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Emergency Department Laboratory Evaluations of Fever Without Source in Children Aged 3 to 36 Months

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Emergency Department Laboratory Evaluations of Fever Without Source in Children Aged 3 to 36 Months

WHAT'S KNOWN ON THIS SUBJECT: Little is known about emergency department (ED) physicians' practice patterns in diagnostic testing of patients with fever without source (FWS) in the 3- to 36-month-old age group, particularly after introduction of the 7-valent pneumococcal conjugate vaccine.

WHAT THIS STUDY ADDS: In the majority of US ED visits for FWS among children aged 3 to 36 months, physicians ordered no tests (complete blood count, urinalysis, blood culture, radiographs, or rapid influenza). Physicians ordered a urinalysis in <50% of visits by girls with a temperature of ≥39°C.

abstract

OBJECTIVE: This article describes ordering of diagnostic tests, admission rates, and antibiotic administration among visits to US emergency departments (EDs) by children aged 3 to 36 months with fever without source (FWS).

METHODS: The 2006–2008 National Hospital Ambulatory Medical Care Survey–Emergency Department was used to identify visits by 3- to 36-month-old children with FWS. Percentages of visits that included a complete blood count (CBC), urinalysis, blood culture, radiograph, rapid influenza test, admission to hospital, and ceftriaxone and other antibiotic administration were calculated. Multivariate logistic regression was used to identify factors associated with ordering of a CBC and urinalysis.

RESULTS: No tests were ordered in 58.6% of visits for FWS. CBCs were ordered in 20.5% of visits and urinalysis in 17.4% of visits. Even among girls with a temperature of ≥39°C, urinalysis was ordered in only 40.2% of visits. Ceftriaxone was given in 7.1% and other antibiotics in 18.3% of visits; 5.2% of the children at these visits were admitted to the hospital. In multivariate analysis, increased temperature, being female, and higher median income of the patient's zip code were associated with increased odds of having a CBC and urinalysis ordered. Being 24 to 36 months of age was associated with lower odds of receiving both a CBC and a urinalysis.

CONCLUSIONS: Most US emergency department visits for FWS among children aged 3 to 36 months, physicians do not order diagnostic tests. Being female, having a higher fever, and higher median income of the patient's zip code were associated with ordering CBCs and urinalysis. *Pediatrics* 2011;128:e1368–e1375

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KEY WORDS

fever, clinical practice variation, emergency department

ABBREVIATIONS

ED—emergency department
FWS—fever without source
CBC—complete blood count
NHAMCS-ED—National Hospital Ambulatory Medical Care Survey–Emergency Department
MSA—metropolitan statistical area
PCV-7—7-valent pneumococcal conjugate vaccine
CI—confidence interval
OR—odds ratio
UTI—urinary tract infection

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Fever is a common reason for emergency department (ED) visits among children. Estimates of the percentage of ED visits among young children that are for a complaint of fever range from 10.5% to 25%.[1–5] Many children with fever present without an obvious source,[6] and a small percentage of them have serious, potentially life-threatening infections.[7–9] Appropriate management of children who present with a fever without source (FWS) has long been a topic of debate, particularly for the 3- to 36-month age group. Several studies have focused on the underlying rates of serious bacterial infections and the corresponding value of laboratory testing in those cases.[10–16]

Although many studies have aimed to understand optimal management, few have focused on actual physician management patterns of children with FWS. Studies have surveyed practitioners and asked (by using vignettes) how they would approach a child with FWS,[17–26] but physician report of practice preferences might not accurately reflect actual practice.[27–29]

For the 0- to 3-month age group, practice patterns have been described,[9] but for the 3- to 36-month age group, existing studies have been limited and conducted in a small number of EDs or physicians' offices.[6,30,31] To our knowledge, no US studies have examined actual practice patterns of ED physicians for patients with FWS in the 3- to 36-month age group.

With this study we aimed to describe US physicians' practice patterns with respect to ordering of a complete blood count (CBC), urinalysis, blood cultures, rapid influenza testing, and radiographs for children aged 3 to 36 months who present to the ED for FWS. We also assessed the use of ceftriaxone, other antibiotics, and admission to the hospital or observation unit for these patients. Although understanding the predictors of all permutations of testing and management strategies is beyond the scope of this article, we evaluate here the association of patient- and hospital-level factors with physician-ordered CBCs and urinalyses to begin to understand current ED management of FWS.

METHODS

We used data from the most recent available years of the National Hospital Ambulatory Medical Care Survey–Emergency Department (NHAMCS-ED) (2006–2008). The NHAMCS-ED is a national probability-sample survey conducted by the National Center for Health Statistics that estimates characteristics of in-person ED visits at nonfederal US hospitals. The NHAMCS-ED uses a 4-stage design that samples primary sampling units as the first stage, hospitals within primary sampling units as the second stage, emergency service areas within EDs as the third stage, and patient visits within emergency service areas as the final stage. Observations are weighted to create national estimates by using the reciprocals of sampling-selection probabilities and nonresponse adjustments. Data collection is conducted throughout the year, although from each hospital, visits are sampled during a 4-week period. Estimates based on $\geq$30 unweighted observations and with a relative standard error of $<$30% are considered reliable and nationally representative. This is the standard for reliability used by NHAMCS-ED and is similar to those for many national health surveys.[32,33] Details of the NHAMCS-ED survey and sampling design can be found elsewhere.[33,34] Response rates for the survey were 82.5% for 2006,[34] 79.5% for 2007,[35] and 86.7% for 2008.[36] Three data years were combined to increase the stability of national estimates.

