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## Original Research Article

## Infection control measures at maternity and children hospital and data analysis

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## ABSTRACT

**Introduction:** Nosocomial Infections are the infections that are neither at incubating state nor present at the time of admission. They are greatly associated with Surgical procedures and Invasive Medical Devices and hence OTs and ICUs are known as ‘Hot Zones’ and Gram Negative and Gram-positive organisms are responsible. Hence, regular surveillance of these areas remains the mainstay to monitor the raising trend of nosocomial infections.

**Aims and Objectives:** To find out the prevalence of Bacteria and Bacterial load in Pre and Post fumigation swabs from various areas of Maternity and Children hospital like OTs, Patient Ward, Labor ward and NICUs and to test the effectiveness of the standard disinfectants.

**Materials and Methods:** The swabs were collected from different areas of MGM Maternity and Children Hospital, Kalamboli Mumbai The swabs were further processed and organisms were identified using standard Microbiological procedures.

**Results:** The standard disinfectants were tested using Kelsey-Sykes Capacity test, and they “Passed” the test. Out of the total Pre fumigation swabs collected, growth was seen in 15% of the swabs while in Post fumigation swabs 3% of growth was seen. In places like Minor OT, Septic OT, Labor Room, Waiting Room a higher value of Chi-square test statistics indicated a statistically significant association between fumigation and growth of microorganisms. Majorly non-pathogenic organism like Bacillus was isolated followed by CoNS and few *S. aureus*. Hence this indicates significant reduction in growth of microorganisms in majority of the areas of post fumigation swabs indicating following of proper infection control procedures.

**Conclusion:** This study describes the profile of Bacterial Load in high-risk areas of Maternity and Children Hospital. Pre and post fumigation swabs were tested from high-risk areas including Minor OT, Major OT, Septic OT, Female Ward, Recovery Room, PNC, NICU. Also, suggestions were made to incorporate air sampling methods for better assessments. The knowledge of these findings and appropriate corrective measures can greatly impact the health of neonates as well as the mothers.

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## 1. Introduction

Hospital Acquired Infections are the infections that are neither at incubating state nor present at the time of admission. They are acquired during hospitalization and clinical manifestations starts to appear after 48 hours of

hospitalization.

They are the highest source of morbidity and mortality rate. 5 to 10% of the patients admitted in hospitals for some other disease unquestionably develop Nosocomial Infections.<sup>1</sup>

Nosocomial Infections are greatly associated with Surgical procedures and Invasive Medical Devices and hence OTs and ICUs are known as ‘Hot Zones’. Majority

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of Gram Negative followed by Gram Positive bacteria are responsible for causing Nosocomial infections which are mostly Multi Drug Resistant.<sup>2,3</sup>

According to CDC, Nosocomial infections are divided into 13 major types which are further classified according to 50 potentially infectious sites majorly including CAUTI, CRBSI, SSI and VAP. They are classified this way mainly for the surveillance purposes.<sup>4</sup>

Prevention of Nosocomial infections is extremely important to save patients from their extended stay in hospital, to reduce morbidity and mortality rate. Surveillance is an important unit of Infection Control program. Laboratories play a major role in surveillance of Nosocomial Infections. Surveillance provides information about the infected patients, source of infection, type and site of infection.<sup>5</sup>

Hence, Infection Control Procedures remains the mainstay to monitor the raising trend of nosocomial infections. The infection control programs not only benefit patients and their career but also the hospital management to save their resources.<sup>6</sup>

Therefore, this study was conducted to understand the bacterial load in surfaces and equipment in critical care units and Operation Theaters of a Tertiary Care Hospital.

## 2. Materials and Methods

This study was conducted after procuring permission from the Institutional Ethics Committee. The sample were collected from different areas of MGM Maternity and Children Hospital, Kalamboli Mumbai. The further standard Microbiological procedures were performed in Microbiology Laboratory of MGM Medical College, Kamothe, Navi Mumbai.

### 2.1. Testing of disinfectants

Oxivir Five 16 Concentration and Virex II 256 were used in the Maternity and Children Hospital, Kalamboli for the disinfection as well as fumigation purpose. These disinfectants were tested quarterly throughout the study period. Kelsey Sykes Test- Capacity Test method was used for testing of disinfectants.<sup>7</sup> The testing was done with ATCC strains of *S. aureus*, *E. coli* and *P. aeruginosa*.

