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Pediatrics 2000;105;260

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Fever in Pediatric Primary Care: Occurrence, Management, and Outcomes

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Abstract. Objective. To describe the epidemiology, management, and outcomes of children with fever in pediatric primary care practice.

Patients. A cohort of 20 585 children 3 to 36 months of age cared for in 11 pediatric offices of a health maintenance organization between 1991 and 1994.

Methods. Using automated medical records we identified all office visits with temperatures $\geq 38^{\circ}\text{C}$ for a random sample of 5000 children, and analyzed diagnoses conferred, laboratory tests performed, and antibiotics prescribed. We also determined the frequency of in-person and telephone follow-up after initial visits for fever. Finally, we reviewed hospital claims data for the entire cohort of 20 585 to identify cases of meningitis, meningococcal sepsis, and death from infection.

Results. Among 3819 initial visits of an illness episode, 41% of children had no diagnosed bacterial or specific viral source. Of these, 13% with a temperature of 38°C to 39°C and 36% with a temperature of $\geq 39^{\circ}\text{C}$ received laboratory testing. Almost half (43%) received some documented follow-up care in the subsequent 7 days. Among the 26 970 child-years of observation in the entire cohort, 15 children (56 per 100 000 child-years) were treated for bacterial meningitis or meningococcal sepsis. Five had an office visit for fever in the week before hospitalization, but only 1 had documented fever $\geq 39^{\circ}\text{C}$ and received neither laboratory testing for occult bacteremia nor treatment with an antibiotic.

Conclusion. The majority of febrile children in ambulatory settings were diagnosed with a bacterial infection and treated with an antibiotic. Of highly febrile children without a source, 36% received laboratory testing consistent with published expert recommendations, and short-term follow-up was common. Meningitis or death after an office visit for fever without a source was predictably rare. These data suggest that increased testing and/or treatment of febrile children beyond the rates observed here are unlikely to affect population rates of meningitis substantially. *Pediatrics* 2000;105:260–266; fever, office visits, bacteremia.

ABBREVIATION. WBC, white blood cell count.

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Received for publication Apr 26, 1999; accepted Aug 31, 1999.

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Fever is one of the most common presenting signs of illness in office-based pediatric practice, and is present in 19% to 30% of encounters.^{1,2} Despite this, the management of febrile children between 3 and 36 months without an obvious source remains controversial. Fever is most commonly associated with self-limited viral illness, but may be the presenting feature of occult bacteremia which, untreated, can lead to meningitis or other serious sequelae.^{3,4} No study in a well defined primary care population has analyzed management of febrile children in the office setting and examined its relation to rates of meningitis or other serious infections.

Previous studies, primarily from emergency departments, have estimated the prevalence of bacteremia to be 1.6% to 3% among children with temperatures $\geq 39^{\circ}\text{C}$ and no obvious source.^{5–8} Randomized trials, also in emergency departments,⁹ have led to the recommendation for laboratory testing and empiric antibiotic treatment for febrile children 3 to 36 months of age who have no apparent source for the fever. Published guidelines have suggested empiric treatment in all clinical settings for children with an elevated white blood cell count (WBC),¹⁰ although there is controversy about their application, especially in primary care settings.^{11–13} Primary care clinicians in the high-volume, low-acuity office setting must weigh the consequences of testing and treatment, including discomfort to the child, financial costs, and unintended consequences of false-positive results, against the small risks of serious bacterial infections. Decision analyses, based on conditions that existed before routine immunization for *Haemophilus influenzae*, arrived at conflicting conclusions.^{14,15} In addition, rising concern about antibiotic resistance may cause increased scrutiny of empiric treatment of low-risk children.^{16,17}

Although others have reported rates of bacteremia in primary care settings,^{6,7,18} there are limited data on the management or outcomes of fever requiring office-based medical care to guide providers. The goals of this study were 1) to describe the epidemiology and management of febrile illness presenting for medical care among a defined population of infants and young children, and 2) to assess the incidence of bacterial meningitis, meningococcal infection, and death from sepsis in relation to antecedent management.

