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Antimicrobial efficacy of an AIRsteril MVX12 air purifying unit in NHS public transport ambulances

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1. Executive Summary

A validation was performed assessing the effect of an air purification unit (MVX12 White medical unit) situated in NHS public transport ambulances on the levels of airborne and surface microorganisms.

Air plate and swab samples were taken as a baseline from vehicles without an MVX12 unit installed, and then test samples were taken from the same positions in vehicles with the units been in place since 01.04.2022. The purification units run continuously when the vehicle is in use and turn off a few minutes following the engine shutting down.

The results from the testing showed:

- Surface contamination – A 1.32LOG10cfu/cm^2 reduction equating to a 95.26% decrease from control vehicle levels when using the AIRsteril unit
- Airborne contamination – A 0.73LOG10cfu/cm^2 reduction equating to an 81.45% decrease from control vehicle levels when using the AIRsteril unit

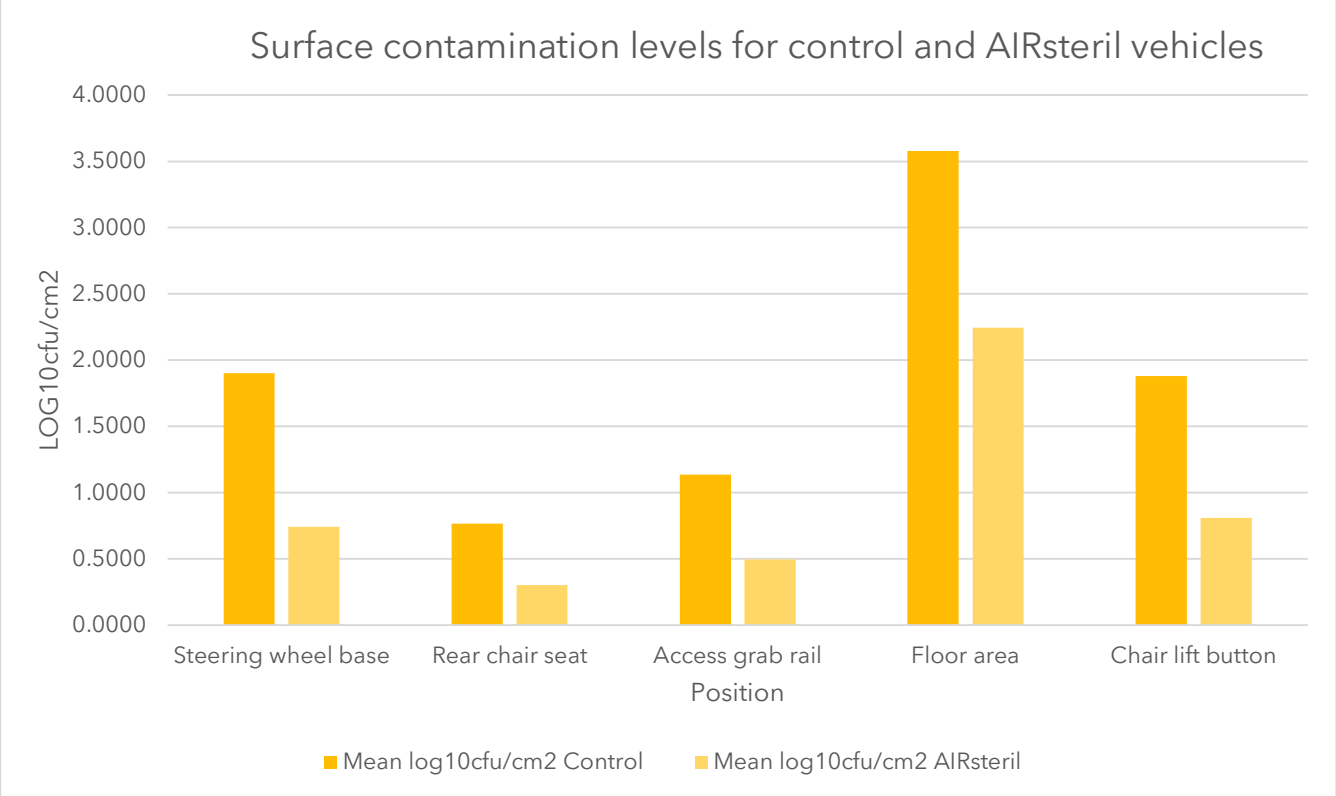

Figure 1 – *Mean TVC LOG10cfu/cm^2 results for all vehicles in the surface contamination (swab) portion of the trial comparing the control condition and the AIRsteril condition.*

