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Prevalence of Nosocomial Infections in Egypt Teaching Hospitals

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Abstract: *This study aimed to isolate and investigate the nosocomial infections in some teaching hospitals in Giza governorate in Egypt. The samples were collected randomly from the air of the delivery rooms and nursing rooms from five teaching hospitals. Ninety samples were collected from the delivery rooms showed 83.33 % positive result for the growth of bacteria, while 74.28 % showed a positive result for the growth of bacteria than seventy air samples collected from nursing rooms. The isolated bacterial species were identified as follows: Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus agalactiae, Streptococcus pyogenes, Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia and Klebsiella oxytoca. Staphylococcus aureus was the highest percentage of bacteria that isolated from the delivery rooms and nursing rooms in all hospitals under study as 61.5% and 38.5%, respectively. Staphylococcus aureus, Staphylococcus epidermidis and Bacillus cereus were more dominant types of bacteria that isolated from the delivery rooms in hospitals were be tested. While Staphylococcus aureus and Escherichia coli showed more dominant organism isolated from nursing rooms in all examined hospitals. The effect of disinfectants commonly used in hospitals to bacterial species isolated showed some bacteria resistant clear about these disinfectants, while some bacterial species showed relative resistance to various concentrations of these disinfectants.*
Keywords*: Nosocomial Infections, delivery rooms ,nursing rooms, teaching hospitals, disinfectants.*

I. Introduction

Bacterial infections still play a major role in diseases in Egypt. The air is not an appropriate way for the growth of pathogenic bacteria, any pathogen, which must be airborne to have originated from a source such as humans, animals, plants, soil, and food or water [1].

More people die each year from hospital infections [2]. Although many of the pathogens that can cause infections in hospitals, but those that are able to survive in the hospital environment for long periods and resistance cleansing also of particular importance in this regard. Perhaps the most important reason *Streptococcus pyogenes* infection hospitalized previously but not a coincidence, now than ever before as it is susceptible to antibiotics. Strains of *Staphylococcus aureus*, resistant to multiple antibiotics and belong to phage type 80 hospitals colonization and infection caused hospitals [3,4].

Staphylococcus epidermidis and group D streptococci are sometimes responsible for nosocomial infections. Gram-negative bacilli intestinal, *Escherichia coli*, *Klebsiella* sp., *Enterobacter* sp., *Proteus* sp. and *Neisseria* sp., it become the most important group of pathogens in the hospital [5], it's always been the most important causes of infection in hospitals because of the intrinsic resistance to most antibiotics, and the ability to survive and reproduce even at low temperatures and disinfectant solutions [3], [6] who mentioned that testing of the piping of new hospital showed that the drinking water was contaminated with *Pseudomonas aeruginosa*.

Bacillus cereus was isolated from hospital patients as a causative factor for the outbreak of the hospital [7]. Hospital infections is still a significant problem in intensive care units [3]. Also, [1] showed that bacteria transmitted through the air in the environment and is believed to be the cause of infection after surgery. [8] Evaluated the presence of bacteria in food and the environment of an iconological service of the National hospital.

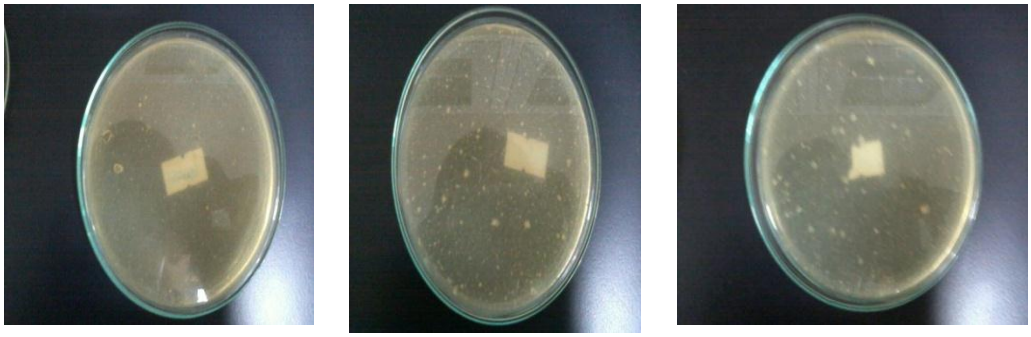
The effective use of antiseptics and disinfectants and sterilization procedures is important in the prevention of nosocomial infections, and agents of material such as moist heat or dry, and played a key role in the sterilization, the sterilization depends on a variety of factors , including the degree of killing germs required and the nature of the item or the surface to be treated [9].

