

# Infections in Childcare Facility in Benghazi Medical Centre

## Abstract

Nowadays, as a result of an increasing proportion of families in which parents are in funded jobs, there has been a steady increase in the demand for care of young children. The present study investigated infections in childcare facility and The samples were taken by sterile cotton swabs from 39 different places, to know the different types of bacteria that in the nursery.. the results revealed that, 6 different types of dangerous bacteria which are (*Staphylococcus aureus*, *Klebsiella pneumonia*, *pseudomonas Aeruginosa*, *streptococcus viridians*, *Corynebacterium*, *Diphtheria*, *bacillus*, and *Enterobacteriaceae Serratia*.). All of the isolate's bacteria were found resistant to at least two antibiotics. Thirteen antibiotics were used in the sensitivity test which are: Cefotaxime, Azithromycin, Tetracycline, *Vancomycin*, *Cefixime*, *ceftolozane-tazobactam* test Doxycycline,, Ciprofloxacin, Ampicillin, Cefotazime, *Amikacin*, and Oxacillin. According to this study, 34% of isolates bacteria was (*Staphylococcus aureus*) and the most common diseases were (Influenza and Diarrhea).

**Keywords:** child, day-care, contaminations, infectious diseases, prevention.

## Introduction

“As a consequence of the percentage of households where both parents work for a living is rising, there has been a stable increase in the demand for children care. This is provided by informal arrangements for example care by relatives and friends, and by formal child care. When youngsters congregate, the risk of illness rises wherever they go. This problem is most noticeable in babies and young children who would typically clean their noses or wash their eyes with their hands before handling toys or interacting with other kids. These kids then touch their noses and rub their eyes, which is how the virus spreads from one child's nose or eyes to another through hands or toys, and the next kid rubs his own nose or eyes.

This is one of the reasons why kids get sick a lot in their early years of life because their bodies are building an immunity to infections”<sup>(1)</sup>.

The scientific literature also recognizes that control measures to reduce transmission of infectious diseases are effective and necessary to minimize the unfavourable consequences for collective health that can result from day care in groups <sup>(2-4)</sup> recommending infection control standards and practices for environments in which children are cared for together <sup>(5-8)</sup>.

“The higher of infections in children attending child care centres can be reduced by applying infection control policies. Despite this, such policies are unlikely to be put into practice without significant support, in the form of training, important advice and basic information that can be provided for workers in child care centres by the public health and clinical community. In numerous child care facilities, the staff simply cannot care for a sick child due to space or staff limitations. Every childcare facility should have a written set of clear policies which will inform and explain to both staff and parents how they can deal with children who are ill when they arrive at the facility, or who become ill whilst they are in these care facilities. Such policies will provide a rigid framework that will help both staff and parents make decisions when children are ill. Each facility staff member should understand the importance of illness avoidance in their day to day work routines. Practices such as appropriate hand washing, diapering, toileting, and food preparation, will limit the spread of bacteria and viruses and will promote a healthy child care environment”<sup>(9)</sup>.

“There are many factors that influence the risks of introduction and spread of infections in child care settings. These factors include the personal hygiene and health status of the staff who are working in centre and the children (as well as their ages) and the situation of the facility (e.g. environmental sanitation, space and quality, food-handling practices, policies for attendance, and ratio of children to caregivers”<sup>(10)</sup>).

“Studying day care-associated infectious disease dynamics aids in formulating evidence-based guidelines for disease control, thereby supporting day care centres in their continuous efforts to provide their child population with a safe and hygienic environment. Illness is common in children. While kids have developed

resistance to the pathogens that are common in their own homes, they will be exposed to a variety of new pathogens when they are around other children”<sup>(11)</sup>.

Long stretches of time might be spent by kids in nursery facilities. A child's risk of contracting an infection increases with the amount of time they spend in these environments and the number of other children they interact with. Therefore, while it is never practically possible to completely avoid infection, it is possible to significantly lower the risk. Thankfully, there are a few easy tactics and exercises that can significantly reduce the risk of infection in nursery environments<sup>(12)</sup>.

“One important idea regarding infectious disease is the ‘infectious dose’, this is the **number** of pathogens that are needed to make a person ill. The ‘infectious dose’ varies from pathogen to pathogen and from person to person, for example: salmonella pathogens. It takes between 1000 and 10,000 cells to make a healthy person ill, but as little as a few hundred to make a small child or elderly person ill. Another example is **Vero cytogenic** *E.coli* it takes less than five of the VTEC (**Vero cytogenic***E.coli*) pathogens to make healthy adults ill, so it will come as no surprise to know that cases of renal failure and deaths (which are not uncommon in cases of VTEC) are much more likely in small children and elderly people”<sup>(13-15)</sup>. “The spread of infections in child care centers is facilitated by crowding and microbial contamination of the childcare environment, as well as the unhygienic behaviors and greater susceptibility of young children”<sup>(16)</sup>.

“Child care workers and other adult contacts are also at increased risk of infections such as upper respiratory tract infection, gastroenteritis and hepatitis A. Concern has been expressed about acquisition of cytomegalovirus (CMV) by pregnant carriers, which may cause severe congenital infection, and parvovirus which may be associated with intrauterine death or stillbirth due to fetal hydrops”<sup>(17)</sup>.

## **Method**

The study was conducted in the child care center of Benghazi Medical Centre (BMC) in Benghazi in 2017. This study a cross-sectional study, it was based on swabs were taken from different places in the childcare center to know the different types of bacteria that could exist in the nursery. The samples were taken by sterile cotton swabs from 31 different places. The first 10 samples were taken in March 2017 from the following places (the handle out of the main entrance door, playing table in the TV room, chairs, beds, toys, studying tables, and staff office).

