MRSA Urinary Tract Infection

According to CDC/NHSN definitions, there are two categories of conditions involving the urinary tract: urinary tract infection (UTI) and asymptomatic bacteriuria (ASB). Basically, the idea is that, when there are bacteria recovered in the urine, the goal is to determine if an infection is present (UTI), or if it just represents a colonization (ASB). The criteria for each are shown below, with my specific comments related to MRSA:

Symptomatic UTI

A symptomatic urinary tract infection must meet at least 1 of the following criteria:

1. Patient has at least 1 of the following signs or symptoms with no other recognized cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness, *and*

   patient has a positive urine culture, that is, $\geq 10^5$ microorganisms per cc of urine with no more than 2 species of microorganisms.

   Since we are presuming we have a urine culture positive for MRSA to begin with, we just need to ensure that the culture shows $\geq 10^5$ organisms to qualify. Then we need to detect the presence of those signs/symptoms, and determine that there is "no other recognized cause."

2. Patient has at least 2 of the following signs or symptoms with no other recognized cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness, *and*

   at least 1 of the following:

~~a. positive dipstick for leukocyte esterase and/ or nitrate~~
~~b. pyuria (urine specimen with ≥10 white blood cell [WBC]/mm3 or ≥3 WBC/highpower field of unspun urine)~~
~~c. organisms seen on Gram's stain of unspun urine~~
d. at least 2 urine cultures with repeated isolation of the same uropathogen (gram-negative bacteria or *Staphylococcus saprophyticus*) with $\geq 10^2$ colonies/mL in non-voided specimens
e. $\leq 10^5$ colonies/mL of a single uropathogen (gram-negative bacteria or *S saprophyticus*) in a patient being treated with an effective antimicrobial agent for a urinary tract infection
~~f. physician diagnosis of a urinary tract infection~~
~~g. physician institutes appropriate therapy for a urinary tract infection.~~

   Since we're only concerned with MRSA infections, none of #2 applies.

~~3. Patient ≤1 year of age has at least 1 of the following signs or symptoms with no other recognized cause: fever (>38°C rectal), hypothermia (<37°C rectal), apnea, bradycardia, dysuria, lethargy, or vomiting...(ignore)~~

~~4. Patient ≤1 year of age has at least 1 of the following signs or symptoms with no other recognized cause: fever (>38°C), hypothermia (<37°C), apnea, bradycardia, dysuria, lethargy, or vomiting...(ignore)~~

   Since we're only interested in adults, neither #3 nor #4 applies.

So basically, for Symptomatic UTI, only criteria #1 applies. Thus, the two goals are to (1) determine if any of the signs/symptoms mentioned are present, and (2) determine if the positive MRSA urine culture has enough organisms.

Note that no mention is made of a urinary catheter. Although CDC/NHSN do not require the collection of information about catheter-associated UTIs, this is still valuable information that we should pursue. So the third goal is to determine if a urinary catheter is present around the time of the positive culture. (It needs to be done for ASB below, anyway.)

Asymptomatic bacteriuria

An asymptomatic bacteriuria must meet at least 1 of the following criteria:

1. Patient has had an indwelling urinary catheter within 7 days before the culture, *and*

   patient has a positive urine culture, that is, $\geq 10^5$ microorganisms per cc of urine with no more than 2 species of microorganisms, *and*

   patient has no fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness.

   Again, since we are presuming to start with a positive urine culture for MRSA, we need to ensure that the culture shows enough organisms. Then we need to make sure there is no mention of those signs/symptoms.

