ADDRESSING ELEVATED BLOOD CULTURE CONTAMINATION RATES WITH PASSIVE CONTROL MEASURES.

Christoph Goessler, BSN, RN, CEN
VAPORHCS Emergency Department

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This project was reviewed by the VA Portland Health Care System Research and Development Service and it was determined to not be research. No further research approvals were required.

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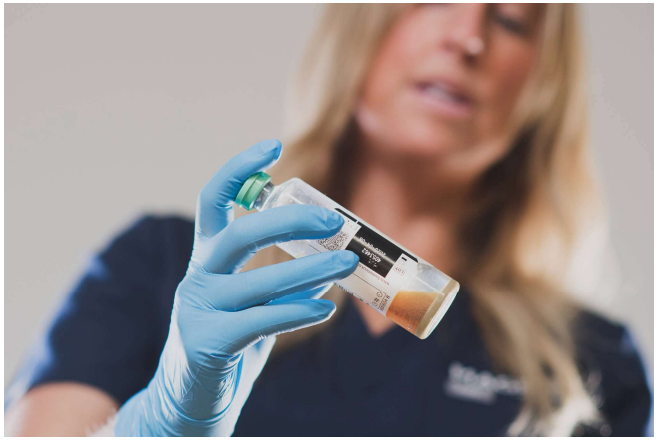
BACKGROUND

Blood Cultures

- Blood Cultures are obtained to help guide care plans and antibiotic therapy selection for patients experiencing complex infections or Sepsis.
- They are drawn in sets which separately identify the presence of aerobic or anaerobic bacteria in the blood. Typically, two sets, sometimes three, are drawn in order to evaluate correctness of lab results. If the two sets do not "agree", then the samples are considered contaminated.
- Blood Cultures take 2-3 days to result. If a sample is contaminated, this will not be known immediately leading to further delay in care of patients.



Source: https://magnolia-medical.com/steripath/the-challenge-of-preventing-blood-culture-contamination/

BACKGROUND

Why it Matters

- One study found that blood culture contamination led to an average of "$8,720 in additional charges per contamination event while the median length of stay increased marginally from 4 to 5 days (Gander, Decrescenzo, Brown, & Baughman)."
- Contamination poses a higher risk to older adults who are more susceptible and less resilient to infection.

Source: https://floridapolitics.com/archives/415042-house-eyes-cuts-to-nursing-homes-hospitals/

BACKGROUND

"The Issue"

- VAPORHCS is a 227 bed hospital in Portland, OR that serves veterans who are typically Older adults who identify as male. The Emergency Department has 22-25 beds, has an average of 60 check-ins per day.
- By March of 2021, the VAPORHCS ED has had 4 months of blood contamination rates being above the 3% acceptable rate. Being that this was during the middle of a pandemic, this was concerning to me. I was aware of a cool device that could be used to divert "contaminated" blood and decrease contamination rates. I was curious in exploring this more.

Source: http://www.portland.va.gov/research/

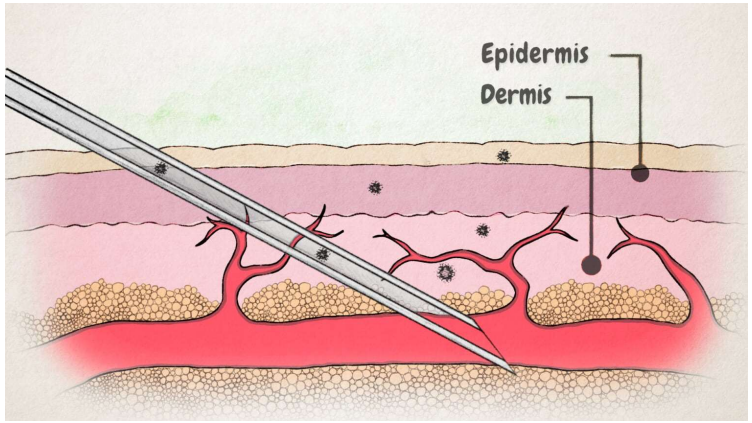
PICO(T) QUESTION

Initial:

In Emergency Department patients (P), how do blood culture diversion devices (I), compared to traditional blood culture drawing (c) affect blood culture contamination rates (o)

