



Decreasing Blood Culture Contamination Rates in the Emergency Department

MORGAN RAY, RN, BSN

THE UNIVERSITY OF TENNESSEE, KNOXVILLE



[This Photo](#) by Unknown Author is licensed under [CC BY-ND](#)

INTRODUCTION

Overview of the Problem

- ▶ Blood cultures (BC) are an integral diagnostic tool used in the diagnosis of bacteremia
- ▶ Emergency Departments (EDs) are commonly the site of initial diagnosis and treatment for bacteremia
- ▶ EDs have the highest BC contamination rates compared to other departments within hospitals

Clinical Significance

- ▶ Contaminated BCs lead to unnecessary use of antibiotics, extended length of stay, and additional laboratory testing
- ▶ Reducing the BC contamination rate will:
 - ▶ Improve patient care and outcomes
 - ▶ Decrease costs for hospitals and patients
- ▶ Implementation of continued education, BC collection kits, and regular feedback have been associated with a clinically significant decrease in BC contamination rate

(Bool et al., 2020; Bowen et al., 2016; Dempsey et al., 2019; Farrell et al., 2020; Harding & Bollinger, 2013; Marini & Truoq, 2013; McLeod, 2019; Overton et al., 2016; Robertson et al., 2015; Snyder et al., 2012)

Clinical Problem

- ▶ Despite a national benchmark for BC contamination rate of less than 3%, EDs have reported rates as high as 12.5% in the literature
- ▶ BC contamination rates are highly varied in EDs as well, leading to inconsistencies in patient treatment
- ▶ EDs serve a diagnostic niche in healthcare, so it is imperative to perform quality diagnostic testing in EDs

Clinical Problem

- ▶ EDs have issues specific to them which increase the likelihood of contaminated BCs including:
 - ▶ Overcrowding
 - ▶ High staff turnover rates
 - ▶ Presence of critical patients
 - ▶ Expectation to obtain tests quickly
- ▶ A need for continued education, adjusted BC collection kits, and regular department-wide feedback was identified for the project site due to high and variable monthly BC contamination rates

