



BACKGROUND

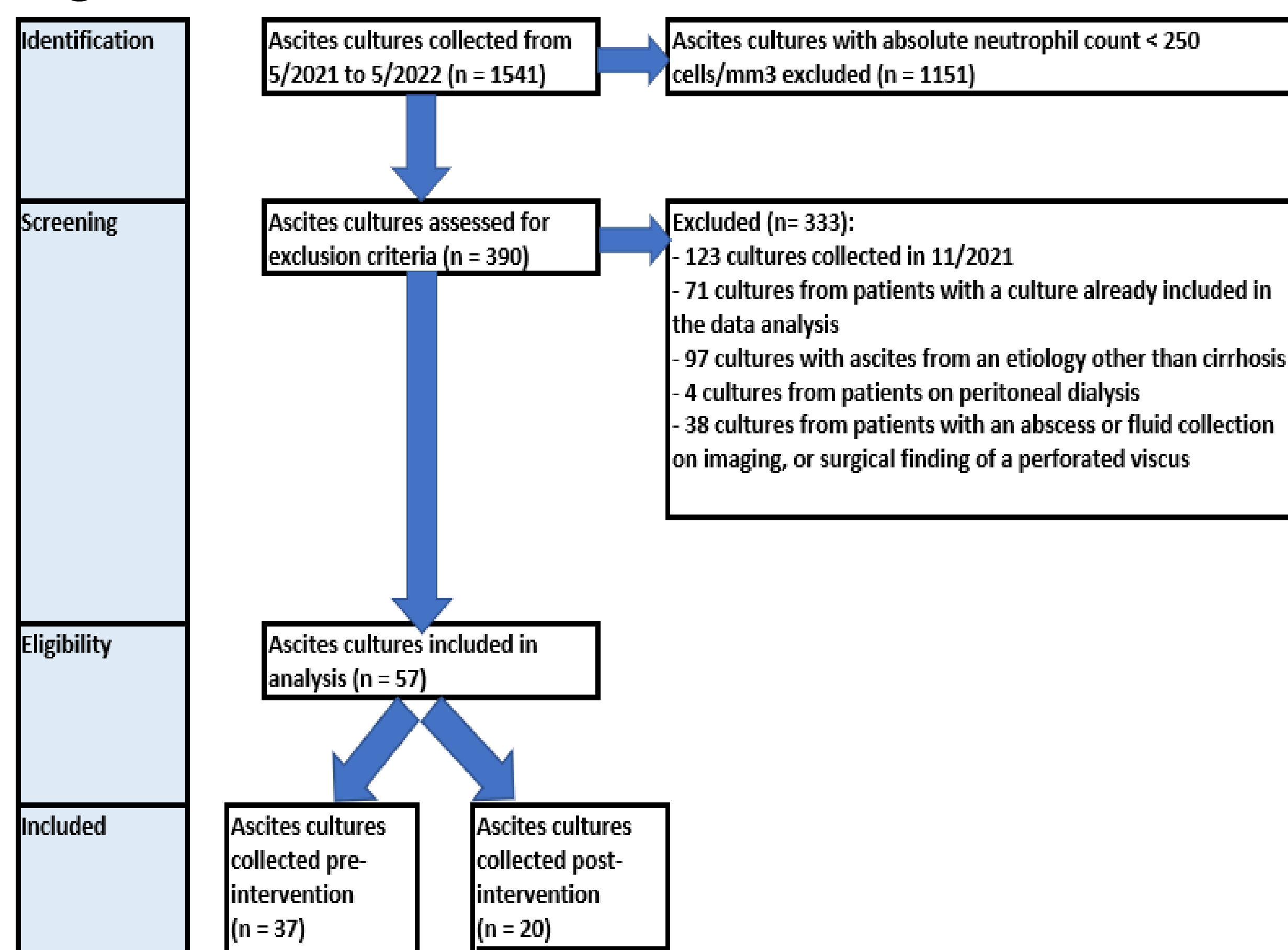
- Cirrhosis, the late-stage result of progressive fibrosis leading to impaired hepatic function, affects over 600,000 people in the United States.¹
- Spontaneous bacterial peritonitis (SBP) is a common and serious complication of decompensated cirrhosis, with an annual incidence of 3.5%² in patients with decompensated cirrhosis and a 1-year survival rate after the first episode of SBP of only 40%.³
- Antibiotic selection is often empiric for SBP; but given the severity of this illness, accurate microbiological diagnosis is critical in order to appropriately treat multi-drug resistant organisms, as well as non-bacterial causes (e.g., fungal, TB, etc.).
- Historically, ascites cultures were performed by plating centrifuged sediment of ascitic fluid onto Blood, MacConkey, and Chocolate agars, along with a Schaedler broth.
- However, culture yields via this method were poor, and it was theorized that utilizing blood culture bottles would improve culture growth rates because they are optimized for low bacterial concentration fluids, as seen in bacteremia and SBP. Blood culture bottles were subsequently demonstrated to have superior culture yield in SBP compared to historical methods (81-93% compared to 35-52%).^{4,5,6}

