The Nursing Management of Fever in Children

A Systematic Review

Robin Watts, Jeanette Robertson, Gail Thomas and Review Panel

This systematic review was conducted by The Western Australian Centre for Evidence Based Nursing and Midwifery, a collaborative centre of The Joanna Briggs Institute for Evidence Based Nursing and Midwifery in conjunction with the Princess Margaret Hospital for Children, Perth, Western Australia

THE JOANNA BRIGGS INSTITUTE
FOR EVIDENCE BASED NURSING AND MIDWIFERY

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Acknowledgments

Review Panel

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Executive Summary

Objectives

The objective of this review was to determine whether the best available evidence supports the types and timing of the various nursing interventions which are commonly used to reduce fever in non-critically ill children, and whether and to what extent the outcomes are influenced by these nursing interventions. The review also provides a narrative summary of the issues raised by incorporating these interventions into the nursing management of fever in non-critically ill children.

Inclusion Criteria

Types of participants

Non-critically ill children aged between 3 months and 16 years of age with fever, i.e. a temperature ranging from 37.5˚C (tympanic or oral)/38˚C (rectal) to 41˚C.

Exclusions

Critically ill children/infants with fever.

Types of intervention

All interventions aimed at reducing fever that fall within the practice of nursing were included. The categories of intervention identified were:

- Administration of antipyretic medication
- Maintenance of hydration
- Use of external cooling measures - direct and environmental interventions are considered

Types of outcome measures

Outcomes of nursing interventions of interest were:

- Effect on fever, e.g. reduction, prevention of increase
- Prevention of febrile convulsions
- Increased comfort, e.g. decreased irritability
- Decreased parental anxiety

Types of research designs

This review considered any randomised or quasi-randomised trials that addressed the effectiveness of interventions which are used to reduce fever in non-critically ill children.

Search Strategy

The search sought to identify both published and unpublished studies in the English language between 1988 and 1998. Published studies before 1988 were also included.

A variety of scholarly electronic databases were searched using accepted search techniques, and included CINAHL, MEDLINE, Embase, Expanded Academic Index, Current Contents and the Cochrane Library.

Assessment of Quality

Quality assessment was undertaken by pairs of independent reviewers drawn from the Review Panel. Authorship of journal articles was not concealed from the reviewers. Methodological quality of studies that met the inclusion criteria was assessed by two reviewers using a developed checklist. Disagreements between reviewers were resolved by discussion with a third reviewer.

Data Extraction and Analysis

A data extraction form was developed and pilot tested. The major categories of data extracted were: study methods, participant characteristics, interventions and outcomes. Two reviewers independently extracted the required data. In the case of disagreement, a third reviewer would extract data and then resolve any differences by discussion.

Although all studies were randomised, heterogeneity precluded a meta analysis being conducted. There was considerable variation between studies in respect to study settings, interventions and measurement of outcomes. In addition, the data required to conduct a meta analysis were not available in sufficient studies within subgroups. Instead narrative comparisons are provided on one outcome measure only: effect on fever. Given the lack of statistical analysis, the results of these comparisons should be interpreted with caution.

Results

Ten studies met the inclusion criteria, one of which was unpublished. All were assessed as meeting the minimum quality standard. With the removal of subgroups that received interventions that are no longer used (aspirin, and sponges using ice water or alcohol), the total number of children included in the 10 studies was 821.

The review provided information on the effectiveness of two of the three categories of interventions - *administration of antipyretics* and *direct cooling measures* - on only one of the four outcome measures identified in the review protocol - reduction of or prevention of increase in fever.

For the other three outcomes - *prevention of febrile convulsions, increased comfort* and *decreased parental anxiety* - there was either insufficient or no evidence available on which to base conclusions.

The results suggest that there is little if any benefit from sponging in temperate climates. Only small decreases in temperature are achieved often at the expense of the child's comfort. However in certain circumstances, for example high environmental temperatures and humidity, or in situations where there is a need for immediate temperature reduction, sponging may be warranted.

The risks of administering antipyretics on a sustained basis over even a short period of time and above a relatively low total daily dosage has been identified. In addition, there is a lack of evidence in the literature that administering antipyretics reduces the incidence of febrile convulsions.

The one study that addressed parental care indicated the need for parental education that focuses on knowledge of the body's protective physiological responses and how to support those responses.

Implications for Practice

The essential question that needs to be asked is: 'Should one intervene?' The answer will vary depending on which intervention is being considered. Uncomplicated fever is relatively harmless but an important immunological defence mechanism. Any intervention that supports the body's beneficial physiological responses to infection should be used. Actions such as encouraging fluids, removing excess clothing or wrappings and ensuring circulating air fall into this category. Parental education is also supported in order to increase their knowledge and skills in caring for their febrile child and to decrease any anxiety.

The use of other interventions needs to be carefully considered. The purpose of intervening should be clearly identified. The primary purpose is to increase the child's comfort (or decrease their discomfort). Another aim might be to reduce parental anxiety. These considerations should be balanced against any harm that might result from intervening, for example increasing the child's discomfort or placing the child at risk of liver damage.

There is a lack of evidence to support the **routine** use of sponging in temperate climates/environments. Sponging does not produce a sustained effect in reducing temperature. In addition there is a significant risk of increasing discomfort, which in turn may raise the child's temperature. In addition there are the economic considerations of using nursing time to carry out ineffective interventions. However, there may well be individual situations where a case can be made for sponging/bathing a child, provided the child does not become upset and/or show other signs of discomfort e.g. shivering.

The administration of antipyretics should also be used selectively and with caution. Despite the comparative safety of acetaminophen (paracetamol), routine sustained administration for the treatment of fever is not supported. Care also needs to be taken in ensuring parents understand the correct dose to administer as there are documented cases of hepatotoxicity in children resulting from accidental overdose due to parental error (Heubi, Barbacci & Zimmerman, 1998).

In summary, care needs to be individualised, based on current knowledge of the effectiveness and risks of interventions.

Introduction

Fever is a common childhood problem faced by medical practitioners, nurses and parents in both hospital and community settings. Statistics from the Accident and Emergency Department of one large urban paediatric hospital indicated that more than 30% of visits included fever as part of the major complaint (Murphy, 1992). However, the nursing management of fever in children is often not based on research and remains inconsistent in practice. Both the point at which intervention occurs and the rationales given for common practices vary considerably (Thomas et al, 1994). Studies of parental knowledge of fever have exposed unfounded fears and misconceptions, leading in many cases to unnecessary or inappropriate treatments and/or visits to hospital or medical practitioners (Andersen, 1988; Leiser, Doitsch & Meyer, 1996).

An initial search of the literature indicated that a synthesis of the existing research evidence had not been undertaken and that there was a need for a systematic review of the literature on the management of fever as it relates to paediatric nursing care.

Research has established that fever is an adaptive physiologic mechanism with beneficial effects (Kluger, 1992). The definition by health care providers of what level of temperature indicates the onset of fever does, however, vary somewhat (Ipp & Jaffe, 1993; Baraff, 1991). In respect to oral temperature, the definition ranges from 37.6˚C-37.8˚C. Using rectal temperatures, definitions of the onset of fever range from 38˚C-38.3˚C (Andersen, 1988; Prebble, 1996). There is also no consensus as to what level of temperature differentiates moderate from high fevers, though there is consensus that children with temperatures over 41.1˚C are at higher risk of serious illness (Press & Fawcett, 1985).

Interventions used were classified into three categories: administration of antipyretics, maintenance of hydration and external cooling methods. The latter can be divided into two sub-groups: direct and indirect or environmental. Direct cooling measures include cool baths, tepid sponging, cool flannels to various parts of the body and removing clothing. Environmental measures are the use of fans and reduction of room temperature.

A preliminary search of the literature indicated that articles on the nursing management of fever can be classified into three main groups. These groups are nursing management practices, including assessment (Gildea, 1992; Wilson, 1995); use of antipyretics (Kelley, Watson, Hayes & Edge 1993; Murphy, 1992); and the nurse's educative role in parental

management of fever (Andersen, 1988; Murphy & Liebman, 1995). More extensive searching revealed a body of literature concerned with the issues of temperature measurement by site and method as part of fever management. As many of the articles published in the nursing literature fit into the lowest category (level IV – expert opinion) of the NHMRC Quality of Evidence (1995), studies were also sought from non-nursing sources for evidence related to nursing care.