Visits to the ED for FWS were identified by using reason-for-visit codes and *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) discharge diagnosis codes. Reason-for-visit codes classify a patient's complaints, symptoms, or other reasons for seeking care as stated in his or her own words.[35] In contrast, discharge diagnoses represent the physician's assessment of the patient's diagnosis. Visits were included in the analysis if the patient was between 3 and 36 months of age and either "fever" was a reason for the visit or the patient had a temperature of $\geq$38°C on presentation to the ED. Visits were excluded when an obvious source for the fever was mentioned, including sore throat, symptoms referable to ears, diarrhea, and urinary symptoms (dysuria). In addition, visits that had an ICD-9-CM code for a source of fever that would likely be diagnosed before ordering tests were excluded. These sources were acute otitis media, pneumonia, croup, bronchiolitis, cellulitis/abscess, group-A streptococcal pharyngitis, scarlet fever, herpangina, herpes simplex virus stomatitis, coxsackie virus, roseola, varicella, lymphadenitis, and sinusitis.

Among visits for children with FWS, rates of CBCs, urinalyses, blood cultures, rapid influenza tests, radiographs, admission to hospital or observation unit, use of ceftriaxone, and use of other antibiotics were estimated for all children aged 3 to 36 months, boys aged 3 to 36 months, girls aged 3 to 36 months, and all children aged 3 to 11 months. Data on blood cultures and rapid influenza tests were only collected in 2007 and 2008, so percentages of visits from which these tests occurred were calculated across these 2 years only, as were percentages for "no testing." Data on urine cultures were not available in the NHAMCS-ED. Separate esti-

mates were made for patients with a measured temperature (rather than parent report) of ≥39°C, because we hypothesized that this sign would be a major factor in decision-making regarding testing. Ordering of each test and admission to the hospital or observation unit were ascertained by check-boxes from the NHAMCS-ED abstraction form. Antibiotics given or prescribed at discharge were also collected from the NHAMCS-ED abstraction form, which enabled determination of whether ceftriaxone or any other antibiotics were used.

Because tests are not ordered in isolation, we also calculated the rates for 4 groups: (1) no CBC or urinalysis ordered; (2) only CBC ordered; (3) only urinalysis ordered; and (4) both CBC and urinalysis ordered. We also estimated "any CBC" and "any urinalysis," which reflect the rates of each test regardless of whether the other was ordered.

Comparisons of rates of ordering a CBC or urinalysis, or any of the combinations of them between groups (temperature groups or according to gender), were conducted by using a χ^2 test. Within the same group, differences in the proportion of visits with different combinations of tests (CBC only, urinalysis only, CBC and urinalysis) were tested by using a Wald test of proportions. The rate of "any CBC" and "any urinalysis" within the same group could not be directly compared because the groups were not mutually exclusive.

Multivariate logistic regression was used to examine factors that might be independently related to whether "any CBC" was ordered. A separate model was considered by using "any urinalysis" as the dependent variable. Because of the importance of gender in the determination of whether a urinalysis is indicated, we also modeled "any urinalysis" among girls aged 3 to 36 months. Independent variables considered for each analysis included age, gender, race/ethnicity, median income of the patient's zip code of residence, temperature on presentation to the ED, region, expected source of payment, hospital metropolitan statistical area (MSA) status, teaching-hospital status, ED volume, quarter of the year, and receipt of care in an ED of a freestanding pediatric hospital or a separate pediatric ED versus receipt of care in an adult or general ED. Also, we examined the percentage of children aged 19 to 35 months in the state who received 4 doses of the 7-valent pneumococcal conjugate vaccine (PCV-7) by using state data from the National Immunization Survey from the Centers for Disease Control and Prevention for the years 2006–2008.[37] Race and ethnicity were imputed when data were missing (25.2% of the visits),[34] and missing categories were created for other missing data, although results for missing categories are not reported.

To create comparable models, variables that were significant in bivariate analysis ($P < .05$) for either CBC or urinalysis were selected for inclusion in both adjusted models after assessing potential collinearity of ordinal variables with polychoric correlation. On the basis of these criteria, both models included gender, median income of the patient's zip code, temperature in ED, ED volume, age, quarter of year during which the visit occurred, and race/ethnicity. We also conducted sensitivity analyses that excluded visits in which the patient was admitted to the hospital or observation unit, because admission could be an indicator that the child was not well-appearing.

All analyses were conducted by using Stata 11.0 (Stata Corp, College Station, TX), taking into account the sample weights and complex survey design. Statistical tests with a P value of $<.05$ are considered statistically significant, with no adjustment for multiple comparisons.

RESULTS

FWS accounted for 21.6% (95% confidence interval [95% CI]: 20.2–23.0) of visits among children aged 3 to 36 months during 2006–2008: ~1 724 000 visits per year (95% CI: 1 502 000–1 946 000). Patient and hospital characteristics of these visits are listed in Table 1.