METHODS

- **Study Design**
 - Single center retrospective chart review
 - Adults with SBP hospitalized at Baylor-St. Luke's Medical Center from 5/2021 to 5/2022
 - Compared outcomes between direct inoculation of ascitic fluid into blood culture bottles at the bedside (12/2021-5/2022) with plating centrifuged sediment of ascitic fluid onto Blood, MacConkey, and Chocolate agars, along with a Schaedler broth (5/2021-10/2021)
- **Primary outcome:** ascites culture positivity rate
- **Secondary outcomes:** days of antimicrobial therapy (DOT), days of hospitalization, time to ascites culture positivity, 30-day readmission rate, ICU admission after culture collection, and 30-day mortality rate

PATIENT SELECTION

Figure 1: Ascites Culture Selection Flow Chart



RESULTS

Table 1: Patient Characteristics

Characteristic	Overall (n = 57)	Pre-Intervention (n = 37)	Post-Intervention (n = 20)	P value
Median Age (IQR) - years	60 (53-66)	62 (55-68)	56.5 (49-62)	0.049
Gender - number (%)				
Female	28 (49.1)	17 (46.0)	11 (55.0)	0.514
Male	29 (50.9)	20 (54.0)	9 (45.0)	
Ethnicity - number (%)				
Hispanic	22 (38.6)	14 (37.8)	8 (40.0)	0.873
Not Hispanic	35 (61.4)	23 (62.1)	12 (60.0)	
Race - number (%)*				
White or Caucasian	45 (79.0)	30 (81.1)	15 (75.0)	0.688
Black or African American	8 (14.0)	5 (13.5)	3 (15.0)	
Asian	1 (1.75)	1 (2.70)	0 (0)	
Unable to Determine or Other	3 (5.3)	1 (2.70)	2 (10.0)	
Cirrhosis Etiology - number (%)**				
Ethanol	33 (57.9)	23 (62.2)	10 (50.0)	0.275
Non-alcoholic steatohepatitis	16 (28.1)	10 (27.0)	6 (30.0)	
Hepatitis C	9 (15.8)	7 (18.9)	2 (10.0)	
Hepatitis B	2 (3.5)	1 (2.7)	1 (5.0)	
Autoimmune hepatitis	3 (5.3)	2 (5.4)	1 (5.0)	
Primary sclerosing cholangitis	1 (1.8)	1 (2.7)	0 (0)	
Unknown	4 (7.0)	1 (2.7)	3 (15.0)	
SBP prophylaxis before ascites culture - number (%)	9 (15.8)	7 (18.9)	2 (10.0)	0.413
Prior episode of SBP - number (%)	18 (31.6)	15 (40.5)	3 (15.0)	0.048
Prior history of variceal hemorrhage - number (%)	12 (21.1)	6 (16.2)	6 (30.0)	0.309
Ascitic fluid total protein < 1 g/dL in prior ascitic fluid sample - number (%)	13 (22.8)	9 (24.3)	4 (20.0)	1
Use of PPIs within 30 days - number (%)	33 (57.9)	21 (56.8)	12 (60.0)	0.813
Median MELD (IQR)	25 (21-32)	25 (21-30)	26 (19.8-33.2)	0.828