The methods for conducting the review and for assessing the quality of the evidence are based on the work of the Cochrane Collaboration (Oxman, 1994) and the Centre for Reviews and Dissemination at the University of York (NHS Centre for Reviews and Dissemination, 1996).

Objectives

The objective of this review was to review the best available evidence on the management of fever in non-critically ill children and to summarise the findings of the relevant studies.

The specific question asked was:

> Does the available evidence, in terms of outcomes, support the types and timing of the various nursing interventions which are commonly used to reduce fever in non-critically children?

The review also provides a narrative summary of the issues raised by incorporating these interventions into the nursing management of fever in non-critically ill children.

Review Method

Inclusion Criteria

Inclusion criteria were used to determine which studies would be included in the review, and to be included a study must meet all criteria.

Types of participants

Non-critically ill children aged between 3 months and 16 years of age with fever, i.e. a temperature ranging from 37.5˚C (tympanic or oral)/38˚C (rectal) to 41˚C. The review excluded adults or critically ill children/infants with fever. The latter groups were excluded as the need for immediate medical intervention has priority over managing the fever.

Types of interventions

The review included all interventions aimed at reducing fever that fall within the practice of nursing. Studies involving medical diagnosis and treatment were not included.

The categories of intervention identified were:

- Administration of antipyretic medication
- Maintenance of hydration
- External cooling measures - direct and environmental interventions are considered

Types of outcome measures

Outcomes of nursing interventions of interest were:

- Effect on fever, e.g. reduction, prevention of increase
- Prevention of febrile convulsions
- Increased comfort, e.g. decreased irritability
- Decreased parental anxiety

Types of research designs

This review considered any randomised or quasi-randomised trials that addressed the effectiveness of interventions commonly used to reduce fever in non-critically ill children.

Search Strategy

The search sought to identify both published and unpublished studies in the English language. Restriction to studies reported in the English language was necessary as no funds were available for translation from other languages. The limitations of this restriction are acknowledged (Egger & Davey Smith, 1995).

Design of the search strategy took into account the findings of Sindhu and Dickson (1997) that 'electronic searching is only as good as the indexing of the studies in the database'. For this reason, while the appropriate MeSH subject headings were identified, free-text searching was also used in order to make the search as broad as possible and allow for discrepancies in indexing. Because the search aimed to identify background material, descriptive studies and clinical trials which provide a broad overview of the management of fever in children, it incorporated a large number of electronic databases. An initial limited search indicated that there was only a small number of clinical trials relevant to the topic, and that some articles which did in fact present the result of trials were not identified as such in the databases. For this reason, the research process did not restrict itself by the use of descriptors such as *Randomised Controlled Trials* or *Clinical Trial*.

The search strategy was adapted to suit the requirements of each database, as terminology differs between index thesauri and some of the databases use different search software.

Search terms/descriptors included: nurs*, manage*, fever, child*, febrile, temperature.

Databases searched were:

- Austhealth
- CINAHL
- Expanded Academic Index
- UnCover
- Biosis
- CAB health
- Embase
- The Cochrane Library
- Cambridge Scientific Abstracts
- Dissertation Abstracts
- PubMed/Medline
- Current Contents

- PsycLit
- Science Citation Index
- Sociofile
- Database of Abstracts of Reviews of Effectiveness (DARE)

(See Appendix 1 for details of search strategy.)

As Sindhu and Dickson indicated, "electronic searching is only the beginning of the process" (1997:216). Considerable effort was made to identify literature which is not included in the major databases, to make contact with relevant researchers worldwide and identify ongoing work. This process included:

- Handsearching of 1998 journals which may not have yet been indexed in the databases (see Appendix 1 for list)
- Making contact with paediatric nursing associations and nursing networks in Australia, NZ, the UK, USA and Canada
- Identification and contact with organisers of paediatric/nursing conferences worldwide
- Disseminating information about the systematic review on the electronic discussion list 'NursRes' which deals with nursing research issues
- Use of the World Wide Web to locate researchers, online journals and sources of information on evidence based health.

The references of all identified studies and background papers were also checked for additional studies and proved a useful guide to when saturation was achieved.

Bibliographic details of potential studies (with abstracts if possible) were initially assessed by the chairperson of the review panel. Copies of relevant articles were then retrieved. If studies were assessed as meeting the inclusion criteria (Appendix 2), they were then passed to two members of the review panel for quality assessment. There were no studies that did not clearly either meet or not meet the inclusion criteria. Those that did not meet the inclusion criteria were primarily studies focusing on medical diagnosis and medical treatment.

Assessment of Quality

Quality assessment was undertaken by pairs of reviewers drawn from the panel. Authorship of articles was not concealed from the reviewers.

Methodological quality of each study was assessed independently by two reviewers using a checklist (Appendix 3). The checklist was pilot tested

before use and some adjustments made. When reviewers could not agree on the assessment of a study, it was discussed and passed to a third reviewer. All 10 studies were either accepted or accepted but with some sections of the study disregarded where sub groups received interventions that are no longer acceptable clinical practice, for example sponging with iced water.

Data Extraction

As a result of the quality assessment of the eligible studies, all 10 studies were accepted for inclusion in the review. The details of these studies are provided in Appendix 4. The studies had been published or presented over a span of 27 years from 1970 to 1997. Two had been conducted in the 1970s, one in the 1980s while the 1990s indicated a resurgence of interest in the topic with seven studies being undertaken. Given that interventions to 'treat' fever had changed over that time, some of the data obtained from the early studies were not extracted. These data involved interventions using iced water and alcohol in tepid sponging, procedures since demonstrated to be harmful. Also, given the more recent research on the effect of aspirin on children, data from subgroups in some early studies to whom aspirin were administered were not included in the review.

Several other interesting observations were made about the studies. One was the widespread locations of the research. The USA was the major site (3 studies) with one each of the remaining studies being conducted in the United Kingdom, Canada, Thailand, Singapore, Malawi, Turkey and Australia. The studies conducted in tropical areas were treated as a subgroup given that environmental temperatures and humidity could influence the effect of some interventions. Some cultural differences were also identified, e.g. in the Thai study the top of the head was not included in the sponge.

In only two studies was a nurse listed as the chief investigator and in a third, the second author. In other studies nurses contributed but were not named or were referred to generically e.g. 'the sponging group'. In the remainder there was no acknowledgement at all. The most comprehensively reported study was that in which the nurse was the chief investigator.

A data extraction form was designed (Appendix 5) and pilot tested. Four major areas of data were sought: study methods, participant characteristics, interventions, and outcomes. Two reviewers independently extracted the required data. Any discrepancies noted were to be resolved by discussion. If differences could not be resolved,

a third reviewer was to extract the data for that study. However, no differences were identified.

The major problem encountered in the data collection process was the incomplete or inadequate reporting of data essential to conducting a systematic review. Efforts to obtain missing data were not successful given the time that had elapsed since the studies were conducted. Inadequate reporting was a particular problem in respect to statistical analysis. Some studies did not report any statistical data, others only provided graphs with no specific text to accompany the graphical representations. This may have been the result of editorial policy given the brief reports of studies provided by some medical journals. Consequently, a meta-analysis could not be conducted nor tables constructed to illustrate comparisons between studies.

Analysis

On examining the data available, it was apparent that considerable variation between studies existed. These variations occurred in the study settings, interventions and measurement of outcomes. Three types of settings were used: hospital, out patient clinics/GPs offices, and the child's home. In respect to interventions, variations existed in the type of drug used (paracetamol or ibuprofen); the drug dosage (decreased in more recent studies); and the length of time and temperature of the water used for sponging. The same problem was encountered with the measurement of outcomes. The measurement of temperatures following the intervention also varied as to site (oral, rectal and axillary), method (rate of fall, amount of reduction, or time to reach pre-determined level) and time period over which measured (from 1 - 4 hours). Although five studies used physical signs to measure discomfort, all five used different scales. In addition, the data required to conduct a meta analysis were not available in sufficient studies. Only two studies reported standard deviations and two reported standard error. Consequently no attempt was made to use statistical techniques to combine studies; instead narrative comparisons are provided. In view of the lack of statistical analysis, the results of these comparisons should be interpreted with caution.

