MEA Launch Week
Strategy meets product: Protective Therapies in the ICU

Dubai October 3\textsuperscript{rd} 2019
Ambassador from Prosperous Luebeck – Katrin Mett
Fortune Teller – Margarita Singer
Introduction „Protective Therapies @Dräger“
Improving clinical outcomes
Enhancing patient experience
Reducing costs of care
Improving staff satisfaction
Protective Therapies
Connected Technologies
Care-centered Workplaces
Comprehensive Services
How our future offering supports improving acute care
Protective Therapies is a collective term for all our offering solutions supporting the *improvement of acute care*.

Our protective therapy solutions enable clinical outcome improvements, help protect patients and caregivers alike and support developing a nurturing environment.
<table>
<thead>
<tr>
<th>OR</th>
<th>Lung Protective Ventilation</th>
<th>Obese</th>
<th>Pediatric</th>
<th>Human Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC</td>
<td>Lung Protective Ventilation</td>
<td>Weaning</td>
<td>Early Mob.</td>
<td>...</td>
</tr>
<tr>
<td>NC</td>
<td>Lung &amp; Brain Protective Ventilation</td>
<td>Nurturing Environment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Improving intensive care outcomes requires more sustainable therapies.

- only 41% of the patients who are artificially ventilated for at least 14 days, will survive the next year.\(^7\)
- 45% - 87% of ICU patient suffer from delirium which accounts for 16 b$ healthcare costs per year in the US.\(^8\)
- up to 350 daily alarms per ICU bed, of which 90% are clinically irrelevant and 50% are not even noticed.\(^9\)
As no patient is alike – Dräger Ventilation. Dedication for better treatment.
As no patient is alike – Dräger Ventilation. Dedication for better treatment.
How to present…

NIV
“Patients with mechanically-assisted ventilation often develop ventilator-associated-pneumonia which potentially lead to a longer hospital stay.”*

“Oversedation during mechanically-assisted ventilation is associated with worse clinical outcomes, including longer time on mechanical ventilation, and increased brain dysfunction.”**

“Complications from intubation can have significant morbidity and mortality risks.”***

WHY do they do what they do?

"Therapy Goals"

HOW do they do it?

"Clinical Strategy"

WHAT we deliver to achieve their goals?

"Products / Solutions"
The goal...

Minimally invasive respiratory support
▪ ... strategy to avoid intubation -> start settings (PEEP, PS); training of staff; accessories ...

▪ ... reduce stress level and create a healing environment

▪ ... reduce length of stay

▪ ... reduce risk of pulmonary / wound infections
...NIV reduces the number of possible complications by 62% and treatment errors by 50%.

...NIV shortens stay on intensive care wards and reduces the length of hospital stay by an average of 3 days.

...a meta-analysis suggested that NIV improved survival in acute care settings, and is more beneficial when applied early rather than as rescue therapy.

...the use of NIV instead of mechanical ventilation is associated with a lower risk of nosocomial infections. A study has shown significantly more infectious complications related to the presence of the endotracheal tube.
NON-INVASIVE VENTILATION

NON-INVASIVE VENTILATION REDUCES COSTS.

- The costs for a pneumonia patient using non-invasive ventilation in Europe are 10,000 Euros, while an intubated patient incurs costs of 25,000 Euros. (Schönfuhrer 2006)

- Non-invasive ventilation can take place away from the intensive care ward, on special ventilation wards, which reduces costs. (Boller 2007)

- Invasive ventilation often brings with it the risk of hospital-acquired infections, particularly ventilator-associated pneumonia, resulting in considerable extra costs. (Schönfuhrer 2006)


- Ventilator-associated pneumonia causes 12,000 dollars of extra cost per patient. (Werner 2003)

NON-INVASIVE VENTILATION REDUCES THE RISK OF HOSPITAL-ACQUIRED INFECTIONS.

- Invasive ventilation brings with it the risk of hospital-acquired infection. (Schönfuhrer 2006)

- In the case of non-invasive ventilation, the lack of tube means that fewer germs make it into the respiratory system, resulting in fewer hospital-acquired infections. (Kuhlen 2003)

- Patients using non-invasive ventilation can be protected from further invasive intervention, such as catheters, which are necessary for invasive ventilation due to the sedation. (Nava 2006, Nava 2007)

NON-INVASIVE VENTILATION CAN REDUCE THE LENGTH OF HOSPITAL STAYS.

