Understanding Doorhandle Microbes at SWOSU

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Abstract

With the onset of COVID-19 all eyes were on the microscopic world. Increased sanitation and proper hygiene slowed the spread of the virus, and there were many other tactics used to battle COVID-19. One of these tactics was to limit the number of times people crossed paths. Southwestern Oklahoma State University (SWOSU) developed guidelines regarding the movement of students through buildings when hybrid classes began in the fall 2020. In the Old Science Building at SWOSU, doors were designated entrances or exits. By implementing this strategy, many people were forced to use the same doorhandles, which are known to harbor microbes. In this work we analyzed the impact of controlling movement through a building on the microbial communities found on door handles. We hypothesized that high traffic doorhandles would have higher concentrations of microorganisms compared to low traffic doorhandles. The following doorhandles were examined, high traffic or low traffic and indoor or outdoor. Three sets of doors were sampled from the first floor, and three were sampled from the second floor. On each side of door, there was either a high traffic handle or a low traffic handle. Three locations, each with an approximate size of two inches squared, were sampled on each doorhandle. Sterile cotton swabs were used to collect microbes and the microbes were inoculated on tryptic soy agar. This experiment was repeated four times. Following incubation, the average colony forming units for each condition were determined. Results were highly variable. We did not detect significant differences in the concentration of microorganisms between any of the treatments. This may be the result of increased disinfection practices.

Spread of Microscopic Organisms by Doorhandles

One of the most used items in daily human life, doorhandles, are known to harbor and spread microorganism (Fig. 1). These microscopic organisms can be beneficial to macroscopic organisms; however, some can inflict harm and even cause death. Understanding that microbes transmitted by doorhandles can cause infection, leads to a need for controlling microbial populations on doorhandles. A recent study observed various doorhandle designs lead to significantly different bacterial spread (Wojgani *et al* 2012).

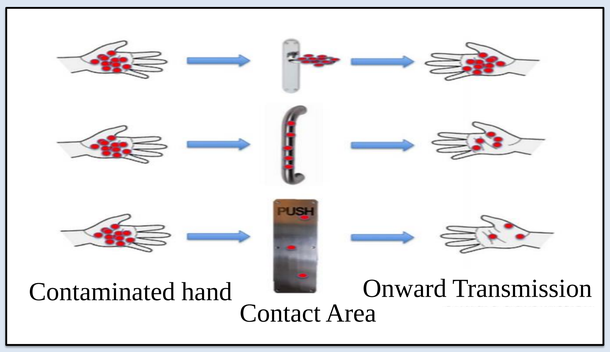

Figure 1. Microbial spread in relation to doorhandle type. Conducted by swabbing doorhandles at an NHS neurological hospital and then determining Total Viable Counts (TVCs) 48 hours after incubation. Greater contamination on the ‘‘in’’ pull handle than the ‘‘out’’ push plate was observed, suggesting that pull handles “captured” more organisms than push plates (Wojgani *et al* 2012).

Methods Used for Sampling Microbial Communities on Doorhandles

Step 1: Swab a two-inch squared portion of the doorhandle (Fig. 2) vertically and rotate the swab 180 degrees and then swab the doorhandle horizontally.

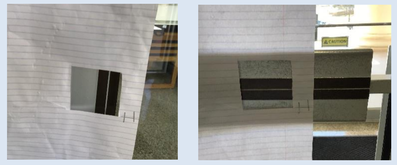

Figure 2. Example template for two-inch squared swab area.

Step 2: On a petri dish containing tryptic soy agar (TSA), inoculate the left half of the plate with the side of the swab used to sample the doorhandle horizontally and then inoculated the right half of the plate with the side of the swab used to sample the doorhandle vertically (Fig. 3).

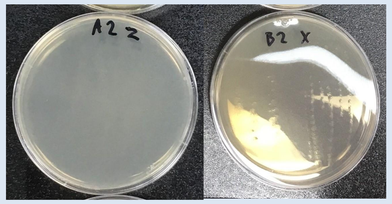

Figure 3. Example TSA petri plate immediately following inoculation.

Step 3: After incubation, the number of colony forming units (CFU) was determined (Fig. 4). CFUs were averaged based on high or low traffic areas and outdoor and indoor locations.