Project Purpose and Goal

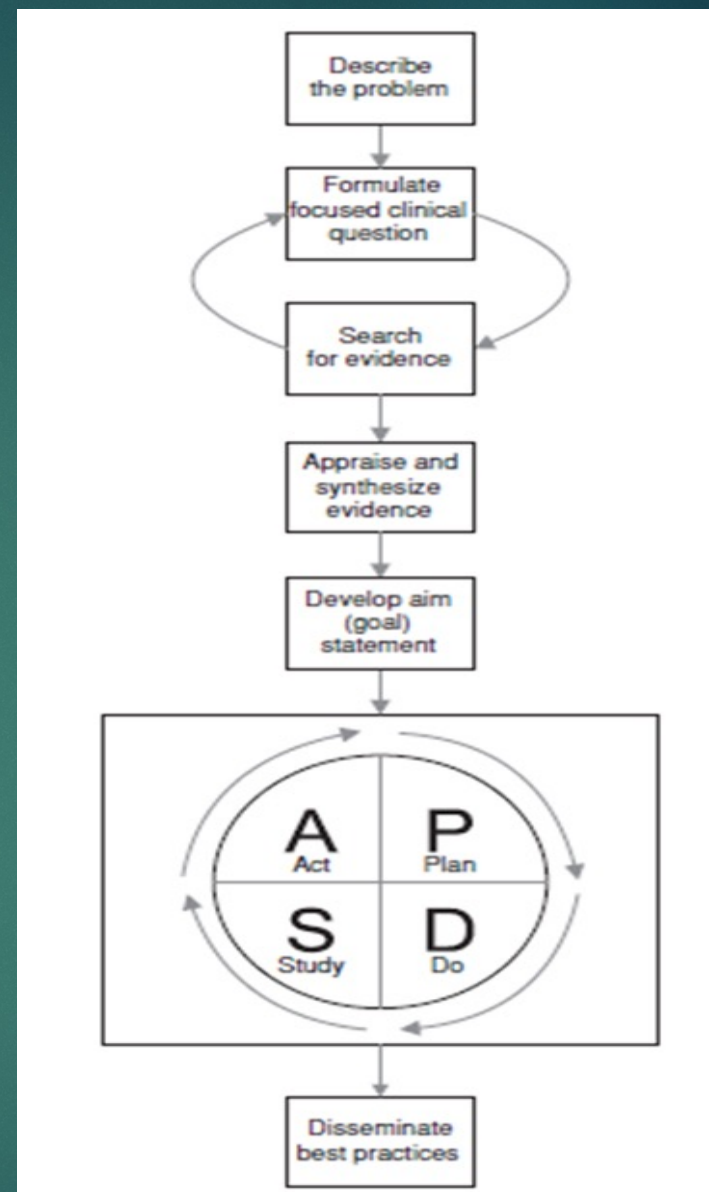
- ▶ Purpose

- ▶ To implement a BC collection toolkit consisting of education, BC collection kits, and regular feedback in the ED

- ▶ Goal

- ▶ To decrease the BC contamination rate in the ED

Guiding Framework: Lewin's Evidence- Based Practice Improvement Model



Note. From "Evidence-based practice improvement: Merging 2 paradigms" by R.F. Levin, J.M. Keefer, J. Marren, M. Vetter, B. Lauder, & S. Sobolewski, 2010, *Journal of Nursing Care Quality*, 25(2), p. 122 (<https://doi.org/10.1097/NCQ.0b013e3181b5f19f>). Copyright 2007 by the Visiting Nurse Service of New York and Rona F. Levin.