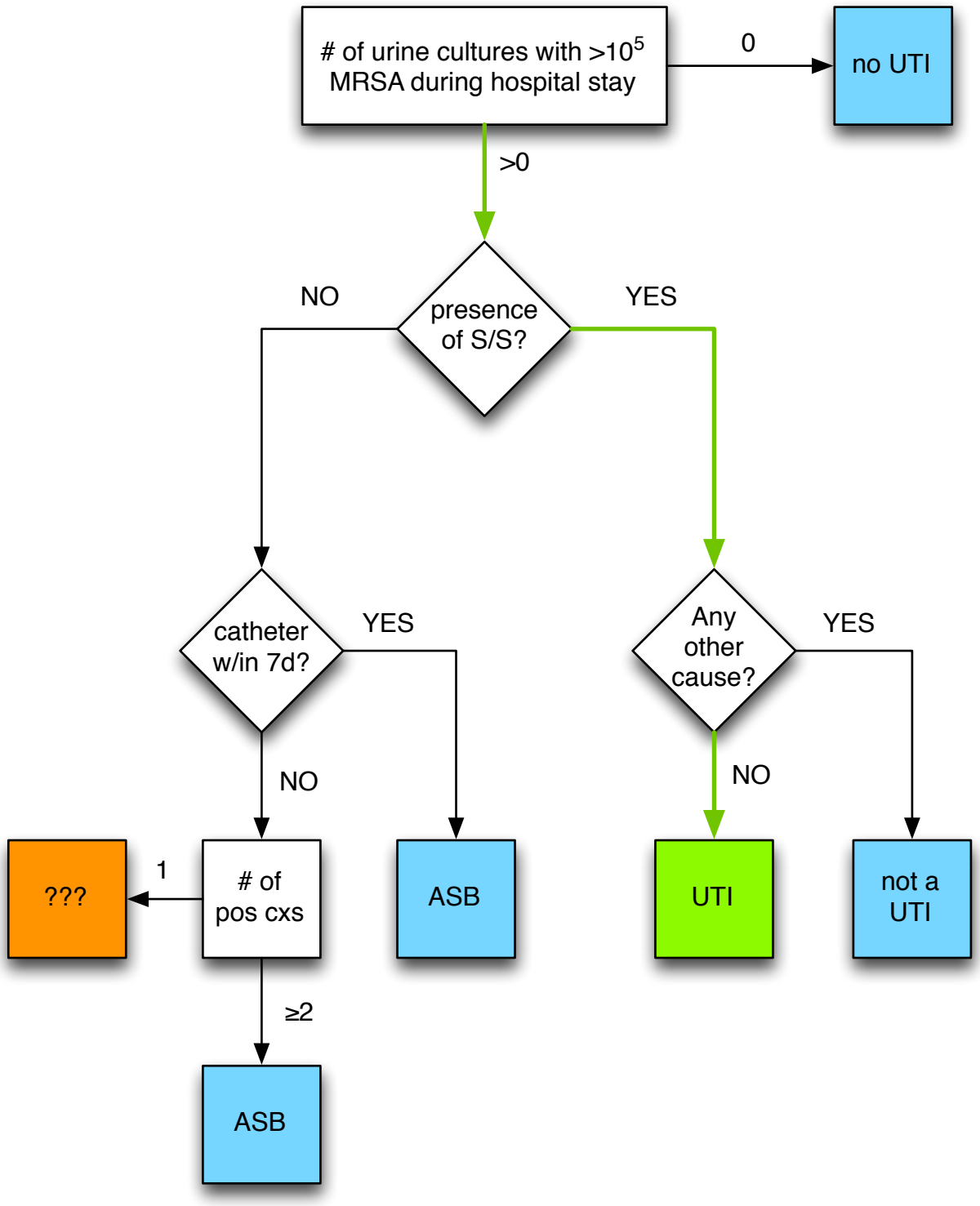
2. Patient has not had an indwelling urinary catheter within 7 days before the first positive culture, *and*

   patient has had at least 2 positive urine cultures, that is, $\geq 10^5$ microorganisms per cc of urine with repeated isolation of the same microorganism and no more than 2 species of microorganisms, *and*

