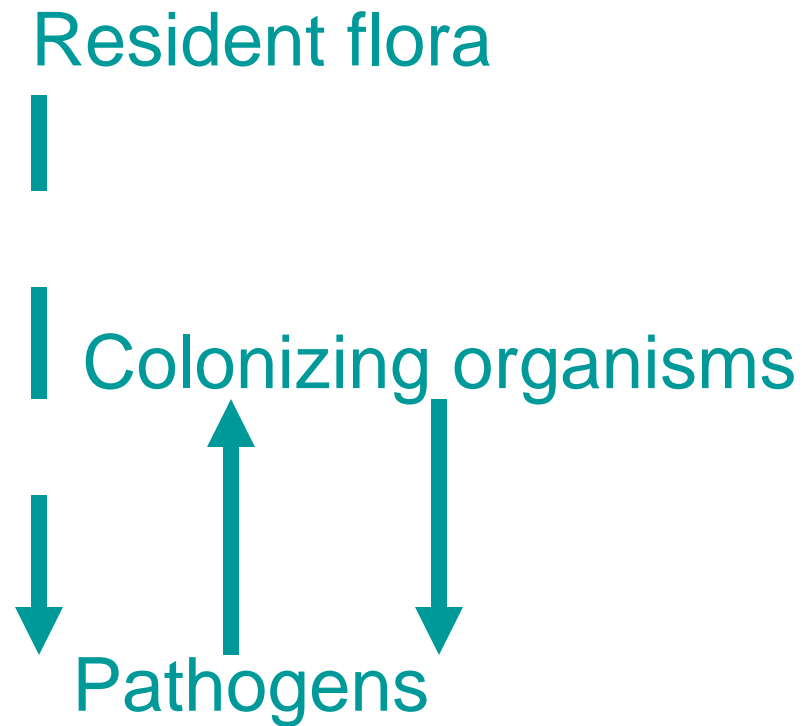


# Work up of Respiratory & Wound Cultures:

- **Culture work up**
  - ◆ **3 Systematic approaches**

# Work up of Respiratory & Wound Cultures



# Work up of Respiratory & Wound Cultures:

## Clinical Relevance

- **There are no clear guidelines for working up bacterial cultures.**
  - literature
  - colleagues
- **There seems to be a need for some consistency when performing culture work up.**
  - uniformity in work up and reporting of bacterial isolates
  - agreement in AST testing

# Work up of Respiratory & Wound Cultures:

## Specimen Quality

- **Premise:**
  - ◆ PMN are an indication of infection or inflammation
  - ◆ SEC indicate superficial contamination = If a specimen contains a large amount of SEC, superficial contamination is likely
    - ☞ the specimen should “ideally” be recollected (resp)
    - ☞ alternatively, bacteria isolated from such specimens should be minimally worked up (wounds)
  - ◆ Extensive testing on heavily mixed cultures should not routinely be performed.

# Work up of Respiratory & Wound Cultures:

## Three approaches\*

- Q-Score System
- Q/234 System
- PMN-association System

\* 2004; ASM Cumitech 7B:  
Lower Respiratory Tract Infections  
(can also be used for wounds)

# Work up of Respiratory & Wound Cultures:

## Q-Score System (RC Bartlett, 1974)

“Q-SCORE” =  
# of potential pathogens (PP) to work up

Squamous cells (-)

Neutrophils (+)

key:

- 0 = no cells
- 1 = 1-9/lpf
- 2 = 10-24/lpf
- 3 =  $\geq 25$ /lpf

	0	-1	-2	-3
0	3	0	0	0
+1	3	0	0	0
+2	3	1	0	0
+3	3	2	1	0

Q0 = no cult  
Q1 = 1PP  
Q2 = 2PP  
Q3 = 3PP

# Work up of Respiratory & Wound Cultures: Q-Score System

## “Q-Score” system

Up to 3 organisms can be considered potential pathogens (PP) and be worked up (ID/AST) if from a good quality specimen (Q3).

The lower quality of the specimen (e.g., the more SEC present) the fewer the organisms worked up (Q2, Q1).

# Work up of Respiratory & Wound Cultures: Q-Score System

## “Q-Score” system

# PP in culture  $\leq$  Q-score: work up PP with ID/AST  
(2PP) (Q3)

# PP in culture  $>$  Q-score: Look to Gram stain  
(3PP) (Q2)

- Work up PP that were seen in Gram stain with ID/AST
- If all PP in the culture are seen in Gram stain  
= do not work up; morphological identify (MID) them

# Work up of Respiratory & Wound Cultures: Q/234 System

“Q/2-3-4” system:

- **Gram stain Quality Check: PMN & SEC**

Reject any sputum for culture according to normal protocol.