- Non-invasive ventilation reduces the length of stays in hospital by an average of three days. (Ram 2004)

- Non-invasive ventilation reduces this weaning phase, which results in shorter stays for patients on the intensive care ward and in the hospital. (Ferrer 2003)

- In the case of invasive ventilation, weaning and possible infections prolong the stay on the intensive care ward, which in turn increases costs and occupies valuable intensive care beds. (Nava 2008)

NON-INVASIVE VENTILATION INCREASES THE QUALITY OF LIFE FOR THE PATIENTS.

- Non-invasive ventilation does not require the patient to be sedated. (Kuhlen 2008)

- Invasive ventilation requires anaesthetisation. (Schönfuhrer 2006)

- Patients using non-invasive ventilation can do without masks for varying phases, which allows them to communicate with doctors regarding their condition, and also to talk to visitors or drink something. (Nava 2008, Bowers 2007)

NON-INVASIVE VENTILATION CAN REDUCE COMPLICATIONS.

- With non-invasive ventilation, the number of possible complications is reduced by 82 percent. (Ram 2004)

- Non-invasive ventilation avoids internal injuries, such as those caused to the trachea. (Ram 2004)

- The risk of intubation-related pneumonia increases by one percent every day the tube is used. (Nava 2008, Elliott 2004)
## Proof points for our solutions

### Literature list

<table>
<thead>
<tr>
<th>Writer</th>
<th>Subject</th>
<th>Publication</th>
<th>Page</th>
</tr>
</thead>
</table>
**Proof points for our solutions**

|------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------|

**Objective:**
To describe 2 years of experience and staff learning curves after the introduction of non-invasive ventilation (NIV).

**Methods:**
A prospective, consecutive, strictly observational, 2-year cohort study of all patients treated with NIV in a county general hospital intensive care unit (ICU), with no interventions, was performed.

**Results:**
One hundred and fifty-seven patients with 15 different diagnoses were treated with NIV. An increasing number of patients were treated in the second year and, probably as a result of increased staff experience, the NIV treatment time and overall time spent in the ICU were less in the second year of the study period (30 h vs. 19 h and 55 h vs. 34 h, respectively; P < 0.05). Patients were also intubated earlier if NIV failed during the second year. Of the 157 patients, 119 had a full treatment option (i.e. including the possibility of invasive mechanical ventilation) and 26% died, their Acute Physiology and Chronic Health Evaluation II (APACHE II)- and Simplified Acute Physiology II (SAPS II)-predicted death rates were 31% and 32% respectively (not significant, NS). The overall mortality rate in all NIV patients was 38%, compared with predicted death rates of 36% and 33%, respectively (NS). 'Do-not-intubate' orders were issued for 38 of the 157 patients, and 11 of these (29%) left the hospital alive. Patients treated successfully with NIV had significantly lower APACHE II scores than those in whom it failed (18.8 vs. 22, P= 0.01).

**Conclusions:**
With increasing staff experience, more patients may be treated with NIV and the treatment period decreases significantly. Weaning from NIV has almost exclusively been taken over by nurses. Unselected cohorts of patients with chronic obstructive pulmonary disease can be treated successfully with NIV, and NIV offers a treatment option even for some patients with a 'do-not-intubate' order.
The HOW…

As no patient is alike – Dräger Ventilation. Dedication for better treatment.

Deep dive: Evita V600/ V800 – the new era of adult ventilation
How to present…the WHAT…

APRV
23% of all mechanically ventilated ICU patients develop Acute Respiratory Distress Syndrome (ARDS)*

The mortality rate of ARDS patients is between 35% and 45% *

ARDS might be an iatrogenic disease.**

* Bellani G et al., JAMA 2016; 315(8):788-800
** Villar J and Slutsky, A; Critical Care 2010, 14:120
INGREDIENTS

ARPV
ARDS = VALI?

Villar and Slutsky *Critical Care* 2010, 14:120
http://ccforum.com/content/14/1/120

**COMMENTARY**

*Is acute respiratory distress syndrome an iatrogenic disease?*

Jesús Villar, and Arthur S Slutsky

See related research by Determann et al., http://ccforum.com/content/14/1/R1

physician induced? ventilation induced?
Clinical challenges

Multi Organ System Failure

23%

35%-45%


Figure 1. Postulated mechanisms whereby mechanical ventilation may contribute to MSOF.
WHY do they do what they do?

