

BACKGROUND

Microbial Colonization and Healthcare-associated Infections

- Healthcare-associated infections are a significant cause of adverse outcomes in neonatal intensive care units (NICUs).¹
- Colonization of NICU sinks, particularly with Gram-negative organisms such as *Pseudomonas aeruginosa* or *Serratia marcescens*, can lead to colonization or infection in neonates.²
- One potential contributor to sink colonization is cleaning breast pump (BP) kits in hand hygiene sinks when hospital design does not include a dirty utility sink in the patient room.

Implementation of Dishwasher for Breast Pump Cleaning

- As a mitigation strategy, many institutions have transitioned from hand washing of BP kits to using a commercial grade dishwasher.
- Commercial grade dishwashers allow for standardized cleaning and high temperature rinse cycle disinfection, but there is limited research to compare the effectiveness of manually washing vs. dishwasher cleaning of BP kits.

Study Objectives

- The primary objective was to determine the reduction in bacterial bioburden when using a commercial grade dishwasher for cleaning BP parts.
- The secondary objective was to compare the effectiveness of different cleaning methods in reducing bacterial bioburden.

METHODS

- This laboratory-based study involved BP parts inoculated with a standardized solution of bacteria and breast milk. A total of 4 cleaning methods (M) were compared, with 3 elapsed times (T) of BP kits sitting at room temperature prior to cleaning to mimic practices that may occur in the NICU.
- The testing was first done with new BP kits and then repeated after "used" BP kits had been cleaned in dishwasher to assess the reproducibility of results and the potential impact of repeated use as would occur in real life. Sterility testing of the 3 BP parts was done prior to repeating the procedure to ensure sterility.

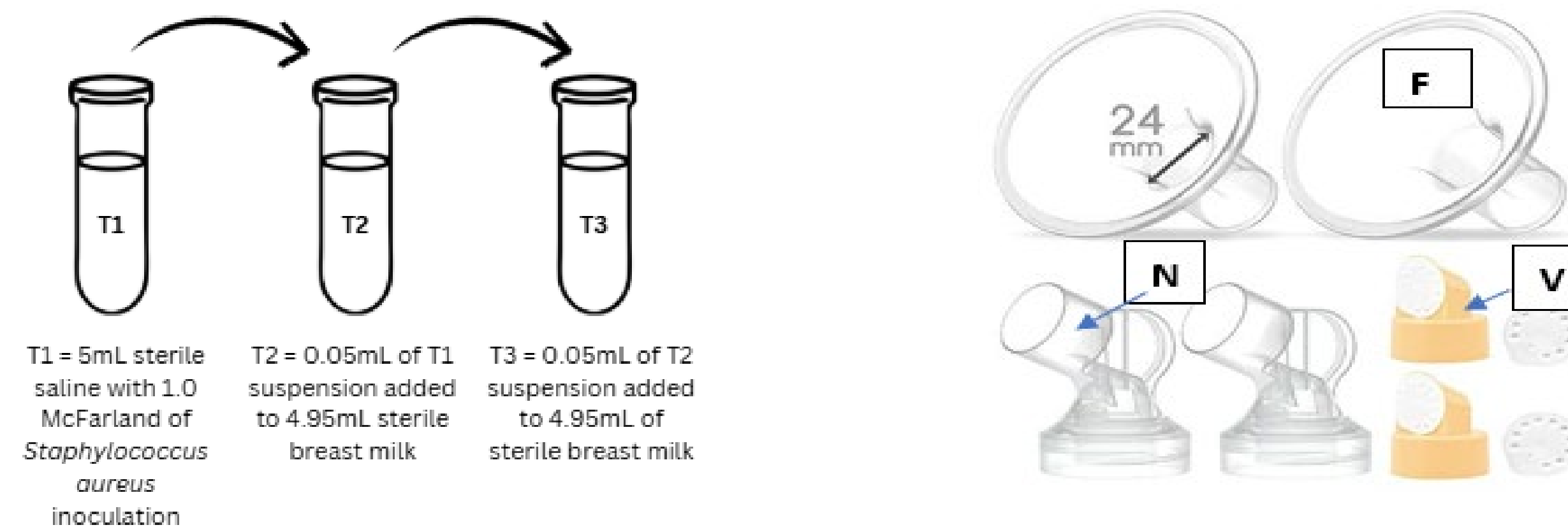
	T1 = Immediately after pumping	T2 = 1 hour after pumping	T3 = 4 hours after pumping
M1 = Unwashed (control)	M1T1	M1T2	M1T3
M2 = Quick rinse (no soap)	M2T1	M2T2	M2T3
M3 = Hand scrub with soap	M3T1	M3T2	M3T3
M4 = Commercial grade dishwasher standardized cycle	M4T1	M4T2	M4T3