METHODS

We analyzed, in detail, the management of febrile episodes presenting to primary care sites for a random sample of 5000 children. To assess the frequency of the rare outcomes of meningitis and death from sepsis, we analyzed data from the entire cohort of 20 585 individuals.

Study Population and Data Sources

We performed a retrospective cohort study including all children 3 to 36 months old enrolled in 11 staff-model pediatric departments of Harvard Pilgrim Health Care between January 1, 1991 and December 31, 1994. Patients at these sites were treated by physicians or pediatric nurse practitioners. All sites offered on-site phlebotomy and laboratory testing. The pediatric population receiving care at these sites reflects the demographic characteristics of their communities. Thirty percent of patients were non-white and 13% were covered under Medicaid.

Frequency and Management of Febrile Episodes

We analyzed the febrile episodes of a computer-generated random sample of 5000 children. We calculated the number of days each child was covered by the health plan beginning on enrollment or on the 91st day of life (whichever came later), and ending at disenrollment or their third birthday (whichever came first). Ambulatory clinical information was obtained from a computerized medical record system, which is the sole clinical record used in these practices for all clinical encounters, described in detail elsewhere.¹⁹ Providers select problem-based codes on a paper encounter form and add free text entries for details of history, examination, and treatment plan; these forms are then entered into the record by medical records department staff. This record captures vital signs on arrival (including temperature), laboratory tests, diagnoses, and medications prescribed in searchable fields. Diagnosis codes (*International Classification of Diseases, Ninth Revision*) for emergency department visits and hospitalizations were obtained from administrative claims files.

We identified all daytime, evening, and weekend visits (including urgent care) during which a temperature $\geq 38^{\circ}\text{C}$ was measured in the office. We analyzed separately visits with a measured temperature of 38°C to 38.9°C and those with a temperature $\geq 39^{\circ}\text{C}$. In order to analyze testing and treatment during initial visits for febrile illness separate from follow-up care, we defined initial visits with fever as those occurring at least 14 days after any preceding office visit (excluding well-child care). All visits during the subsequent 7 days were considered follow-up of the initial illness.

A "primary" diagnosis was assigned for each encounter by the clinician in 78% of initial visits. An additional 12% of visits had 2 or more diagnoses, only 1 of which was likely to be clinically related to the fever (eg, otitis media and diaper rash), and was assigned as primary. For the remaining 10% of cases, in which both diagnoses were possible causes of fever (eg, viral illness and otitis media), the diagnoses were reviewed by an investigator (J.A.F.) who gave priority to a potential bacterial source (eg, otitis media). In this retrospective study, we accepted clinicians' diagnoses without independent confirmation by laboratory testing, because it is their final diagnoses that determine testing and treatment decisions. Primary diagnosis codes were grouped as: presumed bacterial illnesses, specific viral syndromes (including varicella, bronchiolitis, croup, etc), presumed or nonspecific viral illnesses (including upper respiratory illness, gastroenteritis, and viral illness), and codes indicating that no source was identified (including "rule out sepsis," "fever of unknown origin," and "diagnosis deferred"). Because nonspecific viral diagnoses are often diagnoses of exclusion, we combined the last 2 categories for analysis of fever without an apparent bacterial or specific viral source.

For each initial visit, we identified diagnostic tests including WBC, blood culture, chest radiograph, urine analysis and culture, throat culture, and antibiotics prescribed. We also identified all follow-up visits and telephone calls to the health centers of this health maintenance organization (where members are required to seek care unless away from the area) in the week after an initial evaluation, as well as emergency department visits and hospitalizations.

