

Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation (Review)

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TABLE OF CONTENTS

| | |
|---|----|
| ABSTRACT | 1 |
| PLAIN LANGUAGE SUMMARY | 2 |
| BACKGROUND | 2 |
| OBJECTIVES | 2 |
| CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW | 2 |
| SEARCH METHODS FOR IDENTIFICATION OF STUDIES | 3 |
| METHODS OF THE REVIEW | 3 |
| DESCRIPTION OF STUDIES | 3 |
| METHODOLOGICAL QUALITY | 4 |
| RESULTS | 4 |
| DISCUSSION | 5 |
| AUTHORS' CONCLUSIONS | 6 |
| POTENTIAL CONFLICT OF INTEREST | 6 |
| ACKNOWLEDGEMENTS | 6 |
| SOURCES OF SUPPORT | 6 |
| REFERENCES | 6 |
| TABLES | 8 |
| Characteristics of included studies | 8 |
| ANALYSES | 10 |
| Comparison 01. Active chest physiotherapy vs no active chest physiotherapy | 10 |
| Comparison 02. Active chest physiotherapy vs no active physiotherapy - <32 wks gestation | 10 |
| Comparison 03. Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency) | 11 |
| INDEX TERMS | 11 |
| COVER SHEET | 11 |
| GRAPHS AND OTHER TABLES | 13 |
| Analysis 01.01. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 01 Postextubation lobar collapse | 13 |
| Analysis 01.02. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 02 Reintubation within 24hrs | 13 |
| Analysis 01.03. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 03 Pneumonia | 14 |
| Analysis 01.04. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 04 Bradycardia | 14 |
| Analysis 01.05. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 05 Intraventricular haemorrhage-all grades | 15 |
| Analysis 01.06. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 06 Intraventricular haemorrhage - Grades 3 and 4 | 15 |
| Analysis 01.07. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 07 Death prior to discharge | 16 |
| Analysis 01.08. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 08 Duration of mechanical ventilation (days) | 16 |
| Analysis 01.09. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 09 Duration of nasopharyngeal CPAP(days) | 17 |
| Analysis 01.10. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 10 Duration of supplemental oxygen (days) | 17 |
| Analysis 01.11. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 11 Duration of neonatal intensive care stay (days) | 17 |
| Analysis 02.01. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 01 Postextubation lobar collapse | 18 |
| Analysis 02.02. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 02 Reintubation within 24hrs | 18 |
| Analysis 02.03. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 03 Bradycardia | 19 |

| | |
|--|----|
| Analysis 02.04. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 04 | 19 |
| Intraventricular haemorrhage - all grades | |
| Analysis 02.05. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 05 | 20 |
| Intraventricular haemorrhage - Grades 3 and 4 | |
| Analysis 02.06. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 06 | 20 |
| Death prior to discharge | |
| Analysis 02.07. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 07 | 21 |
| Duration of mechanical ventilation (days) | |
| Analysis 02.08. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 08 | 21 |
| Duration of nasopharyngeal CPAP(days) | |
| Analysis 02.09. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 09 | 21 |
| Duration of supplemental oxygen (days) | |
| Analysis 02.10. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 10 | 22 |
| Duration of neonatal intensive care stay (days) | |
| Analysis 03.01. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 22 |
| Outcome 01 Post extubation lobar collapse | |
| Analysis 03.02. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 23 |
| Outcome 02 Reintubation within 24 hours | |
| Analysis 03.03. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 24 |
| Outcome 03 Pneumonia | |
| Analysis 03.04. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 25 |
| Outcome 04 Bradycardia | |
| Analysis 03.05. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 25 |
| Outcome 05 Intraventricular haemorrhage- all grades | |
| Analysis 03.06. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 26 |
| Outcome 06 Intraventricular haemorrhage - Grades 3 and 4 | |
| Analysis 03.07. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 26 |
| Outcome 07 Death prior to discharge | |
| Analysis 03.08. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 27 |
| Outcome 08 Duration of mechanical ventilation (days) | |
| Analysis 03.09. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 27 |
| Outcome 09 Duration of nasopharyngeal CPAP(days) | |
| Analysis 03.10. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 28 |
| Outcome 10 Duration of supplemental oxygen (days) | |
| Analysis 03.11. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), | 28 |
| Outcome 11 Duration of neonatal intensive care stay (days) | |

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This record should be cited as:

Flenady VJ, Gray PH. Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation. *Cochrane Database of Systematic Reviews* 2002, Issue 2. Art. No.: CD000283. DOI: 10.1002/14651858.CD000283.

This version first published online: 22 April 2002 in Issue 2, 2002.

Date of most recent substantive amendment: 31 January 2002

ABSTRACT

Background

Chest physiotherapy has been used to clear secretions and help lung ventilation in newborns who have needed mechanical ventilation for respiratory problems. However concerns about the safety of some forms of chest physiotherapy have been expressed.

Objectives

To assess the effects of active chest physiotherapy on babies being extubated from mechanical ventilation for neonatal respiratory failure.

Search strategy

The standard search strategy of the Cochrane Neonatal Review Group was used. This included searches of electronic databases: Oxford Database of Perinatal Trials; Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 1, 2005); MEDLINE (1966-Jan 2005); and CINAHL (1982-Jan 2005), previous reviews including cross references, abstracts, conferences, symposia proceedings, expert informants and journal hand searching mainly in the English language.

Selection criteria

All trials utilising random or quasi-random patient allocation, in which active chest physiotherapy was compared with non-active techniques (eg positioning and suction alone) or no intervention in the peri-extubation period.

Data collection and analysis

Assessment of methodological quality and extraction of data for each included trial was undertaken independently by the authors. Data were extracted for the primary outcomes of postextubation lobar collapse, use of reintubation, duration of oxygen therapy, intracranial haemorrhage, cerebral cystic lesions, long term neurosensory impairment and death. Subgroup analysis was performed on different treatment frequencies and gestational age less than 32 weeks. Meta-analysis was conducted using a fixed effects model. Results are presented as relative risk (RR), risk difference (RD) and number needed to treat (NNT) for categorical data and mean difference (MD) for data measured on a continuous scale. All outcomes are reported with the use of 95% confidence intervals.

Main results

In this review of four trials, two of which were carried out 15 & 23 years ago, no clear benefit of peri-extubation active chest physiotherapy can be seen. Active chest physiotherapy did not significantly reduce the rate of postextubation lobar collapse [RR 0.80 (95% CI 0.49,1.29)], though a reduction in the use of reintubation was shown in the overall analysis: RR 0.32 (95% CI 0.13,0.82); RD -7% (95% CI -13, -2); NNT 14 (95% CI 8, 50). There is insufficient information to adequately assess important short and longer term outcomes, including adverse effects.

Authors' conclusions

The results of this review do not allow development of clear guidelines for clinical practice. Caution is required when interpreting the possible positive effects of chest physiotherapy of a reduction in the use of reintubation and the trend for decreased post-extubation atelectasis as the numbers of babies studied are small, the results are not consistent across trials, data on safety are insufficient, and applicability to current practice may be limited. Further randomised controlled trials addressing the role of prophylactic active chest physiotherapy for neonates in the postextubation period may be unwarranted.

PLAIN LANGUAGE SUMMARY

Active chest physiotherapy may not be helpful for all babies being taken off mechanical breathing support.

Mechanical ventilation (machine-assisted breathing) increases a baby's lung secretions. Chest physiotherapy (tapping or vibrating on the chest) is thought to clear the baby's lungs, and is often done when taking the baby off the ventilator (extubation). Although this review found a benefit for physiotherapy in terms of less babies needing to go back on the ventilator, no other benefits were shown. Also, this benefit was mainly due to the results of studies conducted a long time ago before advances such as better humidification systems to moisten the air the baby breaths and the drug surfactant. These advances may have reduced the risk of complications around the time of extubation so these results may not apply to babies in today's neonatal nurseries. This review did not show any evidence of harm for babies receiving a short course of chest physiotherapy following extubation.

BACKGROUND

Endotracheal intubation and mechanical ventilation cause trauma and inflammation to the airways and increase secretions in the lungs. These effects may contribute to respiratory complications following cessation of mechanical ventilation and extubation. Post-extubation complications range from problematic secretion build up causing discomfort, agitation and distress (necessitating frequent suctioning) to obstruction of major airways with resultant lung collapse. The presence of lung collapse may require increased support such as additional oxygen and occasionally reintubation for further mechanical ventilation. These complications potentially prolong the recovery phase and may impact on long term outcomes.

The neonate is particularly at risk of respiratory complications due to immaturity of the respiratory system. Decreasing birth weight (Oditia 1993), increasing duration of mechanical ventilation, high oxygen concentrations, multiple intubations (Wyman 1977), presence of disease states such as sepsis and patent ductus arteriosus (Oditia 1993) and nasal intubation (Roper 1976; Spitzer 1982) have been identified as risk factors for postextubation lobar collapse (PEC). The incidence of neonatal PEC has been reported at between 11 and 50% over the past decade (Halliday 1992; Oditia 1993), with reintubation required in 10-30% of cases (Halliday 1992).

Respiratory physiotherapy techniques such as chest percussion and vibrations (often referred to as active chest physiotherapy) are thought to reduce respiratory complications by promoting clearance of secretions (Etches 1978), thus improving ventilation of the lungs. Improvement in oxygenation following active physiotherapy has been reported (Tudehope 1980). However, reports on the effects of the different methods of active physiotherapy show conflicting results (Crane 1978; Curran 1979; Tudehope 1980). Safety in terms of stability of intracranial blood flow during suction (Paratz 1994), no increase in the rate of cerebral lesions (Beeby 1998), and benefit in terms of reducing hypoxaemia during suction (Bradbury-Hough 1995) has been reported. However, concerns have also been expressed regarding the safety of this in-

tervention. Reports of adverse effects include hypoxaemia (Holloway 1969; Fox 1978), rib fractures (Purohit 1975) and associated brain lesions (Raval 1987; Cross 1992; Ramsay 1995; Coney 1995; Harding 1998).

Following the publication of a small trial in 1979 (Finer 1979), the use of active chest physiotherapy techniques for the prevention of postextubation lung collapse became a part of routine care in many neonatal nurseries. However, a growing body of conflicting literature on the effects of active chest physiotherapy has resulted in differences of opinion about the risk/benefit ratio of many neonatal physiotherapy techniques, and also differences in practice (Lewis 1992; Flenady 1997).

OBJECTIVES

To assess the effects of active chest physiotherapy on babies being extubated from mechanical ventilation for neonatal respiratory failure on outcomes of post-extubation lobar collapse, the use of reintubation and adverse effects such as bradycardia, hypoxaemia and the incidence of intracranial lesions.

CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies

All trials utilising random or quasi-random patient allocation, in which active chest physiotherapy was compared with non-active techniques (eg positioning and suction alone) or no intervention in the peri-extubation period.

Types of participants

All infants being extubated following a period of mechanical ventilation for neonatal respiratory failure.

Types of intervention

Active chest physiotherapy techniques including the use of vibrations or percussion with or without the use of devices such as face masks and electric vibrators.

Types of outcome measures

Primary outcomes:

Lobar collapse of the lung shortly after extubation
Use of reintubation
Hypoxaemic episodes
Bradycardia

Duration of oxygen therapy
Intracranial haemorrhage
Cerebral cystic lesions (Periventricular leukomalacia, porencephalic cysts)
Long term neurosensory impairment
Death prior to hospital discharge

Secondary outcomes:

Pulmonary air leak
Duration of mechanical ventilation
Duration of nasopharyngeal CPAP
Chronic lung disease
- oxygen use at 28 days of age
- oxygen use at 36 weeks post menstrual age
Frequency of suctioning and handling
Duration of neonatal intensive care unit stay
Duration of hospital stay

A priori sub-group analyses:

Different treatment intervals - frequent (one and two hourly) versus four hourly.
Different treatment methods - vibrations versus percussion
Preterm < 28 weeks gestation or < 1000 gms birthweight
Preterm < 32 weeks gestation or <1500 gms birthweight

SEARCH METHODS FOR IDENTIFICATION OF STUDIES

See: methods used in reviews.