The objective of this research was to isolate and identify strains of pathogenic bacterial contamination in the air that spread predominantly in the delivery rooms and nursing rooms and study the effect of the common antiseptics used in the hospital to inhibit the growth of these isolated bacterial.

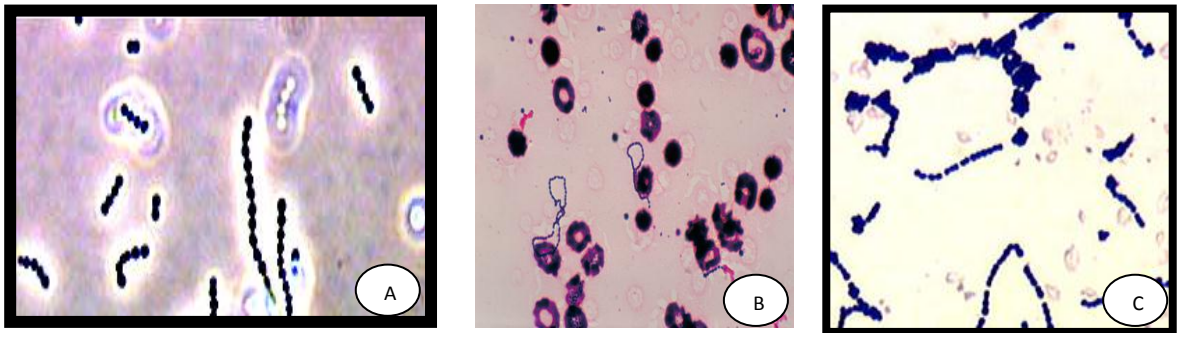
II. Material and Methods

Sample collections:

This study was conducted in the five teaching hospitals distinct Giza governorate in Egypt from June to August 2013. The samples monitoring microbial contamination of the air areas under study using the technique of sedimentation open Petri dishes containing different media. This media have been exposed in room air for 4 hours and then close the Petri dishes. Dishes were planted in many places of the delivery rooms and nursing rooms at different distance from the ground. After collecting samples directly taken Petri dishes for further bacteriological analysis. Preparation has been done Figure (1), the isolation and identification of bacterial species according to [10].



Figure(1): Illustrated pathogenic bacterial which isolated from the air hospitals.



Figure(2): (A), (B) and (C) Shapes of pathogenic bacterial growth isolated from teaching hospitals under light microscopy.

The susceptibility of the isolated organisms towards antiseptics was tested by using the cup -plate diffusion technique described by [11], on Mueller- Hinton agar four cups (8 mm) were cut using a sterile cork borer and then inoculated, the four cups were filled with 0.1 mL of each antiseptic concentrations (100, 90, 80, 70, 60 and 50%) by using adjustable volume digital pipette and allowed to diffuse at room temperature for 2 h, the plates were then incubated in upright position at 37°C for 18 h. Growth inhibition zones were measured.

III. Result

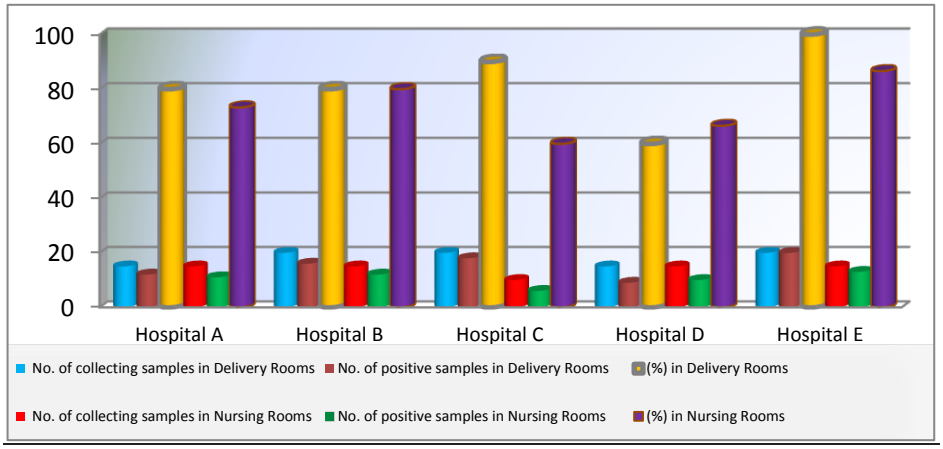
The number and percentage of isolated bacteria from Delivery and Nursing rooms :

The origin of the samples that have been collected from Delivery rooms in different hospitals in Giza governorate are 90 samples, 75 of them (83.33%) showed positive bacteria growth. The percentage of positive samples were 80 ,80 , 90, 60 and 100 % from five hospitals in Giza governorate (Table 1).
The number of samples that have been collected from the Nursing rooms in hospitals in Giza governorate 70

samples, 52 of them (74.28 %) showed positive bacteria growth, the individual percentages of positive samples are 73.33, 80 , 60, 66.6 and 86.6 respectively, in hospitals under study Table (1) & figure (3).