Assessment of Population Outcomes

The claims files for the entire cohort ($N = 20\,585$) were searched for *International Classification of Diseases, Ninth Revision*: codes for meningitis and meningococcal disease. Cases specifically coded as bacterial meningitis, and meningitis cases hospitalized for >4 days, were confirmed by review of the ambulatory record to exclude nonbacterial meningitis and "rule out meningitis." Hospitalizations ending in death with any diagnosis and ambulatory records containing the coded entry for a patient death from any cause were also reviewed. Cases were designated definite bacterial meningitis if there was a cerebrospinal fluid pleocytosis (>5 WBCs/mm³) and a bacterial pathogen grown from a cerebrospinal fluid or blood culture. Patients treated with a full course of antibiotics for meningitis in the absence of a positive culture, often with previous oral antibiotic treatment, were considered to have presumed bacterial meningitis. The ambulatory records of confirmed cases were reviewed by 2 investigators for evidence of an office visit for febrile illness in the week before hospitalization. Because our focus was the management of fever and treatment of occult bacteremia to prevent the development of serious bacterial infection, we excluded visits within 24 hours of hospital admission.

Data were analyzed using the SAS software (SAS version 6.12, SAS Institute, Cary, NC). Statistical comparisons were made using χ^2 tests with Yates correction for 2×2 tables, and, where appropriate, χ^2 tests for trend.²⁰ The number of febrile visits and their management in the population were extrapolated from the diagnosis and management of index visits of the sample of 5000.

RESULTS

There were 20 585 eligible children in the full population. Of the random sample of 5000 children, 2411 (48%) were female and 13% were covered by Medicaid at some time during the study period. The subjects had a mean observation time of 1.3 years, and contributed a total of 6551 child-years.

Among the sample of 5000 children, we identified 5508 visits for febrile illness; of these, 3956 had documented temperatures of 38°C to 38.9°C , and 1552 had fevers $\geq 39^{\circ}\text{C}$. There were a total of .84 (95% confidence interval [CI]: .82, .86) visits with fever $\geq 38^{\circ}\text{C}$ per child-year, and .24 (95% CI: .22, .27) visits per child-year with fever $\geq 39^{\circ}\text{C}$ (Fig 1). Of the 5508 visits, 3819 met our criteria for first contact for a febrile illness episode (ie, index visits). Of the index visits, 1069 (28%) were for fever $\geq 39^{\circ}\text{C}$.

Figure 2 shows the diagnoses assigned at the initial visits. Fifty-six percent of febrile children with fever $\geq 39^{\circ}\text{C}$ were diagnosed with a bacterial source for infection, 3% with a specific viral syndrome, and 32% with a nonspecific viral illness; the distribution of diagnoses was similar among children with fever 38°C to 38.9°C . The remaining children (5% of those with fever 38°C to 38.9°C and 9% with fever $\geq 39^{\circ}\text{C}$) were explicitly designated "rule-out sepsis," "fever of unknown origin," or "diagnosis deferred." The most common diagnosis was otitis media, accounting for 48% of index encounters. An antibiotic was prescribed at 56% of index visits. Almost all (93%) children with a diagnosed bacterial infection were prescribed antibiotics, compared with 9% of those diagnosed with a viral illness.

Diagnostic testing and antibiotic treatment rates for febrile children without a bacterial or specific viral source are shown in Fig 3. WBC, blood cul-

