Ventilator-associated pneumonia
A successful story

Dr Arthur Chun-Wing Lau, Associate Consultant
ICU, Pamela Youde Nethersole Eastern Hospital, Hong Kong

27th August, 2015

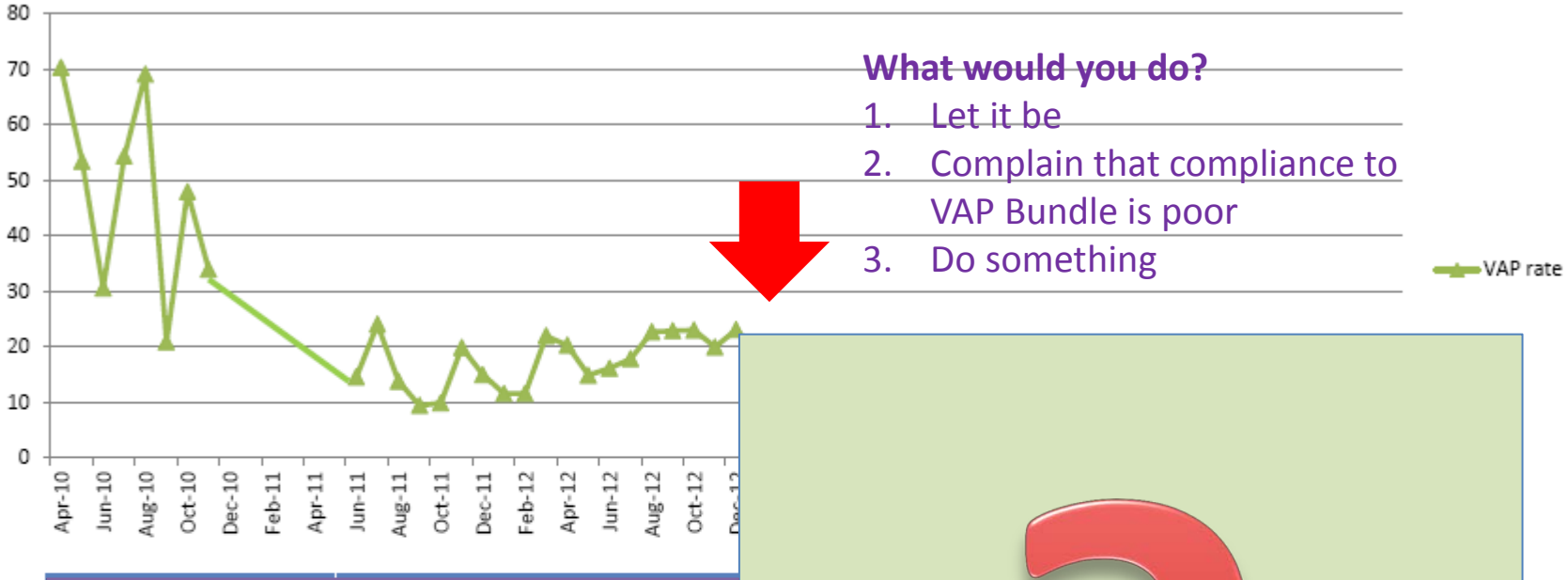
PYNEH ICU

- **ICU, PYNEH**
  - **1993** – PYNEH established
  - **1994 to 2006**
    - Closed ICU under Dept of Anaesthesia
    - Medical HDU under Department of Medicine
  - **After 2006** – Independent Department of Intensive Care, a general mixed closed ICU (except burn and cardiothoracic surgery)
- PYNEH
  - Government-subsidized hospital under the Hospital Authority

Chronology of VAP Prevention Development

1. 1993 – 2005: VAP Prevention strategies in ICU and MHDU based on contemporary knowledge
2. 2006: First VAP audit as advised by microbiologist, CPIS score used as the criteria, with subsequent standardization of many practices
3. 2006 – 2007: First VAP Prevention Programme, VAP Team established and led by nurses: HOB audit, VAP board; VAP bundle compliance audit carried out
4. 2010: VAP Surveillance using CDC PNU1, VAP rate still persistently higher than benchmark

VAP rate in ICU of PYNEH



What would you do?

1. Let it be
2. Complain that compliance to VAP Bundle is poor
3. Do something

NHSN Benchmark Rates (per 1000 ventilator-days)	2002	2012
Mixed Med-Surg ICU	5.1	0.9
Trauma	15.2	3.6
Burns	12.0	4.4

Our thoughts

1. VAP criteria are subjective
2. No single method to deal with VAP prevention
3. Bundle of methods not standardized, outcomes not sure
4. Unsure benefits on eventual patient outcome documented in sufficiently powered well-designed trials
5. A large amount of clinical trials, but yielded few clear-cut answers
6. Casemix differences amongst hospitals
7. Cost-effectiveness ……

Our second thoughts

1. Our rates were indeed persistently higher than benchmark, but compliance to the VAP bundle was satisfactory already by repeated audits, WHY? Have we over-done something?
2. VAP prevention strategies involve improvement in the overall care of ventilated patients, so worth implementing
3. A good chance for doctor-nurse collaboration
4. A good research idea: “危機”
5. There is always room for improvement

Ventilator-Associated Pneumonia (VAP) Audit (PAGE 2) - DATA ENTRY FORM

Day 1 = First day of intubation: (D/M/Y) _____; *Study phase*: 1. pilot (Dec 06); 2: baseline (Jan 07); 3: enforcement (Feb 07)
Key: 1. Tick if done; 2. NA if not applicable; 3. cross if non-compliance, and specify reason

Item No.	Day / Date (D/M)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Disinfection of ventilator & accessories a/c protocol	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	Tubing, bacterial filter and HME change a/c protocol	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3	Closed suction system change a/c protocol	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	Hand hygiene	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	Semirecumbent (30° – 45°) body position	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	Drainage of ventilator circuit before repositioning	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7	Regular oral toilet	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8	Daily assessment of readiness to extubate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9	Stress ulcer prophylaxis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10	DVT prophylaxis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11	Verification of appropriate placement of the feeding tube	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12	Regular assessment of the patient's tolerance to NG feeding	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13	Daily check of ETT cuff pressure	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14	Subglottic secretions suction before cuff deflation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
A	CPIS (fill in the Score no.)	■	■	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
B	Tracheal aspirate culture collected	■	■	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
C	Onset of VAP (Study can be stopped at VAP onset)	■	■	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Reasons of non-compliance:

Day	Item	Reason	Day	Item	Reason	Day	Item	Reason

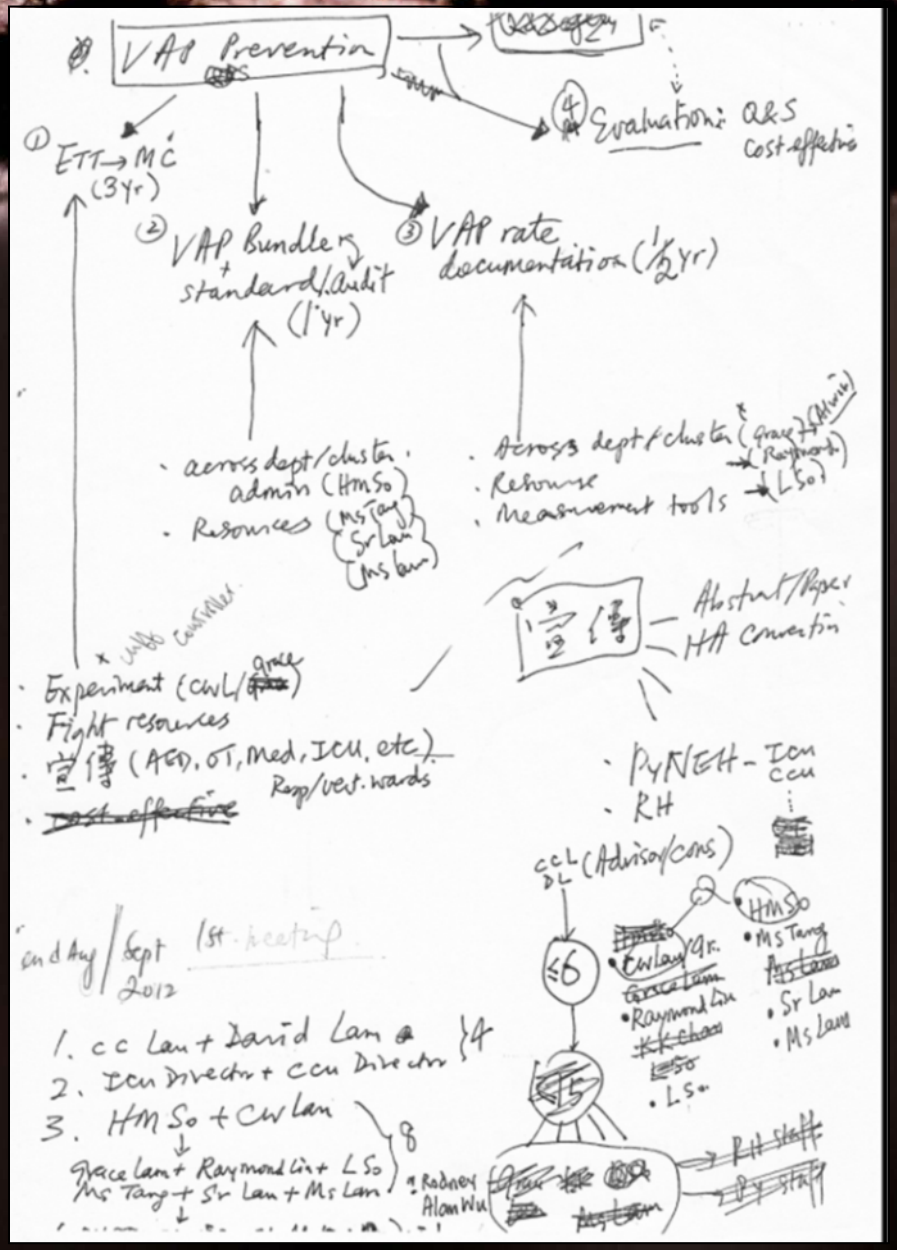
2007: CPIS score and our VAP Bundle

2012: Task Force on VAP Prevention in Critical Care Areas in HKEC

2012: VAP Prevention Task Force led by Sr HM So in ICUs of PYNEH and RH (HK East Cluster) since 2012

Setting the goals and schedule

1. Setting the goals and schedule
2. Identifying the problem and attack it
3. Planning
   - Teams: doctors and nurses
   - Pragmatic approach
4. Monitoring, persevere to achieve the goal, and ready to adjust the strategy
5. Promotion



Departmental Effort

Set up a task force

Quality Improvement Project: Prevention of Ventilator-associated Pneumonia (VAP) in Critical Care Areas, HKEC

A. **Aims**: to decrease the rate of VAP by implementing all elements of the ventilator bundle to more than 95% of ventilator patients in critical care areas within 2 years

B. **Objectives:**

1. To determine the baseline VAP rate
2. To determine the VAP after the enforcement of ventilator bundle
3. To look for reasons why some preventive measures of VAP cannot be carried out
4. To conduct ongoing outcome surveillance for VAP and process surveillance to ventilator bundle.

C. **Scope of project:** This is a Hong Kong East Cluster based project.

D. **Phases of Project**

1. Phase I : Pilot the tool for monitoring patient for incident of VAP and pilot the audit tool for current practice to prevent VAP (complete before 15 Dec 2012)
2. Phase II : clinical audit to determine baseline VAP rate x 2 months (Period: 1 Jan 2013 – 28 Feb 2013)
3. Phase III: Review ventilator bundle and conduct training to all staff on VAP prevention program (complete before 1 Mar 2013)
4. Phase IV : Enforcement of ventilator bundle (start time : on 1 Mar 2013) Duration : 2 year

Task Force for the Prevention of VAP in Critical Care Areas of HKEC

Quality Improvement Project: Prevention of Ventilator-associated Pneumonia (VAP) in Critical Care Areas, HKEC

Key Members as at 26 Nov. 2012

Project Champions	Dr Lau Yuk Kong	Consultant, C/CICU,	RHTSK
	Ms. Monica Ng	DOM, C/ICU	RHTSK
	Dr Yan Wing Wa	COS, ICU	PYNEH
	Ms. Nora Kwok	DOM, ICU	PYNEH
Project Sponsors	Ms. Cecilia Chan	GMN	RHTSK
	Ms. Civy Leung	GMN	PYNEH
Project Managers	Dr Raymond Liu	SMO, C/ICU	RHTSK
	So Hang Mui	Nurse Consultant (Intensive Care)	HKEC
Project Leaders	Ms. Tang Sui Lan	WM, C/ICU	RHTSK
	Ms. Lau Lan	WM, ICU	PYNEH
Team members	Ms. Chan Yuen Shan, Patricia	Nursing Officer, C/ICU	RHTSK
	Ms. So Yuk Lan	RN, C/ICU	RHTSK
	Dr Lau Chun Wing	Associate Consultant, ICU	PYNEH
	Dr Alwin Yeung	Resident, ICU	PYNEH
	Dr Lam Sin Man	Associate Consultant, ICU	PYNEH
	Ms. Chiu Mei Chun	APN, ICU	PYNEH
	Ms. Mok Chi Man	RN, ICU	PYNEH
	Ms. Wong Po Man	RN, ICU	PYNEH
	Ms. Lam Yin Ha	WM, CCU	PYNEH

PYNEH and RH joined

Quality Improvement Project: Prevention of Ventilator-associated Pneumonia (VAP) in Critical Care Areas, HKEC

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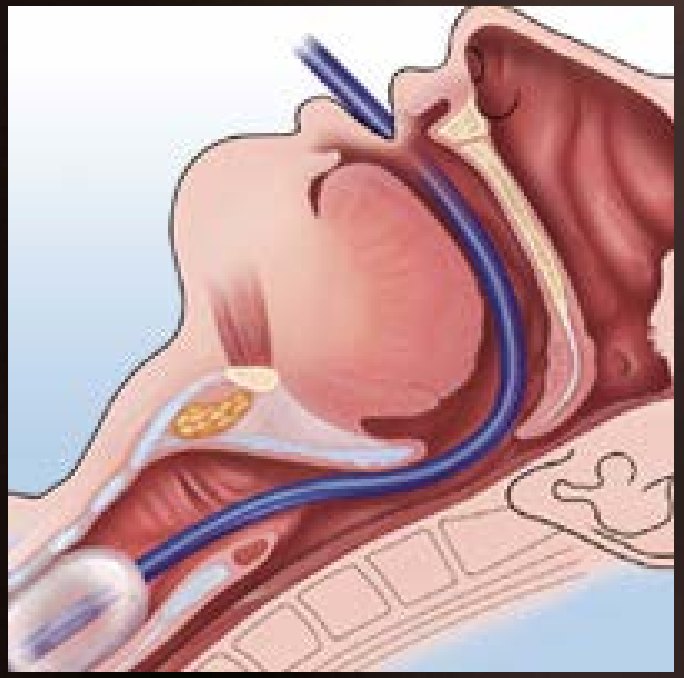
Identifying the problem and attack it

- The ETT allows direct access to the lower respiratory tract, impairing the cough reflex and mucociliary clearance, but provides incomplete sealing to secretions above the cuff.
- Major mechanisms:
  1. Microaspiration (of materials from oropharyngeal cavities, sinuses, gastro-intestinal tract)
  2. biofilm formation
  3. Inhalation
  4. Bacteraemia
  5. haematogenous spread



Development of VAP Prevention

- The most widely practised and well-known set of strategies is the **Ventilator Bundle** developed by the Institute for Healthcare Improvement (IHI) in 2001.
- Its original aim was to improve better ventilator care overall, and not VAP alone, although its practice does reduce the VAP rate by 45%.
- The components:
  1. elevation of the head of bed to between 30° and 45°;
  2. daily 'sedative interruption' and daily assessment of readiness to be extubated;
  3. peptic ulcer disease prophylaxis;
  4. deep venous thrombosis prophylaxis (unless contra-indicated); and
  5. daily oral care with chlorhexidine.

How-to guide: Prevent ventilator-associated pneumonia. Available from: http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventVAP.aspx. Accessed 20 Jul 2014.