Table 1: Number and percentage of positive bacterial growth from Delivery and Nursing rooms at Giza governorate hospitals.

Hospitals	Delivery Rooms			Nursing Rooms		
	No. of collecting samples	No. of positive samples	Percentage (%)	No. of collecting samples	No. of positive samples	Percentage (%)
A	15	12	80.0	15	11	73.33
B	20	16	80.0	15	12	80.0
C	20	18	90.0	10	6	60.0
D	15	9	60.0	15	10	66.6
E	20	20	100.0	15	13	86.6
Total	90	75	83.33	70	52	74.28



Figure(3): Number of positive bacterial growth from Delivery and Nursing rooms.

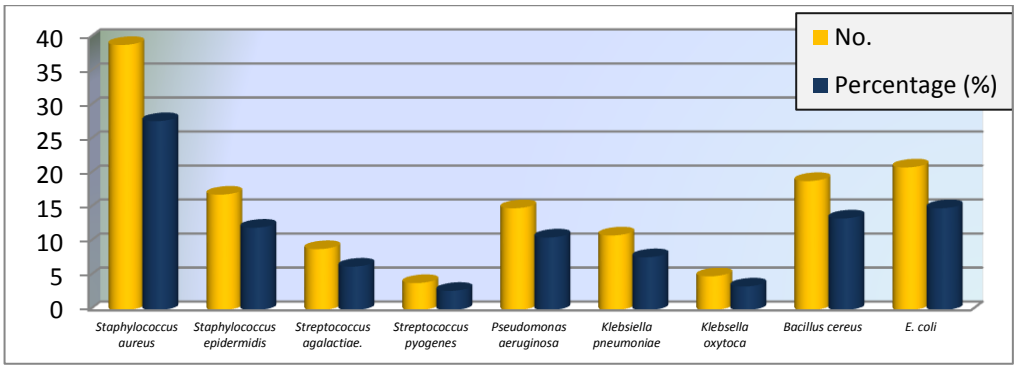
The number and percentage of bacterial species isolated:

Bacterial isolates were identified according to the morphological appearance, cultural characteristics and biochemical reactions as gram-positive bacteria which identified as *Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus agalactiae, Streptococcus pyogenes,* and *Bacillus cereus.* The Gram-negative bacteria were identified, such as *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia, Klebsiella oxytoca.*

As shown in Table (2) & figure (4). 140 microorganisms were isolated from the delivery and nursing rooms of all hospitals that have been studied, These were also classified as *Staphylococcus aureus* 39 (27.8%), *Staphylococcus epidermidis* 17 isolates (12.14%), *Streptococcus agalactiae* 9 isolates (6.42%), *Streptococcus pyogenes* 4 isolates (2.85%), *Pseudomonas aeruginosa* 15 isolates (10.7%), *Klebsiella pneumonia* 11 isolates (7.8%), *Klebsella oxytoca* 5 isolates (3.5%), *Bacillus cereus* 19 isolates (13.5 %) and *E. coli* 21 isolates (15%).

Table 2: Number and Percentage of pathogenic bacteria isolated from Giza governorate hospitals.

Organisms	No.	Percentage (%)
Staphylococcus aureus	39	27.8
Staphylococcus epidermidis	17	12.14
Streptococcus agalactiae.	9	6.42
Streptococcus pyogenes	4	2.85
Pseudomonas aeruginosa	15	10.7
Klebsiella pneumoniae	11	7.8
Klebsella oxytoca	5	3.5
Bacillus cereus	19	13.5
E. coli	21	15.0
Total	140	



Figure(4): Number and Percentage of pathogenic bacteria isolated from Giza governorate hospitals.