The second set of swabs were taken at June 2017 from different places (the handle out of the main entrance door, beds, changing table, toys, carpet, windows, eating tables, staff office, broom, wall, chair, building up game, and carpet of the playing room, toilet (tap water1, tap water2, toilet seat 1, toilet seat2)

## **Results**

Cultural and biochemical characterization of bacteria isolated from targeted sites showed the presence of seven species of bacteria, namely: *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Streptococcus viridians*, *Staphylococcus aureus*, *Corynebacterium diphtheria*, *Bacillus*, *Serratia*. They were identified as follows:

### **Identification of *Klebsiella pneumoniae*:**

Gram-negative rods gave positive citrate and urease test. It appeared lactose fermented mucoid pink colonies on MacConkey agar (Fig8) and confirmed by TSI media (acid in butt and slant with production of gas and H<sub>2</sub>S)(fig9)

### **Identification of *Pseudomonas aeruginosa*:**

Gram negative rod, motile, gave large, flat, haemolytic colonies on blood agar (fig10). The isolates have a distinctive smell due to aminoacetophenone production, whereas on MacConkey agar, it showed non-lactose fermenting colonies with yellow-green pigment (fig11) their biochemical reaction gave positive oxidase test (fig12)

### **Identification of *Staphylococcus aureus*:**

Which appeared as yellow colonies on blood agar (fig13) and gave orange colonies on MacConkey agar (fig14). The identification was by production of catalase enzyme (fig15) both coagulase test (fig16) and DNase test showed a positive reaction(fig 17)

#### ***Identification of Streptococcus viridians:***

Gram positive, diplococci **non capsulated** bacteria, facultative anaerobic, producing a green coloration on blood agar (fig 18) or alpha-haemolytic and resistant to (op) optochin antibiotic disc, (fig19).

#### **Identification of Corynebacterium:**

Gram positive, aerobic, rod shape (fig 20), cultivated on blood agar (fig 21) with 5% defibrinated sheep blood smooth convex colonies with entire margin cultivation 24 hours, 37°C in an aerobic atmosphere enriched with 5% carbon dioxide<sup>(18)</sup>. For species differentiation further testing required.

#### **Identification of Bacillus**

*Bacillus* is a genus of Gram-positive, rod-shaped bacteria (figure 22) and a member of the phylum Firmicutes, showed gray **non**hemolytic colonies on blood agar (figure 23). “*Bacillus* species can be obligate aerobes (oxygen reliant), or facultative anaerobes (having the ability to be aerobic or anaerobic). They will test positive for the enzyme catalase when there has been oxygen used or present”<sup>(18-20)</sup>. Ubiquitous in nature, *Bacillus* includes both free-living (non-parasitic) and parasitic pathogenic species, they grow in Sheep blood agar (SBA) Colonies are non-hemolytic, flat or slightly convex with irregular edges and ground-glass appearance. There are often comma-shaped projections from the colony edge producing a “Medusa-head” colony.No growth on MacConkey agar.

#### **Identification of Serratia.spp :**

Genus of Gram-negative, facultatively anaerobic, red pigment on MacConkey agar fig (24), endospore forming <sup>(22)</sup>rod-shaped bacteria of the Enterobacteriaceae family. “The most common and pathogenic of the species in the genus, *S. marcescens*, this normally the only pathogen and usually causes nosocomial infections. However, rare strains of *S. plymuthica*, *S. liquefaciens*, *S. rubidaea*, and *S. odoriferae* have caused diseases through

infection”<sup>(23)</sup> “*S. marcescens* is typically found in showers, toilet bowls, and around wetted tiles. Members of this genus produce characteristic red pigment, prodigious, and can be distinguished from other members of the *Enterobacteriaceae* family by their unique production of three enzymes: DNAs, lipase, and gelatinase”<sup>(23)</sup> .

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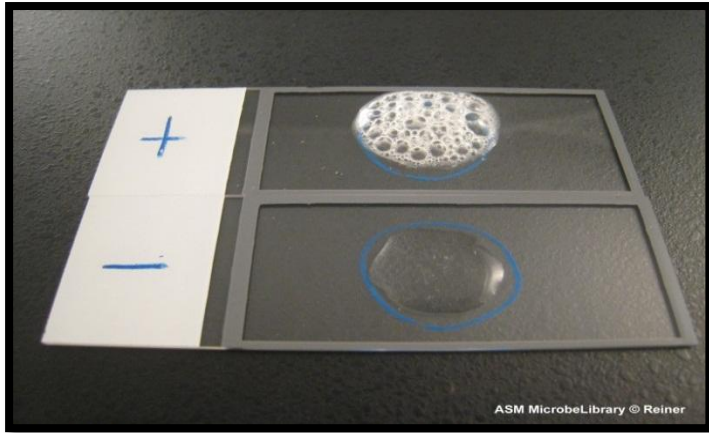


