

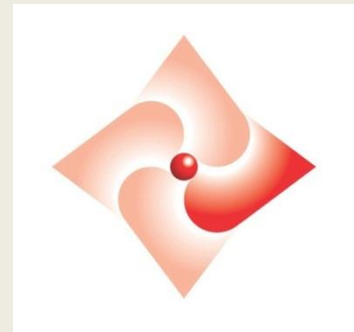


# A Multi-pronged Strategic Approach to Prevent Ventilator-Associated Pneumonia in ICU

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Nurse Consultant (Intensive Care), HKEC

8 May 2014



# Ventilator Associated Pneumonia (VAP)

## Definition:



Pneumonia that occurs in a patient who was intubated and ventilated at time of or within 48 hours before onset of pneumonia.

NHSN, CDC, [www.cdc.gov/nhsn](http://www.cdc.gov/nhsn)

(National Healthcare Safety Network)

NHS Report 2010

# VAP

## Incidence & Impact

- 10-20% of MV patients
- Highest in Neurosurgical, t  
Edwards JR, e
- 0-5.8 per 1000 ventilator days

- 1 to 12.5 per 1000 device-days, attributable mortality:  
13%  
(n=6284, Nelson WG et al, Lancet Infect Dis 2013)



Ventilator

Intensive  
hos  
ve  
NI  
ra

Associated Events  
VAP

**Aware**



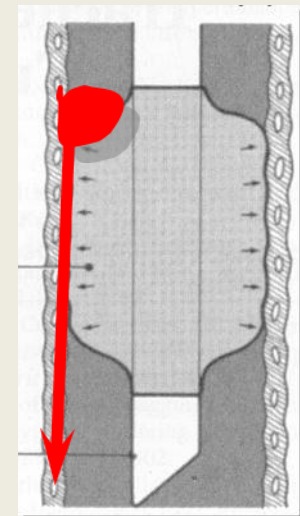
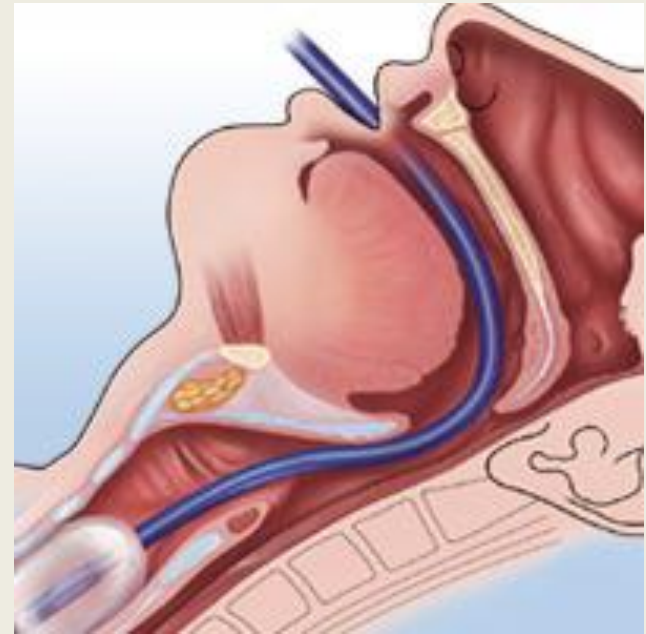
**VAP rate in  
ICU of PYNEH  
(40-70 per 1000  
ventilator days  
In 2010)**

Dudeck et al, Report 2010

# Revisit the VAP Process

## Pathogenesis of VAP

- Bacteria enter the lower respiratory tract via two pathways:
  - Aspiration of organisms from the oropharynx and GI tract (most common cause)
  - Via ventilatory circuit & tracheal tube



# Review Evidences

- ✓ Head of bed at 30°
- ✓ Antiseptic oral rinse
- ✓ Perform hand hygiene
- ✓ Assess patient's readiness to wean and to extubate
- ✓ Prevent condensate from entering patient's airway
- ✓ Maintain proper care to respiratory consumables
- ✓ Conduct ongoing VAP surveillance

## Recommendations on Prevention of Ventilator-associated Pneumonia

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

June 2010

June  
2010

2006

## VENTILATOR ASSOCIATED PNEUMONIA

### Getting Started Kit: Prevent Ventilator-Associated Pneumonia

### How-to Guide

#### Alert Statements:

patients receiving mechanical ventilation, as well as those at high risk for aspiration (e.g., decreased level of consciousness; enteral tube in place), should have the head of the bed (HOB) elevated at an angle of 30 to 45° unless contraindicated.<sup>1-7</sup> (Level VI)

Use an endotracheal tube (ET) with a dorsal lumen above the endotracheal cuff to allow drainage by continuous suctioning of tracheal secretions that are not routinely change, on the basis of

#### Supporting Evidence:

critically ill patients who are intubated for pneumonia (VAP)<sup>1,2,18-20</sup> and those intubated with a decreased level of consciousness, presence of gastric or small intestine, are at risk to occur at rates of 10 to 35 ca