INITIAL EVIDENCE SUMMARY

- New research is showing that bacterial ”skin plugs” reside in deeper levels of skin that cannot be cleaned by topical antiseptics (Zimmerman et. al., 2020).
- Skin contaminants can be introduced into blood cultures since blood cultures are the “first drawn” sample when drawing labs (Zimmerman et. al., 2020).
- ”Wasting” the initial 3-5ml of blood will divert this contamination away from the blood cultures (Zimmerman et. al., 2020).
- Blood can be “diverted” either with specific devices or with Lab Tubes/ Syringes.



https://www.betterbloodcultures.com/best-practices/

EVIDENCE RETRIEVED

Blood Culture Diversion – Evidence Table, Goessler 2020 PICOT: In Emergency Department patients (P), how do blood culture diversion techniques(I), compared to traditional blood culture drawing (c) affect blood culture contamination rates (o)						JHEBP Evidence Rating		
Author and Date	**Study Design**	**Sample Size**	**Intervention**	**Findings**	**Limitations**	**Level**	**Quality**	**OSU Scale**
Zimmerman et. Al. (2020)	Randomized Control Trial:	N=934 490 (Control) 474 (Diversion)	Diverting initial blood into blue heparin tube prior to drawing blood culture.	Contamination of: Control was 5% Diversion was 2%	-Based in Israel based Emergency Dept. -Due to random nature of group assignment, control group had higher acuity patients from long term living facilities. -Unable to double blind study due to staff drawing culture easily identifying items from each group.	1	A	2
Lalezari et. Al. (2019)	Randomized Control Trial:	N=756 400 (Control) 356 (Diversion)	Diverting initial blood into blue heparin tube prior to drawing blood culture.	Contamination of Control was 5% Diversion of 1.7%	-Based in Israel based hospital system (majority in ED setting). -Potential contamination from non-sterile tubes -No analysis of cost or harm done.	1	B	2
Patton et. Al (2010)	Quality Improvement Project	7876 Pre 9 months (3733) 9 Month Trial (4143)	Diversion of 3ml into sterile BD tube.	Pre 3.8% Trial 1.9%	-Conducted in one hospital. -Pre data appears to have non-randomized mix of both diversion device and standard technique where post-group was just diversion device only. -Facility IRB required informed consent which made difficult to have participation from altered patients.	3	B	6
Syed et. Al (2020)	Quality Improvement Project	14,046 patients	Diversion of 7ml of blood into gold o green top tube	Pre: 2.46% Post: 1.70%	-Conducted in both inpatient and emergency department. -Decrease in both areas found Pre and Post data both over 18 month periods. -Statistically significant	3	B	6

- Databases searched: Pubmed and Cochrane Nursing Library
- Key words used: Blood Culture, Blood Culture AND Contamination, Blood Culture AND Diversion

Levels of Evidence Synthesis Table

Level of Evidence	1	2	3	4	5	6	7
Level II: Randomized controlled trial	X	X					
Level VI: Qualitative or descriptive study, CPG, Lit Review, QI or EBP project			X	X	X	X	X

LEGEND

1= (Lalezari, Cohen, Svinik, Tel-Zur, Sinvani, Al-Dayem, & Strahilevitz, 2020) , 2= (Zimmerman, Karameh, Ben-Chetrit, Zalut, Assous, & Levin, 2020) , 3= (Patton, & Schmitt, 2010) , 4= (Babiker, Ramakrishnan, Howard-Anderson, Holdsworh, Jacob, & Jacob, 2020) , 5= (Baxter, Cook, & James, 2020), 6= (Rupp, Cavalieri, Marolf, & Lyden, 2017), 7= (Syed, Liss, Costas, & Atkinson, 2020)

Outcomes Synthesis Table

↑, ↓, —, NE, NR, ✓ (select symbol and copy as needed)	1	2	3	4	5	6	7
Blood Culture Contamination Rates	↓	↓	↓	↓	↓	↓	↓

SYMBOL KEY

↑ = Increased, ↓ = Decreased, — = No Change, NE = Not Examined, NR = Not Reported, ✓ = applicable or present

LEGEND

1= (Lalezari, Cohen, Svinik, Tel-Zur, Sinvani, Al-Dayem, & Strahilevitz, 2020) , 2= (Zimmerman, Karameh, Ben-Chetrit, Zalut, Assous, & Levin, 2020) , 3= (Patton, & Schmitt, 2010) , 4= (Babiker, Ramakrishnan, Howard-Anderson, Holdsworh, Jacob, & Jacob, 2020) , 5= (Baxter, Cook, & James, 2020), 6= (Rupp, Cavalieri, Marolf, & Lyden, 2017), 7= (Syed, Liss, Costas, & Atkinson, 2020)