Figure 1 catalase test

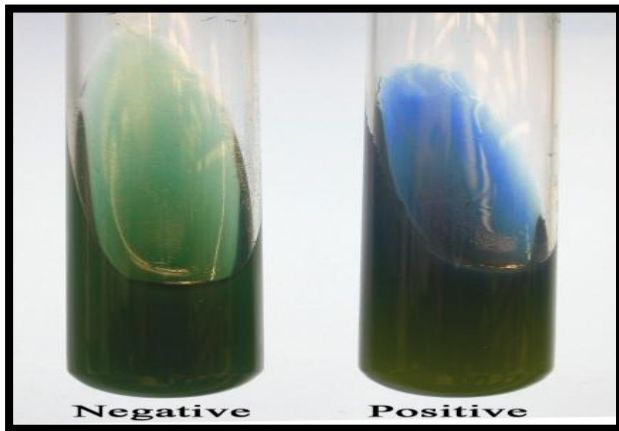


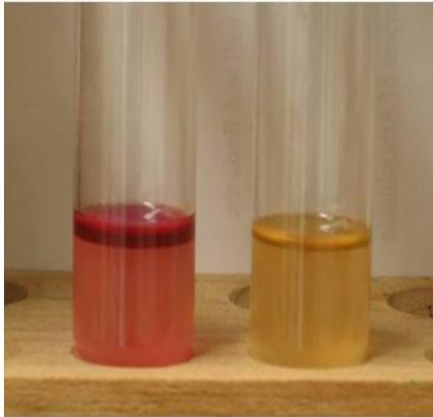
Figure 4 urease test



Figure 1 coagulase test



Figure 3 citrate utilization test



(+) Indole test on left — (-) Indole test on right

Figure 2 TSI test

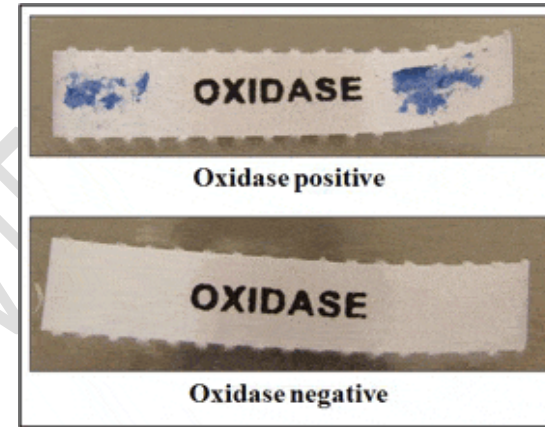


Figure 6 oxidase test

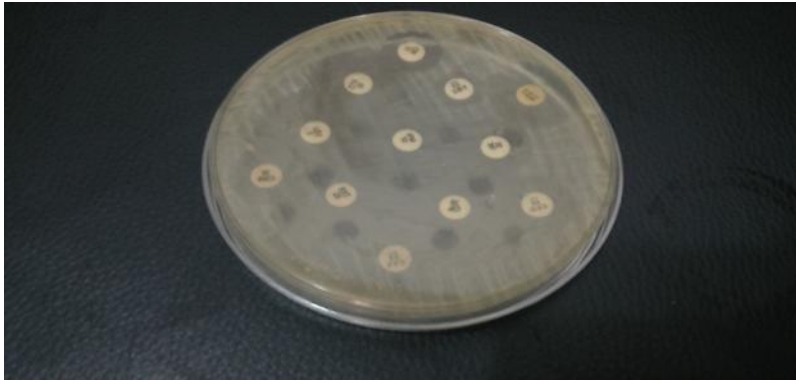


Figure 7 Sensitivity test to antibiotics

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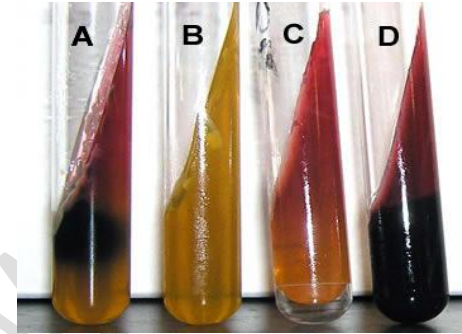


Figure 8 *K.pneumoniae* on Figure 9 *k.pneumoniae* on MacConkey

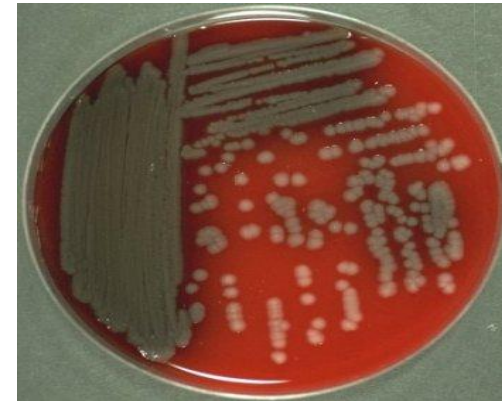
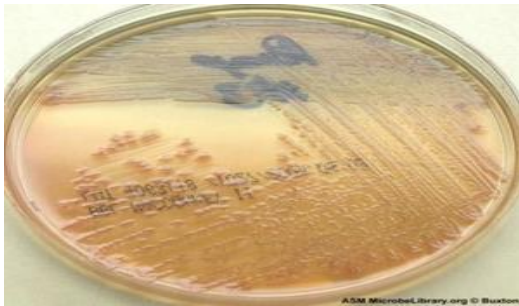


Figure 11 *pseudomonas aeruginosa* on MacConkey Agar Figure 10 *pseudomonas aeruginosa* on blood agar