**Culture work up is based on number of PP present:**

**2PP = Work up ( $\leq 2$  PP)**

**4PP = MID**

**3PP = Look to Gram stain\***



**\*Work up to 2 PP if they are seen in the GS.**

**If all 3 PP are seen in the GS, MID all 3.**

**NOTE: If mixed flora > PPs = MID PPs.**

# Work up of Respiratory & Wound Cultures: PMN-association System

“PMN-Association” system:

- Quantitation of organisms in Gram stained smears can vary from technologist to technologist, and from day to day.
- Variability in specimen sampling is also a concern that can lead to inaccurate assessment of a patient’s condition.

**THUS:**

- Do not quantitate organisms in Gram stains; rather....
- Review Gram stains for the presence of a predominate bacterial morphotype(s) associated with PMNs = report these organisms; Do not report organisms that are in association with SECs.

# Example 1: sputum

**GS:** my PMN (+3), few SEC (-1), my enteric-like gnb  
**CULT:** mod. *P.aeruginosa*, mod. *E.coli*, mod. *Proteus* sp.,  
few diphtheroids

**WORK UP:**

Q-Score (Q2=2PP):

---

Q/2-3-4 (3PP):

# Example 1: sputum

**GS:** my PMN (+3), few SEC (-1), my enteric-like gnb  
**CULT:** mod. *P.aeruginosa*, mod. *E.coli*, mod. *Proteus* sp.,  
few diphtheroids

## WORK UP:

**Q-Score (Q2=2PP):** > Work up *E.coli* & *Proteus* sp;  
> MID PSA & report mixed flora

---

**Q/2-3-4 (3PP):**

# Example 1: sputum

**GS:** my PMN (+3), few SEC (-1), my enteric-like gnb  
**CULT:** mod. *P.aeruginosa*, mod. *E.coli*, mod. *Proteus* sp.,  
few diphtheroids

## WORK UP:

**Q-Score (Q2=2PP):** > Work up *E.coli* & *Proteus* sp;  
> MID PSA & report mixed flora

---

**Q/2-3-4 (3PP):** > Work up *E.coli* & *Proteus* sp;  
> MID PSA & report mixed flora

# Example 2: wound

- **GS: mod. PMN (+2), few SEC (-1), my gpc/clusters (staph), my gpc/chains (strep)**
- **CULT: my *S.aureus*, mod.  $\beta$ -strep, mod. coag - staph, few diphtheroids**
- **WORK UP:**
  - ◆ **Q-Score (Q1= 1PP):**

---

  - ◆ **Q/2-3-4 (2 PP):**

# Example 2: wound

- **GS: mod. PMN (+2), few SEC (-1), my gpc/clusters (staph), my gpc/chains (strep)**
- **CULT: my *S.aureus*, mod.  $\beta$ -strep, mod. coag - staph, few diphtheroids**
- **WORK UP:**
  - ◆ **Q-Score (Q1= 1PP): > MID SAU,  $\beta$ -Strep, & report mixed flora**

---

  - ◆ **Q/2-3-4 (2 PP):**

# Example 2: wound

- **GS: mod. PMN (+2), few SEC (-1), my gpc/clusters (staph), my gpc/chains (strep)**
- **CULT: my *S.aureus*, mod.  $\beta$ -strep, mod. coag - staph, few diphtheroids**
- **WORK UP:**
  - ◆ **Q-Score (Q1= 1PP): > MID SAU,  $\beta$ -Strep, & report mixed flora**

---

  - ◆ **Q/2-3-4 (2 PP): > Work up SAU &  $\beta$ -Strep, & report mixed flora**

# Example 3: wound

- **GS:** my PMN (+3), no SEC (0), my gnr (enterics), my gncb
- **CULT:** mod. *Kleb sp.*, mod. *Bacteroides sp.*, few *Enterococcus*
- **WORK UP:**
  - ◆ Q-Score (Q3=3PP):

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  - ◆ Q/2-3-4 (3PP):

# Example 3: wound

- **GS:** my PMN (+3), no SEC (0), my gnr (enterics), my gncb
- **CULT:** mod. *Kleb sp.*, mod. *Bacteroides sp.*, few *Enterococcus*
- **WORK UP:**
  - ◆ **Q-Score (Q3=3PP):** > Work up *Kleb*, *Enterococcus* & *Bacteroides sp.*

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  - ◆ **Q/2-3-4 (3PP):**

# Example 3: wound

- **GS:** my PMN (+3), no SEC (0), my gnr (enterics), my gncb
- **CULT:** mod. Kleb sp., mod. *Bacteroides* sp., few *Enterococcus*
- **WORK UP:**
  - ◆ **Q-Score (Q3=3PP):** > Work up Kleb, *Enterococcus* & *Bacteroides* sp.