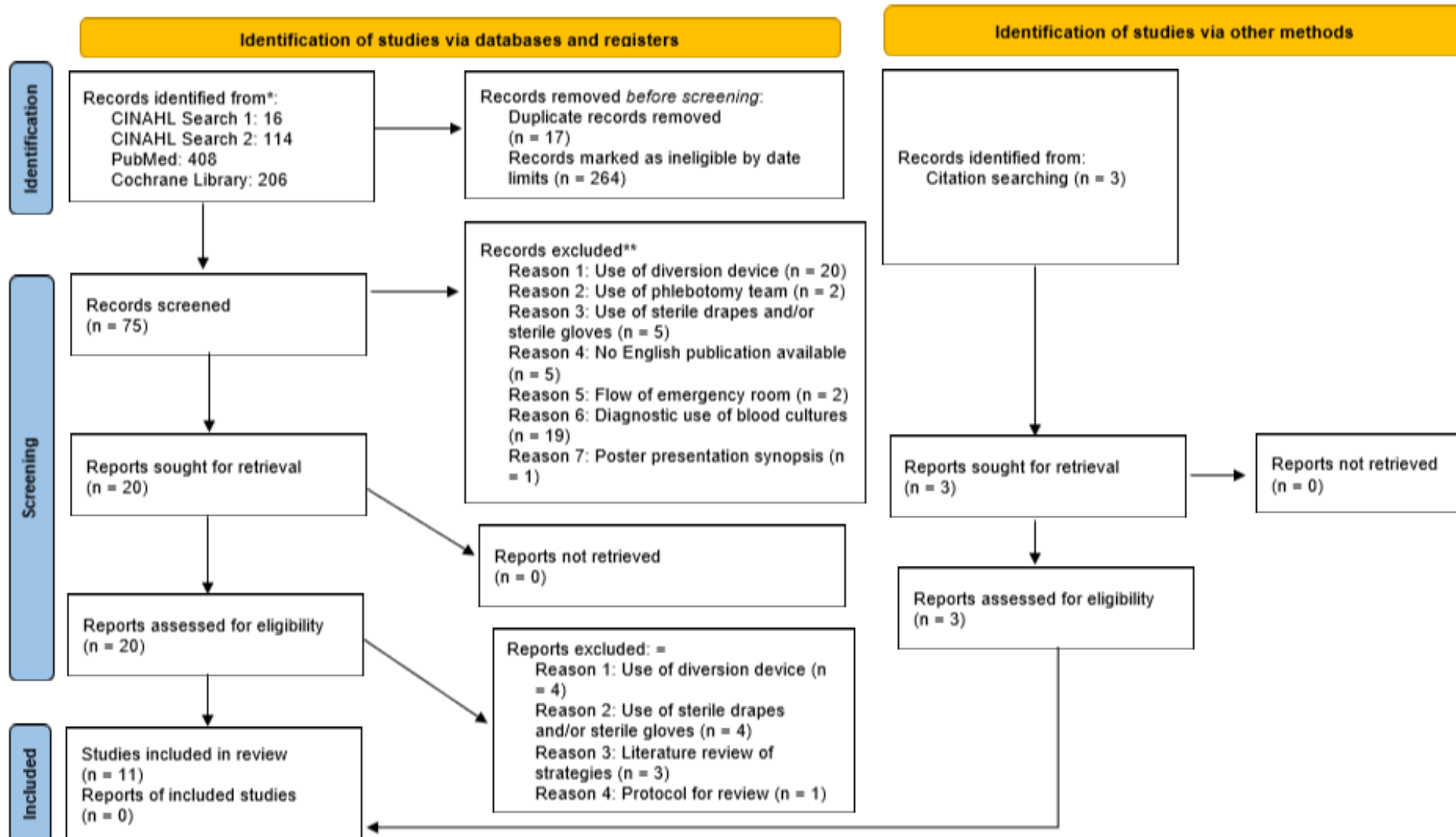
PICOT Question

“In emergency room patients, how does a blood culture collection toolkit compared to no blood culture collection toolkit affect blood culture contamination rates within three months?”

EVIDENCE



Literature Search



Critical Appraisal

- ▶ All studies were critically appraised using the Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professional Model tools
- ▶ During critical appraisal, a quality grade and evidence level were assigned to all studies to determine the strength of recommendations made from them
 - ▶ One study was a level I, one study was a level III, and nine studies were level V
 - ▶ Five studies were assigned a quality grade of A, while six studies were assigned a quality grade of B

Synthesis of Evidence

- ▶ The evidence found was synthesized in three categories:
 1. Research Evidence
 2. Clinical Expertise and Non-Research Evidence
 3. Patient and Family Preferences and Values
- ▶ Each type of evidence is needed to implement a well-rounded evidence-based practice project

Research Evidence

- ▶ Two pieces of research evidence were found
 - ▶ Cervero et al. (2019) showed a statistically significant decrease in BC contamination rate in the ED with individualized feedback
 - ▶ Snyder et al. (2012) did not have a clinically significant decrease in BC contamination rate with the implementation of prepackaged BC collection kits alone
- ▶ No conclusions could be drawn on the effect of interventions on the BC contamination rate using these studies alone

Clinical Expertise and Non-Research Evidence

- ▶ Most studies found are quality improvement projects (non-research evidence)
- ▶ Evidence suggests a clinically significant decrease in BC contamination rate in the ED with a bundled approach consisting of staff education, packaged BC collection kits, and regular feedback to staff collecting BCs
 - ▶ Multiple factors contribute to contamination, so research supports the implementation of multiple interventions

