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Usability and Acceptability of an Electronic Clinical Decision Support Tool for Antibiotic Selection for Common Pediatric Infections in Outpatient Rural Healthcare Clinics

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Abstract

The purpose of this project was to determine the potential role of an electronic clinical decision support tool (ECDST) for optimizing antibiotic prescribing practices in rural clinical practice. The specific aim was to evaluate the usability and acceptability of an ECDST for antibiotic prescribing in pediatric patients in outpatient rural health clinics. The data was collected from providers working with pediatric patients at Community Health Center of Southeast Kansas. The ECDST used in this project was found to require a low mental demand, have a high usability value, and was accepted as a potential tool for clinical practice by the majority of the providers who used it.

Introduction

- Estimated **2 million illness** and **23,000 deaths** caused by antibiotic resistance annually (Centers for Disease Control and Prevention, 2013).
- Antibiotic resistance is attributed to multiple factors, such as overuse and misuse of medications, lack of new drug development, and public's perception and use of these medications (Ventola, 2015).
- Approximately **half of all outpatient antibiotic prescribing may be inappropriate**, (eg. incorrect selection of the antibiotic, dosing, duration, and necessity) (Sanchez et al., 2016)
- At least **thirty percent** of outpatient antibiotics prescribed in the United States are completely unnecessary (Fleming-Dutra et al., 2016).
- The pediatric population receive a disproportionately high number of these antibiotics compared to the middle-aged population (Ready et al., 2004
- Some of the areas contributing to the inappropriateness includes:
    - prescribing for an unnecessarily prolonged duration
    - selecting an unnecessarily broad-spectrum antibiotic
    - prescribing an antibiotic when it is not indicated such as for infections from viral origins.
- The pediatric population is a great place to begin working on decreasing the number of inappropriate antibiotic prescriptions, especially for common infections.

Specific Aims

- Specific aim: evaluate the usability and acceptability of an ECDST for antibiotic prescribing in pediatric patients in outpatient rural health clinics.
- Exploratory aim**:** to assess the impact of ECDST use on antibiotic prescribing practices among healthcare providers who used the tool.

Hypotheses

The primary hypothesis was that providers would find that the ECDST requires a low mental demand and has a high usability value. Based on the exploratory aim, it was hypothesized that providers would more often choose the correct diagnosis and related treatment when using the ECDST.

Methods

- A descriptive vignette-based study
- Pre-survey information was gathered including demographic information and information on the participants prior knowledge about ECDSTs
- Participants completed two different case scenarios. One related to acute otitis media and the other on acute bacterial rhinosinusitis
- During each case scenario participants used an interactive PowerPoint created using Microsoft PowerPoint 2016 by the lead researcher using the American Association of Pediatrics and Infectious Disease Society of America's evidence based clinical guidelines for diagnosis and management of common infections
- After using the ECDST the participants completed two standardized surveys; one to assess the usability of the application (the System Usability Scale), and the other to assess subjective mental workload using the NASA Task Load Index (Hart & Staveland, 1988).
- Post survey questions; one to assess the acceptability of the ECDST, another that assessed whether or not the ECDST changed the way the provider diagnosed and treated the patient.

Results

Table 1

Demographics

Items	Frequency (%)
Gender	
Female	7 (70)
Male	3 (30)
Age	
30-39	5 (50)
40-49	4 (40)
50-59	1 (10)
Provider Type	
Family Nurse Practitioner	7 (70)
Pediatrician	1 (10)
Physician Assistant	2 (20)

Table 2

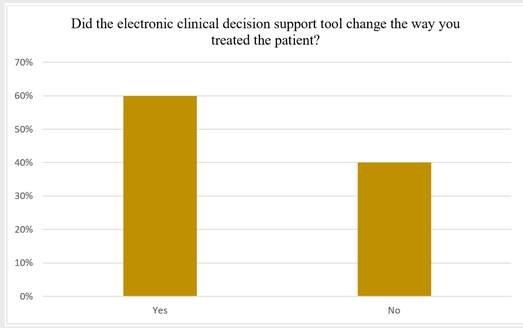
Case Study Results

	Mean	SD	Median	Q1	Q2	IQR
Case Study 1	73%	31%	83%	41%	100%	59%
Case Study 2	77%	35%	100%	66%	100%	34%

Table 3

NASA-TLX Results

	Mean	SD	Median	Q1	Q2	IQR
Mental Demand	4.5	4.28	2	1	7.75	6.75
Physical Demand	1.3	0.67	1	1	1	0
Temporal Demand	1.9	1.45	1	1	2	1
Performance	1.3	0.48	1	1	1.75	0.75
Effort	1.5	0.97	1	1	1.75	0.75
Frustration	2.8	3.16	1	1	1.75	0.75



Results

- The hypothesis that the participants would choose the correct diagnosis and treatment options the majority of the time while using the ECDST was met.
- The median SUS score for all participants was 93.75 with an IQR of 12.5 meaning that the ECDST has a high usability value based on the participants overall rating of the system
- The NASA-TLX rating scale is numbered from one to 21, with 1-4 being very low and 18-21 being very high or requiring more demand. The median score for mental demand was 2 (IQR 6.75).
- Participants found the ECDT tool to be very convenient and easy to use making their task manageable with very little stress.
- Sixty percent of the participants said that the ECDST changed they way they treated the patient.
- The post survey also asked, "Would you consider using this ECDST in your future practice?" This question helped to assess the acceptability of the ECDST. The vast majority (90%) of the participants said that they would consider using this tool in their future practice

Conclusion

It was discovered that the antibiotic selection ECDST has a high usability value, requires low mental demand, and was generally accepted by the providers who used it. The ECDST used in this project can easily be integrated into outpatient clinical settings to optimize antibiotic prescribing practices. With the use of clinical practice guidelines used in the ECDST providers can feel confident knowing that they're treating their patient's safety and doing their part to combat antimicrobial resistance.

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