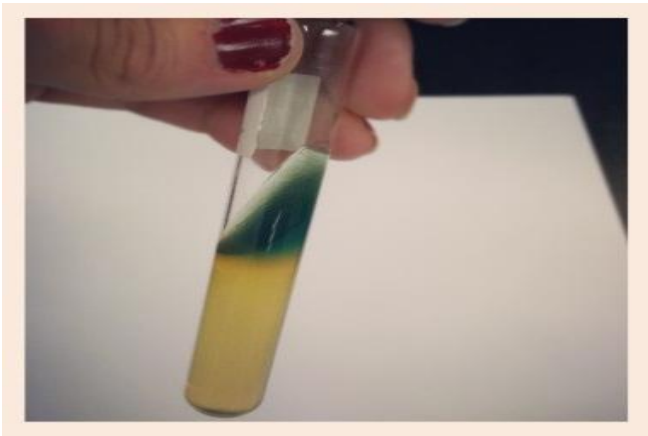


Figure 12 pseudomonas aeruginosa on oxidase test

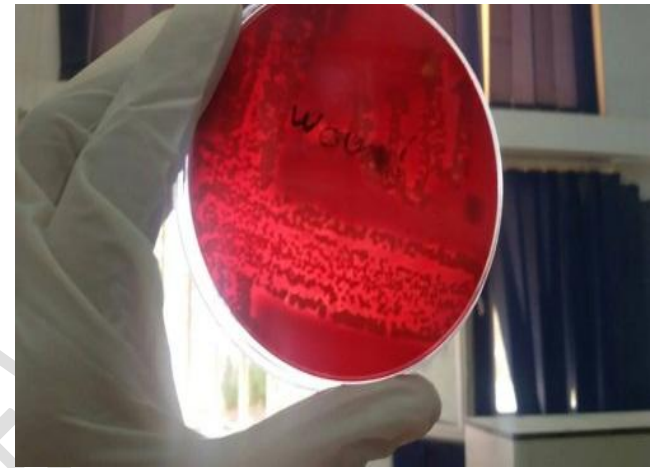


Figure 13S .aureues on blood agar



Figure 14S. aureus on MacConkey agar



Figure 15S. aureus on catalase



Figure 16 S.aureus on coagulase

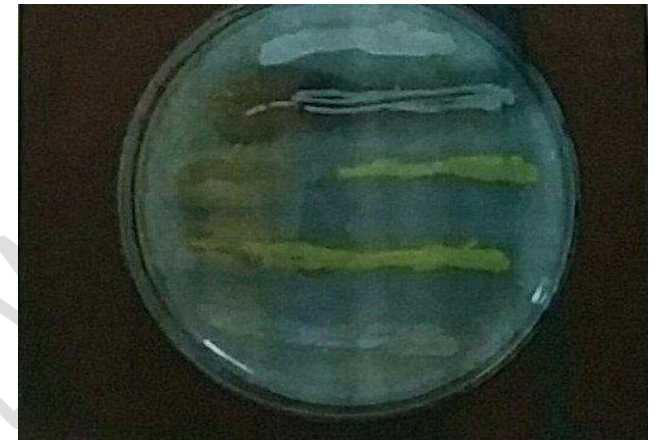


Figure 17 S.aureus on DNA test

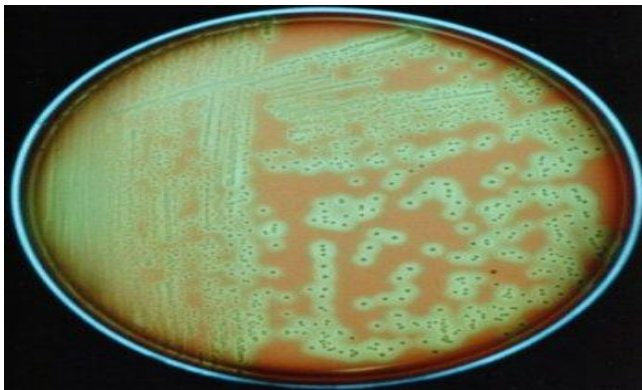


Figure 18 viridians on blood agar



Figure 19 viridians resistant to(opto)optochin antibiotic



Figure 20 Corynebacterium on blood agar

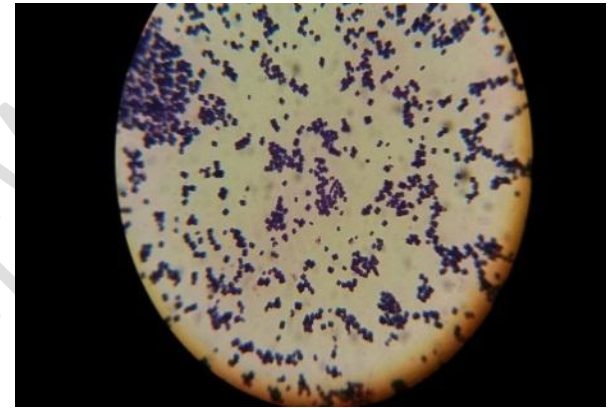


Figure 21 Corynebacterium on microscope

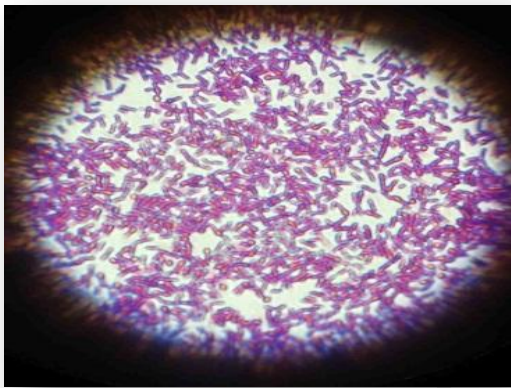


Figure 22 bacillus under microscope



Figure 23 bacillus on blood agar

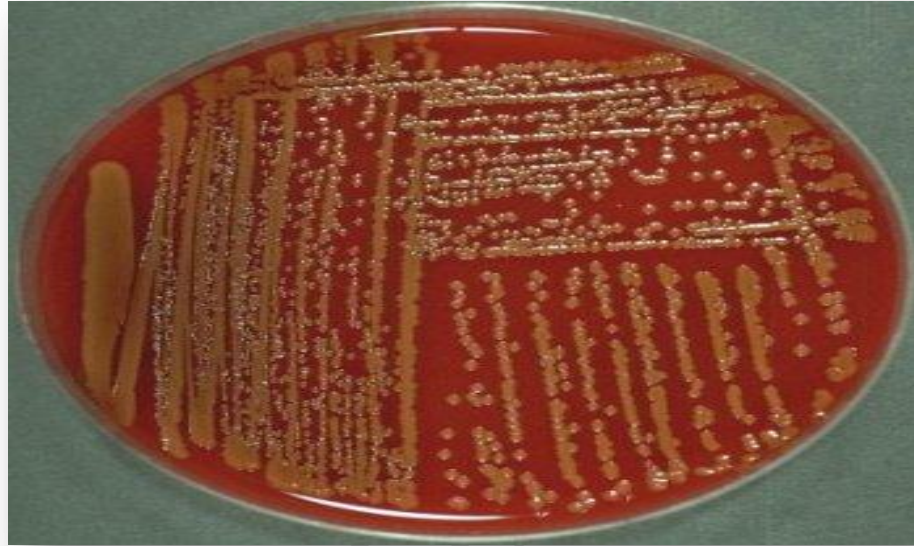


Figure 24 *Serratia* on MacConkey

**Table(1):Table of antibiotic resistance**

Isolate Bacteria	DO+	SXT	Cip	IMP	CAZ	CIX	AZM	TE	VA+	FOX	CT_	AK	OX+	OP+	D+N	R	S
<i>Bacillus Spp</i>	R	R	S	S	R	R	R	R	R	R	R	S	R	-	-	60	20
<i>Bacillus</i>	K	R	S	S	R	R	R	R	R	R	R	S	R	-	-	60	20
<i>Corynebacterium Spp</i>	R	R	S	S	R	R	R	S	R	R	R	R	S	-	-	33.3	46.7
<i>S. Aureus</i>	S	R	S	S	S	S	R	R	R	R	R	S	S	-	-	40	40
<i>Bacillus</i>	R	R	S	S	R	R	S	S	R	R	S	S	S	-	-	33.3	46.7
<i>K. pneumonia</i>	-	S	S	S	R	S	R	R	R	-	R	R	-	-	-	33.3	20
<i>Viridians</i>	S	R	S	S	S	S	R	R	R	R	S	S	R	R	-	46.7	46.7
<i>K.pneumoniae</i>	-	R	S	S	R	R	S	S	-	R	S	S	-	-	-	26.7	40
