Aerobic Colony Count Assessment on Projector Remote Controls at BCIT Major Classrooms

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Abstract

Classroom equipment has been linked to different outbreaks. Surfaces such as tables, chairs, keyboards can harbour pathogens such as Noro virus, Methicillin-resistant Staphylococcus Aureus (MRSA), Influenza A virus and Vancomycin-resistant Enterococci (VRE). Bacteria and viruses can then be transferred to another individual by the mode of touch and leading to potential infections when the individual touches their mouth, nose, eyes or open wound. Institutions usually have their own cleaning and sanitation schedule that covers most of the items in a classroom. However, some common items have been overlooked. Take the project remote controls at the British Columbia Institute of Technology (BCIT) for example. They are often found in filthy condition due to the amount of usage. It is unclear how many sicknesses have been the result of neglecting this device out of their daily cleaning and sanitization schedule. This paper examined the sanitation status of projector remote controls at BCIT. The focus has been placed on major classrooms and laboratories at building SW 1, SW 3 and SE 12 in BCIT. By utilizing the Aerobic Plate Count method, projector remote controls were swabbed using the wet swabbing technique. Swabs were then incubated and results in colony forming units per area in center meter square (CFU/cm^2) were collected. A wide range of CFU/cm^2 values were observed from projector remote controls. The maximum CFU/cm^2 value obtained was 177 and the minimum value was 0. Inferential statistics was performed comparing the mean CFU/cm^2 to a stand value of 5 CFU/cm^2. Result showed that the mean CFU/cm^2 of remote controls in SW 1, SW 3 and SE 12 at BCIT are statistically significantly more than the standard value of 5 CFU/cm^2. This suggest that most of the remote controls at BCIT are not in sanitary conditions and BCIT should start to include remote controls into their daily cleaning and sanitization program to prevent students from contracting potential bacteriological infections.

Key words: remote control, APC, equipment, classroom

Introduction

The risk of contracting an infectious disease in school settings is often overlooked by students, school residence and staff despite it being an reoccurring problem year after year (Shapiro Emily, 2016) (ServicesFor Education, 2017). Many studies have assessed personal hygiene, personal items and infectious disease control; however only a handful described the bacterial environment in classrooms. Thus, the risk of contracting infectious disease in a classroom setting is largely uncertain (Bright, Boone, & Gerba, 2010) (Chen, 2013) (Meadow, Altrichter, Kembel, & et al, 2014). As different institutes have different equipment and settings, there are limited institution specific studies aiming at their sanitation standard.

In March 2017, a 11-year old boy contracted an infection leading to flesh-eating disease from a classmate. Two other boys from the same classroom were also infected but with a milder form of the disease. (Vancouver Sun, 2017) This disease was caused by Strep A Streptococcus bacteria and these boys might have contracted this disease through inhalation, contact or ingestion of the bacteria from a carrier in the class. (Health Link BC, 2016) Frequently touched pieces of equipment are high risk items as disease carriers could transfer harmful pathogens onto equipment surfaces without noticing. Keyboards have been reported to be five times dirtier than the average toilet seat and it gets worse if people are sharing the same computer (Fragomeni, 2010). Vancomycin-resistant Enterococci (VRE) and methicillin-resistant Staphylococcus aureus (MRSA) which can lead to serious disease were found living on the keys for 24 hours. When people do not wash their hands after using this equipment and then rub their eyes, it creates an ideal access point for bacteria. (Fragomeni, 2010) In 2008, Noro virus was implicated in a gastrointestinal outbreak in an elementary school in Columbia U.S. This outbreak resulted in 29 cases of acute gastroenteritis with symptoms including nausea,

vomiting and diarrhea. The Columbia Department of Health later concluded that the cause of the outbreak was due to a lack of cleaning and sanitation for computer keyboards. (BCCDC, 2008)

Transmission of disease in school is problematic given the number of students who might be using the same equipment in a single day. Sanitation of school equipment must be controlled strictly through cleaning schedules. At the British Columbia Institute of Technology (BCIT), a daily cleaning program occurs in all classrooms except on Sunday. However, there are over 18,000 full time students, 29,000 part-time students and a dozen of classrooms spread over all three campus locations. This inevitably adds pressure to the effectiveness of BCIT's cleaning process. This research study will examine the sanitization status of the projector remote controls located in classrooms at the BCIT Burnaby campus. This piece of equipment is targeted due to a lack of existing sanitation plan and its high utilization while having no protective cover.

Literature Review

A study in 2010 examined the occurrence of bacteria and viruses on 12 different surfaces in an elementary classroom. (Fig 1) Items related to the classroom such as the manual pencil sharpeners handle and computer keyboards were found to be the second and third most contaminated. This sheds light on items that are easily neglected during the cleaning procedure. However, the author did not find a statistically significant difference between classrooms with treatment and classrooms with no treatment. The reason is probably not due to ineffective cleaning agent, but the validity of using Heterotrophic Plate Count (HPC) to test for the bacterial load. (Bright, Boone, & Gerba, 2010)

The same author (Bright, Boone, & Gerba, 2010) also tested for the occurrence of Influenza A virus and Noro virus on selected surfaces as listed in (Fig 2). The author found that influenza A was present in 24% (13/54) of all classroom tested. Among these areas, student desktops were found to have the highest ratio. The same was found for Noro virus which was identified in 16.4% (9/55) of all classrooms. (Bright, Boone, & Gerba, 2010) Influenza A is a highly contagious virus that causes respiratory illnesses and is spread from person to person by inhalation of droplets or contracting the virus from contaminated surfaces and subsequently touching one's nose or mouth. Noro virus has been implicated in numerous foodborne illness.

These data suggest that places where students spend much of their time could harbor harmful pathogens. Given that a student desktop is relatively easy to clean, it is surprising that it appears to harbor the most pathogens. On the other hand, sink faucet handles and paper towel dispensers were also heavily contaminated with mostly Influenza A.

A similar study examined contamination specifically on computer keyboards at the BCIT Burnaby Campus. In this study the author utilized Hygiena Ultrasnap Swabs to measure the ATP level on a given surface. The author also compared the differences in ATP reading after brushing off the dust and sanitizing the keyboard with 66.5% ethyl-alcohol antimicrobial wipes. The result suggests a mean contamination level of uncleaned keyboard surfaces of 393.2 RLU and after sanitization the number drops to 278.3 RLU registering a 30% average reduction. However, the author also suggested that there are currently no guidelines or standards regarding to keyboard contamination. Thus, the 30% reduction in RLU value can only confirm that there is a reduction in contamination level but cannot establish that cleaning and sanitization are sufficient to achieve a

safe hygienic level. (Chen, 2013)

In this research project assessing bacterial level of projector remote control, no cleaning procedures will be conducted before testing. Although Chen's approach established its own cleaning procedure, it doesn't reflect the effectiveness of any cleaning procedures that might be in place at BCIT. This research project will provide a snap shot of the effectiveness of BCIT's sanitation procedures on the projector remote controls at the time of sampling. One limitation to Chen's utilization of the ATP method to assess bacterial load is that it might not be accurate. This is because food residues and dead microbes will also contain ATP, thus a high ATP reading does not necessarily indicate a high microbial contamination on computer keyboards. Projector remote controls and computer keyboards are of similar nature. Both are likely to come into contact with people's hands on an hourly basis. (Chen, 2013)

Apart from studies that examine the bacterial load and bacterial type related to classroom and school environment, a study by James et al. examined the bacterial communities on classroom surfaces in relation to human movement. They sampled desks, floors, chairs and walls. The researcher conducted rRNA sequencing to enumerate the specific strains of bacteria. Their results which is shown in Figure 3 are complementary to the results shown in Figure 2, that is, different surfaces harbored significantly different bacterial communities. The author noted that each of these communities within each surface type was also not possible to be predicted by spatial distance indicating that different bacterial communities are not influencing each other. One explanation for this is due to site-specific factors such as dispersal from specific body sites or habitat selection. (Meadow, Altrichter, Kembel, & et al, 2014) These site-specific factors suggest human activities such as touching, rubbing, sitting, sneezing and wiping lead to different bacteria being deposited

It is important to notice from Figure 3 that of the 4 surface categories, chairs and desks have important public health implications due to their frequency in encountering people's hands. Staphylococcus saprophyticus, the leading cause of cystitis or a form of unitary tract infection in young women, was identified on the surfaces of chairs (Raz, Colodner, & Kunin, 2005). Corynebacterium confusum, also found on chairs has been isolated from patients with foot infections and was first seen in 1998 (Guido Funke, 1998). Among desk surfaces, Streptococcus oralis and Streptococcus intermedius are concerning. Streptococcus intermedius is invasive and could lead to hepatic abscesses, brain abscess, and endocarditis while Streptococcus oralis is a significant agent of infective endocarditis and a major threat to immunocompromised patient (Byers, Tarelli, Homer, & Beigton, 2000) (Tran, McMilan, Khalife, & Young, 2008). These potential harmful micro-organisms in addition to influenza A and Noro virus in Figure 2 again confirm with the indication that commonly touched surfaces could harbor harmful pathogens if not properly cleaned and sanitized.

