**Project Title: Predicting Absence of Serious Bacterial Infection in Critically Ill Children**

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PEDIATRIC CRITICAL CARE CLINICIAN INTERVIEW GUIDE

INTERVIEWER INSTRUCTIONS:

• COLLECT INFORMATION ON HOW CRITICAL CARE PROVIDERS AND NURSES DECIDE WHETHER OR NOT TO ADMINISTER ANTIBIOTICS DURING THE FIRST 24 HOURS OF A CHILD’S PICU ADMISSION. WE ARE PARTICULARLY INTERESTED IN UNDERSTANDING THE TYPES OF DATA THAT CLINICIANS VALUE WHEN DECIDING WHETHER ANTIBIOTICS ARE INDICATED (E.G. PAST MEDICAL HISTORY, PATIENT SYMPTOMS, VITAL SIGNS, AND LAB TESTS).

• DETERMINE WHICH PIECES OF PATIENT DATA A CLINICIAN WOULD PREFER TO HAVE IMMEDIATELY AVAILABLE WHEN MAKING ANTIBIOTIC DECISIONS

• EXPLORE THE PREFERRED PRESENTATION OF RELEVANT DATA THAT WOULD BEST FACILITATE THESE DECISIONS

• EXPLORE THE CLINICIAN’S PRIOR EXPERIENCE WITH CLINICAL DECISION SUPPORT TOOLS IN THE ELECTRONIC HEALTH RECORD. WHAT ASPECTS OF THESE TOOLS HAS THE CLINICIAN FOUND HELPFUL AND IN WHAT WAYS ARE THEY LESS HELPFUL? IF WE DEVELOPED A TOOL TO HELP THE CLINICIAN IDENTIFY CHILDREN WITHOUT SERIOUS BACTERIAL INFECTIONS AND ENCOURAGE AVOIDING ANTIBIOTICS, HOW SHOULD THIS PREDICTION/RECOMMENDATION BE PRESENTED TO ENSURE IT IS USEFUL TO THE CLINICIAN?

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We are now going to begin the interview. We will be discussing how clinicians in the pediatric intensive care unit make antibiotics decisions for children newly admitted to the PICU: specifically, during the first 24 hours of their PICU admission. Keep in mind there are no correct or incorrect answers to any of these questions. Later we will explore your thoughts on how the team should implement a predictive model that is able to identify children without bacterial infections. The goal of that model will be to help clinicians avoid unnecessary antibiotics and associated adverse effects. If at any point a question is not clear, please feel free to ask for clarification. In general, we would like to avoid using the names of patients, patient family members, or your colleagues to protect their privacy. If you accidentally say a person’s name, we can ask the transcriptionist to remove it from the recording later.

I will now turn on the recorder. Are you ready?

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[Turn on recorder]

State the date:

Time:

Location (Zoom)

Participant’s unique ID number:

This guide is meant to encompass many types of clinicians in the PICU. As such there may be questions you do not have any personal experience with or opinion about. When answering these questions, try to share with me your experiences based on the intersection of your role with the topics we’re talking about.

EXPLORE WHEN AND HOW PICU CLINICIANS MAKE DECISIONS ABOUT ANIBIOTIC ORDERING:

1. To start off with, can you tell me your position at the Hospital?

ATTENDING PHYSICIAN,

CRITICAL CARE FELLOW,

CRITICAL CARE ADVANCED PRACTICE PROVIDER (NURSE PRACTITIONER OR PHYSICIAN ASSISTANT),

CRITICAL CARE NURSE,

PHARMACIST

How long have you been in your current role? How many years of experience do you have working in critical care?

2. Thank you. I’d like to start by discussing the timing of antibiotic ordering for new PICU admissions.

1. Are orders for antibiotics to be given in the PICU ever placed prior to the patient’s physical arrival in the PICU? If so, for what types of patients and under what circumstances does this occur?
2. PROBE: Are orders for antibiotics ever placed by a provider not assigned to that patient?