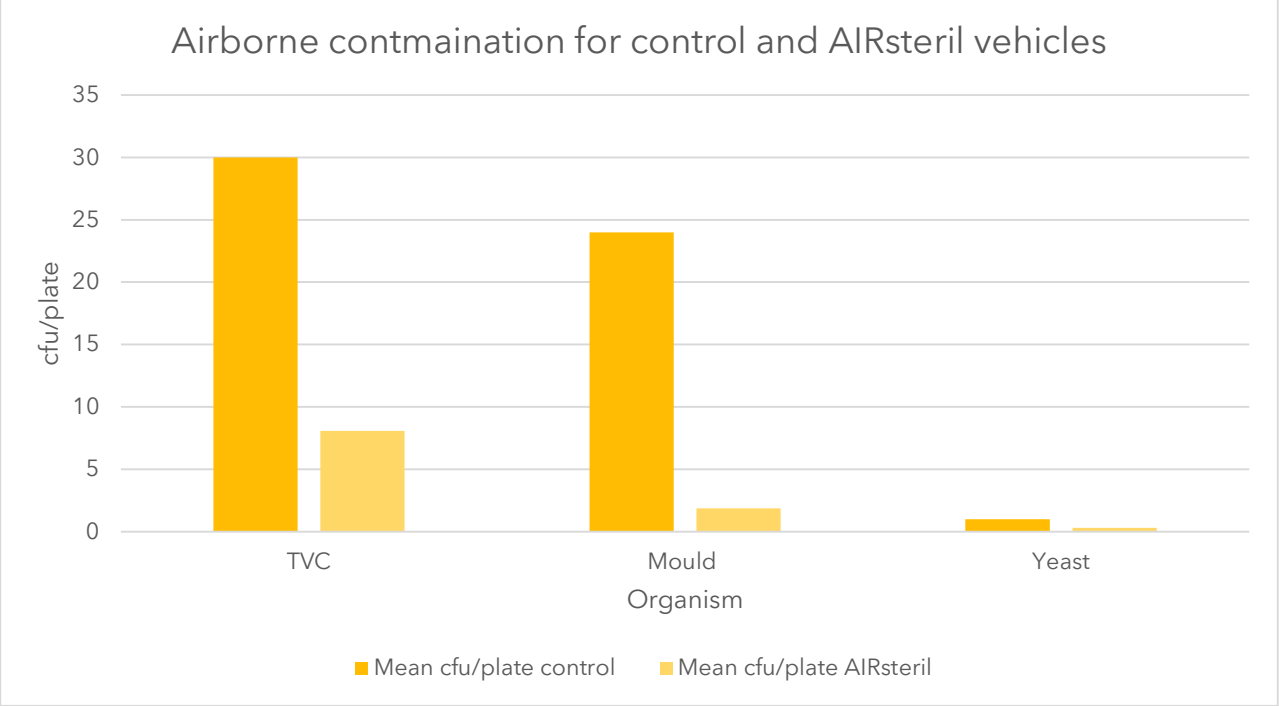

Figure 2 – *Mean cfu/plate results for all vehicles in the airborne contamination (settle plate) portion of the trial comparing the control condition and the AIRsteril condition.*

2. Rationale and Overview

This assessment is based on the reduction in colony forming units on settle plates and swabs taken from the inside of public transport ambulance vehicles for Epsom and St. Helier university hospitals NHS trust. Analysis was conducted on one occasion on 10 control vehicles with no sterilization unit and 9 vehicles with a AIRsteril MVX12 white medical unit fitted.

The assessment will be based on the theoretical and practical analysis of the data generated by and extrapolated from the trial including but not limited to enumeration testing of both settle plates to evaluate airborne microorganisms, swab testing for the evaluation of microbiological load on surfaces and calculations performed on the data following the practical portion of the test.

The settle plates were set out inside the vehicles for 60 minutes to monitor the cultivable airborne microbial flora with all windows and doors closed throughout testing. The testing was conducted 15.05.2022. The plates were set out inside the vehicles at four predetermined positions. Swabbing was completed as per standard environmental monitoring procedures and in five set locations over the vehicles.

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This report details the validation of air purification units situated inside NHS patient transport vehicles. Sampling was completed by the AIRSteril team and analysis of settle plates; result interpretation and report writing was completed by the Specialist Microbiology Team at ALS Rotherham which operates under ISO 17025 regulations. The project was carried out in May 2022 on request from Darren Magee Head of Medical Physics & Clinical Engineering at Epsom & St Helier University Hospitals NHS Trust.

3. Analytical Procedure

3.1 Trial Conditions

Swab and settle plate samples were taken from 10 control vehicles and 9 vehicles fitted with the AIRSteril system. Only 9 vehicles were available for the AIRSteril condition at the time of sampling. All samples were taken by one member of staff from AIRSteril over one night – 15/05/2022 when all vehicles had returned from active work. All samples were taken between 1am and 6am.

The sampler recorded the following regarding the sampling event: "Testing was performed in all the "Control" vehicles first, then the "AIRSteril" vehicles, and it rained quite heavily halfway through the testing. All vehicles were accessed through the side door to rear section with the door immediately closed when inside the vehicle to place/collect samples and again once I had left the vehicle. Sample dishes were placed onto driver's seat from rear of vehicle, swabs of steering wheel were performed from rear where possible and by accessing via the driver's door when required due to bulkhead design. Two of the "AIRsteril" vehicles would not unlock and had to be started up by the onsite representative (this meant the gentleman sat in the driver's seat touched the steering wheel).