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  - ◆ **Q/2-3-4 (3PP):** > Work up Kleb & *Bacteroides* sp.  
> **MID** *Enterococcus*

# Example 4: sputum

- **GS: mod PMN (+3), few SEC (-1), many gpc-staph, many mixed flora (w/ few gnb-enterics)**
  - **CULT: mod. CN-staph, mod. dipthhs, few *E.coli*, rare *S.aureus***
  - **WORK UP:**
    - ◆ **Q-Score (Q2=2PP):**
- 
- ◆ **Q/2-3-4 (2PP):**

# Example 4: sputum

- **GS: mod PMN (+3), few SEC (-1), many gpc-staph, many mixed flora (w/ few gnb-enterics)**
  - **CULT: mod. CN-staph, mod. dipthts, few *E.coli*, rare *S.aureus***
  - **WORK UP:**
    - ◆ **Q-Score (Q2=2PP): > Work up *E.coli* & *S.aureus*, > Report mixed flora**
- 
- ◆ **Q/2-3-4 (2PP):**

# Example 4: sputum

- **GS:** mod PMN (+3), few SEC (-1), many gpc-staph, many mixed flora (w/ few gnb-enterics)
- **CULT:** mod. CN-staph, mod. dipthhs, few *E.coli*, rare *S.aureus*
- **WORK UP:**
  - ◆ **Q-Score (Q2=2PP):** > Work up *E.coli* & *S.aureus*,  
> Report mixed flora

---

  - ◆ **Q/2-3-4 (2PP):** > Report mixed flora,  
> MID *E.coli* & *S.aureus*

**\*\*NOTE: If mixed flora > PP = MID PP.**

## Example 4: sputum

- **GS: mod PMN (+3), few SEC (-1), many gpc-staph, many mixed flora (w/ few gnb-enterics)**
- **CULT: mod. CN-staph, mod. dipthts, few *E.coli*, rare *S.aureus***
- **WORK UP:**
  - ◆ **Q-Score (Q2=2PP):** > Work up *E.coli* & *S.aureus*,  
> Report mixed flora

---

  - ◆ **Q/2-3-4 (2PP):** > Report mixed flora,  
> MID *E.coli* & *S.aureus*\*\*

# Premise for “Q” systems

- **Based on published prevalence of potential pathogen colonization of the oropharynx;**
- **The more superficially contaminated the specimen, the higher the # of colonizing organisms present;**
- **Quality of specimen is important in determining acceptability of specimen and extent of culture work up;**
- **If organisms seen in smear, greater chance they are associated with an infective process.**

# Advantages for “Q” systems

- 1. Offers a consistent approach for interpreting cultures:
  - ☞ Based on specimen quality (primarily SECs).
  - ☞ Based on organisms seen in Gram stain (if see organism on smear, should be in a significant number in the specimen,  $\geq 10^5/\text{ml}$ ).
  - ☞ Limits # of organisms worked up from mixed cultures, so that the reporting of misleading information can be minimized.

# Advantages for “Q” systems

## 2. No Potential Pathogen is ever ignored:

- All PP listed out; but may not be fully identified or have full AST performed.
- The pathogens that some believe should “ALWAYS BE WORKED UP”, such as *S. aureus*,  $\beta$ -strep, *P. aeruginosa* are identified and always indicated on the report.
- Can be modified to include screening for MRSA, VRE, etc.

# Advantages for “Q” systems

## ■ 3. Guidelines:

- ➡ **The Q-Systems offer “Guidelines” for a systematic culture interpretation approach**
- ➡ **These Guidelines are just that = Guidelines! Exceptions can be made if necessary.**
- ➡ **Any concerned physician can consult with microbiology to have further work performed on any culture if clinically indicated.**

## Q-Reference:

**C Matkoski, S E Sharp, and D L Kiska.  
Evaluation of the Q Score and Q234  
Systems for Cost-Effective and Clinically  
Relevant Interpretation of Wound  
Cultures. 2006. *J. Clin. Microbiol.* 44:  
1869-1872.**

# Matkoski, et. al.

## Conclusions:

- **The utilization of one of the Q-systems can help to:**
  - ◆ minimize the likelihood of reporting out misleading information to clinicians that might result in inappropriate antibiotic therapy
  - ◆ limit unnecessary work-up of mixed specimens that have little clinical relevance
- **One must keep in mind that exceptions to these protocols exist, and a physician may have a valid reason for deviation from these recommendations.**
  - ◆ The laboratory needs to remain open to discussion on the necessity to have further ID and/or AST performed on particular isolates.

