

# Description of Transesophageal Echocardiography Prescribing Practices in non-*Staphylococcus aureus* Gram-positive Bacteremia with Application of Scoring Systems

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## Background

- Practices of obtaining transesophageal echocardiography (TEE) vary among clinicians in the management of non-*Staphylococcus aureus* gram-positive bloodstream infections
- DENOVA and HANDOC scoring systems offer guidance for obtaining transesophageal echocardiography (TEE) in patients with *Enterococcus faecalis* and non-beta hemolytic streptococci bloodstream infections<sup>1-3</sup>
  - High sensitivity in predicting low risk of infectious endocarditis with scores <3
  - Limited in application to coagulase-negative staphylococci, *Enterococcus* spp. other than *faecalis*, and beta-hemolytic *Streptococcus* spp.
- This study aimed to evaluate the use of TEE with application of DENOVA and HANDOC scoring systems to coagulase-negative staphylococci (CoNS), *Enterococcus* spp. and *Streptococcus* spp. bloodstream infections

## Methods

- IRB-approved, retrospective, cohort study conducted at two tertiary care hospitals within a single health care system
- Electronic data pull identified patients based on blood culture results
- Inclusion criteria
  - ≥18 years old & admitted between November 2017 and November 2019
  - ≥1 positive blood culture with *Enterococcus* spp. or *Streptococcus* spp. or ≥2 positive blood cultures with CoNS with matching susceptibilities within 48 hours
- Exclusion criteria:
  - Polymicrobial bacteremia
  - History of infectious endocarditis with the same organism
- Data collected
  - Demographics
  - Microbiology results and treatment course
  - Echocardiography
  - DENOVA/HANDOC score parameters
  - Infectious Disease consultation
  - Infection recurrence
  - In-hospital mortality
- Definitions
  - Endocarditis: bloodstream infection treated with at least six weeks of antibiotics
  - Adherence to DENOVA/HANDOC: completion of TEE with score ≥3 or no TEE if score <3 in patients with *Enterococcus* spp. or *Streptococcus* spp. bacteremia
  - Embolization: concern for septic emboli by provider documentation, embolic stroke, or imaging consistent with septic emboli
  - Infection recurrence: positive blood cultures with same organism within 90 days
- Primary outcome: comparison of DENOVA & HANDOC scores between those who underwent TEE vs. no TEE
- Statistical analysis utilized R Statistical Software (Version 3.5.3):
  - Chi-square or Fischer exact tests for categorical data
  - Mann-Whitney U tests or independent t-tests for continuous data