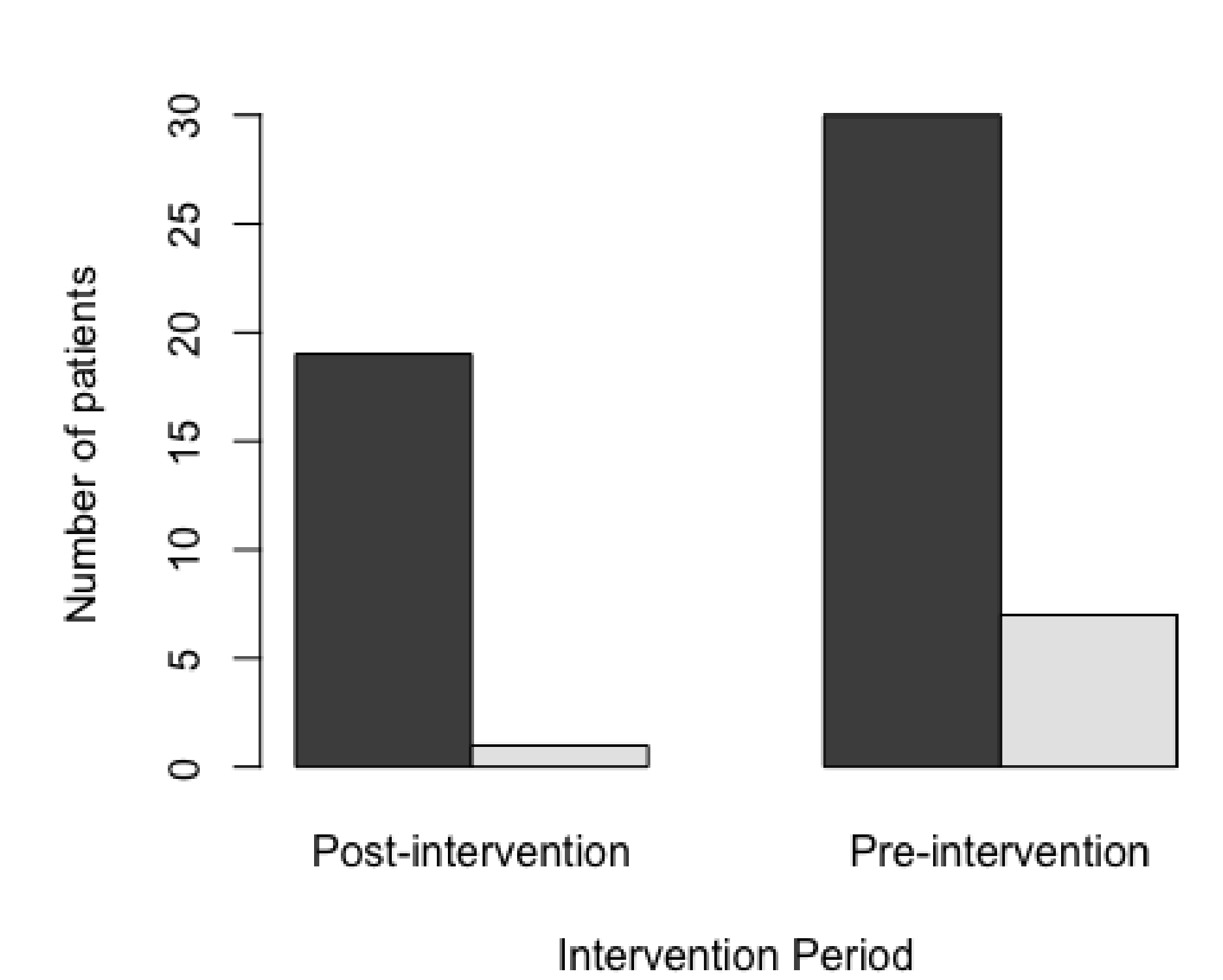
IQR: interquartile range (Q1-Q3); SBP: spontaneous bacterial peritonitis; PPI: proton pump inhibitor; MELD: model for end stage liver disease (utilized Organ Procurement and Transplant Network model)
*For the purposes of statistical comparison, races were combined into White or Caucasian vs. Non-White or Caucasian (due to low n).
**For purposes of statistical comparison, cirrhosis etiologies were combined into cirrhosis secondary to ethanol versus cirrhosis not secondary to ethanol (due to low n). If a patient had a cirrhosis etiology attributed to more than one etiology (e.g., hepatitis C and ethanol), they were then counted as one patient in each of those etiologies.