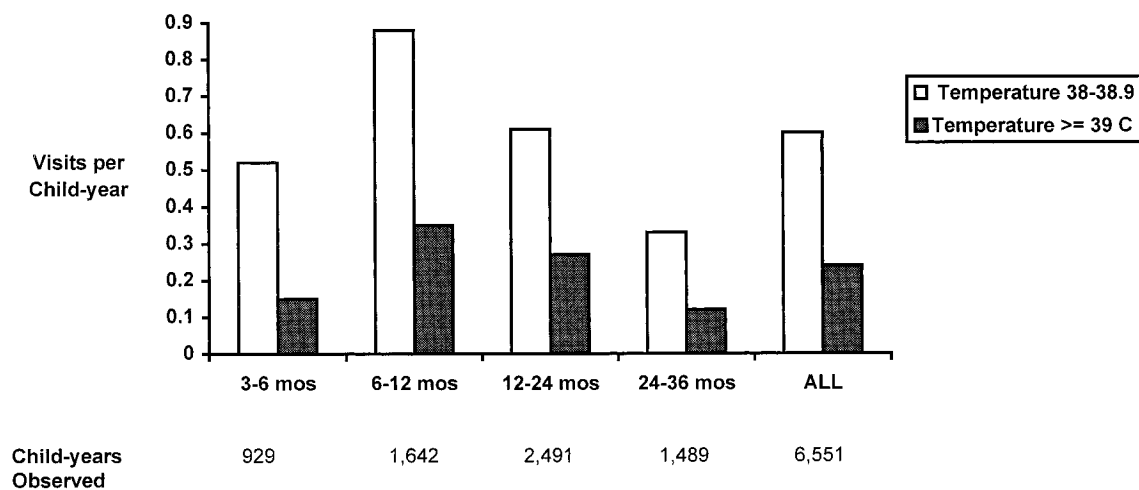


Fig 1. Visits with documented fever by age.

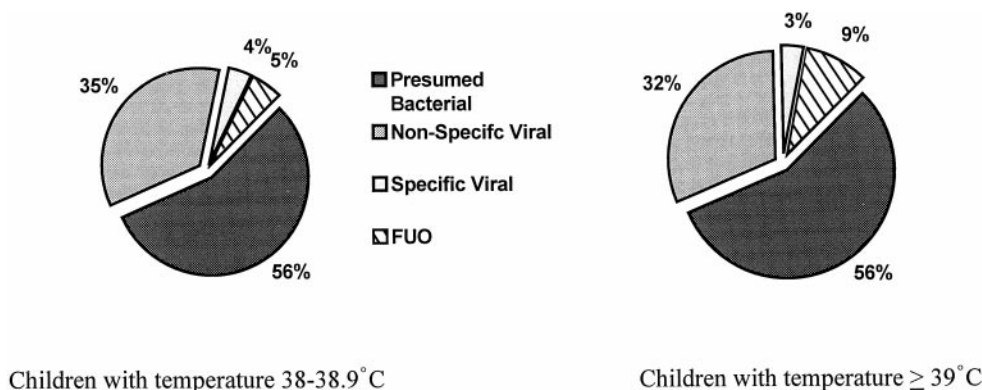
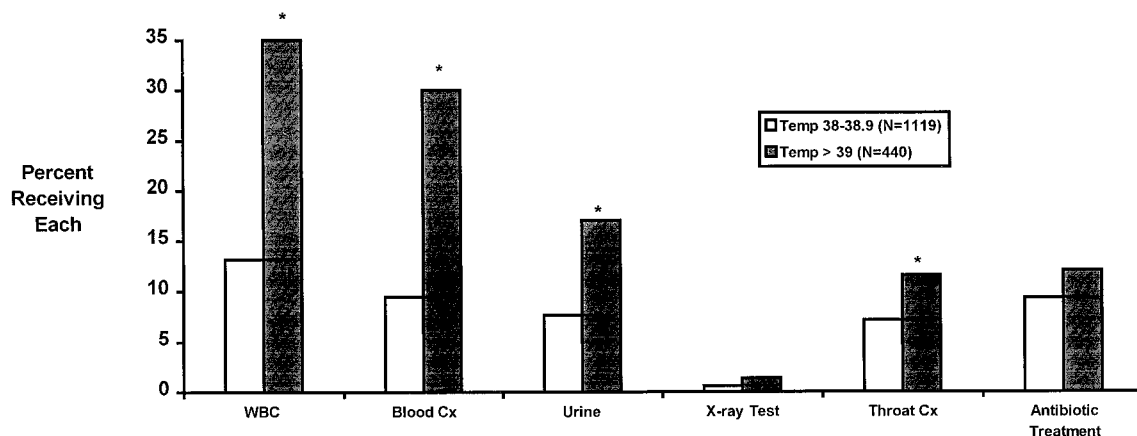


Fig 2. Diagnoses for febrile visits.



