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TITLE PAGE

Title: Community use of paracetamol and ibuprofen in children with fever

Type of manuscript: Original article

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Key Words: fever; child; fever management; fever education.

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Community use of paracetamol and ibuprofen in children with fever.

Abstract:

Objective: To establish, in children aged from 3 months to less than 13 years with a febrile illness, caregiver medication usage patterns and drivers. Secondary objectives assessed caregiver knowledge and concern about fever.

Methodology: This was a prospective, observational study of a convenience sample of 147 children presenting to a tertiary Paediatric Emergency Department, where the caregivers reported a concern of fever within the preceding 48 hours. A paper-based survey was completed by the caregivers, and the results analysed both qualitatively and quantitatively.

Results: 92.4% of caregivers had administered medication for fever in the 48 hours prior to presentation. Dual therapy of paracetamol and ibuprofen was used by 45.8%, with paracetamol used more frequently as monotherapy (35.4%). Almost one-third of caregivers woke their child to administer medication. Just over one-third of respondents stated that a temperature of less than 38.0°C is a fever. The majority of caregivers (67.6%) said that fever is bad for their child, with 97.9% being concerned by fever. Almost half the children (46.8%) were given medication purely to treat the degree of the temperature. General practitioners were reported as the strongest influence on medication decision (60%).

Conclusions: This study provides insight into current knowledge and practices of parents regarding fever and its treatment. The results of this study may be used to direct future interventions to educate caregivers on this topic.

Key Words: fever; child; fever management; fever education.

Brief Points:

What is already known on this topic:

1. The aim of treating fever should be to improve comfort rather than to decrease temperature.
2. Combined use of paracetamol and ibuprofen reduces fever more effectively than individual use of either agent however this difference is modest and short-lived.
3. Fever plays a beneficial role in immune function.

What this paper adds:

1. Contemporaneous data on Australian community knowledge regarding fever and its management.
2. Australian parents are almost unanimously concerned by fever.
3. General Practitioners are the strongest influence on parental decisions regarding medication use in a febrile child.

1.Introduction:

Fever has been shown to be a cause of concern amongst parents and accounts for up to 22% of presentations to emergency departments (ED).¹ Up to 50% of parents administer an incorrect dose of medication when treating their child's fever.^{2,3} Evidence suggests that fever enhances immune function⁴ and that the key outcome of treatment should be to minimise distress rather than reduce fever.⁵ There is evidence that paracetamol and ibuprofen lower fever and they are heavily marketed as antipyretics.^{6,7} Many parents have an exaggerated fear about fever and use multiple therapies, including paracetamol and ibuprofen, to reduce fever.³ Even simple analgesics are not without potential side effects, with concerns raised regarding negative immunomodulatory effects of ibuprofen and paracetamol, although there is no agreement regarding disease causation, including complicated pneumonia and asthma.⁸⁻¹¹

There is a paucity of current literature regarding Australian community knowledge of fever, management of fever, and parental antipyretic use. Researching these gaps in the literature aims to better understand antipyretic misuse, enabling us to understand drivers of this behaviour, address areas of misinformation and devise strategies to improve antipyretic misuse. By providing education to the community that addresses these drivers, fever phobia and inappropriate management may be reduced.

2.Method:

2.1 Study Objectives

The primary objective was to determine the proportion of parents administering medication to treat fever. The primary outcome was the prevalence of ibuprofen and paracetamol use in febrile children, and the reasons for their administration.

Secondary objectives were to assess caregiver definition of fever; caregiver assessment of fever; caregiver levels of concern around fever; and caregiver level of education.

2.2 Study Design

This was a prospective, observational study of a convenience sample of children presenting to the Paediatric Emergency Department (PED) at The Royal Children's Hospital, Melbourne, (a tertiary PED with an annual census of over 85,000) between October 2018 and January 2019. Eligible children were aged 3 months to less than 13 years and had a presenting complaint that included a parental report of fever within the preceding 48 hours. Patients were excluded if there was difficulty reading and understanding English, if they had a current or past oncological diagnosis, or if they were triage category one or two. The caregivers of eligible patients were approached by clinical staff, when available, between 8am and 12am. After obtaining verbal consent for the study, clinicians handed the parents a paper-based survey that was completed without assistance. Families who completed the survey then returned it to PED staff. No information that identified either parents or patients was included on the survey forms. We did not record the number of families eligible, nor the number of eligible families approached, for the study.

Qualitative and quantitative information was collected. For the survey questions that provided categorical data the caregivers were given options of answers and needed to choose from this list (see Supporting Information). Categorical data is presented as number and percentage. Descriptive data underwent a thematic analysis using a deductive and latent approach, with the most common themes presented. Thematic analysis was used for the method of non-medication cooling and why parents perceived fever to be bad for their child. The study was approved by the local Human Research and Ethics Committee. For the purposes of this study, a fever relates to a temperature of at least 38°C.