Table 2: Primary and Secondary Outcomes

Outcome	Pre-Intervention (n = 37)	Post-Intervention (n = 20)	P value
Primary Outcome			
Ascites Culture Positivity Rate - number (%)	7 (18.9)	1 (5.0)	0.238
Secondary Outcomes			
Median Days of Antibiotic Therapy - days (IQR)	7 (2-11)	7 (2.5-10)	0.840
Median Days of Hospitalization - days (IQR)	15 (10-28)	19.5 (8-43.8)	0.682
Median Time to Positivity - hours (IQR)	25.9 (23.8-41.0)	23.5 (23.5-23.5)	0.383
Readmission Within 30 Days - number (%)	10 (27.0)	6 (30.0)	0.812
ICU Admissions After Ascites Culture - number (%)	6 (16.2)	5 (25.0)	0.491
30-Day Mortality - number (%)	7 (18.9)	1 (5.0)	0.238

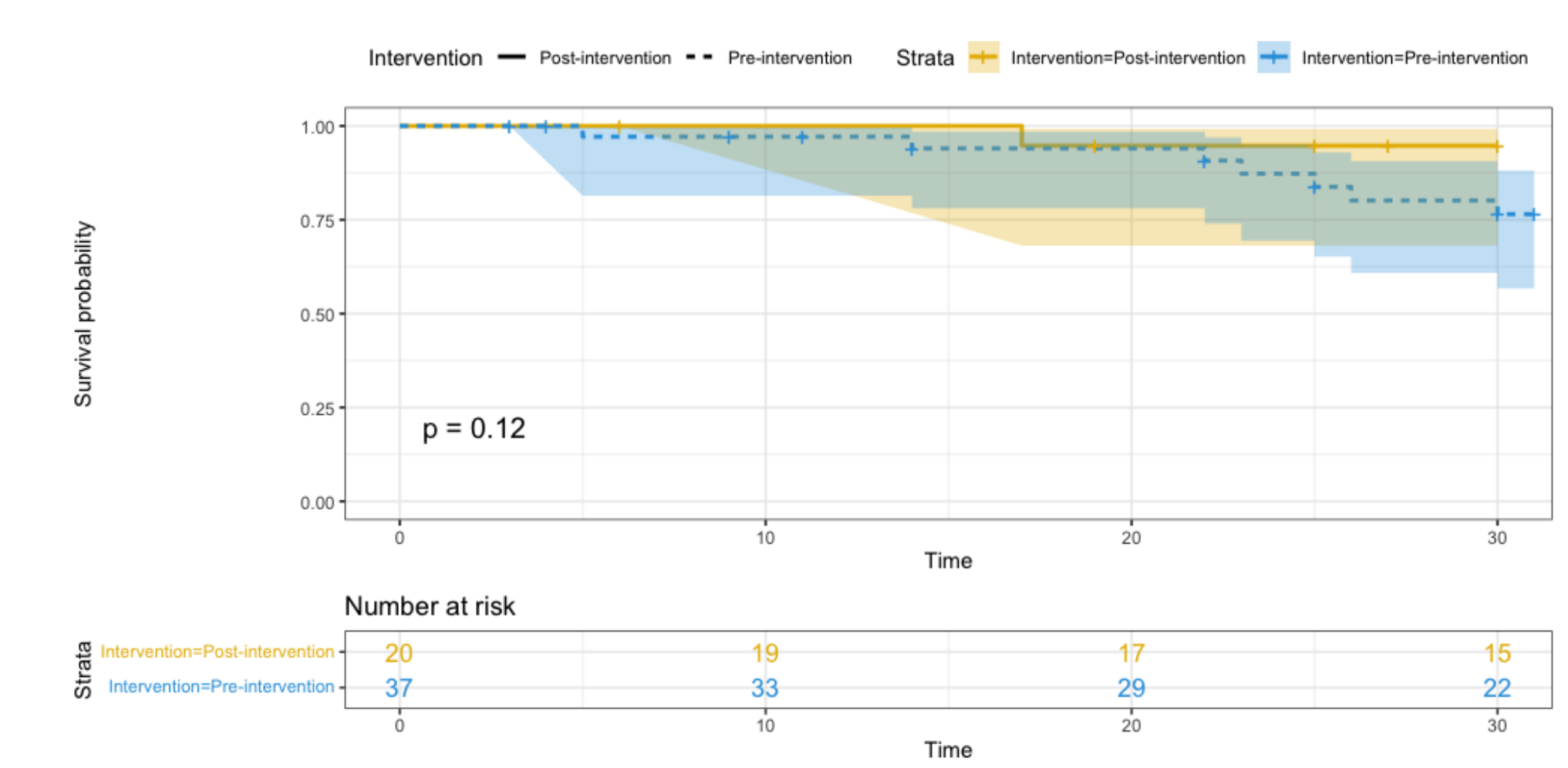
IQR = interquartile range (Q1-Q3)