### 2.2. Samples and identification

Over a year, Pre-fumigation swabs and post-fumigation swabs collected from different surfaces of areas like OT, ICU, Labor Room, Waiting Room, PNC etc were sent to the Microbiological laboratory.

The swabs were inoculated of MHA plates and RCM broth and were incubated at 37°C to examine the microbial growth. The isolates were then isolated and identified according to the standard microbiological procedures.

## 3. Results

### 3.1. Testing of disinfectants

The disinfectants were tested quarterly showed No growth against the ATCC *S. aureus*, *E. coli* & *P. aeruginosa* strains. Hence, the disinfectants tested in this study “Passed” the test and therefore were termed as an ideal disinfection to be used in the critical units.

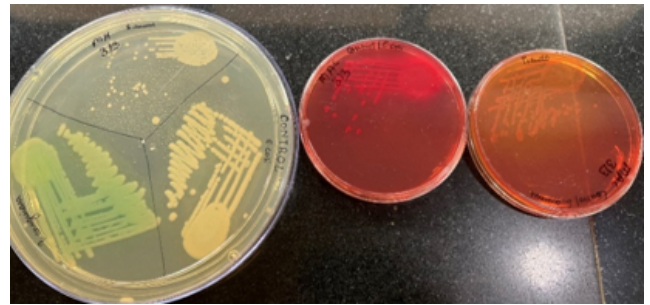


Fig. 1: Control plates with ATCC strains

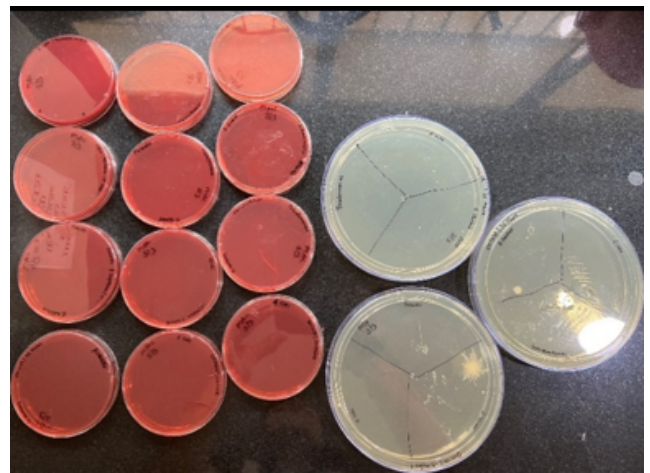


Fig. 2: Test plates of virex and oxivir

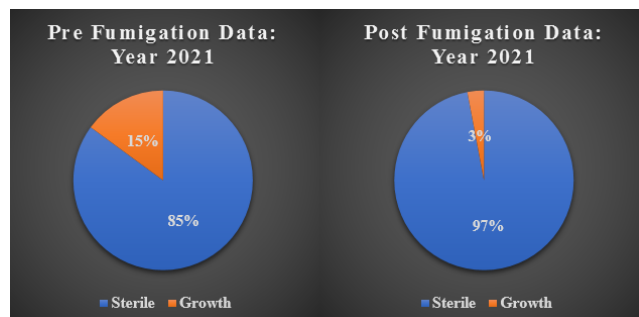
### 3.2. Identification of isolates

Any growth on the MHA plates were identified by Gram’s staining and Biochemical Reactions. Majority of the organisms were Gram Positive Bacilli which were identified as *Bacillus* spp’s and few were Gram Positive cocci further classified as *S. aureus* and CoNS according to the biochemical reactions.

The RCM medium showed no color change and no turbidity during the whole study.

### 3.3. Growth Observed in Pre- and Post-fumigation swabs

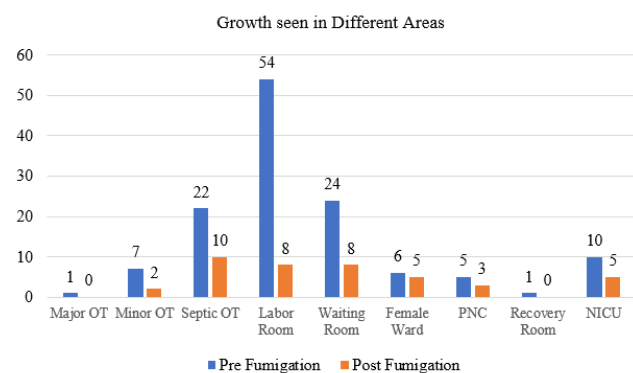
During the study period, 14.94% of growth of organisms were seen in pre fumigation swabs, while only 2.98% of growth of organisms were seen in post fumigation swabs.