Results

Characteristics of Study Samples

The total number of children included in all 10 studies was 1026. With the removal of subgroups that received interventions that are no longer acceptable clinical practice (aspirin, ice water or alcohol sponges), the total number was 821. Sample size in the studies ranged from 224 to 20. Most of the participants were from the first year of life to around 5 years of age. Of the seven studies that reported means for age, five indicated means in the second year of life. There were relatively even numbers of males and females (see Appendix 4).

Outcomes

Initially five categories of outcome measures had been suggested. One of these categories, effect on length of hospital stay, was deleted as a number of studies were conducted with children not admitted to hospital. The 10 studies were examined for information on outcomes related to the remaining categories: effect on fever, comfort of the child, prevention of febrile convulsions and effect on parental anxiety.

Effect on Fever

Three comparisons between interventions can be commented on:

1. sponging compared to antipyretic only (paracetamol) - 7 studies
2. sponging compared to antipyretic + sponging - 5 studies
3. antipyretic compared to antipyretic + sponging - 8 studies

Comparison 1: Antipyretic only compared to sponging

Studies: Agbolosu, Aksoylar, Friedman, Hunter, Kinmonth, Steele, Teo

In all seven studies, the antipyretic alone when compared to sponging reduced the child's temperature more. However in only three studies (Agbolosu, Aksoylar & Friedman) was there a reported statistical difference 1 hour+ after the treatments were administered. Teo's study did not demonstrate a significant difference while the remaining three studies did not report on whether the results were statistically significant or not.

In seeking an explanation as to why Teo's results vary, a comparison was made with the study by Friedman. Both studies employed the shortest time period of measuring temperature response: one hour. In both the

length of time for sponging was similar (15-20 minutes) but the water temperature used in Friedman's study was warmer (37˚C compared to 27-28˚C). Also the dosage of paracetamol was higher for some children in Friedman's study than Teo's: 10-15mg/kg compared with 10mg/kg (see Appendix 4).

From a clinical perspective, in the three studies reporting a statistical difference the mean reduction in temperature in the antipyretic group at one hour ranged from 0.8˚C to 1.1˚C. On the final measurement in these studies (1 to 4 hours) the mean reduction in temperature ranged from 0.9˚C to 1.85˚C. In the sponge only groups the mean reduction at both one hour and on final measurement ranged from 0.55˚C to 0.75˚C.

Comparison 2: Antipyretic plus sponging compared to sponging only

Studies: Friedman, Hunter, Kinmonth, Steele, Teo

In all five studies, the combination of antipyretic and sponging was more effective than sponging alone. Three studies (Friedman, Steele & Teo) reported a significant difference, while the remaining two (Hunter & Kinmouth) did not include the outcomes of statistical analysis in respect to this comparison in their reports.

In those studies reporting a statistical significance, for the combined antipyretic + sponging groups the mean reduction in temperature on final measurement ranged from 1.7˚C to 1.3˚C. This compared to the range for the sponging only groups of 0.55˚C to 1.2˚C.

Comparison 3: Antipyretic + sponging compared to antipyretic only.

Studies: Friedman; Hunter, Kinmonth , Mahar, Newman , Sharber, Steele, Teo.

In all eight studies the combination of antipyretic plus sponging lowered the temperature more than the antipyretic alone. However, while in four studies (Friedman, Mahar, Steele & Teo) a significant difference was identified, another three (Hunter, Newman & Sharber) demonstrated no significance difference between the interventions. Kinmouth did not provide any information on statistical difference between the two interventions in her study.

In those studies reporting a statistical difference, the mean reduction in temperature in groups receiving medication plus sponging ranged from 1.3˚C to 1.7˚C. In those groups receiving an antipyretic only, mean reductions on final measurement ranged from 0.9˚C to 1.3˚C.

Of the four studies demonstrating a significant difference between the two interventions, three (Mahar, Steele & Teo) were conducted in tropical climates: Bangkok, Hawaii, and Singapore. All three studies included

information on room temperatures and humidity recorded during the studies. Although the room temperatures were not notably high (28-30.5˚C, 23˚C & 25.5˚C), the humidity levels (65-90%, 70-80%, 69-74%) were higher than the remaining study sites (Melbourne, Australia; Toronto, Canada; Southhampton, UK; St Louis and Tuscon, USA) would normally experience. (A fourth study - Agbolosu - was conducted in a tropical climate - Malawi - but only compared antipyretic with sponging).

Comfort of Child

Studies: Agbolosu, Hunter, Mahar, Sharber, Steele.

Five studies measured discomfort as an outcome of the interventions. All five studies used physical signs as a measure. No comparisons can be made between the studies as each study used a different rating scale and the signs assessed varied, although some were common e.g. crying.

Two studies (Mahar & Sharber) reported a significant difference in observed discomfort between those receiving only antipyretic medication and those being sponged. In contrast Agbolosu reported there was no significant difference in discomfort between these two interventions. This outcome is in contrast to the other study in this group conducted in a tropical climate - Mahar. It was noted in Mahar's study that the child was sponged continuously until the temperature fell below 38˚C, while in Agbolosu's study the child was given an initial sponge then only sponged again if the skin was dry and the temperature was still above 38.5˚C. The temperature of the water used also differed somewhat, with the Mahar study using water ranging from 28-30˚C and Agbolosu 28-34˚C.

One of the studies (Steele) provided descriptive statistics on which to compare assessed discomfort. Using a rating of good, fair and poor, 66% of the children being sponged with tepid water were rated as being fair or poor compared to 22% of children receiving only medication.

In the remaining study (Hunter) although discomfort was measured the outcomes were not reported.

Kinmonth's study assessed acceptability of the intervention to the child and parent. Although not directly comparable, this can be associated with measures of comfort in respect to sponging. Of the children being sponged by their parents 46% were assessed as objecting somewhat to the procedure but an equal number apparently enjoyed the warm bath.

Prevention of febrile convulsions

Of the total sample of 821 only one febrile convulsion (0.12%) was reported as occurring during a study (Agbolosu). This 12 month old child

was in the tepid sponging group only and convulsed 90 minutes after commencing treatment when her temperature was 39.7°C - 0.7°C higher than when admitted. She had no history of febrile convulsions.

Two studies (Friedman & Kinmonth) reported excluding any child with a history of febrile convulsions. No data were reported in any of the studies as to the participants' history of febrile convulsions or existence of risk factors.

Effect on parental anxiety

This outcome was not measured in any of the ten studies.

Kinmonth rated acceptability of intervention to the parents. In all cases the care was provided by the parents on advice from the nurse. The interventions were unwrapping, warm sponging, paracetamol, and warm sponging + paracetamol. Medication only was the most acceptable ("very happy"), followed by warm sponging and antipyretic medication ("happy"). Parents were "not sure" about warm sponging only and unwrapping.

Other findings with implications for practice

Kinmonth found that parental response to treatment advice was variable. Most parents reduced the amount of clothing on the child, although some parents added wrappings. However, advice to increase fluid intake was not heeded by most. The average fluid intake over a four hour period was 163 mls, with 1 in 5 parents (19%) offering no fluids at all over that period.

Discussion

The essential question is whether intervention in an effort to reduce the fever is warranted. Uncomplicated fever is relatively harmless but an important immunologic defence mechanism. When recommended, intervention is directed to reducing the child's discomfort, not the fever. However, interventions should also be assessed in terms of potential risks. It is within this context that the results of the review are discussed.

Antipyretics

Based on results from animal studies (Benheim & Kluger, 1976), concern has been expressed that antipyretics might retard the immune response in humans. In a randomised control trial comparing paracetamol with a placebo, Kramer, Naimark, Roberts-Brauer, McDougall and Leduc (1991) found that there was no significant difference between the two groups in terms of the duration of fever or other symptoms. In respect to general well being, based on parental ratings, those children receiving paracetamol demonstrated some improvement in activity and alertness, but there were no significant differences between the two groups in mood, comfort, appetite or fluid intake.

In 1998, the Drug Therapy and Hazardous Substances Committee of the Canadian Paediatric Society (CPS) published a review of the efficacy and safety of acetaminophen (paracetamol) and ibuprofen in the management of fever in children. The review concluded that in febrile children with temperatures less than 41°C, significant antipyresis can be achieved with single doses of paracetamol 10-15mg/kg. At therapeutic doses, the Committee concluded that paracetamol is 'remarkably' safe. They recommended that the upper limit of the total dose in one day should be 100mg/kg.

