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Impact of a Mobile Device-Based Clinical Decision Support Tool on Guideline Adherence and Mental Workload Among Trainee and Attending Physicians

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CMH Research Days
May 16, 2019



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Disclosures

- I have no disclosures.

Background

- Serious bacterial infection (SBI) occurs in 8-12% of febrile infants <90 days of age
- Different risk stratification criteria have led to wide variation in evaluation of febrile infants with suspected SBI
- Clinical practice guidelines (CPGs) can help standardize care of febrile infants

Aronson et. al. *Pediatrics* 2014.

Pantell et. al. *JAMA* 2004.

Aronson et. al. *Pediatr Emerg Med Pract* 2013.

Background

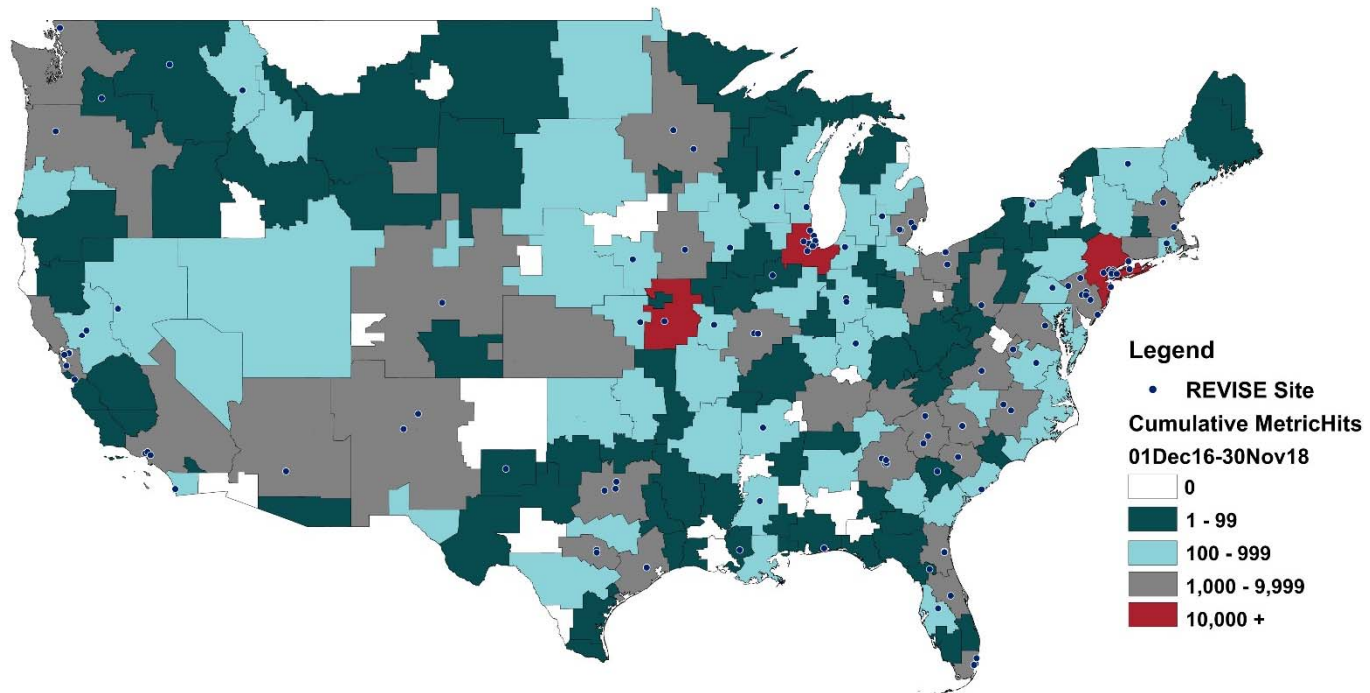
- Electronic clinical decision support tools (ECDS) can effectively disseminate CPGs
- ECDS tools can be helpful in many settings
- No formal evaluation of the efficacy of ECDS tools exists and very little evaluation comparing attending and trainee physicians

McCulloh and Alverson. *Pediatrics* 2012.
Denson P. *Trans Am Clin Climatol Assoc* 2011.
Cortez et. al. *NEJM* 2014.

