GAMING CHIP SANITATION

Edward Gene Mc Keown, M.S.
Department of Hospitality and Tourism Management
PhD Student, Purdue University

and

Brittany J. Gasper
Department of Biological Sciences
PhD Student, Purdue University

and

James D. McGlothlin, MPH, Ph.D., CPE
School of Health Sciences
Associate Professor, Purdue University

and

SooCheong (Shawn) Jang, Ph.D.
Department of Hospitality and Tourism Management
Associate Professor, Purdue University

and

Barbara Almanza PhD, RD,
Department of Hospitality and Tourism Management
Professor, Purdue University

ABSTRACT

Those that work in and the customers who enjoy the casino environment may be at risk for exposure to infectious diseases, especially bacterial diseases. The purpose of this study to determine if and what type of bacterial microorganisms live on gaming chips. A total of 26 gaming chips (13 used actively in a casino and 13 never used) were utilized for the study. Swabs of the chips were performed and placed on blood agar Petri dishes where cultures were allowed to grow for 48 hours. The results of this growth showed a statistically significant number of bacteria and fungi development with a p < 0.05. Additional statistical analysis was performed on the level of contamination based on used versus unused chips and on the location of the swab related to the obverse, reverse or rim of the chip, with overall results being statistically significant for the presence of pathogenic contaminants.

Keywords: *Casino, Gaming, Sanitation, Tourism*

INTRODUCTION

Saldmann, 2008, reported that illness causing virus and bacteria that can be spread through casual contact include: *E. coli, Tatumella ptyseos, Serratia plymuthica, Citrobacter ferundii, Proteus penneri, Erwinia,* and *Helicobacter pylori*. Each of these infectious diseases can spread through casual contact between people and can be spread from contact with objects that have been touched by individual carriers of these items. Further, if bacteria or viruses are deposited on an object, for example someone who is infected with human influenza and sneezes without covering their mouth, then the infectious organism can live from 1 to 48 hours, depending on the environmental conditions (Saldmann, 2008)

One of the major barriers to effectively controlling the spread of infectious disease is proper personal hygiene, particularly handwashing. The Centers for Disease Control and Prevention (CDC) has worked to create the Clean Hands Coalition (CHC) in an effort to "create and support coordinated, sustained initiatives to significantly improve health and save lives through clean hands" (Prevention, 2009). Based on a recent study, it has been determined that public rest rooms can be a source of bacterial and viral infection because of improper hand washing (Bakalar, 2005). Further, if people are using public rest rooms in a casino, then there is the additional cross contamination to casino chips used by casino patrons as well as its workforce.

The purpose of this pilot study was to establish if there are infectious bacteria on casino chips that have been in use by casino workers and their customers and compare the bacteria counts of these chips to casino chips that are new and have never been used in a casino. The eventual goal is to determine effective disease prevention strategies for the safe handling and use of casino chips, based on the presence of significant levels of infectious bacteria.

LITERATURE REVIEW

Individuals come into contact with microorganisms many times throughout the day. Some of these microorganisms are beneficial for our daily development, while others are more harmful and can cause disastrous effects within the human populace. While much of the research within the hospitality area revolves around foodservice sanitation as it pertains to consumer health, the recent pandemic of 2009 H1N1 has brought the conditions of nonfood contamination and infection within the focus of employee and consumer protection (Aaltonen, 2009). Medical professionals continually study the effects of handwashing on infections within the health care world, however, many infections from microorganisms occur outside of medical facilities (Rutala, White, Gergen, & Weber, 2006). As a result, the thought of infection caused by contact from inanimate objects rarely gets discussed when evaluating sanitary conditions of a workplace. Most medical research on the contamination of surfaces and inanimate objects was originally performed between the 1950s and 1970s (PATTERSON, 1971). It has only been in recent years, with the increased awareness of viral pandemics such as the H5N1, and most recently H1N1, that interest was around in viral and bacterial contamination of everyday objects that can infect and spread in the human population.

In the medical and health care field, hand washing practices are determined by monitoring the bacterial levels located on objects such as keyboards and wireless communication devices (Brady, Fraser, Dunlop, Paterson-Brown, & Gibb, 2007; Rutala, et al., 2006). The results of these studies show that despite continual use and cleaning, disinfectants were continually

required to ensure that disease causing microorganisms were controlled to safe levels (Brady, et al., 2007; Rutala, et al., 2006). This is critical, especially in light of recent research that disease causing viruses can remain on everyday surfaces such as door knobs, desk tops, and chairs even after disinfectants have been used to sanitize the contaminated area (Terpstra et al., 2007).

Those that work in and customers who enjoy the casino environment may be at risk for exposure to infectious diseases, especially bacterial diseases. The purpose of this study was to determine if and what type of bacterial microorganisms live on gaming chips. The information gathered from this study will provide possible recommendations that can reduce and prevent infectious bacterial disease among casino workers and casino customers.

