Isolation of patients with Vancomycin Resistant Enterococci (VRE): Efficacy of an electronic alert system

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Abstract. This study investigates the implementation of an alert system for the isolation of vancomycin resistant enterococci (VRE) colonized patients. Given the risk of admitting a patient colonized by VRE it is necessary to implement efficient isolation measures. An electronic alert system integrated into a health information system (HIS) could help with the detection of these patients and their isolation in proper units. Objectives: Determine the efficacy of an electronic alert system in improving the rate of properly isolation of patients colonized with VRE. Methods: two consecutive series of admission in adults units of 67 patients that were infected or colonized with VRE were compared. The time period of the study was six months before the implementation of the alert system and six months post-implementation of the system. Results: The proportion of admission with proper isolation of the patient in correct units increased 44% after the alert system implementation. Conclusion: The implementation of an alert system improved the proportion of properly isolated patients with VRE.

Keywords. Electronic Health Record, Electronic Reminder, Vancomycin Resistant Enterococci (VRE), Isolation.

Introduction

Over the last several years, there has been an emergence of resistance to antibiotics bacteria in hospitals setting. One of the most common bacterium usually found is vancomicyn resistant enteroccoci (VRE). A study published in 2001 with data from 25 North American intensive care units (ICUs) showed that of the total of enterococci bacterium cultured, 28% were resistant to vancomycin (1). This bacterium has the characteristic that can contaminate almost every surface, surviving for extended periods of time; days, weeks even months depending on the surface. It is easily transmitted to susceptible patients by hands or contaminated equipment like stethoscope or thermometer, causing disease especially in immunosuppressed subjects (2). Moreover, the VRE can transfer resistance to antibiotic to others bacteria such as Staphylococcus aureus and Streptococcus, and cause more severe diseases even in healthy people (2)

Factors such as being admitted to rooms previously occupied by patients colonized or infected with VRE and the burden of patients in the unit can affect the spread of the

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contamination. Also the proximity to patient with VRE and the time spent in hospital, especially if they are expose to patients colonized with VRE, are important determinants for the spread of the bacterium. Patients in long-term care facilities are a reservoir for vancomycin-resistant enterococci (3). The Centers for Disease Control (CDC) recommend early detection, quick identification and isolation of patients with VRE to prevent further transmission of the disease (4). Since health information system have proven useful for the logistics management of patients (5) at Hospital Italiano de Buenos Aires (HIBA) developed an electronic alert system for the detection of patient previously infected with VRE at the moment of the admission to the hospital.

The aim in this study is to assess the efficacy of an electronic alert system integrated to HIBA's healthcare information system (HIS) for detection of VRE colonized or infected patients in improving the proportion of isolation in the specific hospital sector.

1. Methods

The design of the present research project is a before and after quasi-experimental study. The period time analyzed was from January 2006 through January 2007. It corresponds to a period of six months before the implementation of the alert system on July 2006 and the six months period after it.

The study took place in Hospital Italiano de Buenos Aires (HIBA) in Argentina. HIBA has a network of two hospitals with 750 beds (200 for intensive care), 500 home care patients under care, and 23 clinics. In 1998, HIBA began to implement a HIS by integrating clinical information with administrative applications already in use. HIS was completely developed in-house and currently collects and leverages the clinical and administration information. The HIBA information infrastructure includes a terminology server that allows the mapping of local vocabularies to SNOMED CT (6,7).

The initial step in this project was the creation of a VRE patient registry. This registry was developed in January 2005. The infection committee was in charge of the management. Infection committee members followed the VRE cases, and added new patients to the registry based on the laboratory results and patients follow up. Since July 2006, this registry was integrated to HIBA's HIS. This integration allowed HIBA's HIS alerts users from the following systems: 1) Admission system: users can see that the patient is positive for EVR and need to be isolated and admitted in a specific unit (hospital sector 14 or 19). Figure 1 shows the alert in the admission system. 2) Electronic Health Record (EHR): the EHR shows a logo that identifying the patient as VRE. Also there is a link to information about which are the isolation measures for patients with VRE. 3) Nurse scheduling system: displaying the same logo and information described for the EHR.

For the analysis we compared 2 consecutive series of admission in adults units of patients infected or colonized with VRE. The first series covers the pre-implementation phase, and the second series the 6 months post implementation. The unit of the analysis for the study was each hospital admissions of a patient positive for VRE. Each admission was considered as an independent event.