1. If a bacterial infection is suspected, are antibiotics typically ordered right at the time of admission or does the team often wait to discuss the decision with the fellow and/or attending?
2. PROBE: Does the timing of this decision change if the patient recently received antibiotics (e.g., in the emergency room or at the referral hospital)?

3. Now we are going to explore your approach to antibiotic discussions with team members and with the patient’s family. When considering ordering antibiotics for a newly admitted PICU patient:

1. What are your priorities when discussing antibiotics with your team?

1. What do you perceive are the priorities of the other PICU team members regarding antibiotic ordering?

1. How quickly do antibiotic decisions need to be made for a new PICU admission who may have a bacterial infection but does not have sepsis or septic shock?
2. How is the antibiotic decision-making process different when a patient is being co-managed with another service (such as pediatric surgery).
3. How do you go about resolving disagreements when team members disagree on whether to order antibiotics?
4. Do parents approach the need for antibiotics differently than you? What do you perceive are their values regarding antibiotic decisions?

4. Are there specific situations in which a bacterial infection is thought less likely however the PICU team decides to order antibiotics anyway?

a. **[IF YES]** What factors motivate the decision to order antibiotics in these situations?

b. **[IF YES]** Is there specific information that, if supplied, might persuade the PICU team to not order antibiotics in such cases?

5. Now we will discuss the various aspects of a patient’s history and presentation that you find helpful in deciding if antibiotics are appropriate for a new PICU admission. For the purposes of these next few questions, please consider a new admission without obvious sepsis or hemodynamic instability for whom the diagnosis of a bacterial infection is unclear.

1. What patient signs or symptoms are particularly helpful in determining if a bacterial infection is present? Are there any signs or symptoms that help you rule-out a bacterial infection?
2. How does the patient’s past medical history affect the decision to order antibiotics?

* 1. PROBE: How does immune system status (for example if a patient has a history of cancer or a bone marrow transplant) affect antibiotic ordering decisions?

1. Are there specific vital sign changes or lab tests that help you determine the need for antibiotics?
2. How easy is it for you to find the information from your electronic health record that you need to make an informed decision on whether to order antibiotics?
   1. Follow-up: what electronic health record does your institution use (e.g. Epic, Cerner)
3. How does the time of day affect the decision to start antibiotics? If the patient is admitted toward the end of a shift or in the middle of the night, is the care team more or less likely to order antibiotics? If so, why?
4. How do you think about the risks of not starting antibiotics in a patient who ends up having a bacterial infection?
5. How do you think about the risk of starting antibiotics in a patient without a bacterial infection?
6. How certain do you need to be about the absence of a bacterial infection to withhold antibiotics in a new PICU admission? 50%? 90%? 99%? [PAUSE FOR ANSWER AND EXPLANATION]
   1. Does this threshold change if the patient recently received a dose of antibiotics say in the ED before their arrival to the PICU?
   2. Does the patient’s past medical history affect this threshold?

EXPLORE HOW CLINICIANS WOULD PREFER THE PRESENTATION OF DATA WITHIN AN ANTIBIOTIC DECISION-MAKING TOOL:

The research team has designed a predictive model that uses data from the electronic health record to identify children in the PICU who are very unlikely to have serious bacterial infection. The team is planning on building a clinical decision support tool that can be integrated into the electronic health record that helps the PICU care team identify newly admitted PICU patients who are at **low risk** of having a bacterial infection. The primary goal is to provide data and predictions to help clinicians minimize unneeded antibiotics and associated adverse effects in these low risk patients. We would like to discuss how to design such a tool so that it can be as helpful and effective as possible.

6. A few examples of Clinical Decision Support tools, which I will refer to as CDS tools, include pop-ups in the electronic health record, alerts sent to your phone or computer, published care paths or protocols, condition-specific ordersets, and information displayed while placing orders (for example dosing recommendations for medications).

1. What CDS tools have you used in the past while working in the PICU?
2. Are there specific tools have you found helpful? PROBE: What about these tools did you like?
3. Are there CDS tools you did not like? PROBE: how could the tools have been better?