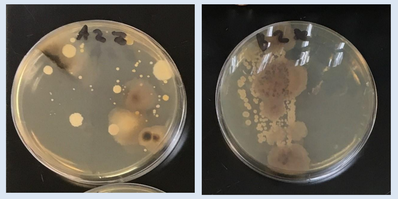

Figure 4. Example CFU on TSA petri plate.

Impacts of Traffic on Microbial Concentration

- Though significant difference threshold was not reached, there does seem to be a pattern to high and low traffic conditions (Fig. 5).
- Future studies should focus on high versus low human traffic without increased disinfection practices being present.

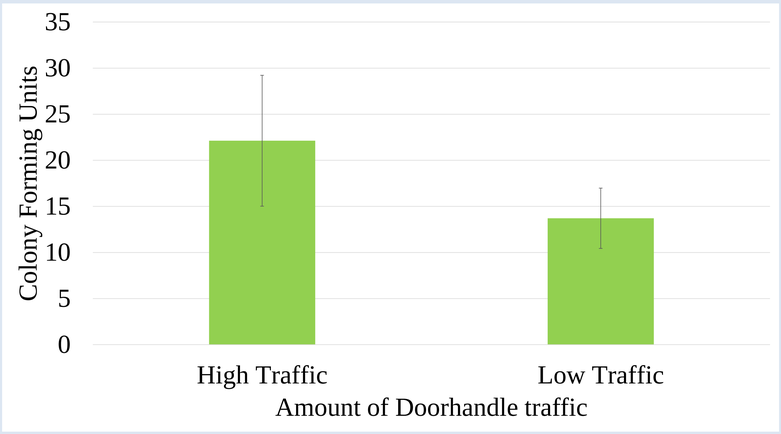

Figure 5. High vs. low traffic conditions using data from each incubation time preformed in this study (n=64; Student’s T-test=0.29)
(Cossey and McGrane unpublished data, 2020).

Impacts of Exposure to Outdoor Air and Traffic on Microbial Concentration

- Significant difference was not detected; however, there does seem to be a pattern to microbial growth being higher in indoor conditions compared to outdoor conditions (Fig 6).
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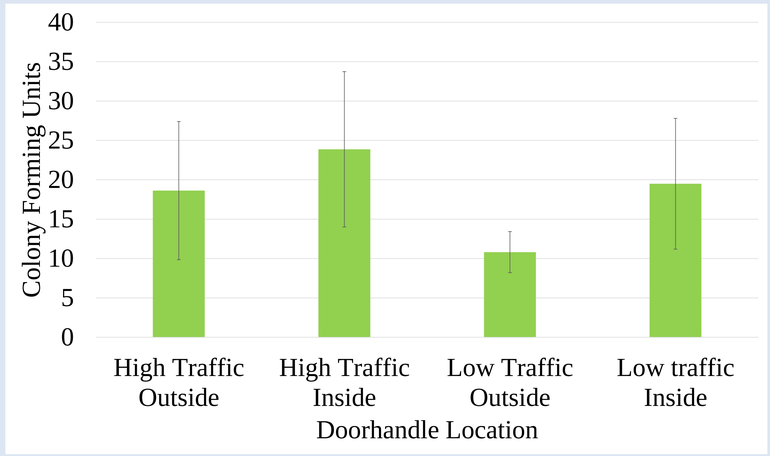

Figure 6. High and low traffic considering each outdoor and indoor doorhandles separately. Data was collected from all incubation times to avoid any bias (Single Factor ANOVA, p-value=0.61) (Cossey and McGrane unpublished data, 2020).

Conclusions and Future Directions

There does seem to be a pattern in the conditions, designs, and traffic amounts to doorhandles. This study was trying to take advantage of the forced traffic for each doorhandle; however, there was also an unusual amount of sanitation taking place at the time due to the COVID-19 pandemic. We hypothesize that this is the reason we did not detect significant differences in this study. However, there still needs to be further investigation into how traffic and indoor vs. outdoor environment effect microbial communities. In sensitive location such as hospitals and jails, each microbe present could be a risk factor for infection. The more that is understood about how doorhandles serve as fomite, the better we are equipped to eliminate pathogens.

