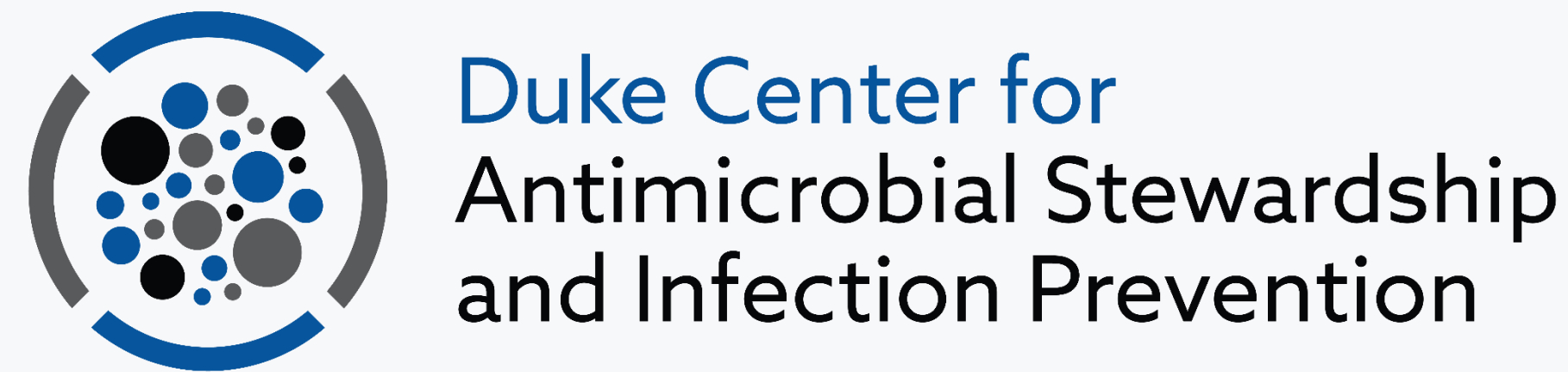


Measuring the Contamination of Transport and Emergency Ambulances and Emergency Medical Service (EMS) Providers



Graves Amanda M^{1,2}, Schaps D³, Isaacson J³, Barrett A^{1,2}, King C^{1,2}, Warren BG^{1,2}, Anderson DJ^{1,2}
 1- Duke Center for Antimicrobial Stewardship and Infection Prevention, Durham, NC, USA; 2- Disinfection, Resistance and Transmission Epidemiology (DiRTE) lab, Durham, NC, USA; 3- School of Medicine, Duke University, Durham, NC, USA



Background

- HAIs represent the most frequent adverse event during care delivery¹ and traditionally focused on stationary medical facilities
- Medical transports are often connected to many medical facilities and there is not a lot of data on transport contamination and transmission.

Methods

- Study ambulances and providers enrolled and sampled prior to start of day shift on each sampling day.
- Ambulances were disinfected with bleach by a study member. Ambulances and providers were sampled again immediately following shift completion and before final disinfection
- Cellulose sponges, flocked swabs, and RODAC plates were used. Sponges and swabs were pre-drenched and RODACs were filled with disinfectant neutralizing agar
- All samples were plated on general and selective media for study pathogens
- Calculated total colony forming units (CFU) for each sample area and proportions of samples harboring clinically important pathogens (CIPs), defined as MRSA, MSSA, and VRE