METHODOLOGY

This is a case and control design to determine if infectious bacteria exist on casino gaming chips. Thirteen gaming chips that have never been used in a casino were compared to thirteen gaming chips that have been in play at an undisclosed casino. Since each gaming chip contains three sides (obverse or front, reverse or back, and side or rim), a total of n=78 tests were performed ((39 for the case (casino used chips), versus 39 for the control (never used casino chips)). Obverse and Reverse sides of the chips were determined based on design of the chips and positioning of colored stripes. Chips were then randomly removed from a clean plastic container marked as either used or unused with forceps that had been sterilized by dipping in a container of ethyl alcohol and ignited with flame from a Bunsen burner. Each gaming chip was then swabbed for bacteria using 6" sterile cotton tipped applicators that had been dipped into a sterile solution of glove elution fluid containing 1% tween and 0.3% lecithin (Gaonkar, Geraldo, Shintre, & Modak, 2006), from the obverse side of the chip surface area, and then the reverse side, and finally on the rim. Swabs 22 through 27 were reversed to determine if swabbing order affected the results of the study; while a different bottle of sterile elution fluid was introduced at swab number 49. Both bottles of sterile elution fluid were made at the same time, and both sterile elution fluids were tested to determine that they were not contaminated before and after the study was completed. Swabs were then directly streaked across numbered blood agar Petri dishes, with the number corresponding to the location of the chip being swabbed, to determine reactionary issues based on microorganism growth. Once all of the Petri dishes had been swabbed they were placed upside down for optimal growing condition in a growth incubator set at 37°C for 48 hours. At the conclusion of the 48 hour time period, the Petri dishes were removed from the incubator and placed in a refrigerated cooling area until such time as the results could be analyzed. This protocol for growing bacterial from contaminated surfaces is standard procedure (Bykowski & Stevenson, 2008).

RESULTS

Results of the study were analyzed through the use of ANOVA for bacterial growth comparisons between the control and case chips. The statistical program STATA version10.1 was used to perform these tests. A probability of $p < .05$ was used for determining significant differences between the case versus control chips for bacterial growth. An n of 39 controls versus an n of 39 cases offers enough statistical power to determine the statistical significance noted above.

Of the 78 tests compiled, only one produced unusable results based on an amount of colony growth that was too numerous to count accurately. Each result was counted for the number of bacteria or fungi colonies that grew in the agar Petri dish. For bacteria, the 77 usable results had a mean of 12.96 colonies and a standard deviation of 39.03 with a minimum of zero and a maximum test result of 310 colonies, while fungi resulted in a mean of 10.68 colonies and a standard deviation of 19.55 and a minimum of zero and a maximum of 110 colonies.

According to the ANOVA results for bacteria on used versus unused gaming chips, $F(1,75) = 7.77$, $p < 0.01$, which means that there is a statistically significant difference between the amount of bacteria found on used versus unused gaming chips. Additionally, according to Bonferroni, used gaming chips have a higher mean score than that of unused gaming chips with a significance of $p < 0.01$. However, the measure of explained variation within this study shows that 9.39% of the variance in bacteria levels is explained by the differences between used and unused gaming chips. In addition, the results for fungi was also statistically significant with $F(1,75) = 14.13$, $p < 0.001$, where 15.85% of the variance is explained by the difference between the used and unused gaming chips.

ANOVA was also performed on the numbers associated with the section of the gaming chip being swabbed. Bacteria was found not statistically significant, where $F(2,74) = 1.60$, $p > 0.05$, while fungi was found to be statistically significant, where $F(2,74) = 4.78$, $p < 0.05$. The amount of variance between the differences in the sections being swabbed were 4.15% for bacteria and 11.43% for fungi.

Finally, bacteria was found to be statistically significant on the obverse and reverse sides ($p < 0.01$) of the gaming chips as opposed to the rim of the chips ($p > 0.05$), while the fungi was found to be statistically significant on all sections ($p < 0.05$, $p < 0.001$). The amount of variation explained for each test is 16.88%, 13.22%, 38.25%, and 7.57% respectively.

CONCLUSION/DISCUSSION

As shown in the results, both bacteria and fungi were found in statistically significant amounts on casino gaming chips.

Further microscopic examination of the cell arrangements of the yellow colonies, found on plates 1, 4, 24, 28, 36, 43, 46, 49, 53, 56, 68, 71, and 77, were diplococcic and in tetrads which means that this was most likely a hand bacterium known as *Micrococcus luteus* (Greenblatt et al., 2004). The fungus, showed conclusively under a microscope to be a fungus, however without expensive DNA sequencing it was not possible to determine which type. Moreover, the fungus resulted in complete hemolysis within the agar Petri dish, also known as beta-hemolysis (β-hemolysis). This increased hemolysis suggested that the fungi were capable of being pathogenic.

With the increased awareness of disease causing micro-organisms and the recent pandemics associated with influenza, these results show that casino gaming chips can be carriers of organisms that can cause illness in susceptible populations. As a result, this study shows that additional studies need to be performed to determine precisely the amounts and types of micro-organisms that can be found on casino gaming chips. One limitation of this study is that the used chips were from one casino and were of one specific denomination. Currently, there are hundreds of casinos around the world where gaming chips are used and chips are available in multiple denominations. Due to limited funds, the variability of chip denominations and casinos was sacrificed. In addition, the limited funds dictated the amount of testing that was performed.

Future studies on gaming chips should include DNA profiling of the micro-organisms in addition to testing for possible viral pathogens.

After testing for multiple types of pathogens on multiple gaming chips from multiple casinos, tests should be performed to determine the best method for cleaning and sterilizing gaming chips to ensure a healthy population or the chips should be redesigned to control for the ability to harbor these micro-organisms. For this study, we placed a gaming chip in liquid bleach for 24 hours with no noticeable discoloration, in addition to placing a gaming chip in an autoclave with no noticeable effects to the gaming chip. While these are two basic methods of sterilization, tests should be completed on methods of sterilization that would be practical and usable within the casino industry.

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