<i>Serratia.Spp</i>	-	R	S	S	S	R	S	S	-	R	R	R	-	-	-	33.3	33.3
<i>Serratia.spp</i>	-	R	S	S	R	R	S	S	-	R	R	R	-	-	-	40	26.7

Coagulase Negative. Staph	S	R	S	S	R	R	S	S	S	S	–	S	S	–	S	20	66.7
<i>CN</i>	R	R	R	S	R	R	S	R	R	S	–	S	R	–	S	53.3	33.3
<i>K.pneumoniae</i>	–	R	S	S	R	R	R	R	–	R	S	S	–	–	–	40	26.7
<i>Streptavidin's</i>	S	R	S	S	S	S	S	R	S	R	–	S	S	R	–	26.7	60
<i>K.pneumoniae</i>	–	R	S	S	S	R	S	S	–	R	S	S	–	–	–	20	46.7
<i>Pseudomonas Aeruginosa</i>	–	R	S	R	R	R	S	R	–	R	S	S	–	–	–	40	26.7
<i>Bacillus. Spp</i>	S	S	S	S	R	R	S	S	S	R	–	S	S	–	–	20	60
<i>Serratia.Spp</i>	R	S	S	R	R	R	S	S	–	R	S	S	–	–	–	33.3	40
<i>S.aureus</i>	S	R	S	S	S	R	S	R	S	R	–	S	R	–	–	33.3	46.7
<i>K.pneumoniae</i>	–	R	S	S	R	R	S	S	–	S	S	S	–	–	–	20	46.7
<i>S.aureus</i>	S	R	S	S	R	R	R	R	S	R	–	S	R	–	–	40	33.3
<i>Serratia</i>	–	R	S	S	R	R	R	R	–	S	S	S	–	–	–	33.3	33.3

S= Sensitive, R= resistant, Do= Doxycycline, SXT=Septrin , Cip= Ciprofloxacin, Imp= Impicillin , Caz= Cefotaxime , Cix= Cefotaxime , Azm=Azithromycin, TE= Tetracycline, VA+= Vancomycin, Fox= Cefoxime, CT- =ceftolozane-tazobactam , AK=Amikacin, OX+= Oxacillin,

Levels of antibiotic resistance were obtained among the bacterial isolates and ranged between (6.7% - 80%) the highest ranges of bacteria were 80% *S. aureus* and 60% *Bacillus Spp* All the bacterial isolates from the daycare were resistance towards two or more antibiotic.

