Easy Ways to Fix Microbiology's Five Biggest Problems

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Objectives

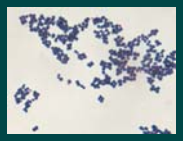
- List 5 of the most common problems in microbiology laboratories seen today
- Discovering those problems in your laboratory
- Gathering data
- Possible solutions

What do we know…..

- Microbiology the science
  - Flooded with variability
    - Specimen types – not just blood , serum or plasma
      - Body parts – arm, ear, lung
      - Affliction – Abscess, wound, pain
      - Procedures – Aspirate, surgical, swabbing
      - Specimen – urine, stool, bronch wash
    - Specimen Containers
    - Causative agent –
      - Fungus, Viruses, Parasites, bacteria
      - Agents of bioterrorism and reportable organisms

What do we know…..

- the science continued..
  - Variability
    - Gram positive, Gram negative, Gram variable
    - Cocci, bacilli, pleomorphic
    - Fermenter, non-fermenter
    - Sensitive, Intermediate or resistant
    - MRSA, MSSA or VRSA
    - ESBL, KPC producers
  - Microbiology struggles with living organisms
    - Consistently evolve and adapt



What do we know…..

- Microbiology the mystery
  - Investigation
  - Examination
  - Diagnosis
- Microbiology the process
  - Mostly manual, very little automation in the last 30 plus years
    - Prone to errors?
  - Complexity of processes
    - Media selection, incubation temperature, atmospheric conditions
    - Decontamination
    - Concentration
    - Gram Stain, Culture, Ag testing, PCR, Chromogenic media etc.

What do we know…..

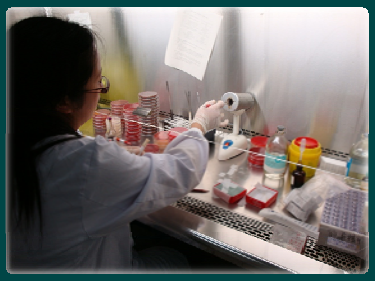
- Microbiology the knowledge
  - Aging Work Force
  - Heavy reduction in Medical Technologist programs
  - Developing a skilled microbiologist takes a significant amount of time and resources
- Volumes are increasing

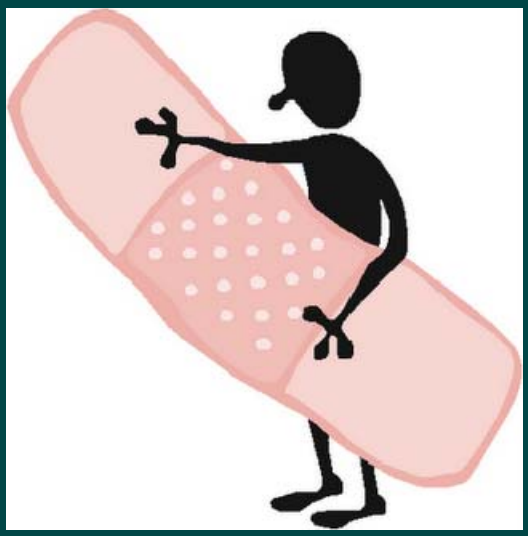
What have we done…

- Staffing
  - Recognized that MT programs have closed and recruiting is difficult
  - Recognized that baby boomers are about to retire
    - FMLA
    - Sick leave
    - Disability

Staffing Solution

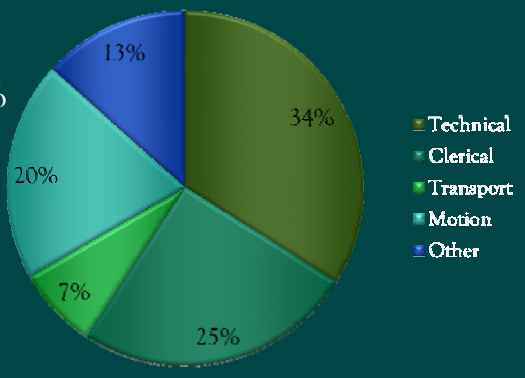
- Add Lab Assistants
  - Plate specimens
  - Non-technical task
  - Stocking/re-stocking
  - Other
- Add Labor