No tests (CBC, urinalysis, blood culture, radiograph, rapid influenza test) were ordered in 58.6% of the visits. Testing varied, as expected, according to temperature: no tests were ordered in 63.7% of the visits when temperature was <39°C or in 46.5% when temperature was ≥39°C ($P < .001$) (Table 2). No tests were ordered in 51.2% of visits by girls and 64.9% of visits by boys ($P < .001$). Differences according to gender were significant for visits with a temperature of <39°C ($P < .001$) but not for those at ≥39°C ($P > .05$). Neither a CBC nor urinalysis was ordered in 72% of the visits. Overall, a higher percentage of boys than girls received neither test ($P < .001$); also, boys had a higher percentage among both visits with temperatures of <39°C ($P < .001$) and temperatures of ≥39°C ($P < .01$).

Overall, a CBC was ordered in 20.5% of visits for FWS, in 17.3% among those with a temperature of <39°C, and 28.1% among those with a temperature of ≥39°C ($P < .001$) (Table 2). Urinalysis was ordered in 17.4% of the visits, in 13.7% among those with a temperature of <39°C, and in 26.4% among those with a temperature of ≥39°C ($P < .001$). The rates of urinalysis only, CBC only, and both CBC and urinalysis were not significantly different from one another overall or in the temperature subgroups.

As expected, rates of urinalysis were higher in visits by girls than in visits by boys (25.5% vs 10.4%), and this differ-

TABLE 1 Characteristics of Visits Among Children Aged 3 to 36 Months Presenting to a US ED With FWS: 2006–2008 NHAMCS-ED

Characteristic	
Total, *N*	1600
Age, *n* (% [95% CI])	
3–11 mo	601 (37.7 [34.7–40.7])
12–23 mo	619 (39.2 [36.4–42.0])
24–36 mo	380 (23.2 [20.4–26.2])
Gender, *n* (% [95% CI])	
Male	857 (53.4 [49.9–56.9])
Female	743 (46.6 [43.1–50.1])
Race/ethnicity, *n* (% [95% CI])	
White non-Hispanic	621 (44.6 [39.6–49.8])
Black non-Hispanic	413 (25.5 [21.4–30.1])
Hispanic	437 (24.1 [20.4–28.3])
Asian	68 (3.2 [2.1–4.8])
Other	61 (2.6 [1.7–3.8])
Quartile of median income of patient's zip code , *n* (% [95% CI])	
Lowest (poorest) quartile	545 (33.3 [28.9–38.0])
Second	398 (25.8 [22.6–29.3])
Third	314 (21.8 [18.4–25.7])
Highest quartile	262 (14.4 [11.8–17.5])
Missing	81 (4.6 [3.0–7.0])
Temperature on presentation to ED, *n* (% [95% CI])	
<38.0°C	546 (33.0 [29.0–37.3])
≥38.0°C to ≤38.9°C	539 (33.6 [30.6–36.8])
≥39.0°C to ≤39.9°C	353 (21.5 [19.1–24.1])
≥40.0°C	111 (8.0 [6.5–9.9])
Missing	51 (3.9 [2.5–6.1])
Region, *n* (% [95% CI])	
Northeast	313 (14.9 [12.0–18.4])
Midwest	285 (17.1 [12.2–23.3])
South	655 (48.0 [41.5–54.7])
West	347 (19.9 [15.4–25.4])
Expected source of payment, *n* (% [95% CI])	
Private insurance	389 (25.5 [21.8–29.6])
Medicaid/SCHIP	963 (54.7 [50.1–59.3])
Self-pay	116 (9.0 [7.2–11.1])
No charge/charity/Medicare/other	37 (3.3 [2.0–5.3])
Unknown	95 (7.6 [4.2–13.3])
Hospital metropolitan status, *n* (% [95% CI])	
MSA	1437 (83.3 [78.1–87.5])
Non-MSA	163 (16.7 [12.5–21.9])
Hospital type, *n* (% [95% CI])	
Teaching	489 (20.6 [15.7–26.4])
Nonteaching	1096 (78.8 [73.0–83.6])
Missing	15[a]
ED visit volume, *n* (% [95% CI])	
≤30 000 per y	403 (31.0 [24.1–38.8])
30 001–50 000 per y	444 (23.5 [18.7–29.1])
50 001–70 000 per y	331 (22.0 [16.1–29.2])
≥70 000 per y	361 (20.6 [15.9–26.2])
Data missing	61[a]
Pediatric ED, *n* (% [95% CI])	
No	976 (73.4 [65.3–80.2])
Yes	624 (26.6 [19.8–34.7])
Quarter of year, *n* (% [95% CI])	
January to March	496 (36.4 [30.3–42.9])
April to June	352 (21.8 [17.5–26.7])
July to September	315 (17.2 [13.4–21.8])
October to December	437 (24.6 [19.7–30.3])
Characteristics with continuous values	
Median income of patient's zip code, *n*; mean (95% CI), $	1519; 40 041 (38 680–41 402)
Children aged 19–35 mo who received 4 doses of PCV-7, *n*; mean (95% CI), %	1600; 74.6 (73.8–75.4)

SCHIP indicates State Children's Health Insurance Program.

[a] Unreliable because cell size is <30 or the relative SE is >30%.

ence persisted in visits by children with a temperature of ≥39°C (40.2% vs 15.0%) or <39°C (19.6% vs 8.4%) ($P <$ .001 for all comparisons). Visits by girls also had a higher rate of CBCs ordered than visits by boys (23.5% vs 17.9%; $P <$ .05), but this difference was only significant in the group of those with a temperature of <39°C (20.7% vs 14.3%; $P <$ .05).

