

# National Approach to Standardize and Improve Mechanical Ventilation

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## Abstract:

NASAM (National Approach to Standardize and Improve Mechanical Ventilation) is a national collaborative quality improvement project in Saudi Arabia. It aims to improve the care of mechanically ventilated patients by implementing evidence-based practices with the goal of reducing the rate of ventilator-associated events and therefore reducing mortality, mechanical ventilation duration and intensive care unit (ICU) length of stay. The project plans to extend the implementation to a total of 100 ICUs in collaboration with multiple health systems across the country. As of March 22, 2019, a total of 78 ICUs have registered from 6 different health sectors, 48 hospitals, and 27 cities. The leadership support in all health sectors for NASAM speaks of the commitment to improve the care of mechanically ventilated patients across the kingdom.

## Keywords:

Evidence-based practice, mechanical ventilation, ventilator-associated event, ventilator-associated pneumonia

Several hospitals in Saudi Arabia have published findings on successful efforts to reduce ventilator-associated pneumonia (VAP), but these were mostly single-center

studies and focused on reducing VAP rather on an overall improvement in the care of mechanically ventilated patients.<sup>[1-6]</sup>

In 2013, the Armstrong Institute for Patient Safety and Quality at the Johns Hopkins Hospital launched the Comprehensive Unit-based Safety Program (CUSP) for improving the care of mechanically ventilated patients (CUSP 4 MVP project).<sup>[7,8]</sup> A cohort of 15 ICUs from six hospitals in Saudi Arabia participated collaboratively with this project between September 2015 and December 2016.<sup>[9]</sup> The project included

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multiple interventions (CUSP team formation, training, audit, and feedback) to improve several aspects of the care of mechanically ventilated patients following evidence-based guidelines. Over a relatively short period of time, there was a significant improvement in key indicators of the care of mechanically ventilated patients with a trend toward reduction in mortality. This project demonstrated the feasibility of performing a multicenter quality improvement project. A large-scale project with a longer duration may lead to major impact on the care of mechanically ventilated patients in Saudi Arabia.

In sustaining much of these efforts, we plan to extend the implementation to a total of 70–100 ICUs in collaboration with multiple health systems across the country. The objective is to improve the care of mechanically ventilated patients and eliminate preventable harm associated with mechanical ventilation (MV). A significant component of this project includes measuring the safety culture of ICUs, which is one of the Ministry of Health indicators for Vision 2030.<sup>[10]</sup>

### Objectives

The National Approach to Standardize and Improve Mechanical Ventilation (NASAM) is a national collaborative quality improvement project in Saudi Arabia which aims to improve the care of mechanically ventilated patients by implementing evidence-based practices with the goal of reducing the rate of ventilator-associated events (VAEs) and therefore reducing mortality, MV duration, and ICU length of stay.

### Project overview

Over the course of 2 years, ICU teams from different hospitals will work simultaneously through the NASAM project. This data-driven project includes generating data on key performance indicators, attending workshops and biweekly online training sessions, and leading on local safety efforts to reduce patient harm. Participating teams are invited to join the NASAM project web portal which provides educational materials for frontline staff, infection control practitioners, and allied health-care professionals; evidence-based toolkits; data collection tools to evaluate local practices; and a robust web-based data platform to generate real-time data reports. Participating ICUs can track their performance over time and compare their performance with others. Reports can be shared with the team members, frontline staff, and hospital leaders to sustain engagement in the program.

### Interventions

The project focuses on driving change to improve the compliance with evidence-based practices through technical and adaptive improvement.

## Evidence-Based Practices

### National Approach to Standardize and Improve Mechanical Ventilation bundle

Elements of the NASAM bundle were selected based on the previous experience with CUSP 4 MVP project and based on the potential to make an impact on patient outcome and applicability in Saudi ICUs [Table 1]. The NASAM bundle includes the use of subglottic suctioning and head of bed elevation, both have been proven to reduce VAP occurrence in critically ill patients;<sup>[11]</sup> spontaneous awakening trials and spontaneous breathing trials which have both been incorporated in the worldwide evidence-based bundle, known as the ABCDEF bundle (Assessing pain, Both spontaneous awakening and breathing trials, Choice of analgesia, Delirium management, Early mobility, and Family engagement); and minimization of sedation and avoidance of neuromuscular blockers unless there is a clear indication, which are widely accepted and highly relevant practices that should be targeted for improvement.<sup>[11-14]</sup>

