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A CROSS-SECTIONAL STUDY COMPARING THE NOSOCOMIAL INFECTION RATES BEFORE AND AFTER THE IMPLEMENTATION OF COHORTING AMONG PEDIATRIC PATIENTS ADMITTED IN THE WARDS

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ABSTRACT

Objective: **To determine if the implementation of cohorting lowered the nosocomial infection rate in the Pediatric Wards**
Design: **Retrospective cohort study**
Setting: **Pediatric wards in a tertiary hospital**
Patients: **All patients from 0 to 17 years of age admitted in Wards 9 and 11 from September 1, 2000 to August 2002**
Methods: **Data on the nosocomial infection rates in Wards 9 and 11 were collected from September 1, 2000 to August 2001 when cohorting was not yet implemented and compared with the data from September 2001 to August 2002 during the implementation of cohorting. Statistical analysis is through Fisher's exact test**
Results: **Reduction in the overall nosocomial infection rate from 16.99% to 13.85% upon the implementation of cohorting was observed to be not significant. Although there was no decrease in mortality seen, the savings of the decrease in nosocomial infections was estimated at PhP 4.7M. The months of January, February and April showed significant reduction in the nosocomial infection rate.**
Conclusion: **Cohorting reduced the nosocomial infection rates at the wards but other factors such as discontinuing use of recycled syringes and regular orientation of the hospital staff regarding basic principles and infection control also contributed to this outcome. Although there was no decrease in mortality seen the savings of the decrease in nosocomial infections is estimated at PhP4.7M.**

INTRODUCTION

For years, surveillance of nosocomial infections has been conducted in the pediatric wards of the Philippine General Hospital, 1,000-bed acute care referral institution accommodating indigent patients nationwide. The nosocomial infection rates (NIR) of the pediatric wards (Wards 9 and 11) had been stable over the past three years ranging from 13.7% to 16.7%. Despite the stable rates, these values are alarmingly high. In an effort to lower the nosocomial infection rate, the Department of Pediatrics implemented the cohorting scheme at the Pediatric Emergency Room (PER), Wards 9 and 11 on September 1, 2001. Patients admitted at the PER and pediatric wards were cohorted based on their disease transmission. The guidelines on cohorting were based on the recommendation of the HICPAC of the CDC (1997).

One of the factors identified to cause infections in hospitals is the person-to-person spread of bacteria stemming from poor aseptic practices which may occur in crowded units and when the nurse to patient ratio is low.[1] Traditional control measures such as handwashing, antibiotic control and isolation or cohorting of infected and colonized patients were recommended to lower the incidence of nosocomial infections[1]. Cohorting was observed to be a practical and effective method to improve compliance with infection control measures and control the transmission of vancomycin-resistant enterococci.[2] Cohorting and handwashing significantly reduced the incidence of nosocomial respiratory syncytial virus infection[3]. Hygiene, cohorting and antimicrobial therapy were also observed to effectively control an outbreak of shigellosis[4] Cohorting and disinfection of incubators and wards were effectively implemented to control an outbreak of *Enterobacter cloacae* in a neonatal unit.[5] Cohorting and prompt administration of varicella zoster immunoglobulin to susceptible patients were instituted to prevent an outbreak of varicella in an intensive care unit.[6] However, studies on the impact of cohorting alone as an intervention to lower the rate of nosocomial infection are lacking.

This is a retrospective cross-sectional study that aims to determine if the implementation of cohorting diminishes the nosocomial infection rates at wards 9 and 11. The specific objectives are :

1. To compare the overall nosocomial infection rates in the pediatrics general wards before and after cohorting.

Keywords: cohorting, nosocomial infection, nosocomial infection rate.
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2. To compare the individual nosocomial infection rates in ward 11 and ward 9 before and after cohorting.
3. To determine the number of admissions, discharges, length of stay and mortalities per ward before and after cohorting.