With the exception of one "AIRsteril" vehicle which arrived around 1am all vehicles tested were on site before this time. Design of all vehicles was very similar with a few minor differences, some bulkheads were completely open, others only had a small access hatch, slightly varying button systems for rear chair lift, alternative grab handle types, some had a stretcher in the rear, others only chairs. Sample dish number 3 was placed in a central location between two chairs, when a stretcher was present this location was not viable (would have been underneath) so the plates were relocated alongside the stretcher to remain as close as possible to original location.

Swabs were performed in as close as practical location within each vehicle, for swab 13 (floor swab) the area selected appeared visibly clean in the first vehicles swabbed, but in certain vehicles obvious wet mud/water was present, there was concern this would corrupt data therefore the swab location was adjusted by up to 10cm to avoid this issue where possible"

The units are in different positions in each vehicle depending on the medical equipment present. All MVX12's are fitted with a 6.5mg bulb inside the unit which has been calculated by AIRsteril as the correct output for the size of the vehicles and the air changes expected.

All settle plates were set out for 60 minutes and collected within 2 or 3 minutes of the 1-hour endpoint. The test site used for this testing was Cotswold Road, Sutton, Surrey SM2 5NF for Epsom and St Helier University Hospitals NHS Trust.

3.2 Microbiological Testing

Airborne microorganisms were evaluated in 4 areas in each vehicle using dRBCA, and TVC plates to cover relevant microorganisms; yeasts, moulds, and bacteria. dRBCA media will recover most mould and yeast species. TVC plates will recover most bacteria, mould and yeast present in the air. The raw data will be reported in cfu/plate (colony forming units per plate) which measures how many viable organisms have landed on the settle plates and formed a colony. The dRBCA plates have a countable range of 150 cfu/plate and TVC plates have a countable range of 300cfu/plate.

Swab testing using 5ml neutralizing buffer swabs was also completed on 5 areas in each vehicle. Swabs were processed for TVC testing on receipt back to the laboratory. A standard 10cm x 10cm square was swabbed for each position.

The testing points for this trial are listed below in table 1 and the methods used listed in table 2.

The details and method extract for the method used have not been included in this report however they are available on request.

Trial	Test points	Testing carried out
Air testing	Control vehicles x10 (4 positions)	TVC, Yeast and Mould enumeration
	AIRSteril Vehicles x9 (4 positions)	TVC, Yeast and Mould enumeration
Surface testing	Control vehicles x10 (5 positions)	TVC enumeration
	AIRSteril Vehicles x9 (5 positions)	TVC enumeration

Table 1 – *Testing points/sampling for this trial.*

Target Organism	Method	Method Details	ALS method reference
Yeast and Mould Enumeration (Settle Plate)	Airborne Environmental Monitoring	Method derived from the ISO 21527-1:2008 and is compliant with Marks & Spencer Manual of Microbiological Methods, Method 3.8, June 2015	ESGMM312/ESGMM322
Total Viable Count (Settle Plate)	Airborne Environmental Monitoring	Method derived from the ISO 21527-1:2008 and is compliant with Marks & Spencer Manual of Microbiological Methods, Method 3.8, June 2015	ESGMM312/ESGMM322
Total Viable Count (Swab)	Surface Environmental monitoring	Method derived from the ISO 21527-1:2008 and is compliant with Marks & Spencer Manual of Microbiological Methods, Method 3.8, June 2015	ESGMM312/ESGMM003

Table 2 – *Methods employed for this project please note ESGMM methods are UKAS accredited.*

4. Results

4.1 Swab results

Sample Description	TVC result cfu/area swabbed	Mean cfu/area swabbed per vehicle
NRW000385b - Control - AYD - Steering wheel base	20	
NRW000385b - Control - AYD - Rear chair seat	10	
NRW000385b - Control - AYD - Access grab rail	110	
NRW000385b - Control - AYD - Floor area	38800	
NRW000385b - Control - AYD - Chair lift button panel	0	7788
NRW000385b - Control - AWZ - Steering wheel base	33600	
NRW000385b - Control - AWZ - Rear chair seat	2920	
NRW000385b - Control - AWZ - Access grab rail	10	
NRW000385b - Control - AWZ - Floor area	5400	
NRW000385b - Control - AWZ - Chair lift button panel	23600	13106
NRW000385b - Control - AXX -Steering wheel base	0	
NRW000385b - Control - AXX -Rear chair seat	0	320

