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### A Management Strategy to Decrease Ventilator Associated Pneumonia:

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From Scientific Data and Recommendations to Clinical Practice

#### Authors



**M. Königs, M.D.**

**K.H. Polderman, M.D. Ph.D.**

**A.R.J. Girbes, M.D., Ph.D.**

*Department of Intensive Care*

*University Hospital VU Medical Centre, Amsterdam*

#### Summary

*This article describes a management and educational strategy to increase quality of care and awareness of quality of care in healthcare workers in ICU. Following implementation of the strategy in a 14 bed ICU, the incidence of ventilator associated pneumonia decreased.*

#### Correspondence

Professor **Armand R.J. Girbes**

e-mail: [arj.girbes@vumc.nl](mailto:arj.girbes@vumc.nl)

**Ventilator associated pneumonia (VAP) is defined as a nosocomial pneumonia in mechanically ventilated patients occurring more than 48 hours after endotracheal intubation. The incidence varies in different reports from 10 – 25% [1, 2]. VAP contributes not only to mortality and morbidity, but also increases length of stay in the ICU and hospital.**

Taken together with the need for additional diagnostics, and additional treatment with antibiotics, it is not surprising that VAP considerably increases costs in the ICU. It is, however, difficult to estimate exactly the magnitude of the additional costs, and amounts vary from US\$ 1255 per VAP in older studies to as high as US\$ 40,000 in trauma patients, in more recent studies [2]. It seems therefore urgent for every ICU to minimize the occurrence of VAP, not only for the sake of their patients, but also for the sake of the community as a whole. Clinical every day practice is not always reflected in carefully designed studies in selected centres. Performing prospective studies on VAP strategies with careful monitoring induces bias by paying extra attention to various measures and details especially by nurses. Basic aspects, such as hand washing and careful practice of lung suctioning procedures, probably contribute considerably to reducing the incidence of VAP.

Establishing the diagnosis of VAP is notoriously difficult. The diagnosis is usually based on systemic signs of infection, new or worsening infiltrates on the chest X-ray and microbiological evidence of pulmonary (parenchymal) infection. These issues can generally be handled in daily practice. In a recent outstanding state of the art paper, Chastre and Fagon recommend that bronchoscopic techniques are to be included [2]. This, however, requires the permanent availability of diagnostic bronchoscopy and – in our view – does not sufficiently address the disadvantage in clinical practice of the application of this technique, such as a fall in oxygen saturation and (temporary) clinical deterioration. Furthermore, reports on the value of the addition of bronchoscopic diagnostic techniques on outcome mostly come from countries with high rates of resistant microbes, which, for example is not the case in The Netherlands. Additionally, the importance of organizational aspects, such as closed format ICU, numbers of available intensivists and doctors, and especially nurses are in general not sufficiently acknowledged or even mentioned in studies on VAP prophylaxis, although several reports indicate the importance of organizational and/or management aspects in this matter [3, 4, 5].

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In this paper we will focus on the role of management to reduce incidence of VAP and we will illustrate this with our experience in reducing VAP in a mixed 14 bed ICU. As a practitioner-intensivist and new ICU director, one of us (AG) acknowledged in 1998 the very high rates of VAP in his new working environment compared to previous ones over seven years of ICU experience. A set of measures was implemented on which we will report, focussing on management and group management aspects, leading to a significant fall in incidence of VAP. The incentive for writing this paper was also fuelled by the experience of the first author (MK), who in 2003 started working in our ICU and noticed as a clinician-intensivist with many years of experience elsewhere, the low incidence of VAP, compared to that observed in all his previous clinical experience.



VAP, using standard and predefined criteria, is currently regularly prospectively measured in our ICU by the nursing and medical staff, in cooperation with the epidemiological service of our hospital, as a quality parameter.

### **Definition of VAP**

We used adapted CDC criteria for clinical definition of VAP, mostly without bronchoscopic techniques. Briefly, these include more than 48 hours of mechanical ventilation and a new or progressive radiological infiltrate in combination with at least two of the following criteria: leucocyte count  $< 3$  or  $> 10$  ( $\times 10^3/\text{mm}^3$ ), new onset purulent sputum (obtained transtracheally), temperature  $> 38.5$  or  $< 35.5^\circ\text{C}$ , isolation of pathogens present from transtracheal aspiration.