The standard search strategy for the Cochrane Neonatal Review Group was used. This included searches of electronic databases: Oxford Database of Perinatal Trials; Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 1, 2005); MEDLINE (1966-Jan 2005); and CINAHL (1982-Jan 2005) using MeSH term infant-newborn and text terms extubate*; atelectasis; lung collapse; lobar collapse; chest physiotherapy; respiratory therapy, chest physical therapy and previous reviews including cross references, abstracts, conference and symposia proceedings, expert informants, journal hand searching in the English language.

METHODS OF THE REVIEW

The standard methods of the Cochrane Collaboration and its Neonatal Review Group were used.

All included studies were assessed for blinding of randomization, blinding of intervention, completeness of follow-up, and blinding of outcome assessment. The authors independently undertook this assessment and assigned a rating of either Yes (Adequate), Can't Tell (Unclear), or No (Inadequate) for each. Differences were resolved by discussion. Each author independently extracted data then compared and resolved differences. In this update, extraction of data from the previously included trials was conducted for the additional outcomes specified.

Additional data on neonatal morbidity were sought from the investigators of three trials (V- Beresford 1987; Al-Alaiyan 1996; Bagley 1999). One trial (Bagley 1999) provided additional data. Data were received on outcomes for one infant excluded following randomisation in Al-Alaiyan 1996. In Bagley 1999, there were four post randomisation exclusions for the outcome of postextubation collapse (PEC), two for intraventricular haemorrhage (IVH) and one for the outcome of duration of oxygen therapy. In this review, all infants randomised into this trial were included in the denominator for the outcomes of PEC and IVH. Bagley 1999 also provided additional data on the outcome of cerebral cystic lesions at six weeks of age; however, due to large number of losses to follow up (20 and 30% in the two groups), this outcome has not been included in the review. Data for the outcomes of the duration of mechanical ventilation, oxygen therapy, CPAP and neonatal intensive care stay came from one trial (Bagley 1999). In this trial, these outcomes were calculated for the period from admission to the nursery (not from the time of random allocation) to discharge from hospital.

Information was also sought and received on methods of random allocation for two trials (V- Beresford 1987; Al-Alaiyan 1996).

Two trials included study groups of differing treatment frequencies (Al-Alaiyan 1996; V- Beresford 1987). In the analysis, the hourly, two hourly and four hourly physiotherapy groups in V- Beresford 1987 and the two hourly and four hourly groups in Al-Alaiyan 1996 were combined for the overall comparison. Meta-analysis was conducted using the fixed effect model. Mean Differences (MD) were used for outcome data measured on a continuous scale and relative risk, risk difference and number needed to treat as appropriate for categorical data. 95% Confidence Intervals (CI) are presented for all reported outcomes.

DESCRIPTION OF STUDIES

Four randomised trials addressing the issue of active chest physiotherapy in the peri-extubation period were identified and included

in this review. A full description of each is included in the table, Characteristics of included studies.

Participants

The participants of the four trials differed somewhat with respect to primary diagnosis and gestational ages. The groups in Finer 1979 and Al-Alaiyan 1996 were more mature than in V- Beresford 1987 and Bagley 1999. Mean gestational age in was 35 weeks in Finer 1979, 33-35 weeks across the groups in Al-Alaiyan 1996, 29-32 weeks in V- Beresford 1987 and 30 wks in Bagley 1999. Nine babies had multiple intubations (maximum of three) prior to enrolment in Finer 1979. Two trials randomised infants undergoing extubation from a primary course of ventilation only (V- Beresford 1987; Bagley 1999). The number of courses of mechanical ventilation prior to randomisation is unknown for infants in Al-Alaiyan 1996. The main diagnosis of babies enrolled in the four trials was respiratory distress syndrome, however Al-Alaiyan 1996 enrolled a higher proportion of babies with thoracoabdominal surgery (30%) and only Finer 1979 included infants with meconium aspiration and bacterial pneumonia.

Intervention

The intervention differed in that Finer 1979 and Al-Alaiyan 1996 used vibrations whereas V- Beresford 1987 and Bagley 1999 used percussion. Al-Alaiyan 1996 used an electric vibrator to deliver the chest wall vibrations. The frequency of treatments differed among the three trials. Al-Alaiyan 1996 and V- Beresford 1987 enrolled babies into groups of differing treatment frequencies. V- Beresford 1987 and Finer 1979 commenced active physiotherapy 1 hour prior to extubation whereas Al-Alaiyan 1996 and Bagley 1999 commenced the treatments following extubation.

Outcomes

The outcomes of postextubation lobar collapse and the use of endotracheal reintubation within 24 hours of extubation were assessed in all trials. Adverse effects were assessed in Bagley 1999 (short term neonatal morbidity and mortality) and V- Beresford 1987 (bradycardia only). Bagley 1999 reported on duration of respiratory support (mechanical ventilation, oxygen therapy and CPAP) and also for neonatal intensive care and hospital stay for the period from admission to the nursery to the initial discharge from hospital.

METHODOLOGICAL QUALITY

Details of each study appear in the table, Characteristics of Included Studies.

Concealment of allocation

All of the included trials assigned babies to study groups by random allocation. Adequate concealment of treatment allocation by the use of sealed envelopes was undertaken in three trials (Finer 1979; Al-Alaiyan 1996; Bagley 1999). Concealment of treatment allocation was not achieved in V- Beresford 1987. In this trial,

four treatment allocations (one for each of the four groups) were included in one sealed envelope.

Blinding of the intervention was not possible.

Blinding of outcome

Diagnosis of post-extubation collapse was performed by an assessor blinded to the treatment allocation in all included trials.

Completeness of follow up

Finer 1979 and V- Beresford 1987 reported on outcomes for all randomised babies. In the Al-Alaiyan 1996 trial one baby who failed extubation was excluded; this baby has been included in this review following personal communication with the investigator. Bagley 1999 excluded four infants for the outcome of post extubation collapse as chest radiography was not performed, and two infants for the outcome of intraventricular haemorrhage as head ultrasonography was not performed; greater than 20% loss to follow up was reported for the outcome of cerebral cystic lesions at six weeks.

RESULTS

Primary outcomes:

Post extubation collapse (PEC) and reintubation were the only outcomes reported in all of the included trials. The overall analysis shows a trend towards a reduction in the rate of PEC with active chest physiotherapy which is not statistically significant [(RR 0.80 (95% CI 0.49, 1.29)]. A significant reduction in the use of reintubation within 24 hours of extubation was shown for babies receiving active chest physiotherapy: (RR 0.32 (95% CI 0.13, 0.82); RD -7% (95% CI -13, -2)). Thus, number needed to treat (NNT) to expect to prevent one baby receiving reintubation is 14 (95% CI 8, 50). There was insufficient information to adequately assess the outcomes of bradycardia, duration of oxygen therapy, cerebral haemorrhage, cerebral cystic lesions, long term neurosensory impairment or death.

Secondary outcomes:

No statistically significant differences were shown in any other short term outcomes (duration of CPAP and mechanical ventilation, duration of neonatal intensive care) reported by one trial (Bagley 1999).

Subgroup analysis by gestation age:

No significant effect of chest physiotherapy on the following outcomes was shown in sub-group analyses of infants born less than 32 weeks gestation reported by one trial (Bagley 1999): postextubation collapse, use of reintubation, duration of oxygen therapy, cerebral haemorrhage, bradycardia, duration of CPAP and mechanical ventilation, duration of neonatal intensive care stay and death. Although no trend to a reduction in PEC was shown as for the overall analysis [RR 1.09 (95% CI 0.45, 2.63)], the trend to a reduction in reintubation remained [RR 0.64 (95% CI 0.11, 3.72)].

Sub-group analyses of differing treatment frequencies:

Four trials contributed to the comparison of more frequent treatment (one and two hourly groups combined) with no treatment. In keeping with the overall analysis there was a nonsignificant reduction in the rate of PEC [(RR 0.76 (95% CI 0.47, 1.24)] and a significant reduction in the use of reintubation: RR 0.24 (95% CI 0.08, 0.72); RD -8% (95% CI -14, -3); NNT 13 (95% CI 7, 33). Less frequent treatment (4 hourly) was compared to no treatment. Two trials were included in this analysis (V- Beresford 1987; Al-Alaiyan 1996), which showed an increase in PEC with active physiotherapy which is not statistically significant [(RR 1.45; 0.51, 4.09)]. The reduction in the use of reintubation is also not statistically significant [(RR 0.80; 0.21, 2.99)].

DISCUSSION

This review identified several important limitations of the presently available evidence from randomised trials:

1. Small sample sizes

Due to small numbers of infants in the four included trials, all estimates of effect are imprecise resulting in the inability to adequately assess the effects of this intervention.

2. Inconsistency of results

Some of the effects, particularly the effect on postextubation alveolar collapse, are inconsistent across trials. In the case of PEC, there is some evidence of a secular trend in that the rates in the control groups of the different trials fell from 38% (Finer 1979) to 25% (V- Beresford 1987) to 13% (Al-Alaiyan 1996) and 20% in Bagley 1999. The size and the direction of treatment effect varies with control event rate, so that the point estimates for risk difference are -38% (Finer 1979), -13% (V- Beresford 1987), +16% (Al-Alaiyan 1996) and -2% (Bagley 1999). Thus, a source of the heterogeneity of treatment effect on PEC may be the level of risk for PEC in the absence of chest physiotherapy. A similar trend across time, again correlated with size of treatment effect, is shown for reintubation. The rate of reintubation and the risk difference in the control groups are as follows: Finer 1979 33% (RD -33%), V- Beresford 1987 25% (RD -21%), Al-Alaiyan 1996 8.7% (RD -1.4%) and Bagley 1999 3.4% (RD -1.1%).

3. Lack of safety data

Over the past decade, concerns regarding the safety of chest physiotherapy, particularly in the small preterm infant, have been reported. Information on possible adverse effects was inadequate in these trials to allow assessment of safety.

Although no difference was found in the number of infants with bradycardia following extubation reported by two trials, the numbers of infants studied are too small to be confident about this outcome or other more important adverse short term outcomes such as hypoxaemia and cerebral haemorrhage or cysts. None of

the included trials reported measures of the important longer term outcome of neurodevelopmental impairment.

4. Applicability to present day practice

Two of the four trials were conducted 15 and 23 years ago. Applicability of the results of the review to current practice may be compromised due to advancements in neonatal care which have occurred over the interval since the earlier trials were performed. Relevant improvements in neonatal care include better techniques for humidification of inspired gases, introduction of exogenous surfactant, strategies to reduce trauma during endotracheal suctioning (less frequent suctioning and the use of measured smaller bore catheters) and the use of prophylactic post-extubation nasal continuous positive airway pressure (NCPAP). These innovations may well have changed the nature of post-extubation complications considerably. For example, the use of prophylactic post-extubation NCPAP has been shown to reduce the rate of post-extubation complications (Davis 2001). Only one trial (Bagley 1999) used routine post-extubation NCPAP prophylactically for preterm infants. Therefore, the results of this review may overestimate the rates of PEC and reintubation in nurseries where prophylactic post-extubation NCPAP is now being used.

Thus, caution is required in interpreting the results of this review and applying them to current practice. Although the number needed to treat of 14 to avoid reintubation shown in the overall analysis of this review suggests that active chest physiotherapy in this situation may be a worthwhile intervention, this finding was heavily weighted by the two trials conducted some time ago (Finer 1979; V- Beresford 1987) and was not supported by the results of the two more recent trials in this review. No benefit for chest physiotherapy was shown in one trial (Bagley 1999) in terms of the duration of mechanical ventilation, NCPAP, oxygen therapy or neonatal intensive care nursery stay. However, adequate assessment of the effects of chest physiotherapy on these outcomes is difficult due to insufficient data and also as the outcomes were measured from admission to the nursery not from randomisation and institution of the allocated treatment.