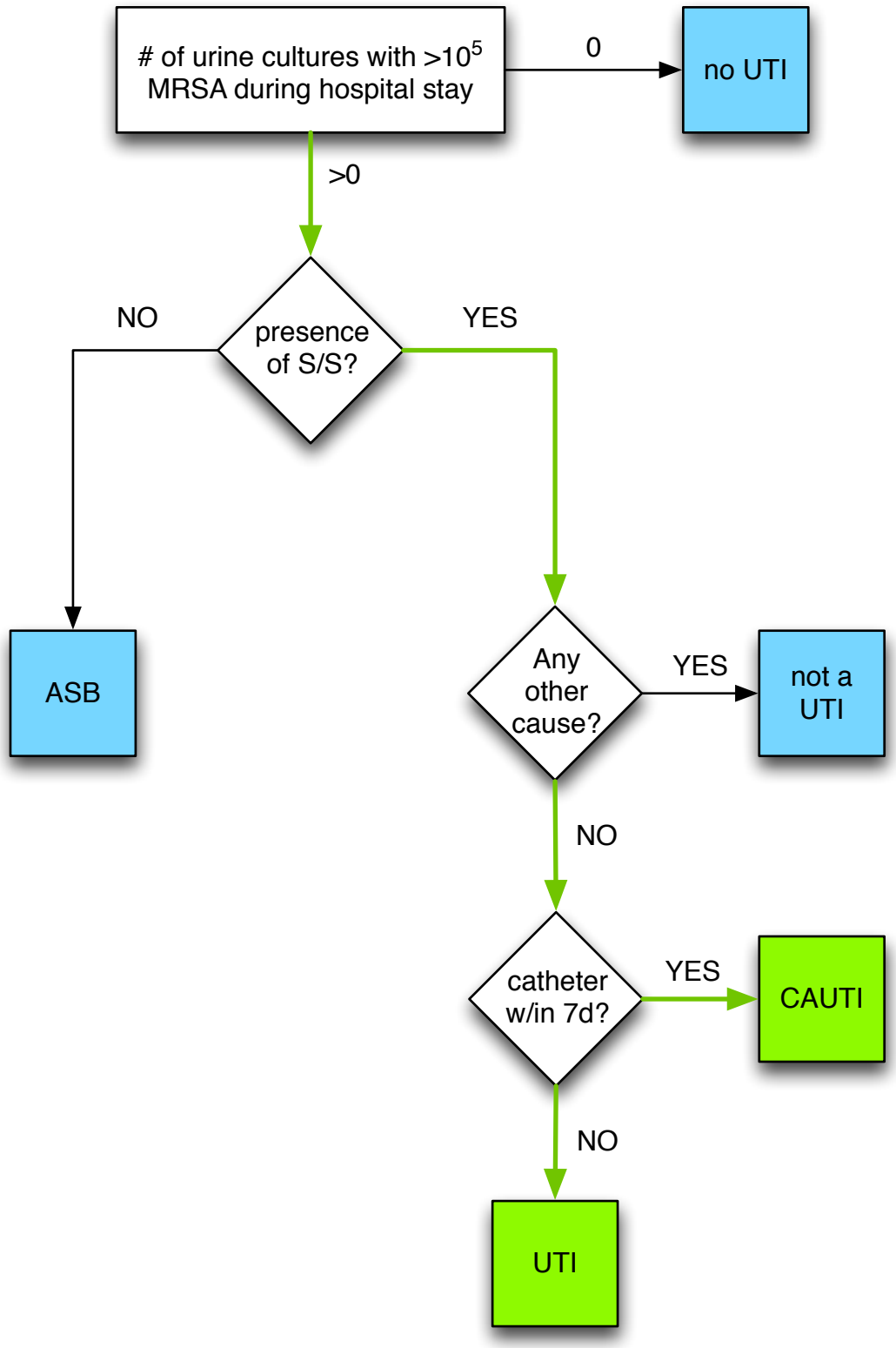
   patient has no fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness.

   Same as above, but we would need two positive cultures with enough organisms.

Synthesizing the above into one flow diagram, we get the following:



On the left side, there is a good deal of information about ASB and its relation to the presence of a catheter (and one branch that is not defined), while on the right, there is nothing that deals with catheters or catheter-associated UTI (CAUTI). Since we don't care much about the details of ASB, and since we would like to be able to determine CAUTI, the above could be modified to arrive at the following:



This simplifies the algorithm so that any situation without signs/symptoms of UTI is classified as ASB, while we now include classification of catheter presence.

The two keys to this classification algorithm, of course, are the two steps "presence of signs/ symptoms" and "any other cause". The plan is to determine the presence of signs/symptoms via NLP, while the plan for determining another cause for the signs/symptoms is less clear. With regard to the latter, the question is really, "is there another infection or condition that would account for the signs/symptoms observed?" There is so easy way to determine this, but one approach we have discussed is to look for MRSA or any other organism grown from other sites besides urine (preferably sterile sites); if present, we can infer that the signs/symptoms were from a different source and not a UTI. Other ideas for approaches are welcome.