### Early mobility

Evidence suggests that the early mobilization of critically ill patients can reduce the physical and neurocognitive impairments in ICU survivors. It can result in reduced length of stay and decreased degree of delirium.<sup>[13]</sup> Although the mobilization of ICU patients at early stages seems to be safe and effective, it is not without risk. Problems with mobilization could occur and lead to injuries such as catheter dislodgement and equipment disconnections. In order to maximize the benefits of early mobilization intervention, it is crucial to understand

**Table 1: Key indicators in the National Approach to Standardize and Improve Mechanical Ventilation project**

Processes	Components
NASAM bundle	Subglottic suctioning endotracheal tube usage Head of the bed elevation Spontaneous awakening trials Spontaneous breathing trials Avoidance of neuromuscular blockers, unless there is a clear indication
Early mobility	Highest level of mobility Identification of barriers to mobility Clinical events associated with mobility Delirium assessment
VAE rates	VAC iVAC pVAP
Objective outcome measures	Mortality Length of stay Duration of mechanical ventilation

NASAM=National Approach to Standardize and Improve Mechanical Ventilation, VAC=Ventilator-associated condition, iVAC=Infection-related ventilator-associated complication, pVAP=Possible ventilator-associated pneumonia, VAE=Ventilator-associated event

the barriers to compliance, which can be related to the awareness level of ICU clinicians, agreement among clinicians on its implementation, and availability of equipment required for this intervention.<sup>[15]</sup> All these elements will be monitored in the NASAM project [Table 1].

### Technical Improvement

1. Data-driven change: The technical improvement involves using data to drive change.
2. Education and training: Workshops and educational webinars that will be conducted biweekly will provide education and training on the best practices in patient safety and on improving the care of mechanically ventilated patients. The topics will include the aspects listed in Table 2.
3. Coaching, audit, and feedback: The NASAM project supports frontline teams by structured team coaching to learn and practice improvement tools.

### Adaptive Improvement

This will be implemented using the concepts of CUSP to improve patient safety awareness and system thinking at the unit level. The CUSP approach was developed by patient safety researchers at the Johns Hopkins Hospital (Baltimore, MD, USA) and was designed to improve local safety cultures and to guide to learn from mistakes by utilizing a structured framework.<sup>[8]</sup> This approach has been linked to large-scale reductions in healthcare-acquired infections,<sup>[16-20]</sup> mortality,<sup>[21]</sup> and associated costs.<sup>[22]</sup>

### The five steps for implementing a comprehensive unit-based safety program team

All the participating units are requested to create a dedicated CUSP team.<sup>[8]</sup> These teams should include

at minimum a local physician and a nursing and a respiratory therapy champion. The CUSP team should meet regularly to discuss patient safety issues in the unit.

1. Educate everyone in the “Science of Safety”
  - The science of safety presents system design, safe design principles, and valuing diverse inputs from clinical and nonclinical health-care providers
2. Identify defects
  - A defect is a clinical or operational event that one would not want to have happen again. It can be identified by administering the following two-question survey:
    1. How is the next patient likely to be harmed on our unit and what do you think we could do to prevent that harm?
    2. On our unit, how do you think we can get patients of the mechanical ventilator faster?
3. Recruit executives (chairs and directors) as active CUSP team members
  - An executive is partnered with a CUSP team on a clinical unit to help address patient safety concerns and award patient safety successes
4. Learn from one defect per quarter. Analyze defects systematically
  1. What happened?
  2. Why did it happen?
  3. What could you do to reduce risk?
  4. How do you know that the risk was reduced?
5. Implement teamwork tools
  - Teamwork tools include culture surveys, handoff tools, shadowing, and other recommended tools

### National Approach to Standardize and Improve Mechanical Ventilation Clinical Outcomes

1. VAEs: We will use the Centers for Disease Control and Prevention definitions of VAE.<sup>[23]</sup> The new

**Table 2: National Approach to Standardize and Improve Mechanical Ventilation webinar topics**

Adaptive	Technical
The science of patient safety	Opportunities for improving the care of mechanically ventilated patients
The concept of CUSP	NASAM bundle
PDSA cycles	Early mobility
Safety culture	Daily sedation interruption
Engagement of staff in patient safety	Spontaneous breathing trial
Learning from defects	VAE surveillance training
Using data for improvement	Data collection
Sustainability	Daily goals
Using daily goals during interdisciplinary rounds	Delirium: Assessment and prevention
	Subglottic endotracheal tubes
	Data collection
	PAD, sedation management
	Low tidal volume ventilation
	Wake up and breathe

