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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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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
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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

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

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

Febrile Infant
Febrile Infant

Febrile Infant Decision Support

Infant Appears Ill

or

Select Infant Age to Start Pathway

0 - 6 Days

7 - 28 Days

29 - 60 Days

61 - 90 Days

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7 - 28 Days

Disclaimer

Nearly 10% of febrile infants without an evident source of infection in this age group will be diagnosed with a bacterial infection.

Of febrile infants 7-28 days old:

- 10% will have UTI
- 3% will have bacteremia
- 1% will have meningitis

Diagnostic Tests
Bacterial Infection Assessment

Please indicate whether the following are present before proceeding:

- Born at <37 weeks gestation?  
  - [ ] Yes
  - [x] No

- History of prior hospitalization?  
  - [ ] Yes
  - [x] No

- Prolonged newborn nursery course?  
  - [ ] Yes
  - [x] No

- Is CBC WBC <5,000/cc or >15,000/cc?  
  - [ ] Yes
  - [x] No

- UA positive for nitrites, leuk esterase, or WBC >5/HPF?  
  - [ ] Yes
  - [x] No

High Risk Recommendations
PedsGuide Application

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
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
**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 nitrates, leuk esterase, or WBC >5/HPF?

**High Risk Recommendations**

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- Glucose
- Bacterial culture
- Enterovirus PCR

**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**
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

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

Recruitment email (n=290)

- No response (n=241)

Responded to recruitment email (n=49)

Excluded:
- Declined to be scheduled (n=5)
- No response to scheduling (n=7)
- Less than 3 years of experience as an attending (n=1)
- Responded after enrollment met (n=1)
- Failed to provide contact information (n=3)

Completed Study (n=32)
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

<table>
<thead>
<tr>
<th>With ECDS</th>
<th>Without ECDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.40%</td>
<td>77.50%</td>
</tr>
<tr>
<td>92.40%</td>
<td>67.30%</td>
</tr>
</tbody>
</table>

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™*
- Majority of participants had used PedsGuide™
- 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
Acknowledgements

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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 practitioners], 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.
References


References

Denson P. Challenges and Opportunities Facing Medical Education. Trans Am Clin Climatol Assoc. 2011; 122:48-58.