References

Wojgani H, Kehsa C, Cloutman-Green E, Gray C, Gant V, Klein N, 2012. Hospital Door Handle Design and Their Contamination with Bacteria: A Real Life Observational Study. Are We Pulling against Closed Doors? PLoS ONE 7(10): e40171. Available from: Hospital Door Handle Design and Their Contamination with Bacteria: A Real Life Observational Study. Are We Pulling against Closed Doors? (plos.org)

Acknowledgments

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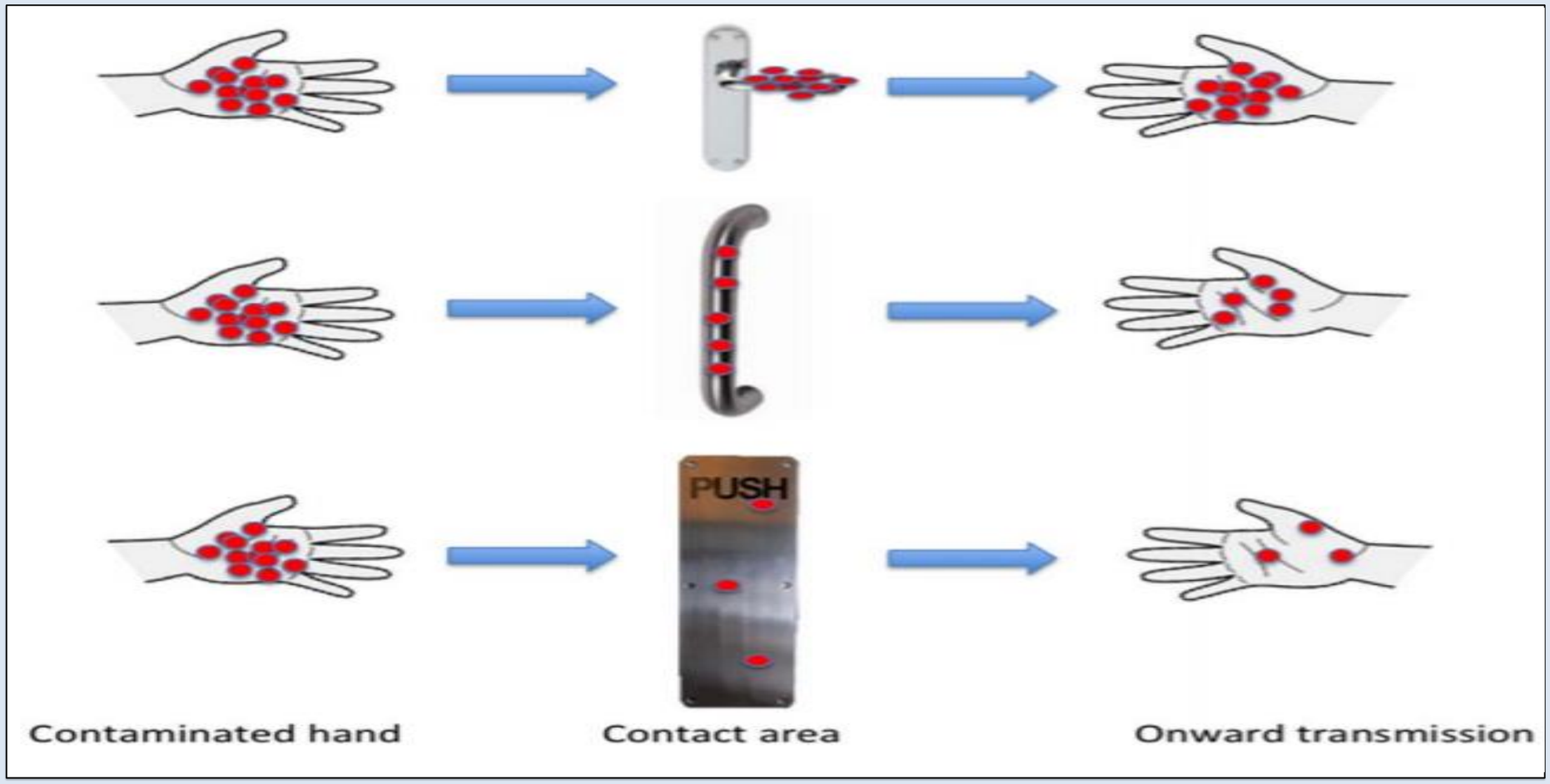

