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BONE MARROW TRANSPLANT ROOM MAKEOVER:

Re-engineering patient rooms can lead to a more sanitary environment

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Abstract

Objectives: To evaluate novel environmental engineering solutions to minimize microbial burden in the rooms of patients undergoing bone marrow transplantation.

Methods: This one-year pilot project (Oct 2015-Oct 2016) examined the environment of nine patients undergoing myeloablative (allogeneic) transplantation who were randomized to stay in a re-engineered or a standard bone marrow transplant (BMT) room. Re-engineered rooms had copper installed on seven high-touch surfaces, wall-mounted ultraviolet C light in the patient washroom, titanium dioxide paint on walls, filtered tap water, as well as no-touch soap, alcohol based hand rub and paper towel dispensers. Both re-engineered and standard rooms received regular cleaning and UV-C light disinfection upon patient discharge as per protocol. Weekly RODAC cultures and ATPB (Adenosine Triphosphate – Bioluminescence) measurements on high touch surfaces as well as standard cultures (Blood Agar Plates) of water and air samples were performed throughout the patient's admission.

Results: Average RODAC CFU/plate were 62.6 +/- 279.9 (n=147) and 6.32 +/- 16.6 (n=175;p=0.0083) while average ATPB RLU were 434.4 +/- 675.5 (n=147) and 62.9 +/- 280.9 (n= 182;p=0.0001) for standard and re-engineered rooms, respectively. The average CFU/BAP on air samples was 14.2 +/-11 (n=21) and15.6 +/- 25.2 (n=25;p=0.8145) for standard and re-engineered rooms. Water counts were 26.5 +/-36.5 CFU/BAP (n=20) and 0.08 +/- 0.28 CFU/BAP plate (n=25;0.0007) for standard and re-engineered (filtered water) rooms, respectively. Minimal tarnishing was noted on copper surfaces.

Conclusions: This pilot project demonstrates that lower microbial counts and ATPB measurements were consistently sustained on high-touch surfaces in re-engineered rooms. Lower microbial counts were also observed in filtered water samples in re-engineered rooms over the one-year pilot project period.

Background

- Hospital environments contribute to pathogen transmission[1,2]
- Self-disinfecting surfaces (e.g. copper alloys, titanium dioxide paint) and no-touch devices (motion-activated faucets, UVC lights etc..) may be useful adjuncts to reducing microbial bioburden

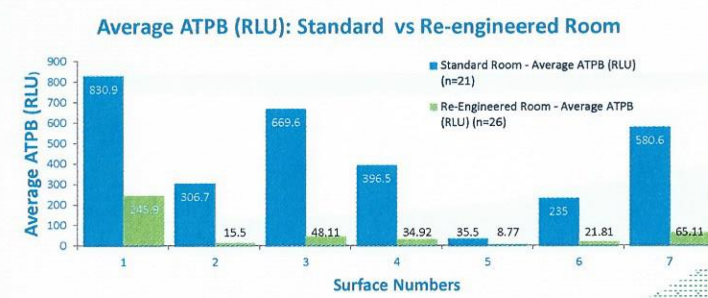
Objectives

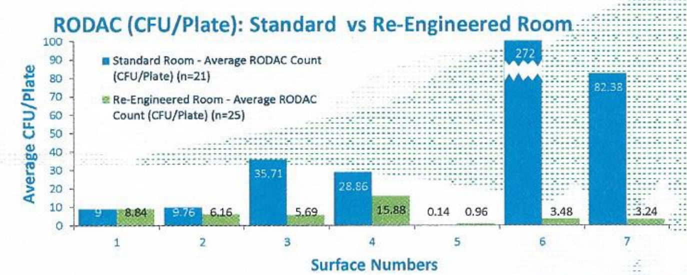
- Assess the impact of re-engineered BMT rooms on microbial bioburden and the feasibility of specimen collection and data analysis

Methods

- One year pilot: nine AML patients undergoing BMT randomized to standard or re-engineered room for duration of stay
- Weekly sampling of a) seven high touch surfaces b) Air (SAS Dual Head Air Sampler) and c) Water (membrane filtration method)
- Samples in duplicate; 2nd sample for genomics (in progress)

Figures 1 and 2: Copper uniformly reduces protein load but only selectively reduces bacterial bioburden by traditional culture





Legend: High Touch Surfaces: 1. Over-bed Table 2. Bedside Table 3. Visitor Chair Armrest 4. Bedside Rail 5. Overbed Console Wall 6. Toilet Seat 7. Bathroom sink

TABLE 1: Microbial Bio-Burden Standard vs Re-Engineered Rooms

Environment	*Units*	*Standard Room*	*Engineered Room*	*p-Value*
Surfaces	Average CFU/Plate	62.6 (n=147)	6.32 (n=175)	0.0083
	Average RLU	434.4 (n=147)	62.9 (n=182)	0.0001
Water	Average CFU/plate	26.5 (n=20)	0.08 (n=25)	0.0007
Air	Average CFU/plate	14.2 (n=21)	15.6 (n=25)	0.8145

Discussion and Conclusion

- Lower ATP RLUs on all copper surfaces.
- Lower microbial counts on 3/6 copper surfaces
- Lower microbial counts in filtered water

This pilot demonstrates the feasibility of a larger, long-term study evaluating types and uses of re-engineering technology. Determining whether there is a direct effect on HAI rates will be important.

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