2.3 Data Collection

Parents were asked to complete a written survey in English (see Supporting Information). The following data was obtained through the survey: patient and caregiver demographic data, details of the child's current illness, medication used to treat the child's fever during this illness, and questions regarding the caregiver's understanding of fever. Data was entered into a password protected Excel spreadsheet.

3. Results:

A convenience sample of 147 families completed the survey. Two were excluded due to being outside the age range, so 145 families are included in the analysis. Demographic data is presented in Table 1. Male and female children were equally represented, and 79% were under 5 years of age. Of the respondents, 77.4% identified as the child's mother and none were non-family caregivers. Most respondents were in the 31-40 year age group. The majority of respondents had a bachelor or post-graduate degree.

3.1 Primary Outcome

Of caregivers 92.4% administered paracetamol and/or ibuprofen to treat their child's fever in the 48 hours prior to presentation. It was most common (45.8%) that carers administered both paracetamol and ibuprofen to the child. At least one dose of paracetamol was administered to 77.2% and for ibuprofen 54.9% of children. Paracetamol was used more frequently than ibuprofen as monotherapy (Table 2). Of those using paracetamol 81.3% had administered it in the past 48 hours, and 77.2% in the past 24 hours. Of those using ibuprofen 56.9% had administered it in the past 48 hours, and 54.9% in the 24 hours prior to presentation (Table 2). Almost one-third of caregivers (30.5%) said they had woken their child to administer medication for the treatment of fever, and almost half (46.8%) gave the medication purely to treat the height of the temperature.

3.2 Secondary Outcomes (Table 3)

3.2a Definition of Fever

Results of fever definition are presented in Table 3. Almost one-third (31.8%) of carers defined a fever as a temperature of less than 38.0°C. Using our definition of fever ($\geq 38.0^{\circ}\text{C}$) 51.4% of carers defined fever correctly.

3.2b Measurement of Temperature

Many caregivers used multiple methods to measure temperature. The common methods of measuring temperature were tympanic (47.9%), forehead (30.6%), and axillary (23.6%). A small proportion used oral measurement (6.3%), or tactile assessment as a sole method of assessment (6.3%). Rectal measurement was not used.

3.2c Understanding of Fever

Caregivers were asked whether fever was bad for their child, and if there is a degree of fever that causes them concern (Table 3). Fever was thought to be bad for their child by 67.6% of caregivers, with only 2.1% responding that fever did not concern them. A temperature of between 38°C and 40°C was concerning for 79.8%.

Of the caregivers who were concerned about fever, 59.3% gave comment as to why. The themes that were identified related to distress, behaviour and activity of the child (32.5%); fear of fever (48.2%); and the risk of illness or impact of illness on the child, 19.3% each. Specific caregiver comments were that “overheating can be fatal” and that fever “cooks the brain”. Caregivers’ responses relating to behaviour change included seeing their child “distressed”, “unsettled” and unable to “get good sleep or eat anything”.

Non-medication cooling methods used included clothing removal (71.4%), sponging or washing (38.8%), cool bath or shower (10.2%), and fanning (6.8%).

When asked about factors influencing their medication decision, 60% said that general practitioners were the strongest influence and 2.9% responded that advertising impacted their decision.

Medication dosing was found to be greater than manufacturers recommendations in 11.6% of those given paracetamol and 11.4% of those given ibuprofen in the 24 hours preceding presentation.

Discussion:

It has been suggested that the aim of treating fever should be to improve comfort rather than to solely decrease the temperature.^{5, 12} A large proportion of our carers (92.4%) used medication to treat fever, and only about half used medication because their child looked unwell or was distressed. There is some evidence that treating fever alone may not be the best option due to the beneficial effects of fever in immune function.⁴ There is insufficient evidence to inform whether using two or more analgesics improves comfort more than using a single analgesic agent.¹³

Whilst paracetamol and ibuprofen are often felt to be benign medications they are not without side effects. There is a potential correlation with ibuprofen and multiple negative immunomodulatory effects, particularly the impact on levels of inflammatory cytokines.⁹ Ibuprofen use has been associated with delays in prescription of appropriate antibiotics.¹⁴ Whilst ibuprofen use resulted in improved clinical outcomes in bovine Respiratory Syncytial Virus bronchiolitis, there was increased virus shedding and decreased inflammatory response.¹⁵ Ibuprofen has also been associated with worsened outcomes in skin and soft tissue infections,¹⁰ and increased risk of bacterial infection in association with varicella infection.^{11, 16} Other well-known side effects of ibuprofen include gastritis and renal impairment.¹⁷ Paracetamol use has been associated with increased asthma symptoms, rhinitis and eczema;⁸ in overdose, including repeated supratherapeutic doses in a child with decreased oral intake, it can result in liver damage with risk of liver failure and death.¹⁸

Both paracetamol and ibuprofen have been shown to lower temperature, with 50% of total temperature reduction occurring within one hour of medication administration.¹⁹ They are extensively marketed as antipyretics.^{6, 7} Paracetamol has been shown to decrease fever by 1.5°C and ibuprofen by 1.9°C at four hours.¹⁹ Alternating paracetamol and ibuprofen has a modest increased antipyretic effect compared with monotherapy of either paracetamol or ibuprofen,^{13, 19} with no significant differences in temperature at 48 hours or five days.¹³ There are no studies that show clinical beneficial effects associated with using medication to lower temperature.