## Results

Figure 1: Patient Enrollment

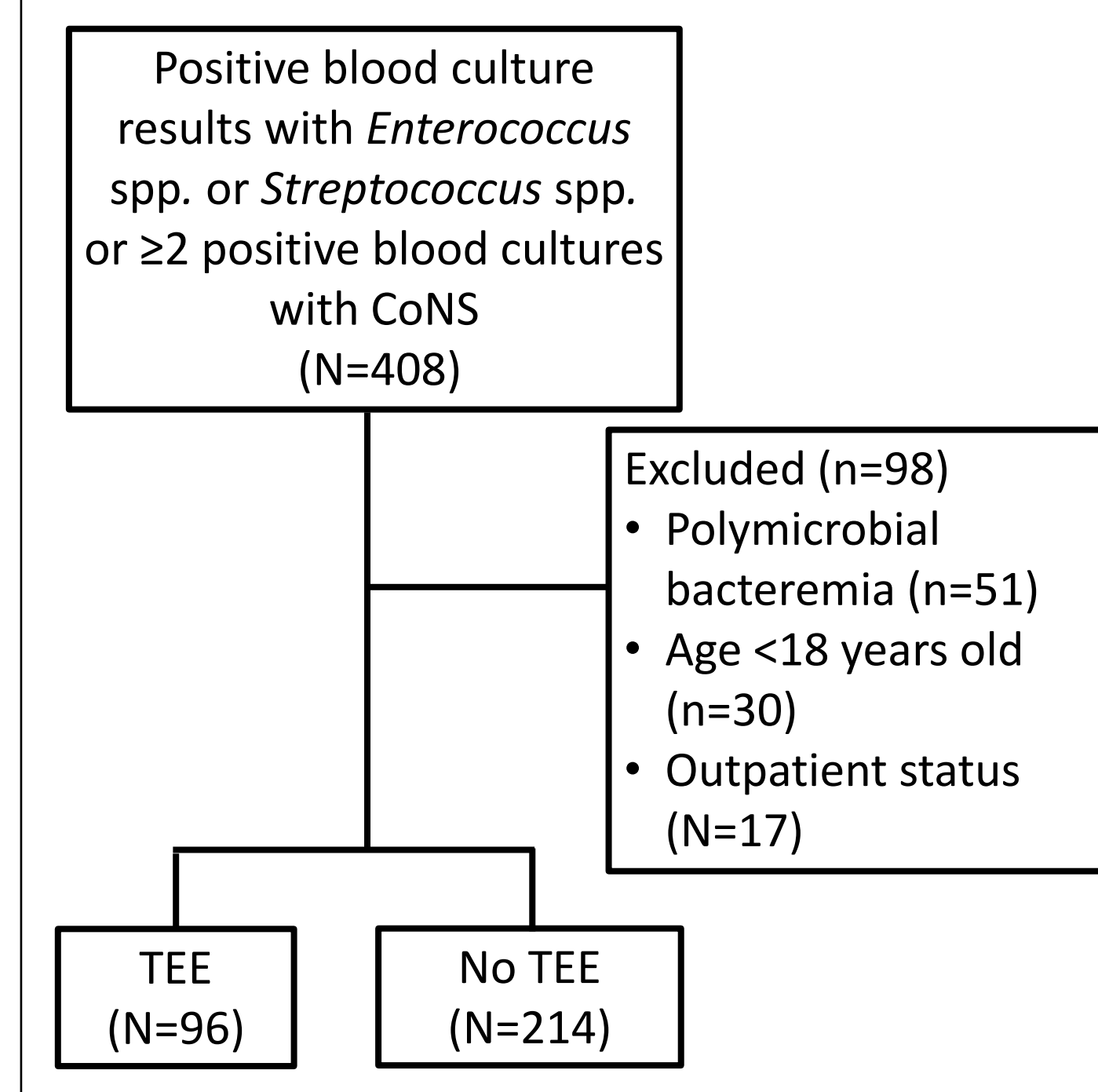


Figure 2: Causative Organisms

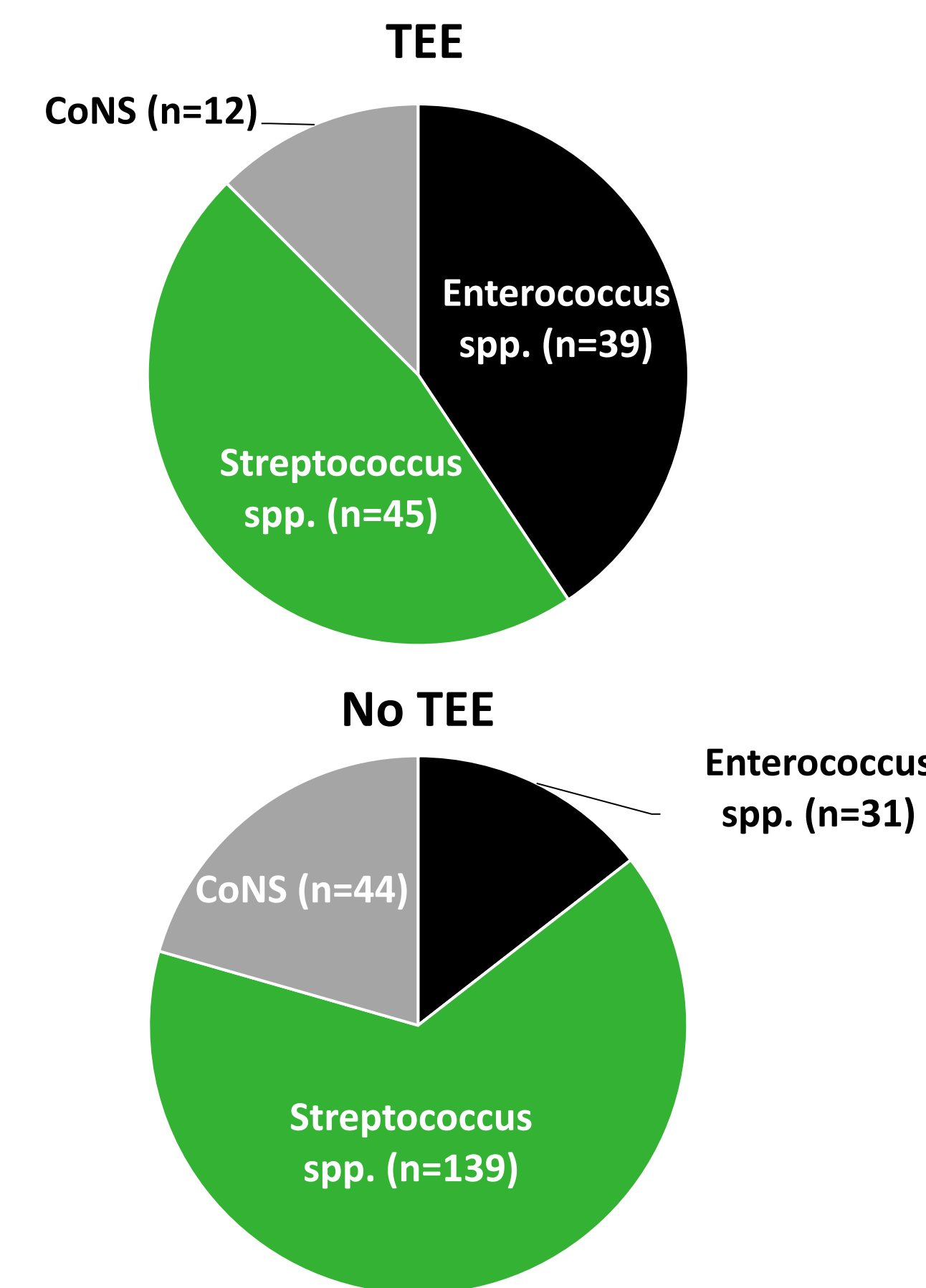


Figure 4: Comparison of DENOVA & HANDOC Scores Based on Organism

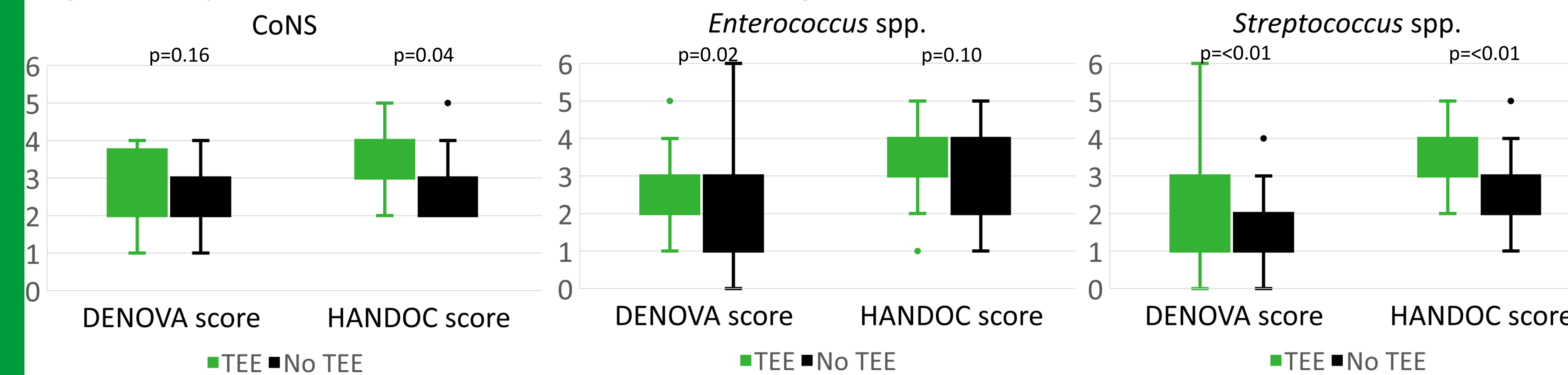


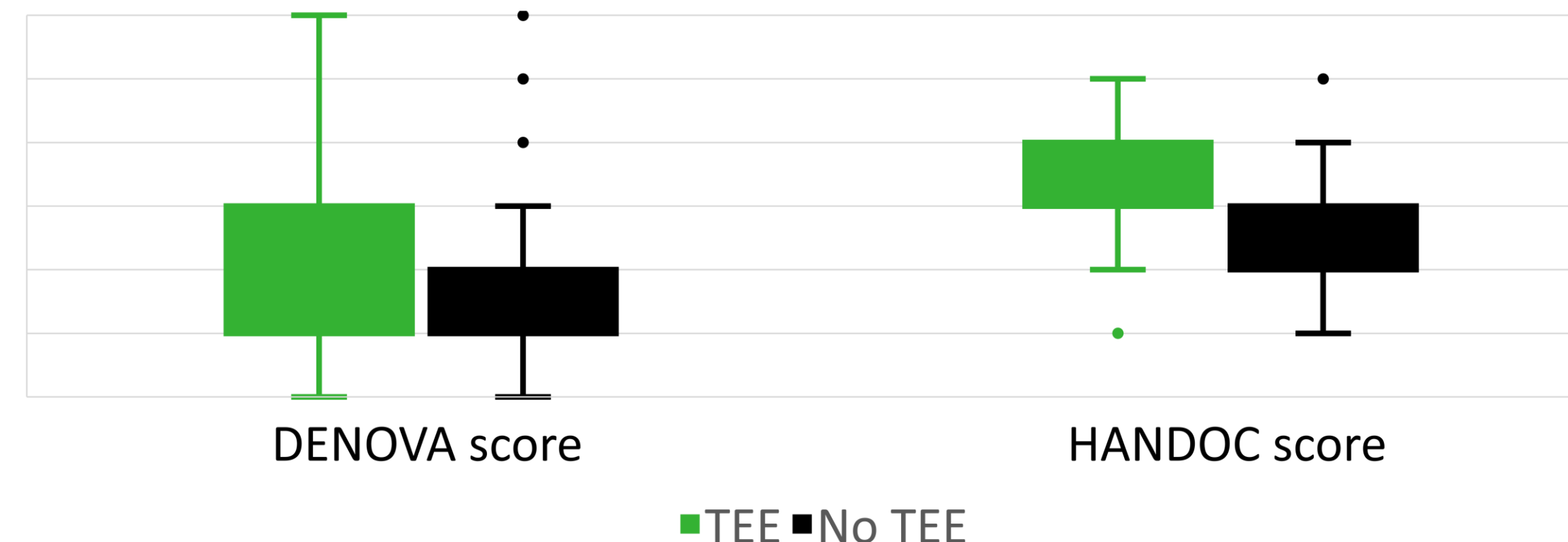
Table 1: Baseline Characteristics	TEE (n=96)	No TEE (n=214)	P-value
Age, years	68.5 (58-76)	67.0 (54-77)	0.27
Sex, male	55 (57.3)	105 (49.1)	0.22
