Hidden in Plain Sight: Exploring Antibiotic Resistance on Surfaces Exposed to People of Different Age Groups

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Abstract

Antibiotic resistance is currently a pressing challenge in modern public health, yet a lot of work still needs to be done in this field. This research project aims to explore whether environment in given age groups influences the antibiotic resistance profiles of bacteria found in high contact surfaces. We studied surfaces tied to different age groups such as: daycares, libraries, and food establishments. Bacteria were isolated, grown, tested for antibiotic sensitivity vs resistance, and later identified using DNA barcoding. Our data shows that antibiotic-resistant bacteria are found in all environments irrespective of the age of the population that it comes in contact with. Our study demonstrates how these bacteria are silently circulating across communal spaces, emphasizing the urgent need towards public health awareness and critical control measures.

Introduction

Antibiotics are the primary defense for combating infectious diseases. However, the rise in bacterial resistance poses one of the most serious public health threats today. Resistance develops when bacteria evolve to survive antibiotic treatment, The primary drivers for resistance are linked to overuse, or misuse of antibiotics across agriculture, healthcare, and food production (Levy et al., 1976; Shallcross & Davies, 2014). Tracking antibiotic resistance is a difficult process that requires years of monitoring subtle change.(Fuhrmeister & Jones, 2019; O'Neill, 2025). An important part of that is studying trends of how resistance develops and spreads. A study of how resistance spreads revealed that an urgent care stay in the same room as a patient with an antibiotic resistant infection leads to higher chances of catching that antibiotic resistant infection. (Huang SS, Datta R, Platt R, 2006) A separate study shows that cleaner environments though have less bacterial diversity but paradoxically can have more resistance. (Mahnert, A Et al. 2019) Studying surfaces contacted by specific age demographics can reveal patterns in how antibiotic resistant bacteria spreads through everyday community contact. In our study we examined the relationship between the presence of antibiotic resistant bacteria in public spaces and the average age group frequenting that space. We hypothesized that age groups frequented by primarily adult populations would have higher levels of antibiotic resistant bacteria due to the increased likelihood of these individuals coming into contact with resistant bacteria.

Materials and Methods

10 Samples collected by swabbing surfaces across- two libraries, a daycare center, and a cafe shop, representing 3 age groups- 1-3 years old, 14-18 years old, and 20+. The swab samples were streaked onto TSA agar plates and incubated at 37°C for 1-2 days. Bacterial colonies were picked or transferred to nutrient broth and incubated by shaking at 37°C for further 16 hours. Kirby Baur assay was used to determine antibiotic sensitivity/ resistance. Mueller Hinton agar plates were swabbed with the isolates, each plate stamped with 12 different antibiotics and incubated further for 48 hours. Zones of resistance were measured to determine the resistance/ sensitivity. The DNA extracted from the isolates using a MoBio kit and the 16s rDNA amplified by PCR using a dehydrated primer and polymerase mixture (PCR Beads), gel electrophoresis performed before sending the amplicons for sequencing. The sequences were then subjected to the DNA subway program to identify the bacterial species.
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Bacterial Isolates	Bacteria Species	Location	Age group	Resistant to:
1- Isolate #2	Kocuria rhizophila	Urban press Cafe	Adult	CIP5
2- Isolate #3	Staphylococcus sp.	Urban press Cafe	Adult	P10, PB300,C30
3- Isolate #4	Paenibacillus sp	NY Hall of science-city works section	Child	CC2,FOX30,S10:
4- Isolate #5	Serratia marcescens	Urban press Cafe	Adult	P10,CC2,CLR15,FOX30, VA10, AM10
5- Isolate #6	Brucella anthropi	Shevach high school	Teen	AM10,FOX30,CC2, C30,P10.S10,TLC75
6- Isolate #7	Serratia marcescens	Gan Devorah	Child	AM10, CC2, P10, VA30
7- Isolate #8	Priestia megaterium	Queens library Corona	Children-Teens	N/A
8-Isolate #11	Serratia marcescens	Gan Devorah preschool	Child	CC2, P10, VA30
9- Isolate#12	Serratia marcescens	New York Public Library 5th avenue	Teens	VA30, P10, CLR15,CC2, AM10
10- Isolate #14	Serratia marcescens	Dunkin Donuts	Adult	AM10,CC2,CLR15,P10,VA30

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Figure 1: The graph displays response of isolates to 12 antibiotics ca tegorized as resistant (R), susceptible (S), and Intermediate (I)

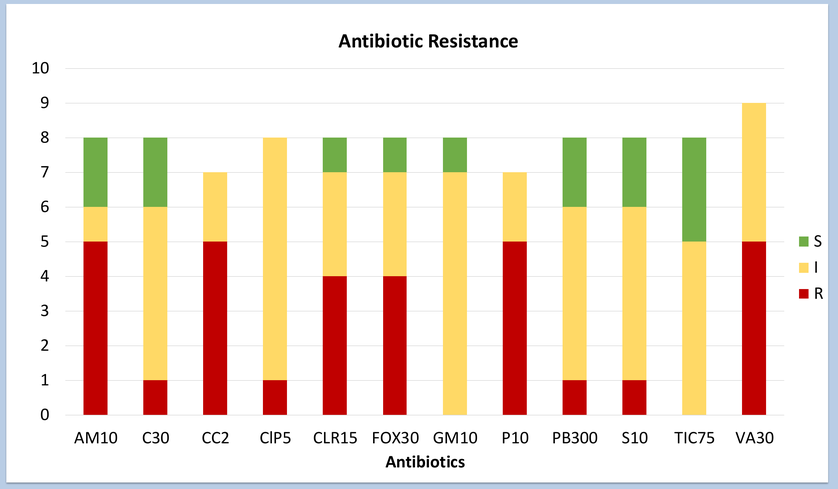
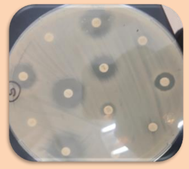


Figure 3: Isolate #3 zones of inhibition

Figure 2: Isolate #5 zones of inhibition



Results and Conclusion

The majority of antibiotics were effective in preventing bacterial growth isolated from various surfaces, especially TIC75 and GM-10.

Most bacteria were resistant to penicillin, which is not surprising because Penicillin is the oldest and most heavily used/ overused antibiotic. In which most bacteria have developed resistance to Penicillin.

There was an overlap between the age groups in that of bacteria types and resistance, most strikingly, Serretia Macresons was collected from nearly every locations and it is resistant to many antibiotics Serretia is gram negative and therefore has higher levels of antibiotic resistance.

Due to limited sample size, we were unable to draw a clear conclusion regarding our hypothesis, but our research does demonstrate the importance of further studies like ours.

Although no significant correlation between the presence of resistant bacteria and age could be drawn there was a noticeable presence of antibiotic-resistant bacteria across all the surfaces. Further research is necessary onto the topic given the importance of monitoring this potential health crisis.

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