衞生防護中心
Centre for Health Protection

Recommendations on Prevention of Ventilator-associated Pneumonia

衞生防護中心乃衞生署轄下執行疾病預防及控制的專業架構
The Centre for Health Protection is a professional arm of the Department of Health for disease prevention and control

Scientific Committee on Infection Control, and Infection Control Branch, Centre for Health Protection, Department of Health

June 2010

Membership (2007 to 2010)

Chairman	:	Dr. Seto Wing Hong
Members	:	Dr. Cheng Chi Fung, Jason
		Ms. Ching Tai Yin, Patricia
		Dr. Ho Pak Leung
		Dr. Kwan Kai Cho, Joseph
		Dr. Leung Lai Man, Raymond
		Dr. Lim Wei Ling, Wilina
		Dr. Que Tak Lun
		Dr. Tong Cheuk Yan, William
		Dr. Tsang Ngai Chong, Dominic
		Dr. Yung Wai Hung, Raymond (up to October 2008)
		Dr. Wong Tin Yau (from October 2008)
Secretary	:	Dr. Carole Tam (up to May 2010)
		Dr. Janet Ho (from May 2010)

I. Infection Control Branch Guideline Team Members:

Ms. Lung Wan Tin (APN, ICB)
Dr. Ho Yuen Ha, Sara (MO, ICB)
Dr. Chen Hong (AC, ICB)
Dr. Wong Tin Yau, Andrew (Head, ICB)

Doctors and nurses who gave comments and feedbacks during the process of recommendation development

II. External Consultation Parties:

Dr. Raymond Chinn (Chairman/Infection Control Committee, Hospital Epidemiologist, Medical Director / Infection Surveillance and Prevention Program, Sharp Memorial Hospital, San Diego, USA)
Dr. Chan Wai Ming (Consultant, AICU, QMH)
Dr. Yan Wing Wa (Director, ICU, PYNEH)
Ms. Leung Fung Yee (DOM, AICU, PMH)
Ms. Chau Lai Sheung (NS, AICU, TMH)
Task Force in Infection Control, Hospital Authority
Co-ordinating Committee in Intensive Care Unit, Hospital Authority
Co-ordinating Committee in Physiotherapy, Hospital Authority

ICU Specialist Infection Control Training Program

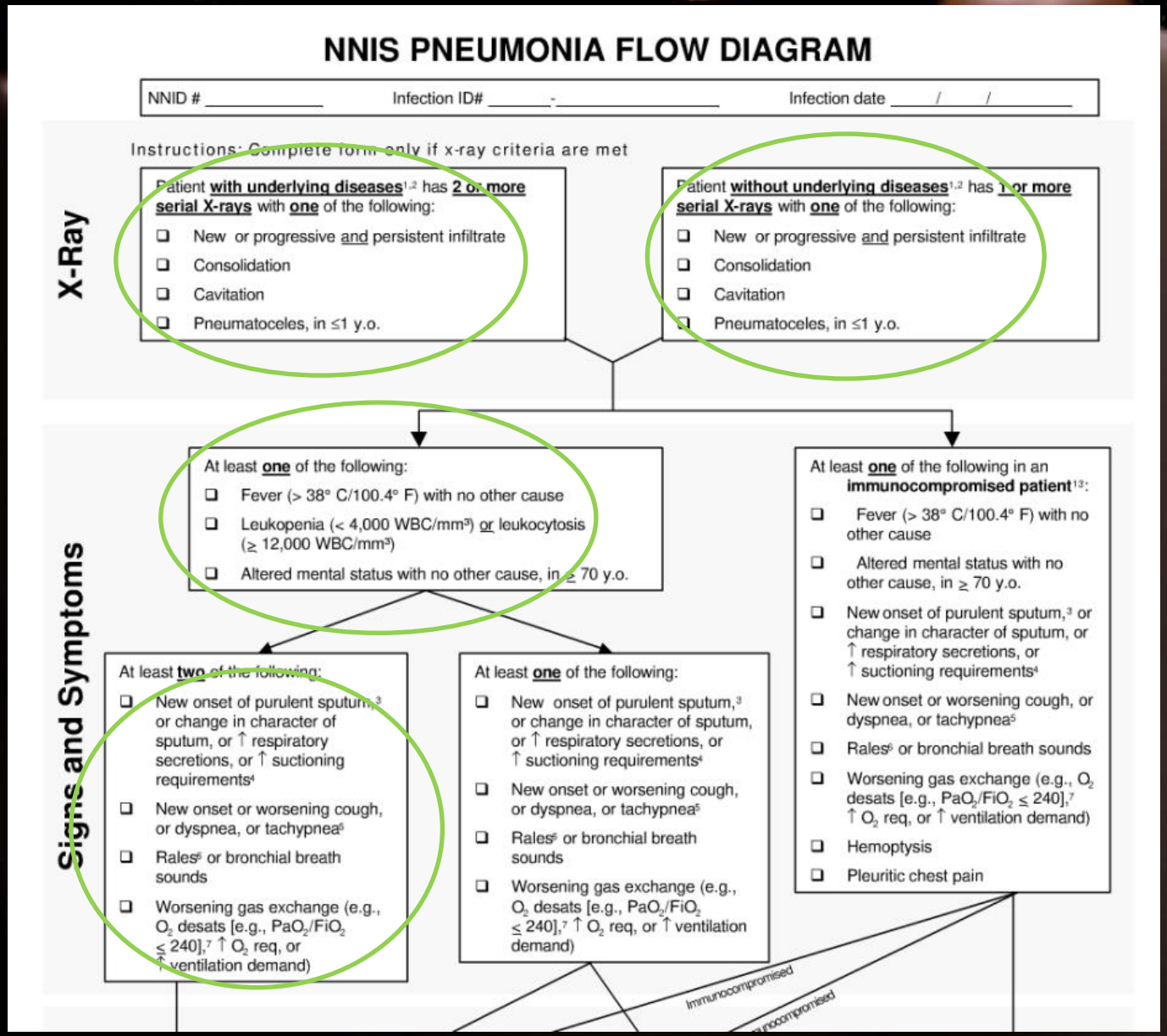
16 April 2013

Internal administration

- VAP prevention protocol in place
- Regular documentation of VAP rate and benchmarking with international data (PNU1)
- Regular audits on compliance with VAP prevention strategies
- Set VAP as regular item in business meeting for discussion, review every VAP case
- Promulgate VAP rate and prevention strategies to all staff through various channels
- Include VAP in orientation of new staff, and update existing staff regularly

The PYNEH VAP Team

Monitoring: The PNU1 criteria



NNIS PNEUMONIA FLOW DIAGRAM

NNID # _____ Infection ID# _____-_____ Infection date ____/____/_____

Instructions: Complete form only if x-ray criteria are met

X-Ray

Patient **with underlying diseases**[1,2] has **2 or more serial X-rays** with **one** of the following:

- ❑ New or progressive and persistent infiltrate
- ❑ Consolidation
- ❑ Cavitation
- ❑ Pneumatoceles, in ≤1 y.o.

Patient **without underlying diseases**[1,2] has **1 or more serial X-rays** with **one** of the following:

- ❑ New or progressive and persistent infiltrate
- ❑ Consolidation
- ❑ Cavitation
- ❑ Pneumatoceles, in ≤1 y.o.

Signs and Symptoms

At least **one** of the following:

- ❑ Fever (> 38° C/100.4° F) with no other cause
- ❑ Leukopenia (< 4,000 WBC/mm³) or leukocytosis (≥ 12,000 WBC/mm³)
- ❑ Altered mental status with no other cause, in ≥ 70 y.o.

At least **two** of the following:

- ❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
- ❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
- ❑ Rales[6] or bronchial breath sounds
- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., PaO_2/FiO_2 ≤ 240],[7] ↑ O_2 req, or ↑ ventilation demand)

At least **one** of the following:

- ❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
- ❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
- ❑ Rales[6] or bronchial breath sounds
- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., PaO_2/FiO_2 ≤ 240],[7] ↑ O_2 req, or ↑ ventilation demand)

At least **one** of the following in an **immunocompromised patient**[13]:

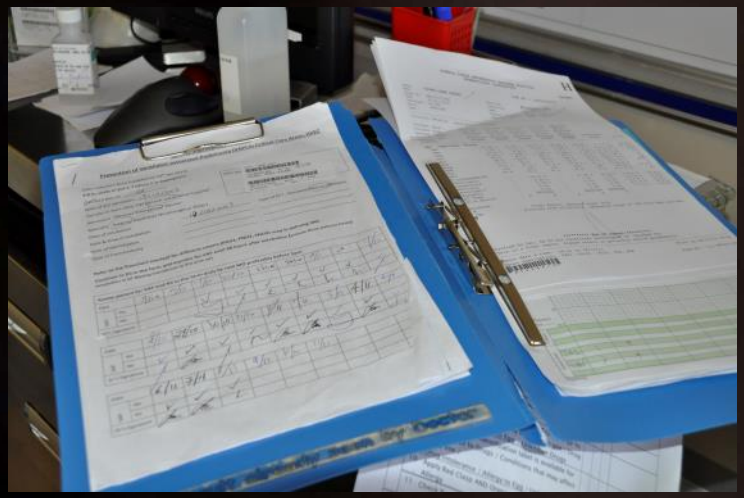
- ❑ Fever (> 38° C/100.4° F) with no other cause
- ❑ Altered mental status with no other cause, in ≥ 70 y.o.
- ❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
- ❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
- ❑ Rales[6] or bronchial breath sounds
- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., PaO_2/FiO_2 ≤ 240],[7] ↑ O_2 req, or ↑ ventilation demand)
- ❑ Hemoptysis
- ❑ Pleuritic chest pain