Figure 2: No Difference in Ascites Culture Positivity Rate Pre- and Post-Intervention



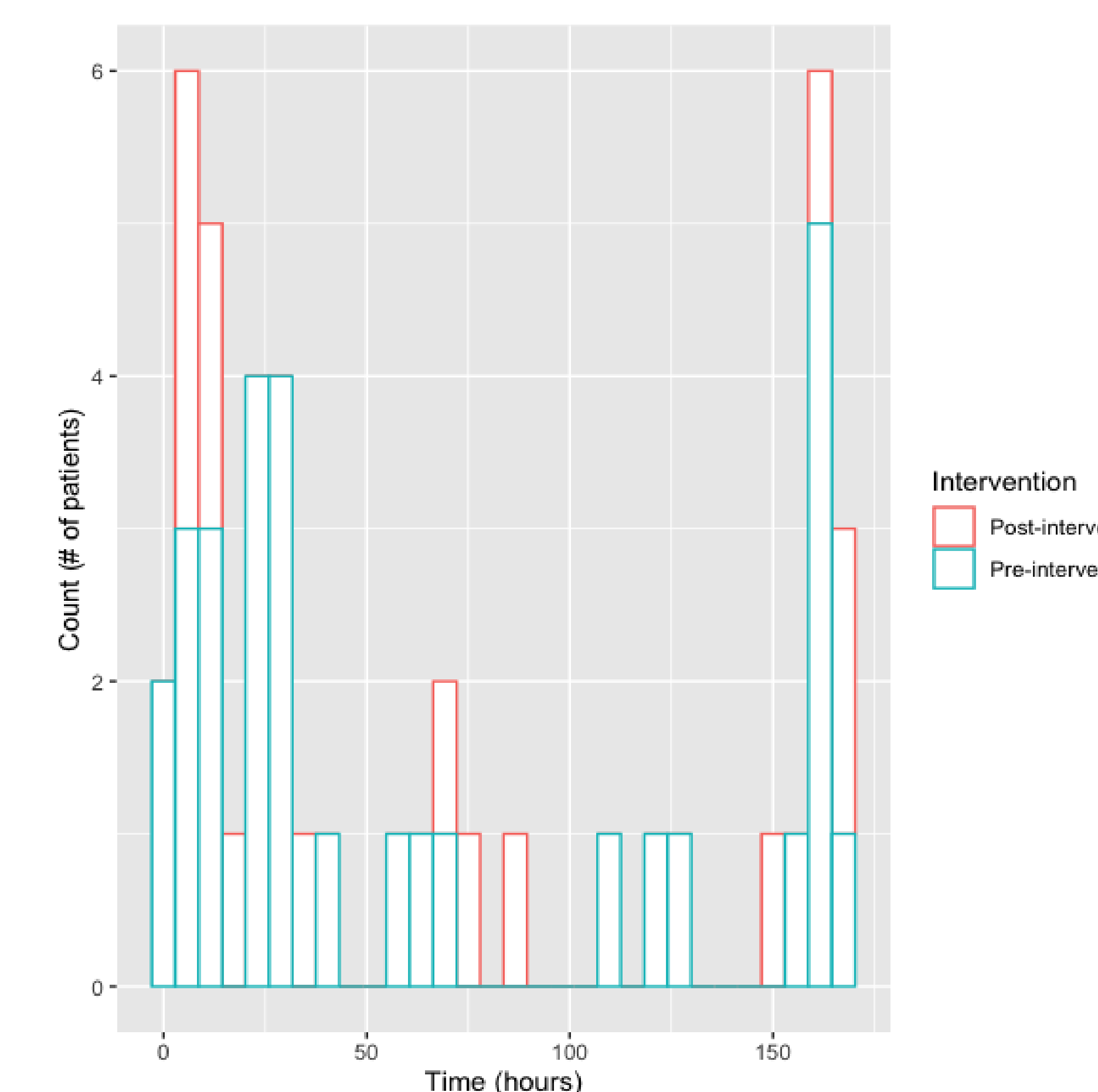
There was no significant difference in ascites culture positivity rate pre- and post-intervention (18.9% and 5.0%, respectively, p = 0.238). Negative culture = dark gray, positive culture = light gray.