The most serious side effect is hepatotoxicity. Kearns, Leeder and Wasserman (1998) suggested that the child at risk of liver toxicity is most likely to be under two years of age, is 'sick' (for example has repeated vomiting and diarrhoea together with poor oral food intake) and has received 90mg/kg/day or greater for more than one day on a sustained basis. Nahata, Powell, Durrell and Miller (1984) demonstrated that repeated therapy at recommended doses can result in accumulation. Several other studies (Agran, Zenk & Romansky, 1983; Rivera-Penera et al, 1997; Swetnam & Florman, 1984) reported cases of serious hepatotoxicity in children in dosages as low as 147-152mg/kg/day when taken for one to four days. Heubi, Barbacci and Zimmerman

(1998) identified six out of a total of 47 cases of hepatotoxicity where the child had received 100mg/kg/day or less of acetaminophen.

In response to several recent cases of severe hepatotoxicity in Australian children on relatively low daily doses of paracetamol, at least one major children's hospital has revised its recommendations to below those of the 1998 CPS guidelines mentioned above. Princess Margaret Hospital for Children (2000) now recommend an upper limit of 60mg/kg/day of paracetamol for the management of fever.

Febrile convulsions

Although the reported incidence of febrile convulsions (0.12%) is lower than the currently accepted level of 2-4% (Camfield & Camfield, 1997) in the 6 months to 5 years age range, no conclusions can be drawn from this review on the effect of the interventions on the occurrence of febrile convulsions as there is no certainty that the reporting of this outcome is complete.

There is a lack of evidence that the use of antipyretics reduces the incidence of febrile convulsions. A Finnish study (Uhari, Rantala, Vainionpaa & Kurttila, 1995), comparing the effectiveness of acetaminophen (paracetamol) with that of a placebo in preventing a reoccurrence of a febrile seizure, found that acetaminophen had no effect. Schnaiderman, Lahat, Sheefer and Aladjem (1993) conducted a controlled clinical study of 104 children comparing the regular 4 hourly administration of acetaminophen with administration only when the child's temperature was above 37.9˚C. The incidence was similar in both groups with four children in each group having a second febrile convulsion within 24 hours of admission. Wolf, et al (1977) noted that for up to 38% of children, the febrile convulsion is the first sign that the child is ill so no intervention had been administered. Also, although the majority of febrile convulsions occur once the rectal temperature is greater than 38.9˚C, in some children they occur at much lower temperatures. Despite this lack of evidence, a number of health advice web sites, for example InteliHealth, Mylifepath, RxMed, recommend giving antipyretics either as a preventative measure or treatment.

Bethune, Gordon, Dooley, Camfield and Camfield's (1993) matched case control study identified that if a child had two or more of the following characteristics, the risk of having a first febrile convulsion was about 28%:

- family (parent, sibling, grandparent, uncle or aunt) history of febrile convulsions
- "slow" development as judged by parents

- delayed neonatal discharge (28 + days)
- attendance at day care (20+ hours/week)

Given the small number of children having two or more of these factors (4%), Camfield and Camfield (1997) suggested that it is worth considering giving anticipatory guidance to their parents.

Recurrent febrile convulsions occur in 40% of children who have had a previous febrile convulsion. The risk of recurrence appears to be increased by having a first convulsion when less than 15 months of age, family history, frequent fevers or if the convulsion occurs soon after the fever has begun or the child's temperature is relatively low. In children with no neurological disorders, only one in hundred will develop epilepsy (National Institute of Neurological Disorders and Stroke, 1999).

Advice to parents

Parental concerns may in some cases amount to what has been labelled 'fever phobia' (Kramer, Naimark & Leduc, 1985; Schmitt, 1980). Advice and support should be directed to minimising these concerns. However, health care providers may inadvertently have the opposite effect. Sharber suggested that health care providers may contribute to parental fears "with mixed messages about the danger of fever and aggressive over treatment" (1997: 188). Kruse (1996) pointed out that guidelines make little reference to the beliefs and feelings of parents. If the parents' health beliefs and expectations of how to care for a child with a febrile illness differ from those of the care provider, problems arise.

A major source of health information in this age of information technology is the world wide web. In a review of the advice available from this source on caring for children with fever at home, Impicciatore, Pandolfini, Casella and Bonati (1997) found that of 41 web sites that provided information on the home management of fever in children, only four adhered closely to the main recommendations in the selected guidelines authored by El-Radhi and Carroll (1994: 232). Aspects of particular concern were the recommendations to use cold sponging (2) cold baths or showers (2) or to sponge with alcohol (2). In respect to antipyretic drugs, several sites still recommended aspirin. Tepid sponging was recommended by more than half the sites (22) with tepid bath or shower by nine sites. Of those listing tepid sponging, 15 could be considered as recommending this as a routine intervention for any fever. The remaining seven indicated that tepid sponging should be confined to those children with temperatures above a certain point (ranged from 38.5˚C to 40.5˚C). Only six sites mentioned giving an antipyretic drug in conjunction with sponging.

Summary

This review provided information on the effectiveness of three categories of interventions - administration of antipyretics and direct cooling measures - on only one of the four outcome measures identified in the review protocol: reduction of or prevention of increase in fever.

For the other three outcomes - prevention of febrile convulsions, increased comfort and decreased parental anxiety - there was either insufficient or no evidence available on which to base conclusions.

Given that only narrative comparisons were able to be undertaken, the results of this review should be interpreted with caution. The results suggest that there is minimal clinical benefit from sponging in temperate climates/environments. When only small decreases in temperature were achieved, they were not sustained over time and were often at the expense of the child's comfort. However in certain circumstances, for example high environmental temperatures and/or humidity, or in situations where there is a need for immediate temperature reduction, sponging may be warranted.

The risks of administering antipyretics on a sustained basis over even a short period of time and above a relatively low total daily dosage has been identified. In addition, there is a lack of evidence in the literature that administering antipyretics reduces the incidence of febrile convulsions.

The one study that addressed parental care indicated the need for parental education that focuses on knowledge of the body's protective physiological responses and how to support those responses.

Implications for Practice

The first question that needs to be asked is: 'Should one intervene?' The answer will vary depending on which intervention is being considered. Any intervention that supports the body's beneficial physiological responses to infection should be used. Actions such as encouraging fluids, removing excess clothing or wrappings and ensuring circulating air fall into this category. Parent education is also supported in order to increase their knowledge and skills in caring for their febrile child and to decrease any anxiety.

The use of other interventions needs to be carefully considered. The purpose of intervening should be clearly identified. The primary purpose is to increase the child's comfort (or decrease their discomfort). Another aim might be to reduce parental anxiety. These considerations should be balanced against any harm that might result from intervening, for example increasing the child's discomfort or placing the child at risk of liver damage.

There is a lack of evidence to support the routine use of sponging in temperate climates/environments. Sponging does not produce a sustained effect in reducing temperature. In addition there is a significant risk of increasing discomfort, which in turn may raise the child's temperature. In addition there are the economic considerations of using nursing time to carry out ineffective interventions. However, there may well be individual situations where a case can be made for sponging/bathing a child, provided the child does not become upset and show other signs of discomfort e.g. shivering. A number of studies reported that some children actually enjoyed the bath, particularly when given by their parents, and were more comfortable. In cases of high parental anxiety, for example with a child with a history of febrile convulsions, providing the parent with the opportunity to give care in the form of bathing the child, when not contraindicated, might be appropriate.

The administration of antipyretics should also be used selectively and with caution, even in otherwise healthy children. Despite the comparative safety of paracetamol, routine sustained administration is not supported by clinical case studies. Information also needs to be obtained about any other medications the child is receiving at the time to ensure the total dose per day is accurately estimated. Young children who are dehydrated and malnourished should not be given antipyretics. Children who are fasting may also be at risk (Heubi, 1998).