Although data in this review are insufficient to permit adequate assessment of this intervention, the lack of clear benefit for postextubation active chest physiotherapy shown is supported by other recent reports. A similar rate of PEC and no evidence for benefit of postextubation physiotherapy in terms of PEC was reported in a recent before-and-after study assessing active postextubation physiotherapy (Bloomfield 1998). Furthermore, the low risk of postextubation complications (PEC and reintubation) evident in the more recent trials in this review (Al-Alaiyan 1996; Bagley 1999) is also supported by a recent retrospective study. Davies 1998 reported a very low risk of PEC with no requirement for reintubation in these infants. Bagley 1999 reported no use of reintubation for any infant with PEC (unpublished data).

Care providers need to consider the role of active postextubation chest physiotherapy in the light of the lack of clear evidence

for benefit, recent reports of severe adverse outcome associated with active chest physiotherapy in some situations (Ramsay 1995; Harding 1998) and the need to avoid unnecessary distress in the care of sick newborn infants from interventions which may not be beneficial. There are challenges in obtaining robust evidence for physiotherapy interventions due to the difficulties with blinding the intervention, and defining and measuring clinically meaningful outcomes (Wallis 1999).

AUTHORS' CONCLUSIONS

Implications for practice

The results of this review do not give a clear direction for the role of active chest physiotherapy for babies being extubated from mechanical ventilation in today's neonatal intensive care settings. Evidence for benefit of this intervention is conflicting and it was not possible to identify sub-groups of babies who may benefit. No benefit for more vs less frequent treatment is evident.

Concerns regarding the safety of active chest physiotherapy for preterm neonates have been reported. Information on adverse effects is inadequate in the trials included in this review to allow assessment of safety. In view of this and the lack of clear evidence for benefit, it would seem wise to use this intervention cautiously.

Implications for research

Further randomised controlled trials addressing the role of prophylactic active chest physiotherapy for neonates in the postextubation period may be unwarranted.

POTENTIAL CONFLICT OF INTEREST

The authors were investigators on the trial Bagley 1999.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Catherine Bagley, Physiotherapy Department, Mater Hospital, Brisbane, Australia; Dr Saleh Al-Alaiyan, Department of Pediatrics, King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia and Ann Vivian-Beresford, Children's Rehabilitation Centre, St John's, Newfoundland, Canada for providing further information regarding their trials.

We would also like to acknowledge Katie Welsh for assistance with literature searching and formatting the review.

SOURCES OF SUPPORT

External sources of support

- Department of Health and Ageing, Commonwealth Government, Canberra, ACT AUSTRALIA

Internal sources of support

- JP Kelly Research Foundation, Mater Hospital, Sth Brisbane, Queensland AUSTRALIA
- Centre for Clinical Studies - Women's and Children's Health, Mater Hospital, Sth Brisbane, Queensland AUSTRALIA
- Department of Neonatology, Mater Mothers' Hospital, South Brisbane, Queensland AUSTRALIA

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Flenady VJ, Gray PH. Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation. *The Cochrane Database of Systematic Reviews* 1998, Issue 1. Art. No.: CD000283. DOI:10.1002/14651858.CD000283.

Flenady 2002

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TABLES

Characteristics of included studies

| Study | Al-Alaiyan 1996 |
|------------------------|--|
| Methods | Blinding of randomization - yes Blinding of intervention -no Complete followup -yes Blinding of outcome measure yes for primary outcome (PEC) |
| Participants | Electively extubated infants who were intubated for more than 24 hours. Exclusions were atelectasis prior to extubation, meconium aspiration or pneumonia. Main diagnoses were respiratory distress syndrome (52%) and thoracoabdominal surgery (30%). Mean gestational age across the groups was 33 - 35 weeks. Duration of MV at randomisation: Physio groups: 11.2 (16.7), and 11.4 (13.8) Control group: 8.3(11.2) Mean (SD) days |
| Interventions | Active chest physio n=41: Postural drainage(lateral decubitus) and bilateral chest wall vibration (using a neocussor) were commenced immediately following extubation and continued for a 24 hour period. Two active chest physio groups: a 2 hrly and a 4 hrly treatment frequency group. All treatments were performed by a physiotherapist. Controls n=23: No active chest physiotherapy. |
| Outcomes | Atelectasis on chest radiography performed at 24 hours post-extubation, the use of reintubation and nasopharyngeal CPAP up to 24 hours postextubation. |
| Notes | All infants enrolled received active chest physiotherapy for postextubation collapse detected on the chest radiography at 24 hrs postextubation. Additional outcome data were received from the author for one infant excluded following randomisation. |
| Allocation concealment | A – Adequate |

| Study | Bagley 1999 |
|---------------|--|
| Methods | Blinding of randomization - yes Blinding of intervention -no Complete followup - no Blinding of outcome measure - yes for primary outcome (PEC) |
| Participants | 177 infants receiving a primary course of MV deemed ready for extubation. Exclusions: MV <24 hrs, unstable infants, infants with GA <28 wks in the first week of life. Main diagnosis was RDS (94%). 97% of extubations were elective. At randomisation: Duration of MV (days): physio-7.3(7.7) Control- 6.5(8.5) Postnatal age (days): Physio: 8.7(8.6) Control: 7.2(7.8) GA (wks): Physio- 30.1 (3.4), Controls- 30.5(3.69) [mean(SD)] |
| Interventions | Active chest physio n= 88: Percussion with a Laerdal or Bennetts face mask 2nd hrly for 6 hrs starting 2 hrs post extubation Majority of physio performed by physiotherapists. |

Characteristics of included studies (Continued)

| | |
|------------------------|--|
| | Controls n=89: No active chest physiotherapy Positioning and suctioning program as for the physio group. |
| Outcomes | Lobar collapse on chest radiography performed at 6 and 24 hrs post- extubation, reintubation and bradycardia within 24 hrs of extubation, total episodes of MV, duration of MV, oxygen treatment and NICU stay, IVH, intracranial haemorrhage, other cerebral lesions, hypoxia measured by continuous pulse oximetry (subgroup only). |
| Notes | Routine nursery practice included: oropharyngeal intubation, 4 hrly & prn ETT suction using 6 gauge catheter, prophylactic post extubation NCPAP for GA <32 wks. Infants remained in the original study group for each subsequent extubation episode. The outcomes of PEC and reintubation for the initial extubation episode only were included in the analysis Additional data to that in the published abstract were included for Bagley 1999 as follows: durations of mechanical ventilation, oxygen therapy, CPAP, neonatal intensive care and hospital stay. Sample size calculation: 430 needed to detect a 50% reduction in PEC from 40% in control group. Trial stopped at interim analysis due to no difference in the rates of PEC. |
| Allocation concealment | A – Adequate |

| | |
|------------------------|---|
| Study | Finer 1979 |
| Methods | Blinding of randomization - yes Blinding of intervention - no Complete followup - yes Blinding of outcome measure - yes for primary outcome (PEC) |
| Participants | Mechanically ventilated for greater than 24 hours. Exclusion criteria are not mentioned. The mean gestational age was 35 weeks. Respiratory Distress Syndrome was the most common diagnosis (60%); other diagnoses included meconium aspiration, bacterial pneumonia, asphyxia, thoracoabdominal surgery and apnoea. Duration of MV at randomisation (mean days): Physio: 6 Controls: 6 |
| Interventions | Active chest physio n=21: Postural drainage and chest wall vibrations commenced one hour prior to extubation and continued for a period of 48 hours as follows: Hourly for 8 hours, 2 hourly for a further 16 hrs and 3 hourly until 48 hrs postextubation. A physiotherapist performed all the treatments for the first 8 hours and nurses for the remainder. Controls n=21: Hourly positioning program for upper lobe drainage. |
| Outcomes | Atelectasis on chest radiographs performed at 8 or 24 hours post-extubation. |
| Notes | All infants enrolled received active chest physiotherapy for postextubation collapse detected on the chest radiography at 8 or 24 hrs postextubation. |
| Allocation concealment | A – Adequate |

| | |
|--------------|---|
| Study | V- Beresford 1987 |
| Methods | Blinding of randomization - no Blinding of intervention - no Complete followup - yes Blinding of outcome measurement - yes for primary outcome (PEC) |
| Participants | Preterm infants with Respiratory Distress Syndrome undergoing a planned extubation from a primary course of extubation were eligible. Exclusions were babies with severe pulmonary oedema, apnoea or bradycardia, tachycardia or other signs of distress. Additional diagnoses were transient tachypnoea and pneumonia. Mean gestational age across the groups was 29 - 32 weeks. Duration of MV at randomisation (days): |

Physio groups:7, 9 and 16.
Control group: 16
Mean (SD) days

| | |
|------------------------|---|
| Interventions | Active chest physio n=24: Chest wall percussion was given in three study groups of different frequency: 4 hourly, 2 hourly and 1 hourly. Commencing at one hour pre-extubation until 24 hrs post-extubation. The treatments were carried out by either physiotherapists or nurses. Controls n=8: No active chest physiotherapy. Similar positioning program as for intervention. |
| Outcomes | Atelectasis (detected on chest radiographs at 24 hours post-extubation), pneumonia, bradycardia, respiratory distress and intolerance of treatment up to 24 hours post-extubation. |
| Notes | Sample size calculation required 60 babies in total- 15 in each arm. Sample size not achieved due to poor recruitment rate. |
| Allocation concealment | C – Inadequate |

ANALYSES

Comparison 01. Active chest physiotherapy vs no active chest physiotherapy

| Outcome title | No. of studies | No. of participants | Statistical method | Effect size |
|--|----------------|---------------------|---|---------------------|
| 01 Postextubation lobar collapse | 4 | 315 | Relative Risk (Fixed) 95% CI | 0.80 [0.49, 1.29] |
| 02 Reintubation within 24hrs | 4 | 315 | Relative Risk (Fixed) 95% CI | 0.32 [0.13, 0.82] |
| 03 Pneumonia | 1 | 32 | Relative Risk (Fixed) 95% CI | 1.00 [0.12, 8.31] |
| 04 Bradycardia | 2 | 209 | Relative Risk (Fixed) 95% CI | 1.01 [0.66, 1.53] |
| 05 Intraventricular haemorrhage- all grades | 1 | 177 | Relative Risk (Fixed) 95% CI | 1.01 [0.58, 1.78] |
| 06 Intraventricular haemorrhage - Grades 3 and 4 | 1 | 177 | Relative Risk (Fixed) 95% CI | Not estimable |
| 07 Death prior to discharge | 1 | 177 | Relative Risk (Fixed) 95% CI | 0.25 [0.03, 2.22] |
| 08 Duration of mechanical ventilation (days) | 1 | 177 | Weighted Mean Difference (Fixed) 95% CI | 1.74 [-1.26, 4.74] |
| 09 Duration of nasopharyngeal CPAP(days) | 1 | 177 | Weighted Mean Difference (Fixed) 95% CI | 1.83 [-0.54, 4.20] |
| 10 Duration of supplemental oxygen (days) | 1 | 176 | Weighted Mean Difference (Fixed) 95% CI | 9.73 [-0.69, 20.15] |
| 11 Duration of neonatal intensive care stay (days) | 1 | 177 | Weighted Mean Difference (Fixed) 95% CI | 3.91 [-2.85, 10.67] |

Comparison 02. Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

| Outcome title | No. of studies | No. of participants | Statistical method | Effect size |
|--|----------------|---------------------|---|--------------------|
| 01 Postextubation lobar collapse | 1 | 120 | Relative Risk (Fixed) 95% CI | 1.09 [0.45, 2.63] |
| 02 Reintubation within 24hrs | 1 | 120 | Relative Risk (Fixed) 95% CI | 0.64 [0.11, 3.72] |
| 03 Bradycardia | 1 | 120 | Relative Risk (Fixed) 95% CI | 1.01 [0.63, 1.64] |
| 04 Intraventricular haemorrhage - all grades | 1 | 120 | Relative Risk (Fixed) 95% CI | 0.91 [0.52, 1.60] |
| 05 Intraventricular haemorrhage - Grades 3 and 4 | 1 | 120 | Relative Risk (Fixed) 95% CI | Not estimable |
| 06 Death prior to discharge | 1 | 120 | Relative Risk (Fixed) 95% CI | 0.24 [0.03, 2.10] |
| 07 Duration of mechanical ventilation (days) | 1 | 120 | Weighted Mean Difference (Fixed) 95% CI | 1.50 [-2.59, 5.59] |

| | | | | |
|--|---|-----|---|---------------------|
| 08 Duration of nasopharyngeal CPAP(days) | 1 | 120 | Weighted Mean Difference (Fixed) 95% CI | 2.20 [-0.91, 5.31] |
| 09 Duration of supplemental oxygen (days) | 1 | 119 | Weighted Mean Difference (Fixed) 95% CI | 9.84 [-3.91, 23.59] |
| 10 Duration of neonatal intensive care stay (days) | 1 | 120 | Weighted Mean Difference (Fixed) 95% CI | 4.79 [-4.02, 13.60] |