(N = 12)

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- BC Women's Hospital Neonatal Intensive Care Unit
- Microbiology Laboratory, BC Children's and BC Women's Hospitals

1. Standardizing the Number of Bacteria on BP Parts



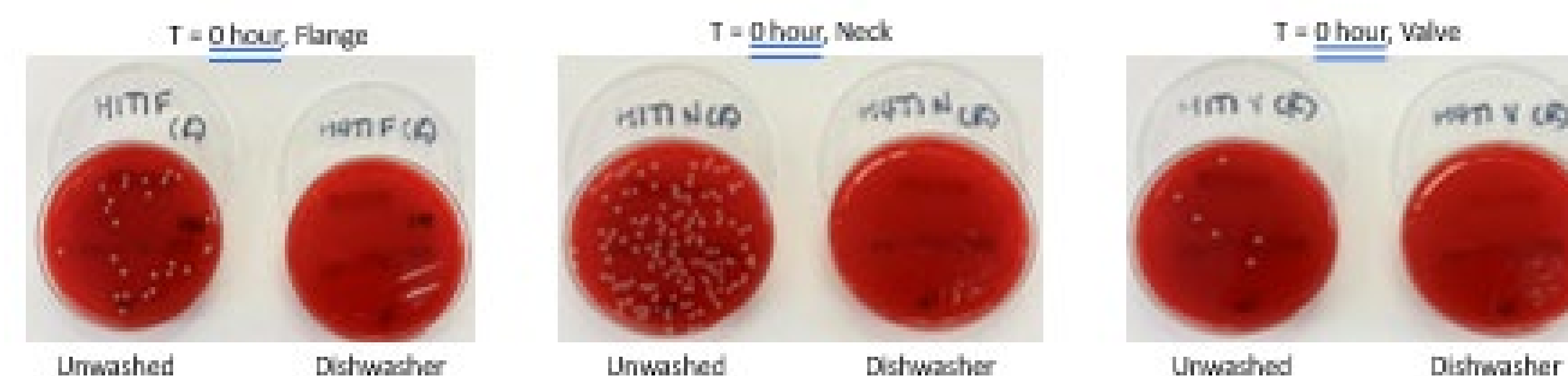
- This solution was constituted to approximate the concentration of bacteria found in breast milk.^{3,4,5,6} It was transferred to a sterile dropper to mimic the mechanical action of breast milk coating the breast pump part when pumping.
- A total of 30 mL were continuously delivered through the flange (F), down the neck (N) and through the valve (V). Breast pump parts then underwent M/T combinations as listed in chart.

2. Testing BP Parts to Determine Bacterial Bioburden

- Three samples were taken from the BP parts at the flange, neck and valve using sterile swabs.
- A 1x1 cm square was vigorously swabbed using uniform pressure and motion (5 strokes horizontally & vertically respectively) for each of the 3 areas.
- The inoculated swab was vortexed into 500 µL of tryptic soy broth (TSB).
- 100 µL of the TSB broth was pipetted onto a blood agar plate and streaked for an even lawn of growth, then incubated for 48hrs at 35°C aerobically.