Look under that Band Aid

- Medical Technologist
  - Still doing < 50% technical work

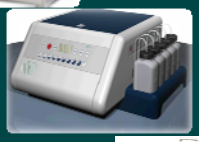


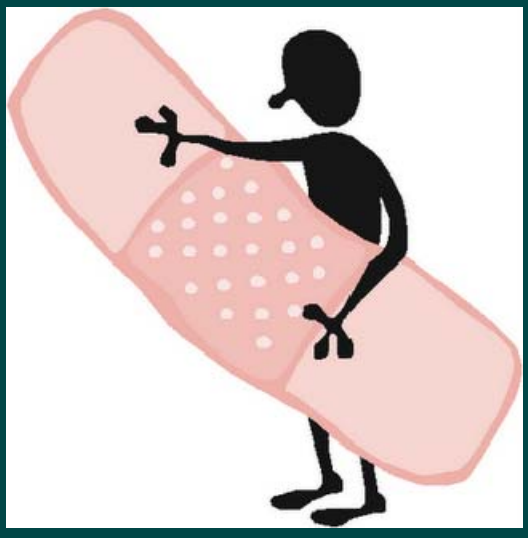
Growing Volume Solution

- Automation









Band Aids are not Solutions

- We did not look at the process

- Waiting
- Bottlenecks
- Hand-offs

Solutions Strategy

IDENTIFY THE REAL PROBLEMS

5 Biggest Problems identified

- Specimen Collection
  - Doing it right the first time
- Priorities
  - Who's Doing What?
- Batching and Scheduling
  - Perception vs. Reality
- Turn around Time
- Defending the Status Quo

SPECIMEN COLLECTION

Doing it Right the Frist Time

- Collect quality specimens
  - Blood Culture
  - Sputum
  - Swab
  - Tissue for OR
  - No swab for AFB and Fungus
  - Stools… It's complicated

"Garbage in = Garbage out"

- Limit the number of acceptable specimen containers

Contamination leads to false positive results

- If you are not using boric acid to preserve Urine Samples
  - ≥ 30% urine cultures are contaminated
  - 50% of the contaminated are worked up
  - Increasing
    - Non-value added activities
    - Labor & cost
    - Workload

Cost of urine contamination

- 30% contaminated urine samples

Avg # of urines per day	150
30% contaminated	45
50% of contaminated are worked-up	23
3 minutes to work up a positive culture	69 min
Total non-value added activity	**69 min/day**
Annual Cost of Labor (based on $70,000 salary)	**$14,125/year**
Cost of reagents avg $ 5.00/work-up	$115.00/day
Annual Reagent spent on contamination	**$ 42,000/year**

Total Estimated Annual Savings = $ 56, 125

Blood culture contamination

- Labor Savings
  - > 40% of all Positive Blood Cultures may represent contaminants. [1]
    1. Weinstein MP et al. CID 24: 584-602,1997

Monthly	
Number of Blood Cultures (2 bottles) 50/day	1500
Positivity Rate (range 9-12%)	10%
# of positive Blood Cultures	150
40% are contaminated Cultures (2 bottles)	60
Avg Cycle time for New Positive bottle	21 min/bottle
Total non-value added activity	42 hrs/month
Annual Cost of Labor (based on $70,000 salary)	$ 16,960/year

Blood Culture contamination cost

Literature	Year	Extra LOS (Days)	Cost (Per Contam)	Cost (2004 U$)*
Bates et al.	1991	4.3	$4,385	$7,761
Souvenir et al.	1995	N/A	$1,000	$1,350
Weinbaum et al.	1996	N/A	$2,500	$3,275
Surdulescu et al.	1998	4.5	$6,743	$8,294