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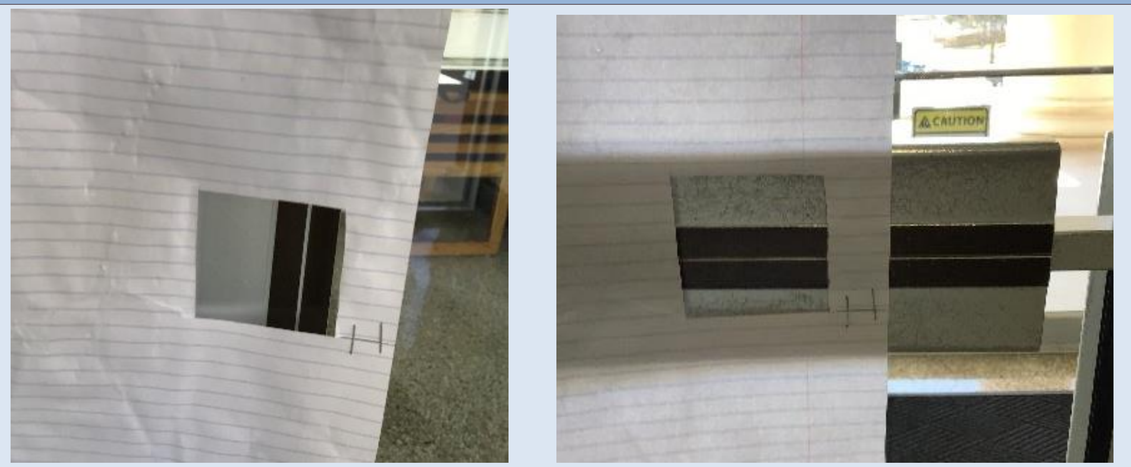

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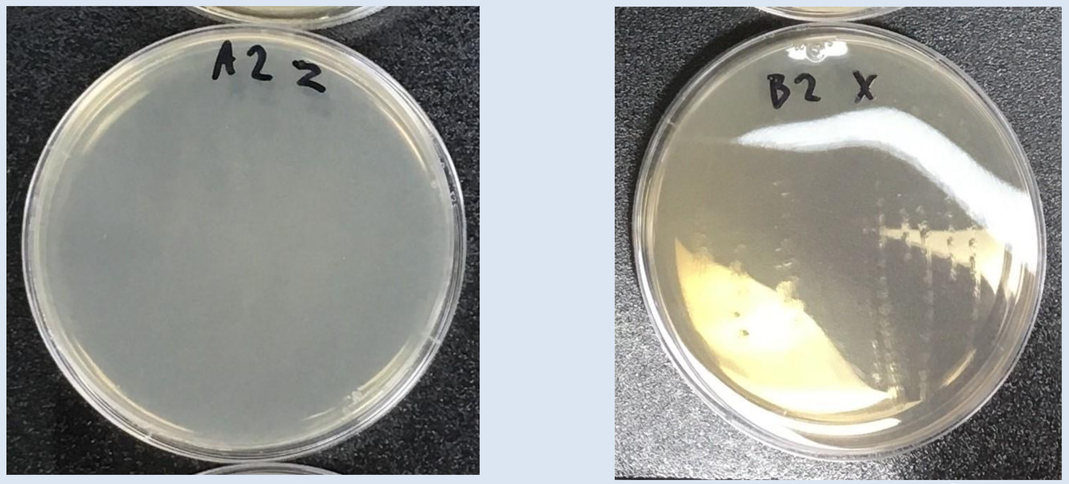

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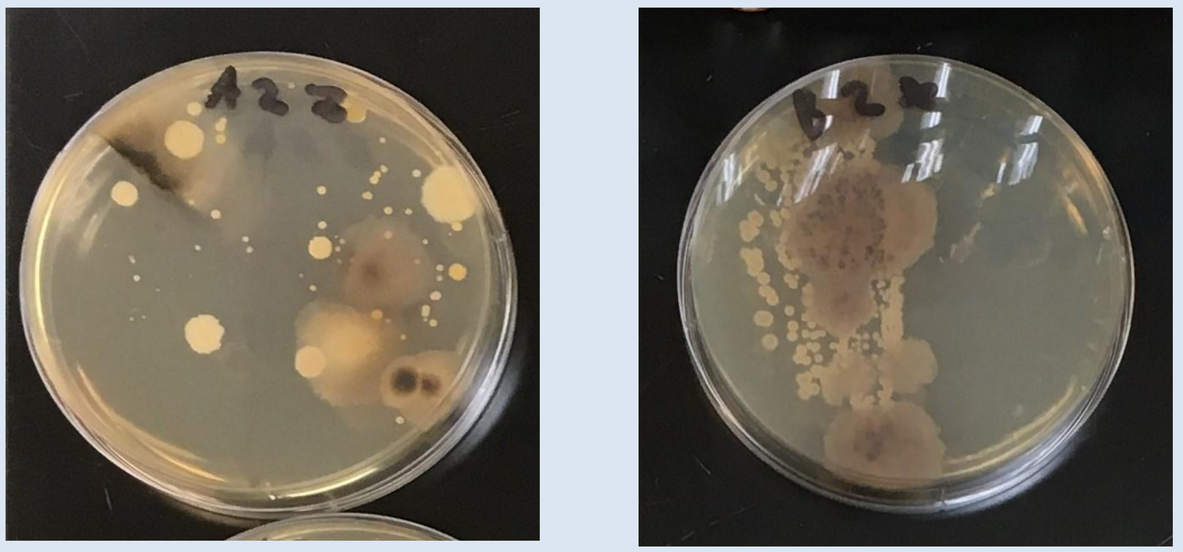