Implications for Practice

Parents should also be cautioned about the use of paracetamol. In cases when paracetamol is given, information provided should emphasise the importance of administering the correct dosage and the maximum doses per day to be given, together with using only paediatric strength preparations and the means of administration noted on the formulation. A number of cases of accidental overdose have resulted from the use of adult strength preparations and the use of a teaspoon to administer the drug when a dropper should have been used. In the study by Heubi, Barbacci and Zimmerman (1998) 52% of the 47 children in their study had received adult strength preparations of acetaminophen. Another problem that has been identified is that labels on over-the-counter medications are often worded in language above the reading comprehension of a significant proportion of the population and/or the instructions are not clear (Heubi, 1997; Smith, Isakson, Frankel & Kerner, 1986).

In summary, care needs to be individualised, based on current knowledge of the effectiveness and risks of interventions. The child (and the parents) should be the focus of nursing care, not the thermometer.

Implications for Research

Given the finding that there is a lack of evidence of the effectiveness of direct cooling measures on the sustained reduction or prevention of increase in fever and a paucity of rigorous and/or comprehensively reported studies, further studies on sponging in the management of moderate fever in children in non-tropical environments are warranted. However the question of whether these are a priority, given the lack of research in so many other areas of nursing care and the limited resources available to nursing research, needs to be considered. The results of the few studies conducted in tropical environments with high humidity suggest that further studies of the effectiveness of tepid bathing in this context might be of more immediate benefit. The results of Kinmonth's study of care by parents in the home also suggest that more research on improving parental response to health providers' advice regarding increased fluid intake and environmental cooling (e.g. unwrapping) is warranted. The focus on home care is particularly important with increasing numbers of children being cared for on an ambulatory basis.

The other recommendation for research arising from this review is the need to fully report all results when publishing the study. The lack of reported basic statistics required for meta analysis was a major impediment. The CONSORT Statement (Begg, et al, 1996) provides a clear guide for reporting randomised control trials. This contains a checklist of 21 items that are considered necessary to evaluate internal and external validity of a study report.

The analysis of authorship of the included studies was instructive. In only two of the ten studies was a nurse listed as the principal investigator, while in another two nurses were the second author. In other studies nurses contributed but were not named, for example in one study they were referred to as "the sponging group". In the remainder there was no acknowledgment at all of nurses' contributions. Nurses are more likely now to be leading research teams investigating nursing care than when many of these studies were conducted. Whether the situation has changed in respect to adequate acknowledgment of the contribution of clinical nurses to the conduct and reporting of studies is a question that needs to be explored. Awareness of the guidelines that govern public acknowledgment of authorship and the assertiveness to negotiate that acknowledgment should be part of nurses' introduction to research.

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Appendix 1

Literature Search Strategies

DATABASE	YEARS COVERED	SEARCH TERMS	RESULTS (NO. OF RELEVANT ARTICLES)
Aushealth	Varies with the databases included	Nurse* or manage* and fever and child	16
Cambridge Scientific Abstracts - Conference Papers Index	1985 -	Fever and child* Nursing and fever	3 1
CINAHL	1982-	Nurse* or manage* and fever and child* Research and fever and child*	57 17
Dissertation Abstracts	1961-	Nurs? or manage? And fever and child? Nurs? or manage? And febrile and child?	5 1
Expanded Academic Index	1980-	Fever and children (subject) Fever and children (keyword) Febrile convulsions Nursing and fever	52 47 22 3
MEDLINE	1990-	Nurse* and fever and child*	19
UNCOVER - Journal of Nursing Research	1989-1998	Fever and children Nurs* and fever	54 21

Appendix 1

Web sites - selected examples	URL	Linked sources	Results
Achoo Internet Healthcare Direct.	http://www.achoo.com/		
Centre Watch		Clinical trials listing service	
Health A to Z	http://www.HealthAtoZ.com/		
Medical Matrix	http://www.medimatrix.org/index.stm	Archives of Pediatrics and Adolescent Medicine JAMA Archives Journal of Pediatrics 1997 Doctor's Guide to Medical Conferences and Meetings The Pediatric Bulletin	
Blackwell Science Journals			2 (fever)
WebMedLit			0 (fever and child)
NursingNet		Online Journal of Issues in Nursing New England Journal of Medicine 1990-	Fever children - 1 Management fever 1 Febrile child - 1
Hardin Meta Directory	http://www.ohsu.edu/bicc-informatics/ebm/ebm_d_f.htm	Peds CCM Resources for Practising Evidence-Based Nrsg	
	http://www.gwent.nhs.gov.uk/cgi-bin/trip-search.pi	TRIP Gwent database	3
DARE			4

Hand Searched Journals 1998

ACTA PAEDIATRICIA (V.87, 1-5)
AMERICAN JOURNAL OF MEDICINE (V.104, 1-4)
AMERICAN JOURNAL OF NURSING (V.98,1-5)
ANNUAL OF EMERGENCY MEDICINE (V.31, 1-5)
ARCHIVES OF DISEASE IN CHILDHOOD (V.78, 1-6)
ARCHIVES OF PEDIATRICS AND ADOLSESCENT MEDICINE (V.152, 1-5)
AUSTRALIAN & NEW ZEALAND JOURNAL OF MEDICINE (V.28 1-2)
AUSTRALIAN NURSING JOURNAL (V.5, 6-9)
BRITISH JOURNAL OF NURSING (V.7,1-11)
BRITISH MEDICAL JOURNAL (3JAN - 20 JUNE)
CANADIAN NURSE (V.94, 1-4)
CLINICAL PEDIATRICS (V.37, 1-5)
JAMA (V.279 1-18)
JOURNAL OF ADOLSESCENT HEALTH (V.16 1-5)
JOURNAL OF ADVANCED NURSING (V.27, 1-4)
JOURNAL OF PEDIATRICS AND CHILD HEALTH (V.34, 1-3)
JOURNAL OF PEDIATRIC NURSING (V.13, 1-2)
THE JOURNAL OF PEDIATRICS (V.132, 1-5)
JOURNAL OF PERIANESTHESIA NURSING (V.13, 1-2)
THE LANCET (V.351, 3 JAN - 6 JUNE)
MCN (V.23, 1-2)
MEDICAL JOURNAL OF AUSTRALIA (V.168, 1 - V.169, 12)
NEW ENGLAND JOURNAL OF MEDICINE (V.338, 1 - V.339, 4)
NURSING (SPRINGHOUSE) (V.28,1 - 6)
NURSING RESEARCH (V.47, 1-3)
NURSING TIMES (V.94, 1-28)

Appendix 2

Selection Critera for Study Inclusion

Criterion	Satisfied	Comments
Types of participants • Age Range • Temperature Site (not essential)		
Types of Interventions • Antipyretics • Hydration • External Cooling - Direct - Environmental		
Types of outcomes • Effect on Fever • Prevention of Febrile Convulsions • Increased Comfort • Length of Stay in Hospital • Decreased Parental Anxiety • Other		

Appendix 3

Minimal Indicators of Quality for Quantitative Studies - Check List

Name of Article: .....

Author: ..... **Year:** .....

Checklist

Place a ✔ or a ✘ in the space provided. A "useful" study will meet at least 4 of the following 6 criteria. (four ✔)

1. Is the method chosen appropriate? (could the study have been done a better way)	
2. Are the measures/data collection tools valid? (do the authors justify the data collection method)	
3. Are confounding variables accounted for? (are there any factors which might have influenced the results, but which have not been accounted for)	
4. Are all relevant aspects of the study reported?	
5. Are the findings clinically as well as statistically significant?	
6. Do the findings have clinical relevance?	

Assessment of bias

(Tick present – P, Not Stated – NS, or Not Applicable – NA as applies)

	P	NS	NA
1. Selection bias Evidence of selection process of subjects Evidence that patients fit the protocol criteria Evidence of nurses being blinded to subject's group allocation			
2. Performance bias Evidence of nurses being blinded to treatment they provide Evidence of assessor being blinded to subject's group			
3. Attrition bias Evidence of reports of what happened to all subjects Discussion of how 'drop outs' were handled			
4. Detection bias Discussion of inter rater reliability testing Parameters for assessment of outcome specified			

Where "Not stated" is ticked, attempt to obtain more information.