Comparison 03. Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

| Outcome title | No. of studies | No. of participants | Statistical method | Effect size |
|--|----------------|---------------------|---|----------------|
| 01 Post extubation lobar collapse | | | Relative Risk (Fixed) 95% CI | Subtotals only |
| 02 Reintubation within 24 hours | | | Relative Risk (Fixed) 95% CI | Subtotals only |
| 03 Pneumonia | | | Relative Risk (Fixed) 95% CI | Subtotals only |
| 04 Bradycardia | | | Relative Risk (Fixed) 95% CI | Subtotals only |
| 05 Intraventricular haemorrhage - all grades | | | Relative Risk (Fixed) 95% CI | Subtotals only |
| 06 Intraventricular haemorrhage - Grades 3 and 4 | | | Relative Risk (Fixed) 95% CI | Subtotals only |
| 07 Death prior to discharge | | | Relative Risk (Fixed) 95% CI | Subtotals only |
| 08 Duration of mechanical ventilation (days) | | | Weighted Mean Difference (Fixed) 95% CI | Subtotals only |
| 09 Duration of nasopharyngeal CPAP(days) | | | Weighted Mean Difference (Fixed) 95% CI | Subtotals only |
| 10 Duration of supplemental oxygen (days) | | | Weighted Mean Difference (Fixed) 95% CI | Subtotals only |
| 11 Duration of neonatal intensive care stay (days) | | | Weighted Mean Difference (Fixed) 95% CI | Subtotals only |

INDEX TERMS

Medical Subject Headings (MeSH)

Drainage, Postural; Infant, Newborn; Intubation, Intratracheal; Physical Therapy Modalities [adverse effects]; *Respiration, Artificial; Respiratory Insufficiency [*therapy]; Suction; Thorax

MeSH check words

Humans

COVER SHEET

| | |
|---------------------------------------|---|
| Title | Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation |
| Authors | Flenady VJ, Gray PH |
| Contribution of author(s) | Vicki Flenady prepared the protocol for the review, initial review and subsequent updates. Peter Gray provided comment. |
| Issue protocol first published | 1997/1 |
| Review first published | 1998/1 |
| Date of most recent amendment | 22 February 2005 |

| | |
|---|---|
| Date of most recent SUBSTANTIVE amendment | 31 January 2002 |
| What's New | This is an update of the existing review "Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation" published in The Cochrane Library, Issue 1, 1998 and updated in Issue 2, 2002 (Flenady 2002). No new trials were identified in the search updated to January 2005, and as a result no substantive changes were made to the review. |
| Date new studies sought but none found | 13 January 2005 |
| Date new studies found but not yet included/excluded | Information not supplied by author |
| Date new studies found and included/excluded | 31 January 2002 |
| Date authors' conclusions section amended | Information not supplied by author |
| Contact address | Vicki Flenady Centre for Clinical Studies-Women's and Children's Health Women's and Children's Health Service Mater Health Services Brisbane Raymond Terrace South Brisbane Queensland 4101 AUSTRALIA E-mail: vflenady@mater.org.au Tel: +61 7 38401591 Fax: +61 7 38401588 |
| DOI | 10.1002/14651858.CD000283 |
| Cochrane Library number | CD000283 |
| Editorial group | Cochrane Neonatal Group |
| Editorial group code | HM-NEONATAL |

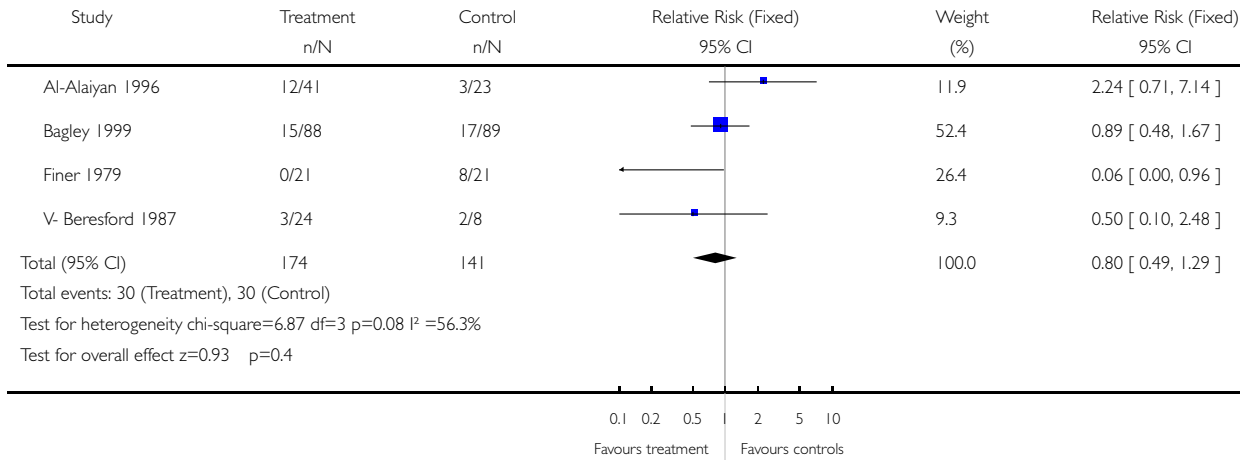
GRAPHS AND OTHER TABLES

Analysis 01.01. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 01 Postextubation lobar collapse

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 01 Postextubation lobar collapse

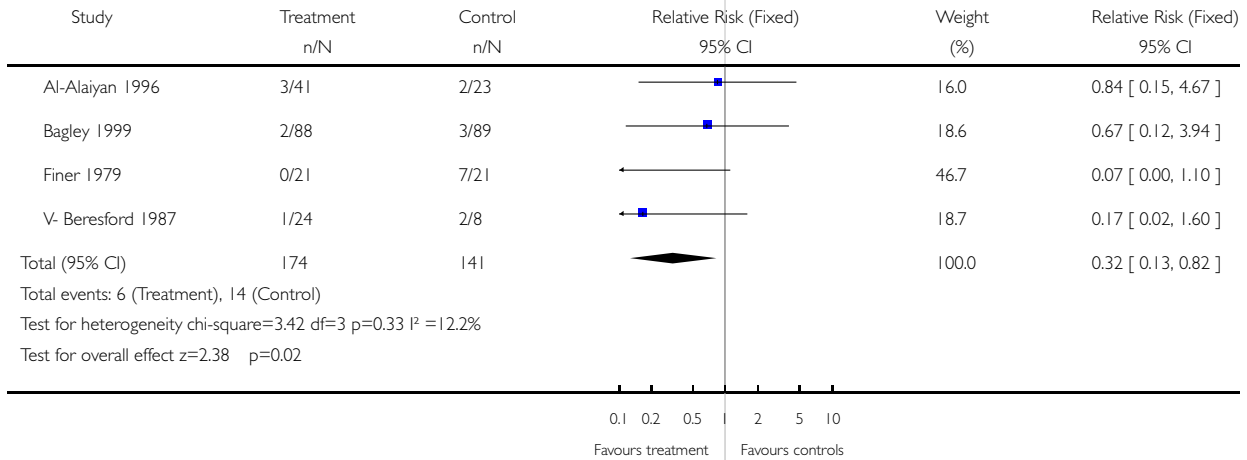


Analysis 01.02. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 02 Reintubation within 24hrs

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 02 Reintubation within 24hrs

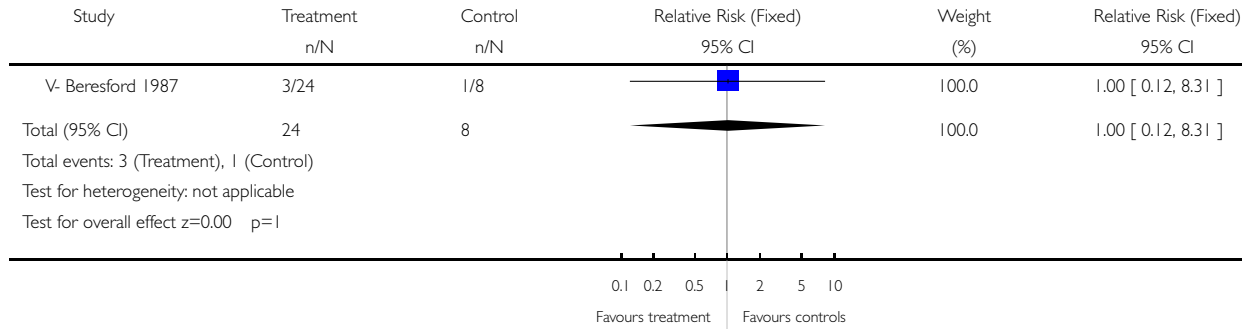


Analysis 01.03. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 03 Pneumonia

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 03 Pneumonia

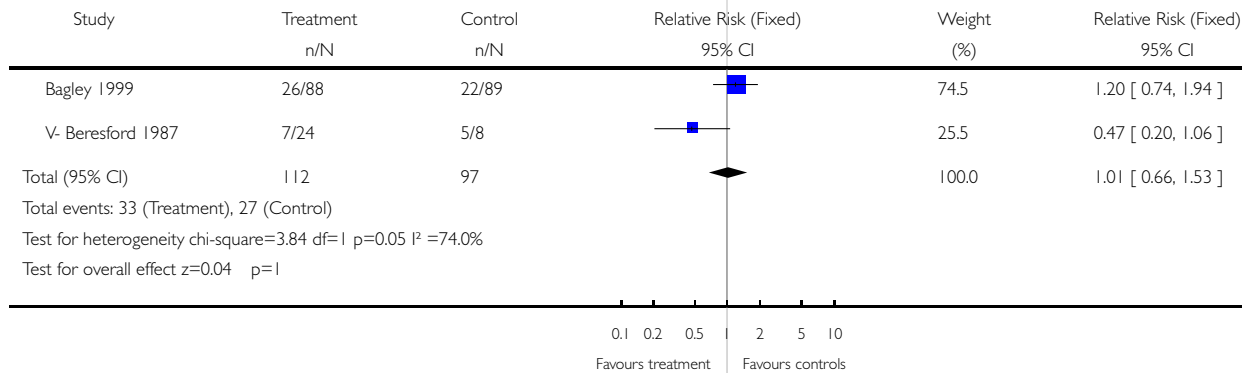


Analysis 01.04. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 04 Bradycardia

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 04 Bradycardia

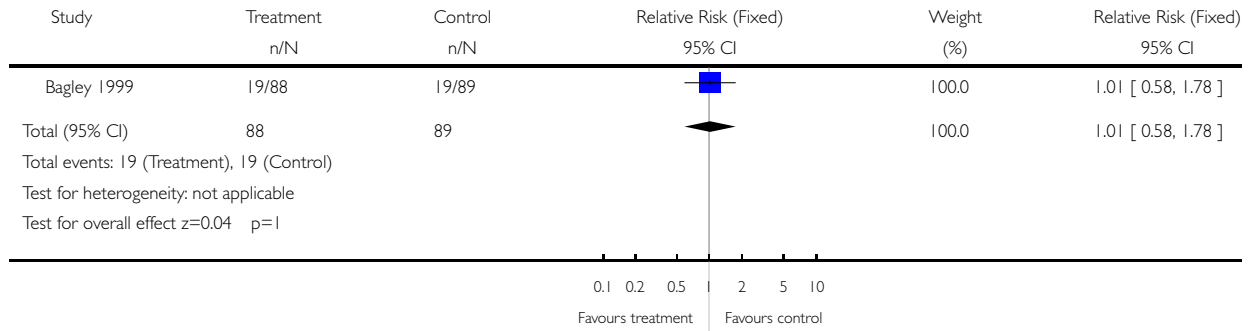


Analysis 01.05. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 05 Intraventricular haemorrhage-all grades