Table created from material in the listed references

** ΔMedical Care CPI to 2004 (1991 = 77%, 1995 = 35%, 1996 = 31%, 1998 = 23%)*

Source: 1. Bates et al. JAMA 1991 Jan; 265(3): 365-9
2. Souvenir et al. J. Clin. Micro. 1998 Jul: 36(7); 1923-1926
3. Weinbaum et al. J. Clin. Micro. 1997 Mar; 35(3): 563-565
4. Surdulescu et al. Clin. Perform. Qual. Health Care. 1998 Apr-Jun; 6(2): 60-2

Bureau of Labor Statistics website: http://www.bls.gov/data/home.htm

Do the math…

Monthly	
# of positive Blood Cultures	150
# of Contaminated Blood Cultures	60
# of patients (4 bottles)	15
Avg Cost of Contaminated Blood Culture*	$5,000
Total Cost	$75,000/month
Estimated Annual Cost	$ 900,000

** Avg cost from 2004 contamination cost slide*

Total Estimated Annual Savings = $ 916,960

Swab Collection Trend

CDC Recommends – "Ideally, swab specimens should be collected using sterile swabs with a synthetic tip (Flocked Swabs) on an aluminum or plastic shaft.[1]

AMERICAN SOCIETY FOR MICROBIOLOGY | Journal of Clinical Microbiology

Comparison of Flocked and Rayon Swabs for Collection of Respiratory Epithelial Cells from Uninfected Volunteers and Symptomatic Patients

Peter Daley[1], Santina Castriciano[1], Max Chernesky[1] and Marek Smieja[1,2,3,4,*]

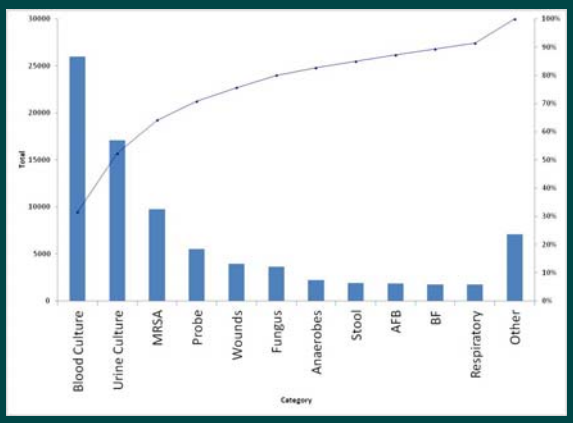
Collection & transposition of Specimen

Solution to Specimen Collection

- Why pay attention to specimen collection?
  - $$$$
  - Bad specimens lead to **False** positive results
- Specimen Collection
  - Ensure proper collection
    - Educate
    - Monitor
    - Enforce
    - Sustain
  - Don't give up
- Automation

PRIORITIES

Volume by Source



Value Stream Assessment focused on Urine and Blood (~50% of volume)

Who's doing What?

Assignments	Hours
Set ups 1	8
Set up 2	8
Blood/SBF	8
Urine	8
Respiratory/Genital	8
Wounds	8
AFB	8
Myco/Parasit	8
Microscan	8
GenProbe	8
2nd Shift	16
Total FTE	12

- Typical shifts
- Most of the culture reading and complex testing in done on 1st shift
- Problem
  - Silo driven assignments
  - Workload not evenly distributed
  - Non priority work will have faster TAT

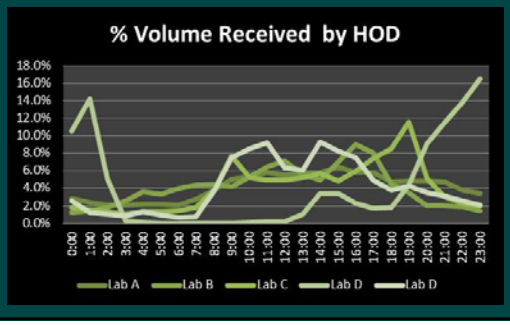
Solution -

- Develop assignments according to priorities rather than specimen types
- Eliminate silo assignments to drive team work and more rapid TAT
- Establish roles and responsibilities for each bench

