

Reduced Bacterial Hand Contamination with an Ergonomic Wheelchair



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Poster
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Figure 1. Standard Wheelchair



Figure 2. Ergonomic Wheelchair

With a standard wheelchair (SW) (figure 1), the location of hand rims and tires potentially exposes the user's hands to the tires (figure 3), which continuously contact the floor. Such exposure risks contaminating the user's hands with floor-source bacteria, possibly increasing infection risk and disseminating resistant bacteria. For improved mechanics, our novel ergonomic wheelchair (EW) (figure 2) spatially separates the drive wheel and hand rims connecting them with a chain. The EW user's hands are distant from the floor contacting tires (figure 4).



Figure 3. Hand touching tire & push rim



Figure 4. Hand touching push rim

The objective of this study was to determine whether our innovative Ergonomic Wheelchair reduces bacterial contamination of the user's hands.

Experimental Design

n=11 non-wheelchair using volunteers randomly assigned to test each wheelchair (SW, EW)

Activity-

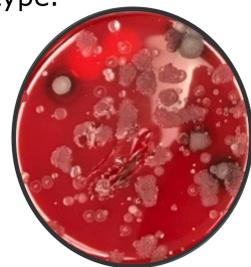
Propelling through standardized course through the Minneapolis VA Medical Center

Sample Collection-

Blinded sample collection from:

- wheelchair tires
- push rims
- gloved hands of volunteers

PRE-RIDE bacterial counts of both wheelchairs from cleaned hand rims, and from riders' hands, were nil. Wheelchair tires exhibited comparably high bacterial counts regardless of chair type.



Wheelchair tire



Cleaned hand rim



Gloved hand

POST-RIDE bacterial counts from riders' hands were substantial, and were consistently lower with the Ergonomic Wheelchair than the Standard Wheelchair.



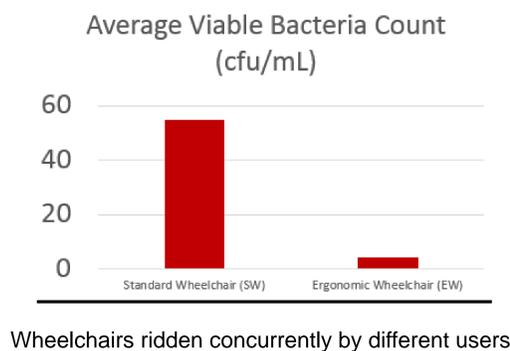
Standard Wheelchair-gloved hand



Ergonomic Wheelchair-gloved hand

Procedures

- Before each test run, the hand rims of each wheelchair were cleaned thoroughly using disinfectant wipes followed by a 70% ethanol rinse, after which the hand rims were cultured.
- Outcomes were assessed by culturing and counting bacterial colonies from the wheelchair hand rims, and the gloved hands of volunteers after each run. Gloved hands were rinsed with phosphate buffered saline (PBS) by immersion in a PBS-filled plastic bag.
- Saline from the hand rinsates were cultured quantitatively by plating serial 10X dilutions in duplicate to blood agar plates (Becton-Dickinson, Sparks, MD, US), followed by incubation overnight at 37° C.
- The entire surface of each chair's hand rims was wiped down with sterile saline wipes (Hygea, Orangeburg, NY, USA). The wipes were then vortexed in saline to release attached bacteria.
- Saline aliquots from the vortexed hand rim wipes were cultured quantitatively by plating serial 10X dilutions in duplicate to blood agar plates (Becton-Dickinson, Sparks, MD, US), followed by incubation overnight at 37° C.



Results-Post-ride hand counts were substantial, and were consistently lower with the EW than the SW.

For riders who tested both chairs (n=8), hand counts were significantly lower (T-test paired two-tailed p=0.02) for riders using the EW (mean=3.1 SE=1.8) versus the SW (mean=56.9 SE=17.8).

For runs in which the two chairs were ridden concurrently by different users (n = 9), the between-chair hand count difference was highly significant (T-test paired two-tailed p=0.008, EW mean=4.2 SE=2.0, SW mean=54.8 SE=17.8), depicted in bar graph above.

In an unpaired comparison between all 9 EW runs and all 10 SW runs, the hand count difference was also significant (Unpaired two-tailed p=0.01).

Conclusion-

Separation of a wheelchair's hand rims and tires significantly reduces bacterial contamination of the user's hands.