7. If a tool or alert was built within your electronic health record to help clinicians identify PICU admissions at low risk for bacterial infection, how should this prediction be communicated to the care team to maximize its impact and help reduce the ordering of antibiotics?

1. Would it be helpful if the tool displayed the most important data from the chart that the predictive model is using to classify the patient as ‘low risk’ of bacterial infection? (For example, a normal c-reactive protein value, a normal respiratory rate, a recent trend toward improved heart rate).
2. Are there particular variables that would be most convincing to you to not start antibiotics? Some examples include vital sign trends, lab values, lack of a central line, level of respiratory support.

1. Would it be helpful if the tool displayed the actual predicted probability of a bacterial infection being present? (For example, “There is a 1% chance of serious bacterial infection in this patient based on available data”).
2. How should the alert be communicated to the PICU team? Possible strategies include an icon in the patient’s chart that you could hover over with your mouse, a message sent to the provider when ordering an antibiotic, or a pop-up in the patient’s chart. If you have a different idea for how to present these predictions, please share.

1. When should this tool’s predictions be displayed to the PICU care team? Continuously or only when a provider attempts to place an antibiotic order?

e. Are there any other functions or abilities this antibiotic decision-making tool should have?

WE WANT TO UNDERSTAND THE POSSIBLE BARRIERS TO THE USE OF AN ANTIBIOTIC DECISION-MAKING TOOL. SPECIFICALLY, WHY WOULD A PICU CLINICIAN NOT TRUST THE RESULTS OF THE CDS TOOL?

8. Many CDS tools are not used by the clinicians they are designed for. Can you think of any reasons why a clinician would be hesitant to trust the prediction of such a CDS tool that identifies a newly admitted PICU patient as being low risk for having a serious bacterial infection?

1. PROBE: If specific patient examples are given, try to understand the motivation for why the CDS tool would not be followed in that case.

9. Which of the following approaches would help motivate clinicians to follow the advice of such an antibiotic decision-making CDS tool? (READ OPTIONS BELOW)

1. Displaying the number of patients correctly and incorrectly identified as not having a bacterial infection by the tool among all admitted patients to date.

c. Displaying the estimated improvement in patient outcomes since roll-out of the tool such as:

i. The number of cases of clostridium difficile (C. diff) prevented

1. The number of instances of acute kidney injury prevented
2. The number of hospital days reduced
3. A personalized email detailing the accuracy of the CDS tool

10. Finally, we want to understand how a patient’s social and demographic background influences antibiotic decisions. For the purposes of the below patient examples, consider an 18-month-old female who was admitted to the PICU with respiratory failure requiring non-invasive ventilation. She is presumed to have viral bronchiolitis. She is currently febrile, tachycardic, and tachypneic but otherwise non-toxic appearing with a normal blood pressure. Her chest X-ray shows findings of bronchiolitis and is borderline for pneumonia in the right middle lobe. Please describe how each of the following situations might influence your decisions on antibiotics and whether you would be more or less likely to follow the guidance of a decision support tool that is predicting that the patient does not have a serious bacterial infection (which includes pneumonia and bacteremia).

1. The family recently immigrated from central American, does not speak English, and an interpreter is not currently available for their language.
2. The patient and her family are currently homeless and on Medicaid. They have been living in a homeless shelter for several weeks.
3. The patient comes from a multiracial family and both parents are weary of the healthcare system and doctors in general.
4. The child is Native American and was transported to your institution from an urgent care clinic on a reservation.

11. Is there anything we didn’t talk about that you think is relevant or anything else you would like to add?

Thank you so much for sharing your experiences and knowledge regarding antibiotic decision. Your contributions will be an important part of how we improve this process for clinicians, patients, and families.

(IF the interviewee is an attending, fellow, or APP): The principal investigator on the project, Dr. Martin, will be conducting brief, under 30-minute follow-up interviews with a small number of clinicians. In these sessions you would get to participate in a virtual prototyping session and build your own version of the antibiotic clinical decision support tool we’ve been discussing, which would help us understand what type of design would be most helpful and effective. Are you open to Dr. Martin reaching out to you to participate?