Figure 1. Alert in the admission system

The alert system was effective if there was an improvement in the proportion of proper isolation of patients with VRE in the specific hospital units and if there was a decrease in number of bed movements from pre-implementation period to post implementation period. The number of properly isolated VRE patient is described in each period with associated percentage and confidence interval. To assess if there is a difference in the proportion of proper isolation, a chi square of homogeneity test was performed.

The number of bed movements of each patient is described in three levels as an ordinal variable (non bed movement, 1 or 2 movements and 3 or more than 3 movements). Each value is described with its associated percentage and 95% confidence interval.

2. Results

Over the 67 patients included in the VRE patient registry, there were 112 admissions in the pre-implementation period and 72 in the post-implementation phase. The median age of the population was 56 years with a minimum of 18 and a maximum of 97 years. 34.3 % (CI95%27.4-41.6%) of the population was females.

Regarding the efficacy of the electronic alert system, during the pre-implementation phase (first six month) there was a 36.6% of properly isolation (CI 95% 27.7-46.2%). While in the post-implementation (the last six month of the study) this proportion was 80.6% (CI95% 69.5 -88.9%). The difference between study phases is shown in figure 2. For this difference the OR was 7.14 (CI95% 3.46-14.43).
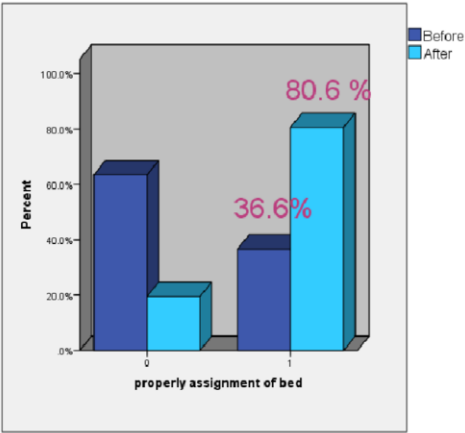
Figure 2. Proportion of properly isolation of patient VRE before and after the system implementation

As it is shown in table 1, more patients remain in the first assigned bed. Also, less patients moved one or two times from one bed to another bed. The table also shows non patients moved 3 or more times after the system was implemented. There is statistical significant difference between the proportion of non-movement of bed between the pre and post-implementation. Observed was a tendency to decrease the movements from one bed to another after the system implementation, in-patient who were not well isolated at admission, but the difference between periods is not significant.

Table 1. Proportion of patients' bed movement in a period of pre-implementation and post-implementation of a warning alert system

	Pre implementation 112	**Post implementation 72**
0 change of bed	79 (70.5%)(CI95% 61.2-78.8)	65 (90.3%) (CI95% 81-96)
1 or 2 changes of bed	24 (21.4%) CI95% 14.2-30.2)	7(9.7%) (CI95% 14.-19)
3 or more	9 (8%) CI95% 3.7-14.7)	0 (CI95% 0-5)

3. Discussion

The electronic alert system implemented at HIBA shows efficacy in increasing the rate of properly isolated patients colonized or infected with VRE. The proportion of adequate isolation increases from 36.6 % to 80.6%. This is consistent with other studies, Abel Kho et al. found similar results in their study at Wishard Memorial Hospital using an alert system for adequate isolation of patient with VRE and methicillin resistant staphylococcus aureus (MRSA) (8). The authors described an increase in the percentage of proper isolation from 33% to 89% after the system implementation. Guillaume Kac et al. described a similar experience in their paper with an improvement of proper isolation of multi-resistance organism after the implementation of a system that alerts directly both, physician and committee infection committee members. They also described after a year the proportion of proper isolation remained the same (9).

In this current study, the results of the comparison of patients' transfer from one bed to another bed were shown. There is a significant difference in patients who remained in the first bed assigned. Possibly, this was due to the significant increase of

proper isolation of patient at the time of admission to the hospital. Findings also included a decrease in the number patient movements from one bed to another but this tendency was not statistically significant. This study likely needed a higher number of subjects to find a statistically significance difference in bed movements. However, the study confirms the role of information system as a powerful tool to use for logistical management of patients with good results.

There were several limitations in the study. First, it was restricted to patients admitted only to one hospital, and into specific units. Moreover, it excluded units such us intensive care units, which in general have an important proportion of patients with VRE. As this was not a randomized controlled trial design, different external factors could affect the results. The study attempted to diminish this situation by expanding the study period time and using the same number of patients included in the registry.
Further studies are necessary to assess if the alert system implemented could decrease the spread of the disease in the entire institution.

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