BATCHING AND SCHEDULING

Batching & Scheduling ~ Perception vs. Reality

- Typical receiving patterns
  - Majority of specimens are received on 2nd shift
  - 3rd shift prophecy
    - Most labs don't receive on 3rd shift, so it's all received on days



What is Really Going On

Shift	A	B	C	D
1st Shift	52.5%	48.5%	59.7%	52.6%
2nd Shift	49.2%	54.2%	48.4%	10.8%
3rd Shift	17.2%	24.2%	12.1%	5.6%

- Microbiology is no longer a 1st shift operation
- 50% or more of specimen volume is received on 2nd shift
  - Are they being processed?

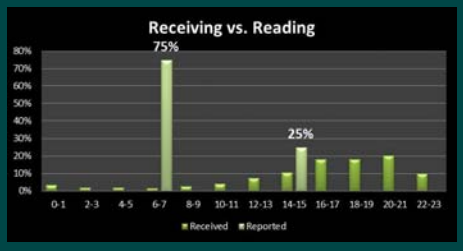
Closer Look at the Process

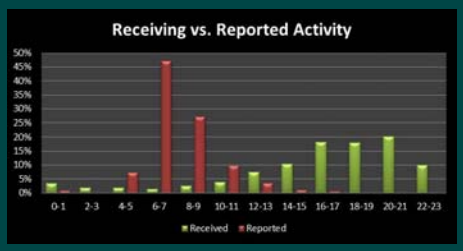
- Urine Cultures as example
- The minimum time line is 34 hours

- If sample is received on 2nd shift then it is likely getting an additional 24 hours due to reading schedule

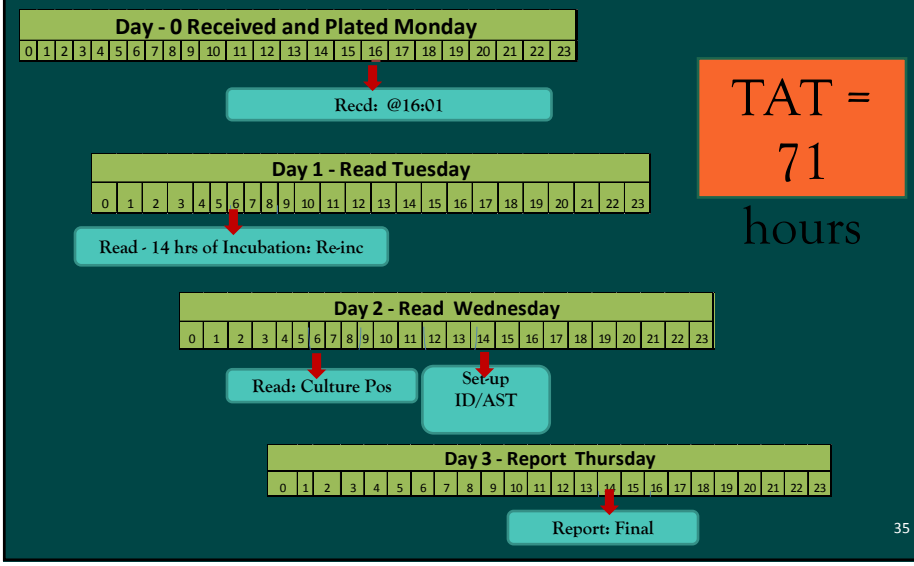
Case Study

- Most cultures are read on 1st shift
  - 85% of specimens are received after 12 noon
  - <18 hours of incubation
    - Re-inc & an additional 24 hour incubation
- Reading and reporting activity is mostly 1st shift





