ISSN: 2582-6751
Journal of Clinical Medical Research

ATHENAEUM SCIENTIFIC PUBLISHERS

Review Article

Selecting the Safest Public Bathroom Stall in the Era of COVID-19

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Citation: Heston TF. Selecting the Safest Public Bathroom Stall in the Era of COVID-19. Jour Clin Med Res. 2023;4(2):1-4.

https://doi.org/10.46889/JCMR/2023.4215

Received Date: 02-08-2023

Accepted Date: 22-08-2023

Published Date: 29-08-2023

Abstract

COVID-19 and other respiratory diseases can be transmitted through contact with shared surfaces such as those found in public bathrooms. High-touch surfaces such as door handles, flush levers and toilet paper dispensers can potentially contribute to spreading disease-inducing viruses and bacteria. One strategy to mitigate this risk at an individual level is to use the least used bathroom stall, with less human traffic and potentially fewer pathogens. This study looked at occupancy rates of bathroom stalls in a public facility. Observation of stall occupancy was recorded at separate times. Only times when at least 1 stall was occupied were recorded. There were three stalls in a row. Stall 1 was located at one end, with one partition of this stall against a wall and the other partition was shared with the middle stall. Stall 2, the middle stall, shared a partition with Stall 1 and 3. Stall 3 shared a partition with Stall 2 and the other partition was adjacent to an open common area in the restroom. There was a total of 37 observations. Stall 1 was occupied 62% of the time, Stall 2 occupied 30% of the time and Stall 3 occupied 32% of the time. Stall 1, Stall 2 and Stall 3 accounted for 50%, 24% and 26% of overall occupancy. Stall 1 was significantly more likely to be occupied than Stall 2 or 3 (62% vs 30%, $p = 0.0051$ and 62% vs 32%, $p = 0.0104$). Stall 2 had the lowest occupancy, but statistically equally likely as Stall 3 to be occupied (30% vs 32%, $p = 0.802$). In conclusion, in a bank of 3 stalls, the least used one was the middle one and the most used was the end one with an adjoining wall.

Keywords: COVID-19; Pathogens; Stall; Viruses; Bacteria

Introduction

The COVID-19 pandemic has underscored the critical importance of hygiene in public spaces, particularly in frequently used areas such as public bathrooms. The role of hygiene in maintaining good health cannot be overstated and its significance is further amplified in the context of infectious diseases like COVID-19 [1]. By their very nature, bathrooms are potential hotspots for transmitting pathogens. The stalls in public bathrooms, especially those that are more frequently used, are more likely to be contaminated and thus pose a higher risk of disease transmission. This is due to the nature of the activities in these spaces and the high-touch surfaces, such as door handles, flush levers and tissue dispensers. These high-touch surfaces can harbor infectious agents, including SARS-CoV-2, the virus responsible for COVID-19 and facilitate their spread [2].

The risk of contamination and subsequent disease transmission in public bathrooms underscores the need for stringent hygiene practices. Hand hygiene, in particular, is a simple yet effective measure to prevent the spread of pathogens. However, achieving consistent hand hygiene compliance, especially in high-pressure environments like healthcare settings, can be challenging due to heavy workloads, improperly designed wards and a lack of quality equipment [3]. Thus, minimizing exposure to high-volume areas likely will decrease exposure and subsequently decrease the spread of disease.

Maintaining good bathroom hygiene is an essential component of public health, especially in the era of COVID-19. While hand

washing is the most critical component, decreasing potential exposure remains vital. In this study, we look at public bathroom stall occupancy to see if certain stalls are more likely to be utilized than others.

Methods

A bank of 3 stalls was observed at different times. All stalls had a partition on each side of the toilet and a door that could be closed. The stall on the left end (Stall 1) had one partition adjoining a wall and the other shared with the middle stall (Stall 2). The stall on the right end (Stall 3) shared one partition with Stall 2 and Stall 3's other partition faced an open area (Fig. 1).

Stall occupancy was recorded anonymously by recording whether a stall door was open or closed. Only times when at least one stall was occupied were recorded. The data was collected in a spreadsheet. The occupancy of each stall was compared to the other stalls and to an expected average occupancy rate through a test of proportions. The unit fragility index, fragility quotient and percent fragility index were calculated for the comparisons [4-6]. Human observations were not conducted; therefore, this research did not meet any human research criteria outlined by federal or global regulations. The only observations made were stall occupancy (yes or no) as determined by whether or not the stall door was closed or open. The raw data is publicly available on Figshare [7].