The data gathered from this study will be used to propose possible interventions and strategies to further reduce the nosocomial infection rate at the Pediatric wards.

PATIENTS AND METHODS:

Patients

All pediatric patients admitted in wards 9 and 11 for the period of September 1, 2000 to August 31, 2002 were considered as the total population at risk. The cohorting scheme was strictly implemented in Wards 9 and 11. The patients at the Pediatric Emergency Room were not included due to the quick turn-over of patients. Likewise, the patients at the PICU and NICU were not included.

Methods

A retrospective cross-sectional study was conducted to determine the nosocomial infection rates in wards 9 and 11. Data on the monthly nosocomial infection rates for the period of September 1, 2000 to August 31, 2001, or the period prior to the implementation of cohorting, were gathered and compared with the data for the period of September 1, 2001 to August 31, 2002 when cohorting was implemented. Data on the monthly nosocomial infection rates at the wards were collected based on the Pediatric Infectious Disease Section's monthly prevalence surveillance wherein the diagnosis of nosocomial infections were based on the criteria set by the section. Data on the monthly number of admissions, discharges and duration of stay of patients at wards 9 and 11 for the year before and after the implementation of cohorting were also obtained. The following are definitions useful in this study:

Nosocomial infection- localized or systemic condition that results from adverse reaction to the presence of an infectious agent(s) or its toxin(s) and that was not present or incubating at the time of admission to the hospital. For most bacterial nosocomial infections, this means that the nosocomial infection becomes evident 48 hours or more after admission.[7]

Nosocomial infection rate (NIR)- number of nosocomial infections divided by the total population or number of patients at risk during the specified period[8]

Total population at risk- number of inherited patients plus the number of admitted patients for the specified period[8]

