MRSA Inferencing Issues

drafted by samson tu, based on 2012.01.10 discussions (involving Mahesh, Pradeep, Ted, Samson)

Notes taken during conf call 1/20/12.

time frame: for “immediate goals” is the current grant year. for longer-term goals (ie, infections other than BSI and UTI; determination of colonization vs infection), time frame is the entire CHIR MRSA project duration, which goes into 2013.

## Inference goals

Given documents and data about a hospitalized patient, determine:

* + 1. MRSA colonization? Yes, distinguish colonization from infection. Brad says it requires a positive culture but Mike Rubin says that the positive test may be from PCR. Agreement on positive lab test and absence of information about infection constitutes colonization.
    2. Discussion of whether or not it is a goal of the project to determine colonization. Mike R: most important thing is to determine infection. If we then have patients who have a positive test but do not have infection then we assume colonization. We won’t be able to do this until later, down the road, when we can identify the other infection types. (see #2)

2. MRSA infection? Yes, it is a goal of the inferencing to determine if there is an infection. We are focusing first on BSI and UTI, and central line asstd is part of the BSI, and primary or secondary is part of that. Hospital-acqd or community-acqd is also part of the task but we can use simple assessment of timing of the infection. We do not have to worry about any other infection right now. there are reporting reqmts for BSI and UTI, but not other infection. So we won’t be able to determine COLONIZATION vs ANY INFECTION until we eventually get around to working on the non-BSI and non-UTI other infections.

a. MRSA BSI?

b. MRSA UTI?

c. Central-line associated infection? Mike Rubin says that Rick just sent out a flowchart that covers this decisionmaking. Can’t have a BSI w/o a positive blood culture for MRSA. The positive blood culture is the trigger for investigating it. in this project, we are taking the stance that we are starting with a positive culture for MRSA so we can say that you do have a BSI. Q: do you need signs and symptoms of infection, or just positive bc? Ans (Mike): if you have a positive culture you have a BSI.

one of the first things to do is to see if the person has a catheter in place that would be temporally-related to the positive bld culture. If the answer is YES, then next look at if there is an infection going on at some other location. Typically if the answer is yes, then most people would just call it a secondary BSI, and not call it a catheter-related infection – not an absolute, there is judgment involved, but in most cases that would be considered a secondary BSI and not catheter related. If there is no sign of infection at some other site, then you make a judgment call. if there is any evidence of inflammatory changes at the catheter site (purulence, redness at catheter entry site) then call it an insertion site or tunnel infection, if there is no such e4vidence then call it a catheter asstd infection.

If there is no catheter temporally asstd then look for other site of infection.

Other infections: the idea of looking for another source of MRSA infection – it is one of the complicated aspects of this classification. There are many different approaches. There are criteria for different sites of infection such as pnx, abd abscess, skin…could see if it meets all those criteria…but that is very complicated way of doing it that requires that you look at all types of infections and we don’t want to do (now). so alternative approach, outlined in what Rick sent, is that the way to determine if there is another source of the infection is to look at all the different microbial cultures for that pt and see if there is MRSA grown from any other source other than blood. If there is MRSA growing from a source other than blood, and temporal relationship is correct, then assume that is the primary source of the infection. A crude way of doing it but much easier than trying to come up with criteria for all the types of infection.

There are different things you could do to make it a little more sophisticated. The way Makodo has done it is to look at all the different cultures for the patient from a site other than blood and categorize them based on the type of culture and the site the culture is drawn from and categorize as to whether it is typically a sterile source or not. if you see MRSA in a site that is typically sterile then it is always an infection (eg CSF). But for sputum or wound swab, these sources are not typically sterile so if you see MRSA you don’t know necessarily if it is a source of infection, so you can look at other things to determine.

d. Primary or secondary? See above. if there is a positive blood culture for MRSA then there is a BSi and you need to categorize it as primary or secondary. If there is another site of infection then the BSI is secondary rather than primary. The way to determine if there is another site of infection is based on cultures from other sites as above.

e. HAI or CAI? See above. based on temporal relationships.

PLAN: MRSA core team will get a written version of this information out to us.

Questions for MRSA project:

* Please clarify inference goals. The (Rubin, 2011 AMIA) document focuses on primary/secondary BSI, CLABI/non-CLABI. Pradeep says "The goal of inference system is not for an independent judgment on MRSA infection. Focus is on binary categorization on intermediate inference goals." What are the "intermediate goals"?
* Please clarify the type of patients we are dealing with in the MRSA project. Mahesh said that surveillance will be performed on any hospitalized patients. The "MRSA Bloodstream Infection" document (Rubin, 2011 AMIA) says, "Since we already know, in this project, that we will be addressing only patients with a known positive blood culture for MRSA..."

## Format of inference results

We assume the results of will not be probabilistic. The format may be:

1. Binary, yes/no

2. Ordinal scale of confidence (e.g., {no, probably no, unknown, probably yes, yes})

Mahesh: Format of inference results should be an ordinal scale of confidence. Question for MRSA project: Please confirm.

## Knowledge for rule-based or algorithmic inference

For rule-based or algorithmic inference, we need explicit rules or algorithms for each inference goal (e.g. algorithm to determine colonization vs. infection, primary or secondary BSI, etc.). If the format of inference results is based on an ordinal scale of confidence, then the algorithms or rules should take that into account.[[1]](#footnote-1) Right now we have a draft algorithm for determining primary/secondary and CLABSI/non-CLABSI BSI as binary choices. (Rubin, 2011 AMIA).

Questions for MRSA project:

1. (Rubin, 2011 AMIA) does not make a distinction between MRSA infection and colonization.
2. Do we have "clinical algorithm" for UTI?
3. Who is/are coordinating the development of "clinical algorithms"? When can we expect the "clinical algorithms" to become available?
4. If the format of inference results is based on an ordinal scale of confidence, then the clinical algorithms need to provide the knowledge for concluding each value of the scale (e.g., when can we conclude that there is "probable" CLABSI (as opposed to "certain" CLABSI)?

## Documents and Structured Data

The types and lists of structured data that are important for rule-based or algorithmic inferences should be specified in the "clinical algorithms" (as they are in (Rubin, 2011 AMIA)).

Questions for MRSA project: What is the procedure and schedule for requesting and getting structured data? What documents are available now?

## Labeled patient cases

If the evaluation of MRSA inference takes the form of sensitivity and specificity of inference results compared to some ground truth or reference cases, we need labeled cases for both training and testing phases. The cases should be selected from the same populations as those for which MRSA surveillance tool will be used.

The cases should be labeled with respect to the goals and format of inferences (see Sections A and B). If the inference results are based on an ordinal scale of confidence, then the cases should be similarly labeled.

Question for the MRSA project:

What kind of labeled cases can we realistically get, when, and in what quantity? If we cannot get cases labeled appropriately for our inference goals and format, we have to change the goals and the format.

1. For an example of inferences based on an ordinal scale of confidence, see Tu, SW, Kemper, CA, Lane, NM, Carlson, RW, Musen, MA. *A Methodology for Determining Patients' Eligibility for Clinical Trials*. Methods of Information in Medicine, 1993, November;32(4):317-25. [↑](#footnote-ref-1)