* Comparison of children with high fever and mild fever, $p < 0.01$.

Fig 3. Management of febrile children without an apparent bacterial or specific viral source.

tures, urine tests, and throat cultures were obtained significantly more frequently for fever $\geq 39^\circ\text{C}$ ($P < .01$). Among the subgroup with fever $\geq 39^\circ\text{C}$ and no evident bacterial or specific viral source, 159 (36%) of 440 received a WBC or blood culture, and 17% had a urine analysis or culture. Not surprisingly,

younger infants were significantly more likely to receive diagnostic tests than older children (Fig 4) ($P < .01$ for each test, except no difference for radiographs, and increasing rates of throat culture with age $P < .05$). Over half of highly febrile infants 3 to 6 months of age received a WBC or blood

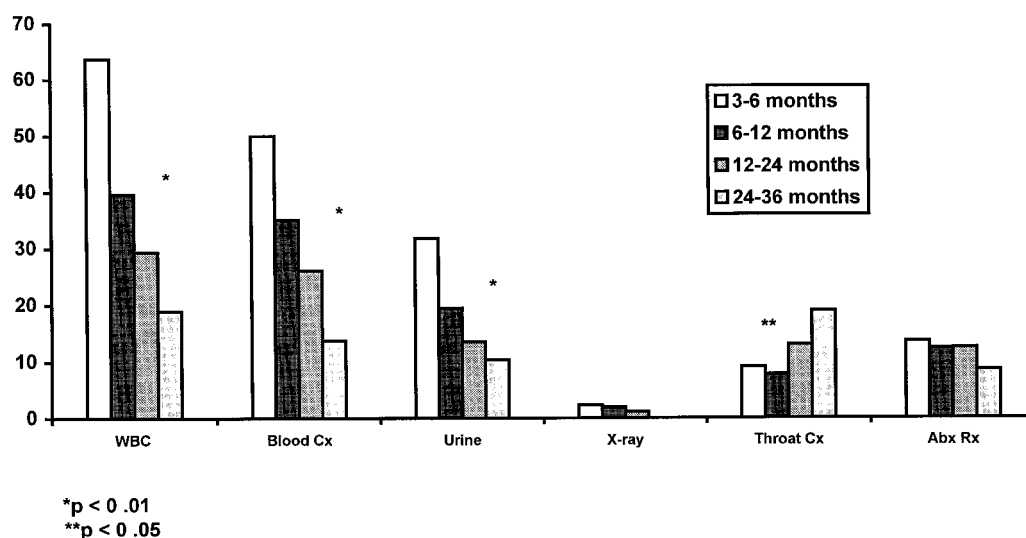


Fig 4. Management of highly febrile (temperature $\geq 39^{\circ}\text{C}$) children without an apparent bacterial or specific viral source by age ($N = 440$).

culture. Of the 132 blood cultures obtained, 8 (6%, CI: 3%, 12%) were positive for bacterial pathogens, all *Streptococcus pneumoniae*.

Table 1 shows the rates of follow-up during the 7 days after an initial febrile visit, stratified by initial antibiotic treatment. A total of 43% of children had medical contact as either an in-person visit or by telephone. Of the 1154 children with a follow-up visit, 121 had a WBC performed, 67 had a blood culture drawn, and 60 had their urine screened. In total, 449 children (12%) were prescribed a new antibiotic at follow-up: 223 received a first prescription for the illness and 226 had their antibiotic switched. Children treated with an antibiotic at the first encounter were less likely to return for follow-up. This was true for children initially presenting with temperatures of 38°C to 38.9°C (27% vs 32%; $P \leq .01$) as well as febrile children who had a

temperature of $\geq 39^{\circ}\text{C}$ at the index visit (29% vs 38%; $P < .01$).