Synthesis Table:
Diversion Method and Level of Evidence

Type of Device	1	2	3	4	5	6	7
Diversion – Lab Tube	RCT[a]	RCT[a]	QI[a]				QI[a]
Diversion- Device				QI[a]	QI[a]	QI[a,c]	

SYMBOL KEY

RCT= Randomized Control Trial, QI= Quality Improvement Project,

a= Statistically Significant, b= question with design

[a]= statistically significant, [b]=statistical significance not specified, [c]=question with design or affliation

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Synthesis Table:
Pre-Post Contamination Rates

Type of Diversion	1	2	3	4	5	6	7
Diversion - Lab Tube	Control: 5% Diversion: 1.7%	Control Post: 5% Variable Post: 2%	Pre: 2.8% Post:1.0%				Pre: 2.46% Post: 1.7%
Diversion- Device				Pre: 4.7% Post: 2.6%	Pre: 4.9% Post: 1.6%	Pre:1.78% Post: 0.22%	

LEGEND

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IN-DEPTH EVIDENCE SUMMARY

- Based on the evidence, the principle of blood diversion, regardless of method, prior to obtaining blood cultures correlates with decreased contamination rates.
- Diverting initial blood into tubes seems to be a comparative, cheaper, and easier to implement strategy opposed to diversion devices.

Source: https://www.infectiousdiseaseadvisor.com/home/topics/nosocomial-infections/curbing-overuse-of-blood-cultures-in-the-emergency-department/

PICO(T) QUESTION

Revised:

In Emergency Department patients (P), how does blood culture diversion *with lab tubes* (I), compared to traditional blood culture drawing (c) affect blood culture contamination rates (o)

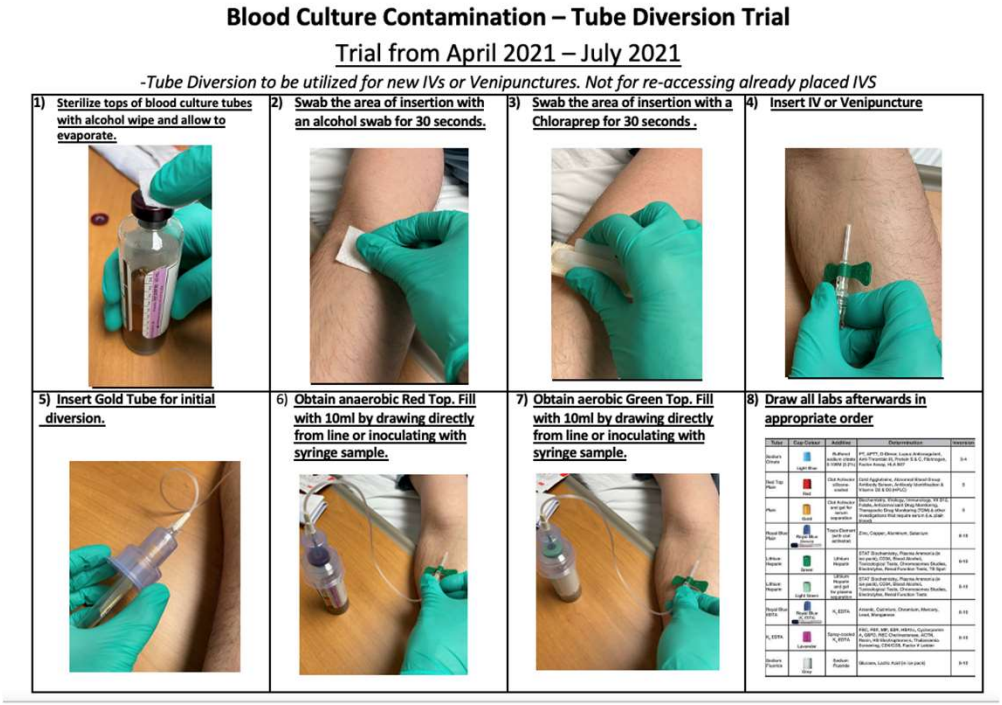
ACTION PLAN

- In December - February, I met with stakeholders in the Lab, Infection Control and ED Leadership to discuss the trial and seek input.
- ED Leadership approved a trial of Tube Diversion from April-July of 2021.
- Two other RNs were selected to be trained as SMEs who could role model the change.