Background

- Children's Mercy Kansas City released a free mobile application for managing febrile infants: PedsGuide™ (formerly CMPeDS)
- Released November 9, 2016
- December 1, 2016- March 2019
 - Used in 64 countries
 - Sessions: 95,000

Map of PedsGuide Sessions



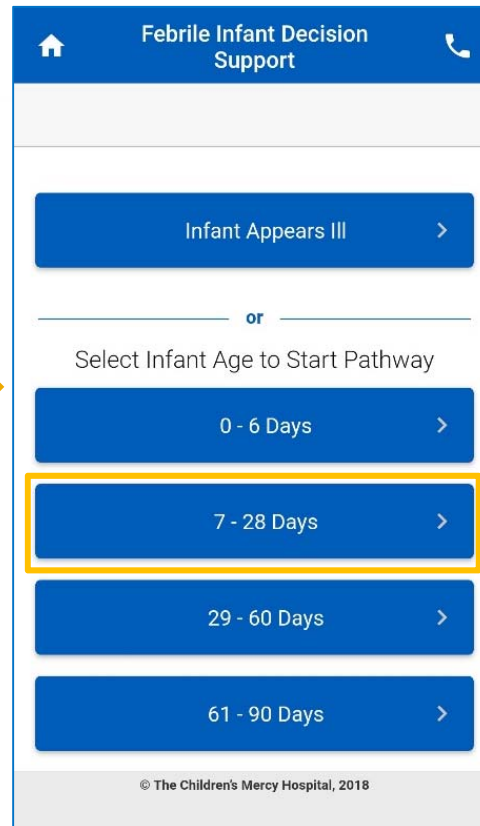
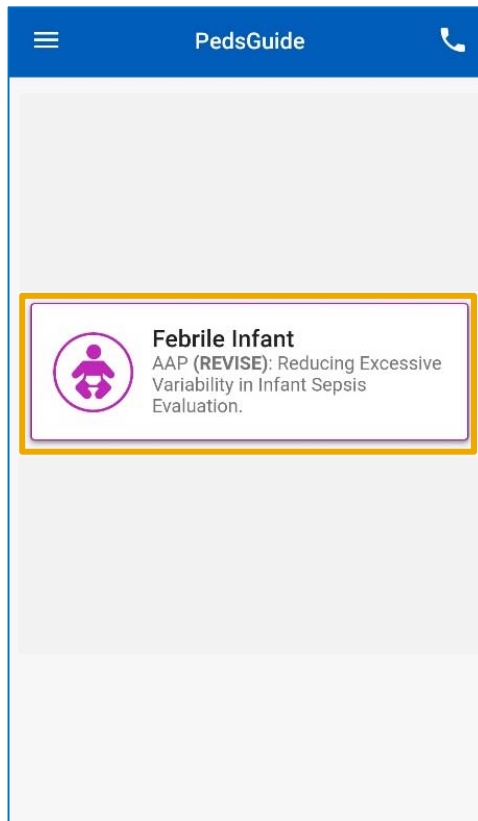
Objective

- Assess the individual level impact of PedsGuide™ on management of febrile infants among attending and resident physicians as it relates to:
 - Medical decision-making
 - Cognitive load