Graph 1: Growth in pre and post fumigation swabs

The growth rate of organisms was higher in pre fumigation swabs to that of the post fumigation swabs. The range of organisms in pre-fumigation was higher in Labor room followed by waiting room, Septic OT, NICU, Female ward, PNC and least was in Major OT and Recovery room.

In post fumigation swabs the highest growth in swabs were seen in Septic OT followed by Labor room, Waiting Room, NICU, PNC and Minor OT. There was no growth in swabs collected from different surfaces of Recovery Room and Major OT.

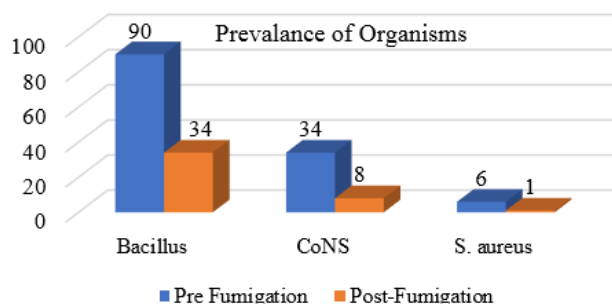


Graph 2: Growth observed in different areas

On applying chi-square test, p value <0.05, obtained in Minor OT, Septic OT, Labor room and waiting room indicated statistically significant reduction in growth of organisms in pre-fumigation and post fumigation swabs. The growth of microorganisms was greater in surfaces like Floor followed by Wall, Table, Suction machine, Bed, Warmer, Boyles in pre-fumigation swabs and there was a significant reduction in growth of microorganisms in post fumigation swabs of surfaces.

In areas like PNC, Female Ward and NICU a lower value of chi-square test statistics indicated statically insignificant association between fumigation/disinfection procedures and growth of microorganisms.

During the study, in pre-fumigation swabs and post fumigation swabs, the organisms identified were in greater no. were Bacillus followed by CoNS and *S. aureus* which indicates prevalence of Non-pathogenic organisms greater to that of pathogenic organisms. The prevalence was higher in places like Floor, Tables, Walls, Bed, Suction machine, warmer and Boyles.



Graph 3: Prevalence of microorganisms

## 4. Discussion

This study was carried out at various units of Maternity and Children Hospital, Kalamboli. The swabs were taken from various areas of critical units like Minor OT, Major OT, Septic OT, Female ward, Waiting room, Labor room, recovery room, PNC and NICU. These places are often at higher risk of infections and hence there is a need to keep bacterial load at lowest in these areas to prevent Nosocomial infections by using good quality disinfectants and following good disinfection procedure protocol.

Beforehand, the disinfectant used in the Maternity and Children hospital were tested and both disinfectants “Passed” the test and hence were ideal for the usage. The swabs were collected before the cleaning procedures (Disinfection and fumigation) as well as after the cleaning procedures from areas like Wall, Floor, Table, Warmer, Boyle etc. The swabs were then processed according to Standard Microbiological procedures for the identification of bacterial load in these areas.

During the study period, in Pre fumigation swabs, 15% of the swabs were recorded for the growth and rest 85% were sterile. Also, in post fumigation swabs only 3% of swabs showed growth and rest 97% were sterile which clearly shows reduction of Microbial Load after applying cleaning procedures.