“Therapy Goals“

HOW do they do it?

“Clinical Strategy“

WHAT we deliver to achieve their goals?

“Products / Solutions“
The goal…

Reduce VALI and ARDS
Clinical strategies to achieve this

- ... stabilize alveoli
- ... facilitate early spontaneous breathing
- ... reduce strain and stress
Technological Dräger solution

APRV

- ... facilitates spontaneous breathing and augments ventilation with brief pressure releases to support CO2 removal
  Downs B et al.; Airway Pressure Release Ventilation (APRV); CHEST 194 4 OCTOBER, 1988

- ... Early preventative mechanical ventilation with APRV blocked ARDS development, preserved surfactant proteins, and reduced pulmonary inflammation and edema despite systemic inflammation

- ... prevent progression of acute lung injury in high-risk trauma patients, reducing trauma-related adult respiratory distress syndrome mortality
Early application of airway pressure release ventilation may reduce mortality in high-risk trauma patients: A systematic review of observational trauma ARDS literature

Penny L. Andrews, RN, BSN, Joseph R. Shiber, MD, Ewa Jaruga-Killeen, PhD, Shreyas Roy, MD, CM, Benjamin Sadowitz, MD, Robert V. O'Toole, Louis A. Gatto, PhD, Gary F. Nieman, BA, Thomas Scalea, MD, and Nader M. Habashi, MD, Baltimore, Maryland
### APRV Literature List

<table>
<thead>
<tr>
<th>Author</th>
<th>Subject</th>
<th>Publication</th>
<th>Page</th>
</tr>
</thead>
</table>

**Nieman et al.** Lung stress, strain, and energy load- engineering concepts to understand the mechanism of ventilator-induced lung injury (VILI)  
*Intensive Care Medicine*  
Experimental 2016 Dec 4.16  
**15**

**Kolisch-Singule et al.** The effects of airway pressure release ventilation on respiratory mechanics in extra pulmonary lung injury  
*Intensive Care Med.*  
Experimental 2015 Dec 3.35  
**16**

**Shreyas et al.** Early stabilizing alveolar ventilation prevents acute respiratory distress syndrome: A novel limiting- based ventilatory intervention to avoid lung injury  
*J Trauma Acute Care Surg.*  
Volume 73, Number 2  
**17**

**Shreyas et al.** Prophylactic application of Airway Pressure Release Ventilation prevents development of ARDS in a rat traumatic hemorrhagic shock model  
**18**

**Kolisch-Singule et al.** Mechanical Breath Profile of Airway Pressure Release Ventilation: The Effect on Alveolar Recruitment and Micro strain in Acute Lung Injury  
*JAMA.* Apr 10; 105(1)Jamasurg. 2014. 1929  
**19**

**Kolisch-Singule et al.** Airway Pressure Release Ventilation Reduces Conducting Airway Micro-Strain in Lung Injury  
*J Am Coll Surg.*  
2014;219:950957  
**20**

**Nieman et al.** Mechanical Ventilation as a Therapeutic Tool to Reduce ARDS Incidence  
*CHEST.*  
2015; 146 (3): 1396 - 1404  
**21**

**Nieman et al.** Impact of mechanical ventilation on the pathophysiology of progressive acute lung injury  
*J Appl Physiol.*  
119: 1243-1261, 2015  
**22**

**Sumeet et al.** The role of high airway pressure and dynamic strain on ventilator induced lung injury in a heterogeneous acute lung injury model  
*Intensive Care Medicine.*  
Experimental (2017) 5.25  
**23**

**Habashi** Other approaches to open-lung ventilation: Airway pressure release ventilation  
*Crit Care Med.*  
2000; 33, No. 3 (Suppl.)  
**24**

**Categories**  
CLIN = Clinical Study  
REV = Review  
CASE = Case study  
ANIM = Animal Study

**Purpose of review:**
Patients who experience severe trauma are at increased risk for the development of acute lung injury and acute respiratory distress syndrome. The management strategies used to treat respiratory failure in this patient population should be comprehensive. Current trends in the management of acute lung injury and acute respiratory distress syndrome consist of maintaining acceptable gas exchange while limiting ventilator-associated lung injury.