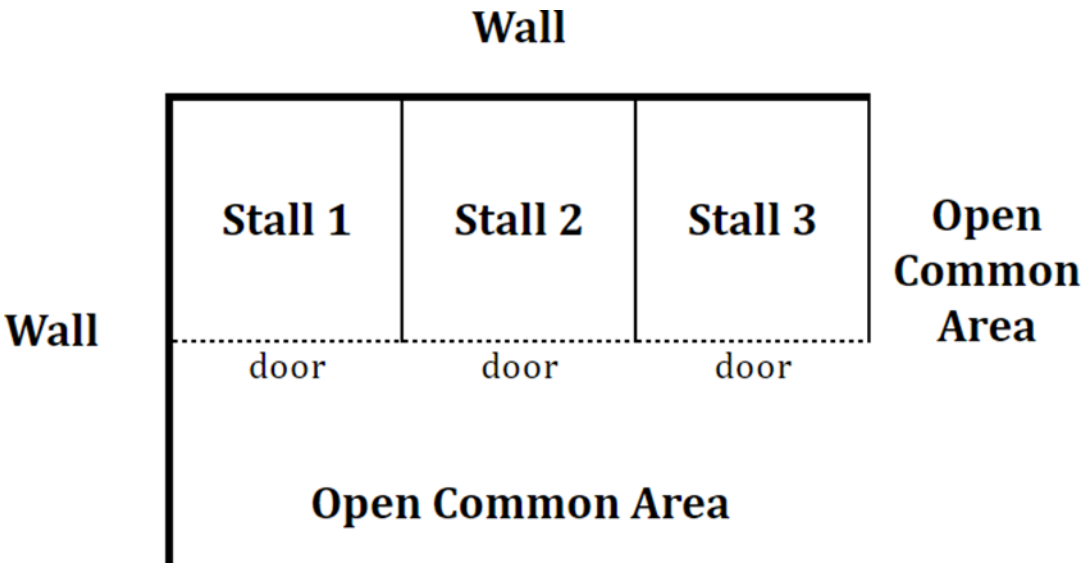

Figure 1: Stall configuration.

Results

There were 37 observations made when at least 1 stall was occupied. Out of the 37 observations, 46 stalls were occupied for an average occupation per observation of 1.24 stalls occupied of 3 stalls observed. Stall 1 was occupied 23 times for an occupancy rate of 62%. Stall 2 was occupied 11 times and Stall 3 was occupied 12 times (24% and 26% occupancy rates). Regarding overall occupancy, Stall 1 accounted for 50% of total occupancy (23/46) and Stall 2 and Stall 3 accounted for 24% and 26% of total occupancy.

For a null hypothesis of an equally distributed occupancy, the expected occupancy count would be 15.3 out of 37 for an occupancy rate of 41%. Stall 1 was significantly more occupied than expected (62% vs. 41%, p=0.0047). Stalls 2 and 3 were not occupied significantly less than expected (30% vs. 41%, p=0.0541; 32% vs. 41%, p=0.0811). Stall 1 was more occupied than Stall 2 or 3 (62% vs. 30%, p=0.0051; 62% vs. 32%, p=0.0104). Stall 2 occupancy was statistically the same as Stall 3 (30% vs 32%, p=0.802).

For the null hypothesis of equally distributed occupancy, the Unit Fragility Index (UFI) for Stall 1 was 3, for Stall 2 was 1 and for Stall 3 was 2. Each stall's corresponding Fragility Quotient (FQ) was 0.0811, 0.0207 and 0.0541, respectively. Each stall's corresponding Percent Fragility Index was 11.7%, 1.95% and 10.12% respectively (Table 1).

Stall	Occupancy (Rate)	UFI	FQ	PFI
Stall 1	23 (62%) *	3	0.081	11.7%
Stall 2	11 (30%)	1	0.027	1.95%
Stall 3	12 (32%)	2	0.054	10.1%
* p = 0.0047 UFI = Unit Fragility Index; FQ = Fragility Quotient; PFI = Percent Fragility Index				

Table 1: Occupancy rate and fragility of findings.

Discussion

The vulnerability we feel when going to the bathroom creates a desire for privacy. We can't always control when we need to go or control what comes out, leading to a feeling of vulnerability and exposure [8]. One study of 155 people found that the most important quality of a bathroom that people desired was cleanliness, followed closely by having the bathroom door close properly and not feeling exposed in the bathroom [9].

The findings in this study support the hypothesis that people seek security when choosing which bathroom stall to use. The top choice in this study which occurred twice as often as the other two choices was that stall with a solid wall on one side and only one exposed partition. It makes psychological sense for people to choose the stall with greater privacy than the others. However, is this the most logical choice? While Stall 1 was chosen most often, presumably due to its increased privacy, this does not necessarily mean it is the wisest choice. Higher occupancy rates mean greater usage and potentially greater chances of disease transmission. Stall 1 was utilized twice as often as the other 2 stalls. The likely consequence of this increased use is an increased chance of disease transmission. It's possible that when using a public restroom, choosing a middle stall is the wisest choice because it is likely to be used less often and thus be cleaner than the most private stall on the end.

This study is limited by sample size. However, typically low sample sizes suffer from type II errors rather than type I errors, meaning that a statistically significant finding in studies with smaller sample sizes is often highly meaningful while nonsignificant findings are not.

Also, fragility testing suggests the findings are robust and likely widely applicable. The finding of Stall 1 being used more than expected if usage was evenly distributed appears robust given the UFI of 3. Also, the PFI shows that a greater than 10% swing in distribution would be required to flip significance from significant to non-significant for Stall 1. While there are no clearly defined cut-offs for fragility, Stall 1's FQ of over 0.03 and PFI of over 10% suggest robust findings.

Conclusion

This study found that in a public bathroom with a bank of 3 stalls, the middle stall was used the least and the stall with the greatest privacy was used the most.

Conflict of Interest

The author has no conflict of interest to declare.

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