NRW000385b - Control - AXX -Access grab rail	0	
NRW000385b - Control - AXX -Floor area	1600	
NRW000385b - Control - AXX -Chair lift button panel	0	
NRW000385b - Control - AVM - Steering wheel base	12000	
NRW000385b - Control - AVM - Rear chair seat	140	
NRW000385b - Control - AVM - Access grab rail	13200	
NRW000385b - Control - AVM - Floor area	712000	
NRW000385b - Control - AVM - Chair lift button panel	13800	150228
NRW000385b - Control - AXA -Steering wheel base	133600	
NRW000385b - Control - AXA -Rear chair seat	10	
NRW000385b - Control - AXA -Access grab rail	0	
NRW000385b - Control - AXA -Floor area	111200	
NRW000385b - Control - AXA -Chair lift button panel	3100	49582
NRW000385b - Control - CXW - Steering wheel base	250	
NRW000385b - Control - CXW - Rear chair seat	38000	
NRW000385b - Control - CXW - Access grab rail	1180	
NRW000385b - Control - CXW - Floor area	3700	
NRW000385b - Control - CXW - Chair lift button panel	395200	87666
NRW000385b - Control - AXR - Steering wheel base	850	
NRW000385b - Control - AXR - Rear chair seat	30	
NRW000385b - Control - AXR - Access grab rail	20	
NRW000385b - Control - AXR - Floor area	16600	
NRW000385b - Control - AXR - Chair lift button panel	107200	24940
NRW000385b - Control - DXC - Steering wheel base	670	
NRW000385b - Control - DXC - Rear chair seat	0	
NRW000385b - Control - DXC - Access grab rail	0	
NRW000385b - Control - DXC - Floor area	1274400	
NRW000385b - Control - DXC - Chair lift button panel	0	255014
NRW000385b - Control - CYO -Steering wheel base	810	
NRW000385b - Control - CYO -Rear chair seat	10	
NRW000385b - Control - CYO -Access grab rail	1840	
NRW000385b - Control - CYO -Floor area	1880	
NRW000385b - Control - CYO -Chair lift button panel	10	910
NRW000385b - Control - AWG - Steering wheel base	80	
NRW000385b - Control - AWG - Rear chair seat	0	
NRW000385b - Control - AWG - Access grab rail	3600	
NRW000385b - Control - AWG - Floor area	1513600	
NRW000385b - Control - AWG - Chair lift button panel	140	303484

NRW000385b - AIRsteril - YBS -Steering wheel base	0	
NRW000385b - AIRsteril - YBS -Rear chair seat	140	
NRW000385b - AIRsteril - YBS -Access grab rail	110	
NRW000385b - AIRsteril - YBS -Floor area	150	
NRW000385b - AIRsteril - YBS -Chair lift button panel	0	80
NRW000385b - AIRsteril - AVD - Steering wheel base	4600	
NRW000385b - AIRsteril - AVD - Rear chair seat	0	
NRW000385b - AIRsteril - AVD - Access grab rail	0	
NRW000385b - AIRsteril - AVD - Floor area	13800	
NRW000385b - AIRsteril - AVD - Chair lift button panel	0	3680
NRW000385b - AIRsteril - AVJ - Steering wheel base	10	
NRW000385b - AIRsteril - AVJ - Rear chair seat	0	
NRW000385b - AIRsteril - AVJ - Access grab rail	0	
NRW000385b - AIRsteril - AVJ - Floor area	7700	
NRW000385b - AIRsteril - AVJ - Chair lift button panel	10	1544
NRW000385b - AIRsteril - DXB - Steering wheel base	10	
NRW000385b - AIRsteril - DXB - Rear chair seat	0	
NRW000385b - AIRsteril - DXB - Access grab rail	1940	
NRW000385b - AIRsteril - DXB - Floor area	40	
NRW000385b - AIRsteril - DXB - Chair lift button panel	0	398
NRW000385b - AIRsteril - AXV - Steering wheel base	0	
NRW000385b - AIRsteril - AXV - Rear chair seat	0	
NRW000385b - AIRsteril - AXV - Access grab rail	0	
NRW000385b - AIRsteril - AXV - Floor area	3500	
NRW000385b - AIRsteril - AXV - Chair lift button panel	80	716
NRW000385b - AIRsteril - AXP -Steering wheel base	0	
NRW000385b - AIRsteril - AXP -Rear chair seat	10	
NRW000385b - AIRsteril - AXP -Access grab rail	0	
NRW000385b - AIRsteril - AXP -Floor area	10	
NRW000385b - AIRsteril - AXP -Chair lift button panel	0	4
NRW000385b - AIRsteril - AYH - Steering wheel base	0	
NRW000385b - AIRsteril - AYH - Rear chair seat	40	
NRW000385b - AIRsteril - AYH - Access grab rail	0	
NRW000385b - AIRsteril - AYH - Floor area	44400	
NRW000385b - AIRsteril - AYH - Chair lift button panel	80	8904
NRW000385b - AIRsteril - CXS - Steering wheel base	3000	
NRW000385b - AIRsteril - CXS - Rear chair seat	0	
NRW000385b - AIRsteril - CXS - Access grab rail	0	1324

NRW000385b - AIRsteril - CXS - Floor area	1720	
NRW000385b - AIRsteril - CXS - Chair lift button panel	1900	
NRW000385b - AIRsteril - CYV - Steering wheel base	340	
NRW000385b - AIRsteril - CYV - Rear chair seat	90	
NRW000385b - AIRsteril - CYV - Access grab rail	140	
NRW000385b - AIRsteril - CYV - Floor area	91200	
NRW000385b - AIRsteril - CYV - Chair lift button panel	15600	21474