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## Discussion

According to the swabs results that were taken from the nursery in Benghazi Medical Center, the highest rates of bacteria were *S. aureus* 34.5%. It was found in (kid's games, carpet nursery, window glass, broom, wall, children's chairs, games installation, bathroom wall, toilet and rug).

It is recognized as a common cause of boils and soft tissue infections as well as more serious conditions such as pneumonia or bloodstream infections <sup>(24)</sup>. It also may cause infection in bone, brain and heart <sup>(25)</sup>.

Followed by *Bacillus. Spp* 17.24% the most two bacillus species that considered medically significant are *B.anthraxis* which causes "anthrax" and *B.cereus* which causes food poisoning <sup>(26)</sup>. These two types of bacteria were found in (children bed, Bed change diapers, carpet nursery, bathroom faucet and External door handle).

In addition, both *K.pneumoniae* and *Serratia. spp* have the equal rates with 13.8%. *Serratia* is an opportunistic human pathogen. *K. pneumoniae* is a normal flora in the human intestines, mouth and skin <sup>(27)</sup>, but it's well known as an important cause of community-acquired bacterial pneumonia, and most frequent site of infection is in the urinary tract <sup>(28)</sup>. As well as, both of them can cause infections in Blood stream, wounds <sup>(29-30)</sup>.

According to the *Centers for Disease Control and Prevention (CDC)* there are an estimated 51,000 healthcare-associated *P. aeruginosa* infections every year in the United States healthcare centers <sup>(31)</sup>.

Common hospital-associated *P. aeruginosa* infections include Urinary tract infection, wounds and burns and also bloodstream infections <sup>(32)</sup>.

Furthermore, *Diphtheria.spp* and *S. viridians* with rate 3.4%. It's a pathogenic bacterium, causes (*Diphtheria*).

Although, these occurrences were not too high, the presence of such bacteria in child day care could cause a serious health risk, especially diphtheria. According to *Centres for Disease Control and Prevention (CDC)* it was a major cause of

illness and death among children, diphtheria is known as childhood disease and own a comprehensive routine vaccination programs, in developed countries the coverage of vaccination is high, but it's low in some countries as (India, Indonesia). So, the circulation of toxigenic *C. diphtheria* continues.

In 2013, 4,680 diphtheria cases globally were reported to the world Health Organization (WHO)<sup>(33)</sup>, and also infection maybe occur to kids which vaccines already exist, or they were under the age of vaccination or even has been abandoned.<sup>(34)</sup>

*S. viridians* is normally found in mouth, gastrointestinal system, upper respiratory tract and genitourinary tract. The *S. viridians* normally do not harm healthy people but may cause disease in people with compromised immune systems. One of the diseases is called Endocarditis: the inflammation of the inner lining of the heart. This can damage the heart's valves and lead to heart failure <sup>(35)</sup>. There are some diseases whose risk is increased for children like:

“Otitis media, it's one of the most common bacterial infection in childhood, and a common cause of auditory acuity in childhood”<sup>(36)</sup>. “Respiratory infections, and are the most common cause of childhood disease and Children who attend daycare are suffering more sever and more in number, Finally the diarrheal diseases, these diseases are an important problem in daycare centers where the microbes are transmitted by direct contact, person to person, or indirectly. Kids who attend daycare have an increased risk of being hospitalized, and also Rotavirus infection is responsible for 20 to 60% of hospital admissions of children due to diarrhea. And Studies show that increased frequency of respiratory disease and diarrhea at daycare centers where hand washing is insufficient, also changing Diaper is considered as a high risk for transmission of enteric pathogens between children and workers at daycare centers”<sup>(37)</sup>.

### **Antimicrobial Susceptibility:**

Among the isolated bacteria there were high levels of them resistant to antibiotics (6.7%-80%). Over the past decades, there were many antimicrobial classes that have been developed. Unfortunately, bacterial resistance against antibiotics has

been shown in all its varieties. Some bacteria that were found in the nursery and could develop their resistance to antibiotics are; *S.aureus*(Methicillin-Resistant *S. Aureus*) and Carbapenem-Resistant *Enterobacteriaceae*. According to WHO *S. aureus* (Methicillin-Resistant *S. Aureus* MRSA) can be very serious, where in U.S there were 11,285 Deaths Per year.

**Moreover**, Carbapenem-Resistant *Enterobacteriaceae* is Resistant to nearly all the available antibiotics <sup>(38)</sup>. In addition, the most type of (CRE) is *K. pneumoniae*. *P. aeruginosa*, may become Multi Drug Resistant (MDR) and its infection is often severe and difficult to treat <sup>(39)</sup>. In addition to unsanitary practices and young children's increased sensitivity, child care facilities' overcrowding and microbial contamination of the environment all contribute to the development of diseases. For these reasons we recommended that, maintain receiving the advised vaccinations at the proper ages, It is important for childcare providers to be up to date on their vaccinations. The main strategy for decreasing transmission of infection is to wash hands with warm running water and soap. Every surface and item should be selected with ease of cleaning in mind. To eradicate germs from contaminated goods, toys and surfaces should be vigorously cleaned every day with water and a neutral detergent. When controlling enteric illness outbreaks, disinfectants should be used as an adjunct; in these cases, the disinfectant should be selected according to the pathogen. Consult a hospital microbiologist or infection surveillance specialist for specific guidance. The best ways to prevent the spread of enteric infections are to make sure that carers have not changed diapers before handling food during the same shift, that there is little to no contact between younger children and older children, and that staff members do not care for both age groups simultaneously. Child care providers should get rigorous in-service training that addresses illness transmission pathways, vaccinations, and cleanliness (including regular hand washing).