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 05 Intraventricular haemorrhage-all grades

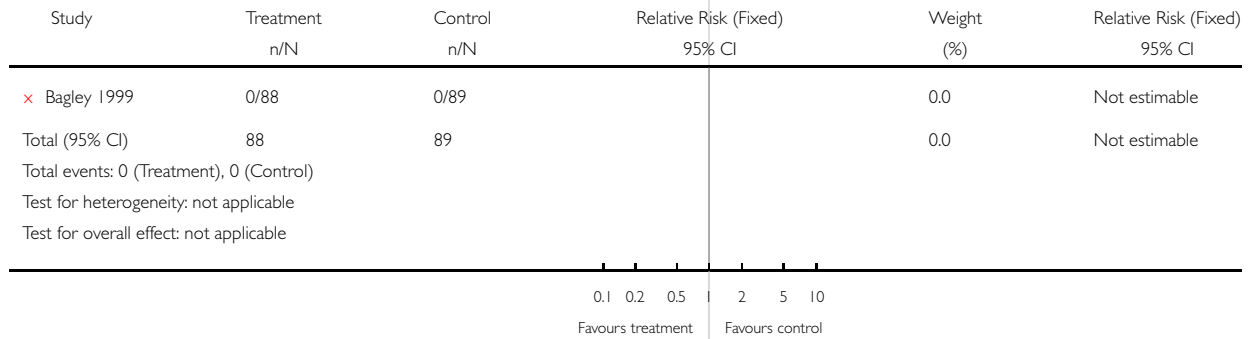


Analysis 01.06. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 06 Intraventricular haemorrhage - Grades 3 and 4

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 06 Intraventricular haemorrhage - Grades 3 and 4

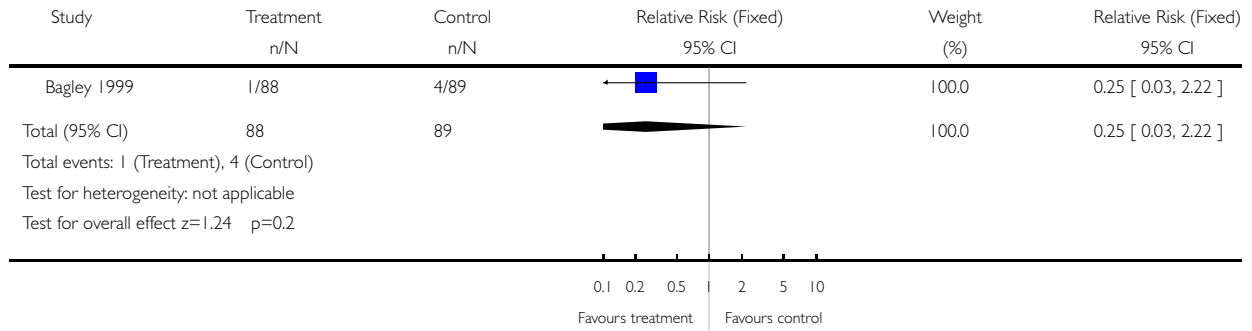


Analysis 01.07. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 07 Death prior to discharge

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 07 Death prior to discharge

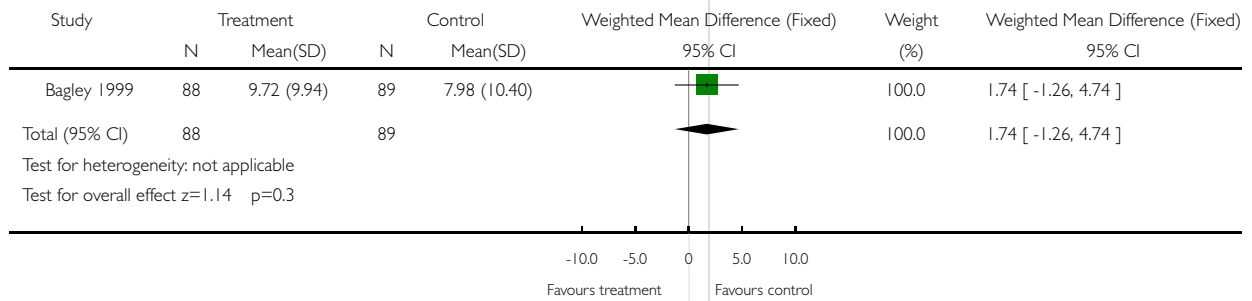


Analysis 01.08. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 08 Duration of mechanical ventilation (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 08 Duration of mechanical ventilation (days)

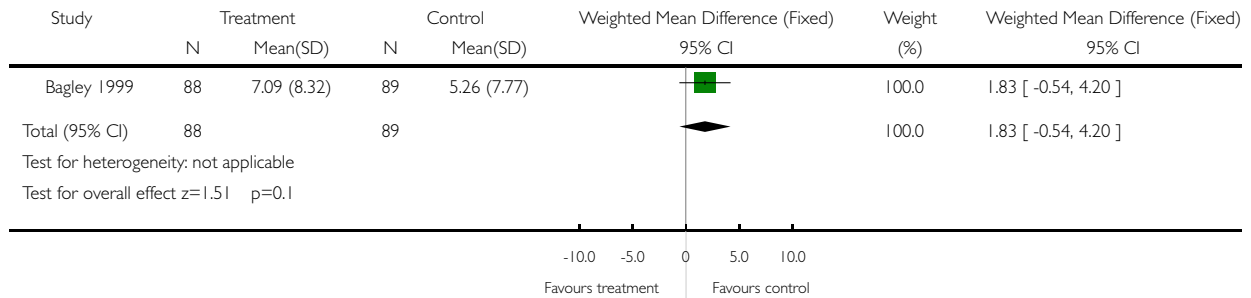


Analysis 01.09. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 09 Duration of nasopharyngeal CPAP(days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 09 Duration of nasopharyngeal CPAP(days)

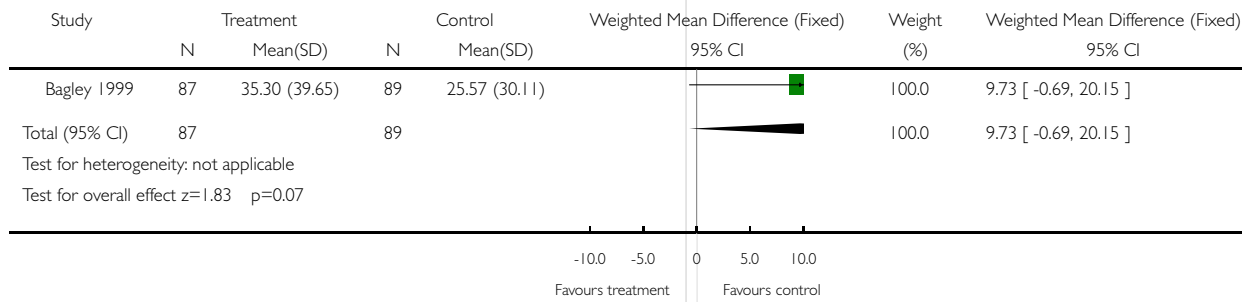


Analysis 01.10. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 10 Duration of supplemental oxygen (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 10 Duration of supplemental oxygen (days)

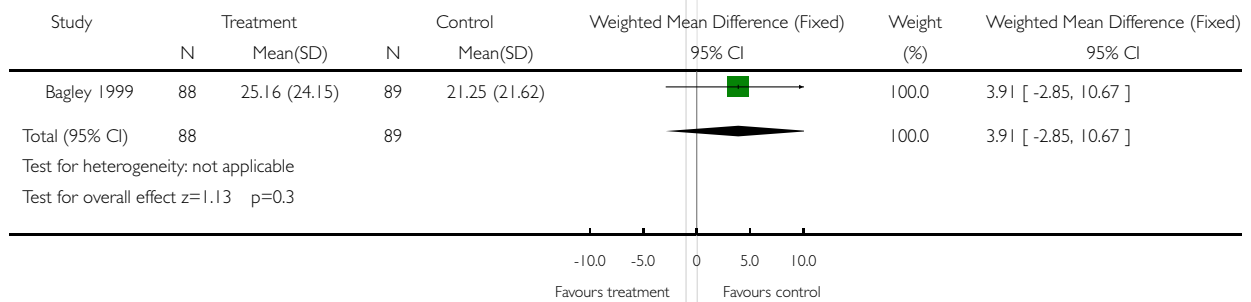


Analysis 01.11. Comparison 01 Active chest physiotherapy vs no active chest physiotherapy, Outcome 11 Duration of neonatal intensive care stay (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 01 Active chest physiotherapy vs no active chest physiotherapy

Outcome: 11 Duration of neonatal intensive care stay (days)

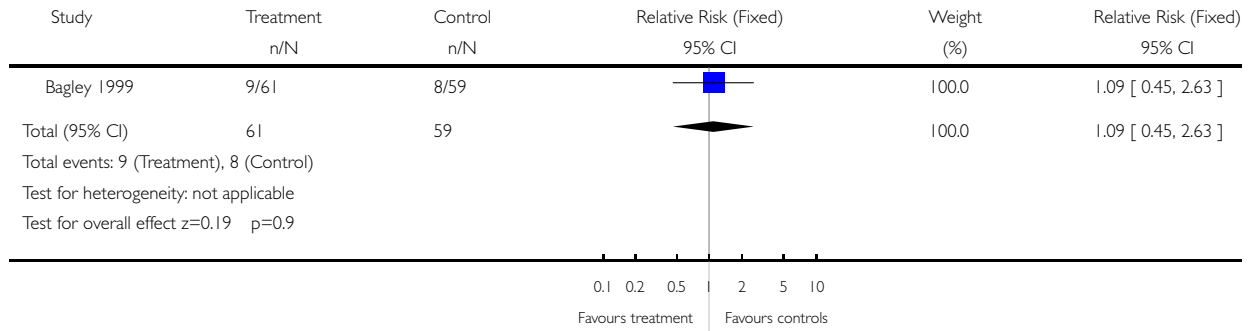


Analysis 02.01. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 01 Postextubation lobar collapse

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 01 Postextubation lobar collapse

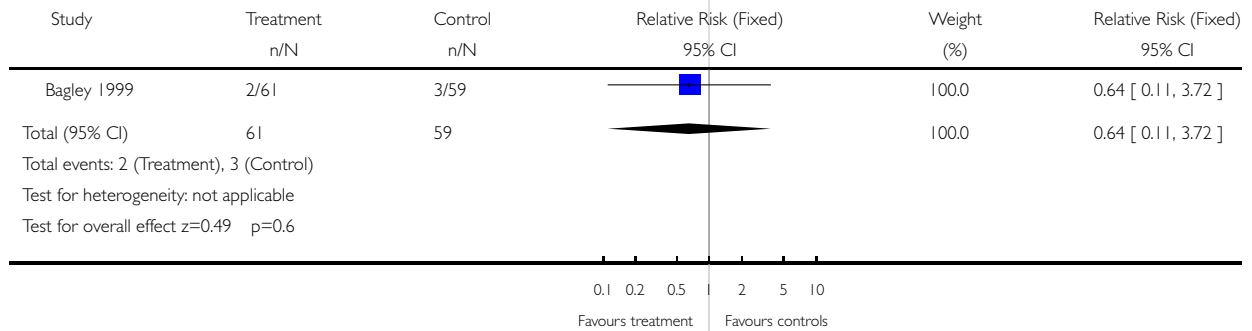


Analysis 02.02. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 02 Reintubation within 24hrs

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 02 Reintubation within 24hrs