One hundred fifty (4%) of the 3819 febrile visits were associated with an emergency department visit within the next week. Eighty-two patients were seen in the emergency department on the same day as the office visit and were likely to have been sent to the hospital directly from the office or within hours of being seen. For the remainder, the most common emergency department diagnoses, which accounted for 62% of visits, were pyrexia of unknown origin, otitis media, viral infection, pneumonia, and bronchiolitis. Ten of these patients were hospitalized with diagnoses of pneumonia (4), septicemia (3), urinary tract infection (2), and cellulitis (1).

In the full cohort of 20 585 children, we identified 14 who were treated for definite (9) or pre-

TABLE 1. Follow-up Management Within 7 Days for Febrile Children

	All Febrile Children <i>N</i> = 3819 (%)	Temperature 38°C to 38.9°C at Initial Presentation		Temperature $\geq 39^{\circ}\text{C}$ at Initial Presentation	
		Antibiotic Prescribed at First Visit (<i>N</i> = 1547) (%)	No Antibiotic Prescribed at First Visit (<i>N</i> = 1203) (%)	Antibiotic Prescribed at First Visit (<i>n</i> = 609) (%)	No Antibiotic Prescribed at First Visit (<i>N</i> = 460) (%)
In-person follow-up	1154 (30)	422 (27)*	381 (32)*	178 (29)†	173 (38)†
Telephone follow-up	895 (23)	305 (20)*	298 (25)*	145 (24)†	147 (32)†
ANY follow-up‡	1630 (43)	592 (38)*	531 (44)*	262 (43)†	245 (53)†
Diagnostic testing at follow-up:					
White blood cell count	121 (3)	30 (2)	47 (4)	11 (2)	33 (7)
Blood culture	67 (2)	10 (1)	28 (2)	4 (1)	25 (5)
Urine screen	60 (2)	10 (1)	28 (2)	3 (0)	19 (4)
Radiograph	49 (1)	19 (1)	22 (2)	2 (0)	6 (1)
Throat culture	36 (1)	3 (0)	28 (2)	0 (0)	5 (1)
Antibiotic prescribed at follow-up:					
Any antibiotic	449 (12)				
Antibiotic switched	226 (6)	161 (10)	N/A	65 (11)	N/A
Antibiotic prescribed for those not initially treated	223 (6)	N/A	153 (13)	N/A	70 (15)

* Comparison of children 38°C to 38.9°C who were and were not prescribed an antibiotic at first visit, $P \leq 0.01$.

† Comparison of children $\geq 39^{\circ}\text{C}$ who were and were not prescribed an antibiotic at first visit, $P \leq 0.01$.

‡ Number of "ANY follow-up" is smaller than the sum of in person and telephone because some patients received both.

sumed (5) bacterial meningitis and 1 death from fulminant sepsis. Five of these children received office care for fever in the week before admission. Two of the 5 had fevers $\geq 39^{\circ}\text{C}$ at the preceding visit. Case 1, who later presented with *H influenzae* meningitis, was seen 2 days before admission with a temperature of 40.6°C and was treated with an oral antibiotic for otitis media. Case 2, with pneumococcal meningitis, was seen 4 days before with a temperature of 39.6°C , and was diagnosed with an upper respiratory infection and received no testing or antibiotic treatment. Three other meningitis cases (1 *S pneumoniae*, 1 *H influenzae*, and 1 with no pathogen identified) had preceding office visits with temperature $< 39^{\circ}\text{C}$. The first received a diagnosis of bronchiolitis and had no testing or treatment. The second was treated with an oral antibiotic for tonsillitis. The third was tested (WBC = 10 600) and was not treated with an antibiotic at the initial visit. In total, during 26 970 child-years of observation, only 1 of the children described above (case 2) received previous office care for high fever and was not either treated for a bacterial infection or screened for occult bacteremia with a WBC. We also note that 3 cases of subsequent meningitis were seen in the office in the previous week with documented temperatures $< 39^{\circ}\text{C}$. These children developed meningitis despite care consistent with published guidelines for highly febrile young children.