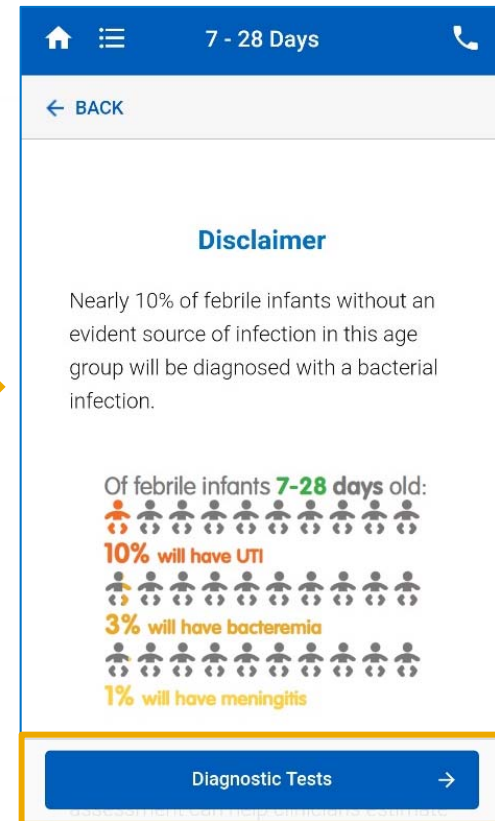
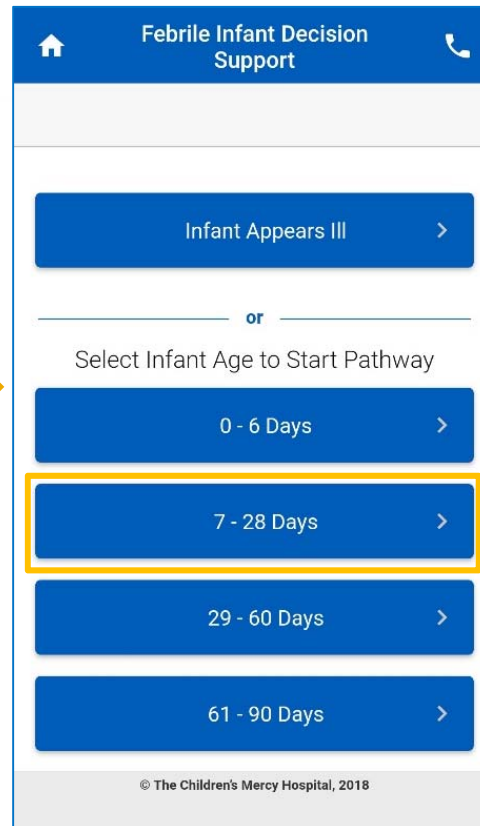
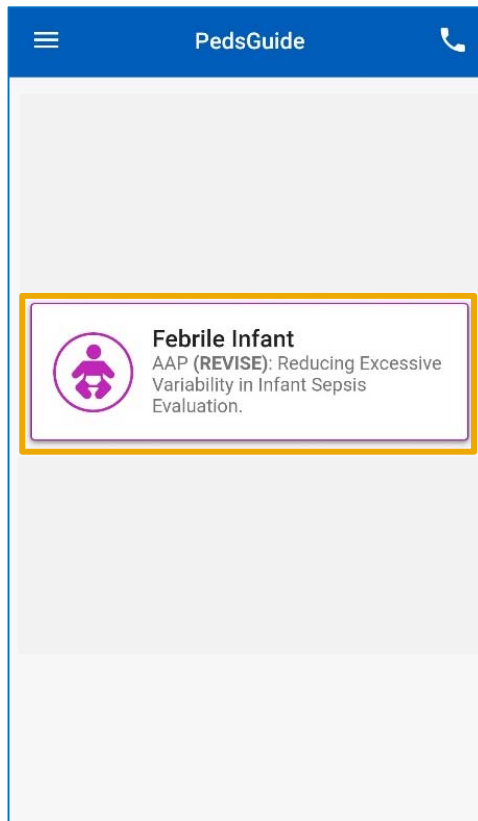
PedsGuide Application






PedsGuide Application




PedsGuide Application



PedsGuide Application


  7 - 28 Days 

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Bacterial Infection Assessment

Please indicate whether the following are present before proceeding:


Born at <37 weeks gestation?




History of prior hospitalization?




Prolonged newborn nursery course?




Is CBC WBC <5,000/cc or >15,000/cc?







UA positive for nitrites, leuk esterase, or WBC >5/HPF?