Table 3 – *Raw cfu/area swabbed results for all vehicles per swabbing position.*

4.2 Settle plate results

Description	TVC Result cfu/plate	Mould Result cfu/plate	Yeast Result cfu/plate	Mean TVC cfu/plate	Mean Mould cfu/plate	Mean yeast cfu/plate
NRW000385b - Control - AYD - Drivers seat	11	26	0			
NRW000385b - Control - AYD - behind bulkhead	30	29	0			
NRW000385b - Control - AYD - middle of vehicle	24	40	0			
NRW000385b - Control - AYD - underneath rear lift	22	41	0	21.75	34	0
NRW000385b - Control - AWZ - Drivers seat	4	8	0			
NRW000385b - Control - AWZ - behind bulkhead	22	10	1			
NRW000385b - Control - AWZ - middle of vehicle	7	11	0			
NRW000385b - Control - AWZ - underneath rear lift	8	12	0	10.25	10.25	0.25
NRW000385b - Control - AXX - Drivers seat	*300	8	1			
NRW000385b - Control - AXX - behind bulkhead	13	13	0			
NRW000385b - Control - AXX - middle of vehicle	14	11	0			
NRW000385b - Control - AXX - underneath rear lift	11	17	0	84.50	12.25	0.25
NRW000385b - Control - AVM - Drivers seat	7	13	0			
NRW000385b - Control - AVM - behind bulkhead	16	13	0			
NRW000385b - Control - AVM - middle of vehicle	10	9	0			
NRW000385b - Control - AVM - underneath rear lift	6	8	0	9.75	10.75	0
NRW000385b - Control - AXA -Drivers seat	2	2	0			
NRW000385b - Control - AXA -behind bulkhead	1	2	0			
NRW000385b - Control - AXA -middle of vehicle	1	4	0			
NRW000385b - Control - AXA -underneath rear lift	1	2	0	1.25	2.5	0
NRW000385b - Control - CXW - Drivers seat	4	12	0			
NRW000385b - Control - CXW - behind bulkhead	6	2	0			
NRW000385b - Control - CXW - middle of vehicle	6	6	0			
NRW000385b - Control - CXW - underneath rear lift	13	5	0	7.25	6.25	0
NRW000385b - Control - AXR - Drivers seat	18	18	0	63	33.25	7.5

NRW000385b - Control - AXR - behind bulkhead	21	16	0			
NRW000385b - Control - AXR - middle of vehicle	192	81	30			
NRW000385b - Control - AXR - underneath rear lift	21	18	0			
NRW000385b - Control - DXC - Drivers seat	22	36	0			
NRW000385b - Control - DXC - behind bulkhead	51	59	0			
NRW000385b - Control - DXC - middle of vehicle	58	82	1			
NRW000385b - Control - DXC - underneath rear lift	38	72	0	42.25	62.25	0.25
NRW000385b - Control - CYO -Drivers seat	19	37	0			
NRW000385b - Control - CYO -behind bulkhead	51	87	1			
NRW000385b - Control - CYO -middle of vehicle	37	64	0			
NRW000385b - Control - CYO -underneath rear lift	94	60	0	50.25	62	0.25
NRW000385b - Control - AWG - Drivers seat	4	7	0			
NRW000385b - Control - AWG - behind bulkhead	20	5	0			
NRW000385b - Control - AWG - middle of vehicle	14	4	1			
NRW000385b - Control - AWG - underneath rear lift	16	4	0	13.5	5	0.25
NRW000385b - AIRsteril - YBS -Drivers seat	2	2	0			
NRW000385b - AIRsteril - YBS -behind bulkhead	5	0	2			
NRW000385b - AIRsteril - YBS -middle of vehicle	2	1	0			
NRW000385b - AIRsteril - YBS -underneath rear lift	1	3	0	2.5	1.5	0.5
NRW000385b - AIRsteril - AVD - Drivers seat	1	1	0			
NRW000385b - AIRsteril - AVD - behind bulkhead	3	7	0			
NRW000385b - AIRsteril - AVD - middle of vehicle	2	0	0			
NRW000385b - AIRsteril - AVD - underneath rear lift	2	3	0	2	2.75	0
NRW000385b - AIRsteril - AVJ - Drivers seat	1	0	0			
NRW000385b - AIRsteril - AVJ - behind bulkhead	3	0	0			
NRW000385b - AIRsteril - AVJ - middle of vehicle	3	2	0			
NRW000385b - AIRsteril - AVJ - underneath rear lift	5	1	0	3	0.75	0
NRW000385b - AIRsteril - DXB - Drivers seat	6	1	0			
NRW000385b - AIRsteril - DXB - behind bulkhead	3	1	0			
NRW000385b - AIRsteril - DXB - middle of vehicle	0	2	0			
NRW000385b - AIRsteril - DXB - underneath rear lift	1	0	0	2.5	1	0
NRW000385b - AIRsteril - AXV - Drivers seat	1	1	0			
NRW000385b - AIRsteril - AXV - behind bulkhead	4	1	0			
NRW000385b - AIRsteril - AXV - middle of vehicle	6	3	0			
NRW000385b - AIRsteril - AXV - underneath rear lift	5	1	1	4	1.5	0.25
NRW000385b - AIRsteril - AXP -Drivers seat	1	1	0			
NRW000385b - AIRsteril - AXP -behind bulkhead	5	0	0			
NRW000385b - AIRsteril - AXP -middle of vehicle	7	2	1	4.75	2.25	1