Figure 1. Timeline of study events

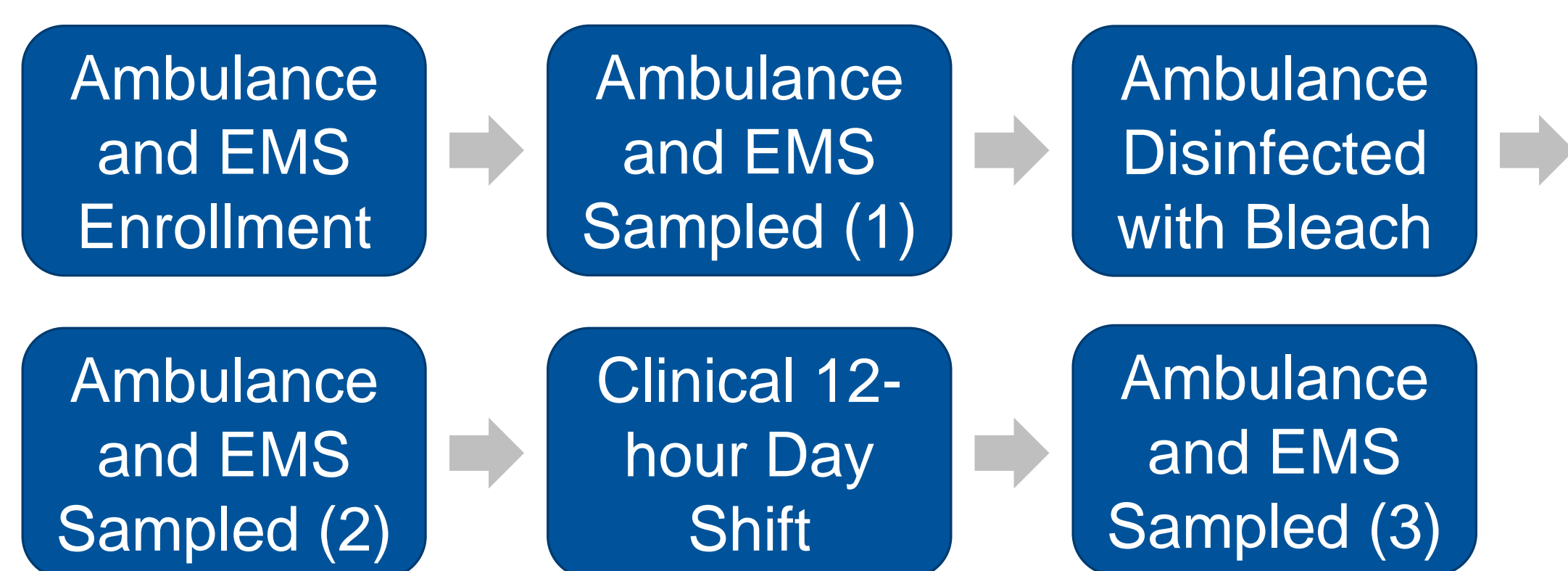


Figure 2. Ambulance CIPs Pre- and Post-Shift

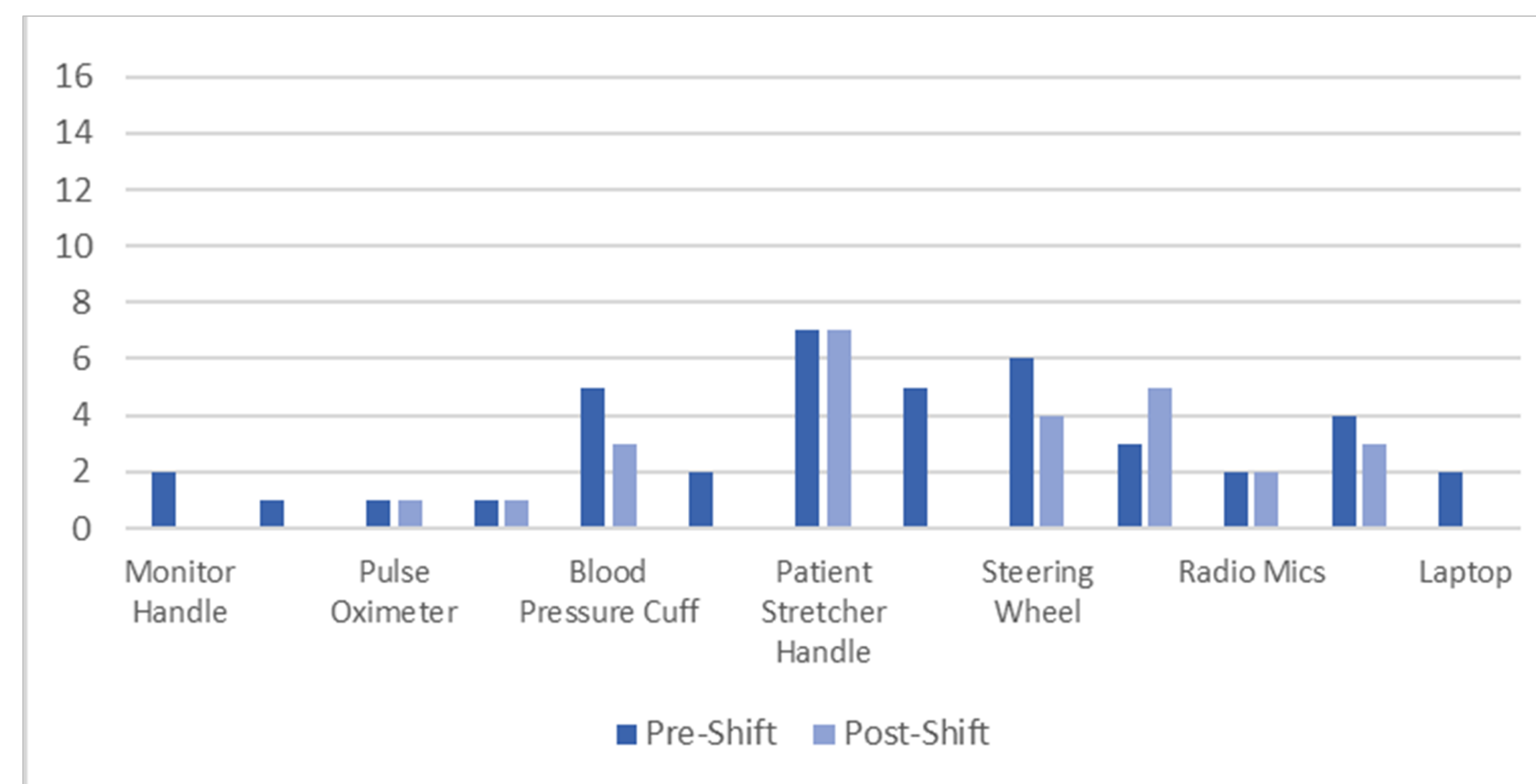


Figure 3. EMS Provider CIPs Pre- and Post-Shift

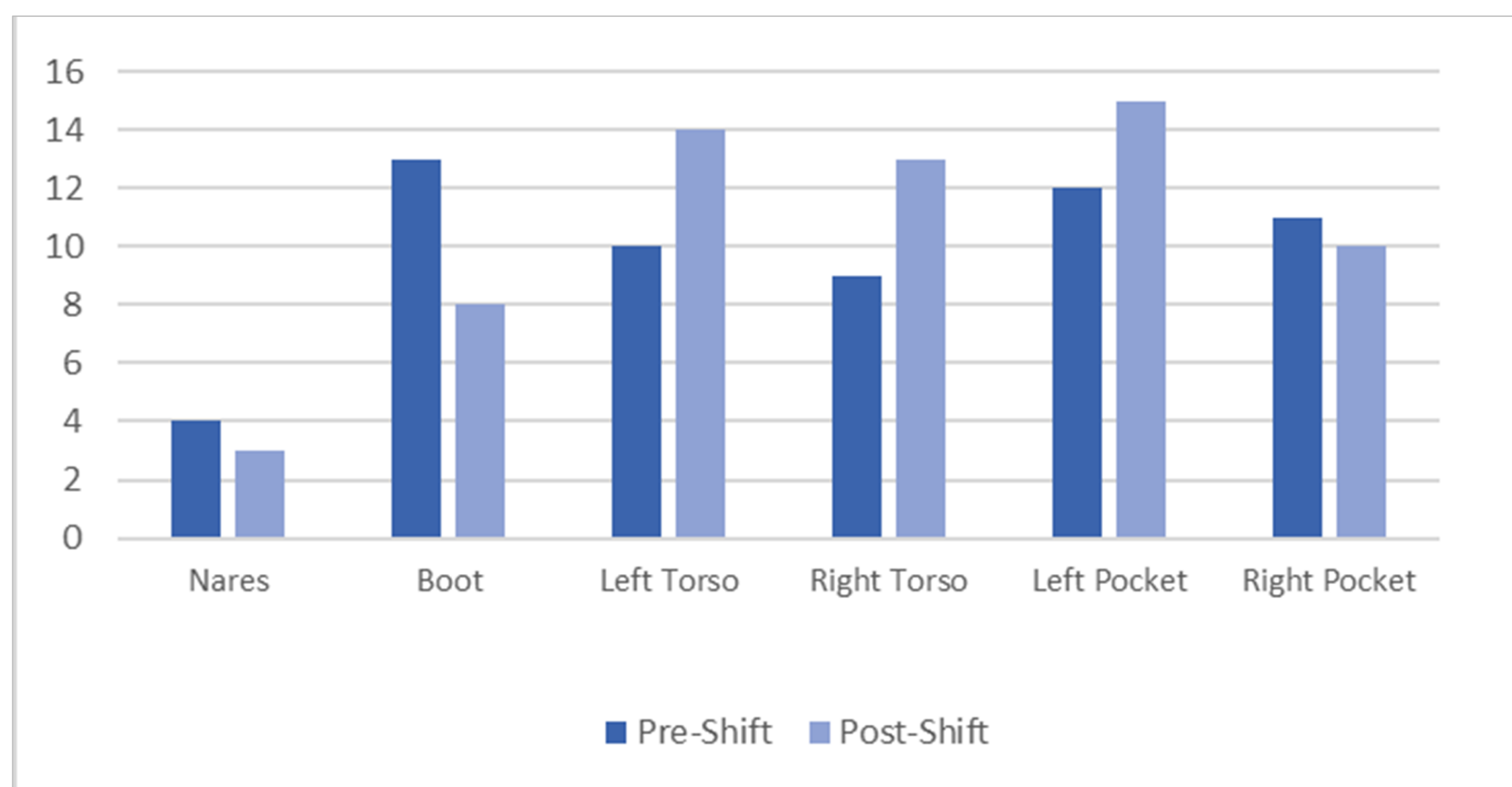


Table 1. Ambulance Median CFUs Pre- and Post-Shift

Ambulances	Overall	Total		P
		Pre-shift	Post-shift	
Median CFU	1531 (150-5196)	1650 (184-5825)	1456 (137-4464)	0.6
Median Monitor Handle CFU, (IQR)	38 (14-57)	48 (12-59)	32 (15-51)	