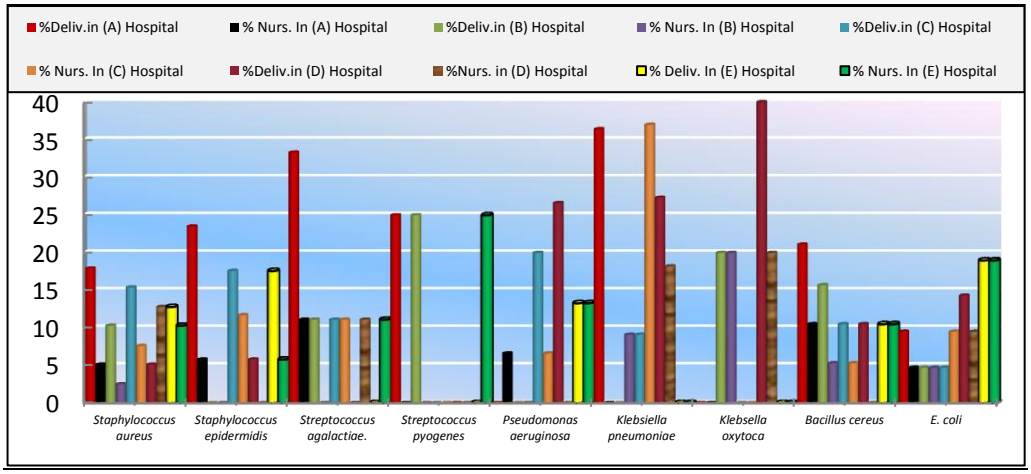
As shown in Table (3) & figure (5). the delivery rooms of five hospitals under study *Staphylococcus aureus* was isolated as 24 (61.5%), *Staphylococcus epidermidis* as 13 (76.5%), *Bacillus cereus* as 13 (68.5%), *E. coli* as 11 (52.4%), *Pseudomonas aeruginosa* as 9 (60%), *Klebsiella pneumonia* as 8 (72.7%), *Streptococcus agalactiae* as 5 (55.5%), *Streptococcus pyogenes* as 3 (75%) and *Klebsella oxytoca* as 3 (60%) .

Table3: Number and percentage of pathogenic bacteria isolated from the Delivery and Nursing rooms in Giza governorate hospitals.

Organisms	Hospital (A)		Hospital (B)		Hospital (C)		Hospital (D)		Hospital (E)		Total	
	Deliv.	Nurs.	Deliv.	Nurs.	Deliv.	Nurs.	Deliv.	Nurs.	Deliv.	Nurs.	Deliv.	Nurs.
Staphylococcus aureus	7 (17.9)	2 (5.13)	4 (10.3)	1 (2.5)	6 (15.4)	3 (7.6)	2 (5.13)	5 (12.8)	5 (12.8)	4 (10.3)	24 (61.5)	15 (38.5)
Staphylococcus epidermidis	4 (23.5)	1 (5.8)	2 (11.7)	-	3 (17.6)	2 (11.7)	1 (5.8)	-	3 (17.6)	1 (5.8)	13 (76.5)	4 (23.5)
*Streptococcus **agalactiae**.*	3 (33.3)	1 (11.1)	1 (11.1)	-	1 (11.1)	1 (11.1)	-	1 (11.1)	-	1 (11.1)	5 (55.5)	4 (44.5)
Streptococcus pyogenes	1 (25)	-	1 (25)	-	-	-	1 (25)	-	-	1 (25)	3 (75)	1 (25)
Pseudomonas aeruginosa	-	1 (6.6)	-	-	3 (20)	1 (6.6)	4 (26.6)	2 (13.3)	2 (13.3)	2 (13.3)	9 (60)	6 (40)
Klebsiella pneumoniae	4 (36.4)	-	-	1 (9.1)	1 (9.1)	-	3 (27.3)	2 (18.2)	-	-	8 (72.7)	3 (27.3)
*Klebsella **oxytoca***	-	-	1 (20)	1 (20)	-	-	2 (40)	1 (20)	-	-	3 (60)	2 (40)
Bacillus cereus	4 (21.1)	2 (10.5)	3 (15.7)	1 (5.3)	2 (10.5)	1 (5.3)	2 (10.5)	-	2 (10.5)	2 (10.5)	13 (68.5)	6 (31.5)
E. coli	2 (9.5)	1 (4.7)	1 (4.7)	1 (4.7)	1 (4.7)	2 (9.5)	3 (14.3)	2 (9.5)	4 (19.0)	4 (19.0)	11 (52.4)	10 (47.6)
Total	25	8	13	5	17	10	18	13	16	15	89	51