Approximately 5% of visits for FWS resulted in hospital or observation-unit admission. The percentage of visits in which a blood culture was ordered was 8.5% overall and statistically similar between the 2 temperature groups. Ceftriaxone was given in 7.1% of the visits and given more often in visits by children with a temperature of ≥39°C ($P <$ .01). Antibiotics other than ceftriaxone were given in 18.3% of the visits, and the rate was not statistically different between the 2 temperature groups ($P >$ .05). In addition, antibiotics were given in 20.0% (95% CI: 15.0–25.0) of cases in which no testing was conducted. Radiographs were ordered in 23.9% of the visits and more often during visits by children with a higher temperature ($P <$ .01).

In multivariate analysis (Table 3), visits by children with a temperature of 39°C to 39.9°C and ≥40°C had significantly higher odds of having a urinalysis ordered than visits by those with a temperature of <38°C (odds ratio [OR]: 2.09 and 5.18, respectively; $P <$ .01 for both). This was also true in the model for CBCs as well (OR: 1.84 [$P <$ .05] and 2.81 [$P <$ .01], respectively). The odds of have a urinalysis and a CBC ordered were both significantly higher in girls than in boys (OR: 3.27 [$P <$ .01] and 1.45 [$P <$ .05]). Visits by children aged 24 to 36 months were less likely to have urinalysis ordered and less likely to have a CBC ordered than visits by children aged 3 to 11 months (OR: 0.55 [$P <$ .01] and 0.59 [$P <$ .05], respectively). Results for a urinalysis model

TABLE 2 ED Visits With Diagnostic Testing, Admission to Hospital or Observation Unit, and Receipt of Antibiotics Among 3- to 36-Month-Old Children With FWS, According to Gender, Age Group, and Temperature: 2006–2008 NHAMCS-ED

	All Temperatures, % (95% CI)	Temperature < 39, % (95% CI)	Temperature ≥ 39, % (95% CI)
All			
No CBC or urinalysis	72.0 (68.5–75.3)	76.5 (72.6–79.9)	61.3 (54.8–67.5)
CBC only	10.6 (8.4–13.3)	9.9 (7.7–12.7)	12.3 (7.9–18.7)
Urinalysis only	7.5 (5.9–9.6)	6.3 (4.6–8.4)	10.6 (7.3–15.0)
CBC and urinalysis	9.9 (8.2–12.0)	7.4 (5.7–9.6)	15.9 (12.1–20.5)
Any CBC	20.5 (17.6–23.7)	17.3 (14.4–20.6)	28.1 (22.4–34.6)
Any urinalysis	17.4 (15.0–20.2)	13.7 (11.3–16.5)	26.4 (21.4–32.1)
Blood culture[a]	8.5 (6.0–11.8)	7.0 (4.7–10.5)	11.9 (7.4–18.6)
Rapid influenza test[a]	9.1 (5.7–14.3)	7.6 (4.4–12.6)	[b]
Radiograph	23.9 (20.7–27.4)	21.6 (18.2–25.5)	29.4 (24.3–35.0)
Ceftriaxone	7.1 (5.7–8.8)	5.5 (3.8–7.8)	10.9 (8.1–14.7)
Other antibiotics	18.3 (16.0–20.9)	18.6 (15.6–22.0)	17.6 (13.2–23.1)
Admitted to hospital or observation unit	5.2 (3.8–7.0)	5.14 (3.6–7.4)	[b]
No testing[a,c]	58.6 (54.0–63.2)	63.7 (58.1–69.2)	46.5 (40.0–53.0)
All girls			
No CBC or urinalysis	64.3 (59.8–68.7)	69.3 (63.7–74.4)	51.9 (42.9–60.9)
CBC only	10.2 (7.8–13.2)	11.1 (8.1–15.2)	[b]
Urinalysis only	12.2 (9.4–15.8)	10.0 (7.2–13.9)	17.6 (11.7–25.8)
CBC and urinalysis	13.3 (10.4–16.8)	9.5 (6.9–13.0)	22.6 (16.0–31.0)
Any CBC	23.5 (20.0–27.3)	20.7 (16.7–25.3)	30.4 (22.6–39.5)
Any urinalysis	25.5 (21.5–29.8)	19.6 (15.7–24.1)	40.2 (31.7–49.4)
Blood culture[a]	10.5 (7.4–14.8)	[b]	[b]
Rapid influenza test[a]	[b]	[b]	[b]
Radiograph	24.7 (20.5–29.5)	23.7 (18.9–29.3)	27.2 (19.7–36.3)
Ceftriaxone	8.7 (6.4–11.8)	[b]	13.7 (9.1–20.2)
Other antibiotics	19.6 (16.2–23.5)	19.6 (15.7–24.2)	19.6 (13.4–27.9)
Admitted to hospital or observation unit	4.8 (3.2–7.1)	5.2 (3.1–8.7)	[b]
No testing[a,c]	51.2 (45.8–56.5)	55.0 (47.7–62.1)	41.0 (31.7–51.0)
All boys			
No CBC or urinalysis	78.7 (74.1–82.7)	82.8 (78.2–86.7)	69.1 (59.3–77.4)
CBC only	10.9 (7.8–15.0)	8.8 (5.9–12.7)	15.9 (9.1–26.3)
Urinalysis only	3.4 (2.2–5.2)	[b]	[b]
CBC and urinalysis	7.0 (5.1–9.5)	5.5 (3.6–8.5)	[b]
Any CBC	17.9 (14.2–22.4)	14.3 (10.7–18.9)	26.2 (18.4–35.9)
Any urinalysis	10.4 (8.1–13.4)	8.4 (6.0–11.7)	15.0 (10.3–21.4)
Blood culture[a]	6.8 (4.1–10.9)	[b]	[b]
Rapid Influenza test[a]	7.6 (4.7–12.0)	[b]	[b]
Radiograph	23.2 (19.2–27.8)	19.7 (15.6–24.7)	31.2 (24.3–38.9)
Ceftriaxone	5.7 (4.2–7.8)	[b]	[b]
Other antibiotics	17.2 (14.1–20.7)	17.7 (13.8–22.4)	15.9 (10.2–24.2)
Admitted to hospital or observation unit	5.5 (3.7–8.2)	5.1 (3.2–8.0)	[b]
No testing[a,c]	64.9 (58.8–70.6)	71.3 (64.5–77.2)	50.7 (41.1–60.2)
All 3- to 11-mo-olds			
No CBC or urinalysis	69.2 (63.5–74.3)	74.1 (68.0–79.4)	56.1 (44.4–67.2)
CBC only	10.8 (7.8–14.7)	11.4 (7.8–16.4)	[b]
Urinalysis only	8.0 (5.4–11.7)	[b]	[b]
CBC and urinalysis	12.1 (9.0–16.0)	8.6 (6.0–12.2)	21.2 (14.1–30.7)
Any CBC	22.9 (18.6–27.8)	20.1 (15.5–25.6)	30.3 (21.5–40.9)
Any urinalysis	20.0 (15.8–25.1)	14.5 (10.8–19.3)	34.8 (24.9–46.1)
Blood culture[a]	11.1 (7.1–16.7)	[b]	[b]
Rapid influenza test[a]	[b]	[b]	[b]
Radiograph	25.1 (20.1–30.9)	21.6 (16.9–27.3)	34.3 (25.1–44.9)
Ceftriaxone	7.2 (4.8–10.7)	[b]	[b]
Other antibiotics	15.8 (12.6–19.7)	17.2 (13.2–22.2)	[b]
Admitted to hospital or observation unit	[b]	[b]	[b]
No testing[a,c]	55.1 (47.9–62.1)	60.6 (52.9–67.9)	40.8 (28.5–54.3)