After examining the pathogens that might be present in commonly touched surfaces such as keyboards, it is necessary to look at factors that might reduce the effectiveness of the normal cleaning processes and enhance bacterial survival. Biofilm is well known for its characteristics of protecting microbes from exposure to disinfectants such as chlorine and quartz and enhancing microbe survival and transmission. Figure 4 shows a remote control from a hotel located in New York city. As shown in the picture, biofilms might have formed as dirt could

contain dead skin cells, nasal secretion, saliva, hand cream/lotion and food residues.

A study conducted in 2014 looked into the survival ability of two strains of harmful Streptococcus bacteria in biofilm and explored whether biofilms could contribute to fomite transmission of Streptococcus. The investigation created a model of evaluating one of the most common bacteria that lives in the human body. (Marks, Reddinger, & Hankansson, 2013)

Results revealed that Streptococcus Peunmoniae grown in both media and dried on plastic surfaces survived for less than three days versus cells in biofilms that survived for longer than 30 days. Whereas, Strep. Pyogenes which is part of the Group A Streptococcal cells showed prolonged survival, remaining viable for less than four months. To investigate whether Streptococcal cells surviving in biofilms retained their infectivity, investigators inoculated mice with each of the two strains. The result showed that, at a relatively low dose of inocula, both strains could colonize the nasopharynx. These results indicate that bacteria could survive desiccation and retain their infectivity for a prolonged period within a biofilm. (Marks, Reddinger, & Hankansson, 2013) Considering Dr. Laura's result, if there are biofilm formations on projector remote controls during the sampling procedure, it is very likely that the remote control might harbor bacteria that are still infectious.

To understand the important role of biofilm in disease transmission, investigators inoculated volunteer's hands with biofilm derived Strep. Pneumoniae and Strep. Pyogenes to simulate circumstances of finding these pathogens from nasal secretion (type of biofilm) on hands. Volunteers remained in the laboratory and their hands did not contact any objects. Results revealed that both strains of Streptococcus with the aid of biofilm could be recovered at high densities after only three hours. However, compared to biofilm derived Streptococcal cells, planktonic derived Strep. Pneumoniae and Strep. Pyogenes lost their viability rapidly. This evidence strongly suggests that while bacteria are inside the biofilm, they are multiplying at a rapid rate as well. Thereby, making our hands a vehicle of transmitting these bacteria through the mode of touching. (Marks, Reddinger, & Hankansson, 2013)

Dr. Laura R's research raises an important question. If biofilms are found on the projector remote controls during sampling should those remote controls be considered as dirty samples with high bacterial counts or should these remote controls still be sampled and plated?

Reasons of Conducting This Research & Knowledge Translation

Based on conversations with the BCIT Janitor Service Department, projector remote controls are not included in daily cleaning and sanitization procedures. Any student or staff at BCIT could submit a cleaning request as needed. Thus, it is unknown if these remote controls have ever been cleaned and sanitized. BCIT's Custodial Services website, indicates that the institution follows the Leadership in Educational Facilities (which also called the APPA) cleaning standards. (BCIT, 2018) However, no further details were given as to which level of the APPA standards the institute is following. APPA cleaning standards are graded by a sliding scale from level 1 to 5. Level 5 cleaning standard is the worst and it means all aspects of the facility are dirty and unkempt. Level 1 means orderly spotlessness. (University of Lethbridge, n.d.) Based on this key information and the results from the literature review, the lack of cleaning and sanitization of projector remote control could be a potential risk to

public health and the lack of cleaning could point to a policy loophole. Figure 5 depicts the proportion of schools in Noro Virus Outbreak in the U.S. between 1994 to 2006. (Zheng, MA, RI, & J, 2010)

Figure 5 (a) shows all Noro virus strains that were responsible for the outbreak. What is of concern is that schools/communities contributed to a large portion of the outbreaks as shown by Figure 5(c) and Figure 5(d). Thus, it might be unacceptable for such a large institution to ignore the cleaning of such a commonly and frequently touched remote control surface. As possible biofilms formation might have harbored harmful pathogens, the risk potential of them causing illnesses could be significant.

This research study attempted to identify potential sources of pathogen transmission and evaluated the sanitation status of projector remote controls at the BCIT Burnaby Campus.

Statistics and Method

Description of Materials Used

For this study, Aerobic Plate Count (APC) Petri film and 3M™ Quick Swabs was utilized. The swab which contains a cotton tip is inserted into a plastic tube. At the top of the tube is a bulb containing Letheen Broth designed to neutralize disinfectant such as quaternary ammonia compound. During wet sampling on dry surfaces, the solution within the bulb is released into the tube to wet the cotton tip before sampling. On the other hand, when doing a dry sampling on a wet surface, the neutralizing solution will be released into the tube to help facilitate the recovery of bacteria and releasing them into the neutralizing solution after sampling when the swab is reinserted into the tube. In this study, wet swabbing technique was utilized using 3M swabs stored at a temperature less than or equal to 8^{o}C (3M, 2017) (3M, 2003) (KUNG'U, n.d.) The type of Petrifilm that was used is called 3M™ Petrifilm™ Aerobic Count Plates. This Petrifilm contains a culture media that is ready to be incubated upon receiving the solution from the swab. The media contains Violet Red Bile (VRB) nutrients needed for bacterial growth and a tetrazolium indicator that facilitates colony enumeration after the incubation period by staining colonies formed. (3M, 2017 (a))

Description of Standard Methods

Standard methods in assessing or monitoring bacterial levels on surfaces include Aerobic Plate Count (APC), ATP method and Contact (Rodac) Plate. For this study, Aerobic Plate Count was selected. These three common methods are described in the following:

- **Aerobic Plate Count – Wet Sampling (Chosen Method)**

Aerobic Plate Count is specially employed for equipment that has irregular surfaces to assess its level of microorganism. For example, remote controls, tables with rough surfaces and equipment with pointy/round edges. It works by following instructions to moisten the sterile cotton tip with Letheen Broth then rub it against the surface in several directions (3M, 2017 (b)). During the swabbing process, coliforms are picked up and accumulate at the tip of the swab. Once the swab in inserted back to the tube containing Letheen broth, a gentle swirl of the tube allows the bacteria to be released into the broth. A 3M™ Petrifilm™ Aerobic Count Plate is then utilized to

incubate bacteria under aerobic conditions. This is done by pouring the Letheen solution onto the Petrifilm. Environmental samples are then incubated for 24 to 26 hours at a temperature of 30°C or 37°C. (3M, 2006) Procedures for using the 3M Quick Swab (wet swabbing technique) are depicted in Appendix 1. In terms of interpretation, the coliforms on the Petrifilm are indicated by red colonies with or without gas. An interpretation example is also available in Appendix 1.

Reliability and Validity of Measures

To ensure reliability of the procedures, all sampling was conducted in the following order to ensure consistency:

1. The back of the remote control
2. The front of the remote control
3. The sides of the remote control

All remote controls were not cleaned and sanitized. Before sampling, a new pair of gloves rubbed with alcohol based sanitizer (70% ethanol) were used. This was to ensure the potential contamination of remote controls during the sampling procedure was minimized. Thus, the sampling result represented the bacterial level at the time the remote controls were sampled. An underused remote control obtained from SW 1240 of BCIT was used as a control. A total of 30 samples were obtained.