www.INICC.org  
International Nosocomial  
Infection Control Consortium

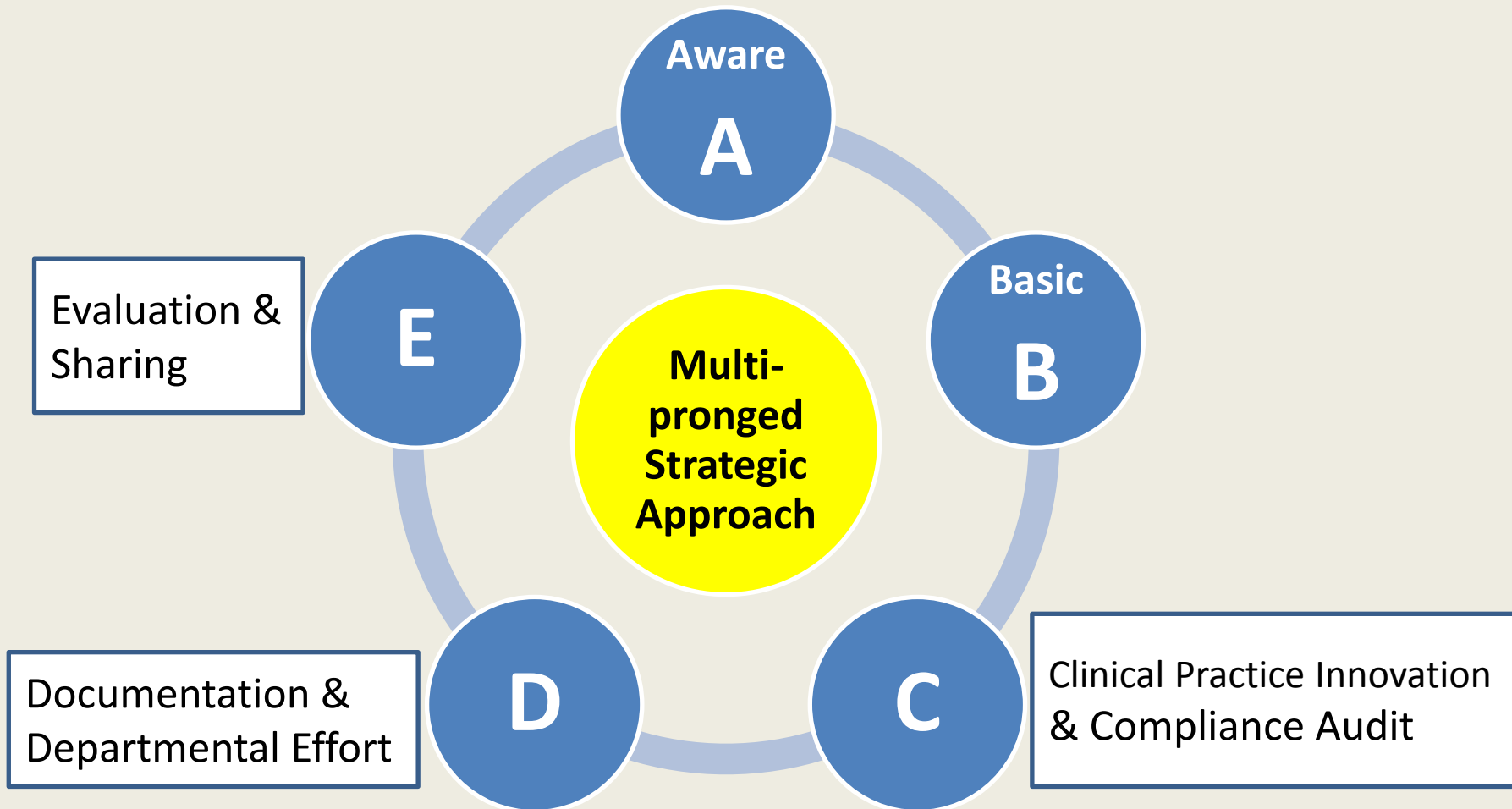
2012

www.FLIN.org.ar  
Foundation to Fight Against  
Nosocomial Infections



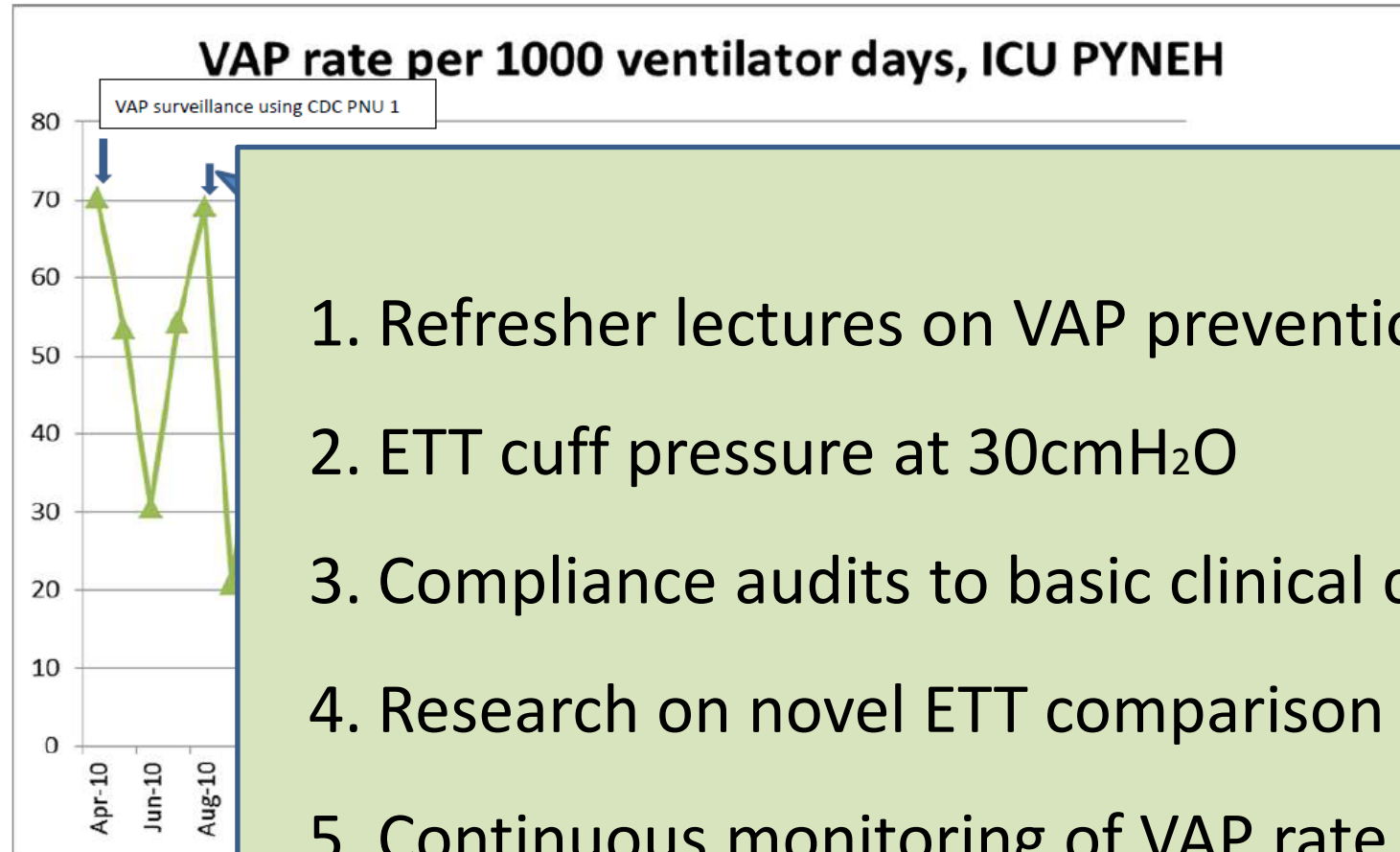
INICC Bundle to Prevent Health Care Associated Pneumonia  
in Intensive Care Units: An International Perspective.

# How did we deal with a high VAP & bring it down?



# Multi-pronged Strategic Approach

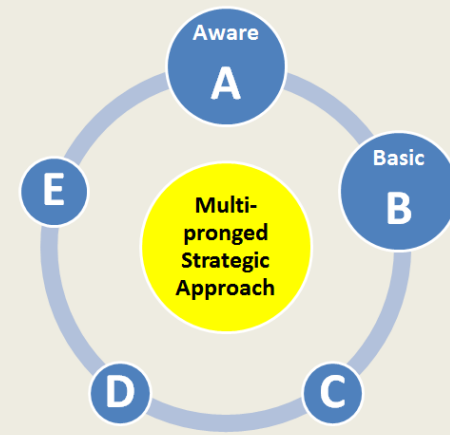
Started from late 2010



1. Refresher lectures on VAP prevention
2. ETT cuff pressure at 30cmH<sub>2</sub>O
3. Compliance audits to basic clinical care
4. Research on novel ETT comparison
5. Continuous monitoring of VAP rate



# Staff Education :Do the Basics



- Reinforce Hong Kong ventilator bundle through repeated educational talks to
  - Doctors, nurses, physiotherapists and
  - Health Care Assistants