Source: https://www.digitalhrtech.com/succession-planning-tools/

ACTION PLAN

- In March of 2020, the trial was notified to all ED RNs via email, 1:1 staff trainings, and published Standard Work
- The trial went live in April of 2021. Staff were notified via email and additional 1:1 trainings.



Blood Culture Contamination – Tube Diversion Trial

Trial from April 2021 – July 2021

-Tube Diversion to be utilized for new IVs or Venipunctures. Not for re-accessing already placed IVS

1) Sterilize tops of blood culture tubes with alcohol wipe and allow to evaporate.

2) Swab the area of insertion with an alcohol swab for 30 seconds.

3) Swab the area of insertion with a Chloraprep for 30 seconds .

4) Insert IV or Venipuncture

5) Insert Gold Tube for initial diversion.

6) Obtain anaerobic Red Top. Fill with 10ml by drawing directly from line or inoculating with syringe sample.

7) Obtain aerobic Green Top. Fill with 10ml by drawing directly from line or inoculating with syringe sample.

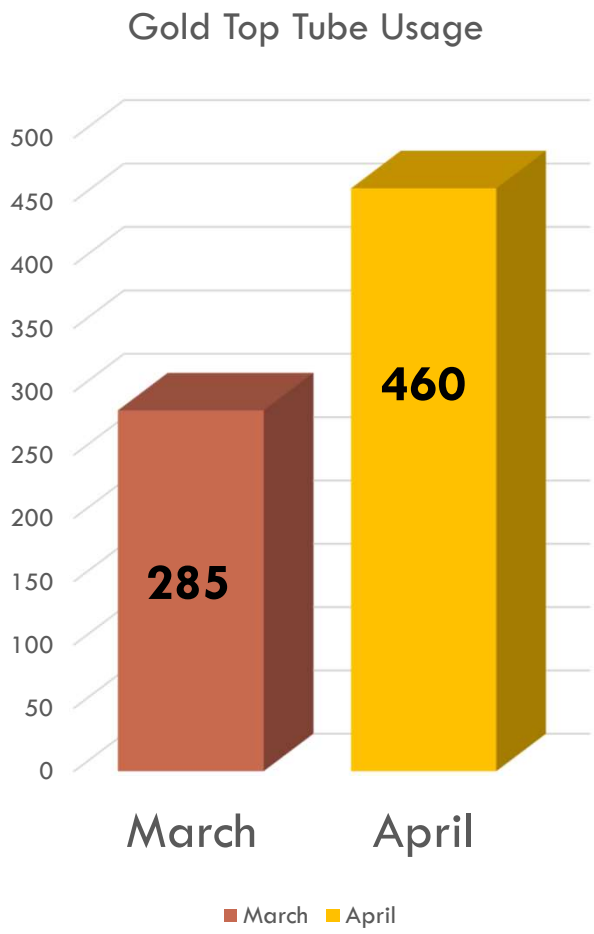
8) Draw all labs afterwards in appropriate order

PROJECT METRICS

	Metric	Operational Definition	Source of Data	Data Collection Frequency	Data Aggregation (frequency & level of analysis – unit, pt. pop)	Feedback Plan (to what stakeholders, & when)
PROCESS	Gold Top Tube Usage	Monthly inventory reports for Gold Lab Tubes	Supply Omnicell Reports	Monthly	Rates reviewed monthly	Report rates to staff monthly
OUTCOME	Contamination Rates	Percentage of contaminated samples drawn in specific month	Data provided by microbiology lab department	All contaminated sampled scanned and recorded	Analyzed quarterly or more if requested.	Monthly report out to nursing staff.