**Recent findings:**
Currently, two distinct forms of ventilator-associated lung injury are recognized to produce alveolar stress failure and have been termed low-volume lung injury (intra-tidal alveolar recruitment and de-recruitment) and high-volume lung injury (alveolar stretch and overdistension). Pathologically, alveolar stress failure from low- and high-volume ventilation can produce lung injury in animal models and is termed ventilator-induced lung injury. The management goal in acute lung injury and acute respiratory distress syndrome challenges clinicians to achieve the optimal balance that both limits the forms of alveolar stress failure and maintains effective gas exchange. The integration of new ventilator modes that include the augmentation of spontaneous breathing during mechanical ventilation may be beneficial and may improve the ability to attain these goals.

**Main Results:** Airway pressure release ventilation is a mode of mechanical ventilation that maintains lung volume to limit intra-tidal recruitment/de-recruitment and improves gas exchange while limiting over distension. Clinical and experimental data demonstrate improvements in arterial oxygenation, ventilation-perfusion matching (less shunt and dead space ventilation), cardiac output, oxygen delivery, and lower airway pressures during airway pressure release ventilation. Mechanical ventilation with airway pressure release ventilation permits spontaneous breathing throughout the entire respiratory cycle, improves patient comfort, reduces the use of sedation, and may reduce ventilator days.
Deep dive: Evita V600/V800 – the new era of adult ventilation
Now you try – how would you present SmartCare/PS?
WHY

WHY

How do they do it?

“What we deliver to achieve their goals?”

“Clinical Strategy“

“How do they do what they do?”

“Therapy Goals“

“What we deliver to achieve their goals?”

“Products / Solutions“
Your ideas and suggestions?
Only 50% of long-term ventilated ICU patients are able to go back to work even one year after discharge *

65% of these patients have functional limitations **

** Kress et al. 2014
WHY

Why do they do what they do?

“Therapy Goals“

HOW

How do they do it?

“Clinical Strategy“

WHAT

What we deliver to achieve their goals?

“Products / Solutions“
Reduce length of ICU stay
Clinical strategies to achieve this

- ... reduce ventilation time
- ... less sedation and encourage cognitive interaction
- ... decrease probability of reintubation
SmartCare/PS

- ... has been shown to reduce weaning times by up to 40% and ventilation times by up to 33%

- ... the only ventilation mode that shortens weaning time and ICU stay
  Rose L et al.; 2003, Automated versus non-automated weaning for reducing the duration of mechanical ventilation for critically ill adults and children (Cochrane Review)

- ... as good as having a 1:1 experienced critical care specialty caregiver to patient ratio
  Rose L. et al., 2008, A randomised, controlled trial of conventional versus automated weaning from mechanical ventilation using SmartCare/PS.
„The use of the automated closed loop system SmartCare/PS resulted in reductions in weaning, ventilation duration and ICU length of stay whereas the ASV and other automated systems including Automode, MMV, MRV and a non-commercially available system did not influence these outcomes.“
# Proof points for our solutions

## SmartCare®/PS

**Literature List**

## INDEX

<table>
<thead>
<tr>
<th>Writer</th>
<th>Subject</th>
<th>Publication</th>
<th>Page</th>
</tr>
</thead>
</table>

**Categories**

- **CLIN** = Clinical Study
- **REV** = Review
### Available for all relevant studies

|-----|----------------|---------------------------------------------------------------------------------|----------------------------------|

**Background:** Automated closed loop systems may improve adaptation of the mechanical support to a patient's ventilatory needs and facilitate systematic and early recognition of their ability to breathe spontaneously and the potential for discontinuation of ventilation.

**Objectives:** To compare the duration of weaning from mechanical ventilation for critically ill ventilated adults and children when managed with automated closed loop systems versus non-automated strategies. Secondary objectives were to determine differences in duration of ventilation, intensive care unit (ICU) and hospital length of stay (LOS), mortality, and adverse events.