[a] Estimates are based on data from 2007 and 2008 only ($n = 986$ for 2 years of data).

[b] Values based on <30 observations or that have a relative SE of >30% were omitted because of lack of reliability.

[c] "No testing" indicates that no CBC, urinalysis, blood culture, radiograph, or rapid influenza test was conducted.

in girls only were similar to those of the model with all children adjusted for gender. ED volume was not a significant predictor of having a CBC ordered. For having a urinalysis ordered, however, EDs that had 30 001 to 50 000 annual visits and those that had >70 000 annual visits had increased odds of ordering urinalysis compared with those that had <30 000 annual visits (OR: 2.00 and 2.05, respectively; $P < .05$ for both). Compared with visits in January through March, visits in October through December had lower odds of having a CBC ordered (OR: 0.59; $P < .05$), and visits in July through September had higher odds of having a urinalysis ordered (OR: 2.28; $P < .01$). Median income of the patient's zip code was statistically significant in both models (OR: 1.17 per $10 000 increase [$P < .05$] for CBC; OR: 1.12 [$P < .05$] for urinalysis; $10 000 corresponds to approximately one-half the difference between the 25th and 75th percentiles of median income of zip code in the data). Race/ethnicity was not a significant predictor in either multivariate model. Sensitivity models that excluded visits in which a patient was admitted were largely similar to the main models.

DISCUSSION

As the epidemiology of serious bacterial infection has changed over time because of the introduction of the *Haemophilus influenza* type b conjugate vaccine and the PCV-7 vaccine,[7,38–40] the guidance for physicians regarding the clinical management of children with FWS in the 3- to 36-month age group has changed as well.[5] Recommendations initially published by Baraff et al[5] in 1993 were revised in 2000 and 2003, and the latter recommendation was endorsed by the American College of Emergency Physicians (ACEP).[10,41] A more recent revision in 2008 has been published but not endorsed by the ACEP.[42] The 2008 Baraff et al[42] recom-

TABLE 3 Multivariate Results: CBC and Urinalysis Use in ED Visits of Children Aged 3 to 36 Months With FWS: 2006–2008 NHAMCS-ED