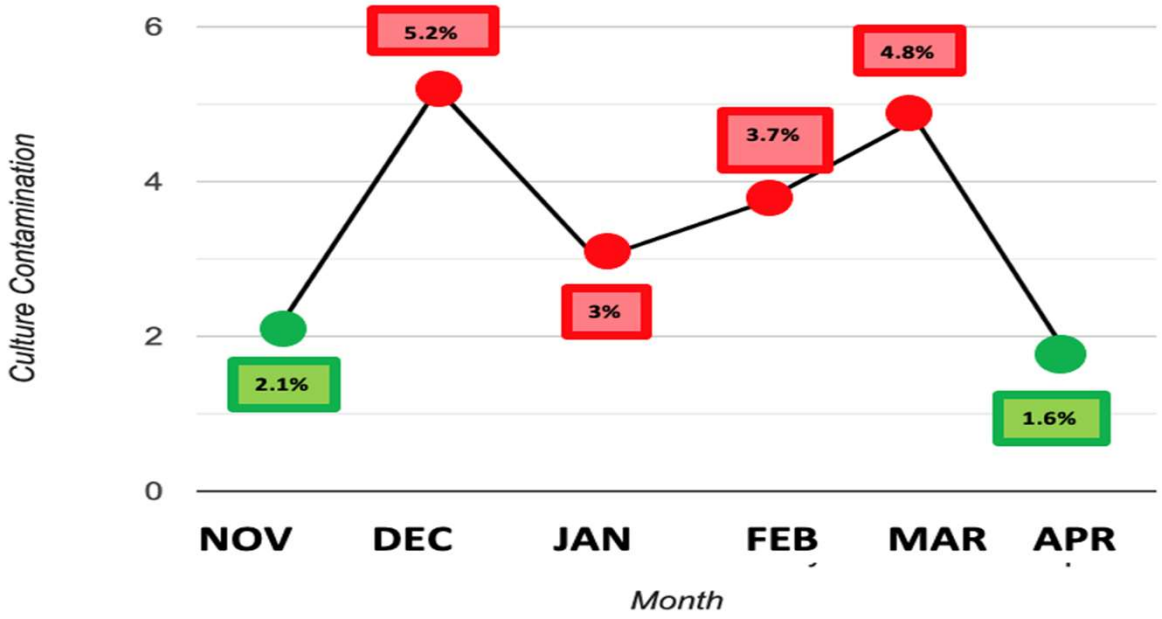
RESULTS – GOLD TOP TUBE USAGE

- Gold Top Tubes were the chosen method of “skin plug” diversion.
- Usage rates were requested to help display compliance with the diversion trial
- Gold Top Tube usage in March 2021 were 285 and rose to 460 in April 2021

