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

Katherine Richardson, MD
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CMH Research Days
May 16, 2019
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.
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 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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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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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?
- 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
Bacterial Infection Assessment

Please indicate whether the following are present before proceeding:

- Born at <37 weeks gestation?
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- 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**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage</th>
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</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>75mg/kg/dose</td>
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<tr>
<td></td>
<td>IV or IM q6H</td>
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<tr>
<td>Cefotaxime</td>
<td>50-75mg/kg/dose</td>
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<tr>
<td></td>
<td>IV or IM q6H</td>
</tr>
<tr>
<td>Gentamicin</td>
<td></td>
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</tr>
</tbody>
</table>
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

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

Attendings p=0.16; Trainees p=0.002
Mean scores of NASA-TLX were lower with use of ECDS.

<table>
<thead>
<tr>
<th></th>
<th>With ECDS</th>
<th>Without ECDS</th>
<th>With ECDS</th>
<th>Without ECDS</th>
<th>With ECDS</th>
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<th>Without ECDS</th>
<th>With ECDS</th>
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<tbody>
<tr>
<td>Mental Demand</td>
<td>5.88</td>
<td>6.81</td>
<td>10.27</td>
<td>13.81</td>
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<tr>
<td>Physical Demand</td>
<td>2.25</td>
<td>2.94</td>
<td>9.06</td>
<td>9.25</td>
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<tr>
<td>Temporal Demand</td>
<td>4.19</td>
<td>4.94</td>
<td>6.69</td>
<td>9.25</td>
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<td>Performance</td>
<td>3.00</td>
<td>5.00</td>
<td>5.94</td>
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<tr>
<td>Effort</td>
<td>5.69</td>
<td>6.00</td>
<td>8.31</td>
<td>10.88</td>
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<td>7.19</td>
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<td>13.06</td>
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</tbody>
</table>

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

- My mentor: Russell McCulloh, MD*
- Sarah Fouquet, PhD
- El Kerns, MPH, CPH*
- Pediatric Infectious Diseases Division at CMKC
- Participants

*Salaries for these personnel in part supported by Office Of The Director, National Institutes Of Health of the National Institutes of Health under Award Numbers UG1HD090849 and UG1OD024953. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.
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