Patient and Family Preferences and Values

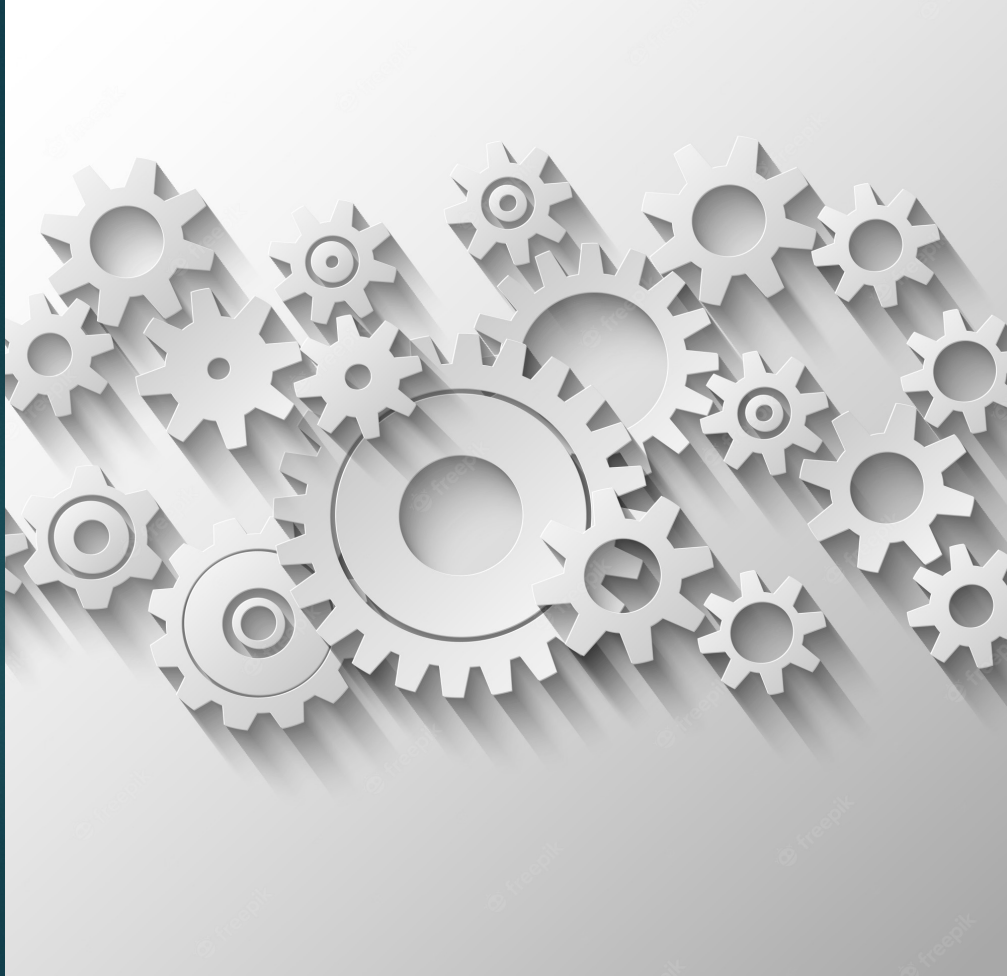
- ▶ Patients must be informed to determine their preference for treatment
- ▶ The education to staff qualified to collect BCs will include the need to educate patients on:
 - ▶ **Why** BCs are being collect
 - ▶ **How** BCs are collected
- ▶ Patients have the right to refuse BCs but are less likely to when making an informed-decision

Recommendations for Practice Change

- ▶ There is **good** and **consistent** evidence to support implementation of a BC collection toolkit including education, BC collection kits, and regular feedback to staff to decrease blood culture contamination rates in the ED.
- ▶ It is recommended the project site implements a BC collection toolkit consisting of all three elements to decrease its BC contamination rate.

Aims for Practice Change

- ▶ To have a BC contamination rate in the ED at the project site less than 3% within 3 months of the implementation of the BC collection toolkit.



IMPLEMENTATION

Setting and Population

- ▶ ED in a community, not-for-profit hospital located in the southeastern United States
- ▶ Serves patients across the lifespan with various illnesses with an average daily census of 115 patients
- ▶ Participants included all nursing staff in the ED-including 40 registered nurses, 6 licensed practical nurses, and 16 patient care technicians
 - ▶ Approximately 10% of the nursing staff is male and 90% is female
 - ▶ Age range for nursing staff is 19-68