What is the influence of bias on the outcome of this study? High Moderate Low

Check list criteria

1. Good - worthy of immediate inclusion
2. Fair/OK - has some points worth considering but of limited value
3. Not worthy of pursuing because study is not valid or not applicable

What is your overall assessment of this study Good Fair Not worth pursuing

Appendix 4

Description of Included Studies

Study	Study Design	Interventions			Measures & Outcomes
		Intervention A Antipyretic only	Intervention B Antipyretic&Sponge	Intervention C Sponge only	
Agbolosu, Cuevas, Milligan, Broadhead Brewster, Graham 1997 To compare efficacy of tepid sponging with use of paracetamol in febrile children Malawi (Blantyre)	RCT Level of evidence II 80 children (37 females, 43 males) Age range: 6mths - 4.5 yrs <u>Setting</u> Hospital outpatient clinic Same room for all treatments - ambient temp 21-32C <u>Inclusion</u> Diagnosis - URTI (45) & (4) &/or (31) malaria Age range 6-60mths Axillary temp. 38.5 - 40˚C <u>Exclusions</u> Admission, urgent investigation or emergency treatment required Antipyretics in previous 4 hrs <u>Allocation</u> Every 5th child meeting inclusion criteria Block randomisation to treatment groups No significant stat difference ($p < 0.05$) between groups in age, sex, relative body surface area, temp, duration of fever on admission and clinical diagnosis In 10% (8) good correlation (SD=0.3) of rectal and axillary temps, therefore axillary temps used for study <u>Data collection</u> No information provided on data collectors or who administered treatments <u>Analysis</u> No dropouts reported	n=40 Mean age: 19.1mths M:F - 22:18 Oral paracetamol 15mg/kg		n=40 Mean age:17.6mths M:F - 21-19 Tepid sponge - whole body excluding scalp leaving thin layer of water on skin then intermittently if skin dry until axillary temp below 38.5˚C. Temp of water - 28-34˚C	Axillary temp (digital thermometer) at 30, 60, 90, 120 mins Assessment of 'discomfort' - convulsions, crying, irritability, vomiting, shivering - at 30, 60, 90, 120 mins Proportion of children in paracetamol group whose temp fell to below 38.5˚C was significantly greater at • 60 mins ($p < 0.005$) • 90 mins ($p < 0.002$) • 120 mins ($p< 0.001$) At 2hrs temp of 37 children in paracetamol group was below 38.5˚C ("good response") cf to 13 in tepid sponge group ($p < 0.001$) Mean cumulative drop in temp at 2hrs Paracetamol - 1.83˚C Sponge - 0.75˚C Discomfort No significant difference between groups 1 febrile convulsion at 90mins - 12mth with temp of 39.7˚C <u>Conclusion</u> Paracetamol alone is effective in reducing temperature of febrile children in a tropical climate, whereas tepid sponging alone is not

Appendix 4

Study	Study Design	Interventions Intervention A Antipyretic only	 Intervention B Antipyretic&Sponge	 Intervention C Sponge only	Measures & Outcomes
Aksoylar, Aksit, Caglaysan, Yaprak, Bakiler, Cetin. 1997 To evaluate & compare antipyretic effects of sponging alone to medication (3 commonly used drugs) Turkey	RCT Level of evidence: II 101 children* (49 females, 52 males) Age range: 6mths - 5 yrs (* 201 children in total study but two groups of n=50 each not included in review as received drugs no longer used - aspirin - or not used in other studies in review - ibuprofen) <u>Setting</u> Hospital - emergency dept <u>Inclusion</u> Diagnosis: Rectal temp. 39°C and above <u>Exclusions</u>: Allergy to medications Diseases: renal, GI, haematological cardiopulmonary, malignant, CNS. Dehydrated Antipyretic in previous 6 hrs. <u>Allocation</u> Method of randomisation to one of four groups not reported No significant difference between groups in respect to age, sex,mean initial temp and diagnosis. <u>Data Collection</u> No information provided on who collected data or provided treatments <u>Analysis</u> 224 commenced 23 excluded as parents took child home before completion of data collection. 11 in groups included in review: 5 paracetamol group (9%) and 6 in sponge group (10.7%)	n=51 (completing) Mean age: 22mths M:F - 26:25 Initial temp - 39.9°C Oral paracetamol 15mg/kg		n=50 (completing) Mean age: 22.8mths M:F - 26:24 Initial temp - 39.9°C Sponge 20mins in basin (method of sponging as per Newman's study) Water temp - neutral to nurse's elbow	Rectal temp every 30mins for 3 hrs. Significant temp difference: @ 30 mins - sponging ($p < 0.001$) (actual difference not reported - from graph approximately 0.5°C) @ 3hrs - paracetamol ($p < 0.05$) (not before this time) No further decrease in temp of sponging group after 30 mins Although discomfort not measured, no serious side effects were observed that required stopping the treatment in either group. <u>Conclusion</u> Management of fever over 39°C: antipyretic medication + sponging to provide a rapid and sustained decrease in temperature.

Study	Study Design	Interventions			Measures & Outcomes
		Intervention A Antipyretic only	Intervention B Antipyretic&Sponge	Intervention C Sponge only	
Friedman & Barton 1990 To compare efficacy of 3 interventions in lowering body temperature USA (St Louis, Missouri)	RCT Level of evidence: II 73 children (33 females, 40 males) Age range: 4 mths - 4 yrs <u>Setting</u> Hospital clinic <u>Inclusion</u> Acute febrile illness Rectal temp 38.9˚C or higher <u>Exclusions</u> Age - less than 6 wks or more than 4 yrs Antibiotics in past 72hrs Antipyretics in past 4 hrs History febrile convulsions Known allergy to acetaminophen <u>Allocation</u> Generated random numbers table to one of 3 groups Groups comparable on age,sex,race Mean temp in all 3 groups – 39.9˚C <u>Data collection</u> No information provided on data collectors or who administered treatments (but reference made to nurse 'sponging group') <u>Analysis</u> No drop outs reported	n=26 Mean age: not reported M:F - not reported Acetaminophen 10-15mg/kg	n=28 Mean age: not reported M:F - not reported Acetaminophen 10-15mg/kg + sponge 20mins Water temp 37.8˚C	n=19 Mean age: not reported M:F - not reported Sponge 20 mins Water temp – 37.8˚C	Rectal temp at 30 & 60 mins At 30mins no difference between groups At 60mins temp reduction • greater in acetaminophen alone than sponging only (p=0.03) • greater in acetaminophen+sponge than acetaminophen alone (p=0.003) • acetaminophen+sponge – 0.9˚C cf to sponge only - 0.4˚C <u>Conclusion</u> Reconsider routine use of sponging of febrile children given discomfort + inconvenience

Appendix 4

Study	Study Design	Interventions Intervention A Antipyretic only	 Intervention B Antipyretic&Sponge	 Intervention C Sponge only	Measures & Outcomes
Hunter 1973 To assess relative efficacy of 4 commonly used antipyretic therapies Australia (Melbourne)	RCT Level of evidence: II 67 children Gender not reported Age range: 6mths - 5 yrs <u>Setting</u> - Hospital casualty dept Controlled environment - Temp 21-22˚C, relative humidity 50-55% <u>Inclusion</u> Temp - rectal above 39.5˚C, oral above 39˚C <u>Exclusions</u> Gastroenteritis or dehydration Required antibiotics <u>Allocation</u> Random assignment to one of 5 groups including placebo (control, n=6) and aspirin (n=12) groups. Placebo group withdrawn as no response (i.e. temp did not fall be 1.5˚C in 4hrs) and "remainder of trial randomised again on basis of remaining treatment groups". (Group receiving aspirin not included in this review n=12) <u>Data collection</u> No information provided on data collectors or who administered treatment <u>Analysis</u> 9 pts excluded after failing to achieve a response or not completing 4 hr period of observation, 1 after a febrile convulsion (15%).	n=12 No exclusions Mean age not reported Paracetamol 5-10mg/kg - single dose	n=13 No exclusions Mean age not reported Paracetamol 5-10mg/kg - single dose + sponge for up to 4hrs or until temp reduced 1.5˚C Water temp 30˚C	n=14 65% responded to treatment within 4 hrs & retained in study Mean age not reported Sponge until temp reduced 1.5˚C up to 4hrs Water temp 30˚C	Rectal or oral temp (four 5yr olds) every 30 min for 4 hrs or until temp reduced 1.5˚C Evidence of discomfort - shivering, crying, restlessness, "etc". Addition of tepid sponging to paracetamol did not produce a significant difference cf to paracetamol only. Tepid sponging only produced a significant effect, but not at level of other treatments. (NB - data from only 65% of patients allocated to this group used) Reduction in temp at 2hrs: • Paracetamol+sponge = 1.8˚C • Paracetamol = 1.6˚C • Sponge = 1˚C No outcomes on discomfort measure reported <u>Conclusion</u> Sponging less efficient as an antipyretic measure than antipyretic drugs. Combining sponging with antipyretic drug produces no additional benefit.