Immunocompromised

CDC

Make staff feel it is important

- VAP set as a standing agenda item in weekly ICU meeting
- Routine VAP documentation by all doctors everyday



321st ICU Meeting

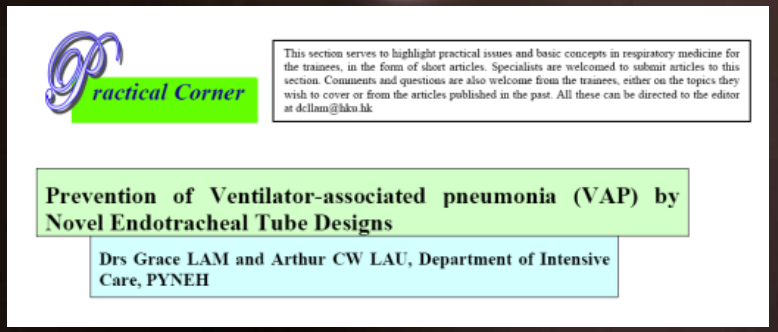
Date: 31st January 2013 (Thursday)
Time: 15:00hour
Venue: D10, Conference Room, PYNEH

Agenda

1 Confirmation of Last Minutes and Matters Arising from Last Minutes
2 Matters Related to Hospital Committees
3 Staff Issue
4 Avian Flu / Novel Coronavirus / Infection Control
5 OSH / AIRS
6 CIS
7 Core Groups Report
8 Incident Review
9 ICU Family Satisfaction Enhancement Programme (FAME)
10 VAP
11 Any Other Business
12 Date of next meeting

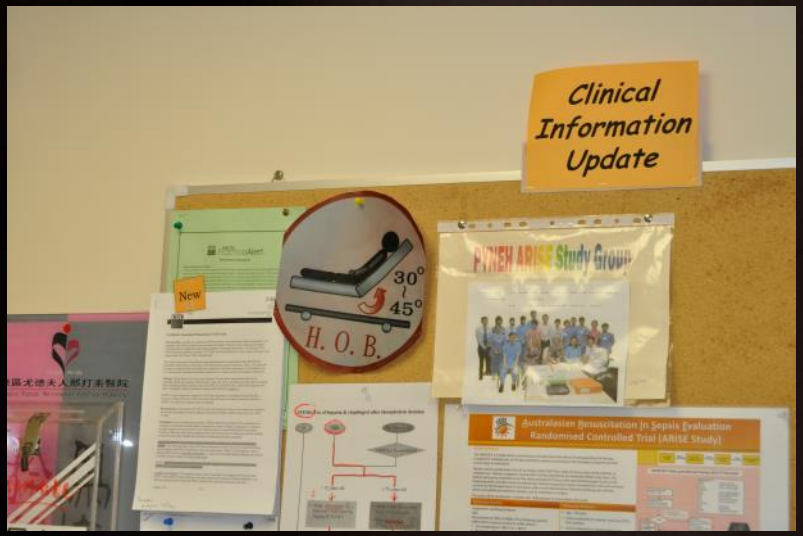
Publicity and Education

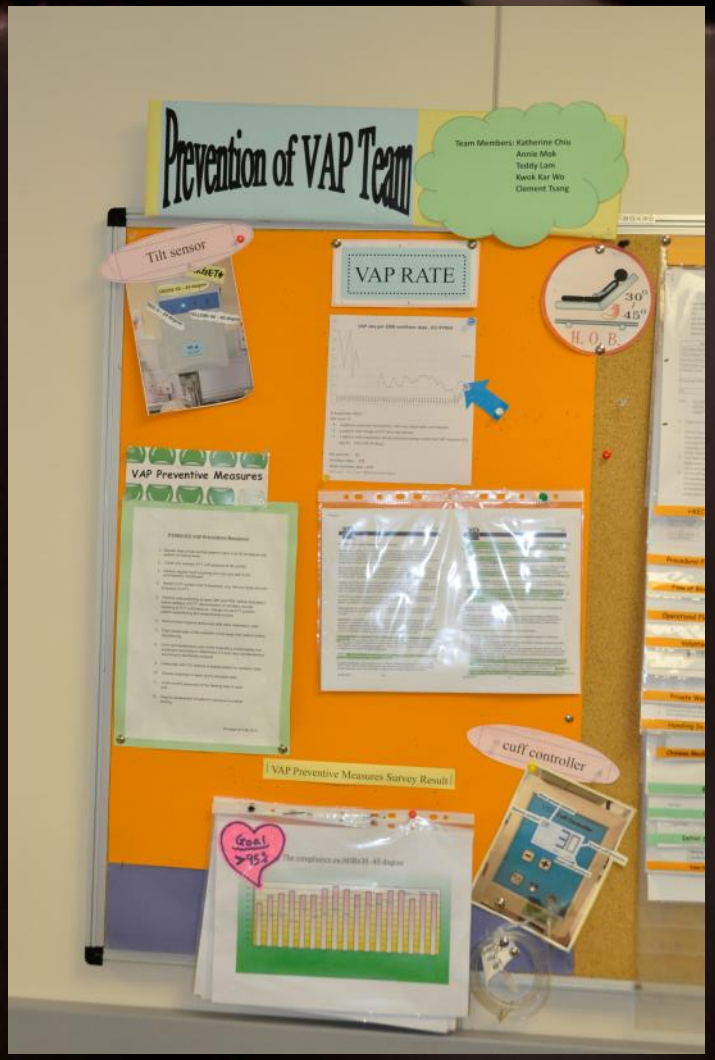
- Articles on Prevention of VAP
  - Prevention of Ventilator-associated pneumonia (VAP) by Novel Endotracheal Tube Designs. Drs Grace LAM and Arthur CW LAU. HKTS Newsletter 2011 May.
  - Prevention of Ventilator-associated pneumonia - An Old Topic with New Tricks. SO HM, HKTS Newslettter Jan 2013
- Also Freely available at
  - Hong Kong Resp Med: www.hkresp.com
  - Hong Kong Society of Critical Care Medicine: www.hksccm.org
- Incorporate VAP Prevention in our Critical Care Respiratory Course



Outcome Evaluation

- Monitor VAP rate at a monthly basis
- Post up the VAP rate on display board at a prominent place
- Disseminate compliance audit results

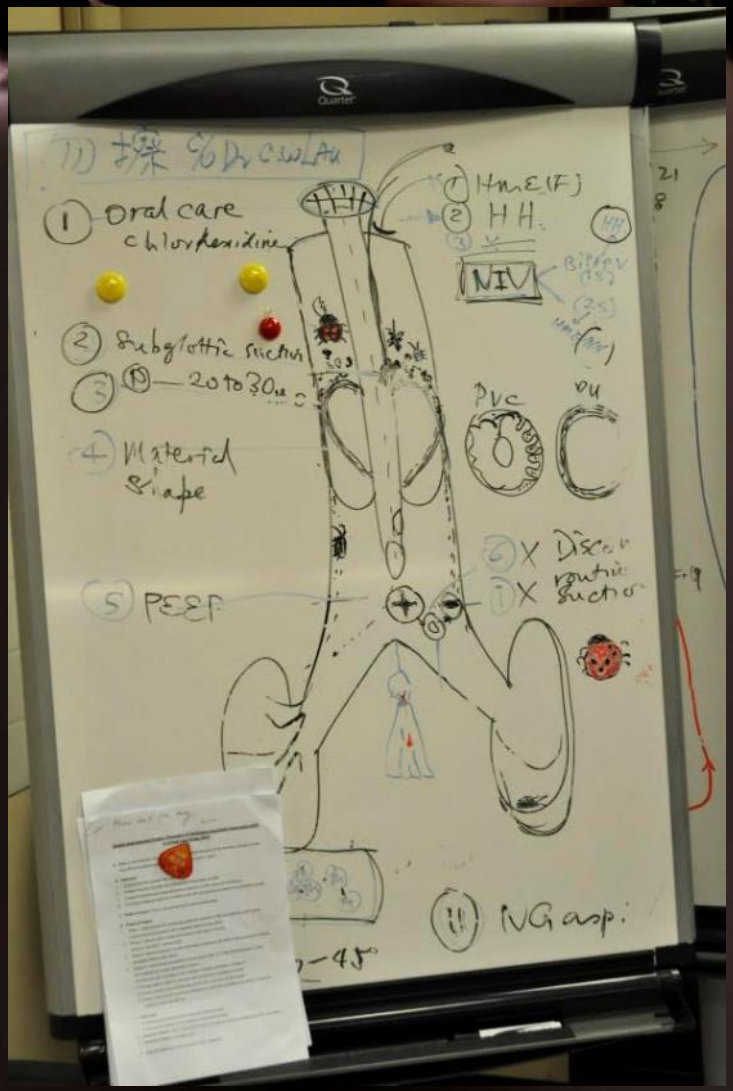




Internal Education

Refresher lecture on VAP

Bed brief talks at bedside



Visual display for bundle promotion

ORIGINAL ARTICLE

Benchtop study of leakages across the Portex, TaperGuard and Microcuff Endotracheal tubes under simulated clinical conditions