Our study data highlights a gap in parental understanding of fever definition, assessment and management, as compared to current recommendations. The majority of our study group, 51.4%, accurately identified that $\geq 38.0^{\circ}\text{C}$ was a fever (in line with our definition), and 31.2% considered a temperature of less than 38.0°C a fever. This reflects a more accurate knowledge of fever compared with previous reports where 50% of parents considered a fever to be a temperature less than 38.0°C .²⁰

In regard to assessment of fever, our study showed that whilst 39.6% of caregivers used tactile measurement of temperature, only 6.3% used this as the sole method. A Turkish study reported that 15.5% of respondents preferred tactile measurement of fever.²¹ Tactile

measurement of temperature is not recommended due to its inaccuracy in our study age range.²²

Our study cohort's management of fever also deviated from currently recommended practices. In our study group, 92.4% of caregivers had administered medication to lower fever in the 48 hours prior to presenting to hospital. The most common treatment (45.8%) was combined use of paracetamol and ibuprofen. Paracetamol monotherapy was used by 33.4% and ibuprofen monotherapy by 11.1%. A study from Turkey, involving 1032 survey respondents, had similar results with 95% of parents giving antipyretics at home, and 40% using dual therapy with paracetamol and ibuprofen.²¹ There are recommendations for monotherapy for treatment of discomfort associated with fever.^{12, 13}

Previous studies have shown that up to 50% of carers identify the incorrect dose of medication for their child or administer doses more frequently than recommended.^{2, 3} In a cross-sectional study of Australian parents 4% gave paracetamol more often than every four hours and 41% gave ibuprofen more frequently than six-hourly.³ In our study 11.6% gave greater than four doses of paracetamol and 11.4% gave more than three doses of ibuprofen in the 24 hours preceding presentation, dosing frequencies that are above the upper limits recommended by the manufacturers.^{6, 7} We did not collect the child's weight so do not know if the daily dose was suprathreshold, or if there was any ongoing suprathreshold administration.

Approximately one-third of respondents, 30.5%, woke their child to administer medication to lower fever. This is less than previously reported, with other studies showing that 76-85% of caregivers woke their child.^{20, 21} The benefit of waking a child to administer medication to lower fever has been questioned, with no favourable clinical outcomes reported.²³

Almost half of our respondents gave medication to treat fever due simply to the height of the temperature. Of the caregivers who gave qualitative responses as to why they thought fever was bad for their child, almost half gave answers indicating a fear of fever. In 1980 the term "fever phobia" was introduced, denoting an exaggerated desire to achieve normothermia by aggressively treating fever.²⁴ Parents in previous studies have reported fears about serious

neurological side effects²⁴ and our respondents listed seizures, brain damage, and death as concerns. These perceptions reveal areas where we can increase health promotion and health literacy. By dispelling myths about the impact of fever we can decrease fever phobia and potentially the associated health care burden of excessive medication administration and presentations to emergency departments.

Limitations:

The small sample size is a limitation of the study and meant that we were unable to calculate significant differences between subsets of respondents. The respondents represent a convenience sample, and we do not know if this is actually a representative sample of the community. We do not know how many families were approached nor how many surveys were handed out. We also do not know how many children presented with fever during the study time period. Not all respondents answered every question, leading to incomplete data, however everyone answered the questions pertaining to the primary outcome. The respondents had been seen by the triage staff and possibly by the waiting room clinical staff prior to completing the survey; this may have impacted their answers if they had received education on fever during these encounters.

Conclusion:

Our study has highlighted a gap in the knowledge of carers of children with fever. Medications were used to treat fever by almost the entire cohort, despite recommendations being to treat distress rather than temperature, and almost half of the group did not have accurate knowledge of fever definition. This information provides a basis for the development of health literacy programs for the management of fever in children in our community. General Practitioners (GPs) were cited as the strongest influence on caregiver medication choice by 60% of respondents; partnering with primary care providers to educate the community may thus have a strong beneficial effect. Future research approaches could include interventional studies evaluating the impact of written and verbal material in PEDs and GP practices, ideally incorporating multiple language translations.

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