CUSP=Comprehensive Unit-based Safety Program, NASAM=National Approach to Standardize and Improve Mechanical Ventilation, VAE=Ventilator-associated event, PAD=Pain, agitation, delirium, PDSA=Plan-Do-Study-Act

algorithm uses objective criteria for the diagnosis of ventilator-associated conditions (VACs) and infection-related VACs. This approach thereby broadens the definition of harm suffered by ventilated patients beyond pneumonia to include pulmonary edema, atelectasis, and acute respiratory distress syndrome.<sup>[24]</sup> The concept of VAEs has been validated and shown to be associated with longer MV duration and ICU and hospital stays and higher mortality<sup>[25-31]</sup>

2. Objective outcome measures
  1. Mortality of mechanically ventilated patients
  2. Duration of MV
3. ICU length of stay

### Patient Safety Culture Survey

We will use the Hospital Survey on Patient Safety Culture (HSOPSC) sponsored by the Agency for Healthcare Research and Quality. The survey includes 42 items that measure 12 composites of patient safety culture.<sup>[32]</sup> The HSOPSC domains are summarized in Table 3.

### Progress

As of March 22, 2019, a total of 78 ICUs have registered for the NASAM [Figure 1], with around 60% started collecting NASAM indicators. The registered ICUs were from 6 different health sectors, 48 hospitals, and 27 cities. In January, there were data collected on more than 5000 patient-days. The leadership support in all health sectors speaks of the commitment to improve

the care of mechanically ventilated patients across the Kingdom.

### NASAM Project Resources

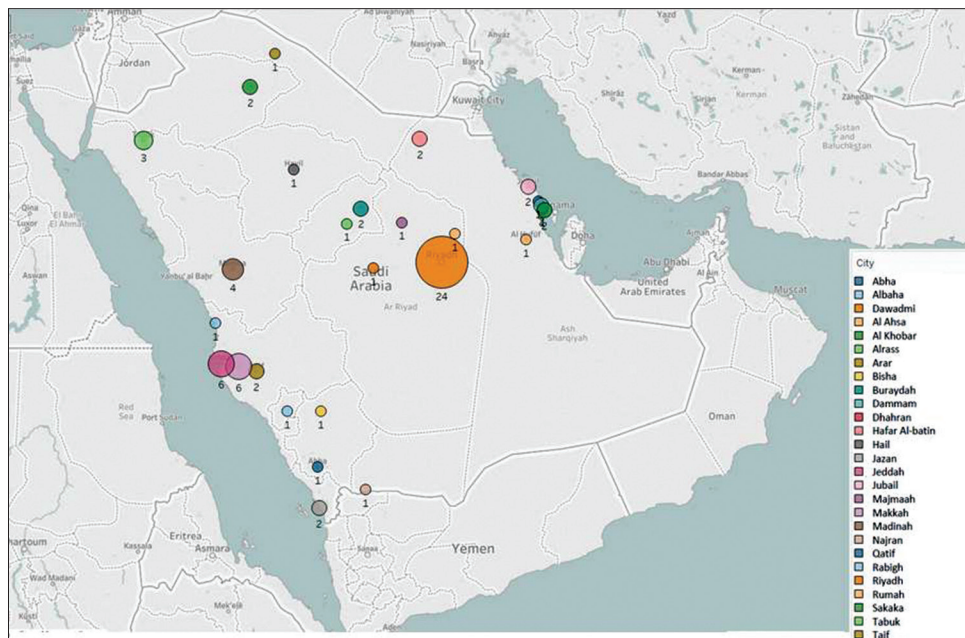
Recorded lectures, powerpoint presentations, related documents, and protocols will be made available through the NASAM website.

### Conclusions

The NASAM project is a quality improvement initiative aimed at improving the care of mechanically ventilated patients at a large scale in Saudi Arabia. Collaboration and culture of safety are key features of this project.

**Table 3: Hospital Survey on Patient Safety Culture Domains<sup>[32]</sup>**

Domains
1. Communication openness
2. Feedback and communication about error
3. Frequency of events reported
4. Handoffs and transitions
5. Management support for patient safety
6. No punitive response to error
7. Organizational learning - continuous improvement
8. Overall perceptions of patient safety
9. Staffing
10. Supervisor/manager expectations and actions promoting patient safety
11. Teamwork across units
12. Teamwork within units



**Figure 1: National Approach to Standardize and Improve Mechanical Ventilation sites**

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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