Race, white	76 (79.2)	170 (79.4)	0.29
Time from culture to echocardiogram, days	2 (1-4)	2 (1-3)	0.64
TTE obtained	28 (29.2)	149 (69.6)	<0.01
Infectious Disease consult	96 (100)	168 (78.5)	<0.01
Scoring system components			
Community acquired infection	45 (53.1)	108 (51.4)	0.62
Embolization	11 (11.5)	10 (4.7)	0.04
Heart murmur	19 (19.8)	16 (7.5)	<0.01
Valve disease	50 (52.1)	46 (21.5)	<0.01
Prosthetic valve	28 (29.2)	8 (3.7)	<0.01
Implantable cardioverter defibrillator	16 (16.7)	18 (8.4)	0.04
Symptoms ≥7 days	29 (30.2)	50 (23.4)	0.21
≥2 Positive blood cultures	82 (85.4)	127 (59.3)	<0.01
Unknown origin of infection	38 (39.6)	103 (48.1)	0.14

Data are represented as number (%) or median (interquartile range)

Table 2: Primary Outcome	TEE (n=96)	No TEE (n=214)	P-value
DENOVA score	2 (1-3)	1 (1-2)	<0.01
HANDOC score	3 (3-4)	3 (2-3)	<0.01

Data are represented as median (interquartile range)