To ensure validity of the measurements, the research followed instructions outlined in the 3M Quick Swab and 3M Petrifilm™ Coliform Count Plates user manual (3M, 2014) (3M, 2006). A list of eligible classrooms from the SW1, SW 3 and SE 12 building at BCIT was compiled based on the inclusion criteria listed below. A total of 30 classrooms were chosen then sampled. The result was compared to the APC standard listed on BCCDC's Environmental Monitoring Guideline for Environmental Health Officers. Based on the guideline, a properly cleaned surface should have less than 5 CFU/cm^2 if swabs were used for sampling. (BCCDC, 2010)

Inclusion Criteria

The inclusion criteria are major classrooms in the SW 1, SW3 and SE 12 buildings with a projector and remote control, classrooms that have a capacity of more than 24 people, classrooms that are utilized for more than five hours per week, projector rooms that are accessible to everyone at BCIT and rooms that are accessible at the time during designated sampling period.

Exclusion Criteria

Classrooms without a projector and remote control, computer classrooms, staff meeting rooms that are unavailable to students and inaccessible laboratories for authorized people only were excluded from this study.

Statistic of Analysis

Description of data

Numeric data was collected in this study. Colony forming units (CFU) were counted and presented as whole numbers for each 3M Petrifilm from classrooms selected. Measures of central tendency such as mean, median and mode were computed as well as measures of spread such as standard deviation and range. The mean CFU was divided by the estimated surface area

of a remote control and compared to the standard of 5 CFU/cm^2.

Description of statistics

Excel was used in computing descriptive statistical analysis for a list of CFU/cm^2 based on the sampling results of projector remote controls (Stephen L. Nelson, 2017). For all data used in computing descriptive statistical analysis, please refer to Appendix 3.

Inferential Statistics

Inferential statistics were performed with the help of NCSS12 Data Analysis. (NCSS Statistical Software, 2017) As there is prior knowledge of that remote controls were not being cleaned by BCIT, the bacterial load of remote controls will be likely to be more than the standard value. Thus, a one tail T-test was proposed for this study. Below is the null and alternative hypotheses of the study. (Heacock & Ma, 2017)

H_o = The mean colony forming unit per cm^2 of remote controls in SW 1, SW 3 and SE 12 at BCIT is less than the standard value of 5 CFU/cm^2

H_a = The mean colony forming unit per cm^2 from remote controls in SW 1, SW 3 and SE 12 at BCIT is greater than the standard value of 5 CFU/cm^2

Please see Appendix 2 for the full report of statistical analysis from NCSS12.

Linear Regression Study

Apart from one sample T-test, a linear regression study was also conducted to examine the correlation between classroom utilization (hours/week) and colony forming units per cm^2 of remote controls in SW 1, SW 3 and SE 12. A print out of the NCSS 12 report could be found in Appendix 2. Below is the hypothesis:

H_o =There is no significant linear relationship between the mean colony forming unit per cm^2 of remote controls in SW 1, SW 3 and SE 12 at BCIT and the time of classroom utilization. Thus, slope is 0.

H_a = There is a significant linear relationship between the mean colony forming unit per cm^2 of remote controls in SW 1, SW 3 and SE 12 at BCIT and the time of classroom utilization. Thus, slope is not 0.

Results

Colony Forming Unit (CFU)/cm2	
Mean	24.40
Median	6.48
Mode	0.00
Standard Deviation	39.95
Range	176.82
Minimum	0.00
Maximum	176.82
Sum	731.90
Count	30

A wide range of CFU/cm^2 values were observed from projector remote controls. The maximum CFU/cm^2 value obtained was 177 and the minimum value was 0. This shows that some of the remote controls in classrooms were in fact clean at the time of sampling while some of them were more than 30 times over the standard value given by the guideline from BCCDC. Due to the wide range of data collected which is 177 CFU/cm^2 the standard deviation was measured at 40 CFU/cm^2.

One tail T-test

Table 1 – CFU/cm^2 From Remote Controls in

Classrooms at SW 1, SW 3 & SE 12 At BCIT Are Not Less Than the Standard Value

Normality of Data	Reject Normality
Probability Level	0.021
Reject H_o	Reject
Power of data	0.828

Non-parametric test was used to interpret the result from NCSS12 because the data was not normally distributed. Therefore, the Wilcoxin Signed-Rank Test was read. Based on the alternative hypothesis, the probability level was 0.021. Thus, the null hypothesis was rejected and it can be concluded that the mean of colony forming unit per cm^2 of remote controls in SW 1, SW 3 and SE 12 at BCIT is statistically significantly more than the standard value of 5 CFU/cm^2. (Heacock & Ma, 2017)

Alpha Error and Beta Error

Alpha error falls within the probability value of 0.01 to 0.05. The closer the probability value is to 0.05, the more likely alpha error will be present. However, given the probability level of 0.021 there is a chance of alpha error. For beta error, it is obtained by subtracting the value of power from 1 (Beta error = 1 – Power). The power value at an alpha of 0.05 is measured at 0.828 or 82.8%, indicating the experiment contains a 17.2% of beta error.

Linear Regression Study

Equation of the straight line relating CFU/cm^2 and Hour/week	CFU/cm^2 = (6.9552) + (0.5013) Hour/Week
R – Squared	0.021
Correlation between CFU/cm^2 and Hour/week	0.1451
Significance of T - test	0.4443
Reject H_0	Can not reject

Based on the equation, the CFU/cm^2 of a remote control can be computed if the Hour/week of a classroom is known. The correlation between CFU/cm^2 and Hour/week is 0.1451 which suggests little to no relationship. The R-squared value which means the proportion of the variation of CFU/cm^2 that can be accounted by variation in Hour/week is 0.021. This means that 2% of the variation in values for one of the measures (Ex. Hour/week) can be accounted for by knowing the amount of CFU/cm^2 of a remote control or vice versa. However, this is a very small percentage. A significance test that the slope is zero resulted in a T-value of 0.7759. This test has a significance level of 0.4443 which is bigger than the alpha of 0.05. Thus, the null hypothesis that the slope is zero is not rejected. Hence, there is no statistically significant relationship between the hours a classroom is used and the amount of colony forming units on the remote control. Higher classroom utilization does not equate to more bacteria on the remote-control device. Regardless on the results of the linear regression, the result of this study showed a statistically significant increase in CFU counts compared to the standard of 5 CFU/cm^2 (Heacock & Ma, 2017)

Discussion

This research demonstrated two important findings. Firstly, the mean colony forming unit per cm2 (CFU/cm2) of remote controls in SW 1, SW 3 and SE 12 at BCIT is statistically greater than the standard value of 5 CFU/cm2 (BCCDC, 2010). This result suggests the sanitation status of remote controls at BCIT is not up to standards despite BCIT claiming it complies with the APPA (Association for Higher Education Facilities Officers) Cleaning Standards (BCIT, 2018) (University of Lethbridge, 2018).

Secondly, a linear regression study suggested that there is no significant relationship between the mean CFU/cm2 of remote controls and the amount of classroom utilization. This suggests not every instructor will utilize the projector while teaching their class or students will be using the projector while attending classes.

Results from this study compliment the experiment conducted by Bright where she tested for the occurrence of Influenza A virus and Noro virus on the commonly used items and contact surfaces in a classroom (Kelly R. Bright, 2010). Although, Bright did not test for projector remote controls, her experiment has shown that Influenza A virus and Noro virus exist on surfaces such as student desktops, sink faucet handles and paper towel dispensers. As one of the most commonly used pieces of equipment in the class, Bright's result point to the possibility that projector remote controls might also harbor harmful pathogens such as Influenza A virus and Noro virus. However, this experiment has limited connections to the results presented by Bright as different items were tested. Moreover, biofilm formations were identified on remote controls with high bacterial count. For example, in room SW 1 2025, black slimy patches of spots were identified between the crevices of buttons and on the back of the generic Sharp Projector Remote Control. As suggested by Dr. Marks' research showing that harmful bacteria retain their viability, infectivity and survive desiccant when inside a biofilm, perhaps it would be worthy to test for the existence of Influenza A and Noro virus on projector remote controls as a next step to this experiment. (Marks, 2013)

On the other hand, the results from this experiment utilizing the Aerobic Colony Count (APC) Method did prove to be more effective than the ATP method Chen utilized during his assessment on the contamination level of computer keyboards at the BCIT Burnaby Campus (Chen, 2013). By utilizing the APC method, bacterial colonies linked to a remote control could be identified and counted. The results could also be compared to a control or standard value and be more effective in assessing the bacterial load before and after cleaning procedures. However, since no cleaning procedures were carried out during sampling to assess the reduction in bacterial load on projector remote controls, results from this experiment are not able to be compared directly with Chen's results.

