Translate knowledge to action: an experience of evidence-based bundle care for preventing ventilator-associated pneumonia in Taiwan

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Background
Ventilator-associated pneumonia (VAP) remains a major cause of morbidity and mortality among critical patients. The estimated incidence of VAP was 10–20%, with a mortality rate of 10%. Patients with VAP have been proven associated with increases in prolonged periods of mechanical ventilation, more antibiotics consumption, extended length of ICU stay and hospitalizations, and incur excessive medical expenses related to treatment.

Latest, a concept of bundle care is emerging. Implementing these interventions collectively results in better patient outcomes than performing individually. In this study, an evidence-based bundle care for preventing VAP was developed. In addition, we integrated these interventions into clinical informatics system for reminding health care personnel in order to promote the application of research evidence.

Aims
The aim of this article was to share the experience and workability of knowledge translation to prevent VAP in Taiwan.

Methods
The “knowledge-to-action conceptual framework” (Graham et al., 2006) was used to design the study (Fig. 1).

Assess barriers to knowledge use
• The accessibility of supraglottic secretion drainage (SSD) and antiseptic-impregnated endotracheal tubes are not paid by the National Health Insurance.
• Physicians/ Nurse: patient ratio was low (1:10 vs. 1:2–3) for better attention and remembering all the evidence-based interventions for patients.

Select, tailor, and implement interventions
We integrated bundle VAP care interventions into clinical informatics system in hospital (Fig 2) for reminding in order to promote the application of research evidence. If patients still intubated with a ventilator, - NSS system can remind physicians to evaluate of sedatives usage, interuption of sedation and assess readiness for extubation with respiratory therapists every day. Physicians also prescribed prophylaxis (oxacillin or甲吸氧injection) for puerperal postpartum infection.
- NSS system will inform nurses to do the VAP prevention interventions, such as: elevation of the head of the bed 30° to 45°, oral care with Paraisun gargle (0.2% chlorhexidine) every shift, daily evaluation the pressure of endotracheal tube cuff (20–30 cmH2O) etc...
• Parents’ opinions, simple flow charts and education resources in plain language about medication can facilitate its clinical application.

Monitor knowledge use
The VAP bundle care interventions were monitored by clinical staff and infection management committees.

Evaluate outcomes
The incidence of VAP decreased from 0.424% to 0.0% in ICUs (Fig 3). Overall, the average cases of ventilator-days were decreased from 1301 to 1213 person-days per month in hospital, from 647.2 to 646.2 person-days per month in ICUs (Fig 4).

Sustain knowledge use
The outcome was presented to the infection control center for preparing Standard of Procedure (SOP) documents and auditing the performance of clinical staff. At the same time, the quality indicator (cases of ventilator-days and the incidence of VAP) were recorded in the hospital’s multi-disciplinary quality control department. The multidisciplinary team members discuss quality indicators every three months and update new research evidence at least every two years.

Discussion & Conclusions
• We developed the VAP bundle care and embedded VAP bundle care interventions into clinical informatics system to facilitate multidisciplinary team in preventing the VAP among patients using ventilators. Based on our experience, the success knowledge translation process help to decrease cases of ventilator-days, the incidence of VAP and improve the quality of care.
• Limitations: First, it was a preliminary research and implemented in a single hospital. A multiple center trial may provide stronger evidence. Second, it is difficult to have a control group because of ethical concern.

Key words
knowledge translation, knowledge-to-action, ventilator-associated pneumonia (VAP), bundle care, intensive care units (ICUs)

Fig 2 Clinical informatics system (Health informatics system, HIS, and Nursing informatics system, NIS) in study hospital in order to promote the application of research evidence

Fig 3 The incidence of VAP in ICUs during 2010–2012

Fig 4 The average cases of ventilator-days in ICUs during 2010–2012

Results
We organised multidisciplinary team to develop the evidence-based recommendations for VAP bundle care in 2009. The team member included hospital administrators, member of infection control committees, clinicians and informatics specialists. The results were demonstrated as following:

Phase (I): Knowledge Creation (Tailoring knowledge)
Knowledge Inquiry
• Main key words (intensive care unit, bundle care, ventilator-associated pneumonia, and nosocomial infections) searches were conducted using Cochrane Library, Medline, Published and CINAHL (2000 to 2009) with restriction of English and Chinese language.
• We also searched the VAP Prevention Bundle recommendations from website of Center for Disease Control, ROC (Taiwan), Centers for Disease Control and Prevention (USA) and Scottish Intensive Care Society Audit Group for clinical practice guidelines.
• Unpublished reports and conferences proceedings were not included.

Knowledge Synthesis
Bundle care to prevent VAP has been published by researchers and several expert groups. Literature evidence was classified into 8 levels of evidence and recommendations as A to D according to the criteria of SIGN.

Knowledge Tools/ Products
Based on the SIGN methodology, we completed the evidence-based VAP bundle care by January 2010. Overall, 16 small groups of interventions related to prevent VAP were proposed as Table 1.

Phase (II): The Action Cycle (Application)
Identify problem: Identify, review, select knowledge
• The incidence of VAP increased as high as 1.3% during fourth season in 2009.
• Lack of standard of interventions caring illness patients with ventilator.

Adapt knowledge to local context
Taking into consideration of patient’s condition, experts experience, national regulation and health insurance payment, final components of the VAP care bundle as Table 2.

Fig 1 Knowledge-to-action conceptual framework. The conceptual framework was developed in order to promote the application of research. There were two phases in the process: Knowledge Creation and The Action Cycle (application).

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