Study	Study Design	Interventions			Measures & Outcomes
		Intervention A Antipyretic only	Intervention B Antipyretic&Sponge	Intervention C Sponge only	
Kinmouth, Fulton & Campbell 1992 To compare acceptability and effects on temperature of advice to unwrap children and give paracetamol or warm sponging treatments in the management of feverish illness at home UK (Southhampton)	Randomised, open, parallel group study using factorial design Level of evidence:II 52 children (31 males, 21 females) Age range: 3mths-5yrs Recruited following visit to one of 21 GP's (from 122 eligible) <u>Setting</u> At home Mean room temp - 21.3˚C <u>Inclusion</u> Axillary temp 37.8˚C - less than 40˚C <u>Exclusions</u> Axillary temp over 40˚C Serious concomitant disease History of febrile convulsions Antipyretics in previous 4 hrs Contradictions to paracetamol Inconvenient recruitment hours (after 6pm) <u>Allocation</u> Randomised by envelopes within blocks stratified by age to one of four groups: Unwrapping (control) Warm sponging +unwrapping Paracetamol + unwrapping Paracetamol + warm sponge +unwrapping All groups were encouraged to take frequent cool drinks Unwrap = light clothing (e.g nappy + vest) <u>Data collection</u> Research nurse Parents administered treatment on advice from nurse <u>Analysis</u> 3 withdrawn (2 @ 2hrs - temp 40˚C; 1 @ 3hrs - additional dose of paracetamol). Temp on withdrawal carried forward into analysis	n=13 Mean age: 34 mths M:F - 5:8 Mean temp - 38.8˚C Oral paracetamol 120mg - up to one yr 240mg - over I yr	n=13 Mean age: 25 mths M:F - 6:7 Mean temp - 38.5˚C Paracetamol 120-240mg + sponge (in bath or bowl - all body for 10-20mins or as long as child comfortable) Mean time 9 mins (1-82mins) Water temp 37.1˚C	n=13 Mean age: 37 mths M:F - 10:3 Mean temp - 38.4˚C Sponge (as for Group B) Mean time 9 mins (1-82mins) Water temp 37.1˚C	Axillary temp (thermistor) - temp logged every 5 mins for 4 hrs Discomfort measured by acceptability to child 1-4 Scale (enjoyed, didn't mind, did mind, refused treatment) -observed over 4 hrs Warm sponging resulted in fastest reduction in temp to 37.2˚C - mean time of 25 mins cf to 63 minutes for paracetamol Mean time below 37.2˚C over 4hrs • greatest for paracetamol +warm sponging Effect over and above unwrapping: • paracetamol = 109 mins • warm sponging = 34 mins Discomfort scores not reported (although some narrative comments made) <u>Conclusion</u> Paracetamol is more effective than sponging in controlling temperature in children at home. Warm sponging has an additive effect and reduces fever more quickly than paracetamol alone

Appendix 4

Study	Study Design	Interventions			Measures & Outcomes
		Intervention A Antipyretic only	Intervention B Antipyretic&Sponge	Intervention C Sponge only	
Mahar et al 1994 To assess the effectiveness of tepid sponging in the reduction of temperature in febrile children in a tropical climate Thailand (Bangkok)	Randomised prospective, open trial Level of evidence: II 75 children (45 males, 30 females) Age range: 6 - 53mths (no withdrawals) <u>Setting</u> Hospital - A&E Dept Humidity 65-90% Ambient temp - 28-30.5˚C in room with wall fans <u>Inclusion</u> Diagnosis: viral infection Rectal temp 38.5˚C + <u>Exclusion</u> Antipyretics within previous 4 hrs Admission required <u>Allocation</u> Randomised by drawing numbered envelope to one of two groups: - paracetamol + sponge - paracetamol (control) No sign diff between groups in age, sex ratio, duration of fever, initial temp, relative body surface <u>Data collection</u> One nurse only - not aware of specific purpose of study <u>Analysis</u> No drop outs reported	n=40 Mean age: 17 mths M:F - 22:18 Mean temp - 40.7˚C Paracetamol (oral) 10-15mg/kg	n=35 Mean age: 19.3 mths M:F - 23:12 Mean temp - 38.9˚C Paracetamol (oral) 10-15mg/kg + sponged continuously head to toe except scalp, until temp below 38˚C Sponge not repeated if temp rose to 38˚C+ with the 2hrs of the study Water temp 29-30˚C		Rectal temp (electronic) monitored at 0, 15, 30, 45, 60, 90 & 120 mins Discomfort - irritability,crying, shivering – monitoring interval as for temperature - obs before temp taken Rate of temp fall to 38.5˚C Temps in the sponged +antipyretic group reached 38.˚5C or less sooner than the antipyretic only group ($p < 0.0001$) No recurrence of temps occurred in the control group cf to 3 in other group. Crying observed more in sponge + antipyretic group ($p < 0.001$) Irritability and shivering only in 1 child – sponging ceased at 30 minutes. <u>Conclusion:</u> Tepid sponge + paracetamol more effective than paracetamol alone in a tropical climate

Study	Study Design	Interventions Intervention A Antipyretic only	 Intervention B Antipyretic&Sponge	 Intervention C Sponge only	Measures & Outcomes
Newman 1985 To evaluate the efficacy of sponging to reduce body temperature Canada (Toronto)	RCT Level of evidence: II 137 children commenced 130 completed (71 males, 59 females) Age range: 3mths - 2 yrs <u>Setting</u> A&E Dept <u>Inclusion</u> Temp 39˚C or higher due to an infectious process <u>Exclusion</u> Too ill to delay investigation Had received antibiotics <u>Allocation</u> Group assignment based on admission number - odd or even No significant statistical difference at $p < 0.05$ between groups in age, sex, initial temperature or timing of administration of antipyretics <u>Data collection</u> No information provided on data collectors or who administered treatments (reference made to help given by nurses in Emergency) <u>Analysis</u> 7 discontinued from drug + sponge group (8.75%) due to shivering - data not used Possibility of Type II error negligible as power to reject diff of 0.3˚C with 95% probability.	Control group n=57 Mean age 1.14 yrs M:F - 33:24 Initial mean temp 39.88˚C Paracetamol 5-10mg/kg (if not received any or adequate antipyretics in previous 4 hrs n=34 Those not requiring antipyretics on admission n=23 All unwrapped to diaper	Treatment group n=80 commenced n=73 completed Mean age 1.04 yrs M:F - 38:35 Initial mean temp 39.7˚C Paracetamol 5-10mg/kg (n= 49 received antipyretics n=24 no additional antipyretics required) Sponge in basin of water for 20mins - hands,face & body continuously sponged with washcloth (to replicate advice given to parents) Water temp - not reported - 'tepid' i.e. neutral to nurse's elbow		Rectal temp Treatment group 30 mins after sponge Control group 50 mins after initial temp (No sign diff between temp measurements intervals between groups) Mean reduction in temp: • Paracetamol+sponge - 1.06˚C (SD+ 0.61) • Paracetamol - 0.92˚C (SD+ 0.57) <u>Conclusion</u> Null hypothesis supported: In febrile children given antipyretics, sponging does not lower the temperature significantly. Suggest that practice of sponging as a mode of temperature reduction in children, where fever is a result of infectious process, should be abandoned.