NRW000385b - AIRsteril - AXP -underneath rear lift	6	6	3			
NRW000385b - AIRsteril - AYH - Drivers seat	0	3	0			
NRW000385b - AIRsteril - AYH - behind bulkhead	0	6	0			
NRW000385b - AIRsteril - AYH - middle of vehicle	2	2	0			
NRW000385b - AIRsteril - AYH - underneath rear lift	2	3	1	1	3.5	0.25
NRW000385b - AIRsteril - CXS - Drivers seat	3	1	0			
NRW000385b - AIRsteril - CXS - behind bulkhead	4	3	0			
NRW000385b - AIRsteril - CXS - middle of vehicle	1	0	0			
NRW000385b - AIRsteril - CXS - underneath rear lift	11	0	1	4.75	1	0.25
NRW000385b - AIRsteril - CYV - Drivers seat	153	5	1			
NRW000385b - AIRsteril - CYV - behind bulkhead	6	2	0			
NRW000385b - AIRsteril - CYV - middle of vehicle	5	2	0			
NRW000385b - AIRsteril - CYV - underneath rear lift	29	0	0	48.25	2.25	0.25

Table 4 – *Raw cfu/plate results for all vehicles per swabbing position per organism. *note TVC counts at 300 were >300cfu/plate but rounded to 300 to be included in calculations.*

5. Discussion

During a microbiological investigation, mean or average levels of the organisms within ±0.5 LOG10 of the initial level are classified as no significant change. Decreases of >0.5 LOG10 cfu/cm2 are indicative of die-off and can therefore be attributed to the effects of the product being tested.

The raw results in colony forming units (cfu) obtained from the trial were tabulated and processed to obtain the cfu/cm2 value in the swab portion of the trial and subsequently the LOG10 cfu/cm2. This is due to the unit Log10 cfu/cm2 being the industry standard measurement of bacterial concentration on surfaces. LOG10cfu/plate were used for the airborne portion of the trial and for the yeast just cfu/plate to retain mathematical sense.

A baseline level or what would be expected in a normal vehicle without these MVX12 units were established by enumerating bacteria on the swabs and settle plates in the 10 control vehicles. The test samples were the swabs and plates taken from the AIRsteril vehicles which has had the units installed 34 days earlier.

Results have been broken down for surface contamination (swabs) and airborne contamination analysis (settle plates) in section 5.1 and 5.2 respectively. All averages used are calculated mean averages from raw data above.

5.1 Swabs

Swab results were analysed per testing point to assess how each position had been affected by the unit (see table 5 and figure 3). All areas demonstrated a decreased in surface microorganisms from baseline (control vehicle) levels when using the MVX12. A total mean LOG10cfu/cm2 was generated from all the data to establish

overall percentage reduction in all positions of surface TVC between the control vehicles and those fitted with an AIRsteril unit.

The total log reduction in the settle plate portion of this trial was calculated at 1.32LOG10/cfu/plate which equates to 95.26% decrease attributed to the AIRsteril unit.

Position	LOG10cfu/cm2 reduction from control levels	Percentage reduction
Steering wheel base	1.16	93.06%
Rear chair seat	0.47	65.85%
Access grab rail	0.64	77.00%
Floor area	1.33	95.36%
Chair lift button	1.07	91.47%
Total	1.32	95.26%

Table 5 – *Mean TVC LOG10cfu/cm² results for all vehicles in the surface contamination (swab) portion of the trial. LOG10cfu/cm2 has been calculated and used to measure percentage reduction in colony forming units.*