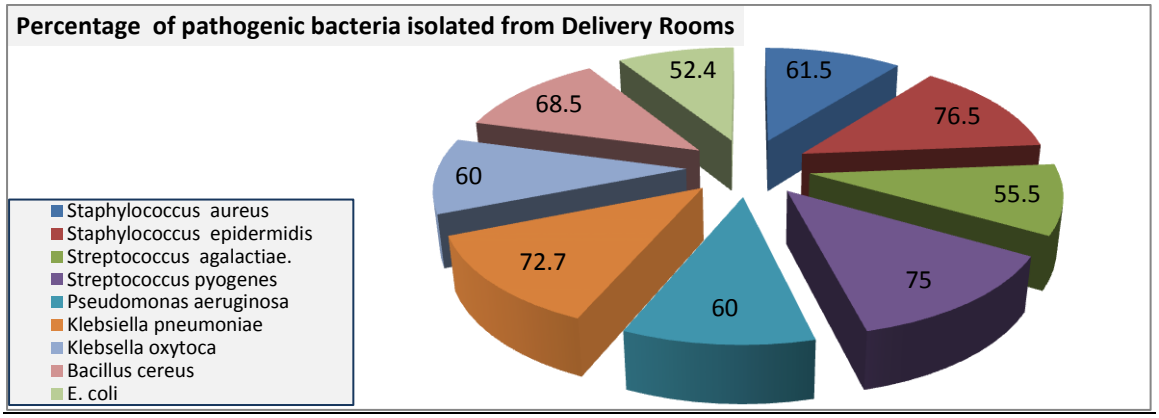
* Values between parenthesis indicates percentage.

* (Deliv): Delivery room. * (Nur.): Nursing room.



Figure(5): percentage of pathogenic bacteria isolated from the Delivery and Nursing rooms.

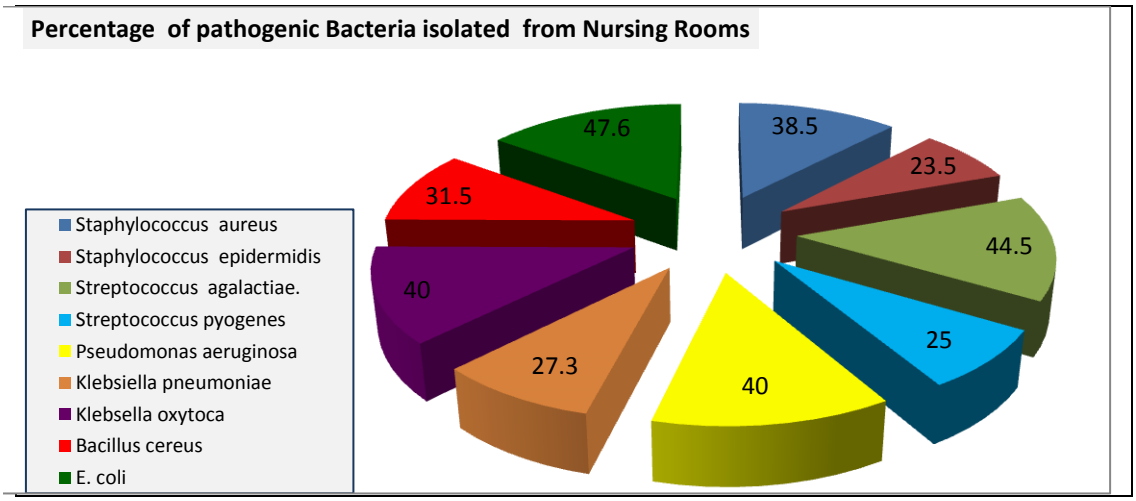
The most predominant bacteria that have been isolated from the delivery rooms of hospitals under study are *Staphylococcus aureus* as shown in (A) hospital followed by *Staphylococcus epidermidis* as shown in (A) hospital, *Bacillus cereus* as shown in (A) hospital, *E. coli* as shown in (D) hospital, *Pseudomonas aeruginosa* as shown in (D) hospital , *Klebsiella pneumoniae* as shown in (A) hospital, *Streptococcus agalactiae* as shown in (A) hospital, *Streptococcus pyogenes* as shown in (A, B & D) hospitals and *Klebsella oxytoca* as shown in (D) hospital Table (3) & figure (6).



Figure(6): percentage of pathogenic bacteria isolated from the Delivery and Nursing rooms teaching hospitals.

Table (3) & figure (5). also demonstrates that in the Nursing rooms of these hospitals, *Staphylococcus aureus* was isolated as a 15 (38.5%), *E. coli* as 10 (47.6%), *Pseudomonas aeruginosa* as 6 (40%), *Bacillus cereus* as 6 (31.5%), *Streptococcus agalactiae* as 4 (44.5%), *Staphylococcus epidermidis* as 4 (23.5%), *Klebsiella pneumonia* as 3 (27.5%), *Klebsella oxytoca* as 2 (40%) and *Streptococcus pyogenes* as 1 (25%) .