High Risk Recommendations 

PedsGuide Application

  7 - 28 Days 

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Bacterial Infection Assessment

Please indicate whether the following are present before proceeding:

Born at <37 weeks gestation? ☐

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UA positive for nitrites, leuk esterase, or WBC >5/HPF? ☐

High Risk Recommendations →



  7 - 28 Days 

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High Risk Recommendations

This infant is at increased risk for meningitis. Lumbar puncture is recommended.

The following CSF (if obtained) studies should be performed:

- Cell count with differential
- Protein
- Glucose
- Bacterial culture
- Enterovirus PCR

PedsGuide Application

7 - 28 Days

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Bacterial Infection Assessment

Please indicate whether the following are present before proceeding:

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High Risk Recommendations →

7 - 28 Days

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High Risk Recommendations

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7 - 28 Days

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Antibiotic Options

Cefotaxime +/- Ampicillin

OR

Ampicillin PLUS Gentamicin

Antibiotic Dosing

Ampicillin

75mg/kg/dose IV or IM q6H

Cefotaxime

50-75mg/kg/dose IV or IM q6H

Gentamicin

Admission Recommendations →

Methods

- Counterbalanced, prospective cross-over simulation study
- PedsGuide™ use in both attending and trainee physicians will be associated with:
 - Increased adherence to evidence-based recommendations
 - Lower cognitive effort

Methods

- November 2017-June 2018
- Subjects:
 - Pediatric emergency medicine and urgent care physicians with >3 years of experience post-training
 - Resident physicians who perform rotations at Children's Mercy
- Recruitment
 - REDCap survey through email
 - Divisional meetings

Methods

- 2 febrile infant scenarios created with answer key
 - No divergence of recommendations based on condition
- Go through one case with PedsGuide™ and the other with *The Harriet Lane Handbook*
- Block counterbalance was used to determine which case and which condition performed first

Methods

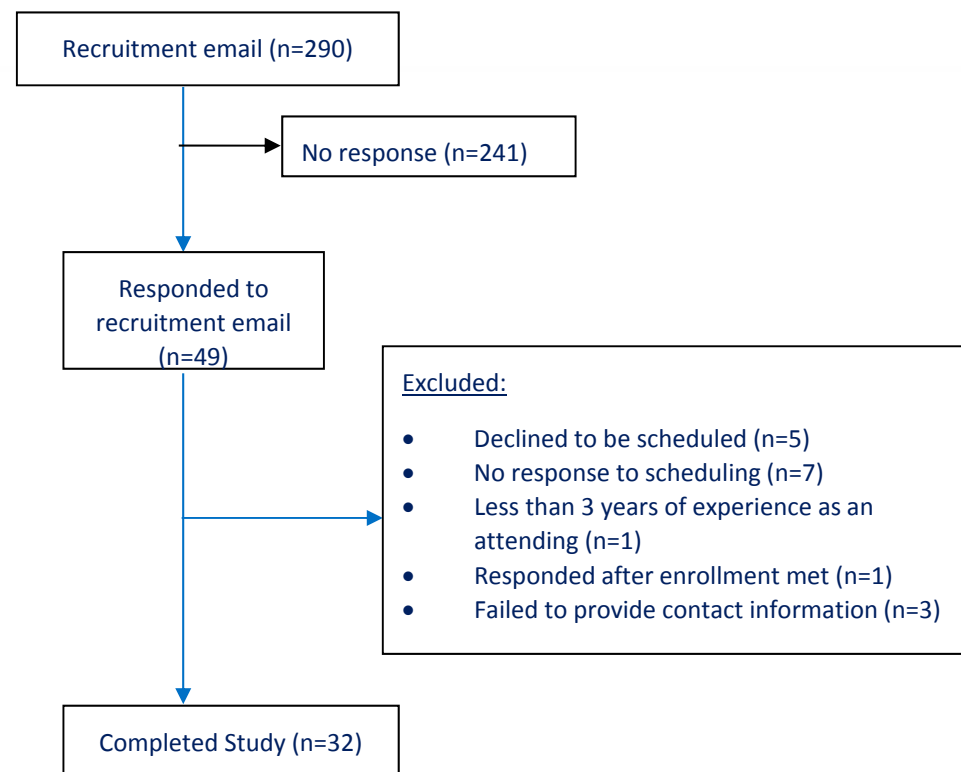
- NASA-TLX performed after each case
 - Validated subjective workload assessment tool
- Feedback provided from participants at the end

Hart SG, Staveland LE. *Advances in Psychology Human Mental Workload* 1988.
Brooke J. *Smart Phone Applications for people with brain injury* 1996.

