VISUALIZING VIRAL SPREAD

WITH FLUORESCENT POWDER IN A THIRD-GRADE CLASSROOM

MICHAEL ROMASHOV

CONTENTS

ABSTRACT

Is the 20 second hand-washing routine actually effective at preventing the spread of viral disease? Previous experiments have shown longer hand-washing routines to be effective at culling bacterial cells, thus the idea is that longer routines have the same effect on viral cells. Using a fluorescent powder, the spread of viral and bacterial cells is visualized in the elementary school environment, painting a very intuitive picture for how human contact acts as a mechanism for infection. A quick, eight-second rinse is then compared with a thorough, 20-second wash, the latter of which is found to be much more effective at disinfecting one's hands from infectious cells. While the experiment shows that current practices are seemingly effective at reducing the risk of infection via human contact, further research must challenge these practices in hopes of perfecting them or developing entirely new ones.

1 INTRODUCTION

Three years into the COVID-19 pandemic, many have chosen to forget the trials and tribulations of quarantine times. Despite the everlasting presence of the virus, it seems that long gone are the days of paranoic hand washing, mask mandates, and enforced social distancing.

As we look back and reflect on the global response to the pandemic, it is important to judge the impact that certain decisions have made on getting us to the point today where a majority of people can comfortably interact with others in close proximity without any shielding. One such decision is the public announcement to encourage people to wash their hands for at least 20 seconds [1]. Long-standing wisdom would suggest that washing your hands for longer does indeed help curtail the spread of infection, but how does the wisdom hold up today?

As a refresher, viruses are a diverse category of parasitic cells that do not contain energy-producing cell structures that are present in ordinary living cells. Much like bacteria, viruses are able to infect living host cells to replicate, but unlike bacteria, which can replicate in culture on their own, a virus cannot survive on its own [2].

Previous experiments on the effectiveness of soap suggest that using soap is generally more effective at removing bacterial contamination as compared to using water or not washing at all [3]. It is therefore logical that soap has a similar effect on viral cells, and that washing your hands for a longer duration provides greater coverage and is effective at curtailing viral spread. To test this theory, fluorescent powder is used to visualize the spread of viruses and bacteria in a third-grade classroom and test the effectiveness of different hand-washing techniques.

2 METHODOLOGY

To test whether washing your hands for longer is more effective at curtailing viral spread, two distinct experiments are performed. These experiements seek to explore the mechanisms of physical transmission of viruses and probe at the effectiveness of conventional hygenic practices.

For both experiments, a powder called Glo Germ is used to visualize the spread of viral cells from human contact. Critically, the powder is invisible to the naked eye but fluoresces intensely under ultraviolet light.

2.1 Viral Spread

This experiment seeks to visualize where viral cells may end up after a whole day of activities within a typical third-grade classroom. The classroom selected to carry out this experiment consists of roughly 20 pupils, and consent has been received from the school's administration and parents.

Prior to the experiment, a control is carried out to determine the presence of pre-existent spots around the room. Objects or stains that appear to glow under the ultraviolet light should be noted down to omit them from the experimental group.

Before the beginning of class, both of the teacher's hands are brushed in a generous coating of Glo Germ powder. The teacher then shakes the hands of three pupils chosen at random as they enter the classroom in the morning. During the break period, a pupil is selected at random to have their hands brushed in a generous coating of Glo Germ aswell.

Two hours later, once the pupils are out of the classroom on lunch break, the ultraviolet light is used to analyze the spread of the Glo Germ powder across the classroom, keeping in mind the spots identified in the control.

2.2 Hand Washing

This experiment seeks to directly test the difference between washing one's hands for a short period of time as compared to a longer period of time.

The experiment begins by applying an ultraviolet-blocking lotion — such as sunscreen — to both of somebody's hands, ensuring complete coverage. The person is then instructed to wash their hands with soap as they usually would from muscle memory, which should take around eight seconds.