### **The Management Approach to Reduce VAP Incidence**

#### **Step 1. Defining the Problem: Is it Real and How Large is it**

Suspecting there to be a problem, in this case mainly for the patient, it is worthwhile investigating whether the problem really exists. A 10 week investigation in 1999 with more than 48 mechanically ventilated patients showed that in 21 out of 46 patients (46%) VAP could be diagnosed. A previously published study in the Lancet on glutamine-enriched enteral nutrition in mechanically ventilated multiple trauma patients, performed from 1992 until 1997 in our ICU, demonstrated a similar result in the control group with a 45% incidence of VAP [6]. The results of this earlier study did not change general practice and in particular no changes in enteral nutrition were implemented. It is therefore concluded that this is a genuine and significant, ongoing problem.

#### **Step 2. Identifying the Cause of the Problem**

Following numerous discussions on the work floor it emerged that most members of the nursing staff felt that VAP was inevitable, no matter what was done. This rather passive attitude was fuelled even more by dissatisfaction at the refusal by the board of directors to adopt selective bowel decontamination as a method to prevent VAP. As this decision was taken outside the ICU, the general feeling was that the cause of the problem was not inside the ICU. A proactive attitude and motivation to prevent VAP was therefore virtually absent. Protocols on infection prevention and VAP prevention were present and in force, however. A nurse hygienist and a medical student, with very good social competencies, investigated the compliance to existing protocols and observed that there was much room for improvement.

#### **Step 3. Making a Plan and Creating Ownership**

If a new director makes plans and wants to change things, he or she should realize that imposing either compliance with or changes to existing rules not only induces opposition, but will also be interpreted as condemnation of previous behaviour as bad practice. Therefore, nurses with special interest in infection prevention and awareness of the high VAP rate were recruited and asked to identify causes and prepare solutions. They were also offered additional training and stimulated to study existing literature and attend international symposia. Additionally, contact with nursing colleagues from hospitals with lower rates of VAP was facilitated. A working group on infection prevention was formed in which ICU nurses, a nurse hygienist, a microbiologist and the director of the ICU participated. Thus the ownership of the problem, and even more importantly, of the solutions was in the hands of the working group, chaired by a nurse. The nurses from the working group also organized education and training for their peer group. All these measures were aimed at changes towards a proactive attitude and awareness to control the problems. The medical organization was also changed to a closed format ICU with the arrival of the new director, thus giving the physicians span of control over the medical treatment.

#### **Step 4. Execution of the Plans and Control of Execution**

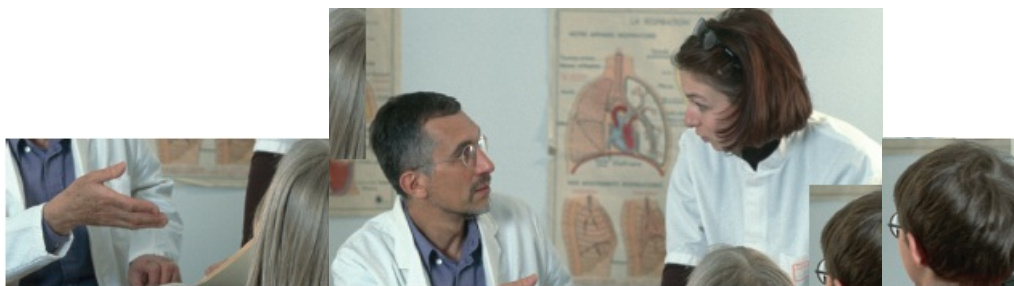
The working group on infection prevention defined a package of interventions, mostly concerning nursing pulmonary care. Strict compliance with existing hygiene protocols, especially hand washing, was reemphasized. Hand washing was facilitated by placement of alcohol-based fluid containers next to every ICU bed. The new interventions included: (1) discontinuing the then current practice of administering standard nebulizing therapy with acetylcysteine and salbutamol 3-6 times daily to all patients; (2) only performing bronchial suction on strict indication. These indications were: sputum retention on auscultation, imminent tube obstruction, visible and/or audible sputum in the endotracheal tube, and before

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turning the patient from supine to prone position. If it was found that bronchial suction was required more than 6 times daily on the basis of the above mentioned criteria, regular bronchial suction was programmed; (3) In case of PEEP > 10 cm H<sub>2</sub>O, a closed catheter suction system was used; (4) a filter, replaced daily, was placed on the bedside ambu balloon, used for ballooning.