The more predominant microorganisms that have been isolated from the nursing room was *Staphylococcus aureus* as shown in hospital (D). Followed by *E. coli* as shown in hospital (E), *Pseudomonas aeruginosa* as shown in hospital (D & E), *Bacillus cereus* as shown in hospital (A, C, D& E), *Streptococcus agalactiae* as shown in hospital *(*A,C,D&E), S*taphylococcus epidermidis* as shown in hospital (C), *Klebsiella pneumonia* as shown in hospital (D), *Klebsella oxytoca* as shown in hospital (B&D), and *Streptococcus pyogenes* as shown in hospital E Table (3) & figure (7).



Figure(7): percentage of pathogenic bacteria isolated from the Nursing rooms in teaching hospitals.

The effect of different concentrations septol on the isolated bacteria:

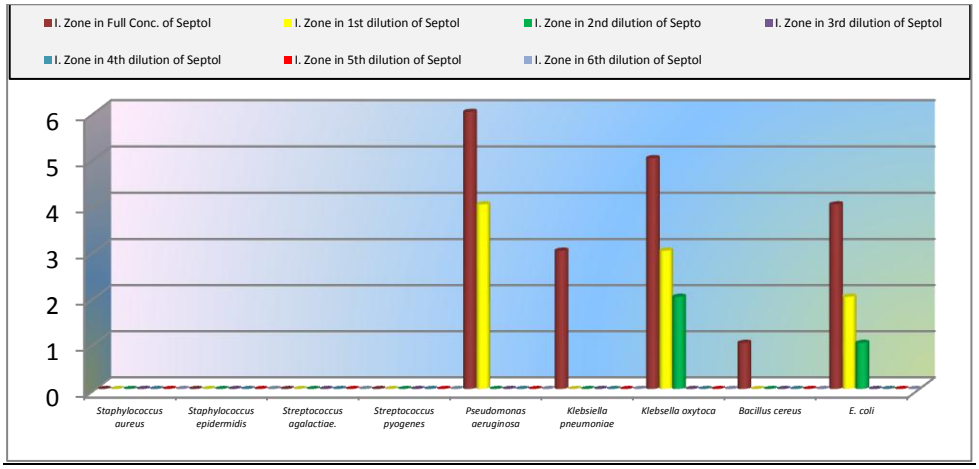
As shown in Table (4) & figure (8). *Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus agalactiae* and *Streptococcus pyogenes* showed marked resistance towards septol disinfectant concentration even in full concentration (100%) without any dilution did not notice any inhibition zones were observed at any plates. *Pseudomonas aeruginosa* showed inhibition zone of 6 mm at full concentration of septol and showed inhibition zone of 4 mm diameter was detected in 10^{-1}. *Klebsiella pneumonia* showed inhibition zone of 3 mm

in the full concentration of septol otherwise no inhibition zones were detected at a dilution of, 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6}. *Klebsella oxytoca* showed inhibition zone of 5 mm in full concentration of the septol, 3 mm and 2 mm zones of inhibition were shown at a dilution of 10^{-1} and 10^{-2} respectively. *Bacillus cereus* showed inhibition zone of 1 mm in full concentration of septol otherwise no inhibition zones were detected at a dilution of, 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6}. *E. coli* showed inhibition zone 4 mm in full concentration of septol ,2 mm and 1 mm zones of inhibition were shown at a dilution of 10^{-1} and 10^{-2} respectively.

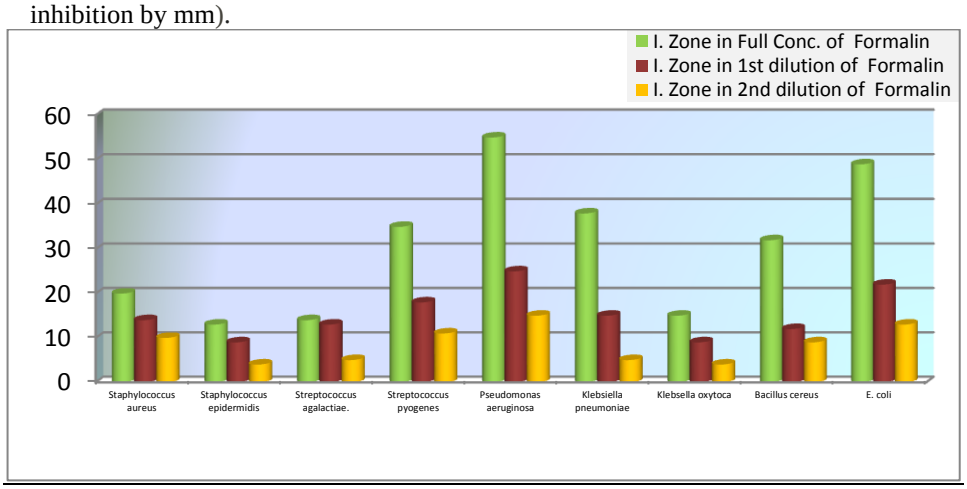
Table 4: Effect of concentrated and diluted septol and formalin on the isolated pathogenic bacteria species (Zone of inhibition by mm).