Restraining Forces

Time/Workload
Education
Lack of change culture
Frequency of feedback

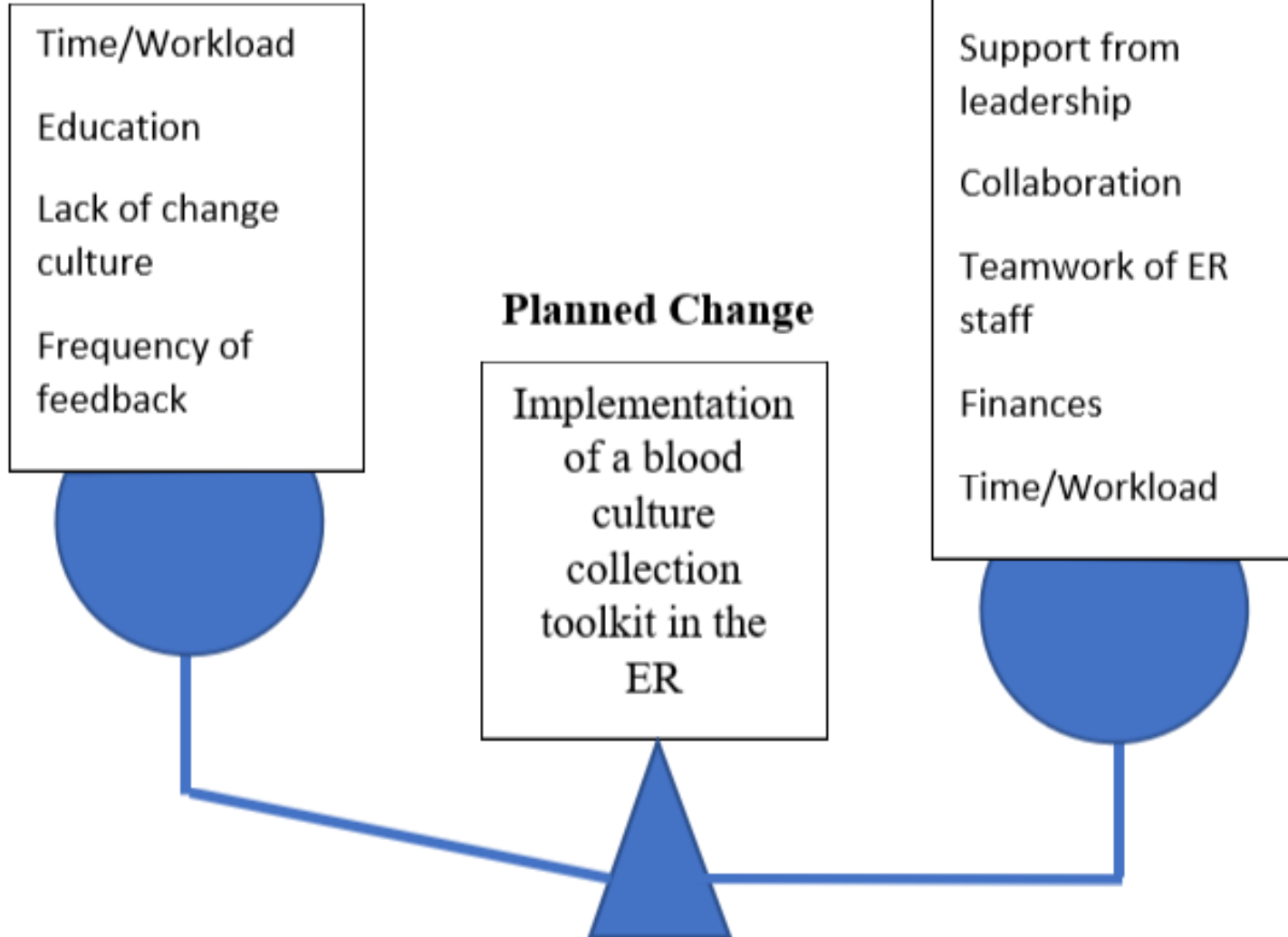
Planned Change

Implementation
of a blood
culture
collection
toolkit in the
ER

Driving Forces

Communication
Support from
leadership
Collaboration
Teamwork of ER
staff
Finances
Time/Workload

Facilitators and Barriers



Project Team/Stakeholders

- ▶ Key project site team members
 - ▶ DNP Student
 - ▶ ER manager (Community member)
 - ▶ ER educator
- ▶ Additional team members
 - ▶ Project chair
 - ▶ ER nursing staff
- ▶ Stakeholders not on the project team
 - ▶ Laboratory director
 - ▶ ER patients



[This Photo](#) by Unknown Author is licensed under [CC BY-NC](#)

Implementation Process

Education

- Education was given at skills fairs in October 2022-January 2023
- A pre- and post-education questionnaire was given

Blood culture collection kits

- Kits were made by DNP student
- Kits were stocked in the ED beginning in November

Monthly Feedback

- Feedback was given monthly starting at the end of November through the end of January
- Feedback was posted in a highly visible bulletin board in department