Variable	Any CBC, OR (95% CI)	Any Urinalysis, OR (95% CI)
Temperature on presentation to ED		
<38.0°C	Reference	Reference
≥38.0° to ≤38.9°C	1.44 (0.91–2.29)	1.24 (0.76–2.01)
≥39.0° to ≤39.9°C	1.84 (1.14–2.98)[a]	2.09 (1.28–3.42)[b]
≥40.0°C	2.81 (1.50–5.23)[b]	5.18 (2.75–9.76)[b]
Gender		
Male	Reference	Reference
Female	1.45 (1.06–1.97)[a]	3.27 (2.28–4.69)[b]
Race/ethnicity		
Non-Hispanic white	Reference	Reference
Non-Hispanic black	0.66 (0.41–1.08)	0.79 (0.50–1.25)
Hispanic	0.67 (0.44–1.04)	1.00 (0.64–1.55)
Asian	0.52 (0.21–1.27)	0.48 (0.20–1.17)
Median income of patient's zip code (per $10 000)	1.17 (1.02–1.33)[a]	1.12 (1.00–1.24)[a]
Quarter of year		
January to March	Reference	Reference
April to June	0.80 (0.46–1.37)	1.06 (0.60–1.86)
July to September	0.87 (0.54–1.41)	2.28 (1.48–3.51)[b]
October to December	0.59 (0.37–0.94)[a]	0.94 (0.60–1.47)
ED volume		
<30 000 per y	Reference	Reference
30 001–50 000 per y	1.20 (0.74–1.95)	2.00 (1.15–3.48)[a]
50 001–70 000 per y	1.25 (0.72–2.15)	1.60 (0.89–2.87)
>70 000 per y	1.27 (0.71–2.26)	2.05 (1.09–3.83)[a]
Age		
3–11 mo	Reference	Reference
12–23 mo	0.81 (0.56–1.15)	0.82 (0.54–1.24)
24–36 mo	0.59 (0.37–0.95)[a]	0.55 (0.36–0.85)[b]

[a] $P < .05$.
[b] $P < .01$.

mendations, which accounted for introduction of the *H influenza* type b and PCV vaccines, suggest that, among well-appearing, fully vaccinated children older than 90 days with an FWS of >39°C, a CBC is not necessary, but a urinalysis and urine culture should be obtained for girls younger than 2 years, uncircumcised boys younger than 2 years, and circumcised boys younger than 6 months.[42]

The American Academy of Pediatrics has not endorsed guidelines for FWS in general but recently updated its 1999 guidelines concerning urinary tract infection (UTI). The 1999 guidelines suggested that all children aged 2 to 24 months with FWS receive a urinalysis or urine culture.[43] The updated 2011 guidelines provided an algorithm for understanding the risk of UTI in children aged 2 to 24 months with FWS that was based on clinical and demographic characteristics but stated that each physician's threshold for testing for UTI should be based on factors such as his or her confidence that contact with the family will be maintained and his or her comfort with diagnostic uncertainty.[44]

NHAMCS data do not include enough information to make direct comparisons with either the Baraff et al recommendations or the 2011 AAP guidelines for UTI. The data do not include vaccination status, circumcision status, duration of fever, whether the child was well-appearing, or information on urine cultures. However, with these caveats in mind, urinalysis was ordered for only 43.3% (95% CI: 34.1–52.9) of girls between 3 and 24 months of age with an FWS of ≥39°C, whereas Baraff et al would recommend that all of them receive one. Similarly, among visits by a group of children with FWS who would be considered high risk according to the AAP guidelines (non-Hispanic white girls aged 3–24 months with a temperature of ≥39°C), only 35.7% (95% CI: 23.4–50.3) had a urinalysis ordered. Baraff et al also suggested that no CBC or blood culture be ordered for well-appearing boys or girls in the 3- to 24-month age range. In contrast, we have estimated that 22.3% (95% CI: 19.0–26.1) of children aged 3 to 24 months with an FWS have a CBC ordered and 9.3% (95% CI: 6.5–13.1) have a blood culture ordered. Even given our incomplete clinical picture, it seems that urinalysis in girls might be underused according to both the AAP and Baraff et al recommendations, whereas CBCs and blood cultures for all children might be overused according to the Baraff et al recommendations.

Most children who present with FWS do not receive any diagnostic testing, which indicates that physicians are opting to forego testing in favor of history and clinical examination in this era of PCV and *H influenza* type b vaccinations. However, antibiotics (ceftriaxone or another antibiotic) were prescribed in ~25% of visits, including 20% of visits in which no testing was conducted, despite the patients having no apparent common clinical diagnoses that require antibiotics. This result is consistent with previous findings that antibiotics are often inappropriately prescribed for upper respiratory infections.[45,46]

When testing was conducted, the rate of having only a CBC ordered was not statistically different from that of receiving only a urinalysis or both tests, and this was true for all children and for girls alone. Given that rates of UTI might be as much as 20-fold higher than rates of bacteremia in the post–PCV-7 era,[47] physi-

cians' practice patterns seem inconsistent with the epidemiology of serious bacterial infections. That is, one might expect that given the relative commonality of UTI as a source of FWS compared with bacteremia, urinalysis would be more common than use of a CBC, but that was not observed in these data. Also, although the finding that visits by girls were more likely to result in a urinalysis being ordered was expected; that visits by girls were more likely to results in a CBC being ordered was not.

Finally, we hypothesized that individual patient, geographic, seasonal, or hospital characteristics might influence the probability of testing. It is most notable that patients from zip codes with higher median incomes had higher odds of having a CBC ordered and of having a urinalysis ordered. Future research could explore this effect further to determine whether it might be because of patient-level characteristics such as unmeasured patient severity or practice differences at hospitals that serve more affluent populations. In all models, including sensitivity analyses, teaching-hospital status, hospital MSA versus non-MSA status, expected source of payment, percentage of children aged 19 to 35 months within the state who had had 4 PCV-7 vaccines, and pediatric ED status were not significant predictors of testing.

