

# IMPLEMENTATION OF VENTILATOR ASSOCIATED PNEUMONIA BUNDLE IN ADULT INTENSIVE CARE UNIT TO REDUCE MORTALITY RATE

## *VAP Bundle in ICU to Reduce Mortality Rate*

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**Abstract :** Healthcare Associated Infections significantly cause illness and deaths, ending up into subsequent medical conditions, elevated treatment cost and/or shattering emotional consequences. It is one of the prime responsibilities of all the healthcare settings to curb the foreseen and/or unforeseen medical consequences prior-hand. Concurrent short report is an outcome of such a venture attempting to raise the standards of healthcare in a tertiary care hospital. Implementation of VAP bundle in ICU aims to decrease the incidence rate of VAP and reduction of mortality rate in tertiary care hospital. This prospective and observational study was conducted for the duration of 12 months. Patients requiring mechanical ventilation and intubation for >48 hrs were eligible. VAP diagnosis was based upon clinical radiographic and quantitative microbiological sample culturing criteria. Seven major guidelines by CDC were followed daily on intubated patients. As reported earlier, VAP incidence rate was 98% initially in the hospital followed by reduction to 60% after the implementation of VAP Bundle. An Overall VAP Bundle compliance rate was found 88.5%. Further, mortality rate reduced from 99% to 60.11%. It was challenging to deploy all strategies in hospital setting; however, efforts were made, to curb the mortality rate.

**Index Terms-** Nosocomial Infection, Ventilator Associated Pneumonia, VAP Bundle.

## I. INTRODUCTION

An alarming number of deaths in hospitals due to Nosocomial Infection and/or other medical errors beckon the attention of medical practitioners to rework the overall patient care system <sup>1</sup>. VAP is developed followed by 48 hrs or more on mechanical ventilation via Tracheostomy and/or Endotracheal tube. Despite of many well-documented causes of VAP, classical VAP pathogens having resistance for antimicrobial drugs prevail. VAP is directly proportionate either to the morbidity or extensive patient care resulting in elevated costs due to prolonged mechanical ventilation and hospital stay <sup>2</sup>. A patient care bundle or VAP bundle approach ensures improved care with firm outcomes, which encircles a combination of key components for procedures extending systematic method to enhance and review the patient care processes and delivery <sup>3</sup>. Development of VAP complication occurs in 27% of patients who receive mechanical ventilation. The rate of VAP increases with duration or time interval of mechanical ventilation. In United States, reportedly, in 2011, 157,000 cases of Nosocomial Pneumonia were observed in acute care hospitals out of which 39% were found to be of ventilator associated <sup>4</sup>. *Pseudomonas* and *Acinetobacter sp.* are associated with high mortality rates than those of other associated organisms <sup>5</sup>. Current report encircles a systematic improvement in a tertiary care hospital. Based upon a previous survey depicting high incidence of VAP (90%) in ICUs, a VAP bundle approach has been implemented and data was collected during twelve months.

## II. SUBJECTS AND METHODS:

This prospective and observational study was conducted in medical ICU of a tertiary care hospital located in Jalandhar, Punjab, India and was approved by Hospital Infection Control Committee. In concurrent study, patient inclusion criteria was based upon CDC guidelines {Identifying Healthcare-associated Infections (HAI) for NHSN Surveillance} squaring a total of 75 patients (M-57/F-18) aging between 25 to 80 years, requiring mechanical ventilation support for preceding 48 hrs. Clinically VAP is defined by four criteria as radiographic appearance of new or progressive pulmonary infiltrates, fever, leucocytosis and purulent tracheobronchial secretions as explained by CDC and given in Table 1 <sup>6</sup>.

