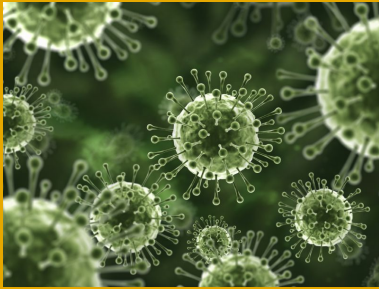


# PneuX Prevention System for Ventilator-Associated Pneumonia



## Programmes

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- > NIA
- > Spread and Adoption

**NHS Innovation Accelerator Fellow:** Peter Young

The PneuX System is designed to stop ventilator-associated pneumonia (VAP), which is the leading cause of hospital-acquired mortality in Intensive Care Units (ICUs).

The System is designed to prevent VAP by minimising the risk of pulmonary aspiration and micro-aspiration during long-term mechanical ventilation, which is expected to take more than 24 hours but no more than 30 days.

PneuX is a cuffed ventilation tube and an electronic cuff monitoring and inflation device which prevents leakage of bacterial laden oral and stomach contents into the lungs, which is a problem associated with standard tubes. An extension tube is also part of the system. They are manufactured by Venner Medical (Singapore) Pte and both devices are CE marked as medical devices.

The PneuX System was designed by Peter Young, a Consultant in Anesthesia and Director of Critical Care at the Queen Elizabeth Hospital, King's Lynn. Peter says his experience has shown that conceiving the idea is not difficult, but scaling a great innovation across the NHS presents many challenges. His ambition is to overcome the barriers to diffusion: –

(<https://www.cambridgenetwork.co.uk/news/kings-lynn-drs-nhs-england-fellowship-for-innovation/>).

View the videos here: –

[https://www.youtube.com/watch?v=MWv\\_AedBw-g](https://www.youtube.com/watch?v=MWv_AedBw-g)

<https://www.youtube.com/watch?v=12cJneGCl7w>

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### Challenge/Problem Identified

Ventilator-associated Pneumonia (VAP) is the most frequent ICU acquired infection amongst patients receiving mechanical ventilation (Segers and de Mol, 2009). It is estimated that the incidence of VAP in the Critical Care environment ranges from between 10% and 20% of patients (Safdar et al, 2009), resulting in mortality between 24% to 50% (Cook et al, 1998).

Not only does the prevention of VAP save lives, it can also have a significant impact upon hospital capacity, productivity and costs. The additional cost of a VAP is estimated to be between £6,000 and £20,000 per episode (Wagh & Acharya, 2009).

Up to 20% of patients receiving more than 48 hours of mechanical ventilation will develop VAP (Safdar et al, 2005).

Patients with VAP have significantly longer ICU lengths of stay (an average of 6.1 days) (Safdar et al, 2005).

The incidence of VAP increases with the duration of mechanical ventilation. VAP causes longer ICU and hospital stays, higher mortality, and higher hospital costs (up to approximately £24,000 per case) (Gentile et al, 2010).

Critically ill patients with VAP are twice as likely to die when compared with similar patients without VAP (Safdar et al, 2005).

Tubes with single subglottic drainage ports frequently fail (48% incidence) (Dragoumanis et al, 2007), and this failure is associated with an increased incidence of VAP (Rello 1996).

### Outcome

As an NHS Innovation Accelerator Fellow, Peter has: –

- Engaged with clinical champions through national leaders and presentations at key conferences
- Developed a growing economic case. For example, an independent health economic evaluation at New Cross Hospital in Birmingham demonstrated a saving of £718 per patient receiving treatment with the PneuX System (analysis independently conducted by the University of Birmingham and the Royal College of Surgeons).
- Had international interest in PneuX and is currently working with Massachusetts General Hospital to implement the device across all their ICUs as a quality improvement initiative.

The PneuX™ System has won the following safety and innovation awards: –

- [2nd Cleveland Clinic Top Ten Award](#) (2010)
- [FAB Awards Finalist](#) (2016)

### Impact

**The PneuXTM VAP Prevention System** addresses multiple known risk factors associated with intubation systems in current standard use. Its design features have been proven in practice to prevent leakage and aspiration of secretions by the patient (Young, 2006).  
infographic £718 saved

The PneuX System was trialled in New Cross Hospital, Birmingham and the economic evaluation  
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showed a saving of £718 per patient for those treated with PneuX. This study compared the cost effectiveness of converting to the PneuX™ endotracheal tube from standard endotracheal tube. The study results were independently analysed by statisticians at the Royal College of Surgeons and health economists the University of Birmingham, who found the using the PneuX™ endotracheal tube saved their hospital >£700 per patient. They found that using the PneuX™ reduced VAP by 50%, however in order for it to be cost neutral it only had to reduce VAP rates by 8% (Oral abstract presentation, presented at the 29th European Association for Cardio-Thoracic Surgery, 2015, Amsterdam).