Arthur CW Lau 劉俊穎
SM Lam 林倩雯
WW Yan 殷榮華

ONLINE FIRST

DOI: 10.12809/hkmj133930

This article was published on 22 July 2013 at <www.hkmj.org>.

This version may differ from the print version.

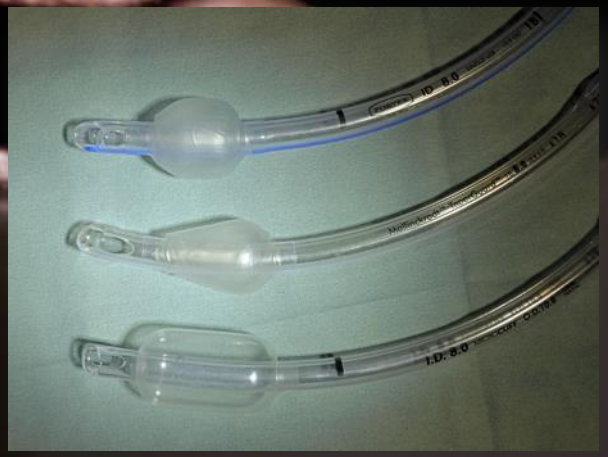
Objectives To compare three endotracheal tubes for leakage across the cuff (microaspiration) under a comprehensive set of simulated clinical situations. These were the Mallinckrodt TaperGuard (Covidien, US) with a tapered polyvinyl chloride cuff; the KimVent Microcuff (Kimberly-Clark Health Care, US) with a cylindrical polyurethane cuff, and a conventional Portex (Smiths Medical International Ltd, UK) with a globular polyvinyl chloride cuff.

Design A benchtop experimental study.

Setting and materials A silicone cylinder serving as the model trachea was intubated with each of the three endotracheal tubes, one at a time. A total of 20 mL of water were added above the cuff and leakage measured every minute for 20 minutes under five simulated mechanical ventilation scenarios, including different positive end-expiratory pressure levels, and disconnection with and without spontaneous breathing efforts. Each scenario was studied under three cuff pressures of 10, 20 and 30 cm H_2O, and then repeated with the application of a continuous suction force of 200 cm H_2O, and leakage measured every minute for 3 minutes.

Results The outcome of interest was the cumulative amount of leakage. The Microcuff endotracheal tubes with an ultrathin polyurethane cuff consistently provided the best protection against microaspiration under all simulated clinical situations, followed by TaperGuard with a tapered cuff, and lastly Portex with a globular polyvinyl chloride cuff. Clinical scenarios associated with the greatest leakage were mechanical ventilation with zero positive end-expiratory pressure, circuit disconnection with spontaneous breathing efforts, application of suction, and a low cuff pressure.

Conclusions Microcuff endotracheal tubes outperformed TaperGuard and Portex endotracheal tubes in preventing microaspiration, which is one of the major mechanisms for ventilator-associated pneumonia.



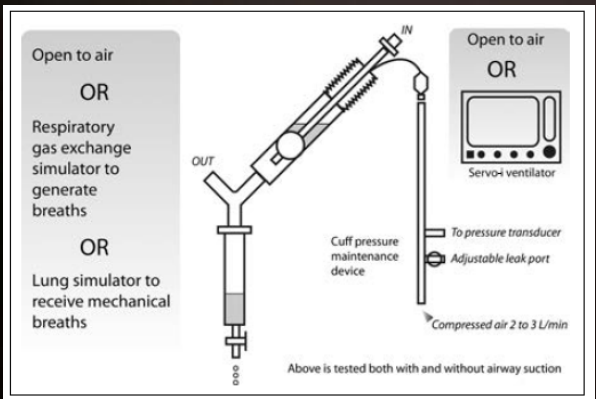


FIG 1. Graphical representation of the experimental setup
For the study of positive pressure mechanical ventilation, the distal end of the model trachea was connected to a lung simulator (SMS Lung Simulator, SMS Technologies, UK). For the study of spontaneous breathing, it was connected to a respiratory gas exchange simulator which generated breaths to mimic different metabolic rates. For the study of total disconnection, it was opened to atmospheric pressure

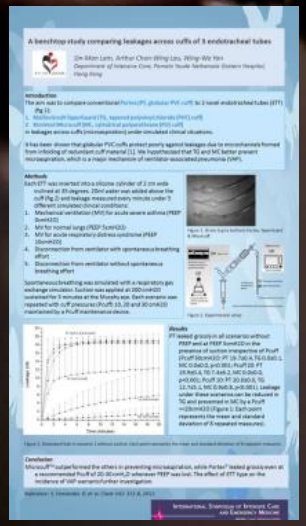
Lau ACW, et al. HKMJ 2013
Lau et al. HKMJ 2014

Portex

TaperGuard

Microcuff

Research, Publications and Promotion



Lam SM, Lau ACW. ISICEM 2013 Abstract

MEDICAL PRACTICE

Prevention of ventilator-associated pneumonia

Arthur CW Lau *, HM So, SL Tang, Alwin Yeung, SM Lam, WW Yan; Hong Kong East Cluster Task Force on Prevention of Ventilator-associated Pneumonia in Critical Care Areas

ABSTRACT

Ventilator-associated pneumonia is the commonest, yet mostly preventable, infection in mechanically ventilated patients. Successful control of ventilator-associated pneumonia can save hospitalisation cost, and is possible by using a multidisciplinary clinical and administrative approach. The ventilator-associated pneumonia rate should be expressed as the number of ventilator-associated pneumonia days per 1000 ventilator days to take into account the device-utilisation duration for meaningful comparison. Various strategies address the issue, including general infection control measures, body positioning, intubation and mechanical ventilation, oral and gastro-intestinal tract, endotracheal tube, airway pressure, cuff pressure, selective digestive and/or oropharyngeal decontamination, and probiotic or early antibiotic treatment, as well as overall administration at a policy level. The rationale and controversy of these approaches are discussed in this article. The authors suggest that all units treating mechanically ventilated patients should have a ventilator-associated pneumonia prevention protocol in place, and ventilator-associated pneumonia should be seriously considered as a key performance indicator in local intensive care units.

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Lau ACW, et al for the HKEC Task Force on Prevention of Ventilator-Associated Pneumonia 2015

Crit Care & Shock (2012) 15:111-119

Ventilator Associated Pneumonia in Intensive Care Unit: Incidence, patient characteristics, outcome and validation of VAP-PIRO score in a local Chinese cohort

Arthur Ming-Chit Kwan, King-Chung Chan, Arthur Chun-Wing Lau, Wing-Wa Yan

Abstract

Objective: Despite a systematic scoring system has been developed to assess the severity and to stratify the mortality risk of Ventilator-Associated Pneumonia (VAP), few clinical studies had published in validating this scoring system. We intend to study the incidence of VAP in a local Chinese cohort and to validate the VAP-PIRO (Predisposition, Insult, Response, Organ Dysfunction) score.

Design: A prospective, observational cohort study.

Setting: A 20-bed mixed medical-surgical adult Intensive Care Unit (ICU) of a regional referral centre serving 650,000 populations.

Patients and participants: 269 consecutive patients who had been intubated and mechanically ventilated for more than 24 hours during an 8-month study period.

Interventions: None.