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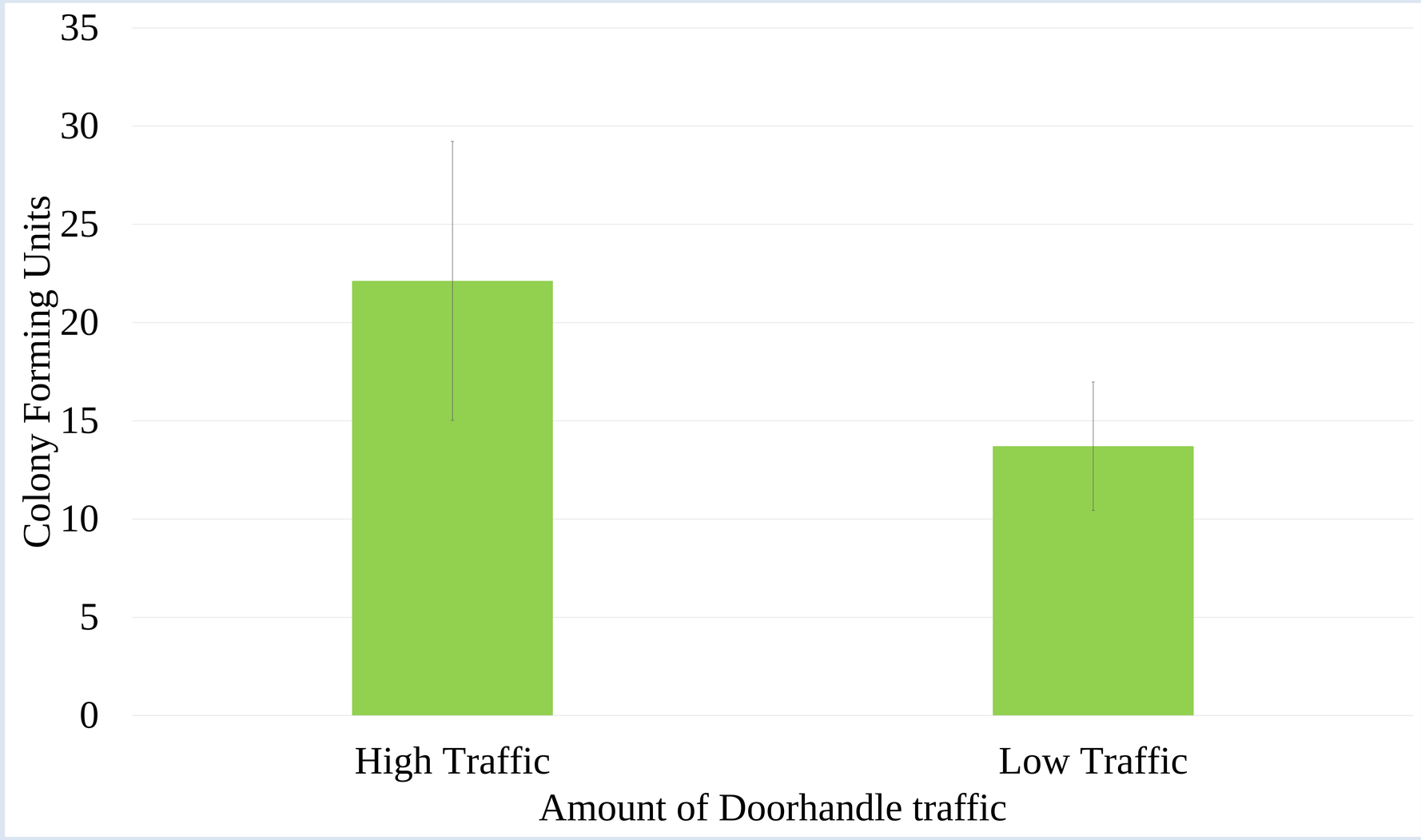