Validity of Experiment and Methodological Limitations

In this experiment the validity of results was ensured by using carefully designed sampling procedures to limit cross contaminations during sampling, the use of applicable bacterial assessment method and equipment according to manufacturer's instructions, the collection of the minimum number of required samples, correct handling of samples and incubation of samples according to manufacturer's guideline. (3M, 2006) (Heacock & Ma, 2017) The limitations regarding the use of APC method is that it does not correlate with the presence of harmful pathogens or toxin even when APC is high nor it is a health risk indicator itself as it only indicates a lack of hygiene. This method will allow all bacteria that are able to grow in an aerobic condition to form colonies regardless of the type of bacteria or its harmfulness. Thus, anaerobic bacteria are not considered and researchers will not be able to tell whether an item is bacteriologically safe or not based on results obtained by using the APC method. High APCs may reasonably be assumed to be potential health hazards and a pathogen screening may be carried out. (Murray-Brown Laboratories, 2018) Overall, only the general

sanitation status could be assessed by using the APC method. Moreover, due to the lack of standard CFU/cm2 value specific to remote control surfaces, it is difficult to establish conclusions on whether the results are satisfactory or not.

Knowledge Translation

In this research the general sanitation status of projector remote controls will be presented to Facilities Services at BCIT who manages and oversees a third – party contract that provides custodial services for the campus community. The contract details the frequency and specification for all services provided. (BCIT, 2018). The expected outcome as a result from this study is to have BCIT Facility Services change the conditions in the contract with the third-party company to include project remote controls within their daily cleaning schedule. The contract should also detail the frequency such as twice a day and how these remote controls should be cleaned. For example, specifications regarding the cleaning procedures and the type of disinfectant that will be used.

Limitations

In this study, limitations include financial and equipment. Due the money constrains, only 30 samples were collected providing only a snapshot in time regarding the sanitation status of projector remote controls. If budget allowed, a total of 60 samples would have been collected and a cleaning procedure using brush and diluted chlorine disinfectant would have been created. Thirty samples would have been collected before the intervention then another 30 samples after the intervention. This would provide a much better image of what a properly cleaned projector remote control should have in terms of CFU/cm^2. Thus, providing a reference point for BCIT's future sanitation plan on projector remote control. Moreover, due to timing constrains, only classrooms at SW1, SE 12 and SW3 at BCIT were chosen to be sampled. This could lead to a decrease of external validity because these three facilities were not randomly selected. Although these three facilities host a high number of classes at BCIT, the results could be heavily biased. If time allowed, buildings at BCIT should be randomly selected then within those building, a list of eligible classrooms should be generated randomly and sampled. This would in turn make the results less biased and more applicable to all the building at BCIT Burnaby campus.

Future research

Due to the lack of available time and money, bacterial enumeration was not an option for this study. Bacterial enumeration requires sending off samples to a laboratory at a cost and waiting for the results to come back. However, this process would identify specific strains of bacteria that are of interest to public health. For example, Noro virus, Influenza A Virus and Staphylococcus Aureus. Results from this study could provide to a much stronger argument for BCIT Facility Services to change their policy immediately to protect public health if harmful pathogens are identified. Moreover, aerobic colony count could also be expanded to test for other commonly used items in a classroom. For example, sanitation status of student desktops, door knobs, projectors connection cables and traditional digital light processing (DLP) projector's on/off button.

Conclusions

The result from this research study suggests that projector remote controls at building SW1, SE12 and

SW3 of BCIT's Burnaby campus are not being properly cleaned. The formation of biofilms on some of these projector remote controls would not only act as habitat for harmful pathogens to survive and multiply but also a mode of transmission. Students might be exposed to the influenza virus by using these remote controls then touching their eyes, nose and mouth. This experiment suggests that BCIT Facility Services must make an effort to ensure commonly used classroom items are properly cleaned to reduce the possible transmission of bacteria and viruses.

Appendix 1

Figure 1. **HPC Bacterial Contamination of Surfaces. Contamination is ranked from high to low in a top down fashion** (Bright, Boone, & Gerba, 2010)

TABLE 2. Summary of Heterotrophic Plate Count (HPC) Bacteria Recovered From Surfaces in Control (No Treatment) and Intervention Classrooms (Wiped With Quaternary Ammonium Disinfecting Wipe [DW])[a]

Fomite	*Treatment*	*N*[b]	*Geometric Mean (per cm²)*	*Standard Deviation*	*p*[c]
Water fountain toggle	None	12	26.42	69.6	.089
	DW	12	7.22	63.3	
Manual pencil sharpener handle	None	12	5.14	4.7	.434
	DW	12	4.45	3.2	
Computer keyboard	None	36	2.39	9.7	.058
	DW	36	0.83	4.0	
Sink faucet handle	None	12	1.05	26.4	.971
	DW	12	0.86	17.0	
Paper towel dispenser lever	None	12	0.62	4.1	.143
	DW	12	2.19	176.6	
Sink countertop	None	12	0.61	2.8	.967
	DW	12	0.67	4.3	
Computer mouse	None	36	0.41	10.1	.518
	DW	36	0.14	9.1	
Student desktop	None	48	0.28	1.5	.799
	DW	48	0.26	1.9	
Student chair back	None	48	0.23	7.3	.258
	DW	48	0.19	0.3	
Soap dispenser lever	None	12	0.14	0.5	.119
	DW	12	0.46	13.0	
Exit doorknob	None	12	0.04	0.3	.584
	DW	12	0.04	0.1	
Entrance doorknob	None	12	0.02	0.1	.147
	DW	11	0.05	0.2	

a. Sample sites are ranked in descending order from the most contaminated surface to the least contaminated.

b. N = total number of samples taken.

c. p = bacterial counts from the control and intervention classrooms were compared by analysis of variance. This difference is considered significant if $p \leq .05$.

Figure 2. Viral Occurrence on Most Touch Areas (Bright, Boone, & Gerba, 2010)

TABLE 3. Occurrence of Influenza A (Infl A) Virus and Norovirus (Noro) on Surfaces in Three Control Classrooms[a]

	Morning		*Recess*		*Afternoon*		*Total*	
Fomite	*Infl A*	*Noro*	*Infl A*	*Noro*	*Infl A*	*Noro*	*Infl A*	*Noro*
Student desktop	1/10	2/10	1/10	2/10	3/7	2/7	5/27	6/27
Sink faucet handle	1/3	0/3	1/2	1/2	2/2	0/2	4/7	1/7
Paper towel dispenser	1/2	0/2	0/1	1/1	1/1	0/1	2/4	1/4
Soap dispenser	0/1	0/1	0/1	0/1	ND	0/1	0/2	0/3
Water fountain toggle	0/3	1/3	0/2	0/2	0/2	0/2	0/7	1/7
Entrance doorknob	0/3	0/3	1/2	0/2	1/2	0/2	2/7	0/7
Total	3/22	3/22	3/18	4/18	7/14	2/15	13/54	9/55

NOTE: ND = not determined.

a. Results are presented as the ratio of the number of positive samples to the total number of samples collected.