## Visual display for better promotion



Refresher lecture on VAP



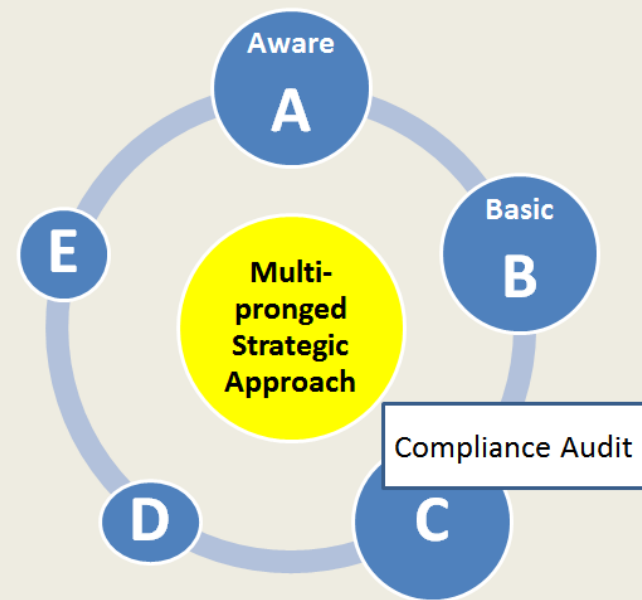
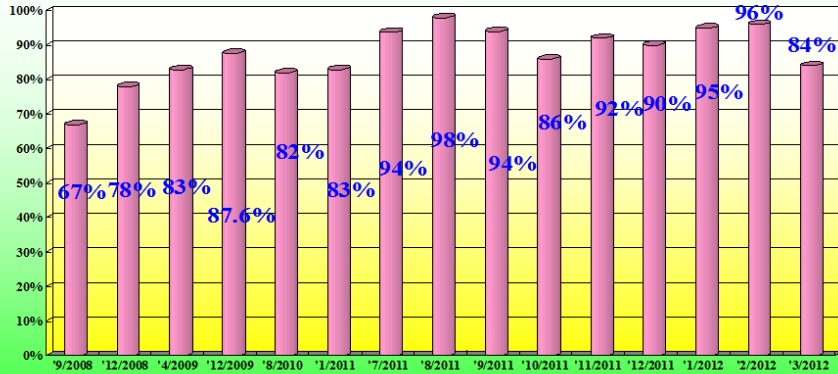
Brief talk at bedside

- Included in orientation of new staff

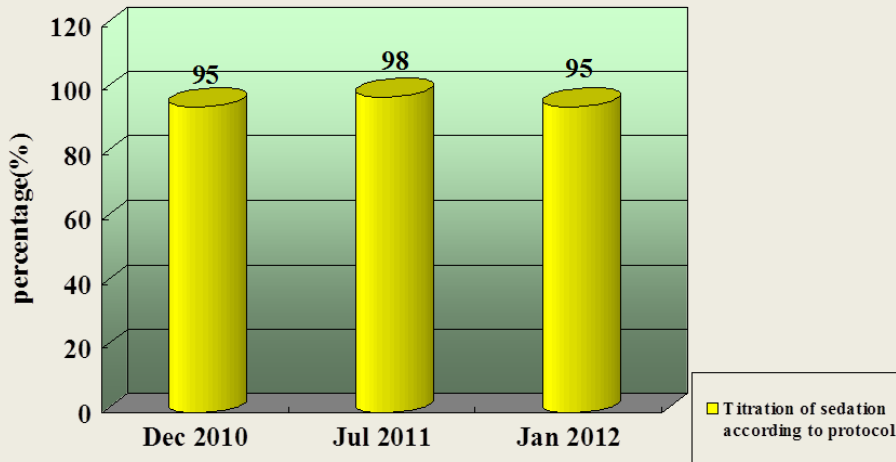




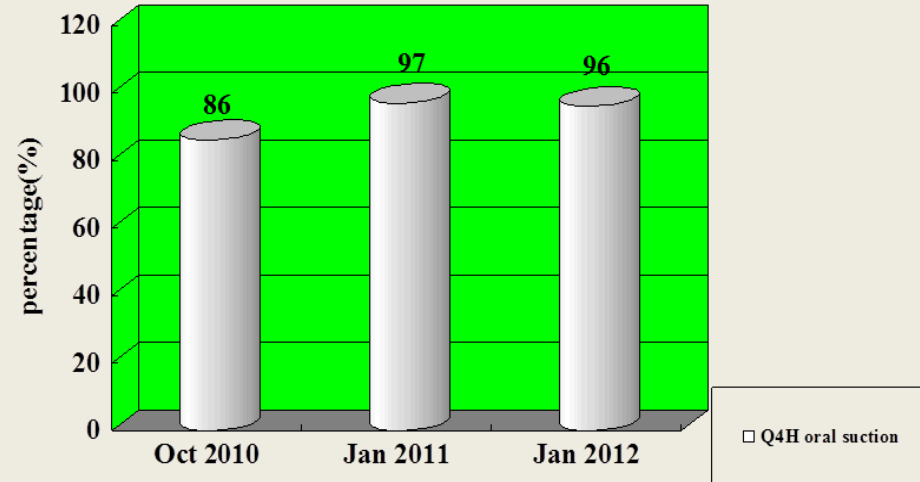
# Compliance of HOB>30°



## The compliance on titration of sedation



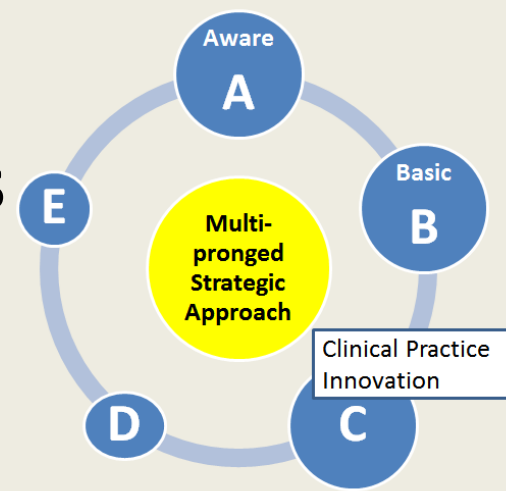
## The compliance on oral suction



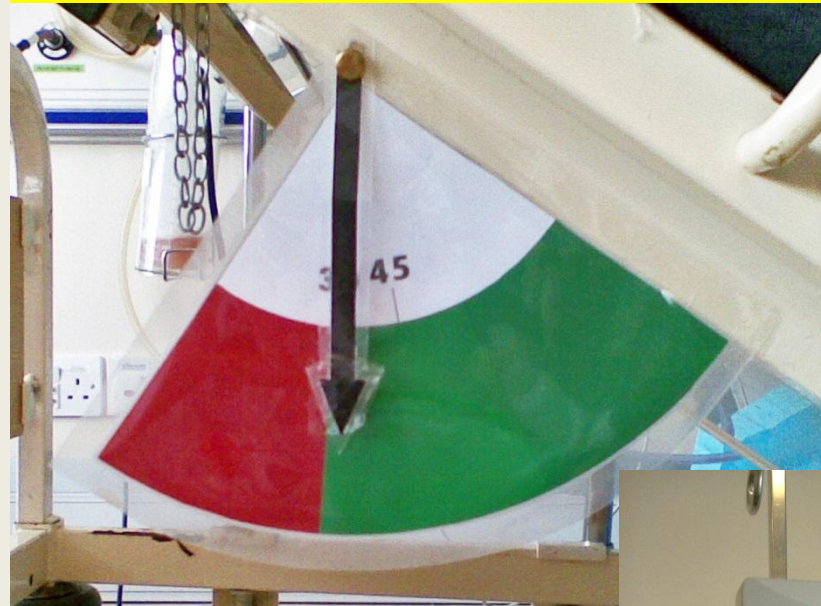
**Process audit on staff compliance to VAP prevention measures, ICU PYNEH**