Implementation Timeline

- ▶ September 2022: Sought IRB determination
- ▶ October 2022-January 2023: PDSA cycles/intervention implementation and data collection
- ▶ January-March 2023: Data analysis
- ▶ August 2023: Dissemination of findings to stakeholders

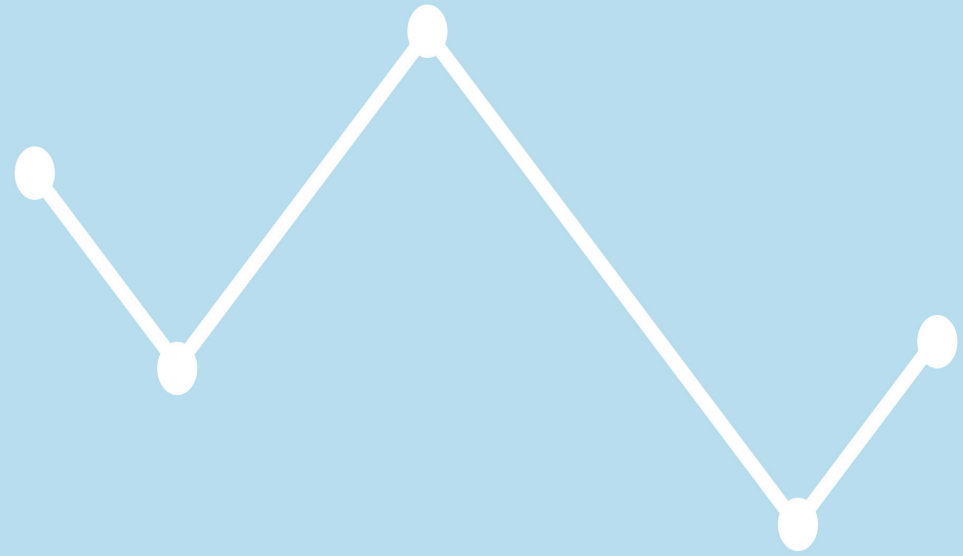
Ethical Considerations for Implementation

- ▶ The project was granted an IRB review exemption from the UTK IRB and the project site's IRB
- ▶ Project does not involve human subject testing
- ▶ No patient or nurse identifiers included in data
- ▶ Approval was obtained from the ED administration team for implementation of the proposed project

Limitations to Implementation

- ▶ Results may not be generalizable as the sample size was limited and restricted to one ED
- ▶ Decrease in BC contamination may not be sustained if correct procedure is not followed
- ▶ Post-education questionnaire was not conducted consistently
- ▶ The laboratory director was slow to disseminate monthly BC contamination rates
- ▶ No causality was proven and no control group used
- ▶ Multiple interventions were used

EVALUATION



Measures of Success

- ▶ Outcome measures include:
 - ▶ Monthly BC contamination rate
 - ▶ Knowledge of nursing staff pre- and post-education



Data Collection

- ▶ Data Collection
 - ▶ Retrospective monthly BC contamination rate for the 3 months prior to implementation and the corresponding 3 months from the previous year
 - ▶ BC contamination rates for the 3 months during implementation
 - ▶ Note: the pre- and post-scores for the education questionnaire were unable to be obtained
- ▶ Data Variables
 - ▶ Number of contaminated BCs in the ED
 - ▶ Time of collection

Data Security

- ▶ Physical copies of monthly report of BCs contaminated in the ED included no patient or staff identifiers
 - ▶ Any physical copies of data were shredded at the completion of the project
- ▶ Nursing staff were instructed to put no identifiers on pre- and post-education questionnaires
- ▶ All data was recorded in UT OneDrive and shared with the UTK statistician via UT Vault

Data Analysis

- ▶ Most recent version of Statistical Package for the Social Sciences software
- ▶ Descriptive statistics are reported for each variable
- ▶ Chi-square test of independence was used to determine:
 - ▶ Effectiveness of interventions on the monthly BC contamination rate

Cost Effectiveness and Plan for Sustainability

- ▶ Cost effectiveness
 - ▶ No additional costs needed for project
- ▶ Sustainability
 - ▶ Expected to be easily sustainable as interventions were simple, yet effective
 - ▶ Project took aspects already present in the ED and utilized resources more effectively
 - ▶ Use of the EBPI framework for implementation