This study has several limitations. First, some important variables were not available, including urine cultures, vaccination status, clinical presentation, duration of fever, and circumcision. Second, identification of sources for fever was limited to common sources that are apparent before diagnostic testing, but others certainly exist. Third, we did not attempt to identify patients who were immunocompromised, which could have influenced testing, although the number of such cases is likely to have been small.

CONCLUSIONS

Overall, we found that in the majority of US ED visits for FWS among children aged 3 to 36 months, physicians order no tests (CBC, urinalysis, blood culture, radiographs, or rapid influenza test). However, antibiotics are still used with some frequency, including 20% of visits for FWS in which no testing was conducted, which indicates potential overuse of antibiotics. Physicians ordered a urinalysis in fewer than half of the visits by girls with a temperature of ≥39°C, which indicates underuse of urinalysis, at least among some groups at higher risk of UTI. Girls and boys with higher temperatures were more likely to receive a CBC and to receive a urinalysis, although girls were more likely than boys to receive CBCs and urinalyses. Finally, higher zip-code–level median income was associated with more testing.

REFERENCES

1. Massin MM, Montesanti J, Gerard P, Lepage P. Spectrum and frequency of illness presenting to a pediatric emergency department. *Acta Clin Belg*. 2006;61(4):161–165
2. Nelson DS, Walsh K, Fleisher GR. Spectrum and frequency of pediatric illness presenting to a general community hospital emergency department. *Pediatrics*. 1992;90(1 pt 1):5–10
3. Krauss BS, Harakal T, Fleisher GR. The spectrum and frequency of illness presenting to a pediatric emergency department. *Pediatr Emerg Care*. 1991;7(2):67–71
4. Machado BM, Cardoso DM, de Paulis M, Escobar AM, Gilio AE. Fever without source: evaluation of a guideline [in Portuguese]. *J Pediatr (Rio J)*. 2009;85(5):426–432
5. Baraff LJ, Bass JW, Fleisher GR, et al. Practice guideline for the management of infants and children 0 to 36 months of age with fever without source. Agency for Health Care Policy and Research [published correction appears in *Ann Emerg Med*. 1993;22(9):1490]. *Ann Emerg Med*. 1993;22(7):1198–1210
6. Finkelstein JA, Christiansen CL, Platt R. Fever in pediatric primary care: occurrence, management, and outcomes. *Pediatrics*. 2000;105(1 pt 3):260–266
7. Sard B, Bailey MC, Vinci R. An analysis of pediatric blood cultures in the postpneumococcal conjugate vaccine era in a community hospital emergency department. *Pediatr Emerg Care*. 2006;22(5):295–300
8. Herz AM, Greenhow TL, Alcantara J, et al. Changing epidemiology of outpatient bacteremia in 3- to 36-month-old children after the introduction of the heptavalent-conjugated pneumococcal vaccine. *Pediatr Infect Dis J*. 2006;25(4):293–300
9. Pantell RH, Newman TB, Bernzweig J, et al. Management and outcomes of care of fever in early infancy. *JAMA*. 2004;291(10):1203–1212
10. Baraff LJ. Management of fever without source in infants and children. *Ann Emerg Med*. 2000;36(6):602–614
11. Bauchner H, Philipp B, Dashefsky B, Klein JO. Prevalence of bacteriuria in febrile children. *Pediatr Infect Dis J*. 1987;6(3):239–242
12. Shaw KN, Gorelick M, McGowan KL, Yakscoe NM, Schwartz JS. Prevalence of urinary tract infection in febrile young children in the emergency department. *Pediatrics*. 1998;102(2). Available at: www.pediatrics.org/cgi/content/full/102/2/e16
13. Teele DW, Pelton SI, Grant MJ, et al. Bacteremia in febrile children under 2 years of age: results of cultures of blood of 600 consecutive febrile children seen in a "walk-in" clinic. *J Pediatr*. 1975;87(2):227–230
14. McGowan JE Jr, Bratton L, Klein JO, Finland M. Bacteremia in febrile children seen in a "walk-in" pediatric clinic. *N Engl J Med*. 1973;288(25):1309–1312
15. Isaacman DJ, Shults J, Gross TK, Davis PH, Harper M. Predictors of bacteremia in febrile children 3 to 36 months of age. *Pediatrics*. 2000;106(5):977–982
16. Alpern ER, Alessandrini EA, Bell LM, Shaw KN, McGowan KL. Occult bacteremia from a pediatric emergency department: current prevalence, time to detection, and outcome. *Pediatrics*. 2000;106(3):505–511
17. Wittler RR, Cain KK, Bass JW. A survey about management of febrile children without source by primary care physicians. *Pediatr Infect Dis J*. 1998;17(4):271–277; discussion 277–279
18. Zerr DM, Del Beccaro MA, Cummings P. Predictors of physician compliance with a published guideline on management of febrile infants. *Pediatr Infect Dis J*. 1999;18(3):232–238
19. Young PC. The management of febrile in-

fants by primary-care pediatricians in Utah: comparison with published practice guidelines. *Pediatrics*. 1995;95(5):623–627