# Try New Tricks:

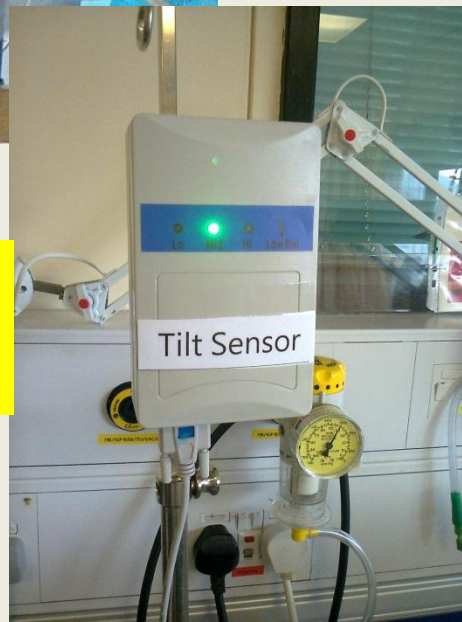
## (1) Promote HOB with Visual Indicators



### Innovative home-made HOB indicator



Green light showed  
HOB at 30-45°

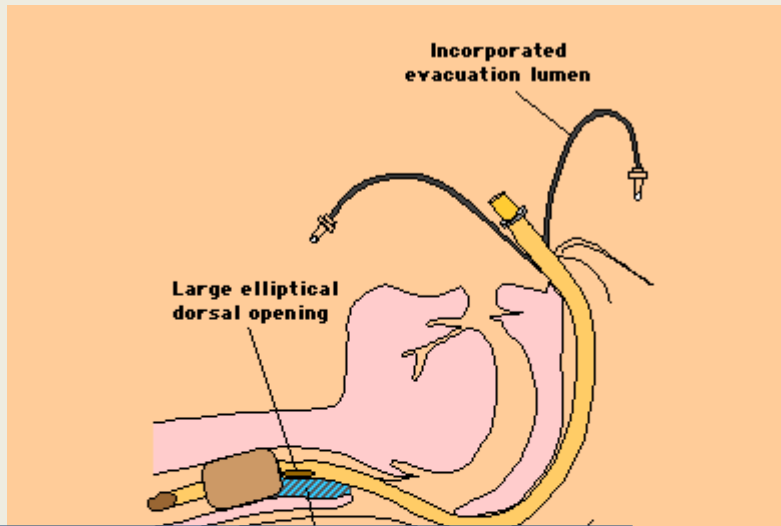
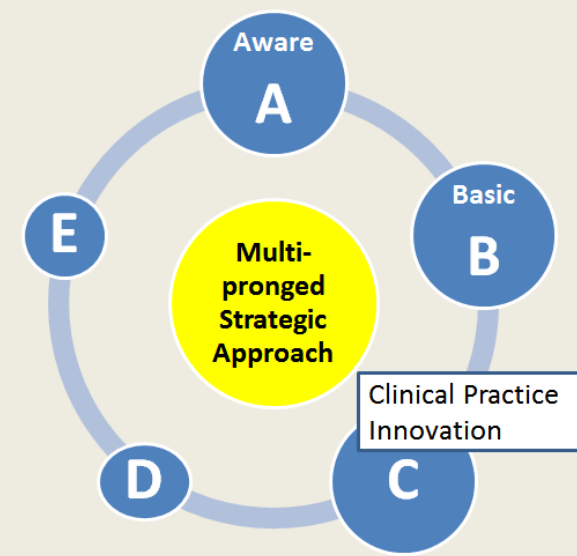


### Reverse trendelenberg



## (2) Minimize Micro-aspiration with New ETT designs

- Promote trial use of



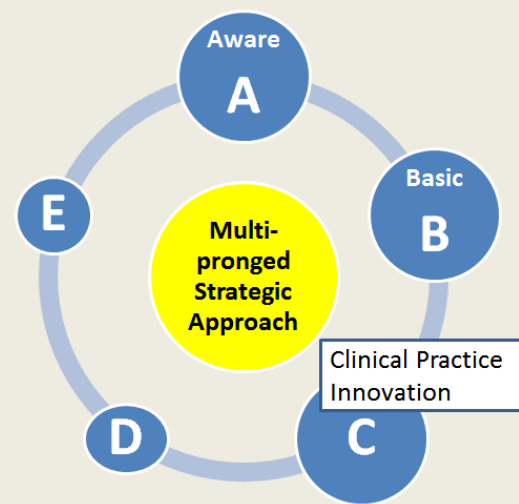
**TaperGuard Evac ETT with subglottic drainage port**



## Novel Microcuff ETT



# (3) Results of a recent research of our group on novel ETT



**Results: Microcuff ETT provide the best protection against microaspiration**

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.

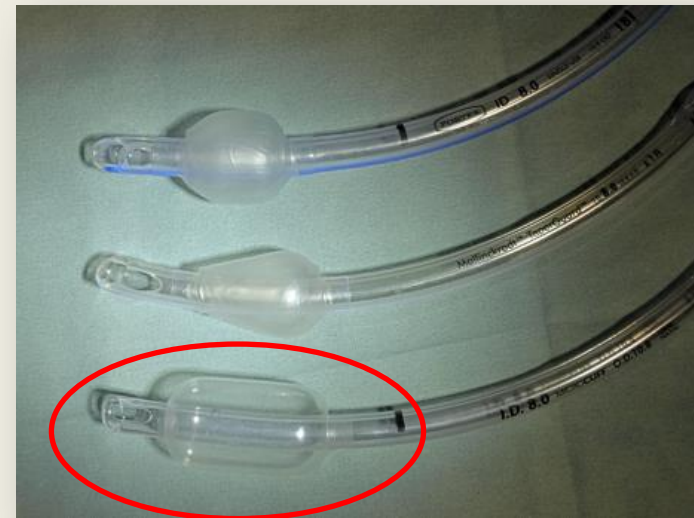
**Objectives** To compare three endotracheal tubes for leakage across the cuff (microaspiration) under a comprehensive set of simulated clinical situations. These were the Mallinckrodt TaperGuard (Covidien, US) with a tapered polyvinyl chloride cuff; KimVent Microcuff (Kimberly-Clark Health Care, US) with a cylindrical polyurethane cuff, and a conventional Portex (Smith 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 connected to each of the three endotracheal tubes, one at a time. 20 mL of water were added above the cuff. Measurements were taken every minute for 20 minutes under three simulated mechanical ventilation scenarios, including mechanical ventilation with positive end-expiratory pressure levels, and disconnection with and without spontaneous breathing efforts. Each scenario was studied under three pressures of 10, 20 and 30 cm H<sub>2</sub>O, and then repeated with the application of a continuous suction force of 200 cm H<sub>2</sub>O, 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.