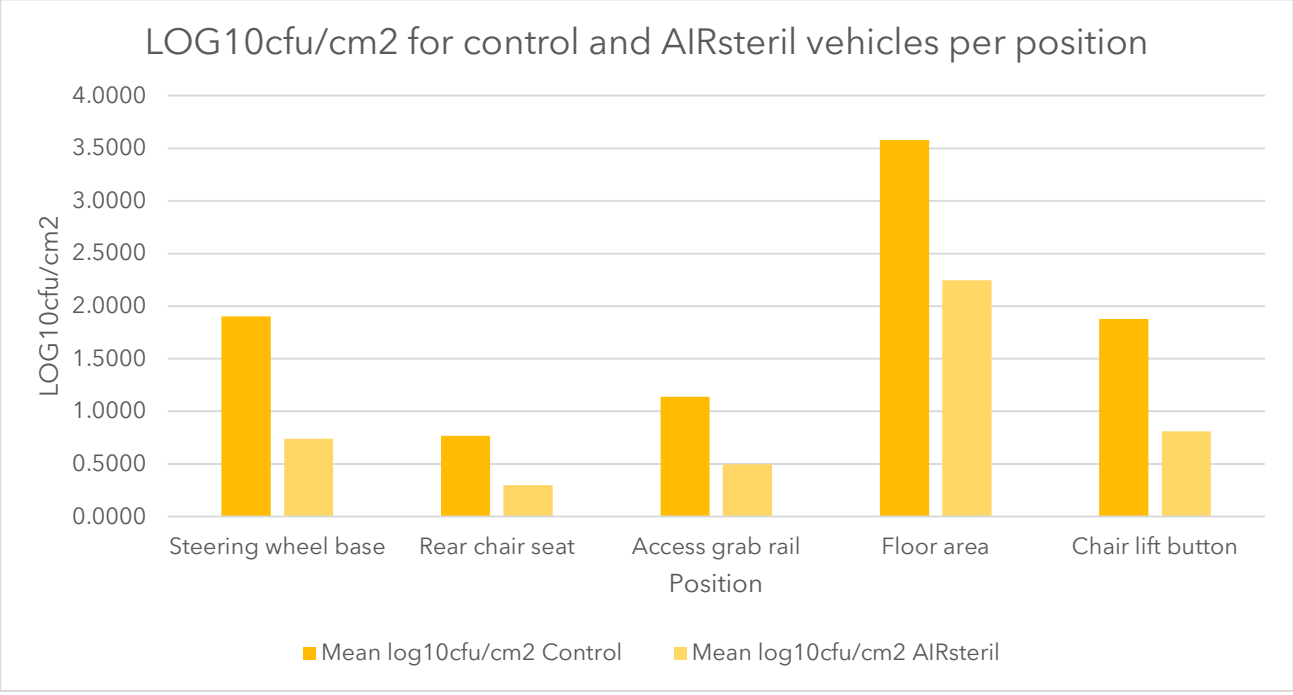

Figure 3 – *Mean TVC LOG10cfu/cm² results for all vehicles in the surface contamination (swab) portion of the trial comparing the control condition and the AIRsteril condition. Graph using LOG10cfu/cm² due to a large range of results per area which distorted the graph for cfu/cm² results.*

5.2 Settle plates

Settle plate results were analysed in this portion of the trial per organism to see how each was affected by the unit see figure 4. Percentage reduction was calculated between the control condition (the baseline) and the AIRsteril condition. Results were also analysed per position in the vehicle, see figure 5.

The total log reduction in the settle plate portion of this trial was calculated at 0.73LOG10/cfu/plate which equates to 81.45% decrease attributed to the AIRsteril unit. All areas and organisms showed a significant decrease from baseline levels.

Organism	LOG10cfu/plate reduction	Percentage reduction
TVC	0.67	78.55%
Mould	0.94	88.51%
Yeast	N/A**	72.00%
Total	0.73	81.45%

Table 6 – *Mean LOG10cfu/plate results for all vehicles per organism in the settle plate portion of the trial. LOG10cfu/plate has been calculated to measure reduction in colony forming units in each condition. **Percentage reduction was calculated from cfu/plate for the yeast results as the levels on the plates were too low to use the standard unit of measurement (LOG10cfu/cm^2). LOG10cfu/plate was used instead of cfu/cm^2 for the same reason.*

Position	LOG10cfu/plate reduction	Percentage reduction
Driver's seat	0.4826	67.08%
Behind bulkhead	0.9308	88.27%
Middle of vehicle	1.2160	93.92%
underneath rear lift	0.7418	81.88%

Table 7 – *Mean LOG10cfu/plate results for all vehicles per position in the settle plate portion of the trial. LOG10cfu/plate has been calculated to measure reduction in colony forming units in each condition.*

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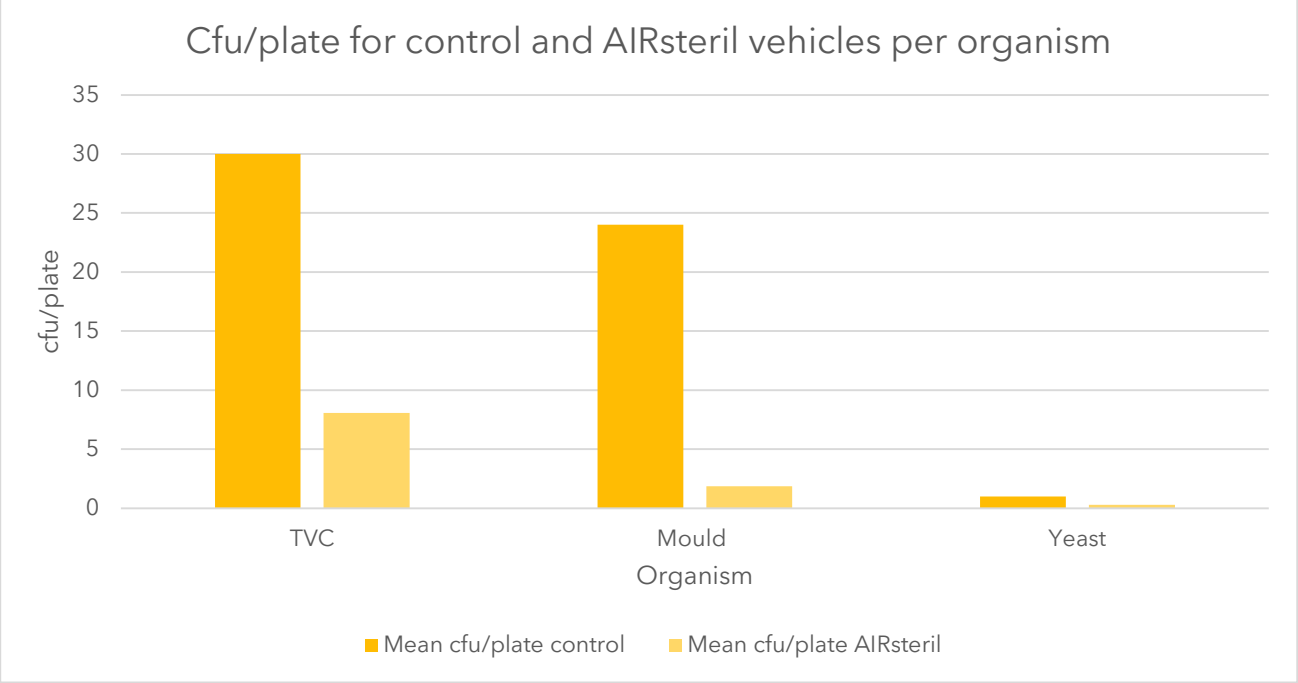