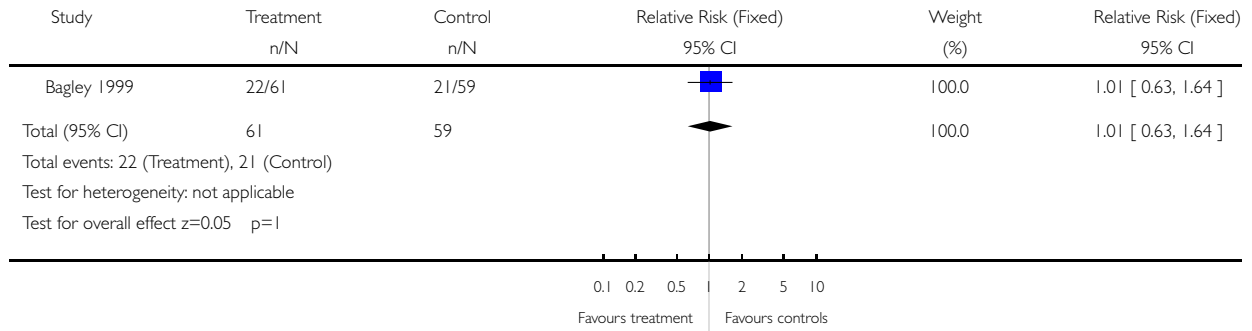


Analysis 02.03. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 03 Bradycardia

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 03 Bradycardia

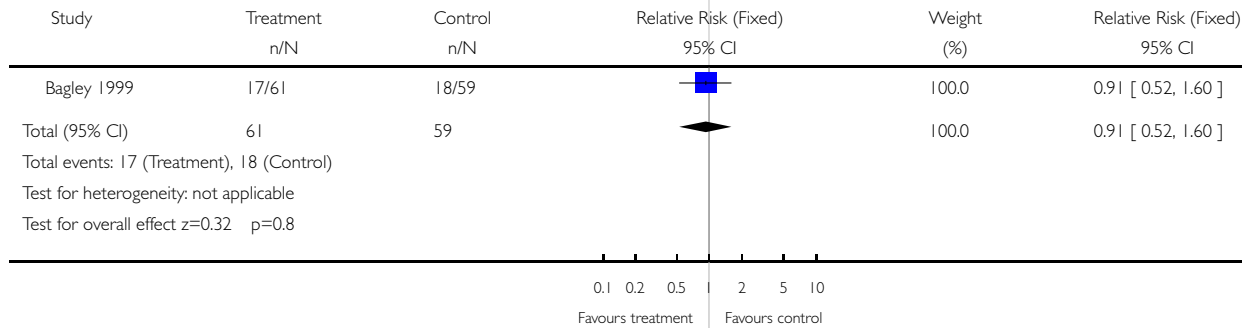


Analysis 02.04. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 04 Intraventricular haemorrhage - all grades

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 04 Intraventricular haemorrhage - all grades

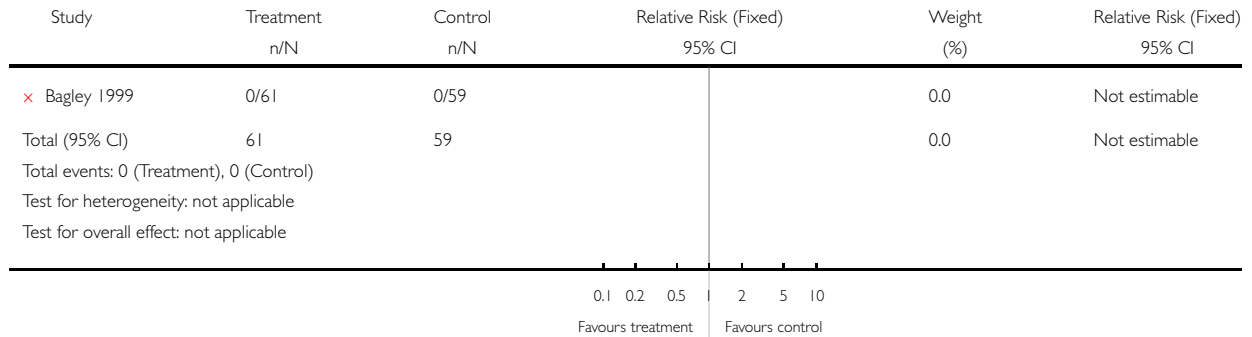


Analysis 02.05. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 05 Intraventricular haemorrhage - Grades 3 and 4

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 05 Intraventricular haemorrhage - Grades 3 and 4

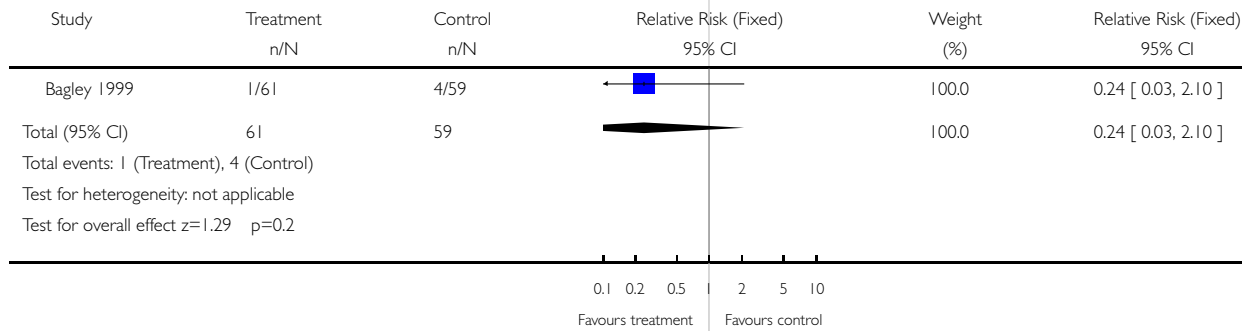


Analysis 02.06. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 06 Death prior to discharge

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 06 Death prior to discharge

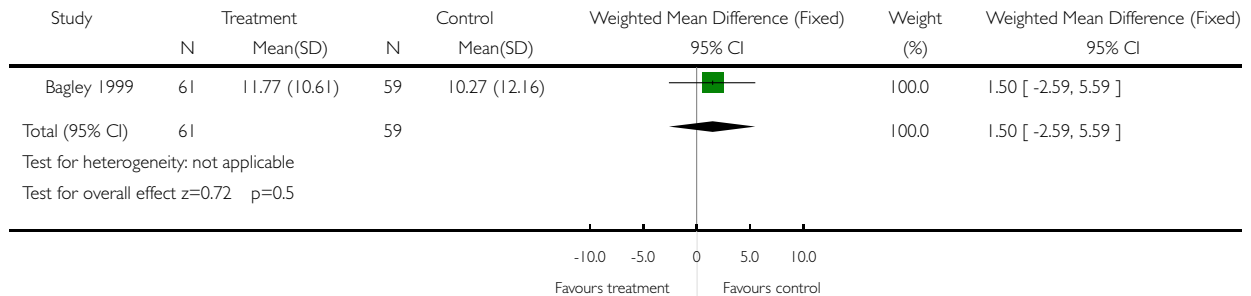


Analysis 02.07. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 07 Duration of mechanical ventilation (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 07 Duration of mechanical ventilation (days)

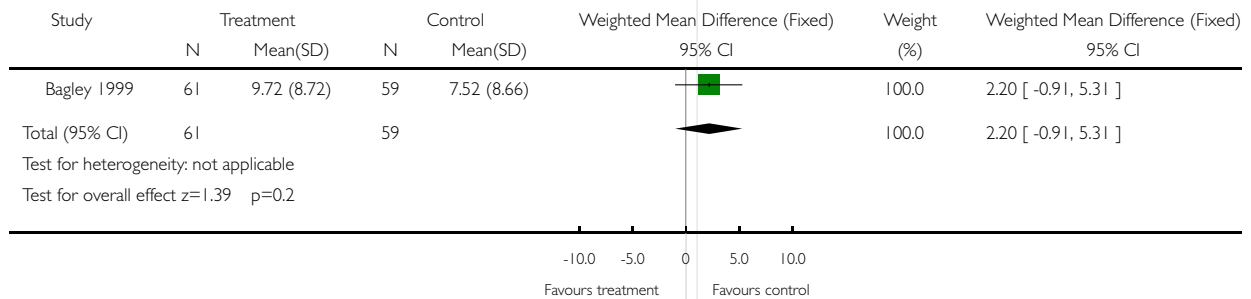


Analysis 02.08. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 08 Duration of nasopharyngeal CPAP(days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 08 Duration of nasopharyngeal CPAP(days)

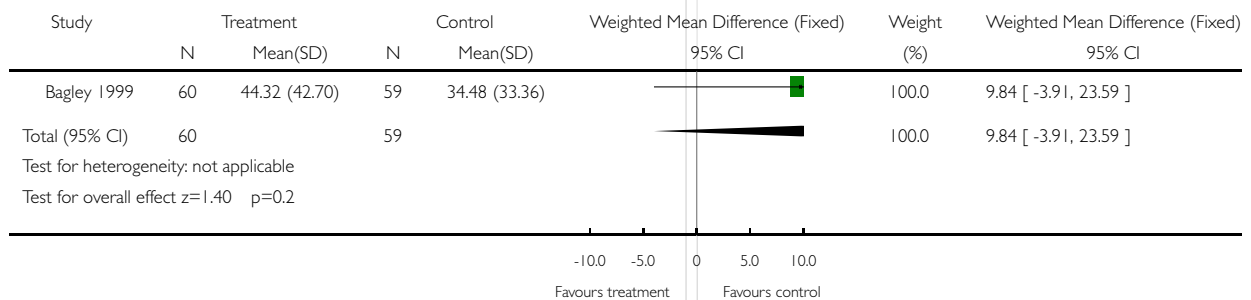


Analysis 02.09. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 09 Duration of supplemental oxygen (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 09 Duration of supplemental oxygen (days)

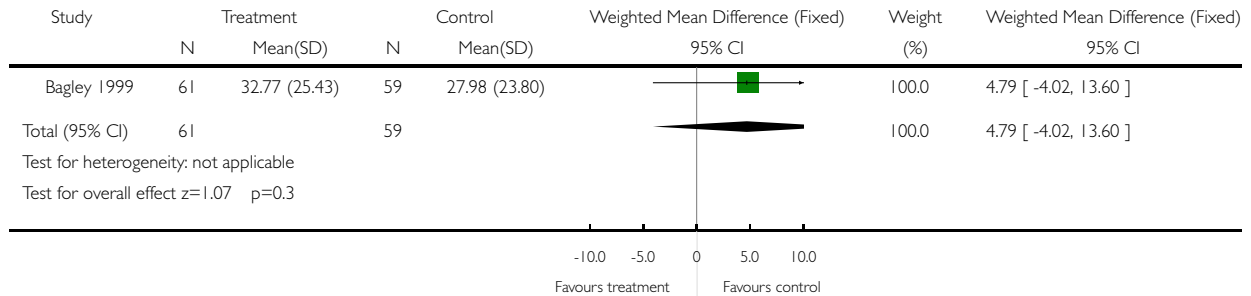


Analysis 02.10. Comparison 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation, Outcome 10 Duration of neonatal intensive care stay (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 02 Active chest physiotherapy vs no active physiotherapy - <32 wks gestation

Outcome: 10 Duration of neonatal intensive care stay (days)

