GETTING OUR BLOOD UP: IMPROVING BLOOD CULTURE VOLUMES AND POSITIVITY ACROSS >15 HOSPITALS

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http://medifitbiologicals.com/blood-culture/
Blood culture bottles
Each bottle needs 10 ml of Blood
Drawing a “blood culture”

- 10 ml
- 10 ml
- 10 ml
- 40 ml!
More blood means more yield

• Blood culture yield (pathogen recovery) is directly dependent on volume
• Study from Mayo Clinic, 2004

<table>
<thead>
<tr>
<th>Fill amount</th>
<th>Number of bottles</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 ml</td>
<td>2 (1 set)</td>
<td>65%</td>
</tr>
<tr>
<td>40 ml</td>
<td>4 (2 sets)</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>(most common)</td>
<td></td>
</tr>
<tr>
<td>60 ml</td>
<td>6 (3 sets)</td>
<td>96%</td>
</tr>
</tbody>
</table>
Identifying the problem

- Low blood culture volume reduces blood culture yield
- Do we have low blood culture volumes?
Barriers to change

Modified from: https://upload.wikimedia.org/wikipedia/commons/c/cb/Map_of_the_Boroughs_of_New_York_City_and_the_counties_of_Long_Island.png
Need a better quality monitor

Solution: we required consistent volume monitoring
- **Lab driven** initiative
- **Monthly** feedback to hospitals
- **Unblinded** data

MIC.22640  Blood Culture Volume  Phase I

The laboratory has a policy and procedure for monitoring blood cultures for adequate volume and feeding back the results to blood collectors.

Good afternoon,

This is the last of the 2017 blood culture fill volume reports. As always, the summary file is named “BCFV metric 12-2017.pdf”, and the special report for the emergency departments is “Emergency departments BCFV 12-2017.pdf”.

Unfortunately, there was quite a “downtick” in fill volumes in December. A total of 8 hospitals showed a negative trend, resulting in a decrease of the system wide average volume to 7.4 mL (yellow).

Similarly, the EDs also fell down to 7.7 mL.

Kudos to the winner of the year 2018: XXXXXXXXXX Hospital with 8.7 mL, followed by XXXXXXXXXXX (2nd), XXXXXXXXXXX and XXXXXXXXXXX (both 3rd), XXXXXXXXXXX (5th) and XXXXXXXXXXX (6th).

Congratulations to everyone: The increase of system wide fill volume compared to last year is 2.5 mL, and there was not a single hospital that didn’t improve this year.

VERY NICE!!!
Measuring volume is not easy

• How to measure blood volume in the lab?
  • Visual inspection
  • Weighing bottles
Measuring blood fill in the lab

Solution: Active, automated blood volume monitoring system

Credit: Dr. Stefan Juretschko
Increasing blood volume over time

Compiled by Dr. Stefan Juretschko, Director of Infectious Disease Diagnostics, Northwell Health
Increasing blood volume over time

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Measuring volume is not easy

- How to measure blood volume during the draw?
  - “Eyeballing”
Measuring volume is not easy

Solution: Marking the bottles
Education

**Collect to Detect**

Did you know that 80% of LJI Blood Culture bottles are under filled?

**COLLECT TO DETECT**

- Overfilling may cause false positive
- Under filling reduces sensitivity

Each ml of blood adds 3.5% to test sensitivity

**8 to 10 mL**

**Background**

A blood culture is the collection and inoculation of blood into culture medium with the aim of proving pathogenic bacteria or fungi for diagnostic purposes (Reference #1).

- Many factors influence the yield of blood cultures, but the single most important factor is blood volume. Several studies have shown that the rate of isolation of pathogens from blood cultures increases with the quantity of blood submitted. Hence, a blood culture may be falsely negative from an inadequate-volume blood culture (Reference #2).
- For each additional 2 mL of blood collected, there is a 1% increase in positivity (Reference #3).
- The volume of blood collected per culture remains the single most important determinant for optimal yield of organisms. Current national recommendations are to submit at least 10 mL of blood per culture on the basis of repeated evidence that less volume markedly decreases yield of organisms (Reference #4).

**Blood Cultures ~ Fill Me Up!**

(But Not Too Much)

**Future Plan**

- Continue to monitor blood culture volumes
- Continue to educate in-service current staff and new hires
- Move to plastic blood culture bottles for patient and employee safety
- Continue to monitor to ensure that all staff continue to follow proper procedures

**Intervention**

- Started to monitor draw levels in-house, with the marking of fill lines on blood culture bottles.
- Collaborated with nursing units using levels and fill lines.
- Decreased situational awareness about volumes required for accurate blood culture results, in collaboration with nurse educators and nurse managers.

**The Team**

- Ingrid Cistulli
- Carol McHale
- Carole Aikman
- Joseph Eshel
- Mina Pridilla
- Jennifer Renganathan
- Kathleen Ziasa & Matt Walsh

**Acknowledgements**

- North Shore LIJ Franklin Hospital
- Department of Medical Laboratory Services

**Fun Fact**

- 30 positive cultures per day (25%)
- 600 blood culture bottles per day
- 25,000 blood culture bottles per month
- Machine can hold 600 bottles at a time!
Education!

• Hospital-specific seminars on the value of blood volume
• Seminars on marking, labeling, disinfecting, blood collection kits etc.
• Briefings to administrative and medical leadership
• Training of individual clinicians
• Developed a simple guide poster for blood culture collection

Blood Culture Collection Instructions

Prepare Blood Culture Bottles

• Step 1
  • Mark Bottle at desired fill level (each hatch mark on label is 5ml)
  • 8 ML – 10ML Required (for adults)

• Step 2
  • Remove cap
  • Wipe the top of each bottle with a single alcohol swab and allow to dry.

Collect Blood Sample

• Step 3
  • Cleanse the venipuncture site with 70% isopropyl alcohol.
  • Swab with chlorhexidine-gluconate
  • Allow site to air dry.

• Step 4
  • Use Butterfly and Vacutainer holder. (Acceptable method)
  • Select aerobic bottle first. (Blue band on bottle)
  • Hold bottle upright and fill to desired level (8ml-10ml)

Note: Venipuncture policy and standard precautions MUST be followed when collecting blood culture. Blood Culture MUST be collected before all other specimens.
Positivity rate
Summary

• Correctly presenting a monitor may dramatically impact an initiative

• Initiatives we implemented were simple:
  • Consistent measurements & monitors
  • Minor operational changes, occurring organically
  • Support from ALL levels of the health system

• Blood culture volumes, positivity, and potential pathogens all increased!

• Change is slow – took 3 years of active pressure
Next steps

- See greater increases in our blood culture positivity
- Other patient outcomes
- Overutilizing blood cultures?
Positivity rate

![Diagram showing the positivity rate over time, with a trend line indicating an increasing positivity rate.](image)
Positivity rate
Acknowledgments

- Dr. Stefan Juretschko
- Dr. James Crawford
- Dr. Tarush Kothari
- Bioinformatics group: Dr. Tylis Chang, Yehuda Jacobs, Liya Lomsadze

- Microbiology managers – all sites
- Elizabeth Balestrieri