COHORTING PROCEDURES

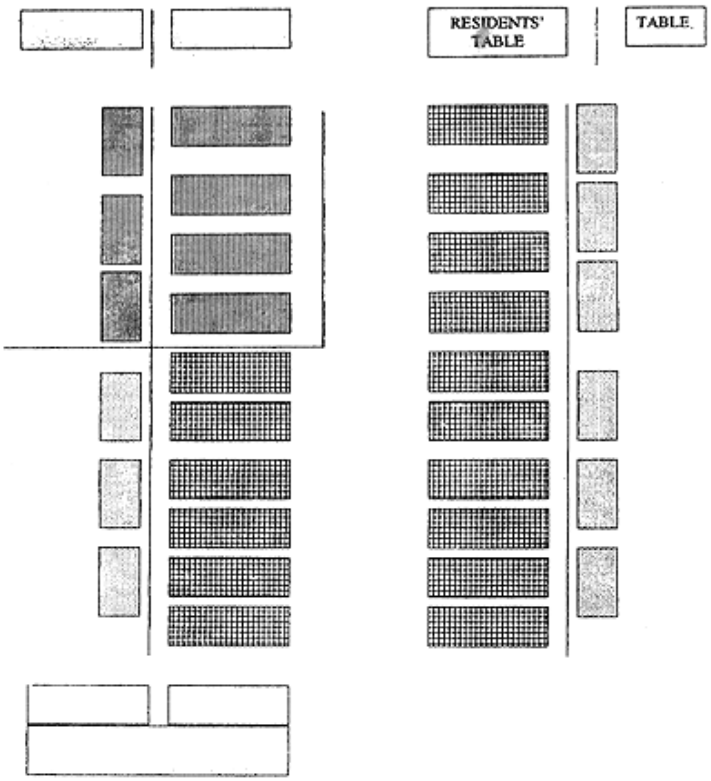
Ward 9

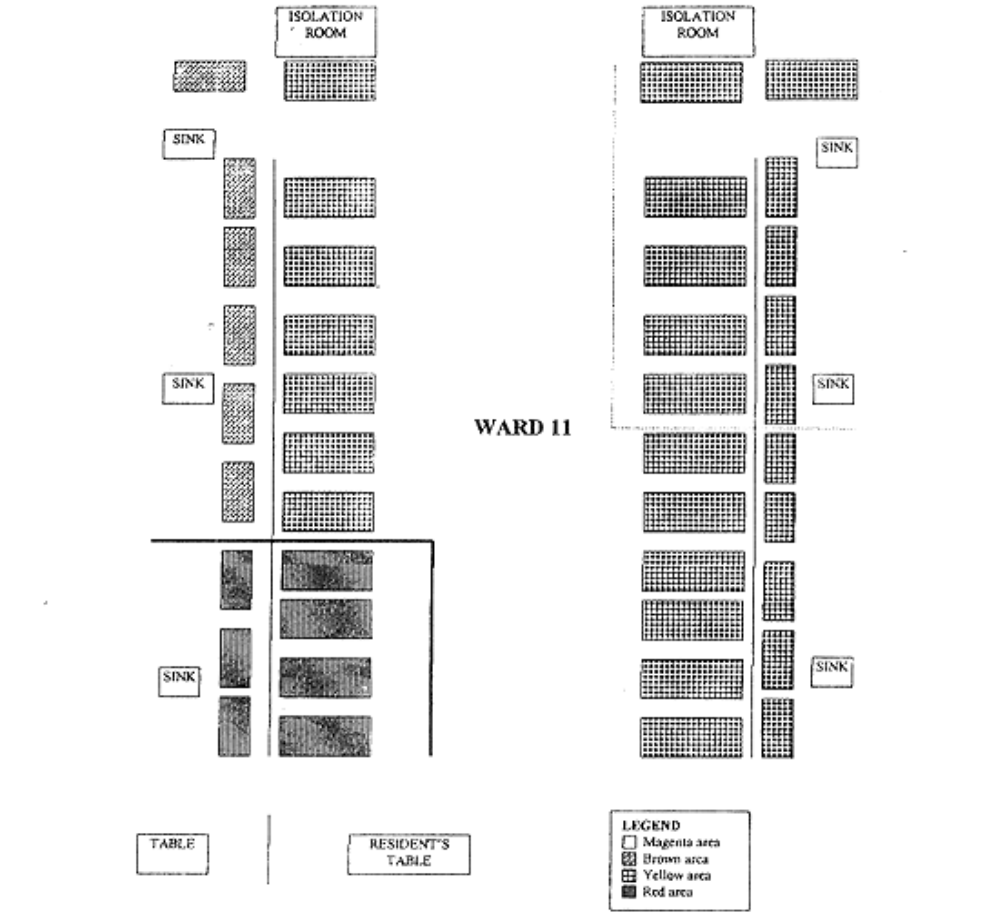
A. Patients with non-infectious diseases, neonates, immunocompromised, and patients with other infectious disease not transmitted by droplet or airborne route and with the following color code purple, blue and green will be admitted at Ward 9.
B. Once the patient develops a nosocomial infection, the service senior will ensure that the patient was transferred to the appropriate area within the same ward.
C. Once the nosocomial infection has resolved, but still needs hospitalization either for continuation of IV medications or for diagnostic work-up, the patient may be retained in the same area depending on the availability of space.
D. Overflow of patients that needs to be admitted at ward 9 may be admitted to ward 11 only with the approval of the PIDS fellow and consultant.

Ward 11

A. All patients with diseases that are spread by airborne, droplet and contact transmission and with the following color codes magenta, yellow and brown will be admitted at ward 11.
B. Isolation Room 1 is for patients with tuberculosis.
C. Isolation Room 2 is for patients with viral exanthems and meningococcemia.
D. Overflow from the Isolation Room will be placed in the area near the Isolation Room 1 with barrier precaution.
E. All patients for completion of IV medications shall be placed on the corresponding area near the Isolation Room 2.
F. All patients with Dengue Hemorrhagic Fever and malaria should use mosquito nets at all times.
G. Overflow of patients from Ward 9 may be admitted at ward 11 upon the approval of the PIDS fellow

WARD 09 COHORTING M AP





and consultant.