Figure 3: Visual Representation of Primary Outcome

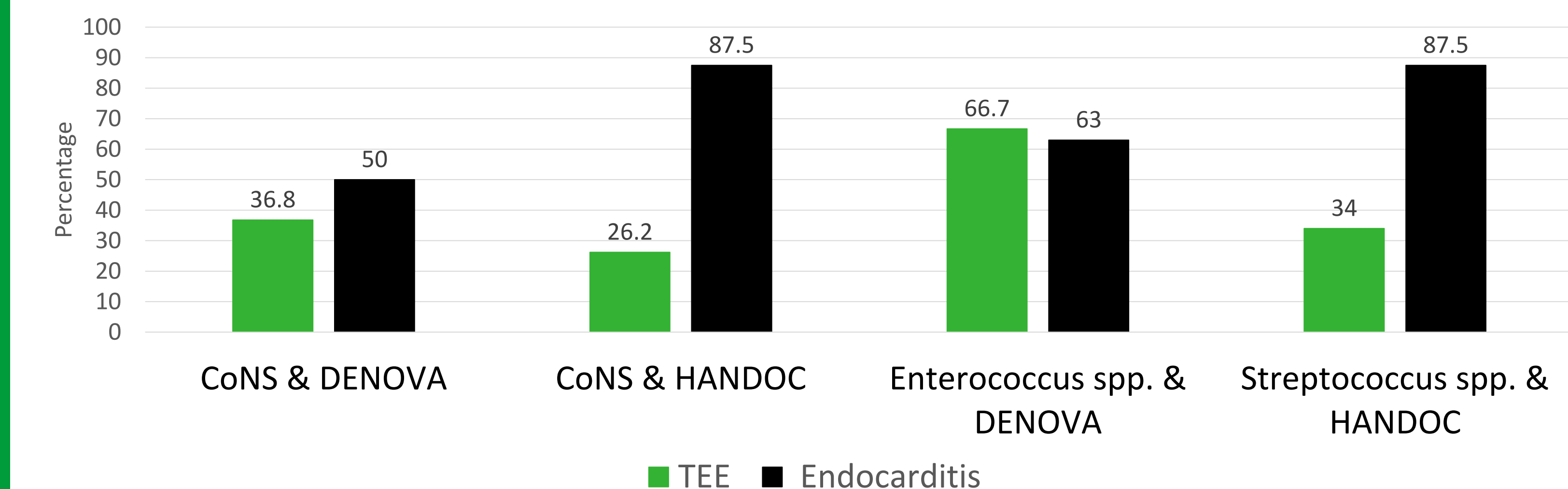


## Results

Table 3: Secondary Outcomes	TEE (n=96)	No TEE (n=214)	P-value
Endocarditis	45 (46.9)	14 (6.5)	<0.01
CoNS	5 (5.2)	3 (1.4)	0.12
Enterococcus spp.	23 (24.0)	4 (1.9)	<0.01
Streptococcus spp.	17 (17.7)	7 (3.3)	<0.01
Antimicrobial duration, days	31 (16-45)	14 (1.5-16)	<0.01
Culture dismissed as contaminant	0 (0)	54 (25.2)	<0.01
Length of stay following positive blood culture, days	9 (7-14)	7 (4-11)	<0.01
Infection recurrence	2 (2.1)	2 (0.9)	0.59
In-hospital mortality	2 (2.1)	13 (6.1)	0.16

Data are represented as number (%) or median (interquartile range)

Figure 5: Incidence of TEE and Endocarditis in Patients with Scores of 3 or Greater



## Conclusions

- DENOVA & HANDOC scores were significantly higher in patients who underwent TEE in all organisms combined
- The HANDOC score may be applicable to CoNS given the significantly higher value in patients with TEE in addition to the rate of endocarditis of 87.5%
- Adherence to DENOVA and HANDOC scores in *Enterococcus* spp. and *Streptococcus* spp. suggest many TEEs were unnecessary, however this conclusion is limited given the retrospective nature of this study and lack of real-time patient assessment
- Efforts to encourage the judicious use of TEE should be made in conjunction with Infectious Diseases providers as they were involved in every TEE case

## References

1. Bouza E, Kestler M, Beca T, et al. The NOVA score: a proposal to reduce the need for transesophageal echocardiography in patients with enterococcal bacteremia. *Clin Infect Dis*. 2015; 60(4):528-35.
2. Berge A, Krantz A, Ostlund H, et al. The DENOVA score efficiently identifies patients with monomicrobial *Enterococcus faecalis* bacteremia where echocardiography is not necessary. *Infection*. 2019; 47(1):45-50.
3. Sunnerhagen T, Tornell A, Vikbrant M, et al. HANDOC: A Handy Score to Determine the Need for Echocardiography in Non-B-Hemolytic Streptococcal Bacteremia. *Clin Infect Dis*. 2018; 66(5):693-8.