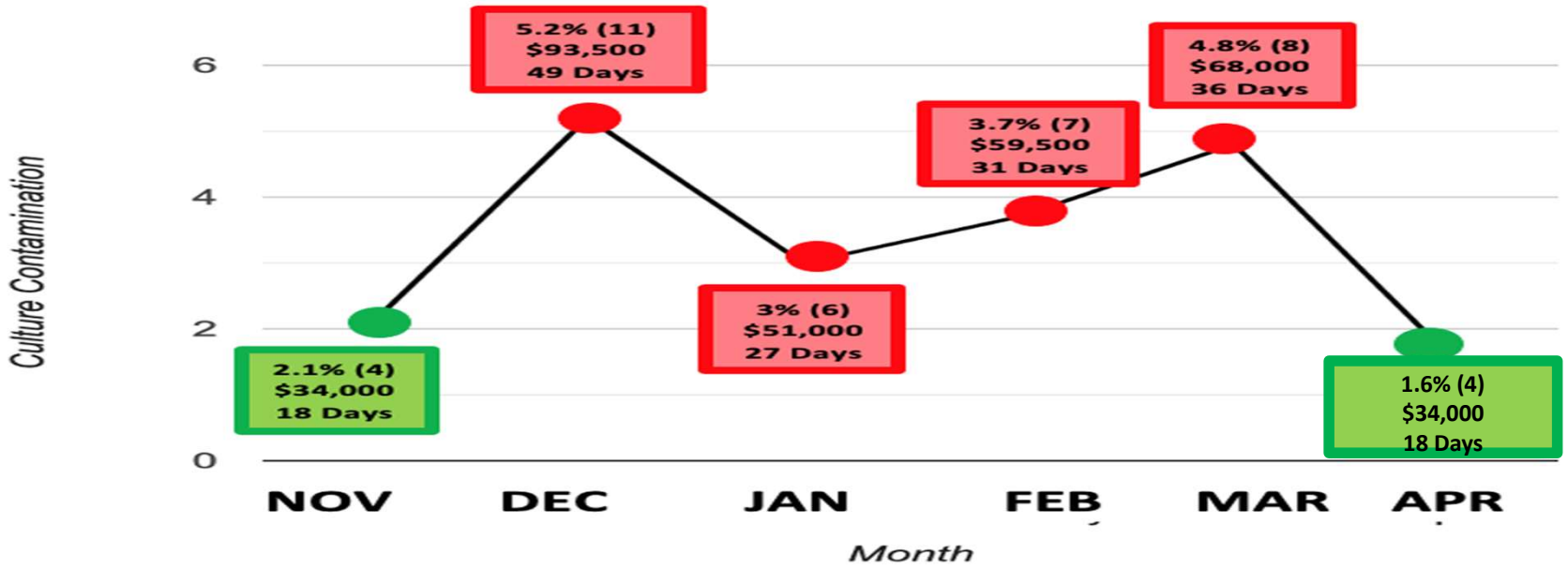


RESULTS – CONTAMINATION RATES

- For our first trial month in April, after 4 sustained months of having rates of 3% or above, contamination rates were found to be 1.6%. With 252 total blood cultures, 4 of these cultures were contaminated.



RESULTS – CONTAMINATION RATES



1 Contaminated Blood Culture Set leads to:

- An average of $8,720 in additional charges
- An average increased patient Length of Stay (LOS) 4-5 days

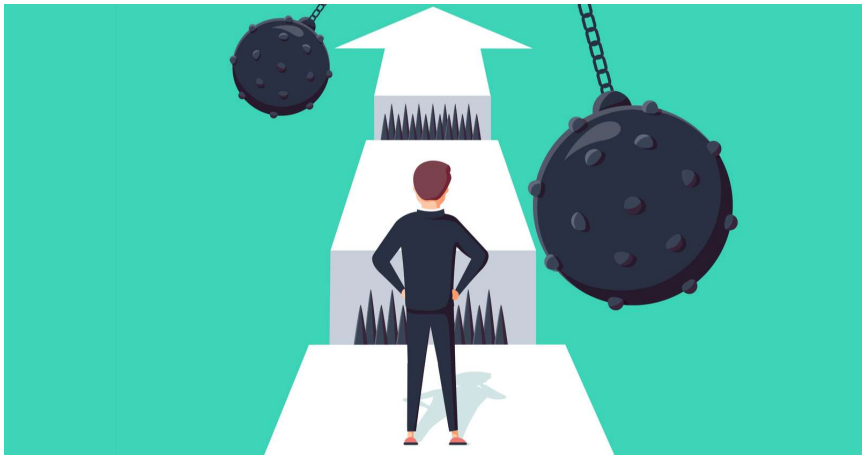
(Gander, Decrescenzo, Brown, & Baughman 2009).

RETURN ON INVESTMENT

Cost of Change		Benefit of Change		
Gold Top Tube:	$0.13		Baseline	Post
		One-time reduction (supplies, labor, equipment)	**NA**	**NA**
		Ongoing reductions (supplies)	**NA**	$32.76
Equipment:	NA	Increased revenue (e.g., higher patient volumes, reduced LOS or readmissions)	**Dec 20-Mar 21 36 average projected monthly additional LOS Days** $1769/36 days = $63,684	**average projected additional LOS Days in April** $1769/18 =$31,842+32.76
Subtotal	**April Tube Usage:** $0.13x 252= $32.76	Subtotal	$63,684	$31,874.76
OVERALL RETURN ON INVESTMENT		**$31,809.24 cost savings for the month of April**		

CHALLENGES

- Tracking compliance of trial in-situ proved challenging
- While informal 1:1 debriefs and updates of trial were done monthly, none of these were not formally recorded.
- During the month of April, the ED was faced with a staffing crisis making it difficult to ensure new staff were receiving prompt trainings.



Source: https://www.searchenginejournal.com/seo-challenges/212614/

IMPLICATIONS FOR PRACTICE

- Sustained decrease of contamination rates could lead to both a decrease of patient LOS and additional accrued hospital costs.
- If tube diversion trial shows continued effectiveness, could be use as rationale to trial diversion device which could further lower rates below 1%.
- Practice could be trialed in both ICU and Vascular Access.

Source: https://smith.queensu.ca/insight/content/5_steps_to_a_winning_team_debrief.php

CONCLUSION

- Tube Diversion is a newer evidence based practice that is be shown to correlate with the reduction of Blood Culture Contamination rates.
- While the initial trial month at the VAPORHCS Emergency Department has shown reduction in rates to below 2%, continued research is required to evaluate trial effectiveness.
- Added process compliance tracking should be added to further assure effectiveness of trial and reduce concerns of variable interference.

QUESTIONS & DISCUSSION

REFERENCES

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