**Search Methods:** We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2011, Issue 2); MEDLINE (OvidSP) (1948 to August 2011); EMBASE (OvidSP) (1980 to August 2011); CINAHL (EBSCOhost) (1982 to August 2011); and the Latin American and Caribbean Health Sciences Literature (LILACS). In addition we searched the Health Technology Assessment Database (HTA Database). We also searched the Web of Science Proceedings; conference proceedings; trial registration websites; and reference lists of relevant articles.

**Selection Criteria:** We included randomized controlled trials comparing automated closed loop ventilator applications to non-automated weaning strategies including non-protocolized usual care and protocolized weaning in patients over four weeks of age receiving invasive mechanical ventilation in an intensive care unit (ICU).

**Data Collection and Analysis:** Two authors independently extracted study data and assessed risk of bias. We combined data into forest plots using random-effects modelling. Subgroup and sensitivity analyses were conducted according to a priori criteria.

**Main Results:** Pooled data from 15 eligible trials (14 adult, one paediatric) totaling 1173 participants (1143 adults, 30 children) indicated that automated closed loop systems reduced the geometric mean duration of weaning by 32% (95% CI 19% to 46%, P = 0.002); however heterogeneity was substantial (I² = 89%, P < 0.00001). Reduced weaning duration was found with mixed or medical ICU populations (43%, 95% CI 8% to 65%, P = 0.02) and SmartCare/PSTM™ (31%, 95% CI 7% to 49%, P = 0.02) but not in surgical populations or using other systems. Automated closed loop systems reduced the duration of ventilation (17%, 95% CI 8% to 26%) and ICU length of stay (LOS) (11%, 95% CI 0% to 21%). There was no difference in mortality rates or hospital LOS. Overall the quality of evidence was high with the majority of trials rated as low risk.

**Conclusions:** Automated closed loop systems may result in reduced duration of weaning, ventilation, and ICU stay. Reductions are more likely to occur in mixed or medical ICU populations. Due to the lack of, or limited, evidence on automated systems other than Smartcare/PSTM™ and Adaptive Support Ventilation no conclusions can be drawn regarding their influence on these outcomes. Due to substantial heterogeneity in trials there is a need for an adequately powered, high quality, multi-centre randomized controlled trial in adults that excludes ‘simple to wean’ patients. There is a pressing need for further technological development and research in the paediatric population.
Focus during pre-launch and launch phase

Protective Therapies:
Protective ventilation & patient outcome
Focus during pre-launch and launch phase

Protective Therapies: Protective ventilation & patient outcome

based on our...

As no patient is alike – Dräger Ventilation. Dedication for better treatment.

Respiration Pathway
All in line with the approach you have seen already many times today...

We follow our argumentation line:

- THE WHY: Clinical challenges
- THE HOW: Clinical strategies
- THE WHAT: Techn. Dräger solution
Let's take a closer look at two examples

1

Our solution...

Clinical strategy...

Customer goals...

ICU focus...

Reduce VALI/ARDS

Reduce Mortality

Avoid ICU acquired weakness

Reduce cognitive impairment

Stabilize alveoli & reduce strain & stress
Let’s take a closer look at two examples

ICU focus...

Customer goals...

Clinical strategy...

Our solution...

Improve patient comfort

Variable Pressure Support

Improve variability of breathing & synchrony

- Avoid ICU acquired weakness
- Reduce cognitive impairment
- Reduce Mortality
Different examples in one wheel available
Different examples in one wheel available

Back side

* available in Q3 2019
We have created outcome packages for (almost) all of the features
Part of the outcome packages are...
Respiration pathway – support whenever you need it

Make your ventilation therapy soft and gentle

Mechanical ventilation: As non-invasive as possible, as invasive as necessary. Patients in the intensive care unit (ICU), who are dependent on mechanical ventilation, need the best care from admission to discharge – and beyond. However, a variance of different tools are required for different therapy phases. Variability and diversity of treatment tools clearly improve the decision-making in clinical practice – and the treatment.

› Prevent intubation       › Protect the lung       › Wean comfortable
› Avoid reintubation      › Which mode is optimal?  › Customer Case Study
› Ventilator portfolio
Create awareness: Teaser available

(1) SmartCare/PS
(2) APRV
(3) Variable Pressure Support

(4) High Flow Therapy
(5) PulmoVista 500
(6) Image-guided lung protect.

(7) NIV
(8) Early Mobilization
(9) Volume Guarantee
Thank you for your attention!
Any questions?