Statistical Analysis

Statistical analysis using the Fisher's exact test to compare the nosocomial infection rates before and after the implementation of cohorting was done.

Results:

The total number of patients admitted to the wards decreased from 2507 to 2321 after the implementation of cohorting. Likewise, the total number of patients discharged from the wards also decreased from 1798 to 1761. The total number of inherited patients in the wards also decreased from 859 to 834. However, the total duration of hospital stay did not significantly vary at a mean of 11 days. The total number of mortality decreased from 343 (10.19%) to 299 (9.47%) after the implementation of cohorting.

Table 1. The Admission, Discharge and Average Length of Stay in Wards 9 and 11 before and after the Implementation of Cohorting

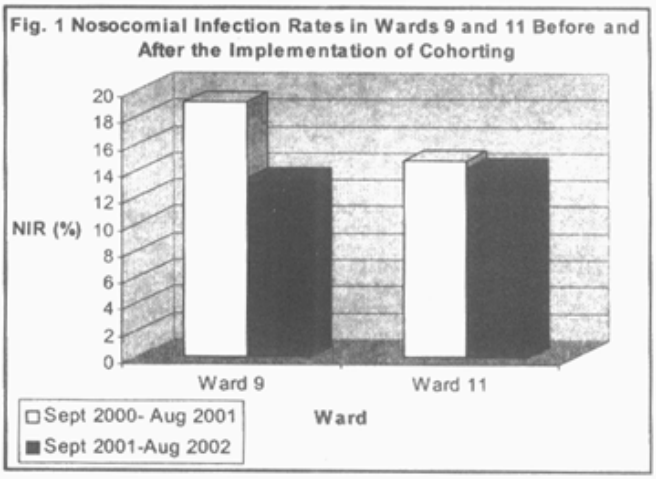
Before Cohorting (Sept. 1, 2000 - Aug. 31, 2001)						Cohorting (Sept. 1, 2001 - Aug. 31, 2002)				
Ward	Inherited	Admission	Mortality	Discharge	Length of Stay in days (mean)	Inherited	Admission	Mortality	Discharge	Length of Stay in days (mean)
Ward 9	464	1247	186	887	11.13	451	1217	165	915	11.60
Ward 11	395	1260	157	911	12.52	383	1104	134	846	11.67

Comparison of the Total Nosocomial Infection Rate Before and After Cohorting

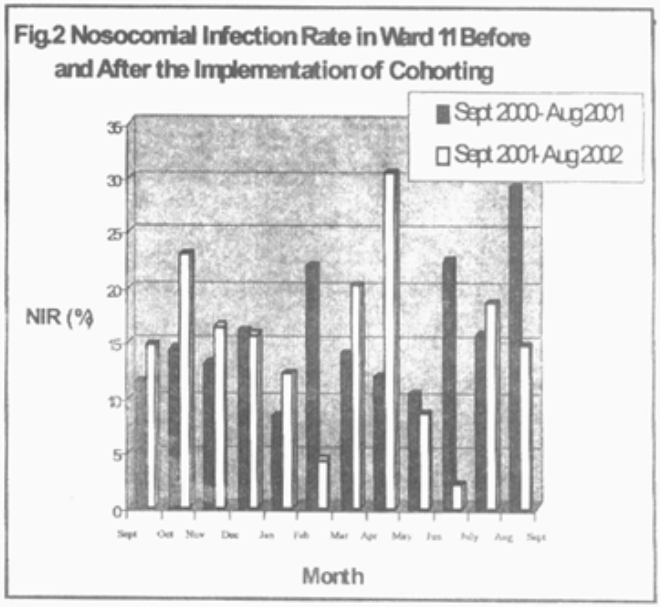
After the implementation of cohorting (September 2001 to August 2002), out of the 3155 total population at risk, a total of 437 nosocomial infections developed. Before the implementation of cohorting, 572 nosocomial infections developed from the total population at risk of 3366. The NIR decreased from 16.99% to 13.85% after the implementation of cohorting however this was not statistically significant (p=0.320). Comparing the difference in NIR of the two groups per month, there was a significant decrease in NIR in January (p=0.058), February (p=0.016) and March (p=0.004).