Median Knob CFU, (IQR)	6 (1-14.5)	7 (3-16.5)	6 (0-12)	
Median Pulse Oximeter CFU, (IQR)	16 (1-48)	22 (2-48)	10 (1-59)	
Median EKG CFU, (IQR)	708 (307-1663)	975 (290-1350)	489 (324-1976)	
Median BP Cuff CFU, (IQR)	2473 (993-8098)	2798 (1069-11390)	2449 (872-7828)	
Median Ceiling CFU, (IQR)	426 (159-3040)	413 (159-2986)	635 (175-3040)	
Median Patient Stretcher Handle CFU, (IQR)	2914 (1486-7526)	2925 (1527-7440)	2828 (1460-10626)	
Median Counter CFU, (IQR)	3541 (1658-15300)	6292 (2408-16500)	2310 (1110-6438)	
Median Steering Wheel CFU, (IQR)	3948 (1980-6150)	4784 (2084-9846)	3672 (1571-5930)	
Median Seat CFU, (IQR)	4309 (2275-15000)	5488 (2722-15300)	3749 (1853-7410)	
Median Radio Mics CFU, (IQR)	1428 (575-3314)	1178 (625-2909)	1429 (455-3602)	
Median Provider Stretcher Handle CFU, (IQR)	5728 (2997-15000)	7861 (3985-16800)	4550 (2871-13950)	
Median Laptop CFU, (IQR)	804 (275-2800)	781 (31-2550)	1098 (360-3050)	

