control group Cordoba, Argentina.	Clinical score/ respiratory distress. Length of hospital stay.	No decrease in length of hospital stay. No significant improvement in the respiratory distress clinical score.	Routine CPT does not produce clinically important benefits or decreased length of hospital stay in the treatment of acute bronchiolitis. Therefore no routine prescriptions of CPT in acute paediatric patients with bronchiolitis were advised.	Recommendation A Level of evidence (1b)
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Discussion

This review investigated the efficacy of chest physiotherapy including percussion, postural drainage and suctioning in non-ventilated paediatric bronchiolitis patients, from newborn to 24 months of age. This review found that these physiotherapy techniques should *not* be used *routinely* on patients with acute bronchiolitis, as such treatments have not been proved beneficial for specific clinical outcomes. Furthermore, routine chest physiotherapy may even be detrimental by increasing stress and irritability, especially in the premature infant (Piedra & Stark, 2009). No standardised protocol for chest physiotherapy treatment should therefore be prescribed in paediatric patients with acute, uncomplicated viral bronchiolitis unaccompanied by co-morbidities. These findings are in agreement with amore recent study by RoquéiFiguls, Giné-Garriga, Granados et al. (2012).

The strengths of the current study are the number of databases searched (n=11) and the inclusion of studies from non-English-speaking European and other countries. Furthermore, the local setting and perspectives of South African caregivers, health professionals, policy makers and its community were taken into account during appraisal of included studies (CASP tool).

The limited number of good methodological quality studies included is a limitation of this study. In addition, the authors of included studies, as well as national and international experts, were not contacted to ask for any additional studies and reports from the grey literature. The authors also did not make use of the GRADE system as part of the evaluation process.

Lastly, the application of the results in the South African paediatric bronchiolitis clinical setting might be limited due to the high prevalence of HIV/AIDS. The co-morbidities and respiratory complications caused by HIV/AIDS put an added burden on bronchiolitis, as HIV/AIDS can cause different presentations of bronchiolitis and different reactions to treatment.

Implications for research and clinical practice

The findings imply that medical practitioners should not refer *uncomplicated* acute bronchiolitis paediatric patients for routine chest physiotherapy. The findings imply that no routine chest physiotherapy should be administered to paediatric patients suffering from acute bronchiolitis who do not have underlying pathologies, co-morbidities or bacterial infections. Applying this evidence can assist clinicians in the decision-making process and improve efficacy of services, so that physiotherapy intervention can rather be applied in areas of proven benefit. Therefore this study can add value to policies, guidelines, cost-effectiveness and evidence-based practice.

Suctioning as a stand-alone technique could be further investigated, as subjects in the control groups also received suctioning, and in some cases, modified postural drainage and were therefore not true controls. This fact could explain the absence of a statistically significant difference between the experimental and the control groups. In cases where chest physiotherapy could be indicated, such as retention of secretions or secondary bacterial infections, responsive physiotherapy may reduce the level of respiratory distress and minimise the side-effects caused by standardised chest physiotherapy. In the case of respiratory distress from a blocked nose, suctioning may be indicated to alleviate discomfort and to improve clinical status. Other techniques included in the scope of chest physiotherapy in European countries, such as passive exhalation techniques and the Increased Expiratory Flow (IEF), should be investigated in countries such as SA as potential alternatives. Passive exhalation techniques could provide greater benefit to the patient without the side-effects of routine, conventional chest physiotherapy.

The authors recommend that the efficacy of alternative physiotherapy roles, such as that of an educator, should be investigated. Education of parents and caregivers plays an important role in the successful management of paediatric patients with bronchiolitis (Green, Zar, Jeena, Madhi & Lewis, 2010). Parents and significant others could, for example, be educated about factors that influence the incidence and severity of bronchiolitis. Possible topics would be effective hand-washing practices, minimising physical contact between siblings, the advantages of breastfeeding, and the dangers of smoke from tobacco and indoor cooking (Steiner 2004; Wainwright 2010). With education and effective preventative measures the incidence of RSV

infections, and especially bronchiolitis, could be reduced which could result in the curbing of the long-term complications of severe bronchiolitis, such as wheezing and asthma in particular.

Many studies of physiotherapy treatment of bronchiolitis were included in databases, such as Medline, CINAHL and PEDro during the 1970s and 1980s. Between 2004 and 2009, no new studies on chest physiotherapy treatment of paediatric bronchiolitis were published, as the present study produced the same results as Perotta et al. (2008). The body of knowledge of physiotherapy can be augmented by high quality research in the field of respiratory paediatrics in order to ensure that clinical practice reflects evidence-based measures.

Physiotherapy and therefore the health team, would benefit from more high-quality research in the field of respiratory paediatrics.

Conclusion

On the basis of the evidence (Level A, grade 1a and b), this study found that chest physiotherapy techniques (percussion, postural drainage and suctioning) should not be used as rigid protocols or as routine standardised treatment as they do not increase a range of outcomes measures.

In countries such as South Africa, where resources are scarce, physiotherapists could be more effectively utilised in areas of proven effect, rather than administering chest physiotherapy to bronchiolitis patients when there is little evidence of its efficacy. By applying evidence-based physiotherapy in this field, practice costs may be reduced and resources can be distributed to areas of real need where physiotherapists can make a positive difference.

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