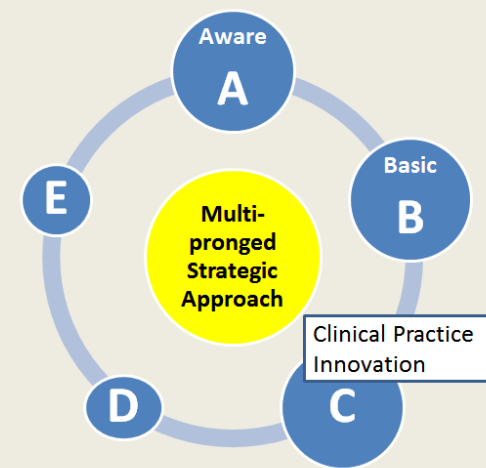
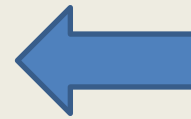
**Conclusions** Microcuff endotracheal tubes outperformed TaperGuard and Portex endotracheal tubes in preventing microaspiration,





## (4): Minimize Micro-aspiration with New Cuff Monitoring Device

- Promote use of continuous cuff monitoring device

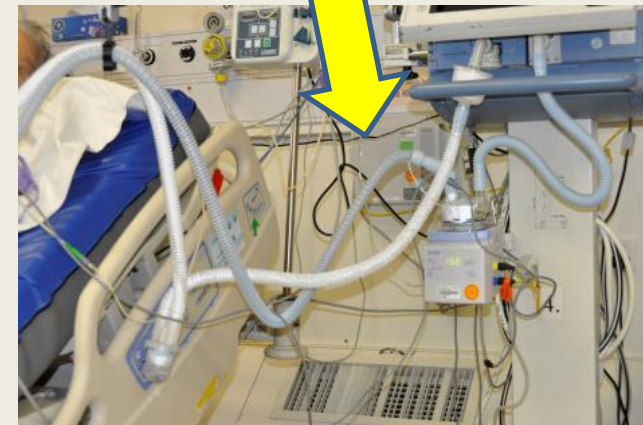
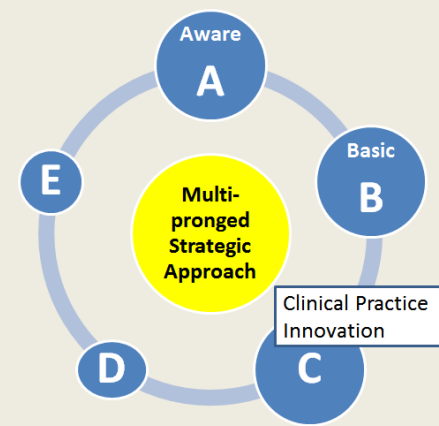


- ↓ VAP when compared with intermittent pressure control device.

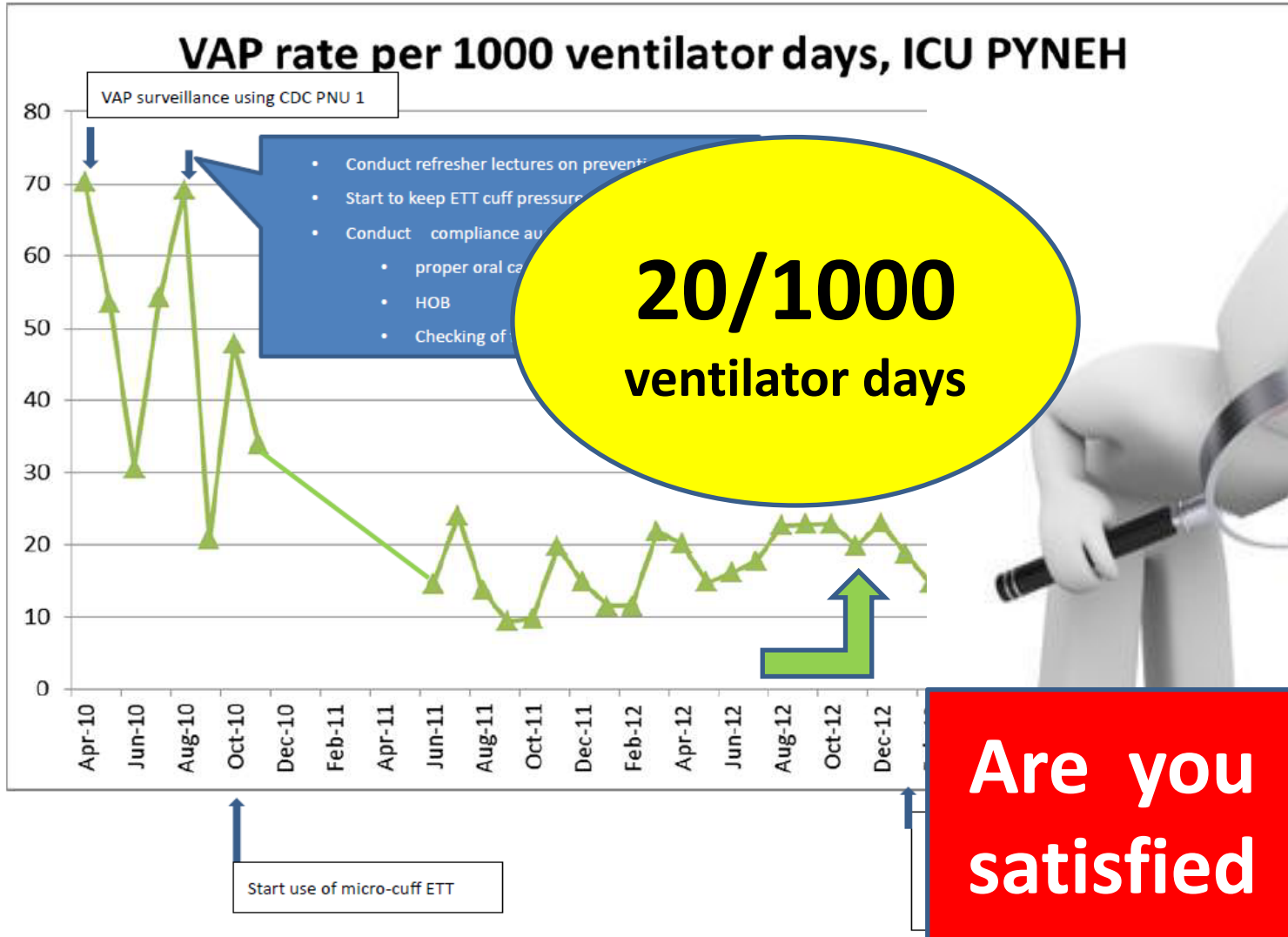
Lorente, et al. (2014). Critical Care, 18: R77

# (5) To do more .....

- Promote minimal 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

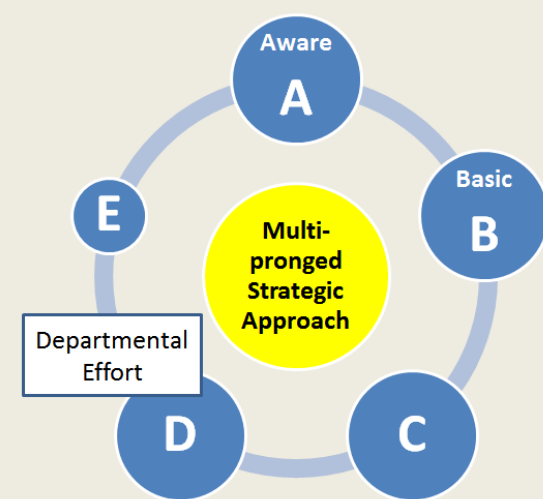


# 2012: VAP rate similar, rising?





# Departmental Effort : A Quality Improvement Project



## 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

## Set up a task force

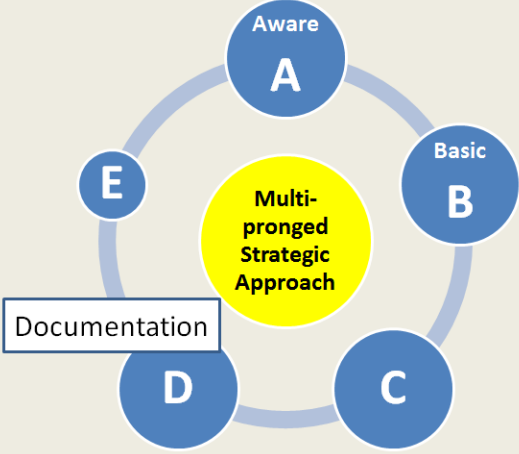
### Quality Improvement Project: Prevention of Ventilator-associated Pneumonia (VAP) in Critical Care Areas, HKEC