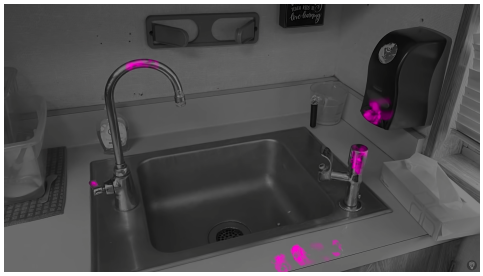
Photographs are then taken under ultraviolet light to record the presence of the lotion after the hand washing. The experiment is then repeated, but the person is now told to wash their hands with soap thoroughly for around 20 seconds. Again, the results are recorded under ultraviolet light.

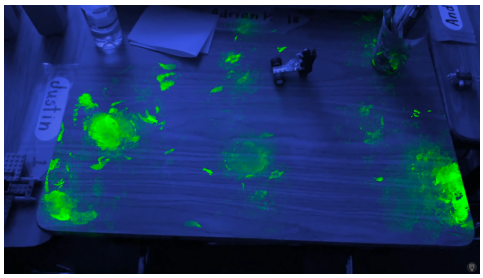
3 RESULTS

3.1 Viral Spread

Substantial spread of the Glo Germ powder was seen at the conclusion of the experiment. Tabletops, water taps, containers, and commonly used devices such as telephones all had distinct fluorescent spots that were not present in the control group.

The images below have been modified to isolate the bright fluorescence of the Glo Germ powder and overlay it onto an illuminated phootgraph of the area.





Glo Germ was also detected in significant amounts on the faces of many participants, pupils and staff alike. Despite the pupils' best efforts to wash their hands throughout the day, the powder was still detected all over their hands.

3.2 Hand Washing

There was a clear difference between the amount of lotion remaining on one's hands after a quick rinse with soap when compared with a thorough 20-second wash.

After just an eight-second rinse, there were considerable hotspots of fluorescent lotion remaining on the palms, fingertips, and the spaces in between fingers. After a deliberate 20-second wash, there are no hotspots of lotion and very little residue.

4 DISCUSSION

The first experiment showed the incredible ease with which particles on our hands are able to spread and proliferate within our environment. When somebody coughs or sneezes, they not only project viral and bacterial cells onto surfaces around them, but they allow these cells to remain on their hands and encourage further spread. Viruses are able to survive for hours or even days on hard surfaces, especially stainless steel and plastic, where they are still infectious [4]. This highlights the importance of carefully washing one's hands in order to reduce other people's exposures to viral infection.

The second experiment supported the initial hypothesis that washing one's hands for a longer duration would be more effective at disinfecting them of viral cells. After only eight seconds, the majority of the lotion may have been gone; but significant hotspots existed on the palms and fingertips, which happen to be the parts of our hands that most often come into contact with hard surfaces. These hotspots are bound to spread viral inflection in the same mechanism as was demonstrated in the first experiment. It is only after a thorough, 20-second wash that hotspots are eliminated and the risk of spreading viral infection is minimized.

Though the experiment showed the relative effectivenes of washing one's hands with soap and water for longer periods of time, the study did not address other disinfection methods such as alcohol-based hand sanitizers. A similar study could be repeated to show the effectiveness of various hand sanitizers on removing viral and bacterial cells from one's hands. Additionally, the experiment focused solely on the elementary school environment. To approach a more complete understanding of various sanitary practices, similar experiments can be conducted in workplace and home environments.

5 CONCLUSION

As a result, the recommendation to engage in more delibrate hand-washing procedures is an effective response to the dangers of the COVID-19 pandemic. Whether or not this had a significant impact on the outcome of the quarantine period is outside of the scope of this study, but it is a topic worth studying as to improve our response to a potential future pandemic. As a general rule, washing one's hands thoroughly with soap and water is the first and easiest step anybody can take to reduce their exposure to viral infections, and should be adopted as a basic routine far beyond the timeline of the pandemic.

Constant research is necessary to keep our hygenic practices up to date with the ever-evolving and microscopic opponents, but these practices are ineffectual if the general population does not comply. Hopefully, this study offers both a visual and an intuitive understanding of the importance of following such procedure, and hopefully you, the reader, will be more mindful of your part in preventing the spread of disease.

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