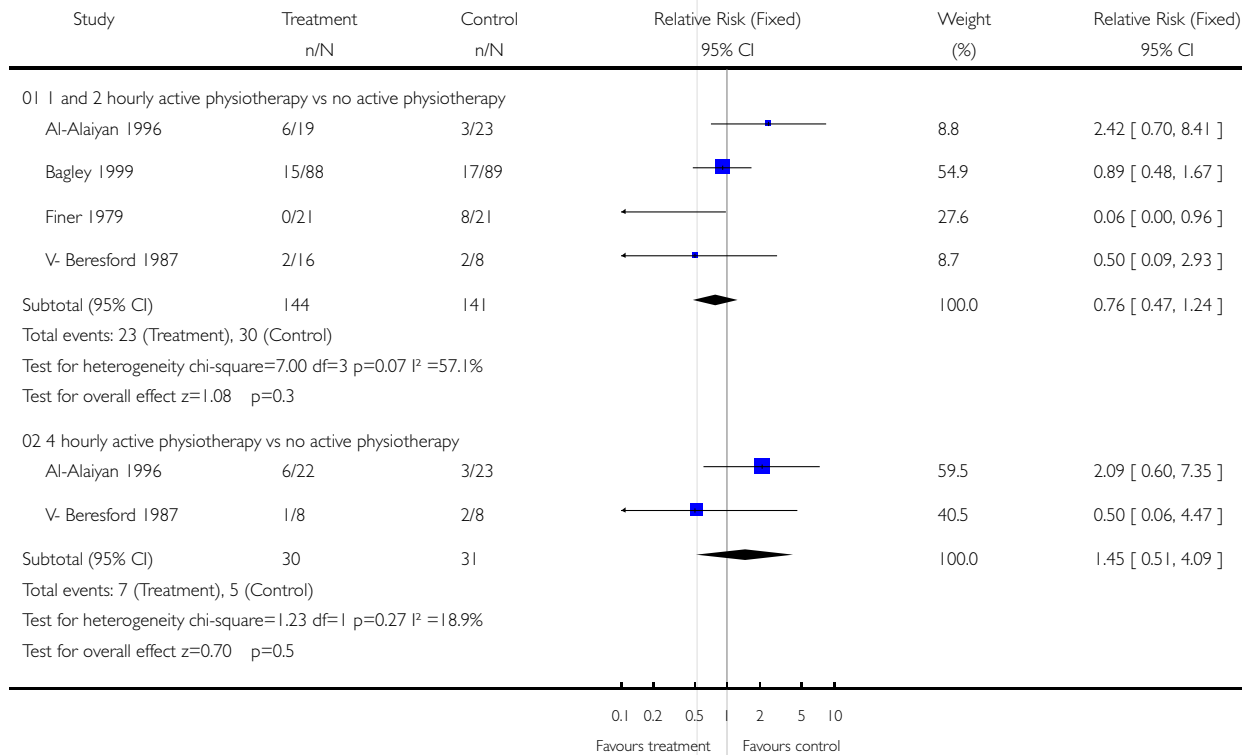


Analysis 03.01. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 01 Post extubation lobar collapse

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 01 Post extubation lobar collapse

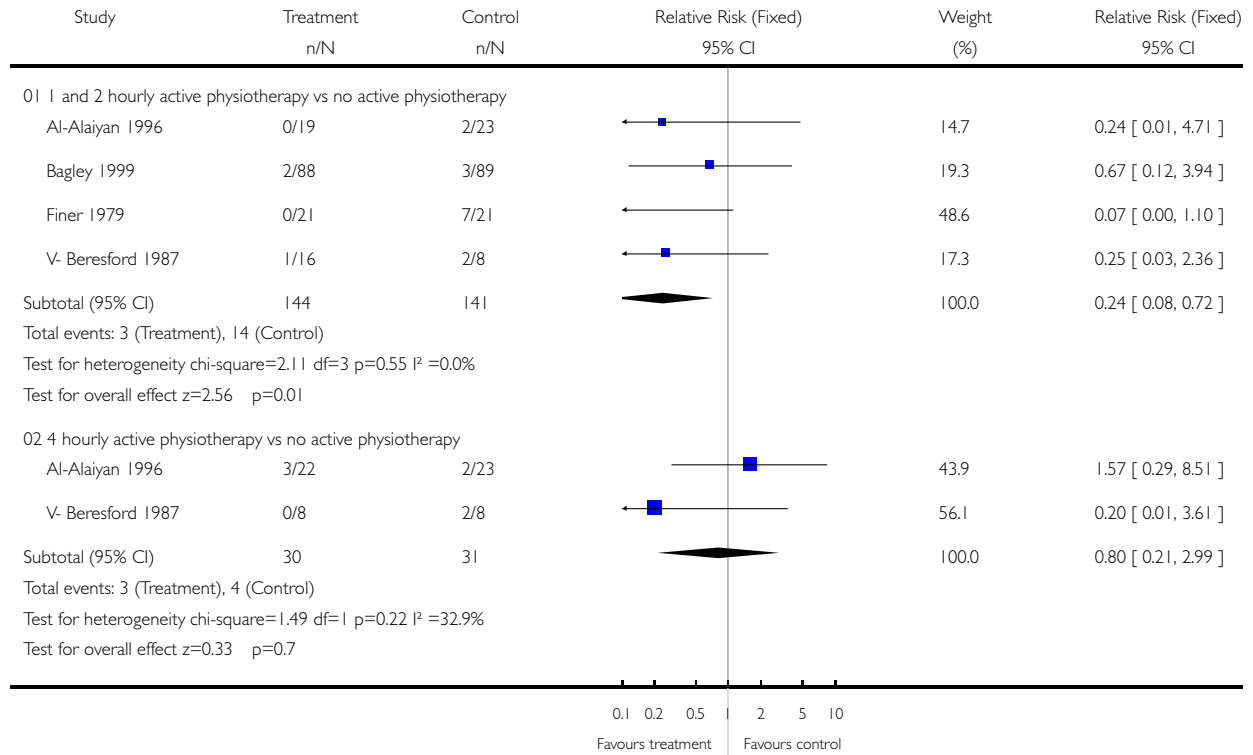


Analysis 03.02. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 02 Reintubation within 24 hours

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 02 Reintubation within 24 hours

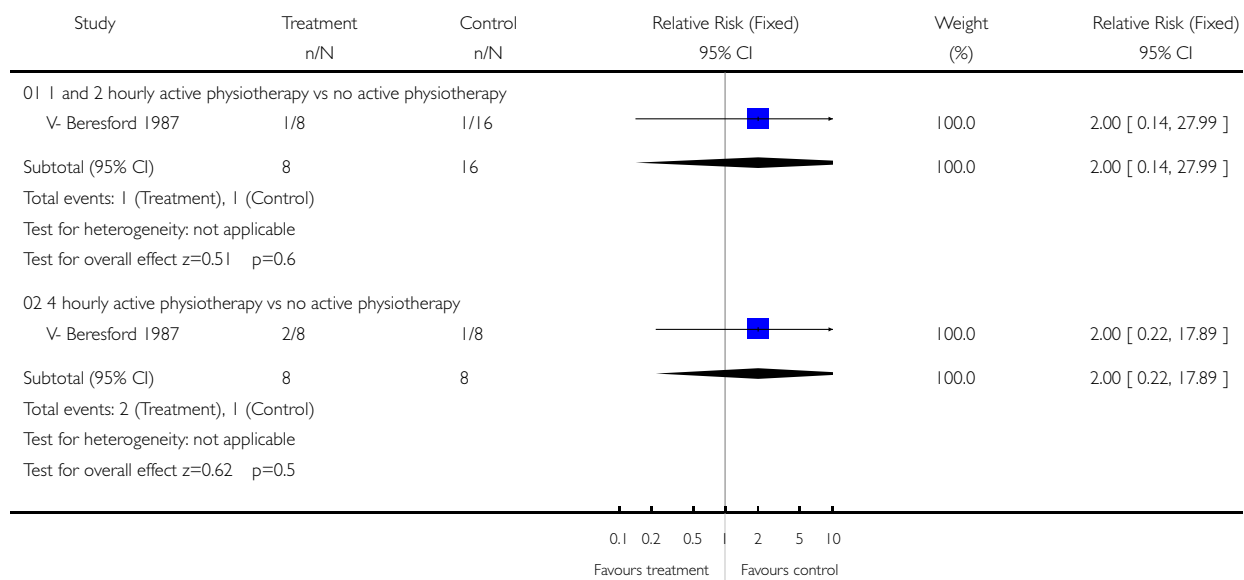


Analysis 03.03. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 03 Pneumonia

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 03 Pneumonia

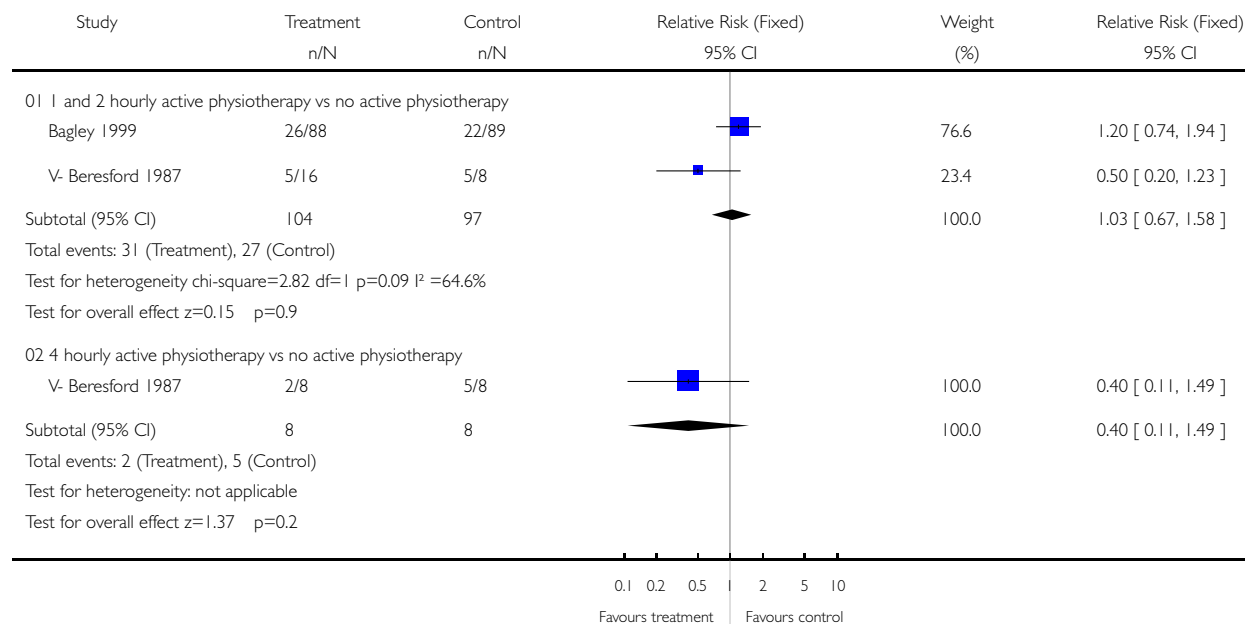


Analysis 03.04. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 04 Bradycardia

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 04 Bradycardia

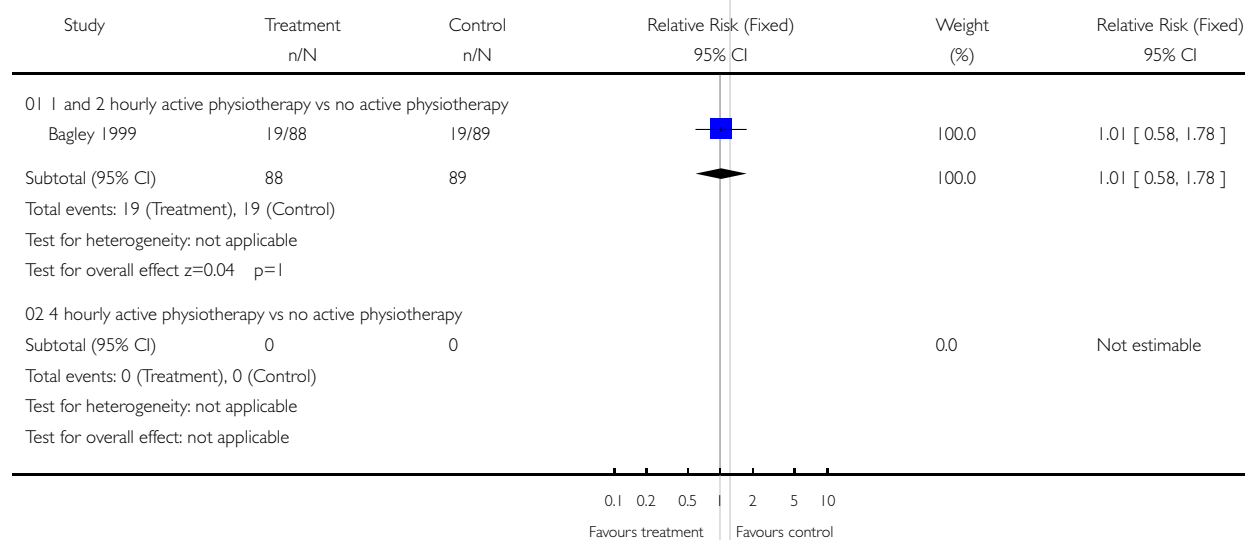


Analysis 03.05. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 05 Intraventricular haemorrhage- all grades