H → Key Members as at 26 Nov. 2012

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

# Structured Surveillance on VAP

## CDC surveillance criteria 2009- Pneumonia flow diagram



### Quality Improvement Project:

### Prevention of Ventilator-associated Pneumonia (VAP) In Critical Care Areas, HKEC

Data collection form (updated on 24<sup>th</sup> Jan 2013)

Fill in, circle or put a ✓ where it is appropriate.

D10/B10 Bed no. \_\_\_\_\_

Date of ICU admission \_\_\_\_\_

Transfer in from AED/ OT/ general ward/ other hospital

Admission : Elective/ Emergency/ Trauma

Specialty : Surgery/ Medicine/ Neurosurgery/ Others

Date of intubation \_\_\_\_\_ Type of ETT : Standard/Microcuff/Others

Date & time of extubation \_\_\_\_\_

Date of reintubation \_\_\_\_\_

Affix patient label here

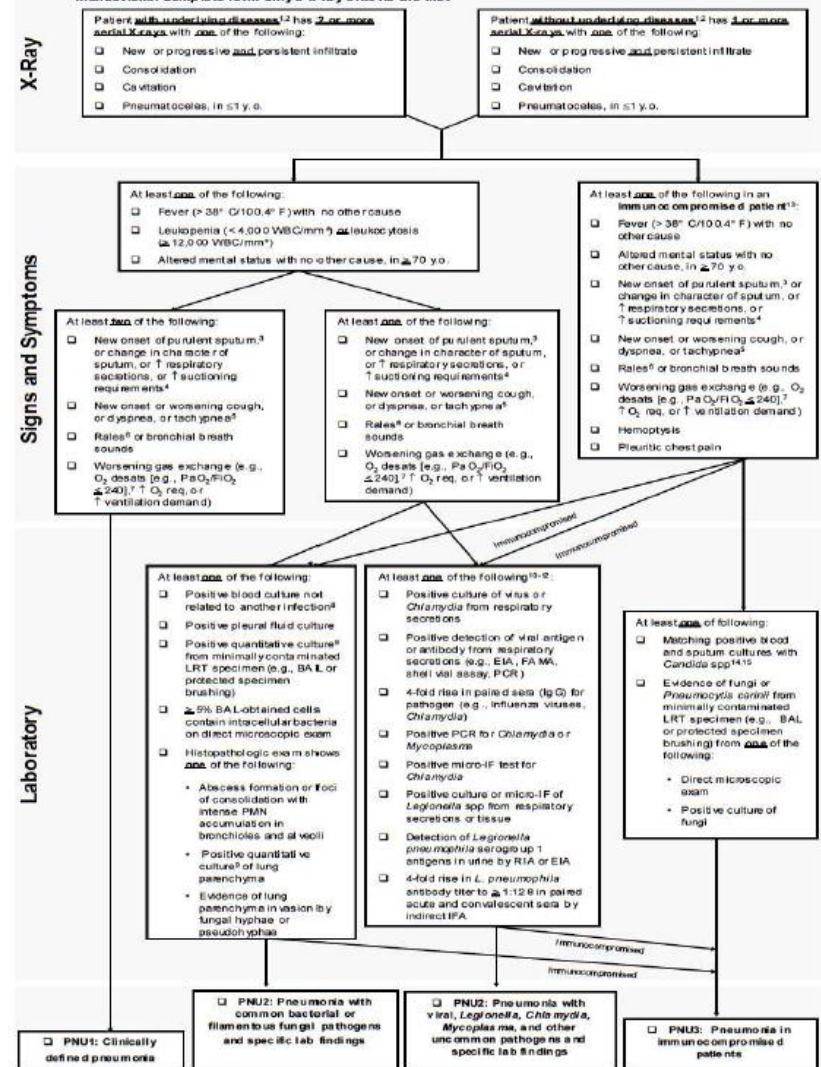
## Daily round to capture any VAP

Refer to the flowchart overlay for different criteria (PNU1, PNU2, PNU3) used in defining VAP.

Continue to fill in the form and monitor for VAP until 48 hours after extubation (include those patients having extubation in OT & being transferred to ICU post-op)

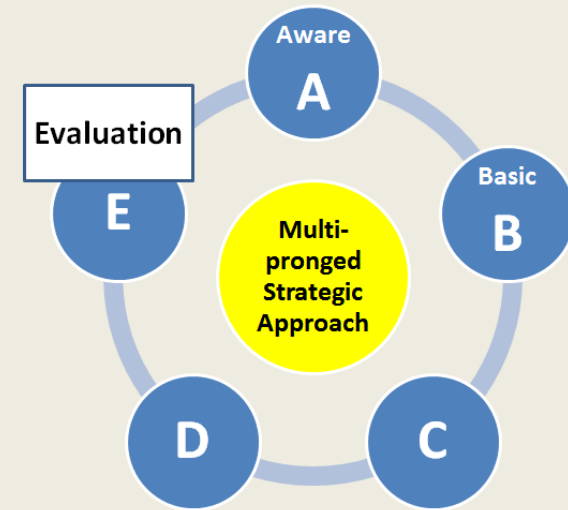
Assess patient for VAP and fill in the form daily by case MO preferably before 1pm.