**Table 1:** Centers for Disease Control and Prevention Guidelines; Clinical Criteria to Diagnose VAP

Clinical Signs	Laboratory
Fever (temperature > 38°C)	New or progressive and persistent infiltrate
New onset of purulent sputum, or change in character of sputum	Positive growth in blood culture not related to another source of infection
Increased respiratory secretions, or increased suctioning requirements	Five percent or more of cells with intracellular bacteria on direct microscopic examination of Gram-stained bronchoalveolar lavage fluid
Worsening gas exchange	Histopathological evidence of pneumonia

For each patient, ventilator checklist by CDC was followed which includes major 7 strategies to reduce VAP incidence and mortality rate are given below<sup>7,8</sup>.

- Elevation of head of bed
- Sedative vacation
- Daily assessment of readiness of wean
- Daily spontaneous breathing trial
- PUD prophylaxis
- Chlorohexidine mouth care
- DVT prophylaxis

Apart from given strategies other parameters were also recorded as

- Number of mechanical ventilator days
- Age, Gender
- Reason of ventilation
- X-ray report
- Frequency of VAP

VAP bundle implemented on total 75 patients during 12 months from March 2018 to February 2019. The total no. of ventilator days were 300 (calculated from VAP bundle of individual patients). Followed by VAP Bundle implementation number of positive VAP cases were 18 and number of deaths due to VAP were 11. Calculations were done to compare initial results and results after implementation of bundle. Initial data was provided by the hospital record cell. Initial calculations (prior implementing VAP Bundle) depicts VAP incidence rate 98%, compliance rate of VAP bundle 56.5% and mortality rate 99%.

VAP Incidence, VAP, Mortality and Compliance Rate(s) followed by VAP Bundle Implementation:

$$\text{VAP Incidence Rate} = \frac{\text{Number of Positive Cases}}{\text{Total Number of Patients}} \times 100$$

$$\text{VAP Incidence Rate} = \frac{18}{75} \times 100$$

$$\text{VAP Incidence Rate} = 24\%$$

$$\text{VAP Rate} = \frac{\text{Number of Ventilator Cases}}{\text{Number of Ventilator Days}} \times 1000$$

$$\text{VAP Rate} = \frac{18}{300} * 1000$$

$$\text{VAP Rate} = 60\%$$

$$\text{Mortality Rate} = \frac{\text{Number of Deaths due to VAP}}{\text{Total Number of VAP Patients}} \times 100$$

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$$\text{Mortality Rate} = \frac{11}{18} \times 100$$

$$\text{Mortality Rate} = 61.11\%$$

$$\text{Average Compliance Rate} = 88.5\% \text{ (Calculated from VAP Bundle)}$$

**Table 2:** Outcomes of VAP Bundles

Rates	Before implementation	After implementation
VAP Incidence Rate	98%	60%
Compliance Rate	56.50%	88.50%
Mortality Rate	99%	61.11%

### III. RESULTS:

As depicted through figures in Table 2, a high rate of compliance of VAP bundle had a reduced rate of VAP incidences. On an average the VAP rate decreased by 38% while calculated through the data available from VAP bundle, compliance rate increased by 32% and mortality rate reduced by 37.89%.

### IV. DISCUSSION:

VAP is considered as severe complication of critical illness resulting in cost extensive health care services and elevated mortality rate. However, it is important to note that interventions focusing on the prevention of VAP are first and important priority of ICU hospital. Additionally, care givers find it easy to implement processes when multiple complicated systems are assembled together forming a simple bundle. VAP in ICU is the biggest drain on health and economic resources. The Bundle theory is quite promising and widely accepted in health care processes because each component of a bundle is well supported by scientific research. Since the bundles are aimed to improve overall patient care, reliable process development and monitoring is critical in current health care system. A goal-oriented team work is prerequisite prior expecting the firm outcomes from any of the processes. Process standardization in ICUs is highly desired as it is hard to achieve success from all the components of the respective bundle. This standardization process takes many months and commitment beginning from hospital administration to the care taker is essential. Current report extends the concrete evidences that further improvements are required in ICUs, nevertheless, more strategic observational studies are needed to confirm the result of current one. A similar study conducted elsewhere also suggests a significant improvement in patient care and reduced mortality rate<sup>9</sup>. An overall transformation in culture and process of any organization is central to make processes (viz bundles) a notable success.

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