Figure 4 – *Mean cfu/plate results for all vehicles in the airborne contamination (settle plate) portion of the trial comparing the control condition and the AIRsteril condition per organism.*

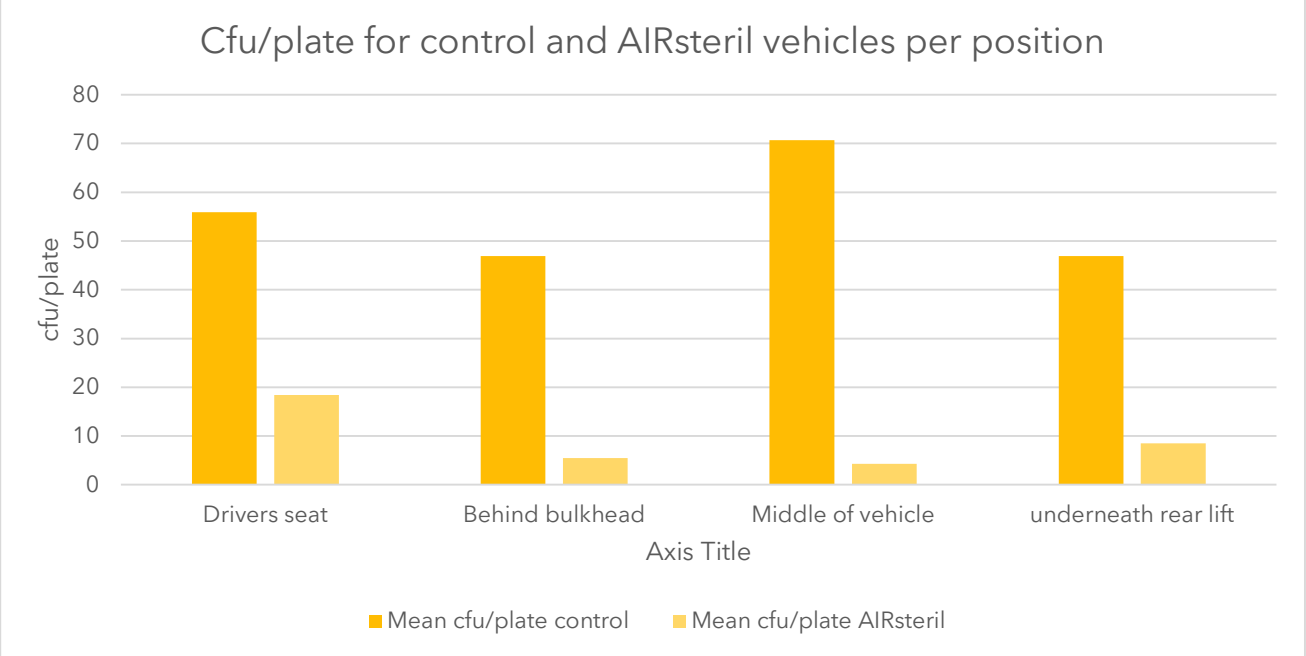

Figure 5 – *Mean cfu/plate results for all vehicles in the airborne contamination (settle plate) portion of the trial comparing the control condition and the AIRsteril condition per position of the plates in the vehicle.*

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6. Conclusion

The validation project detailed in this report was aimed at assessing the effects of the MVX12 Medical sterilisation unit in natural contamination in public transport ambulances within the NHS at Epsom and St Helier University Hospitals NHS Trust.

In this trial the MVX12 unit was recorded to show a reduction in the measurable surface microorganism levels on inside the test vehicles by 95.26% and measurable airborne microorganisms by 81.45%.

The airborne organism affected most by the unit was mould (88.51%) and least were yeasts (72%). The vehicle position 'middle of vehicle' showed the greatest reduction in airborne microorganisms.

The surface microorganism levels reduced most when exposed to the unit in swabs taken from the 'floor' position and least in the 'access grab rail' position, 95.36% and 77.00% respectively.

7. Final Details

This report was created by Bethany Draper, Microbiology Specialist at ALS Rotherham, Units 7&8 Aspen Court, Bessemer Way, Rotherham S60 1FB UK. This report was finalised as dated on the front page of this report and a copy will be held on file.

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