Date									
VAP	Yes								
	No								
Dr's Signature									



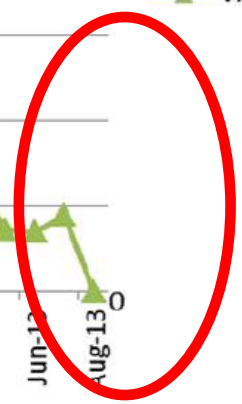
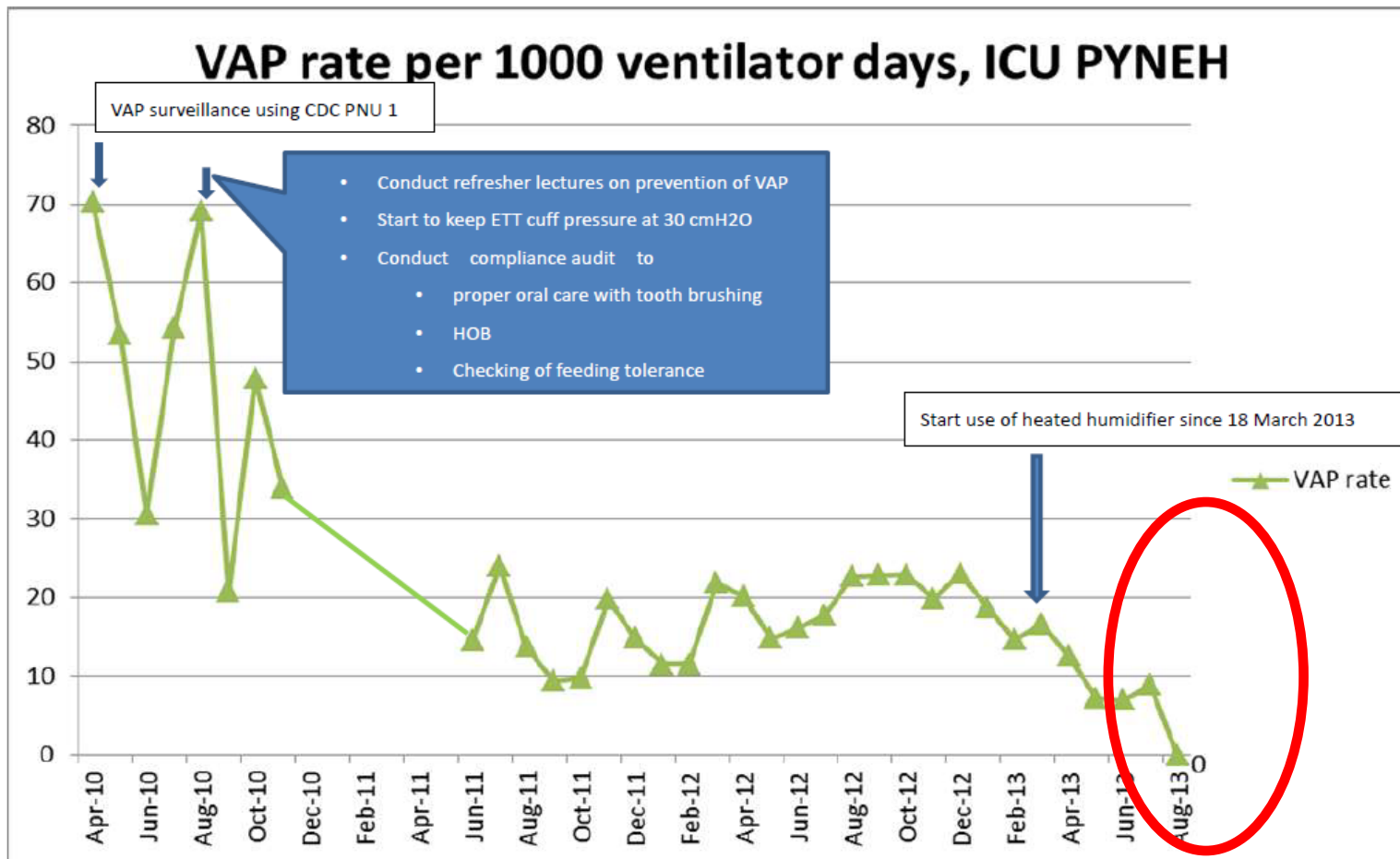


# Process Evaluation



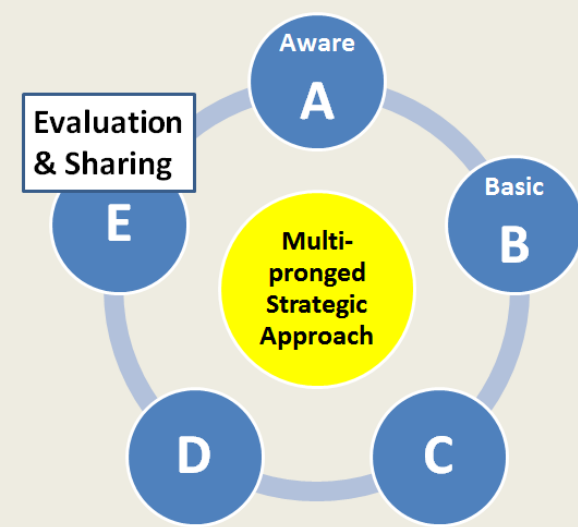
- Obtain baseline compliance rate on ventilator bundle
- Conduct compliance audit at regular period to monitor the sustainability of the good practice