DISCUSSION

Our finding that there are on average .8 visits for fever per child per year, one quarter of which are for fever $\geq 39^{\circ}\text{C}$, is a lower bound of the actual rate. For example, it does not include the many children whose fever prompted the office visit, but who defervesced (with or without an antipyretic) by the time it was measured in the office. These data from a defined managed care population are nonetheless useful for estimating the impact of procedures done and costs incurred of various strategies for the management of fever in primary care settings.

Our data highlight the fact that diagnosis of focal bacterial infections and antibiotic treatment are frequent among febrile children. This retrospective study relies on the clinical diagnoses that providers document in the patient record, which we believe are more accurate than claims-type diagnostic information used primarily for billing purposes. However, these data do not permit us to assess the accuracy of these diagnoses, including otitis media. This analysis focuses on diagnoses assigned, and testing and treatment that follow, rather than the natural history of confirmed bacterial infection.

Assessment of these clinicians' practices in relation to published guidelines depends on the interpretation of "fever without a source," defined in the guideline as "an acute febrile illness in which the etiology of the fever is not apparent after a careful history and physical examination."¹⁰ Some take this to include all fevers without a focal bacterial infection or a well defined viral syndrome, such as varicella or croup. A recent study by Kupperman et

al²¹ suggests that children with bronchiolitis are extremely unlikely to be bacteremic. However, it is not clear whether less specific symptoms, such as rhinorrhea or diarrhea, constitute enough evidence of viral infection to obviate the need for testing. Therefore, we and others^{5,6} include children with diagnoses such as "viral syndrome" and "upper respiratory illness" in our analyses of febrile children without a focal source. Our belief that these diagnoses are often used as diagnoses of exclusion is supported by the 30% rate of blood testing among highly febrile children with these diagnoses.

Although 75% of primary care physicians responded in a survey that they would obtain a WBC in a 20-month-old highly febrile child with no source,²² in practice the rate was much lower. We believe the observed rates of 35% for obtaining a WBC and 30% for a blood culture among children with high fever is higher than average for private practices because of the on-site availability of phlebotomy and laboratory services at the study sites. Published scales to assess clinical appearance²³ have not reliably identified bacteremic patients in emergency departments.²⁴ Whether physicians in this study identified a high-risk group to test is unclear because the 6% rate of positive blood cultures (all *S pneumoniae*) is based on too small a number (132 cultures obtained) to draw a firm conclusion. The rate of urine testing in highly febrile children without a source was low (17%). It is possible that some cases of febrile urinary tract infection were therefore missed, or inadvertently treated under another diagnosis.

The ongoing relationship between patients and providers in primary care settings is often cited as justification for a less aggressive diagnostic approach. Our data confirm that many young febrile children receive follow-up care by telephone or at a subsequent office visit. For example, almost half of children with high fever had follow-up the next week, and many received additional diagnostic testing or were treated with antibiotics. In fact, if we include antibiotics given in follow-up encounters, 62% of all febrile children received antibiotics during the episode of illness. We observed higher rates of follow-up visits among those not initially treated with an antibiotic. Explanations include the possibility that viral illness may not resolve as quickly as treated bacterial infection, or that parents or physicians have a lower threshold for initiating a follow-up visit if no antibiotic was prescribed. Whatever the explanation, the possibility exists that reducing antibiotic prescribing²⁵ could increase the number of follow-up visits for febrile illness.