Measurements and results: VAP was diagnosed by National Healthcare Safety Network (NHSN) PNU1 criteria. Clinical characteristics, medical resource use and outcome of the cohort were studied. The VAP-PIRO score of each VAP case was calculated. The medical resource use and mortality in each PIRO risk group were compared. Of 269 patients admitted to ICU during the study period there were 59 VAP cases. The VAP incidence was 47.81 per 1,000 ventilator days. VAP-PIRO score was unable to stratify medical resource use and mortality in our cohort.

Conclusion: VAP-PIRO score cannot significantly differentiate mortality and usage of medical resources in our cohort. This is likely due to the severity of VAP in our cohort is modest when compared to the original cohort.

Kwan AMC, et al. Crit Care & Shock 2012

To minimize disconnection of ventilator circuit

- Use of heated humidification instead of HME
- Perform ETT suction only as needed
- Perform oropharyngeal suction at regular interval and before disconnection of ventilator circuit
- Routine use of sophisticated smaller sized ventilator (e.g. Hamilton) so that it can be used for transport without disconnection
- Withholding regular chest physio while on ventilator (because involved regular suction, turning, percussion, etc)

Cuff pressure maintenance

To avoid deflation of balloon during checking of pressure

continuous cuff pressure monitoring and maintenance device

Tracoe Smart Cuff Manager

Letter to the NEJM Editor on this article:

ORIGINAL ARTICLE

A Trial of Intraoperative Low-Tidal-Volume Ventilation in Abdominal Surgery

Emmanuel Futier, M.D., Jean-Michel Constantin, M.D., Ph.D., Catherine Paugam-Burtz, M.D., Ph.D., Julien Pascal, M.D., Mathilde Eurin, M.D., Arthur Neuschwander, M.D., Emmanuel Marret, M.D., Marc Beaussier, M.D., Ph.D., Christophe Gutton, M.D., Jean-Yves Lefrant, M.D., Ph.D., Bernard Allaouchiche, M.D., Ph.D., Daniel Verzilli, M.D., Marc Leone, M.D., Ph.D., Audrey De Jong, M.D., Jean-Etienne Bazin, M.D., Ph.D., Bruno Pereira, Ph.D., and Samir Jaber, M.D., Ph.D. for the IMPROVE Study Group

N Engl J Med 2013; 369:428-437 | August 1, 2013 | DOI: 10.1056/NEJMoa1301082

n of water was used
edian tidal volumes
per kilogram of pre-
2005 and 2013.
s that by Futier et al.
rive their data from
that used contem-
Moreover, these data
ecision support data-
contemporary data
ntilation strategies?

.P.H.

TO THE EDITOR: Futier et al. attributed the outcome of fewer postoperative complications in the protective-ventilation group, in which low-tidal-volume ventilation and PEEP were used, mainly to the prevention of atelectasis. We postulate that microaspiration could be another reason for the higher rate of postoperative pneumonia in the nonprotective-ventilation group.

In our recent study,[1] we found that without the provision of PEEP there was downward leakage of fluid across the cuff of the endotracheal tube, even at a recommended cuff pressure of 20 to 30 cm of water. This leakage was eliminated with the use of a PEEP as low as 5 cm of water or with the use of endotracheal tubes with newer cuff designs. In another study[2] in which high-tidal-volume ventilation was compared with low-tidal-volume ventilation, with a PEEP of 5 cm of water in both groups during major upper abdominal surgery, no significant difference was detected in postoperative lung function or clinical outcome. We believe the application of PEEP is the critical variable in the study by Futier et al. We also wonder whether the inflammatory condition associated with pneumonia contributed to the anastomotic leak.

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Kenny K.C. Chan, M.D.

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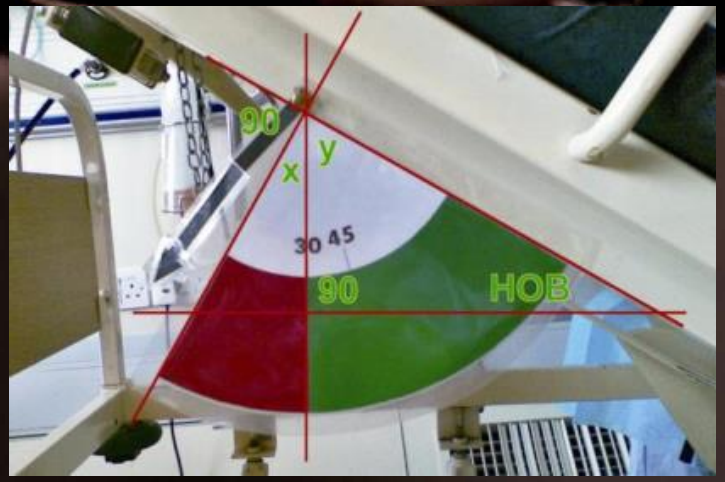
No potential conflict of interest relevant to this letter was reported.

1. Lau ACW, Lam SM, Yan WW. Benchtop study of leakages across the Portex, TaperGuard and Microcuff endotracheal tubes under simulated clinical conditions. Hong Kong Med J 2013 July 22 (Epub ahead of print).
2. Treschan TA, Kaisers W, Schaefer MS, et al. Ventilation with low tidal volumes during upper abdominal surgery does not improve postoperative lung function. Br J Anaesth 2012;109:263-71.

DOI: 10.1056/NEJMc1311316

Body positioning

- The semi-recumbent position (30°-45° to the horizontal) is widely practised as one of the components of the IHI Ventilator Bundle, but which was based on only one randomised study with a non–intention-to-treat protocol of 86 mechanically ventilated patients, comparing the supine and semi-recumbent positions, in which the VAP rates were 34% and 8%, respectively.21
- Subsequent studies were not able to reproduce these results, and found that a 45° position was difficult to maintain, and the mean angle achievable was only 28°.



HOB indicator
Ref: Williams, Zev MD, PhD; Chan, Rodney MD; Kelly, Edward MD. Critical Care Medicine 2008

Semi-recumbent

Tilt Sensor: light signifies HOB 30°-45°

Angle indicator

Nurse-led early weaning protocol

Date:_____ Patient name (English):_____

Pamela Youde Nethersole Eastern Hospital
Departmenet of Intensive Care
Ventilator Weaning Trial Checklist

1. Inclusion and Exclusion Criteria

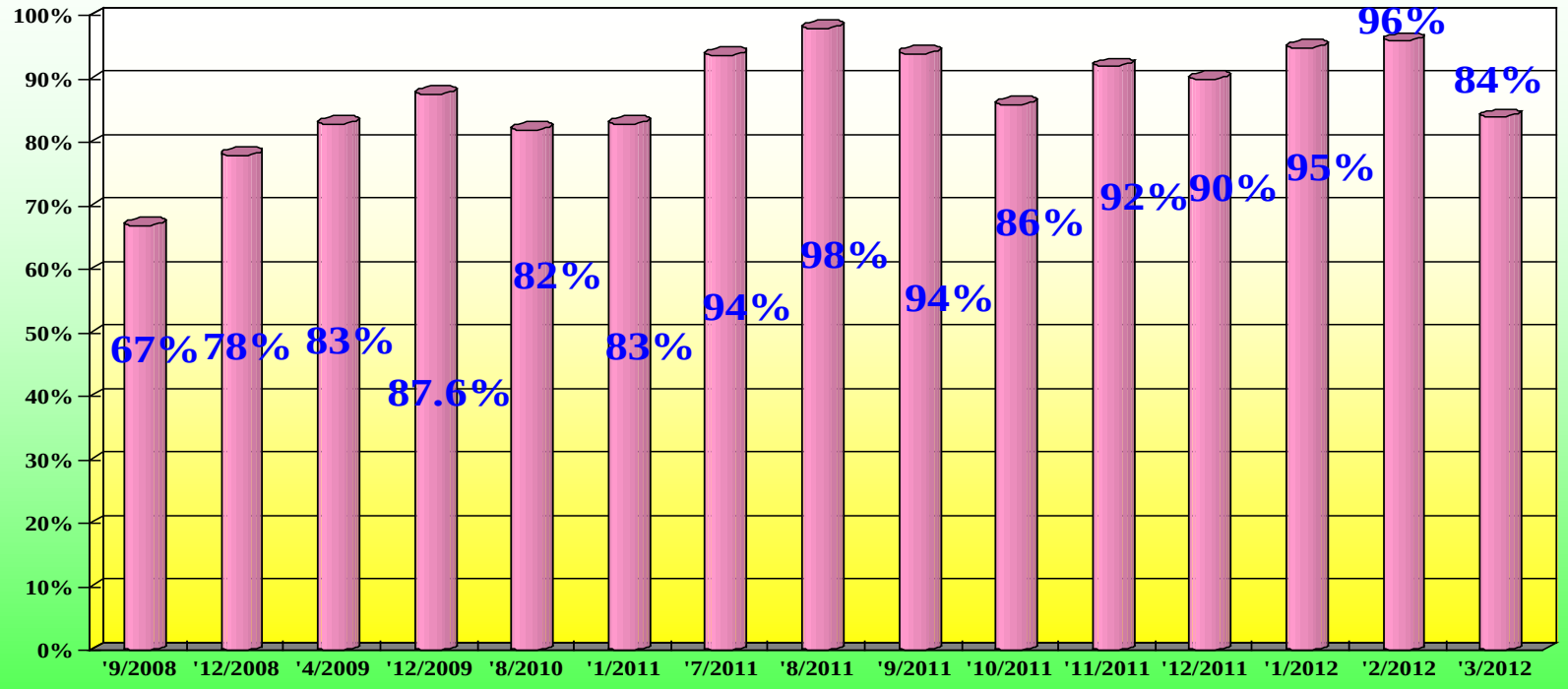
- **Inclusion**: All cases with mechanical ventilation ≥ 6 hours
- **Exclusion**: Neurosurgery case or tracheostomy case