# 2013: VAP rate

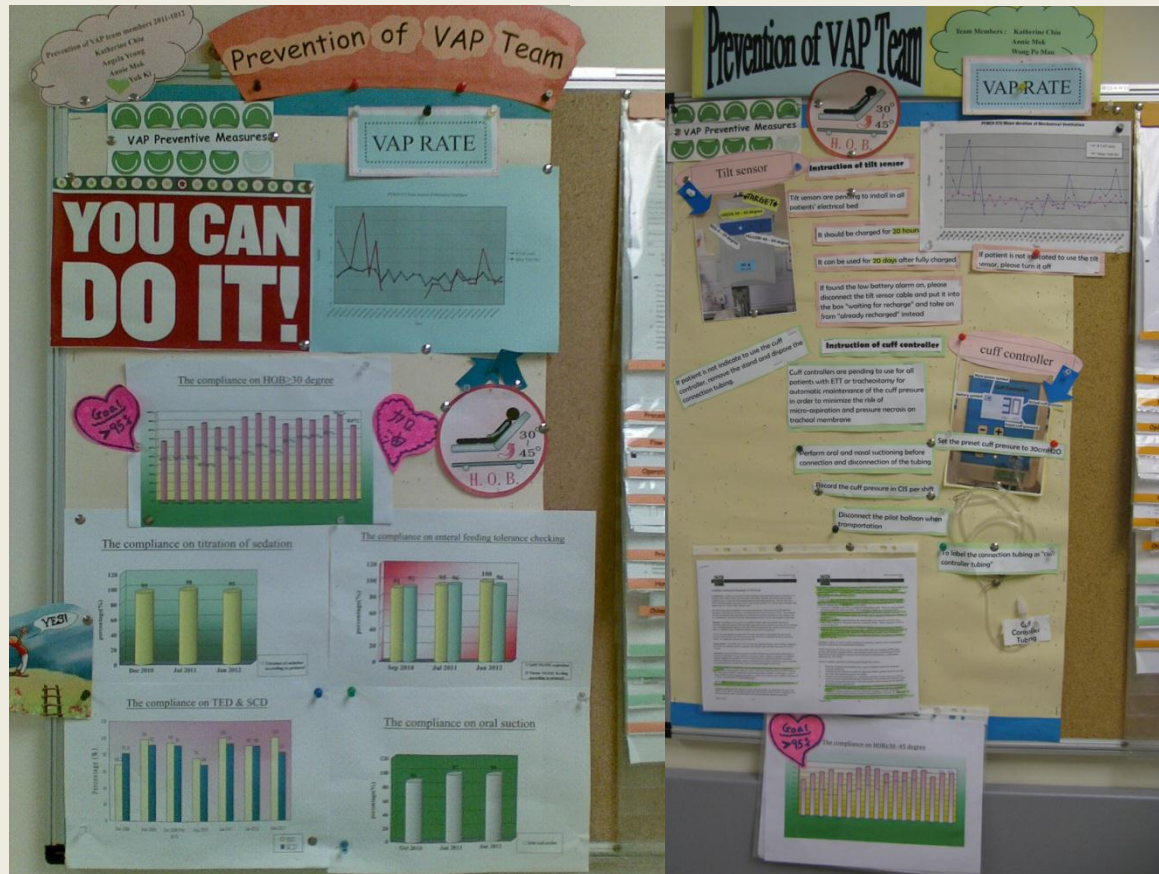




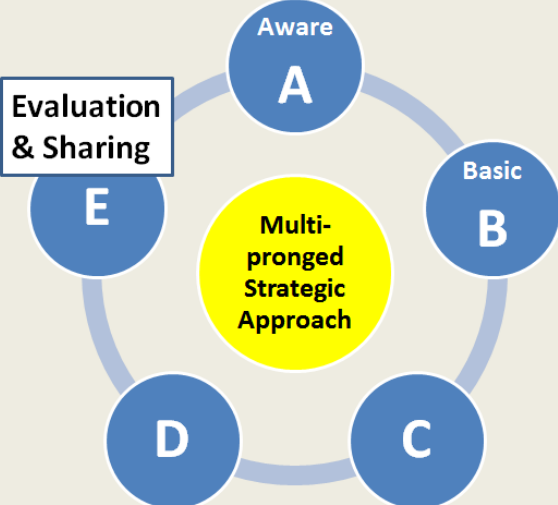
# Reinforce good practice : feedback to staff



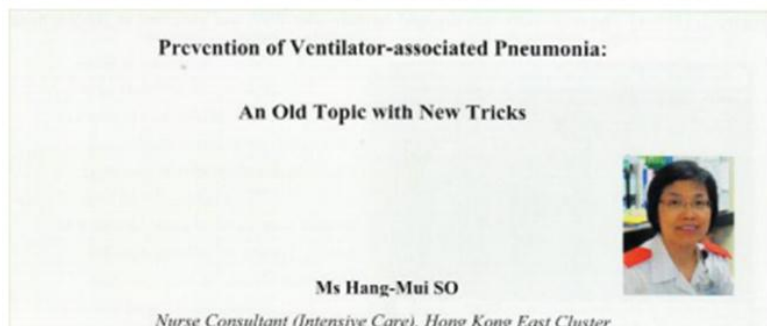
- ✓ Report monthly VAP rate
- ✓ Eye catching display board
- ✓ Disseminate compliance results



# Share Good Practices



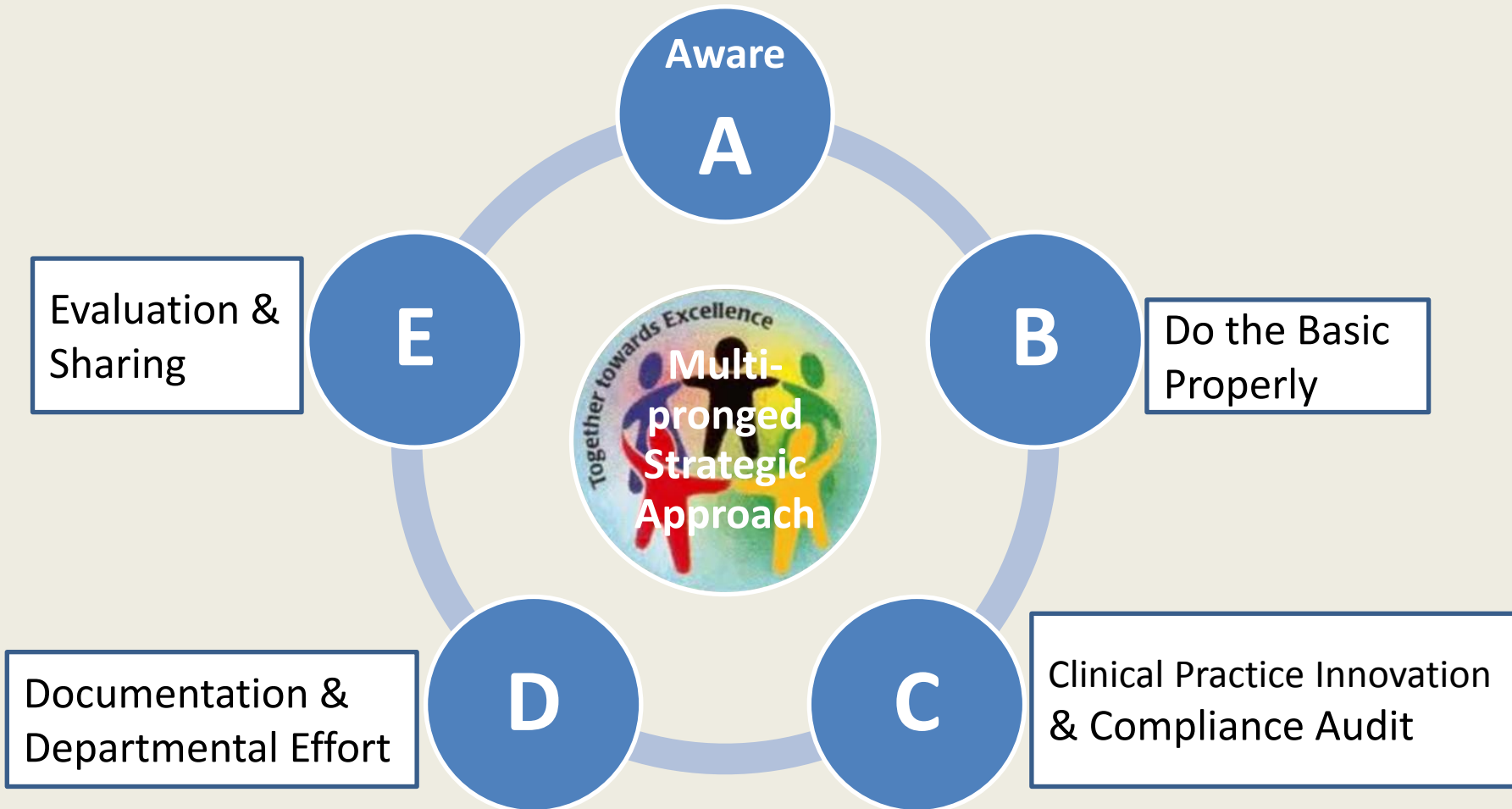
- Articles on Prevention of VAP
  - Lau, ACW, Lam SM, Yan WW (2014). Benchtop study of leakage across the Portex, TaperGuard and Microcuff Endotracheal tubes under simulated clinical conditions. HKMJ, Vol. 20 No.1, p. 7-15.
  - An Old Topic with New Tricks. SO HM Jan 2013
  - CICO's Biweekly Update (June 2013)
- Can access the articles via web
  - Hong Kong Resp Med: [www.hkresp.com](http://www.hkresp.com)
  - Hong Kong Society of Critical Care Medicine: [www.hksccm.org](http://www.hksccm.org)
  - Hong Kong Medical Journal [www.hkmj.org](http://www.hkmj.org)





# Conclusion :

## Multi-pronged Strategic Approach: ABCDE



# Thanks to all staff involved

On behalf of the team, ICU PYNEH

Chiu Mei Chun, APN

Mok Chi Man, RN

Wong Po Man, RN

Dr Lam Sin Man, AC

Dr Lau Chun Wing, AC

Lau Lan, WM

Nora Kwok, DOM

Dr Yan Wing Wa, COS

*Thank You*