Table 2. EMS Provider Median CFUs Pre- and Post-Shift

EMS Providers	Overall	Total		P
		Pre-shift	Post-shift	
Median CFU, (IQR)	108 (51-300)	102 (51-300)	125 (50-300)	0.9
Median Boot CFU, (IQR)	21157 (16521-30000)	21301 (17060-30300)	20555 (16521-28800)	
Median Left Torso CFU, (IQR)	111 (77-242)	145 (66-277)	110 (84-172)	
Median Right Torso CFU, (IQR)	149.5 (78-292.5)	130 (78-275)	178 (81-294)	
Median Left Pocket CFU, (IQR)	241 (150-367)	243 (137-358)	241 (164-407)	
Median Right Pocket CFU, (IQR)	223 (153-388)	234 (153-385)	221 (134-433)	

Results

- 10 emergency and 10 transport ambulances, 40 EMS Providers were sampled from September 2021-March 2022 resulting in 980 total samples.
- Before a shift, or when ready to use, trucks and providers overall were contaminated, as well as after a full shift
- Contamination between samplings were similar and in-fact higher pre-shift.
- Pre-shift: 100 samples harbored CIPs (19 MRSA, 66 MSSA, 15 VRE): 59 (59%) of CIPs recovered from EMS uniforms, and 41 from ambulances
- Post-shift: 88 new CIPs were covered (24 MRSA, 53 MSSA, 11 VRE): 62 (70%) of CIPs were harbored on EMS uniforms, 26 from ambulances