## **Conclusion**

It has been found that, there are several harmful bacteria (*S.aureus* , *K.pneumonia* , *P.aeruginosa* , *S.viridians*, *C.diphtheria* , *bacillus* and *EnterobacteriaceaeSerratia*.) and some of them resistant to different types of antibiotics (Cefotaxime , Azithromycin, Tetracycline, Vancomycin, Cefoxitin, ceftolozane-tazobactamtest Doxycycline, Septrin , Ciprofloxacin, Ampicillin,

Cefotazime, Amikacin, Oxacillin). These harmful bacteria spread inside the child day care and it's had negatively effect on their health. Especially, the nursery is located inside the hospital that makes the possibility of increasing spread of bacteria more than any other nursery. Finally, infection control policies should be implemented in the correct manner to prevent transmission of infection among children and staff.

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#### Ethical Approval

There were no ethical issues and this study was conducted after submitting an official application paper from the Arab Medical University to BMC Hospital and it was officially approved for data collection.

#### Conference disclaimer:

Some part of this manuscript was previously presented and published in the conference: 3<sup>rd</sup> Libyan Conference on Medical and Pharmaceutical Sciences 2019, Janzur 2019 Web Link of the proceeding: <https://www.researchgate.net/profile/Rima-Ali>

## References

1. Council on Early Childhood (2017 American Academy of Pediatrics)/ Reducing the Spread of Illness in Child Care (accessed2017)available online at <https://www.healthychildren.org/English/health-issues/conditions/prevention/Pages/Prevention-In-Child-Care-or-School.aspx>
2. . Mann V, Buffett C, Campbell M, Lee K, O'Donnell R. Effectiveness of day care centre infection control interventions. Ontario: Ontario Ministry of Health; 1999. Disponívelem: <http://old.hamilton.ca/phcs/ephpp/Research/Full-Reviews/98-99/Day-Care-Centre-Infection-Control-review.pdf>. [accessed:21/5/2017]
3. Aiello AE1, Larson EL. Lancet Infect Dis. 2002 Feb;2(2):103-10. What is the evidence for a causal link between hygiene and infections? <https://www.ncbi.nlm.nih.gov/pubmed/11901641>
4. Ejemot RI1, Ehiri JE, Meremikwu MM, Critchley JA/. Hand washing for preventing diarrhoea. 2008 Jan 23(accessed2017)available online at <https://www.ncbi.nlm.nih.gov/pubmed/18254044>
5. American Academy of Pediatrics American Public Health Association National Resource Center for Health and Safety in Child Care2002/Caring for Our Children: National Health and Safety Performance Standards (accessed2017) available online at <http://fcs.sites.mjc.edu/PerformanceStandards.pdf>
6. Canadian and handwriting ergonomics Well beings: a guide to promote the physical health, safety and emotional well-being of children in child care centres and family day care homes. 2nd ed. Ottawa: Canadian Paediatric Society; 1992[accessed2017]available online at. <https://books.google.com.ly/books?isbn=0203609166>
7. Australia. National Health & Medical Research Council. Staying healthy in child care. 3rd ed. [on line]. Canberra: National Health & Medical Research Council; 2001. Disponívelem:. Acesso:2017. <http://www.nhmrc.gov.au/publications/synopses/ch40syn.htm>

8. United Kingdom. Department for Education and Skills. Full day care: national standards for under 8s day care and childminding. Great Britain: Department for Education and Skills; 2001a. Disponível em: Acesso: 2017 <http://www.surestart.gov.uk/doc/P0000411.PDF>
9. Preventing Illness in Child Care Settings Community Care Facilities Branch Ministry of Planning Victoria, BC V8W 3C8 Revised 2003 [accessed 2017] available online at <http://www.health.gov.bc.ca/library/publications/year/2003/com018.pdf>
10. Chris Anna M. Mink, MD\* Sylvia Yeh, MD. Infections in Child-care Facilities and Schools, 2009. available online <http://pedsinreview.aappublications.org/content/30/7/259> [last accessed ....]
11. Timothy R. Shope/ Infectious Diseases in Early Education and Child Care Programs May 2014 (accessed 2017) available online at, <http://pedsinreview.aappublications.org/content/35/5/182>
12. Dr Paul McKeown (Chair) Management of Infectious Disease in Childcare Facilities and Other Childcare Settings Preschool and Childcare Facility Subcommittee in Septembers 2007 May 2014 [accessed 2017] available online at [http://www.tusla.ie/uploads/content/Pre\\_School\\_ManagementInfectiousDisease.pdf](http://www.tusla.ie/uploads/content/Pre_School_ManagementInfectiousDisease.pdf)
13. Matson DO. Viral gastroenteritis in day care settings: epidemiology and new developments. Pediatrics. 1994 [accessed 2017] available online at <https://www.ncbi.nlm.nih.gov/pubmed/7971090>
14. Morrow AL, Townsend IT, Pickering LK. Risk of enteric infection associated with child day care. Pediatr Ann. 1991 available online at [http://www.scielo.br/pdf/jped/v83n4/en\\_v83n4a04.pdf](http://www.scielo.br/pdf/jped/v83n4/en_v83n4a04.pdf)
15. Staat MA, Morrow AL, Reves RR, Bartlett AV, Pickering LK. Diarrhea in children newly enrolled in day-care centers in Houston. Pediatr Infect Dis J. 1991; [accessed 2017] available online at <https://www.ncbi.nlm.nih.gov/pubmed/2062623>
16. Mark J Ferson Infection control in child care settings : 27 November 1997 [accessed 2017] available online at <http://www.health.gov.au/internet/main/publishing.nsf/content/cda-pubs-cdi-1997-cdi2122-cdi2122a.htm>
17. Communicable Diseases Intelligence Volume 21 Issue, Number 22, contains