2. Weaning Criteria

- **Wake and wean** is ordered by ICU doctor
- Sedation stopped: Time (24-hr format)_____ Date(D/M/Y) _____
- Case nurse assesses patient **Q1H** for the following weaning criteria within **0700-2100**

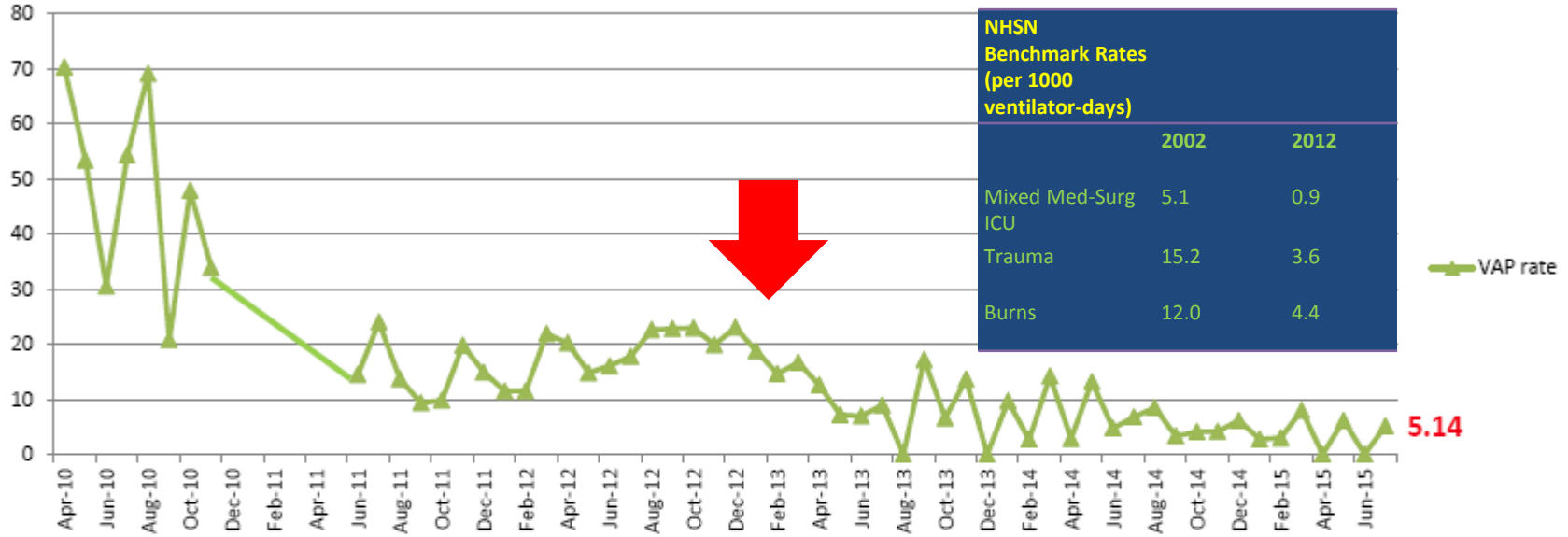
Time of meeting all weaning criteria	
$FiO_2 < 0.5$, RR > 8 /min and < 35 /min, $SpO_2 \geq 90\%$	☐
MAP ≥ 60mmHg & HR ≤ 140/min	☐
Minimal inotropes (1SNA ≤ 10ml/hr)	☐
GCS ≥ 8	☐
Breathing trigger (If there is no breathing trigger at current ventilator setting, nurse assesses it by setting 50% of frequency for 1 min)	☐

Re-examine Compliance to Maintain Bed Head Elevation



Target: ≥ 95% compliance

VAP rate in ICU of PYNEH



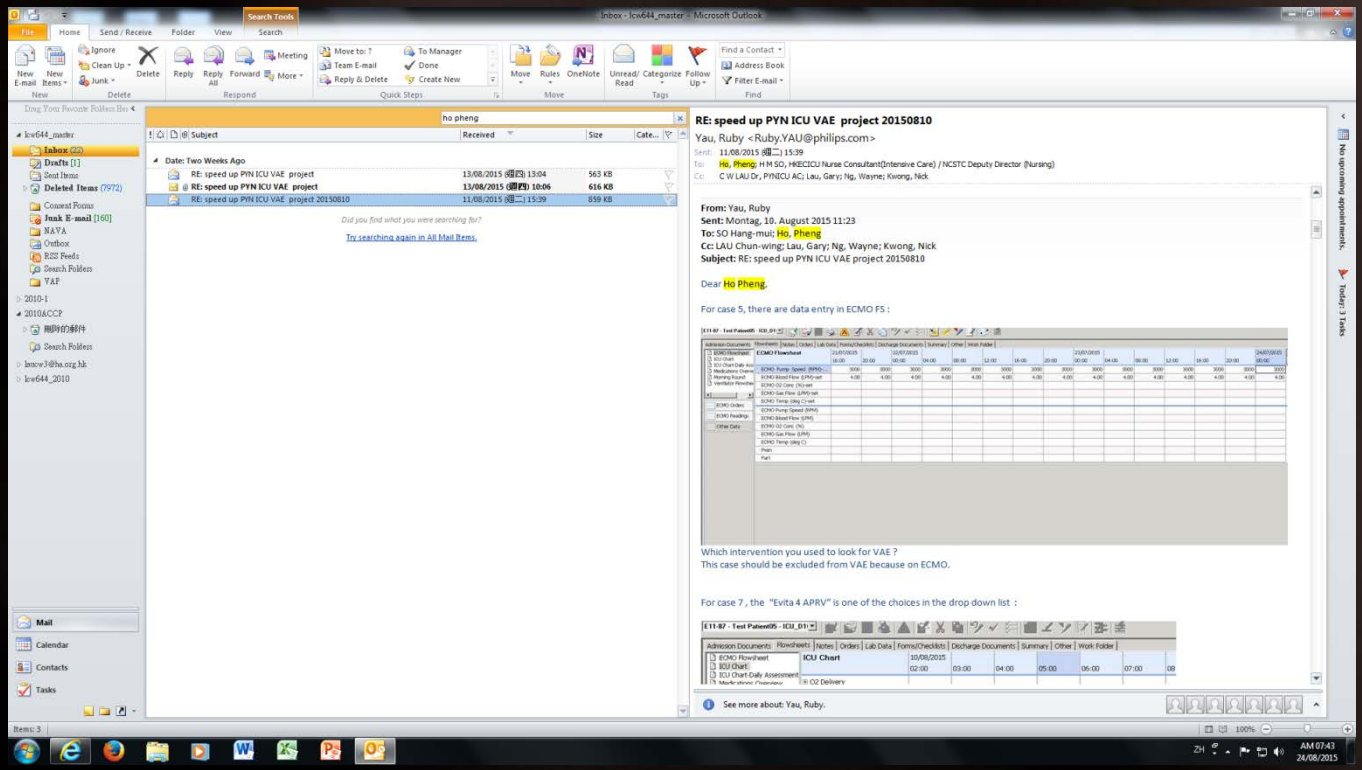
NHSN Benchmark Rates (per 1000 ventilator-days)