# Matkoski, et. al. Conclusions (cont'd)

- **Both the Q-score and the Q234 systems showed clinical relevance, cost effectiveness and would allow for standardized approaches to the work up of wound cultures.**
- **The Q234 system proved to be a more practical procedure to implement in their laboratory.**
- **The Q234 system does not require a change in Gram stain interpretation or physician approval for specimen rejection.**

# Matkoski, et. al. Conclusions (cont'd)

- **All PP are reported from a culture with either ID or MID, allowing for further consultation with the ordering physician if clinically warranted.**
- **The Q234 system, which is more structured and cost-effective than their current method, was acceptable to the ID physicians.**
- **Will allow technologists to make more independent & consistent decisions about the significance of organisms in a wound culture.**

# **“Watch your P’s and Q’s”**

- 1) Determine your “P’s” (potential pathogens)**
- 2) Pick one of the “Q’s” (Q systems)**

**Report consist and clinically-relevant wound culture results.**

# Bronchoalveolar lavage

- Quantitate or not
- What quantity to work up
- What to do with 'normal flora'
- When to do susceptibility testing

?

# Bronchoalveolar lavage

- Quantitative cultures of BAL specimens are imperfect predictors of the presence of pneumonia in mechanically-ventilated patients.\*
- This technique had a reported sensitivity and specificity of 91% and 78%, respectively.\*\*
- However, despite the limitations, there are no alternatives that are clearly better.

\*Fujitani and Yu, Clin Infect Dis 43 suppl 2:S106, 2006

\*\*Mayhall, Emerg Infect Dis 7:200, 2001

# Bronchoalveolar lavage

- Quantitative BAL cultures:
  - ◆ Patients are considered to have a likelihood of pneumonia if there is “at least one microorganism obtained at a concentration of  $\geq 10^4$  cfu/ml of lung fluid.”\*
  - ◆ Commensal flora:
    - ☞ There should be no commensal flora at this site at concentrations  $\geq 10^4$  cfu/ml of lung fluid.
    - ☞ Commensal oral flora, when aspirated, can cause pneumonia.
    - ☞ Quantitation is used to determine whether this has occurred or not.
    - ☞ There should also be NO squamous epithelial cells present (this represents oral contamination).

\*Mayhall, Emerg Infect Dis 7:200, 2001; Baselski & Wunderink, Clin Microbiol Rev 7:533, 1994)

# Bronchoalveolar lavage

## IDSA/AST guidelines\*

- For VAP state that:  
"Significant growth of oropharyngeal commensals (viridans group streptococci, coagulase-negative staphylococci, Neisseria spp., and Corynebacterium spp.) from distal bronchial specimens is difficult to interpret...,  
but these organisms can produce infection in immunocompromised hosts and some immunocompetent patients."

# Bronchoalveolar lavage

## POTENTIAL PATHOGENS:

Quantitate and perform ID/AST on up to 3 potential pathogens if at  $\geq 10,000$  for BAL and  $\geq 1000$  for Brush (if  $> 3$  report MID).

Quantitate and report MID on any potential pathogens if at  $< 10,000$  for BAL and  $< 1,000$  for Brush.

## ORAL FLORA:

1. If SEC were seen on initial GS (= possible contamination is present), quantitate and report 'oral flora' (OF) regardless of amount present.

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2. If no SEC were seen on initial GS, for each OF isolate at  $\geq 10,000$  for BAL and  $\geq 1,000$  for Brush, report MID.

If no SEC were seen on initial GS, for each OF isolate at  $< 10,000$  for BAL &  $< 1000$  for Brush, quantitate and report **TOTAL AMOUNT** of combined 'oral flora' (ie: 7000 diph + 8000  $\gamma$ -strep = 15,000 OF) .

# EXAMPLE: BAL

## INITIAL GS:

Few polys, no SEC, NOS

## CULTURE:

50,000/ml Enterobacter spp.

25,000/ml Klebsiella spp.

8,000/ml coag. neg staphylococci

7,000/ml  $\alpha$ -streptococci (not Pneumo)

## REPORT:

50,000/ml Enterobacter (species) with AST

25,000/ml Klebsiella (species) with AST

15,000/ml Oral flora

# EXAMPLE: BAL

## INITIAL GS:

Moderate polys, no SEC, NOS

## CULTURE:

50,000/ml Staphylococcus aureus

15,000/ml coag. neg staphylococci

15,000/ml  $\alpha$ -streptococci (not Pneumo)

## REPORT:

50,000/ml S.aureus with AST

15,000/ml coag. neg staphylococci

15,000/ml  $\alpha$ -streptococci (not Pneumo)

**ADD CONTACT COMMENT:** Contact microbiology if further work up of this culture is clinically indicated.

# EXAMPLE: BAL

## INITIAL GS:

Moderate polys, few SEC, few GPC/clusters

## CULTURE:

50,000/ml Staphylococcus aureus

15,000/ml coag. neg staphylococci

15,000/ml  $\alpha$ -streptococci (not Pneumo)

## REPORT:

50,000/ml S.aureus with AST

30,000/ml Oral flora