- an outline of infection risk factors in childcare centres and preventative measures for management of infectious diseases
18. Sample Infection Control Policy D.C.C.C2010(accessed2017)available online at <http://www.donegalchildcare.com/wp-content/uploads/2015/08/Sample-infection-control-policy-2010.pdf>
  19. Turnbull PCB (1996). Baron S; et al., eds. Bacillus. In: Barron's Medical Microbiology (4th ed.). Univ of Texas Medical Branch Chesbrough, 2005).
  20. Turnbull PCB (1996). Baron S; et al., eds. Bacillus. In: Barron's Medical Microbiology (4th ed.). Univ of Texas Medical Branch. ISBN 978-0-9631172-1-2.
  21. Basilio J Anía (21 October 2015). "Serratia". Medscape.
  22. -Basilio J. Anía, M.D. "Serratia". eMedicine. Retrieved 2007-03-14.
  23. "Serratia". University of Texas at Houston Medical School. Archived from the original on 2007-01-28. Retrieved 2007-03-14.
  24. Minnesota Department of Health. Causes and Symptoms of Staphylococcus aureus; 2014. [accessed 12\5\2017]Available online at <http://www.health.state.mn.us/divs/idepc/diseases/staph/basics.html>
  25. Anne L.Fritz. EveryDayHealth.What is a staph infection. (2015). [accessed 1\6\2017] Available online at <https://www.everydayhealth.com/staph-infection/guide>
  - 26.Samuel Baron. Medical Microbiology. University of Texas Medical Branch at Galveston, Galveston, Texas 1996. [accessed 1/6/2017] available online at <https://www.ncbi.nlm.nih.gov/books/NBK7699>
  27. KENNETH J. RYAN and C. GEORGE RAY . Sherris Medical Microbiology (2004). (4th ed.)
  28. Podschun, R; Ullmann, U (October 1998). "Klebsiella spp. as Nosocomial Pathogens: Epidemiology, Taxonomy, Typing Methods, and Pathogenicity Factors" Clinical Microbiology Reviews. [accessed 7\2017] available online at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC88898/>
  29. Joseph Bennington-Castro. everyday health. What Is Klebsiella Pneumoniae. (2015) [accessed13\7\2017] available online at <https://www.everydayhealth.com/klebsiella-pneumoniae/guide/>
  30. Steven D. Mahlen. Serratia Infections: from Military Experiments to Current Practice. National Center for Biotechnology Information, U.S. National Library of

- Medicine , 2011 Oct 24[ accessed 13\7\2017] available online at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3194826/>
31. Joseph Bennington-Castro Pseudomonas Aeruginosa. Everyday health.(2015) [accessed 20\8\2017] available online at <https://www.everydayhealth.com/pseudomonas-aeruginosa/guide>
32. Kenneth Todar, Pseudomonas aeruginosa. Online Textbook of bacteriology. [accessed 20\8\2017] available online at <http://textbookofbacteriology.net/pseudomonas.html>
33. Sabrina Weiss; Androulla Efstratiou ; antimicrobe.com. Corynebacterium diphtheriae (Diphtheria). [accessed 20\8\2017] available online at <http://www.antimicrobe.org/b99.asp#top>
34. Maria M. M. Nesti , Infectious diseases and daycare and preschool education. Scielo , (2017) [accessed 9\2017] available online at [http://www.scielo.br/scielo.php?pid=S002175572007000500004&script=sci\\_art\\_text&tlng=en](http://www.scielo.br/scielo.php?pid=S002175572007000500004&script=sci_art_text&tlng=en)
35. Artem cheprasov.Study.com. Strep Viridans: Infection & Treatment.(2017). [accessed 1\9\2017] available online at <http://study.com/academy/lesson/strep-viridans-infection-treatment.html>
36. Zielhuis GA, Heuvelmans–Heinen EW, Rach GH, van den Broek P. Environmental risk factors for otitis media with effusion in preschool children. Scand J Prim Health Care. 1989; 7:33–8.
37. Maria M. M. Nesti , Infectious diseases and daycare and preschool education. Scielo , (2017) [accessed 9\2017] available online at [http://www.scielo.br/scielo.php?pid=S002175572007000500004&script=sci\\_art\\_text&tlng=en](http://www.scielo.br/scielo.php?pid=S002175572007000500004&script=sci_art_text&tlng=en)
38. C. Lee Ventola, MS. The Antibiotic Resistance Crisis. National Center for Biotechnology Information, U.S. National Library of Medicine 2015 Apr. [accessed 1\9\2017] available online at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4378521>
39. Valerie Aloush,<sup>1</sup> Shiri Navon-Venezia,<sup>2</sup> Yardena Seigman-Igra,<sup>2</sup> Shaltiel Cabili,<sup>1</sup> and Yehuda Carmeli<sup>2,\*</sup>. Multidrug-Resistant Pseudomonas aeruginosa: Risk Factors and Clinical Impact. National Center for Biotechnology Information, U.S. National Library of Medicine 2006 Jan.[ accessed 13\9\2017] available online on <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1346794/>