FINDINGS



Results

Month/Year	Number of Blood Cultures Collected	Number of Blood Cultures Contaminated	Blood Culture Contamination Rate (%)
11/21	211	4	1.9
12/21	235	24	10.2
1/22	245	15	6.1
8/22	169	6	3.6
9/22	198	4	2.0
10/22	192	6	3.1
11/22	223	8	3.6
12/22	234	4	1.7
1/23	189	4	2.1

Emergency Department Blood Culture Contamination Rates



Statistics

During project implementation, ED staff collected 646 BCs with only 16 contaminated (2.5% contaminated)

Comparison to 3 Months in the Previous Year

- During the same 3 months the prior year, 6.5% of the BCs were contaminated
- This was a statistically significant decrease in contaminated cultures between the current year and the year prior, $X^2=11.107$, $df=1$, $p<0.001$

Comparison to Immediately Preceding 3 Months

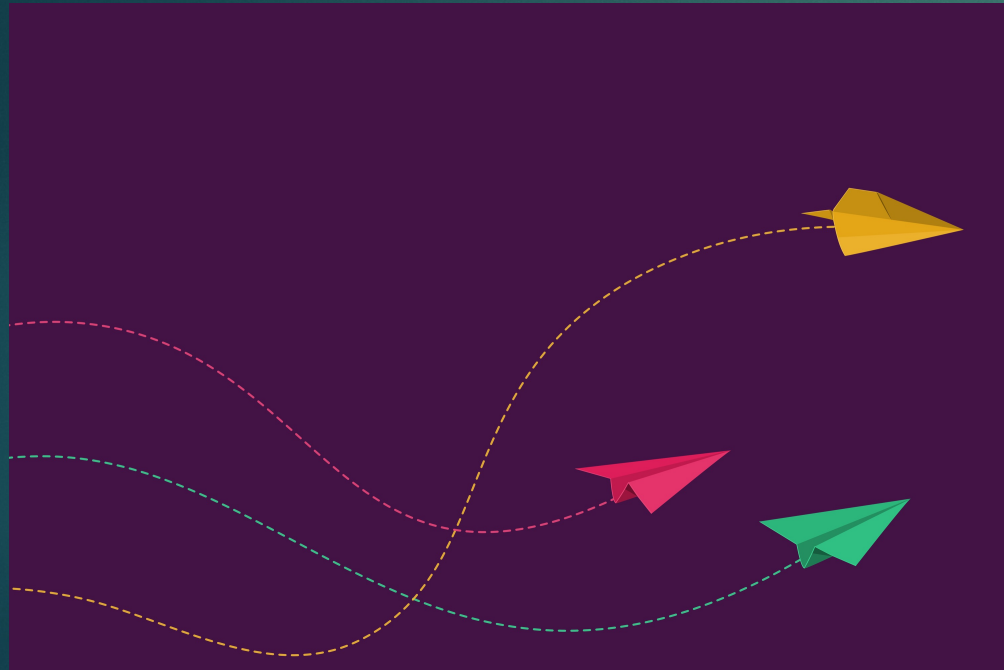
- During the 3 months prior to implementation, 2.9% of the cultures were contaminated.
- This was a clinically significant decrease between 3 months prior to implementation and during implementation, $X^2=0.172$, $df=1$, $p=0.678$

Pre- and Post-education Questionnaire Results

- ▶ The short questionnaire utilized pre- and post-education was not given consistently, therefore no statistical analysis was done
- ▶ However...
 - ▶ 100% of respondents stated the venipuncture collection kits would be helpful on the pre-test
 - ▶ 90.3% answered “yes” when asked if seeing the department’s monthly contamination rate would be helpful on the pre-test

IMPLICATIONS FOR PRACTICE





DISSEMINATION PLAN

Dissemination

- ▶ The final project manuscript will be submitted to the Journal of Emergency Nursing for publication in Fall 2023
- ▶ The final project manuscript will also be supplied to the ER administration team as well as the chief nursing officer at the project site for dissemination within the project site
- ▶ This PowerPoint will be uploaded into UTK's TRACE Library



Questions?

References

- ▶ References provided upon request.