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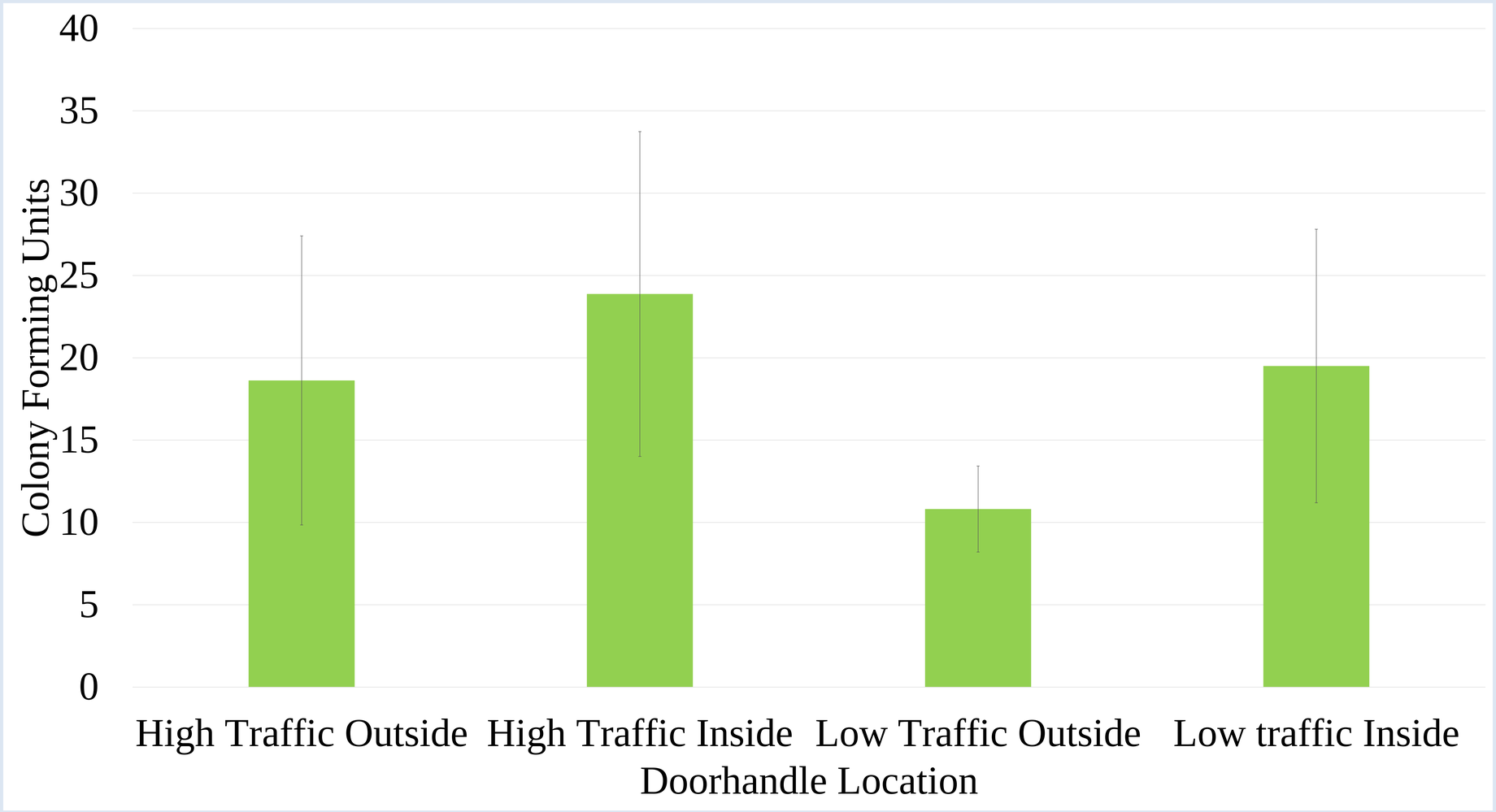

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