3. Reading Inoculated Plates

- Quantification of bacterial colony forming units (CFU) per cm² was performed using the total plate count (TPC) method. The total number of colonies observed was recorded.

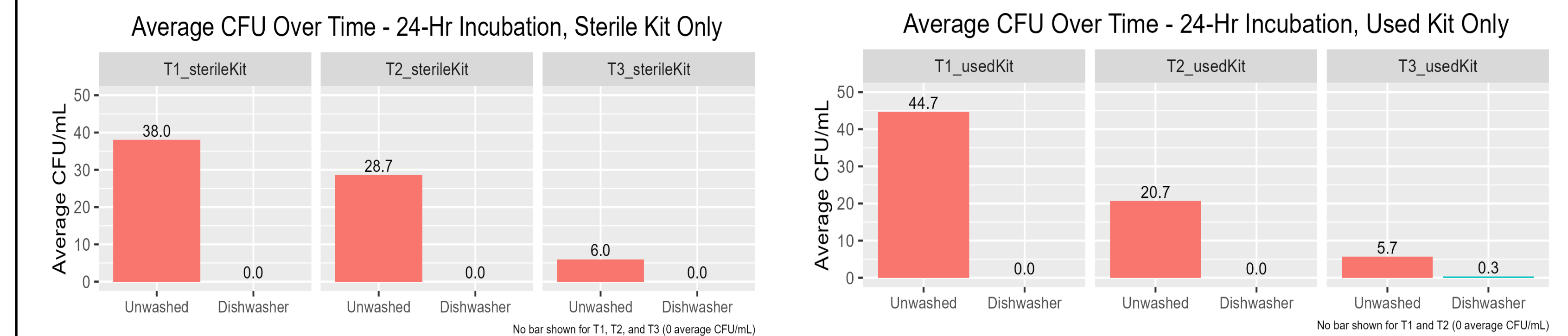


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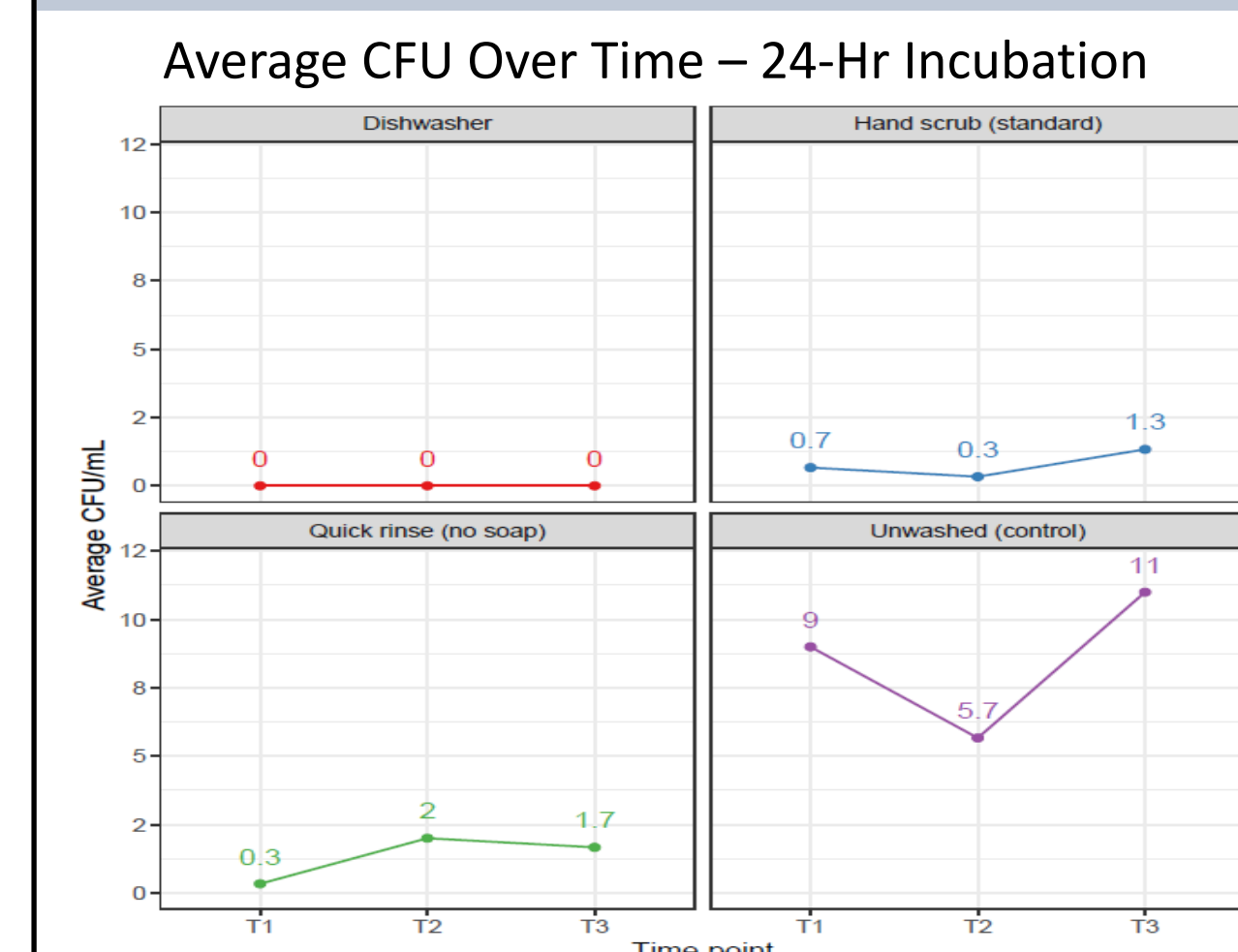
RESULTS

Finding #1: Dishwasher reduced CFU vs. unwashed control (sterile kit + "used" kit)



- Dishwasher cleaning of BP parts resulted in a total reduction in bioburden (0 CFU/cm²); growth was not observed from either sterile or "used" kits.
- The only growth was a single contaminant observed during a M4T3 repeat.

Finding #2: Dishwasher demonstrates greater CFU reduction in comparison to "quick rinse only" and "hand scrub with soap and water"



Dishwasher cleaning of BP parts showed a total reduction of bioburden compared to other cleaning methods.

There was a trend towards more effective reduction of bioburden with the dishwasher compared to the other methods, as seen in the mean CFU for M2 (1.33 CFU/cm²), M3 (0.78 CFU/cm²), and M4 (0 CFU/cm²); results were not statistically significant.

The mean differences in CFU/cm² (95% CI) and p-values were:

- M4 vs. M2 = -1.33 (-4.65, 1.98), p = 0.42
- M4 vs. M3 = -0.78 (-3.90, 2.34), p = 0.61

DISCUSSION

Limitation

- The sample size was small. Further testing will be required to see if the more effective CFU reduction by dishwasher is statistically significant in comparison to other methods of cleaning (quick rinse only and hand scrub with soap and water).
- Longitudinal study will be required to look at degradation of BP parts with prolong high heat sterilization from dishwasher.

Conclusion

- Commercial grade dishwasher is a suitable alternative to manual BP washing, with demonstrated effectiveness in eliminating bioburden. It may also contribute to decreased contamination of NICU hand hygiene sinks from manual BP washing, although future study of this is required.
- By comparing the different washing methods, there is a demonstrable difference with the dishwasher achieving complete elimination of bioburden on pump parts.
- Currently, NICU is still utilizing a hybrid model (hand scrub with soap and water, with dishwasher option), as the dishwasher room is geographically inconvenient to many families. Hence, more dishwashers will be required for ease of use and to accommodate demand.