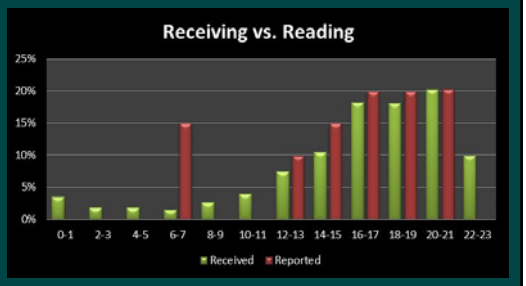
Case Study



TAT = 71 hours

Solution – Match reading to receiving patterns

- Create smaller batches
- Operation of Lab need to be driven by receiving pattern
- Reading and reporting activities match the receiving pattern
- Benefits
  - Reduce stress
  - Improve efficiency
  - Reduce TAT by 25%



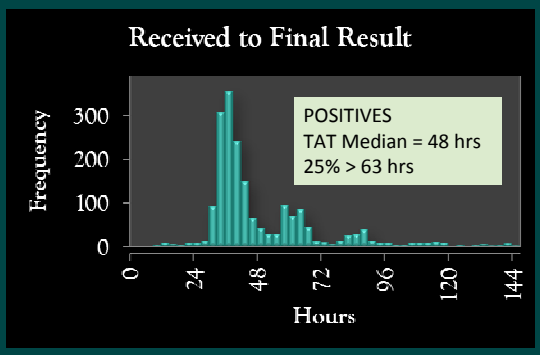
TURN AROUND TIME

Why Should You Care

- A significant amount of volume comes form out-reach
- LOS
- Antibiotic therapy
- Risk of HAI

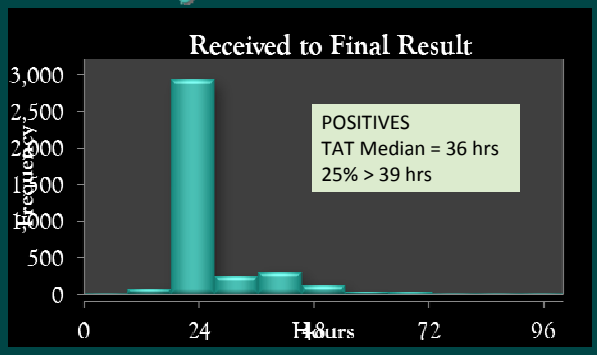
- Patient outcomes

Positive Urine Culture TAT



- Note the 24 reading & reporting patterns
- Build in at a min 32 hrs. value-added activities
  - Non-value added activities such as over-incubation, waiting, re-work drive the TAT

Case Study



- It can be done!

Solution – Know Your TAT

- Identify the high volume cultures and high priority cultures
- Determine base line TAT
- Find what drives the outliers
- Engage in rapid improvement process for immediate results

DEFENDING THE STATUS QUO

Status Quo

- "This is the way we have always done it!"
- "We have been doing it like this since I've been here" ~ 30 years
- Clinically exhaustive microbiology – after 3 days is it really clinically significant?

Old School Stuff

- Using Chop Meat Media
- Using Thioglycolate broths on every wound culture
- 48 hr. Urine cultures
- E. coli O157 & Campy cultures instead of EIA methods
- Exhaustive anaerobic cultures
- Isolator for Blood Culture

Citizens. Against. Virtually. Everything

Far Side: Gary Larson 1989:136

- Microbiology is changing
- More automation is being introduced
- Microbiology techs need to smell it, touch it and grow it
- Beware of C.A.V.E. people
- "Status quo" is no longer meeting the needs
- Educate, commit and implement change

Summary

- Specimen quality as an indicator for specimen collection practices
- Balance resources with priorities for the department
- How are you batching and when – at a minimum eliminate the 24 hour batch
- TAT – it's about the patient
- Out with the "Old", Microbiology is changing

Thank You

Questions?