Figure 3: No Difference in 30-Day Mortality Pre- and Post-Intervention



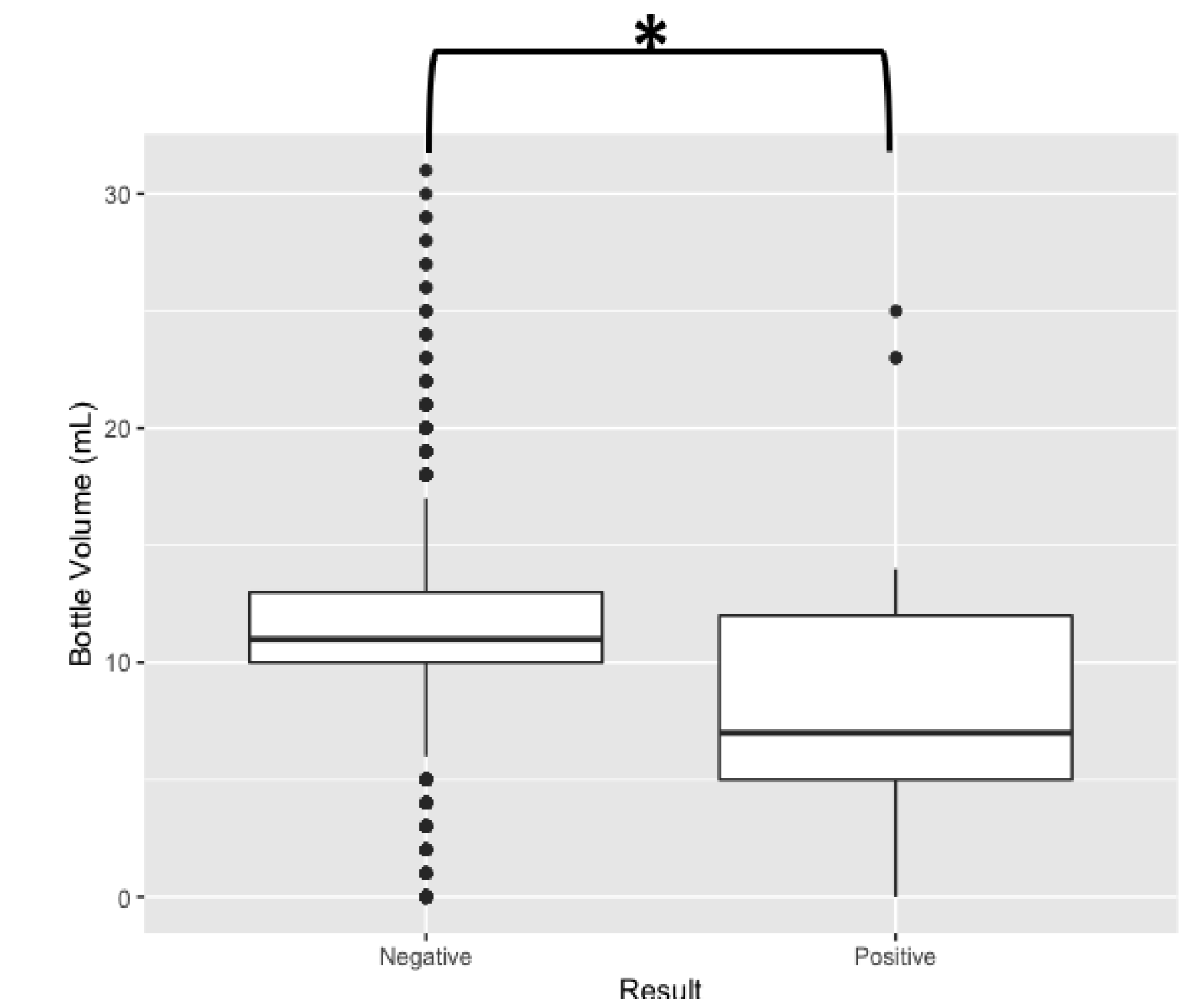
Kaplan-Meier curves comparing the hazard ratios for 30-day mortality between pre-intervention (blue dashed line) and post-intervention (solid yellow line). "Time" on the x-axis is days after ascites culture collection. The "number at risk" section accounts for those lost to follow up - where the number listed is the number of patients with known follow up to that time (i.e., day 10, 20, 30). There was no significant difference in 30-day mortality pre- and post-intervention (p = 0.12).

Figure 4: No Difference in Time from First Antibiotic Administration to Ascites Culture Collection Pre- and Post-Intervention



Histogram of the time from the first antibiotic administered to the patient to the time of ascites culture collection - stratified by pre- (blue) and post-intervention (red) groups. There was no significant difference between groups (p = 0.791).

Figure 5: Positive Ascites Cultures have Significantly Lower Inoculation Volumes



Negative cultures had significantly higher inoculation volumes than positive cultures (p < 0.001). This data is of all ascites cultures (aerobic + anaerobic blood culture bottles) collected from November 2021 to May 2022 (n = 1704), not just those of patients with SBP. Black dots represent outliers in the data set.

DISCUSSION

- There was no statistically significant difference in ascites culture positivity rate after the implementation of bedside blood culture bottle inoculation.
- There was no statistically significant difference in antibiotic administration between the pre- and post-intervention groups.
- Inappropriate inoculation volumes may be the culprit for the lack of expected improvement in culture positivity rate.

FUTURE DIRECTIONS

- Evaluate the optimal inoculation volume for ascites culture yield.
- Change inoculation site from the bedside to the laboratory, implementing new protocols to control inoculation volumes.

CITATIONS

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