



Parkland



Evaluation of costs, technologists time and turn-around times for conventional stool cultures

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ABSTRACT

New enteric panels for the molecular detection of bacterial stool pathogens are currently being developed. To establish a baseline to evaluate the potential future impact of a change from conventional culture to molecular testing for the detection of these pathogens, we determined the current costs, technologists' time and time to a positive and negative result using our current culture methods. We reviewed 206 consecutive stool cultures received from two university hospitals with a total of 421 beds, examining electronic work card entries recorded by medical technologists. The primary stool culture included inoculation of MacConkey, XLD, sheep blood and Campylobacter agars and a selenite broth that was subcultured to XLD agar after 18 hours of incubation. The costs per stool culture for media and reagents were recorded. Average costs for media and reagents for cultures were as follows: No potential pathogens, \$5.74 (n=74); negative cultures with additional workup, \$7.27 (n=127); and positive cultures, \$9.33 (n=5). *Shigella sonnei*, *Campylobacter* species and *Salmonella* species were the bacterial pathogens that were recovered in the 5 positive cultures. To evaluate the technologists' time, 5 different technologists recorded the time that they spent on stool work-ups. The average technologist time required to complete a single final culture was approximately 8 minutes (range of 1-15 minutes). Using an average cost of \$27 per hour for technologists' labor and benefits and 8 minutes of time per culture,

the labor cost per culture was \$3.60. Including media, reagents and labor, the average cost to detect a single positive culture was \$427. While negative cultures with no potential pathogens were reported at 48 hours, positive cultures required 72 to 96 hours to finalize. A rapid enteric panel for the molecular detection of stool bacterial pathogens might generate faster results, reduce costs, and allow technologists to spend time evaluating other more complex samples.

INTRODUCTION

Conventional stool cultures have been an important tool for identification of gastrointestinal pathogens for decades. Now that more modern, molecular-based tests are entering the market, we sought to examine the cost and turn-around time for conventional tests, so that we have a basis of comparison for modern testing methods. There is little data that examines stool culture positivity rates, or the cost and time required to find a single positive culture.

METHODS

Stool cultures are screened for the common enteric pathogens: *Shigella* spp., *Salmonella* spp., and *Campylobacter* spp. Other potential pathogens such as *Aeromonas* spp., *Vibrio* spp., *Plesiomonas* spp., and *Yersinia* spp. may also be encountered on routine stool culture. Screening for bacterial enteric pathogens is accomplished by plating fecal specimens to selective, differential media. Stools are inoculated to MacConkey, XLD, Sheep blood, and Campylobacter plates, and selenite broth. After 18 – 24 hours of incubation at 35 °C, a sample from the broth is inoculated onto a second XLD plate. On MAC and XLD, reactions for lactose and H₂S, testing, respectively, determine the need for further testing with common biochemicals to rule out the presence of pathogens.

We reviewed the work cards of 206 consecutive stool cultures that were completed at University Hospital's Microbiology laboratory. We recorded the media used and tests performed on each culture, as well as the results of positive cultures.

To calculate costs, we used the actual price that we pay for each medium or reagent. For reagents that can be used for multiple tests (e.g. oxidase, Gram stain), we divided the cost of the reagent by the number of tests that could be done. We included the cost of additional supplies, such as a slide for Gram stains and a microaerophilic pouch for the Campylobacter plates, when applicable.

To calculate medical technologist time, we asked that technologists record the number of stool cultures that were finalized and their start and end times for working on all stool cultures for 10 consecutive days. This included work from 5 medical technologists, which was composed of a wide breadth of experience levels (range, 4 –19 years).

Finally, we estimated the turn-around time by examining the work cards for time received in the laboratory to time finalized.