	2002	2012
Mixed Med-Surg ICU	5.1	0.9
Trauma	15.2	3.6
Burns	12.0	4.4

2015	July	June
VAP case	2	0
Risk factors	Pt 1: prolonged mechanical ventilation Pt.2: not sure	
MV patients	75	56
Ventilator days	389	254
Mean vent. days	5.19	4.54
VAP rate (per 1000 Vent. Days)	5.14	0

Lastest progress in August 2015

- Working with Philips to re-program the Clinical Information System to capture VAC and IVAC
- PVAP – possibly needs manual assessment



HKEC Outstanding Team Award 2014

The HKEC (RH + PYNEH) Task Force on Prevention of VAP in Critical Care Areas

Hospital Management Asia 2014 Excellence Award in Clinical Service Improvement

Cebu, The Philippines

Clinical

Summary of strategies

+

Administrative

TABLE. Ventilator-associated pneumonia prevention strategies

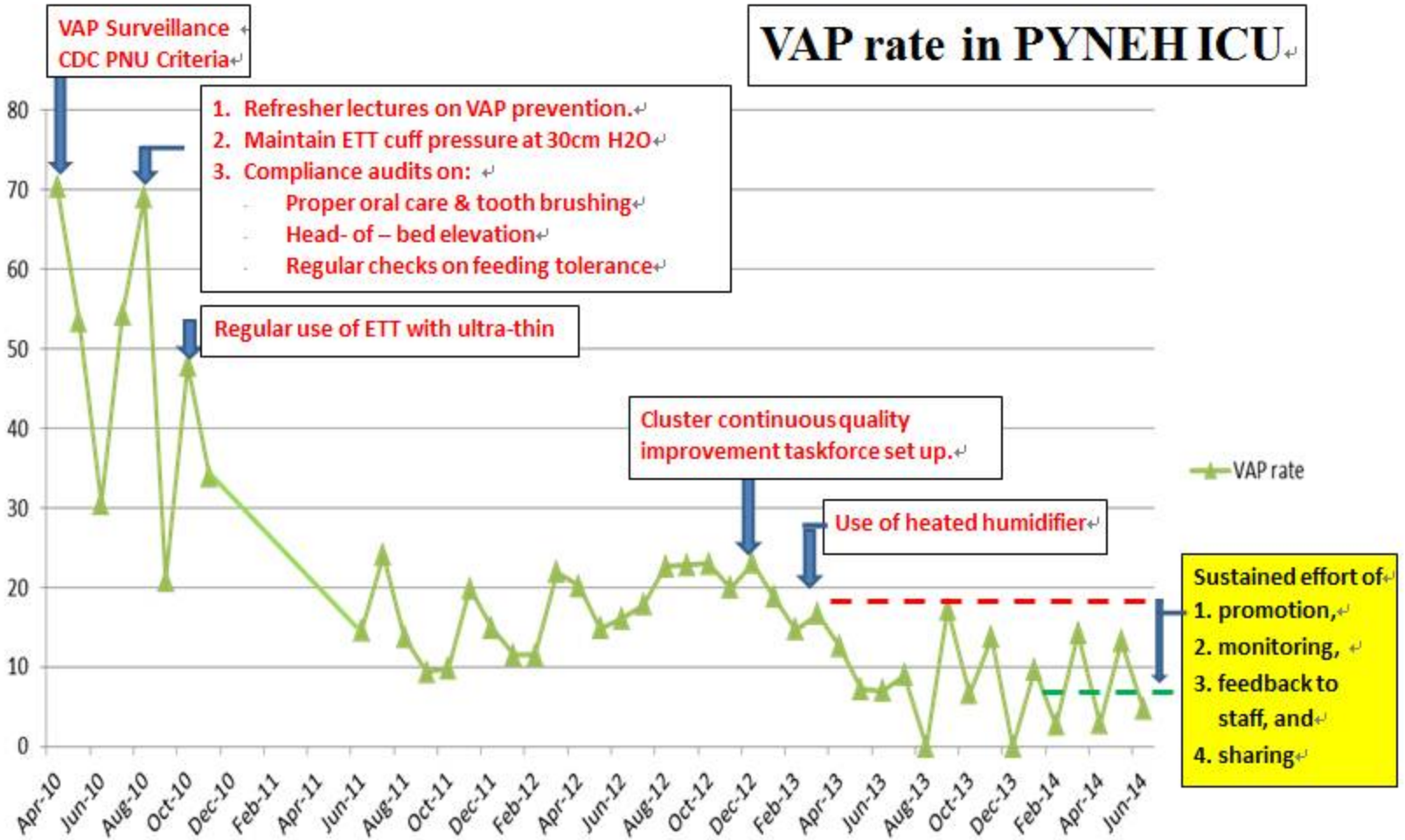
Rationale and controversy behind some of the strategies are elaborated in the text. Strategies that have been suggested in the literature, but are not yet widely practised and/or require further research are listed in *italics*

Category	Strategies
Clinical	
General	Standard precautions of infection control Hand hygiene, observe WHO 5-moment hand hygiene protocol* Regular change of ventilator tubing not more frequent than once a week, unless visibly soiled Drainage of fluid condensate, especially during transport or position change DVT prophylaxis (as a component of IHI VAP bundle) Environment cleansing Regular microbiological surveillance
Body positioning	Semi-recumbent positioning, ie raise head of bed to 30°-45° to the horizontal Use devices for angle monitoring *Continuous lateral rotation therapy (kinetic bed therapy)*
Intubation and mechanical ventilation	Aseptic technique during intubation and tracheostomy tube change Orotracheal route of intubation preferred for less sinusitis and VAP Prevention of self-extubation, and also re-intubation Use NIV as much as possible for evidence-based indications Use NIV for early weaning, especially for COPD Daily sedation holiday Assess fitness for extubation daily, and have weaning protocols Avoid prolonged use of paralytics *Nurse-led sedation and weaning*
Oral and gastro-intestinal tract	Regular oral care with 0.12%-2.0% chlorhexidine *Consider continuous oral suction* Confirm appropriate gastric tube position before feeding Gastrostomy feeding for longer-term feeding Avoid large-bore gastric tube Stress ulcer prophylaxis, a component of IHI VAP bundle, but avoid overuse of acid suppressants *Avoid early enteral feeding* *Consider post-pyloric feeding*
Endotracheal tube	Consider use of novel ETT: subglottic secretion drainage, especially for patients likely to be ventilated for >48 hours, taper-shaped cuff (eg TaperGuard), polyurethane (eg Microcuff instead of PVC cuff material *Consider use of silver-coated ETT for biofilm prevention* *Consider mechanical removal of biofilm*
Airway pressure	Maintenance of PEEP during mechanical ventilation, avoid zero PEEP Avoid routine suction and use the lowest suction force necessary for the shortest duration Minimise airway disconnection as much as possible Avoid frequent patient transport
Cuff pressure	Regular maintenance of cuff pressure of 20-30 cm H_2O, better with an automated cuff pressure maintenance device than manual device
SDD, SOD, and probiotic or early antibiotic treatment	*Consider selective oral decontamination* *Consider selective digestive tract decontamination* *Consider early antibiotic treatment for ventilator-associated tracheobronchitis*
Administrative	
Internal	VAP-prevention protocol in place Regular documentation of VAP rate and benchmarking with international data Regular audits on compliance with VAP-prevention strategies Set VAP as regular item in business meeting for discussion, review every VAP case Promulgate VAP rate and prevention strategies to all staff through various channels Include VAP in orientation of new staff, and update existing staff regularly
External	Liaison with other departments for promotion of VAP-prevention practice Promote good practice on websites, newsletters, medical journals, and symposia Set up Coordination Task Force at hospital, cluster and ICU Central Organising Committee Promote VAP surveillance as a key performance indicator in all ICUs
Continuous improvement	Continual literature update, research, and modifications of existing strategies Cost-effectiveness analysis of the whole Ventilator Bundle Explore the merits of ventilator-associated events by automated electronic capture

Lau et al, HKEC Task Force on Prevention of VAP in Critical Care Areas. HKMJ 2015

HOSPITAL MANAGEMENT ASIA 2014
THE PREMIER LEARNING CONFERENCE FOR HEALTHCARE MANAGERS

What have we done?



Future development and issues

1. VAE: reflecting preventable events?
2. Need to run PNU VAP at the same time?
3. Clinical Information System Programming
4. What measures actually decrease VAP?
5. New technology for VAP diagnosis, e.g. molecular
6. VAP or VAE as KPI, in Hong Kong setting?
7. Further research idea

Acknowledgment: All ICU staff

THANK YOU!