A similar study done by Malik S.A. et al., (2021) in which 32 swabs were collected from various areas of OTs

**Table 1:** Significance of microbial growth in different areas.

Area	Pre-fumigation swabs		Post-fumigation swabs		Chi square value	p-value <0.05	Association
	Sterile %	Growth %	Sterile %	Growth %			
Minor OT	88.52	11.47	99.13	0.86	18.1	0.00	Significant
Septic OT	85.71	14.4	96.96	3.03	21.5	0.00	Significant
Labor Room	83.02	16.92	96.95	3.04	29.2	0.00	Significant
Waiting Room	82.60	17.39	94.66	5.33	10.6	0.00	Significant
Female ward	79.31	20.68	87.80	12.19	1.4	0.24	Insignificant
PNC	82.14	17.85	92.5	7.5	1.7	0.2	Insignificant
NICU	84.37	15.62	93.15	6.84	2.7	0.1	Insignificant

and were processed according to standard Microbiological procedures. The results obtained were nearly similar to this present study. Out of 32 swabs collected (pre and post fumigation), 11 (34.3%) pre-fumigation swabs showed growth of organisms while 7 (21.9%) post-fumigation swabs showed growth of organisms.<sup>8</sup>

In Pre fumigation swabs the heavy growth of organisms was observed in Labor Room followed by waiting room, Septic OT, NICU and rest places showed moderate to low level of growth. In post fumigation swabs Moderate growth was observed in Septic OT followed by Labor Room and, Waiting Room and NICU. A study was done by Asinobi I. N. et al., (2021) to perceive bacterial isolates from the surfaces of NICU in a TCH in Enugu. Around 106 samples were collected out of which growth was observed in 58 (54.7%) samples.<sup>9</sup>

The statistical approaches when applied to the results obtained showed a significant association between fumigation and growth of microorganisms. The p value obtained in areas like Minor OT, NICU, Labor Room and Waiting room were <0.05 which indicates that fumigation played an effective role in reducing the microbial load in these areas.

Also, in areas like Female Ward, PNC and NICU although the post fumigation growth rate is lower but p value was >0.05 which indicates insignificant association between fumigation and growth of the microorganisms. Since fumigation cannot be done in these areas and only surface disinfection was carried out and also due to uncontrolled and recurrent use of these areas, there were growth of microorganisms seen.

Also, Major OT and Recovery room showed no growth of organisms, it can be indicated that fumigation and disinfection procedures are carried out timely and aseptic precautions are maintained.

In this study, in pre fumigation swabs as well as post fumigation swabs, the prevalence of non-pathogenic strains like *Bacillus* was higher to that of pathogenic strains like *S. aureus* and CoNS. Although *Bacillus* is a non-pathogenic organism and its prevalence in lower amount is permissible but presence of *S. aureus* and CoNS even in lower amount have the potential to cause nosocomial infections like sepsis,

VAP, Catheter associated infection in neonates as well as the mother.

Also, there was no prevalence of Anaerobic organisms like *Clostridium*. This indicates that growth of organisms in swabs were under acceptable level and proper Infection Control Procedures were being followed as growth rate fell in post fumigation swabs.

## 5. Conclusion

This study describes the profile of Bacterial Load in high-risk areas of Maternity and Children Hospital. The high-risk areas include Minor OT, Major OT, Septic OT, Female Ward, Recovery Room, PNC, NICU. 'Pre and Post Fumigation swabs were tested according to the standard Microbiological procedures.

In the results, majorly Non-Pathogenic strains like *Bacillus* was isolated and few pathogenic strains like *S. aureus* and CoNS were also isolated. In this study, the incidence of growth was seen highest in Female followed by Waiting room, PNC, Labor Room, NICU, Septic OT, Minor OT, Recovery room and Major OT.

Therefore, in areas like PNC, Female ward and NICU there is an uncontrolled and frequent movement of staffs and patients which can be a potential reason for the contamination of the surfaces. Hence, these areas should focus more on infection control procedures as neonates are more prone to acquire infections even by mild pathogenic organisms. Therefore, it is suggested to restrict the entry of patient's relatives as well as staffs and to perform frequent disinfection like deep cleaning of the surfaces to prevent transmission of nosocomial infections.

Also, it is suggested that apart from surface surveillance, air sampling methods should also be implemented to monitor the quality of air in critical areas. Testing of disinfectants should be done quarterly to keep up with the standards of disinfectants.

The knowledge of these findings and appropriate corrective measures can greatly impact the health of neonates as well as the mothers. So, hospitals should adopt proper and regular disinfection procedures of various objects and Infection Control Committee should do the inspections timely to stop the spread of Nosocomial

Infections.

## 6. Source of Funding

None.

## 7. Conflicts of Interest

There is no conflict of interest.

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