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# Study of hospital acquired infections among different working staff in veterinary hospitals

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**Abstract**
The present study undertaken with aim to describe about nosocomial infections, transmission, and their impact on different working personnel such as teaching staff, non-teaching staff, students and veterinary assistant in a veterinary hospital. In this study, a total of 192 samples collected from the palms of different personnel for a period of two months and these samples carried to laboratory for further analysis of total plate count and presence of pathogenic bacteria like *Escherichia coli, Salmonella* spp and *Staphylococcus* spp. The total viable count from the palms of different working personnel ranging from $59.63^{d}$±4.03 cfu/ml to $211.88^{a}$±12.11 cfu/ml and the percentage of (*Escherichia coli, Salmonella* spp *and staphylococcus* spp*)* present are 66.66%, 54.14% and 87.50% respectively. The result of the present study shows these infections place a heavy financial strain on healthcare systems and increasing patient morbidity and mortality rates, hence proper awareness is required regarding HAI'S and its control strategies.

**Keywords:** Nosocomial, contamination, hospital, evaluation, microbial load

## 1. Introduction
Nosocomial infections, commonly referred to as hospital acquired infections, are illnesses contacted while a patient is being treated in a hospital and are a known danger in both human and veterinary practise (Stull *et al.,* 2015) [9]. Nosocomial infections are a concern to public health, and they often grave human costs (Eleftherios Mylonakis and Panayiotis, 2021) [4]. The hands of healthcare workers are the primary means of healthcare-associated pathogen transmission from patient to patient and throughout the hospital environment (Allegranzi and Pittet, 2009) [2]. Clinicians ought to collaborate with economists and policy analysts to enhance the economic evidence that is already available to lessen hospital complications like nosocomial infection and other negative patient/staff outcomes (Stone *et al*., 2002).
Hand hygiene is the most effective way to stop the spread of antibiotic resistance and to lower healthcare-associated infections (HAIs) (Allegranzi and Pittet, 2009) [2]. Alternating the antibiotics used as empiric therapy and using medication combinations from other classes are further strategies (Weber *et al.,* 1999) [10]. During a 5-year period, 82% of veterinary teaching hospitals in North America and Europe reported at least one HAI outbreak and 45% reported multiple outbreaks. Many of these outbreaks required restricted patient admissions (58%) or closure of the hospital or section (32%) (Benedict K.M *et al*., 2008) [3]. The risk factors in veterinary hospitals are comparable to those in human hospitals. Prevalence studies have shown that 4-9% patients endure from a nosocomial infection (Mielke, 2010) [5].

## Materials and Methods
**Collection of samples**: The samples were obtained from the veterinary clinical complex on three selected days, twice daily of a week. these days are selected assessing the number of cases per day of that hospital. The days selected are Monday Wednesday and Friday, the cases were high on Monday moderate on Wednesday and least cases were noted on Friday. A total of 160 samples collected from four different category working staff in veterinary hospital i.e., Teaching staff (Doctor), non-teaching staff (Cleaning staff), veterinary assistant (veterinary nurse) and internee students before opening and after closing of hospital.
The collected samples were carried on ice for further examination in laboratory for total viable

count (TVC) and specific pathogens (*E. Coli*, *Staphylococcus* spp and *Salmonella* spp) present in the samples.

**Preparation of Agar media:** Standard Plate count agar, Eosin Methylene Blue Agar, Mannitol Salt Agar, Brilliant Green Agar for estimation of total viable count, *Escherichia coli*, *staphylococcus* spp *and Salmonella* spp respectively were prepared based on the directions and measurements labelled on the media by instructor, as per the requirement. For further analysis Serial dilutions were conducted on each sample.

**Processing of samples:** One milliliter of phosphate buffer saline (pbs), in which the material was mixed, was transferred to a test tube containing nine ml of pbs, making a 1:10 dilution. Total viable count (TVC) and pathogens were counted using one ml of $10^3$ dilution. A suitable amount of the appropriate media was put onto the petridish in an aliquot of one milliliter, spread out, and allowed to spread evenly. For 24 to 48 hours, the plates were incubated at 37 °C + 0.5. Using a digital colony counter, the colonies in the range of 30-300 on each plate were counted.

One ml of phosphate buffer saline (pbs) in which sample was mixed transferred to nine ml of pbs test tube which makes 1:10 dilution and so on up to $10^5$ dilutions. One ml of $10^3$ dilution was used for enumeration of total viable count (TVC) and pathogens. One ml of aliquot spread on the Petri dish and sufficient quantity of respective media was poured and allowed to spread uniformly. The plates were incubated at 37 $^0$c ± 0.5 for 24-48 hours. Colonies on each plate having 30-300 colonies were counted by using a digital colony counter. Colonies were chosen and sub cultured on various selective media for the presence of certain pathogens, such as *Escherichia coli*, *Staphylococcus* spp., and *Salmonella* spp., based on colony features. Gram's staining was used to identify and confirm the pathogen, along with typical biochemical tests such the coagulase test, IMViC tests (indole, methyl red, Voges-Proskauer, citrate utilization), urease test, oxidase test, catalase test, nitrate reduction test, and triple sugar iron agar test.