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 05 Intraventricular haemorrhage- all grades

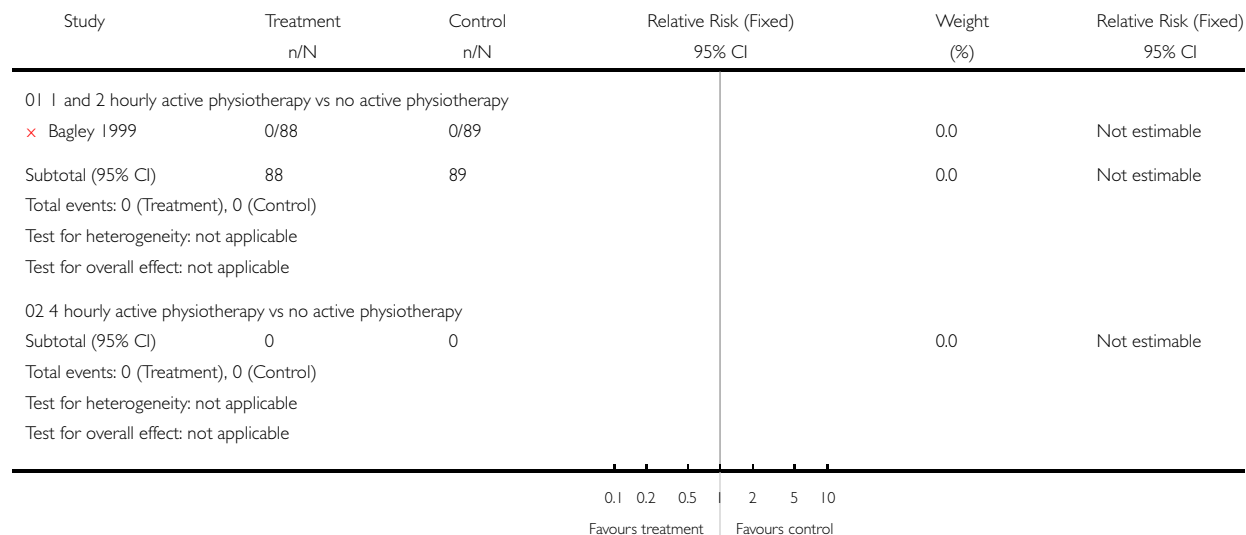


Analysis 03.06. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 06 Intraventricular haemorrhage - Grades 3 and 4

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 06 Intraventricular haemorrhage - Grades 3 and 4

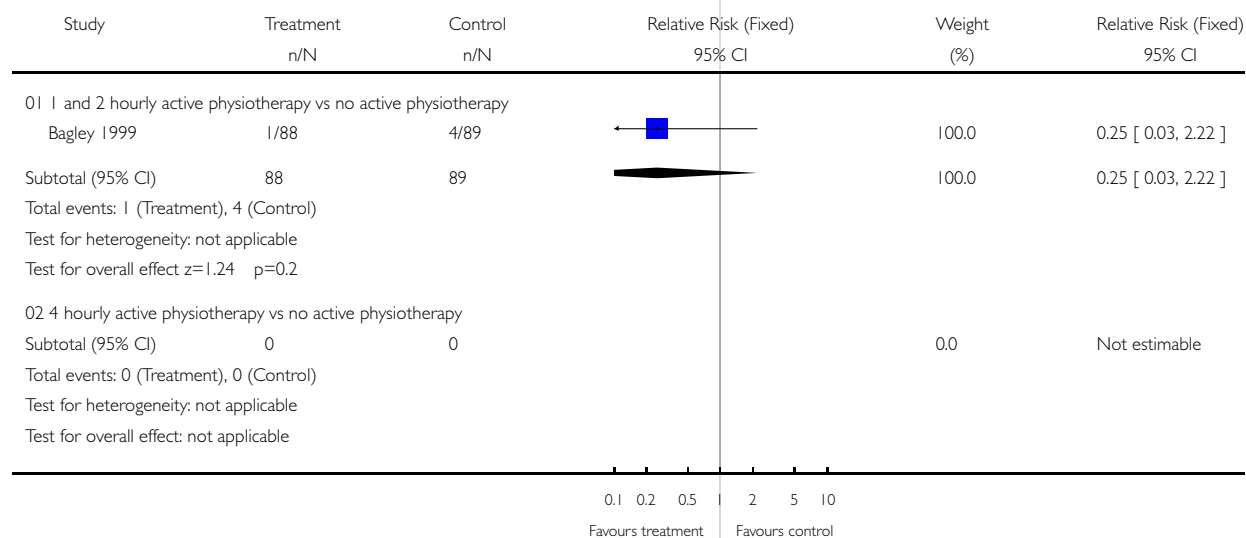


Analysis 03.07. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 07 Death prior to discharge

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 07 Death prior to discharge

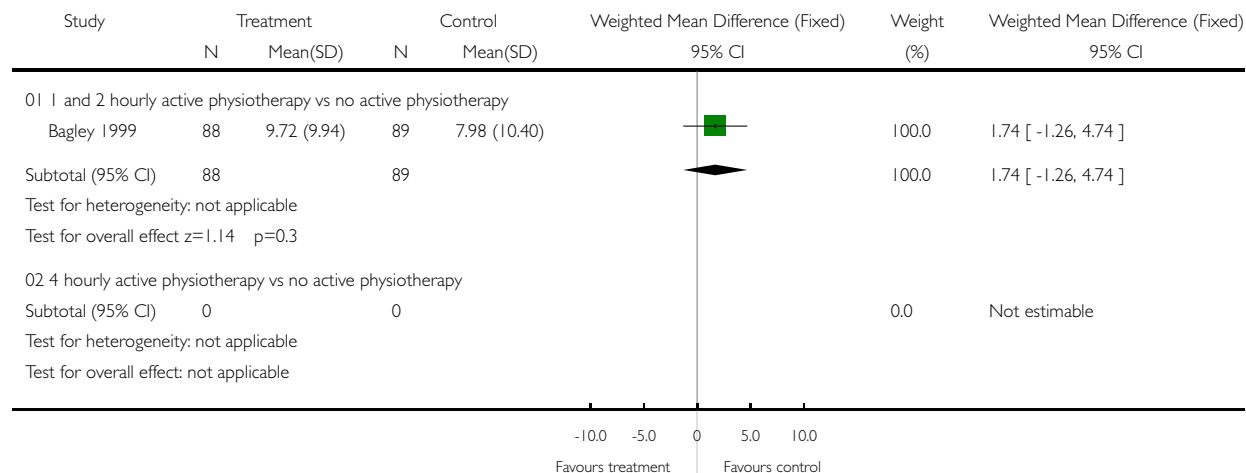


Analysis 03.08. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 08 Duration of mechanical ventilation (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 08 Duration of mechanical ventilation (days)

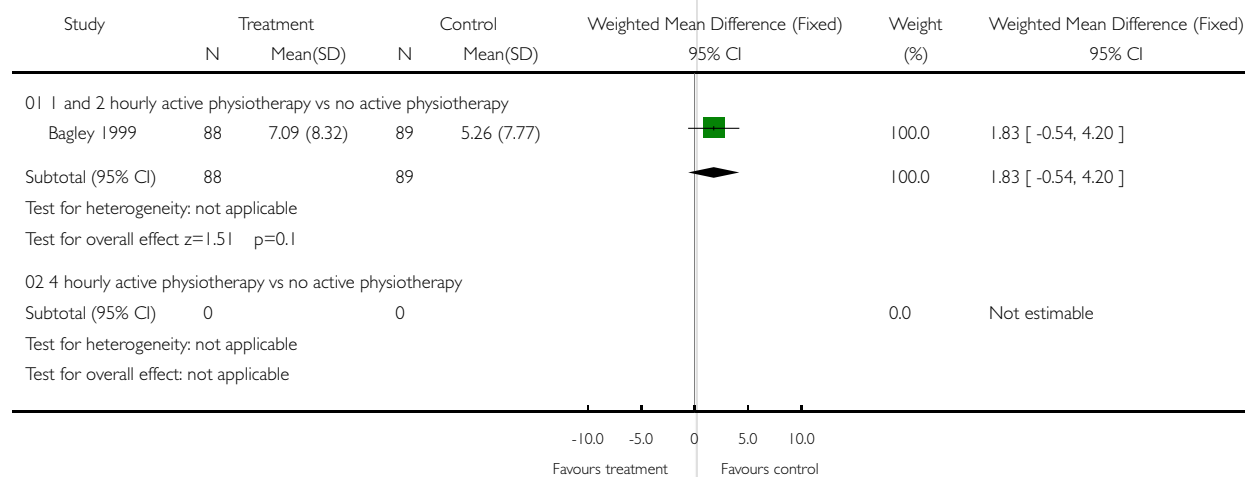


Analysis 03.09. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 09 Duration of nasopharyngeal CPAP(days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 09 Duration of nasopharyngeal CPAP(days)

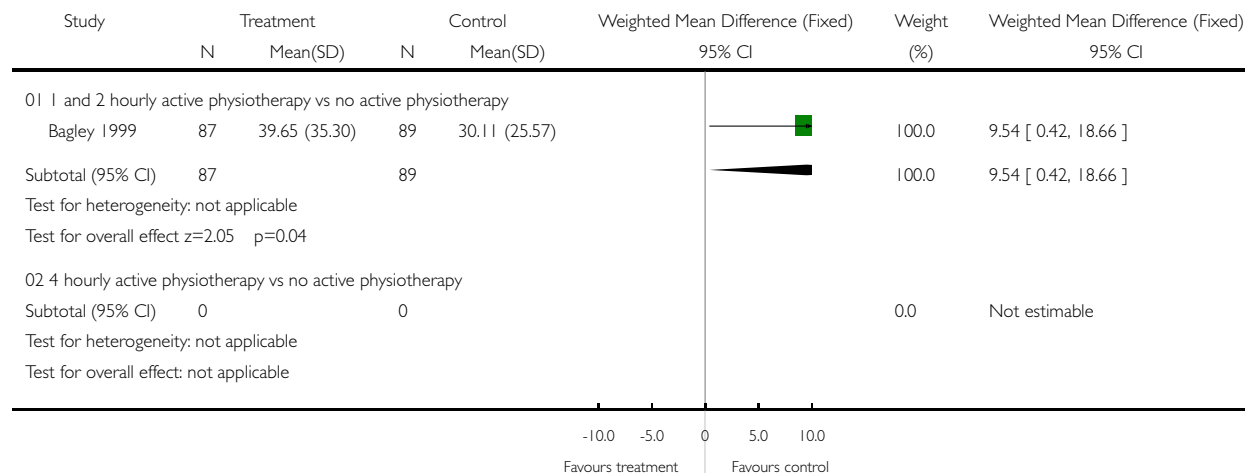


Analysis 03.10. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 10 Duration of supplemental oxygen (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 10 Duration of supplemental oxygen (days)



Analysis 03.11. Comparison 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency), Outcome 11 Duration of neonatal intensive care stay (days)

Review: Chest physiotherapy for preventing morbidity in babies being extubated from mechanical ventilation

Comparison: 03 Active chest physiotherapy vs no active chest physiotherapy (subgrouped by frequency)

Outcome: 11 Duration of neonatal intensive care stay (days)