Figure 3 Different Bacterial Communities Harbored in The Four Types of Surface (Meadow, Altrichter, Kembel, & et al, 2014)

Table 1 Closest known isolates related to indicator operational taxonomic units

Greengenes genus	*P* value	Surface type	Closest 16S NCBI isolate and accession	Isolate source environment	Sequence similarity to isolate (%)
Lactobacillus	0.001*	Chairs	*Lactobacillus johnsonii* NR_075064.1	Human gut	99
Corynebacterium	0.001*	Chairs	*Corynebacterium resistens* NR_040999.1	Human infection	99
Corynebacterium	0.001*	Chairs	*Corynebacterium confusum* NR_026449.1	Human clinical specimens	99
Staphylococcus	0.011*	Chairs	*Staphylococcus epidermidis* NR_074995.1	Human skin	99
Corynebacterium	0.001*	Chairs	*Corynebacterium riegelii* NR_026434.1	Human urinary tract	99
Staphylococcus	0.019*	Chairs	*Staphylococcus saprophyticus* NR_074999.1	Human urinary tract	99
Lactobacillus	0.001*	Chairs	*Lactobacillus crispatus* NR_074986.1	Human vagina	99
Lactobacillus	0.003*	Chairs	*Lactobacillus acidophilus* NR_075049.1	Human gut	99
Streptococcus	0.001*	Desks	*Streptococcus oralis* NR_102809.1	Human oral	99
Streptococcus	0.001*	Desks	*Streptococcus salivarius* NR_102816.1	Human oral	99
Brevundimonas	0.002*	Desks	*Brevundimonas variabilis* NR_037106.1	Pond water	99
Streptococcus	0.001*	Desks	*Streptococcus intermedius* NR_102797.1	Human purulent infection	99
CandidatusPhytoplasma	0.001*	Desks	None**	-	-
Alicyclobacillus	0.001*	Walls	*Tumebacillus permanentifrigoris* NR_043849.1	Soil	99
Chroococcidiopsis	0.028*	Walls	*Halospirulina tapeticola* NR_026510.1	Saline aquatic	96
Alicyclobacillus	0.001*	Walls	*Tumebacillus permanentifrigoris* NR_043849.1	Soil	98
Rhodopseudomonas	0.001*	Walls	*Methylobacterium adhaesivum* NR_042409	Drinking water	98
Salmonella	0.001*	Floors	*Pantoea ananatis* NR_103927.1	Phyllosphere	99
Roseomonas	0.001*	Floors	*Roseomonas gilardii* NR_029061.1	Human blood	99
Roseomonas	0.001*	Floors	*Roseomonas frigidaquae* NR_044455.1	Water-cooling system	99
Salmonella	0.001*	Floors	*Pantoea ananatis* NR_103927.1	Phyllosphere	99

All extant operational taxonomic units labeled in Figure 2 (and thus influential in distance-based redundancy analysis, as well as significant indicator taxa for their respective surface type) were related to their closest known bacterial isolate using 16S rRNA sequences in the NCBI Bacteria & Archaea Isolate Database. Source environments are from each isolate's respective published source environment. *Unadjusted *P* value < 0.05. **Closest known isolate 89% similar. NCBI: National Center for Biotechnology Information.

Figure 4 Dirty Remote Control at Hotel Mela Showing Possible Biofilm Formation (Yelp.com, 2015)

Figure 5. Epidemiologic Characteristics of Noro Virus Outbreak. (Zheng, MA, RI, & J, 2010)

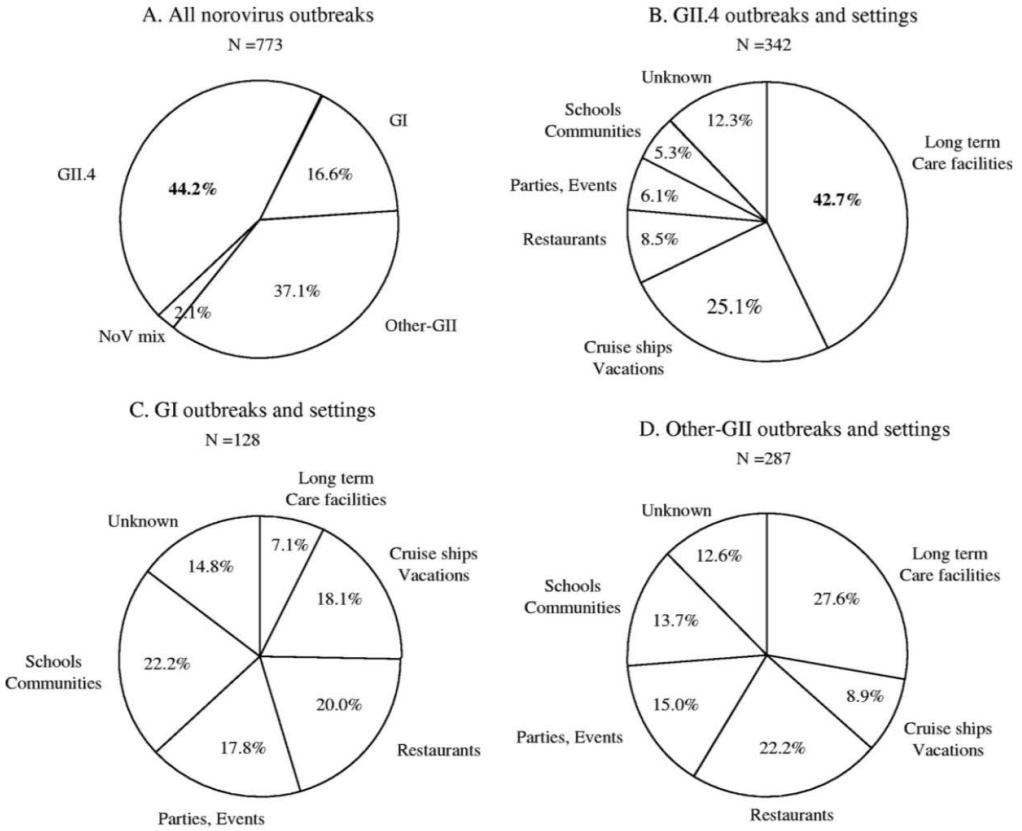
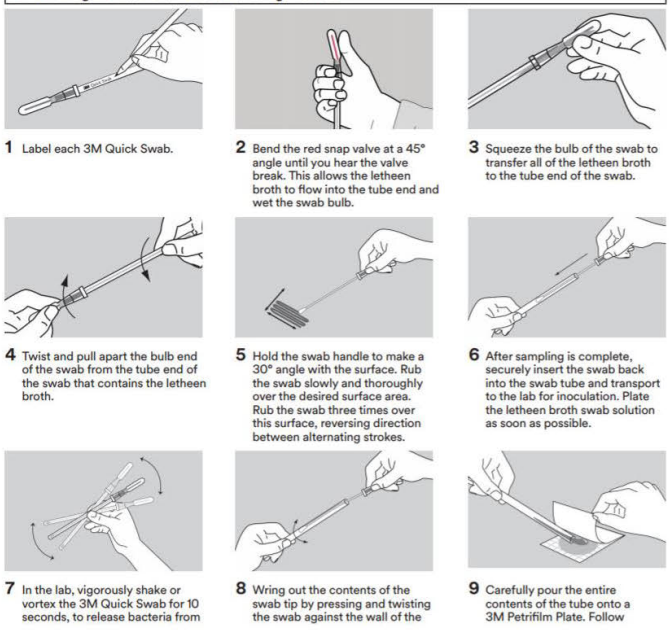


FIG. 2. Epidemiologic characteristics of 773 NoV outbreaks in the United States between 1994 and 2006. Distribution by genogroup and genetic cluster (A) and by setting of GII.4 outbreaks (n = 342) (B), GI outbreaks (n = 128) (C), and other GII outbreaks (n = 287) (D).

Procedures for Using Wet Swabbing Method

Figure 1

1 mL Plating Instructions - Wet Swabbing Method -



1 Label each 3M Quick Swab.

2 Bend the red snap valve at a 45° angle until you hear the valve break. This allows the letheen broth to flow into the tube end and wet the swab bulb.

3 Squeeze the bulb of the swab to transfer all of the letheen broth to the tube end of the swab.

4 Twist and pull apart the bulb end of the swab from the tube end of the swab that contains the letheen broth.

5 Hold the swab handle to make a 30° angle with the surface. Rub the swab slowly and thoroughly over the desired surface area. Rub the swab three times over this surface, reversing direction between alternating strokes.