In ward 11, before the implementation of cohorting, there were 245 nosocomial infections from the 1655 total population at risk. After the implementation of cohorting, 212 nosocomial infections occurred in the1487 total population at risk. The NIR decreased from 14.80% to 14.25% after the implementation of cohorting. The NIR in February 2002 decreased to 4.35% (6/138) from 22.01 % (24/109) in February 2001. Likewise, the NIR decreased to 8.67% (13/150) in May, 2.09% (3/143) in June and 14.8 % (19/128) in August.of the year 2002 (after the implementation of cohorting).

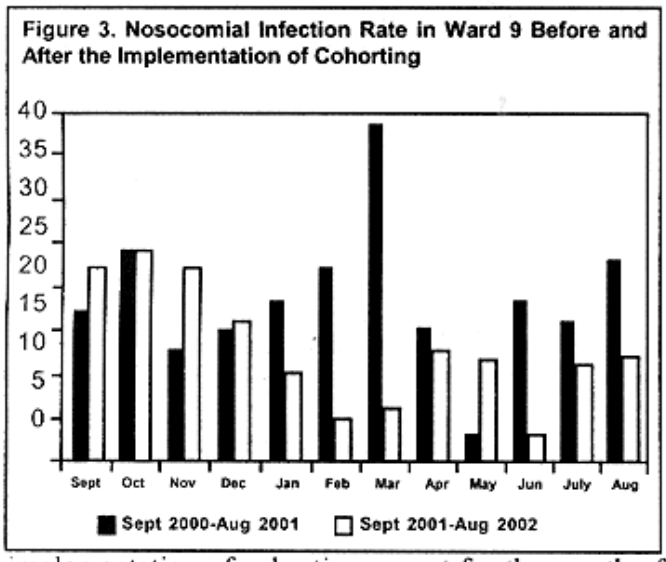
In ward 9, there were 225 nosocomial infections out of the 1668 total population at risk after cohorting was implemented. Before the implementation of cohorting, there were 327 nosocomial infections out of the 1711 total population at risk. NIR decreased from 19.11% to 13.48%. In ward 9, NIR decreased after the



Comparison of Nosocomial Infection Rate at Ward 11 Before and After Cohorting



Comparison of Nosocomial Infection Rate at Ward 11 Before and After Cohorting



implementation of cohorting except for the month of May when it was notably higher at 12.6% (18/142).

DISCUSSION

Initially, the nosocomial infection rates in both wards 9 and 11 increased at the onset of cohorting. This may be attributed to the limitation of patients admitted after the general cleaning of both wards in August 2001 thereby decreasing the denominator and possibly skewing the nosocomial infection rate. In addition, the seasonal nature of diseases led to a backlog of patients causing overcrowding in one ward. Moreover, the principles of cohorting were relatively new and confusing to the ward residents and nurses. Miscommunication regarding the location of patients upon arrival at the wards also arose. As the hospital staff became familiar with the principles of cohorting, less problems were encountered. Subsequently, there was a general reduction in the nosocomial infection rates for both wards 9 and 11. The decrease is most noteworthy in ward 9 where the relatively "infection-free" patients were admitted.

There was statistically no significant decrease in the overall nosocomial infection rate but a trend toward reduction was observed. Likewise, only the months of January, February, and March had a significant reduction in the overall nosocomial infection rates. Starting in January 2002, recycling of syringes were discontinued upon donation of some donors which could be one of the reasons for the significant reduction in the overall NIR . However, in ward 11, the increase in NIR in January 2002 may be attributed to the decrease in the number of discharged patients (62) and thus, more overstaying patients.