In a UK randomised controlled trial (RCT) with 240 high risk patients having cardiac surgery, PneuX was associated with a significant reduction in VAP incidence compared with a standard endotracheal tube (10.8% compared with 21%, p=0.03) (NICE, November 2015).

A UK based retrospective cohort study in ICU reported a VAP incidence of 6% in 48 patients with the PneuX System. Unplanned extubation was reported in 17% of patients; 10% of patients self extubated (NICE, November 2015).

A UK based retrospective cohort study in 53 critically ill patients found no incidence of VAP while the PneuX System was in place (NICE, November 2015).

A UK based retrospective cohort study analysing records of 185 intubations using the PneuX System found that the incidence of unplanned extubations was 0.1% over 982 intubation days (NICE, November 2015).

*The cost of VAP is so high, that it's possible to spend £500 on an endotracheal tube at commonly reported VAP rates even with modest risk reductions and it will still be cost saving for the NHS*

This report assessed the cost effectiveness interventions used to preventing ventilator associated pneumonia in the ICU. They stated that the cost of a single episode of VAP in the ICU is around \$40,000 in the US and around £10,000 in Europe, and this is the equivalent of a further 10 days of ventilation in the ICU. Their calculations state that, if an ICU has a VAP rate of 10%, that ICU can spend £500 on any intervention that prevents VAP by only 50%, and still be cost saving for the NHS (Wyncoll & Camporota, 2012).

*Using the PneuX is highly cost saving*

This report looks at the cost savings that can be achieved when using the PneuX™ endotracheal tube. Their report calculated that the cost of the PneuX™ was only 10% of that which would achieve cost neutrality for the NHS (Morgan & Wise, 2014).

*“We are hugely impressed with the direct benefits to patient safety, through avoidable harm and improving outcomes. We urge health care providers to ensure the system is adopted as best practice. From a patient's perspective, this is an opportunity that cannot be ignored.”* Co-Chair East of England Citizen's Senate.

### **Which national clinical or policy priorities does this example address?**

Ventilator-associated pneumonia (VAP) is the commonest cause of hospital acquired mortality in the ICU. Approximately

50% of antibiotics administered in the ICU is for treatment of VAP (Kalanuria et al, 2014). Prevention of multidrug resistant organisms is both a WHO and NHS England priority.

The PneuX System is not currently part of any NICE guidance.

### Plans for the future / spread and adoption

Massachusetts General Hospital has done a study and are now implementing across all their ICUs as a quality improvement initiative.

### Related links, references and further resources

Websites: <https://www.vennermedical.com/pneux-life-systems/>

<https://www.qualitechhealthcare.co.uk/the-pneux-system.html>

[klipsuk.com](http://klipsuk.com)

YouTube: [https://www.youtube.com/watch?v=MWv\\_AedBw-g](https://www.youtube.com/watch?v=MWv_AedBw-g)

<https://www.youtube.com/watch?v=12cJneGCl7w>

Twitter: [@peterjyoung101](https://twitter.com/peterjyoung101)

AHSN Atlas case study: <http://atlas.ahsnnetwork.com/pneux-prevention-system/>

Factsheet (Venner Medical): [http://exkit1formh7uiyufe693hjh-wpengine.netdna-ssl.com/wp-content/uploads/2016/02/PLS-MK-002-01-REV-B\\_EN-PneuX-factsheet-LORES.pdf](http://exkit1formh7uiyufe693hjh-wpengine.netdna-ssl.com/wp-content/uploads/2016/02/PLS-MK-002-01-REV-B_EN-PneuX-factsheet-LORES.pdf)

Factsheet (Qualitech Healthcare):

<https://nebula.wsimg.com/05d9245b6dfda40f7824cc25ae4721d?AccessKeyId=AB6gDAD95890E568C578&disposition=0&allowor>

Product Literature Sheet [Pneux literature](#)