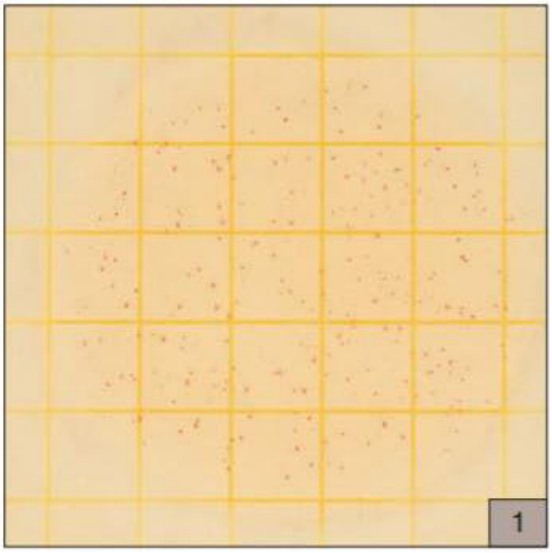
6 After sampling is complete, securely insert the swab back into the swab tube and transport to the lab for inoculation. Plate the letheen broth swab solution as soon as possible.

7 In the lab, vigorously shake or vortex the 3M Quick Swab for 10 seconds, to release bacteria from

8 Wring out the contents of the swab tip by pressing and twisting the swab against the wall of the

9 Carefully pour the entire contents of the tube onto a 3M Petrifilm Plate. Follow

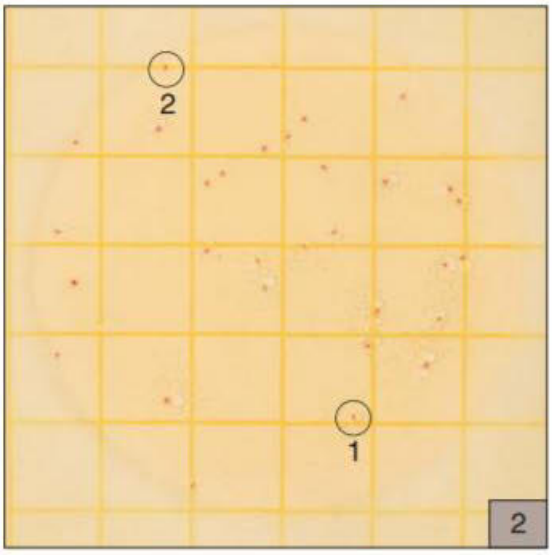
Interpretation of 3M Aerobic Count Plate Petrifilm



Lactic Acid Bacteria Count = 238

The Petrifilm Aerobic Count plate, in combination with an MRS broth diluent and anaerobic incubation, enhances the growth of homo- and heterofermentative lactic acid bacteria.

Colonies are red to reddish-brown in color and may or may not be associated with a gas bubble. The colonies in figure 1 are examples of characteristic homofermentative (non-gas-producing) organisms.

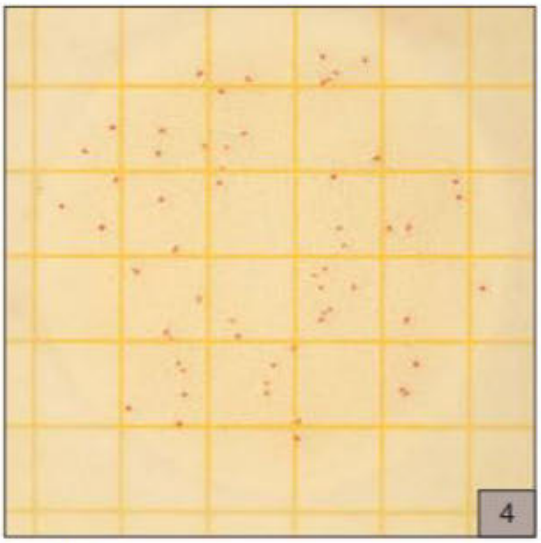


Count = 30

Figure 2 contains both heterofermentative (gas-producing) and homofermentative organisms. The MRS diluent provides a shaded background that highlights gas production from heterofermentative organisms (see circle 1). Heterofermentative colonies within approximately 1/4 inch of the circle's edge may not produce visible gas (see circle 2).

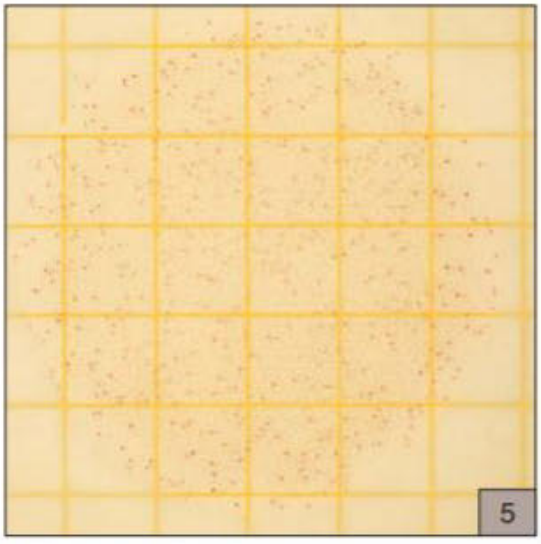
Count = 0

Figure 3 shows a Petrifilm Aerobic Count plate inoculated with an MRS broth diluent. This is referred to as an "MRS diluent control." The MRS diluent and anaerobic incubation cause a slightly shaded growth area with a pale ring.



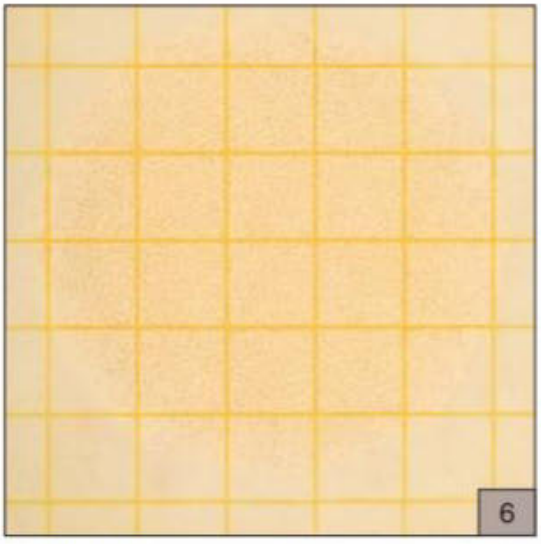
Count = 60

The preferable counting range is 25–250 colonies. Count all colonies regardless of size or color intensity.



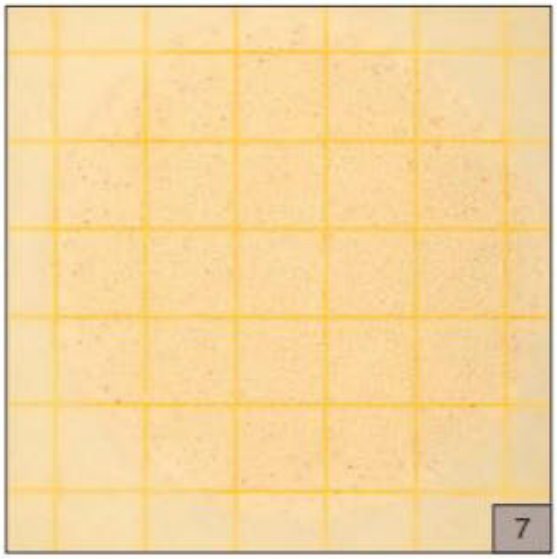
Estimated Count = 440

When colonies number more than 250, as shown in figure 5, estimate the count. Determine the average number of colonies in one square (1 cm^2) and multiply it by 20 to obtain the total count per plate. The inoculated area on a Petrifilm Aerobic Count plate is approximately 20 cm^2.



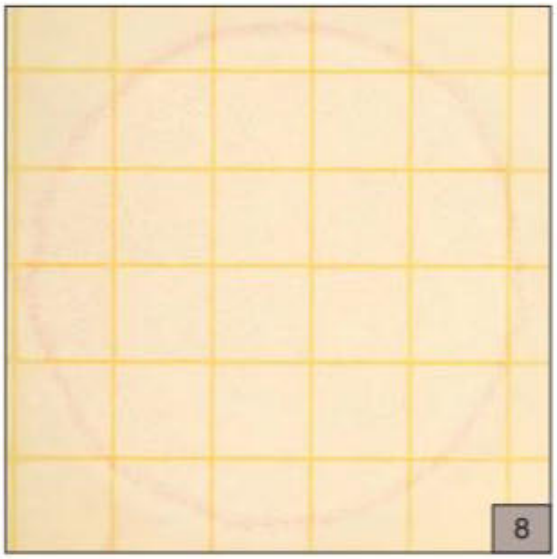
Count = TNTC **(Estimated count = 10^6)**

When colonies are too numerous to count (TNTC), the entire growth area may turn pink, as shown in figure 6. Compare incubated plates to an MRS diluent control because change in background color may be minimal (see figure 3 for MRS control). Further dilution of the sample may be necessary.