Figure 4. Pre-shift CIPs

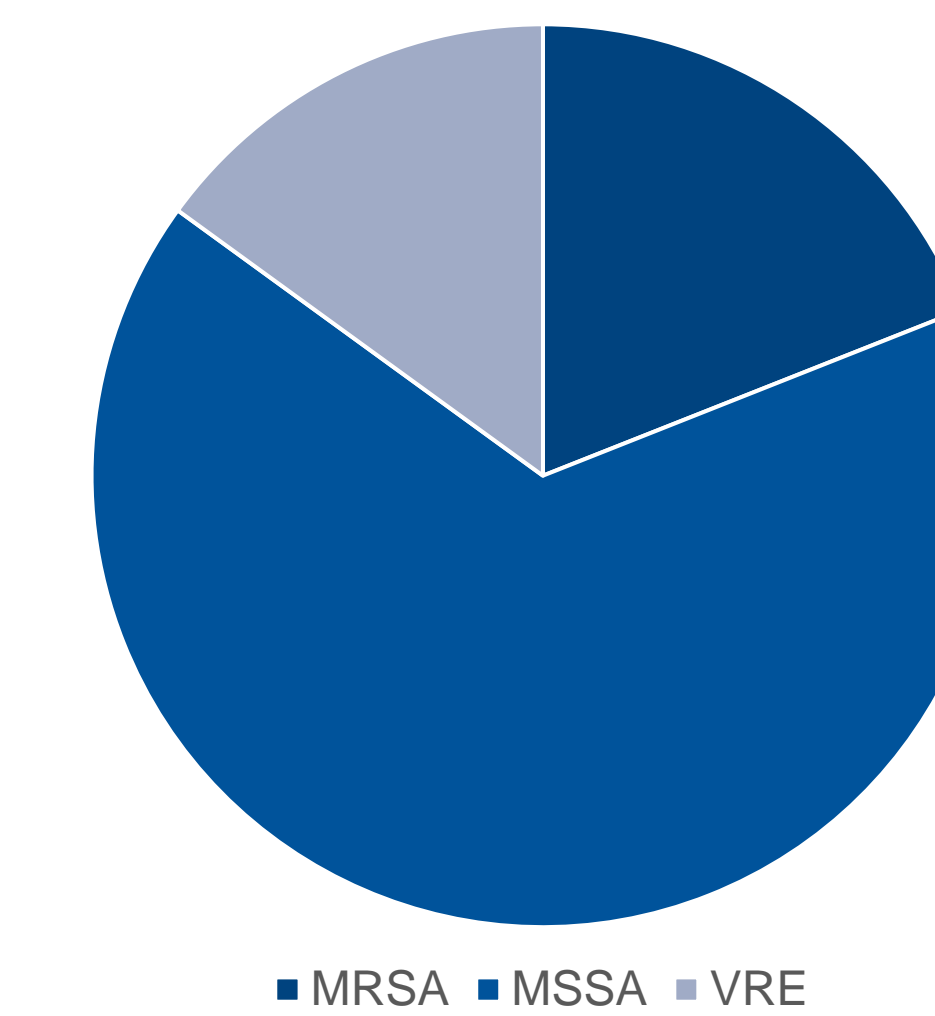
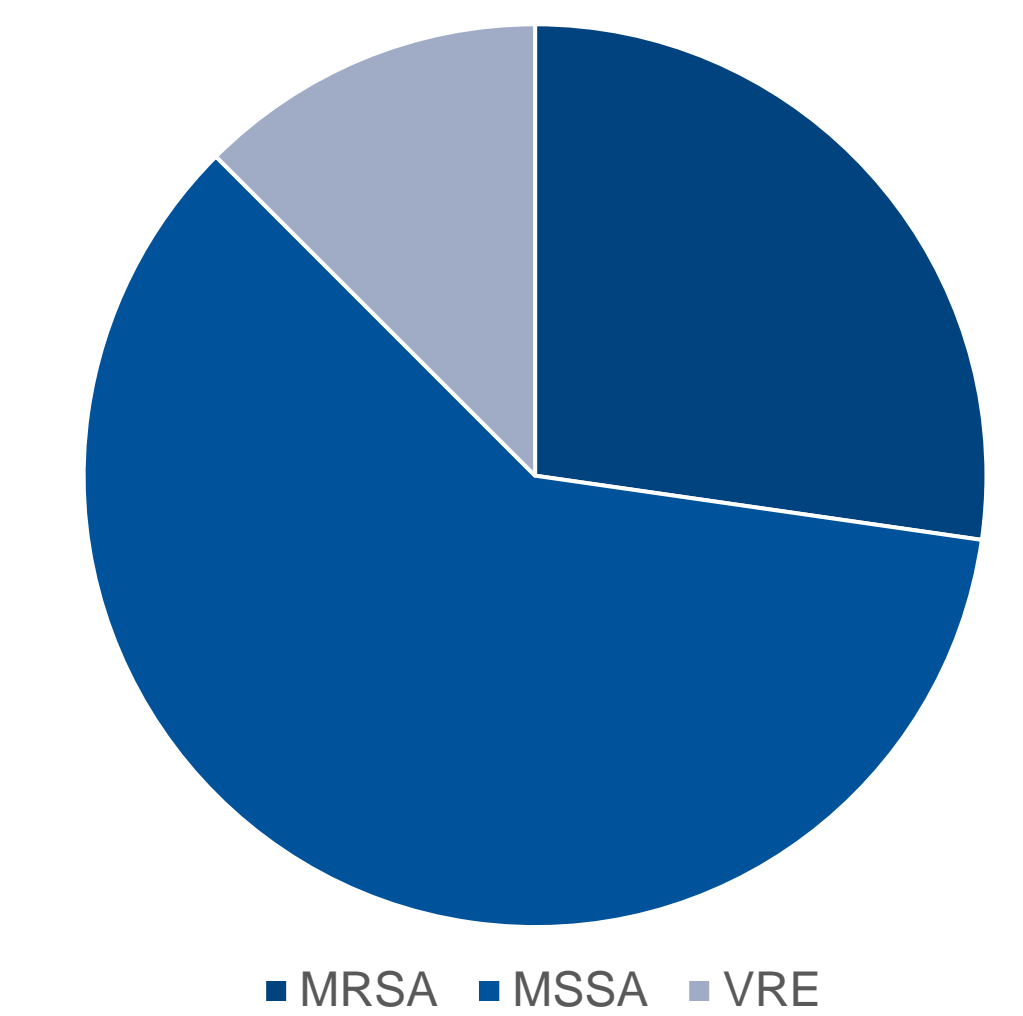


Figure 5. Post-Shift CIPs



Conclusions

- Ambulances were contaminated with general flora and CIPs pre- and post-shift, when deemed ready for service, and are a potential source of HAIs
- CIPs were mostly recovered from EMS Providers clothing
- After we validated disinfections after the first sampling, the areas sampled became similarly contaminated to pre-shift values
- Better disinfection methodology is needed
- Further studies are needed to determine optimal disinfection procedures of ambulances and EMS uniforms