Study	Study Design	Interventions			Measures & Outcomes
		Intervention A Antipyretic only	Intervention B Antipyretic&Sponge	Intervention C Sponge only	
Sharber 1997 To cf efficacy and amount of discomfort between acetaminophen alone and acetaminophen + 15 min tepid sponge bath USA (Arizona)	RCT Level of evidence: II 20 children (10 males 10 females) Age range: 5mths - 5.6 yrs <u>Setting</u> Emergency or urgent care centre Room temp 23.9-27.2˚C <u>Inclusion</u> Rectal 38.9˚C or higher <u>Exclusions</u> Illness requiring immediate antibiotics Antipyretics in previous 4 hrs Non-pyrogenic fever (hyperthermia) Communication barrier precluding informed consent <u>Allocation</u> Randomisation - assigned to treatment group by opening in order next of 20 sealed, serially numbered envelopes containing previously shuffled cards. (Treatment written on card, 10 cards for each treatment). No significant difference between groups on demographic data (age, weight, gender, BSA) All children in diaper (nappy) only and oral fluids encouraged. <u>Data collection</u> By investigator only <u>Analysis</u> 2 cases from sponge group omitted from analysis (20%) due to data collection errors	n=10 Mean age: 23.4mths M:F - 5:5 Mean initial temp - 39.77˚C Room humidity mean 34% Acetaminophen (paracetamol) 15mg/kg	n=10 Mean age: 16.9mths M:F - 5:5 Mean initial temp -39.75˚C Room humidity mean 38.4% (no sig diff between groups) Acetaminophen (paracetamol) 15mg/kg + sponge (in plastic tub 30 mins after drug) continuously all over body for 15mins Water temp 31.1-33.3˚C		Temp - tympanic (infrared) at 30,60,60,120 mins Discomfort - crying, shivering, goosebumps – score 1 for each sign. Monitored every 5mins during sponge, then 15mins up to 2 hrs. Parental rating of discomfort on scale of 0-10 on completion of sponge. Sponged group temp dropped more quickly in first hour but no significant difference between groups over the 2 hrs. Diff in temp (lower in bracket) • 30mins - 0.1˚C (drug only) • 60mins - 0.77˚C (sponge) • 90mins - 0.4˚C (sponge) • 120mins - same Sponged group scored significantly higher on discomfort (p=0.009) during sponge (7 goosebumps and 1 shivering) Plus rated higher on discomfort by parents. Significant correlation between observed and parental discomfort scores. <u>Conclusion</u> There is no significant additional fever reduction from adding tepid sponging to antipyretic treatment in febrile children

Study	Study Design	Interventions			Measures & Outcomes
		Intervention A Antipyretic only	Intervention B Antipyretic&Sponge	Intervention C Sponge only	
Steele 1970 Cf relative effectiveness of sponging with tepid water, ice water, and equal parts of 70% isopropyl alcohol and water in addition to acetaminophen to reduce fever in children Hawaii	RCT Level of evidence: II 65 children Age range: 6mths-5yrs Mean age : 26mths (* 130 in total study - Males - 77, females - 53 - but 3 groups n=65 not included in this review: placebo, acetaminophen + sponging with ice water, acetaminophen + sponging with alcohol and tepid water - see text for explanation <u>Setting</u> Hospital -paediatric clinic Mean room temp-25.5˚C Humidity - 69-74% <u>Inclusion</u> Febrile illness of less than 3 days + rectal temp 39.4˚C or higher <u>Exclusion</u> Antipyretics within previous 4 hrs <u>Allocation</u> Assigned to 1 of 6 treatment by opening next in order of 130 serially numbered envelopes containing randomised cards indicating regimen to be employed Groups comparable is respect to age, sex, aetiology of fever and duration of fever. Clothing removed and oral fluids encouraged in all children <u>Data Collection</u> Temperatures - nurse Discomfort obs - paediatrician (?investigator) + supervised treatment <u>Analysis</u> No drop outs apparent or reported	n=25 Mean age: not reported M:F - not reported Acetaminophen (Paracetamol) Dose varied with age: 6-18mths - 80mg 18-30mths - 160mg 30-48mths - 300mg 48-60mths - 400mg	n=25 Mean age: not reported M:F - not reported Acetaminophen (paracetamol), doses same as Group A + sponge up to 2hrs - continuous to ensure film of water over body - head and face not included Water temp 29.4˚C-32.2˚C	n=15 Mean age: not reported M:F - not reported Sponge up to 2hrs Water temp 29.4˚C-32.˚C	Rectal every 15mins until fell to 38.3˚C or below (all full 2hrs). Discomfort - crying, resistance to procedure, shivering, pallor, cyanosis, "goose flesh" or "other changes in vasomotor tone" - observed every 15 mins. Rated good, fair, poor. % with temp below 38.3˚C at 2hrs: • sponge + drug - -92% • drug alone - 68% • tepid sponge alone - 53%. (placebo group - no change). Significant differences: @ 30 mins - sponge cf placebo @ 45mins - all 3 cf placebo but not to each other @ 60 mins - sponge + drug cf drug alone @ 90 mins - sponge = drug cf drug alone or sponge alone Discomfort - 22% drug alone group rated 'poor' or 'fair' cf to 56% - sponge +drug and 66% -sponge only <u>Conclusion</u> Combination of antipyretic drug (acetaminophen) + tepid sponging effective in reducing temp to below 38.3˚C, whereas placebo, antipyretic drug alone or sponging alone is not.

Appendix 4

Study	Study Design	Interventions Intervention A Antipyretic only	Intervention B Antipyretic&Sponge	Intervention C Sponge only	Measures & Outcomes
Teo, et al 1998 To compare outcome of 3 routine treatments of fever Singapore	RCT Level of evidence: II 104 children (49 males , 55 females) Age range: 6mths-4yrs <u>Setting</u> Hospital - A&E Dept Singapore Humidity not measured (normal range in Singapore 70-80%) <u>Inclusion</u> Axillary temp - 38.5˚C or higher <u>Exclusion</u> History of febrile convulsions or head injury Critically ill <u>Allocation</u> Method of randomisation not reported <u>Data collection</u> A&E nursing staff <u>Analysis</u> Dropouts not reported	n=26 Mean age: 18.2mths M:F - 13:13 Initial mean temp: 39.1˚C Paracetamol syrup 10mg/kg	n=41 Mean age: 17.8mths M:F - 22:19 Initial mean temp: 39.4˚C Paracetamol syrup 10mg/kg + sponge 15-20mins (standardised method + 8 flannels - 6 to forehead, neck,armpits & groin + 2 for sponging body) Water temp - 27 -28˚C (room temperature) Sponging ceased if child shivered and excluded from study	n=37 Mean age: 16.5mths M:F - 14:23 Initial mean temp: 39.1˚C Sponge 15-20mins (same standardised method as Intervention B group) Water temp - 27-28˚C (room temperature) Sponging ceased if child shivered and excluded from study	Axillary temp at 30 & 60 mins (digital thermometer) Discomfort - shivering At 30 mins all treatments reduced temp: • Greatest in paracetamol+ sponge group (p=0.05, mean reduction 1.29˚C) • Sponge alone next (p=0.05; mean reduction 1.11˚C) • Paracetamol alone not stat. significant, mean reduction 0.64˚C. At 60 mins: • paracetamol + sponge p=0.05; mean reduction 1.42˚C • paracetamol alone not stat. significant, reduction 0.33˚C • sponge alone increase in temp (+0.3˚C.) Discomfort not reported <u>Conclusion</u> Combination of paracetamol+sponge most effective method of fever reduction. Clinical policy change. Children with temp below 38.5˚C treated with medication only, 38.5˚C and above by combination of medication and sponging.

Appendix 5

Fever Management in Children Data Extraction Form

Study Title:.....
Author(s): ..... **Year:** .....
Study ID: .....
Comments:
Reviewer: .....

1. Eligibility	(Circle) Yes - 1 No - 2. If No give reason	**Code**
2. Study characteristics		
2.1 Methods		
2.1.1 Type of study		
2.1.2 Selection - method - allocation concealment		
2.1.3 Blinding of outcome assessor		
2.1.4 Attrition - no. of drop outs		
2.1.5 Co-interventions		
2.1.6 Inter-rater reliability		
2.1.7 Parameters for assessment of outcome		
2.1.8 Assessment criteria score		
2.2 Participants		
2.2.1 Age range		
2.2.2 Gender		
2.2.3 Temperature site		
2.2.4 Study setting		
2.3 Interventions		
2.3.1 Use of antipyretics • Name • Dose • Timing of administration		
2.3.2 External cooling Tepid sponging • Length of time • Water temperature		
Environmental cooling (Provide details)		
2.3.3 Hydration (Provide details)		
2.4 Outcomes		
2.4.1 Effect on fever		
2.4.2 Effect in relation to febrile convulsions		
2.4.3 Effect on child's comfort (Means of assessing)		
2.4.4 Effect on parental anxiety		