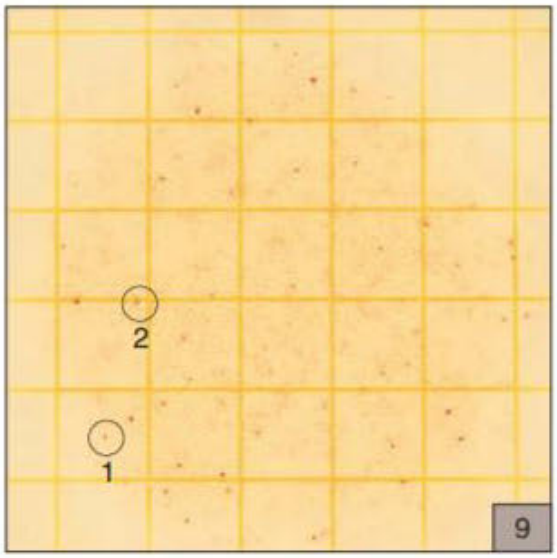
Count = TNTC **(Estimated count = 10^8)**

When you look closely, you can see small pinpoint colonies both in the center and on the edge of the growth area. Record this as a TNTC.



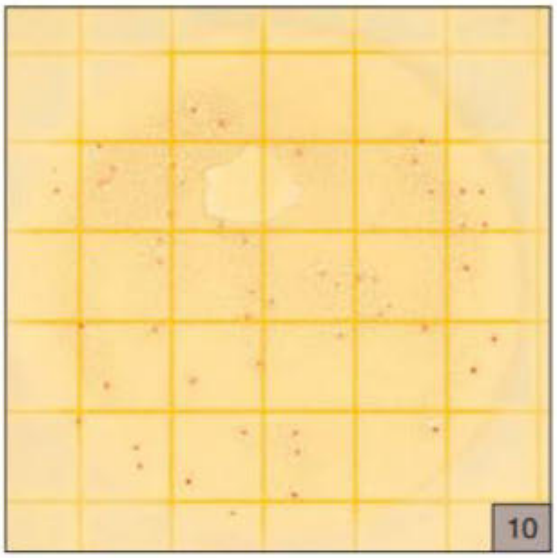
Count = TNTC **(Estimated count = 10^4)**

With very high counts, small pinpoint colonies may surround the circular growth area. Record this as a TNTC.



Count = TNTC

The Petrifilm plate in figure 9 is an example of a TNTC plate. Both homofermentative (non-gas-producing) colonies (see circle 1) and heterofermentative (gas-producing) colonies (see circle 2) are present.



Count = 52

Artifact bubbles may result from improper inoculation of the Petrifilm plate. They are irregularly shaped and not associated with a colony.

Appendix 2 - Print Out Using NCSS 12 – One Sample T-test

One-Sample T-Test Report

Dataset Untitled
Response Variable CFU_100_cm2

Descriptive Statistics

Variable	Count	Mean	Standard Deviation	Standard Error	Median
CFU_100_cm2	30	24.367	39.966	7.297	6.500

Two-Sided Confidence Interval of μ with σ Unknown

							95.0% C. I. of μ	
Variable	Count	Mean	Standard Deviation	Standard Error	T*	DF	Lower Limit	Upper Limit
CFU_100_cm2	30	24.367	39.966	7.297	2.0452	29	9.443	39.290

One-Sample T-Test

Alternative Hypothesis	Mean	Standard Error	T-Statistic	DF	Prob Level	Reject H0 at α = 0.050?
μ ≠ 5	24.367	7.297	2.6542	29	0.013	Yes
μ < 5	24.367	7.297	2.6542	29	0.994	No
μ > 5	24.367	7.297	2.6542	29	0.006	Yes

Power for the One-Sample T-Test

This section assumes the population mean and standard deviation are equal to the sample values.

Alternative Hypothesis	N	μ	σ	Power (α = 0.05)	Power (α = 0.01)
μ ≠ 5	30	24.367	39.966	0.728	0.471
μ < 5	30	24.367	39.966	0.000	0.000
μ > 5	30	24.367	39.966	0.828	0.581

One-Sample T-Test Report

Dataset Untitled
Response Variable CFU_100_cm2

Wilcoxon Signed-Rank Test

Sum of Ranks (W)	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
331.5	232.5	48.56568	0	7	246

Test Type	Alternative Hypothesis	Z-Value	Prob Level	Reject H0 at α = 0.050?
Exact*	Median ≠ 5			
Exact*	Median < 5			
Exact*	Median > 5			
Normal Approximation	Median ≠ 5	2.0385	0.042	Yes
Normal Approximation	Median < 5	2.0385	0.979	No
Normal Approximation	Median > 5	2.0385	0.021	Yes
Normal Approx. with C.C.	Median ≠ 5	2.0282	0.043	Yes
Normal Approx. with C.C.	Median < 5	2.0488	0.980	No
Normal Approx. with C.C.	Median > 5	2.0282	0.021	Yes

* The Exact Test is provided only when there are no ties.

Tests of Assumptions

Assumption	Value	Prob Level	Decision (α = 0.050)
Shapiro-Wilk Normality	0.6442	0.000000	Reject normality
Skewness Normality	4.4013	0.000011	Reject normality
Kurtosis Normality	3.5079	0.000452	Reject normality
Omnibus Normality	31.6774	0.000000	Reject normality

One-Sample Report

Dataset Untitled

Tests of Assumptions
Variable: CFU_cm2

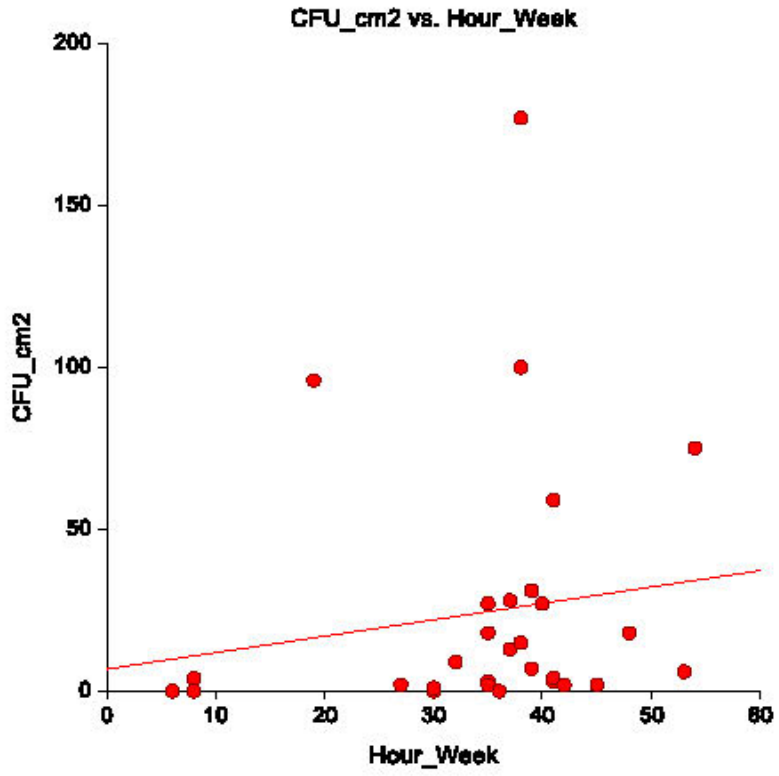
Assumption	Value	Prob Level	Decision (α = 0.050)
Skewness Normality	4.2430	0.000022	Reject normality
Kurtosis Normality	3.7604	0.000170	Reject normality
Omnibus Normality	32.1435	0.000000	Reject normality

Print Out Using NCSS 12 – Linear Regression Report

Linear Regression Report

Dataset Untitled
Y = CFU_cm2 X = Hour_Week

Linear Regression Plot Section



Linear Regression Report

Dataset Untitled
Y = CFU_cm2 X = Hour_Week

Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	CFU_cm2	Rows Processed	30
Independent Variable	Hour_Week	Rows Used in Estimation	30
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	6.9552	Rows Prediction Only	0
Slope	0.5013	Sum of Frequencies	30
R-Squared	0.0210	Sum of Weights	30.0000
Correlation	0.1451	Coefficient of Variation	1.6516
Mean Square Error	1619.5	Square Root of MSE	40.24301

Summary Statement

The equation of the straight line relating CFU_cm2 and Hour_Week is estimated as: CFU_cm2 = (6.9552) + (0.5013) Hour_Week using the 30 observations in this dataset. The y-intercept, the estimated value of CFU_cm2 when Hour_Week is zero, is 6.9552 with a standard error of 23.6125.
The slope, the estimated change in CFU_cm2 per unit change in Hour_Week, is 0.5013 with a standard error of 0.6461. The value of R-Squared, the proportion of the variation in CFU_cm2 that can be accounted for by variation in Hour_Week, is 0.0210. The correlation between CFU_cm2
and Hour_Week is 0.1451.