The quarterly meeting with nurses, residents and the infectious disease section to reiterate the principles of cohorting and infection control, to clarify confusing issues on cohorting and to find solutions to problems in cohorting took place in February 2002 which could have contributed to the significant reduction in NIR for February. In addition, in the last week of February to the middle of March 2001 (before cohorting), there had been cases of measles in ward 11 increasing the NIR during this period. Also, problems regarding some overstaying patients with ventriculitis having an increased length of stay and a decrease in admission rate in ward 9 arose in March 2001. This would account for the highest NIR of 26.98% in March 2001.

The NIR also increased in ward 11 in March and April 2002 (after cohorting). The total number of admissions at this time were low at 87 and 65 for March and April 2002, respectively. This was due to a lot of overstaying patients who stayed at a mean duration of 15 and 19 days for March and April 2002, respectively.

The overall NIR also decreased in June 2002. The increase in NIR in June 2001 was attributed to the observed increase in incidence of patients with *Burkholderia pseudomallei* and *Burkholderia cepacia* infection.

There was no statistically significant decrease in the mortality rates at the wards. From 10.14% before cohorting, the mortality rate decreased to 9.47% but there was a trend toward reduction.

A significant reduction in the cost of nosocomial infection may result if the length of stay due to nosocomial infection was reduced by 7-12 days (reduction of approximately PhP 1-2M or 14-29%), antibiotics were not missed (reduction of approximately PhP 1.2-1.6M or 4.5-21%) and the incidence of nosocomial infection is reduced by 1.5% (reduction of approximately PhP 1.5M or 21%).[9] If a nosocomial infection costs, on average, P35,000, the estimated cost of nosocomial infection before the implementation of cohorting is PhP 20,020,000. After the implementation of cohorting, the estimated cost of nosocomial infection is PhP 15,295,000. With cohorting, the cost savings would be PhP 4,725,000. This cannot overemphasize the fact that infection control is cost-effective considering that approximately one-third of nosocomial infections are preventable.[10]

The observations in this study are not based on an ideal research design because the data were retrospectively gathered. However, methods of detection and surveillance of infections remained

cohorting. Still, variables like the underlying disease of the patient upon admission were not taken into account. Also, since the data were based on the monthly prevalence surveillance of the infectious disease section, the denominator or the total population at risk includes patients who were not discharged in a month's time (inherited) thus overestimating the denominator which could falsely decrease the nosocomial infection rates. Using the number of patient-days as the denominator is of greater value in calculating nosocomial infection rates.[8] However, this is more difficult to determine. Ideally, an increase in the number of discharges, a reduction in the number of inherited patients and a decrease in the number of days the patient stays in the wards result in a decrease in nosocomial infection rates. The overall number of admissions and discharges did not vary between wards 9 and 11 before and after the implementation of cohorting but the monthly admissions and discharges reflected a concomitant change in the monthly nosocomial infection rates.

CONCLUSION

This study showed a reduction in the overall nosocomial infection rate from 16.99% to 13.85% upon the implementation of cohorting but this was not statistically significant. Although it had no significant impact on the mortality rate at the wards, the cost savings, in terms of nosocomial infection expenses, upon implementation of cohorting was estimated at PhP 4.7 M. There was a significant reduction in the overall nosocomial infection rates in January, February and March 2002 but this was not solely attributed to cohorting since other factors such as the re-orientation of hospital staff and the discontinuation of the use of recycled syringes also occurred in that period.

RECOMMENDATIONS

The implementation of cohorting should be continued. However the success of cohorting depends on its strict implementation requiring the cooperation of everyone from the students to the nurses and residents. Regular orientation on the principles of cohorting and infection control procedures should be conducted among the hospital staff. Other measures such as strict handwashing and adherence to the Infection Control Committee's policies on the rational use of antibiotics should also be observed. More extensive studies on cohorting is also recommended.

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