20. Ros SP, Herman BE, Beissel TJ. Occult bacteremia: is there a standard of care? *Pediatr Emerg Care*. 1994;10(5):264–267
21. Gabriel ME, Aiuto L, Kohn N, Barone SR. Management of febrile children in the conjugate pneumococcal vaccine era. *Clin Pediatr (Phila)*. 2004;43(1):75–82
22. Lee KC, Finkelstein JA, Miroshnik IL, et al. Pediatricians' self-reported clinical practices and adherence to national immunization guidelines after the introduction of pneumococcal conjugate vaccine. *Arch Pediatr Adolesc Med*. 2004;158(7):695–701
23. Chiappini E, Galli L, Bonsignori F, Venturini E, Principi N, de Martino M. Self-reported pediatricians' management of the well-appearing young child with fever without a source: first survey in an European country in the anti-pneumococcal vaccine era. *BMC Public Health*. 2009;9:300
24. Belfer RA, Gittelman MA, Muniz AE. Management of febrile infants and children by pediatric emergency medicine and emergency medicine: comparison with practice guidelines. *Pediatr Emerg Care*. 2001;17(2):83–87
25. Jones RG, Bass JW. Febrile children with no focus of infection: a survey of their management by primary care physicians. *Pediatr Infect Dis J*. 1993;12(3):179–183
26. Baraff LJ. Management of the febrile child: a survey of pediatric and emergency medicine residency directors. *Pediatr Infect Dis J*. 1991;10(11):795–800
27. Weingarten S, Stone E, Hayward R, et al. The adoption of preventive care practice guidelines by primary care physicians: do actions match intentions? *J Gen Intern Med*. 1995;10(3):138–144
28. Lawler FH, Viviani N. Patient and physician perspectives regarding treatment of diabetes: compliance with practice guidelines. *J Fam Pract*. 1997;44(4):369–373
29. Woo B, Cook EF, Weisberg M, Goldman L. Screening procedures in the asymptomatic adult. Comparison of physicians' recommendations, patients' desires, published guidelines, and actual practice. *JAMA*. 1985;254(11):1480–1484
30. Isaacman DJ, Kaminer K, Veligeti H, Jones M, Davis P, Mason JD. Comparative practice patterns of emergency medicine physicians and pediatric emergency medicine physicians managing fever in young children. *Pediatrics*. 2001;108(2):354–358
31. Leduc DG, Pless IB. Pediatricians and general practitioners: a comparison of the management of children with febrile illness. *Pediatrics*. 1982;70(4):511–515
32. National Center for Health Statistics. Health, United States 2010: with special feature on death and dying. Report No. 2011-1232. Available at: www.ncbi.nlm.nih.gov/books/NBK54381. Accessed October 26, 2011
33. Niska R, Bhuiya F, Xu J. National Hospital Ambulatory Medical Care Survey: 2007 emergency department summary. *Natl Health Stat Rep*. 2010:6(26):1–32
34. Pitts SR, Niska RW, Xu J, Burt CW. National Hospital Ambulatory Medical Care Survey: 2006 emergency department summary. *Natl Health Stat Rep*. 2008;(7):1–38
35. 2007 NHAMCS micro-data file documentation. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHAMCS/doc07.pdf. Accessed July 21, 2010
36. 2008 NHAMCS micro-data file documentation. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHAMCS/doc08.pdf. Accessed April 12, 2011
37. US Vaccination Coverage Reported by NIS (National Immunization Survey). www.cdc.gov/vaccines/stats-surv/nis/default.htm#nis. Accessed 04/01/2011, 2011
38. Carstairs KL, Tanen DA, Johnson AS, Kailes SB, Riffenburgh RH. Pneumococcal bacteremia in febrile infants presenting to the emergency department before and after the introduction of the heptavalent pneumococcal vaccine. *Ann Emerg Med*. 2007;49(6):772–777
39. Lee GM, Harper MB. Risk of bacteremia for febrile young children in the post-*Haemophilus influenzae* type b era. *Arch Pediatr Adolesc Med*. 1998;152(7):624–628
40. Wilkinson M, Bulloch B, Smith M. Prevalence of occult bacteremia in children aged 3 to 36 months presenting to the emergency department with fever in the postpneumococcal conjugate vaccine era. *Acad Emerg Med*. 2009;16(3):220–225
41. Baraff LJ. Editorial: clinical policy for children younger than three years presenting to the emergency department with fever. *Ann Emerg Med*. 2003;42(4):546–549
42. Baraff LJ. Management of infants and young children with fever without source. *Pediatr Ann*. 2008;37(10):673–679
43. American Academy of Pediatrics, Committee on Quality Improvement, Subcommittee on Urinary Tract Infection. Practice parameter: the diagnosis, treatment, and evaluation of the initial urinary tract infection in febrile infants and young children [published corrections appear in *Pediatrics*. 1999;103(5 pt 1):1052 and *Pediatrics*. 1999;104(1 pt 1):118]. *Pediatrics*. 1999;103(4 pt 1):843–852
44. American Academy of Pediatrics, Subcommittee on Urinary Tract Infection, Steering Committee on Quality Improvement and Management. Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. *Pediatrics*. 2011; In press
45. Nash DR, Harman J, Wald ER, Kelleher KJ. Antibiotic prescribing by primary care physicians for children with upper respiratory tract infections. *Arch Pediatr Adolesc Med*. 2002;156(11):1114–1119
46. McCaig LF, Besser RE, Hughes JM. Trends in antimicrobial prescribing rates for children and adolescents. *JAMA*. 2002;287(23):3096–3102
47. Waddle E, Jhaveri R. Outcomes of febrile children without localising signs after pneumococcal conjugate vaccine. *Arch Dis Child*. 2009;94(2):144–147

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