Organisms	Formalin			Septol						
	FLL I. Zone	10^{-1} I. Zone	10^{-2} I. Zone	FLL I. Zone	10^{-1} I. Zone	10^{-2} I.Zone	10^{-3} I.Zone	10^{-4} I.Zone	10^{-5} I.Zone	10^{-6} I.Zone
Staphylococcus aureus	20	14	10	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Staphylococcus epidermidis	13	9	4	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Streptococcus agalactiae.	14	13	5	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Streptococcus pyogenes	35	18	11	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Pseudomonas aeruginosa	55	25	15	6	4	(-)	(-)	(-)	(-)	(-)
Klebsiella pneumoniae	38	15	5	3	(-)	(-)	(-)	(-)	(-)	(-)
Klebsella oxytoca	15	9	4	5	3	2	(-)	(-)	(-)	(-)
Bacillus cereus	32	12	9	1	(-)	(-)	(-)	(-)	(-)	(-)
E. coli	49	22	13	4	2	1	(-)	(-)	(-)	(-)

I. Zone: inhibition zone (-): No inhibition zone
(Fll): Full concentration



Figure(8): Effect of concentrated and diluted septol on the isolated pathogenic bacteria species (Zone of inhibition by mm).



Figure(9): Effect of concentrated and diluted Formalin on the isolated pathogenic bacteria species (Zone of inhibition by mm).

The effect of different concentrations of formalin on bacteria isolated :
As shown in Table (4) & figure (9), formalin resulted with good inhibition zones with of *Staphylococcus aureus, Streptococcus pyogenes, Pseudomonas aeruginosa, Bacillus cereus* and *E. coli* at full concentration, 10^{-1} and 10^{-2} except 10^{-2} with *Staphylococcus epidermidis, Streptococcus agalactiae, Klebsiella pneumonia, Klebsella oxytoca***,** other concentration showed no activity against all tested bacteria. *Pseudomonas aeruginosa* showed greater inhibition in all areas followed by *E. coli.*

IV. Discussion

The hospital is a place for diagnosis and treatment. The responsibility of all those involved need to provide all the possible ways of cleaning tools used for either hospital or staff or disinfect all surfaces. The study showed that the rate of microbial contamination with bacteria pathogenic potential in the delivery rooms in hospitals and nursing rooms were 83.33% and 74.28 % respectively. Hospital (A) had the highest percentage, and this may be due to that Hospital (A) the largest educational hospital with largest admission data that increase possibility of the presence of pathogenic organisms among patients.

Child birth is one of the life's major events, The way in which it is experienced will have very significant and long term effects on the mother. It is the responsibility of all those involved in the provision of care to achieve a balance between scientific objectivity and the concern for woman wishes. The obtained results are in agreement with [12] who reported that infection rates were higher in hospitals in the large teaching hospitals, which increases the number of the population. these also indicated that there is no evidence to support the claim that hospital is the safest place for women to have normal births. *Staphylococcus aureus* is one of the organisms isolated dominant, and these bacteria are pathogenic bacteria commonly associated with various diseases, which are responsible for many of the respiratory system, gastrointestinal tract, and infections after surgery and urinary tract and skin disorders with antibiotic resistance, multiple, and may be due to some other reason, a sterilization, or environment contamination.

Staphylococcus aureus, *Staphylococcus epidermidis* were among the organisms isolated from the prevailing air of hospitals [13]. The isolation of *streptococcus epidermidis* and *streptococcus agalactiae* in burns units via the airborne route was reported by [14], *streptococcus epidermidis* was also isolated as predominant organisms from indoor air of hospitals by [13].

Pseudomonas aeruginosa, the isolation of this organism which is well known as multi antibiotics resistant organism and the role of these bacteria as nosocomial organism which associated with wounds and eye infections is well documented.

The isolation of *E. coli* from delivery rooms and nursing rooms might be due to and fecal contamination and indicated the possibility of occurrence of different diseases agents especially in immuno-compromise persons such as new babies and delivered women According [15].