Table 1: Standard Media Inoculated for Stool Cultures	
Media	Cost (\$)
MacConkey	0.21
XLD	0.28
Sheep blood agar	0.18
Campylobacter agar & microaerophilic pouch	4.37
Selenite broth → Inoculated onto an additional XLD plate after 18 hours incubation	0.43 + 0.28
Total cost for standard work up	\$5.75

RESULTS

Table 2: Reagent and Supply Costs of Additional Testing on Stools with Potential Pathogens		
Test	Isolates tested	Approximate cost per test (\$)
Oxidase	58	0.05
Gram stain	54	0.80
Restreak to BAP	52	0.18
Wet prep	35	0.50
TSI	31	0.41
LIA	29	0.44
Restreak to MAC	15	0.21
Spot Indole	15	0.05
Biochemical panel for identification and susceptibility ¹	14	3.95
Vancomycin screening agar ²	7	0.90
MDG ³	6	4.51
StrepQuick Card™, ⁴	4	4.80
Restreak to XLD	3	0.28
PYR	3	1.50
Catalase	2	0.00

¹ Performed on the Microscan® Neg Urine Combo Panel Type 55

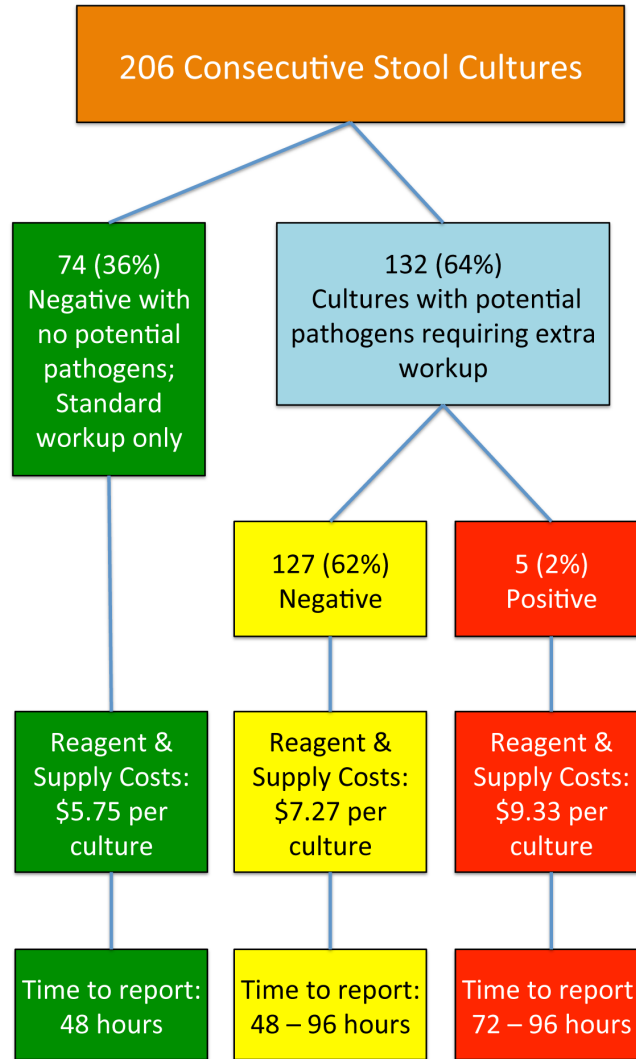
² For detection of vancomycin resistant enterococci

³ Methyl-a-d-glucopyranoside Medium used for differentiation of *E. faecium* and *E. faecalis* from *E. gallinarum* and *E. casseliflavus*

⁴ Detects pyroglutamate aminopeptidase (PYR), leucine aminopeptidase (LAP), and esculin hydrolysis (ESC) activity

Table 3: Cost and Technologist Time Required to Identify Stool Cultures with Enteric Pathogens	
Supplies = \$1395.70 Technologist Time (Average wage = \$27/hour; Average culture time = 8 min, 206 Cultures) = \$741.60 Total cost for 206 cultures	\$2137.30
# of Positives (out of 206 stool cultures) <i>Salmonella</i> spp. (n = 3) <i>Campylobacter</i> (n = 1) <i>Shigella sonnei</i> and <i>Campylobacter</i> (n = 1)	5
Amount spent to detect each positive culture	\$427.46

RESULTS



CONCLUSIONS

- Stool cultures have low positivity rate; therefore, the cost of finding one positive was \$427.
- Medical technologists spent an average of 8 minutes to work up one stool culture, which added personnel costs and limited their ability to work on more complex microbiological testing.
- A majority (63%) of negative stool cultures required some testing beyond the primary media, which adds to costs and may extend the time to a final report.
- Newer methods for detecting gastrointestinal pathogens may be useful for decreasing costs and generating faster results.