Methods

- Data analysis performed with SPSS® v. 23.0
- Scores of cases were converted to percentages and averaged
 - Scores were compared by use of ECDS
- NASA-TLX scores averaged by category and compared by condition state
- Scores on cases and NASA-TLX scores were compared by physician level using t-tests with a Bonferroni α -level of 0.1

Results



Results

Demographics N=32

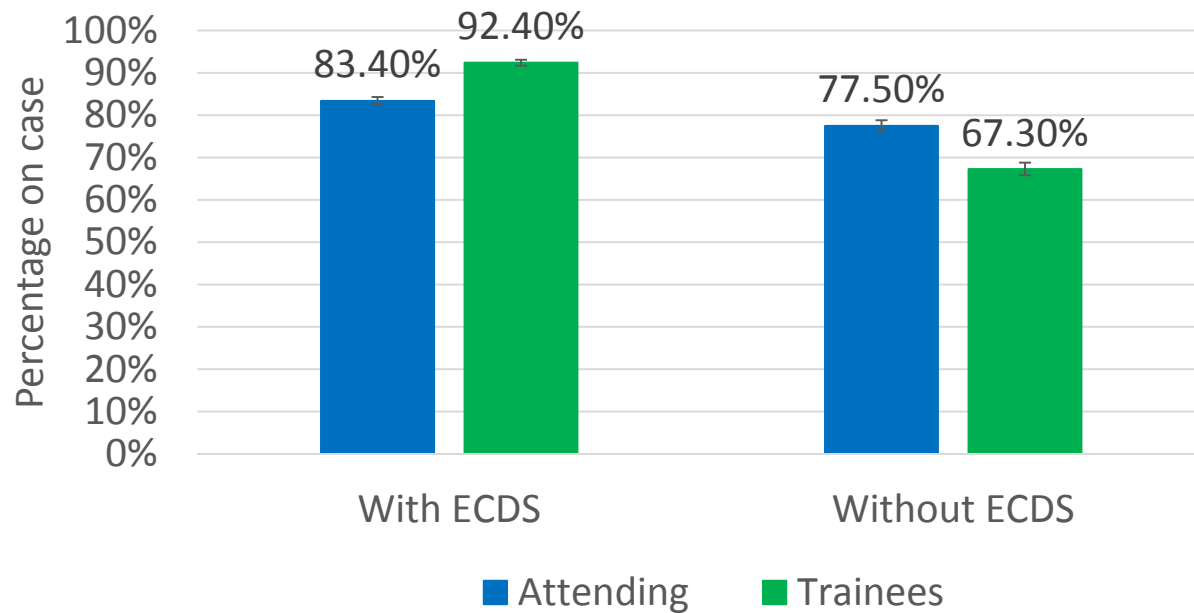
- Gender: Female: 16
- Mean age: 39.3 yrs (24-62 yrs)
- Attendings: 16
 - 75% of attending physicians in practice >10 years
- Primary specialty:
 - Pediatrics: 27
 - Other: 5
 - Internal Medicine-Pediatrics (1), Emergency Medicine (3), Family Medicine (1); PGY=post-graduate year

Results

Familiarity with ECDS tools:

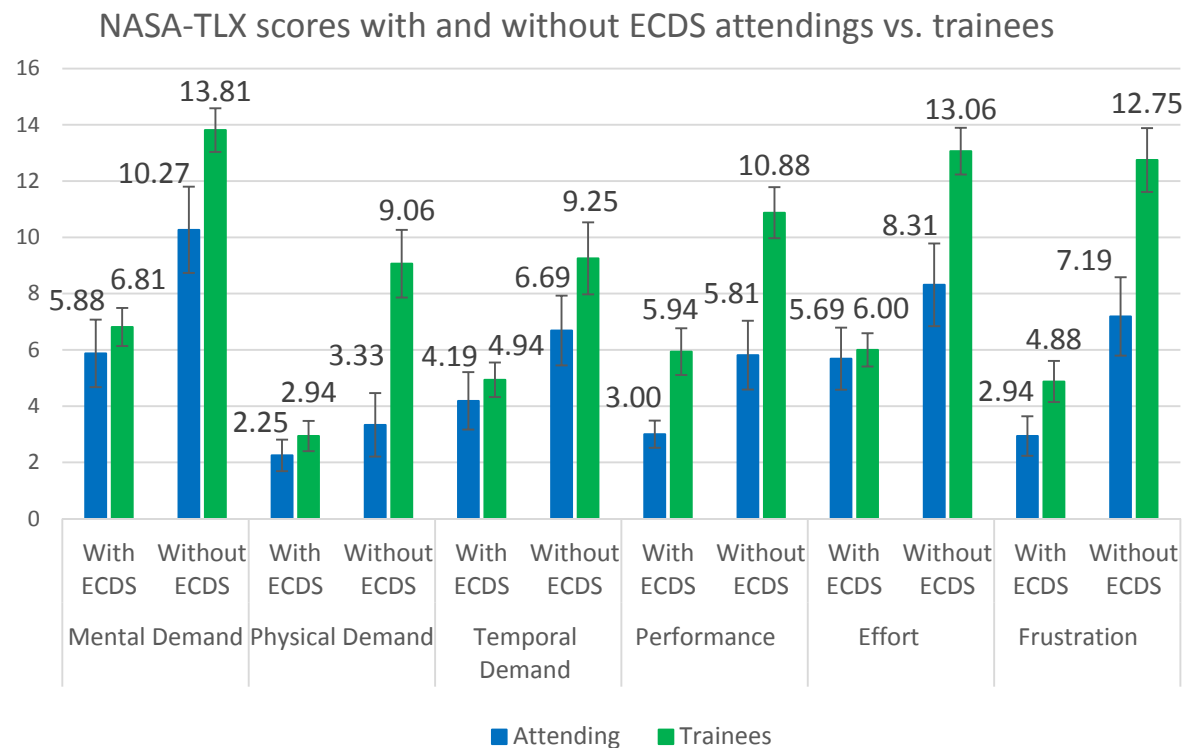
- At least weekly use of ECDS tool: 25 (78%)
- Comfort with ECDS tools: 27 (84%)
- Will use ECDS tools in future: 32 (100%)
- Used PedsGuide™ prior to study: 20 (62.5%)

Scores on cases were higher with use of ECDS



Attendings $p=0.16$; Trainees $p=0.002$

Mean scores of NASA-TLX were lower with use of ECDS



Trainees: $p < 0.01$;
Attendings: Mental Demand $p = 0.07$,
Physical Demand $p = 0.45$, Temporal
Demand $p = 0.13$, Performance
 $p = 0.04$, Effort $p = 0.15$, Frustration
 $p = 0.01$

Limitations

- Use of vignettes vs. real patients
- Control using *The Harriet Lane Handbook*TM
- Majority of participants had used PedsGuideTM
- Majority of participants pediatrics trained

Conclusion

- Use of PedsGuide™ Febrile Infant Decision Support tool led to
 - Increased adherence to guidelines
 - Decreased cognitive workload
- Only significant for trainee physicians
- Use of ECDS tools may be especially helpful for trainee physicians with less experience
- This methodology may be used in future assessments of ECDS

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- Participants

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Download the app

For iPhone



For Android



Questions



Feedback

Only thing I have a hard time with the app is where it's taking me. Where am I going next?

Great for community FPs [family practioners], they call me to ask what to do, and I can tell them to look at the app.

Easy to use, set up one step at a time.

I go through it with rotaters in the ER. I kind of show it to anybody who will listen to me.

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