A significance test that the slope is zero resulted in a t-value of 0.7759. The significance level of this t-test is 0.4443. Since 0.4443 > 0.0500, the hypothesis that the slope is zero is
not rejected.

The estimated slope is 0.5013. The lower limit of the 95% confidence interval for the slope is
-0.8221 and the upper limit is 1.8247. The estimated intercept is 6.9552. The lower limit of the 95% confidence interval for the intercept is -41.4128 and the upper limit is 55.3232.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	CFU_cm2	Hour_Week

Count	30	30
Mean	24.3667	34.7333
Standard Deviation	39.9659	11.5667
Minimum	0.0000	6.0000
Maximum	177.0000	54.0000

Linear Regression Report

Dataset Untitled
Y = CFU_cm2 X = Hour_Week

Regression Estimation Section

Parameter	Intercept B(0)	Slope B(1)
Regression Coefficients	6.9552	0.5013
Lower 95% Confidence Limit	-41.4128	-0.8221
Upper 95% Confidence Limit	55.3232	1.8247
Standard Error	23.6125	0.6461
Standardized Coefficient	0.0000	0.1451
T Value	0.2946	0.7759
Prob Level (T Test)	0.7705	0.4443
Reject H0 (Alpha = 0.0500)	No	No
Power (Alpha = 0.0500)	0.0593	0.1164
Regression of Y on X	6.9552	0.5013
Inverse Regression from X on Y	-802.8502	23.8162
Orthogonal Regression of Y and X	-735.1505	21.8671

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model

(6.95523901164984) + (0.501288704079177) * (Hour_Week)

Linear Regression Report

Dataset Untitled
Y = CFU_cm2 X = Hour_Week

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.1451	0.0210	0.3764
Lower 95% Conf. Limit (r dist'n)	-0.2239		
Upper 95% Conf. Limit (r dist'n)	0.4737		
Lower 95% Conf. Limit (Fisher's z)	-0.2271		0.0187
Upper 95% Conf. Limit (Fisher's z)	0.4802		0.6487
Adjusted (Rbar)		0.0139	
T-Value for H0: Rho = 0	0.7759	0.7759	2.1498
Prob Level for H0: Rho = 0	0.4443	0.4443	0.0404

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Linear Regression Report

Dataset Untitled
Y = CFU_cm2 X = Hour_Week

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	17812.03	17812.03			
Slope	1	974.9731	974.9731	0.6020	0.4443	0.1164
Error	28	45345.99	1619.5			
Lack of Fit	16	29221.13	1826.32	1.3591	0.2991	
Pure Error	12	16124.87	1343.739			
Adj. Total	29	46320.96	1597.275			
Total	30	64133				

s = Square Root(1619.5) = 40.24301

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom,
and the mean square error. The mean square error, which estimates the variance of the residuals,
is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset Untitled
Y = CFU_cm2 X = Hour_Week

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.6611	0.000000	No
Anderson Darling	3.7490	0.000000	No
D'Agostino Skewness	4.4391	0.000009	No
D'Agostino Kurtosis	3.5408	0.000399	No
D'Agostino Omnibus	32.2428	0.000000	No
Constant Residual Variance?			
Modified Levene Test	2.2200	0.147412	No
Relationship is a Straight Line?			
Lack of Linear Fit F(16, 12) Test	1.3591	0.299085	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that
is perfectly normal.

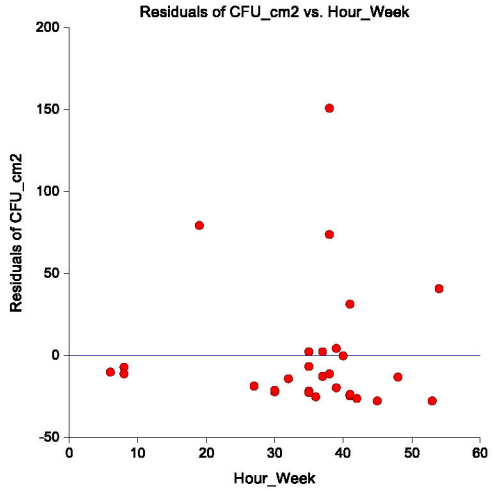
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers,
adding additional independent variables, using robust regression, or using bootstrap methods.

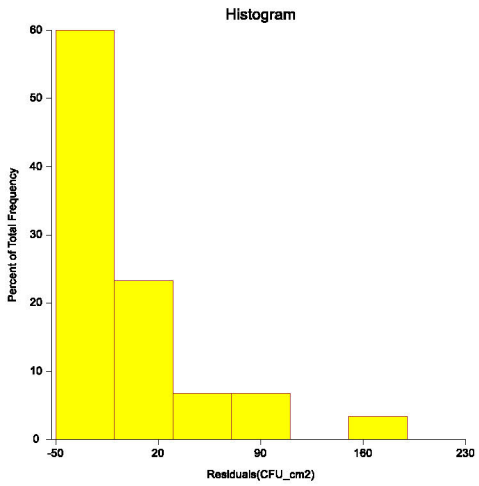
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

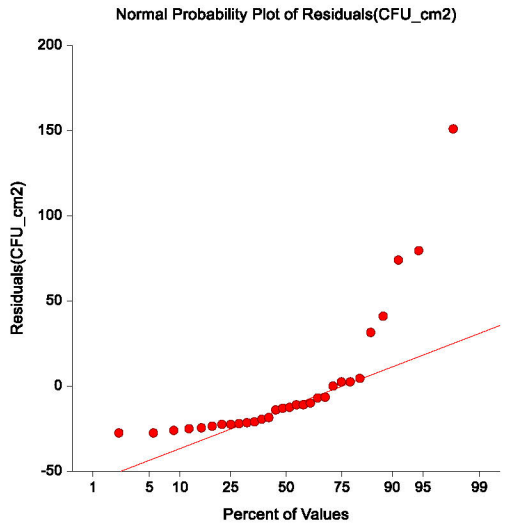
Linear Regression Report

Dataset Untitled
Y = CFU_cm2 X = Hour_Week

Residual Plots Section







Appendix 3 - Data Entry Sheet

Room	CFU	CFU/100 cm2	Hour/Week
SW 1 1240	0	0	6
SW 1 1230 Toshiba	16	4	8
SW 1 1230 Sharp	0	0	8
SW 1 1045	240	96	19
SW 1 3195	6	2	27
SW 1 3021 JVC	0	0	30
SW 1 3021 Optimum	3	1	30
SW 1 2070	20	9	32
SW 3 2745	8	3	35
SW 1 2513	4	2	35
SW 1 2515	106	27	35
SW 1 2519	72	18	35
SW 1 2113	4	2	35
SW 3 4725	1	0	36
SW 1 2004	63	28	37
SE 12 313	30	13	37
SW 1 1205	54	15	38
SW 1 2025 JVC	280	100	38
SW 1 2025 Sharp	400	177	38
SW 1 3190	70	31	39
SW 3 2620	15	7	39
SW 1 2024	60	27	40
SW 1 2019 Sharp	5	3	41
SW 1 2019 Optimum	10	4	41
SW 1 1025	220	59	41
SE 12 302	4	2	42
SW 1 2005	3	2	45
SW 1 3150	40	18	48
SW 1 3170	14	6	53
SW 1 1021	280	75	54

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