All members of the ICU medical and nursing team were informed that three months after implementation of all measures, the incidence of VAP would be measured again, as a parameter of quality of care. The nurse members of the working group were recognized by their colleagues as experts in the field of prevention. They were also ideally situated to check compliance, since they continued to work as a part of the team during all shifts.



#### Role of the Leadership

The leadership role by the ICU director in this aspect of the program was purely coaching and supporting. However, healthcare workers not willing to comply with the new measurements, or expressing negative or lethargic thoughts, were immediately spoken to. These talks were undertaken together with the head nurse. Additionally, a mission statement had been defined at the beginning of the formation of the new truly closed-format department. This mission statement contained issues on high quality patient care, continuous education and training, and research, making it

possible to demand loyalty on the implementation of the measures.

#### Results

Measurement of VAP was repeated in 2001 and 2003. On instigation of the working group additional measures, focussing on extra rinsing and spraying of the oral cavity, were implemented in 2002. The results are depicted in table 1, as an illustration, showing a progressive fall in incidence of VAP.

#### Discussion

We found a fall in incidence in VAP as a result of a management and educational strategy in our ICU. The results could be disputed since no bronchoscopic diagnostics were performed on a routine basis. However, we are fully convinced – together with the nurses involved – that a substantial decrease in VAP incidence was realized. It is of note that the general awareness of span of control on infection prevention has emerged and new initiatives now continuously arise from the nursing team. We are aware of the fact that it remains unclear which factor contributed most to the fall in VAP incidence. The purpose of our effort was, however, not to perform a scientific study to elucidate factors to reduce VAP incidence, but to increase quality of care and awareness of quality of care among all healthcare workers in the ICU.

<b>Table 1</b>		
Ventilator associated pneumonia in 2001 during a 6 month observation period and 2003 during a 7 month period. Both periods show a fall compared to 1999 where 45% of patients at risk developed pneumonia (see text).		
	<b>2001</b>	<b>2003</b>
Number of patients at risk for VAP	82	78
Number of patients with pneumonia	13	2
Percentage	15.9 %	2.6 %
Patients with pneumonia / 1000 ventilator days	12.2	1.6
95% Confidence interval	5.6 – 18.8	1.0 – 3.8

Many papers on VAP prophylaxis and treatment deal with the introduction of new techniques or medical therapy. Few papers describe the impact of organizational factors and management/leadership on issues such as VAP incidence. Changing clinical practice at the bedside is not easy to implement when it involves changing the behaviour of clinicians [7]. Whenever an indication for changes in behaviour is recognized by the leadership, it is important to look for support from “the floor”. A practical approach to obtain support from “the floor” is to make staff members recognize the problem and potential solutions. The “ownership” and resulting credit in case of good results should belong to the group. Contemporary demands require coaching (“servant”) leadership. This, however, does not exclude pointing out individual responsibilities of

healthcare workers in case of non-compliance. Never avoid speaking to individuals who apparently do not wish to comply with the general direction that has been chosen by the group and which is supported by the leadership. The goal of good leadership should be to facilitate expression and development of individual qualities. Assigning responsibilities to individuals and the authority to make choices will help them to fulfil their proper roles. The leadership should demonstrate optimism on all occasions and should not accept lethargy or impotence from anyone. Good communication of nursing and medical staff is a requirement for success that is self-evident. Although we are unable to find evidence from the literature that good communication contributes to a lower incidence of VAP, we are willing to make such a statement.

Much emphasis has been placed on education in a recent paper by Babcock et al. [8]. The authors demonstrated that an educational intervention can be associated with decreased rates of VAP incidence in the ICU setting. In fact many similarities can be seen in their approach, where education is underscored, and our approach, where education is part of a management strategy.

Finally, it is always good to realize that one should let time do its work. In general medical directors overestimate what can be achieved in a short time period and underestimate what can be achieved in the long run. Make time your friend.

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