The rate of culture-positive meningitis in our population, 33/100 000 (95% CI: 15, 36) was consistent with the 15/100 000 reported by national surveillance programs.²⁶ Ten of the 15 cases (67%) cases treated as meningitis or who had fatal sepsis had no previous febrile visit (not including care within 24 hours of admission). Four of the remaining 5 were treated according to guideline recom-

mendations,¹⁰ leaving only 1 who would have received different care based on strict adherence to the guideline. The fact that 3 children who subsequently developed meningitis had only mild fever at their previous visit suggests that a single temperature $\geq 39^{\circ}\text{C}$ documented in the office may not be a sensitive criterion for who may develop meningitis. However, testing all children with fevers $\geq 38^{\circ}\text{C}$ would dramatically increase the number of episodes treated or tested.

These data should be interpreted in light of several caveats. We chose to measure only rates of meningitis, meningococcemia, and death from sepsis because they are the most severe potential sequelae of untreated bacteremia. We believe that it is concern for these life-threatening infections that have been the primary drivers of recommendations for testing and treatment of children with fever without a clear source. Other serious bacterial infections including osteomyelitis, septic arthritis, and others would be important to include in a comprehensive analysis of the sequelae of bacteremia. Also, we identified cases of possible or probable meningitis, relying on hospital claims for this diagnosis with confirmation by very "liberal" criteria. We chose to err on the side of maximizing the rate of possible meningitis cases to test the upper bound of the usefulness of an aggressive approach to testing or treating all highly febrile children. Finally, we excluded patients admitted to the hospital within 24 hours of the only primary care visit. We did this because we sought data on the outcomes of treatment of fever without a source to prevent sequelae of bacteremia, rather than on the accurate diagnosis and management of children who present to their primary care site with signs and symptoms of meningitis or sepsis.

The use of automated managed care data allows analysis of treatment patterns and outcomes in defined populations of children, and calculation of rates of both rare and common events. Ascertainment of the use of medical care services from office visits to hospitalizations is nearly complete, and the denominator of covered children can be calculated precisely based on registration data. Although using such cohorts differs from studying geographically defined populations, managed care systems are an important source of data for epidemiologic and health services research. The generalizability of conclusions from such work depends on the representativeness of the managed care population with regard to the broader community. Likewise, additional research is required to determine if the practices of clinicians in these settings reflect those of local peers practicing in other systems of care.

The practice guideline for febrile children published in *Pediatrics* in 1993¹⁰ was a consensus statement of recognized experts, but was not endorsed by the American Academy of Pediatrics or Red Book Committee. In the practices we studied, the majority of febrile children were diagnosed with a bacterial source and treated with an antibiotic; of those who fit the criteria for the guideline, 36% received recommended laboratory testing.

Strict adherence to the recommendations would have resulted in 1570 additional tests performed in our population. Whether a change in practice toward more aggressive screening for bacteremia is warranted remains an important question whose answer depends on the effectiveness, costs, and discomforts of testing and treatment, the morbidity and costs of meningitis and other serious infections, and the preferences of families. Further work on specific epidemiologic and clinical criteria for improved diagnosis of viral illness may identify a group of children at sufficiently low risk of bacteremia to obviate the need for further testing. In addition, clinical history including the height and duration of fever at home may be informative.

We support the continuing attempts to improve the management of children with fever in primary care settings based on the best available evidence. The benefits and potential disadvantages of increased screening and treatment of febrile episodes in primary care settings beyond the rates observed here are uncertain. However, it is unlikely that more aggressive management will substantially decrease population-based rates of meningitis or sepsis in this age group. Because meningitis and bacterial sepsis are rare, continued monitoring of management and outcomes in large, defined populations will be necessary to further refine guidelines for children with fever.

ACKNOWLEDGMENTS

This study was supported by the Harvard Pilgrim Health Care Foundation. Additional institutional support for this work was provided by the CVS Foundation.

We thank Gary Fleisher, MD, for his helpful comments on earlier drafts of this manuscript, and our colleague, Irina Miroshnik, for her contributions to this analysis.

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Pediatrics 2000;105:260

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