**Analysis by using statistics:** The results were subjected to analysis through (Version, 16; SPPS) by applying one-way ANOVA. The treatment means were ranked using Ducan's multiple range test with significance at 5% level. All the statistical procedures were done as per.

## Results and Discussion

The results of the current study are presented in Table 1 and 2**.** The total viable counts (TVC) of samples collected from Teaching Staff (TS), Non-Teaching Staff (TS), Veterinary Assistant (VA) and Internship Student (INS) before opening of veterinary hospital are 59.63, 108.04, 94.38 and 76.17 respectively and after closing of the hospital are 117.17, 211.88, 200.29 and 168.58 respectively.

The TVC in samples collected from palms of TS were significantly ($p$<0.001) lower when compared with samples collected from palms of NTS, VA, INS both before opening and after closing of veterinary clinic. Total viable count of NTS was higher when compared to TS, VA, INS both before opening and after closing of veterinary Hospital.

The results of the samples collected are given in the Table.1

**Table 1:** Total Viable Count of various the samples

| Sample type | Teaching Staff (TS) | Non-Teaching Staff (NTS) | Veterinary Assistant (VA) | Internship Student (INS) | SEM | P | N |
|---|---|---|---|---|---|---|---|
| Before opening of veterinary hospital (Mean ± SE) | $59.63^{d}$±4.03 | $108.04^{a}$±4.93 | $94.38^{b}$±3.09 | $76.17^{c}$±2.37 | 2.57 | 0.001 | 96 |
| After closing of veterinary hospital (Mean ± SE) | $117.17^{c}$±11.21 | $211.88^{a}$±12.11 | $200.29^{a}$±12.82 | $168.58^{b}$±10.36 | 6.59 | 0.001 | 96 |

*The values obtained are from the 7th serial ten-fold dilution of sample.

The TVC in samples collected before opening of hospital were lower when compared with samples collected after closing of hospital. The number of pathogenic bacteria present in the samples collected from different working personnel are depicted in Table 2.

From the above results it was found that 49, 48 and 87 samples were positive for *Escherichia coli*, *Staphylococcus* and *Salmonella* respectively before opening the hospital and 80, 57 and 80 samples for positive for the same pathogens respectively after closing the hospital.

**Table 2:** Number of pathogenic bacteria present in the samples collected from different working personnel

| Sample type | Before opening of hospital | | | Before closing of hospital | | |
|---|---|---|---|---|---|---|
| | *E. Coli* | *Staphylococcus* | *Salmonella* | *E. Coli* | *Staphylococcus* | *Salmonella* |
| Teaching Staff (TS) | 14 | 9 | 20 | 17 | 8 | 17 |
| Non-Teaching Staff (NTS) | 17 | 16 | 32 | 23 | 14 | 26 |
| Veterinary Assistant (VA) | 7 | 10 | 16 | 18 | 16 | 19 |
| Student (S) | 11 | 13 | 19 | 22 | 19 | 18 |

The Percentage of different pathogenic bacteria in collected samples before opening and after closing of veterinary clinic were presented in Table 3. From the given table we can depicted that *Salmonella* spp., are found to be more common resulting 89.97% of the samples collected whereas *E. coli* are 67.15% and *Staphylococcus* are up to 54.66%.

**Table 3:** The Percentage of different pathogenic bacteria in collected samples

| | *E. Coli* | *Staphylococcus* | *Salmonella* |
|---|---|---|---|
| Before | 51% | 50% | 90.62% |
| After | 83.33% | 59.33% | 83.33% |
| Total | 67.15% | 54.66% | 86.97% |

## Discussion

Ahmed Hussein *et al.* (2020) [1] reported that lowest total viable counts are seen in academic staff when compared to other non-academic staff, cleaners and students. Similar total viable counts are noticed in this study (total viable counts in teaching staff are lower than non-teaching staff, veterinary assistant, and students). The bacterial count is lower in the teaching staff and students which indicates that it will also depend on different criteria. Recent veterinary studies report hand hygiene compliance to be between 20% to 40%, with 85% of workers feeling they should be washing their hands frequently (Nakamura, 2012) [6].

One veterinary study showed that implementing a comprehensive education program could increase compliance, which is consistent with human data on the same subject (Shea, 2012) [7]. Improper sanitation and lack of hygiene might be the reason for higher TVC which may lead to the nosocomial events. It is important that staff should understand the importance of hand hygiene and implications of poor hand hygiene. As a profession we must contribute to minimise the risk of HAIs with additional effort and can significantly reduce this major public health problem.

## Conclusion

After an extensive review of hospital-acquired infections (HAIs) and the associated research, these infections place a heavy financial strain on healthcare systems around the world in addition to increasing patient morbidity and mortality rates. Hence these infections must be prevented and controlled by using a multimodal strategy that includes surveillance, infection control practises, and cooperative efforts.

**Further scope of research**: There is scope for molecular pathogen examination to identify strains and investigate isolate antibiotic resistance.

**Conflict of interest:** Authors have no conflict of interest in this study.

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