The isolation of the bacteria *Klebsiella pneumoniae* and *Klebsiella oxytoca* causing less air contamination as a source of contamination may be water droplets and not survive for long period. The isolation of Bacillus cereus was isolated as 13.5% needed program for elimination according to [13].

*Staphylococcus aureu*s, *Staphylococcus epidermidis* , *Streptococcus agalactiae* and *Streptococcus pyogenes* showed resistance toward septol the disinfectant that commonly used in the most hospitals while *Pseudomonas aeruginosa, Klebsiella pneumoniae, Klebsella oxytoca, Bacillus cereus* and *E. coli*.. The resistant of bacterial hospitals toward disinfectants were reported previously by[16], [17]. All isolated bacteria showed inhibition zones with formalin these result agreement with[18].

One of the main recommendations of the study is to make efforts to improve the health environment in hospitals ,both among mothers and workers in the field of medical tests or personal hygiene in hospitals are advised to raise awareness and educational status of workers in the medical field to reduce the risk of transmission of infection transmitted through the air.

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References

[1] Ishida T., Nakano K., Nakatani H. and Gomi A. (2006). Bacteriological evaluation of Cardiac surgery environment accompanying hospital relocation. Surg. Today, 36: 504-507.

[2] Johnson A. (2002). Nosocomial infections. Vet. Clin. North Am. Small Anim. Pract., 32: 110-126.

[3] Newman J. (2002). Neonatal intensive care Unit: Reservoirs of nosocomial pathogens. West Afr. J. Med., 21: 310-312.

[4] Khojasteh J., Edward-Jones V., Childs C. and Foster H. (2007). Prevalence of toxin producing strains of *Staphylococcus aureus* in pediatric burns units. Burn, 33: 334-340.

[5] Krishna V., Patil A. and Chandrasekhar M. (2007). Extended spectrum beta lactamase producing *Klebsiella pneumoniae* in neonatal intensive care unit. Indian J. Pediat., 74: 627-630.

[6] Behrends, H.B., 2003. Pseudomonas in new hospital building. Gesundheitswesen, 65: 736-737.

[7] Ohsaki Y., Koyano S., Tachibana M., Shibukawa K., Kuroki M., Yoshida and Y. Ito (2007). Undetected Bacillus pseudo-outbreak after renovation work in a teaching hospital. J. Infect., 54: 617-622.

[8] Jimenez, F., L. Garro, Z.E. Rodrique and Z. Zeledon, 2004. Evaluation of the presence of bacteria in food and environment of an Oncological Service of National Hospital, San Jose, Costa Rica. Arch. Latinoam. Nutr., 54: 303-307.

[9] Zaidi M. , Angulo M. and Stifuentes-Osornio J. (1995). Disinfection and Sterilization practices in Mexico. J. Hosp. Infect., 31: 25-32.

[10] Cheesbrough M. (1991). Medical Laboratory Manual for Tropical Countries. 2nd Edn., University Press, Cambridge, pp: 508-511..

[11] Kavanagh, F., 1974. Microbiological diffusion assay II: Design and application. J. Pharm. Sci., 64: 1224-1229.

[12] Abussaud J. (1991). Prevalence of nosocomial infections in Saudi Arabia Teaching hospitals. J. Hosp. Infect., 17: 235-238

[13] Tambekar H., Gulhane P. and Bhokare D. (2007). Studies on environmental monitoring of microbial air flora in the hospitals. J. Medical Sci., 7: 67-73.

[14] Govan, J.R.W., 1992. Pseudononas and Non Fermenters. In: Medical Microbiology, Greenwood, D.R.C., B. Slack and J.F. Peutherer (Eds.). 15th Edn, Churchill Livingstone, New York

[15] Beggs, C.B., 2003. The airborne transmission of infectionin the hospital buildings: Fact or Fiction?. Indoor Built Environ., 12: 9-18.

[16] Rutala, W.A., M.M. Stiegel, F.A. Sarubbi and D.J. Weber, 1997. Susceptability of antibiotic-susceptible and antibiotic resistant hospital bacterial to disinfectants. Infect. Control Hosp. Epidemiol., 18: 417-421

[17] Russell, A.D., 1999. Bacterial resistance to disinfectant: Presence knowledge and future problems. J. Hosp. Infect., 43: S57-S68.

[18] Nunez, L. and J. Moretton, 2007. Disinfectant-resistant bacteria in Buenos Aires City hospital wastewater. Braz. J. Microbiol., 38: 644-648.