Actionable Patient Safety Solution (APSS) #8:
AIRWAY SAFETY

Executive Summary Checklist

Failures of airway management (e.g., inability to mask ventilate or oxygenate, unplanned extubation, failure to intubate) are major causes of inpatient morbidity and mortality. The following steps will establish an institutional, team-based, comprehensive and sustainable system for reliability in airway management.

- ☐ Assemble a core multidisciplinary leadership team to advance airway safety, including:
  - ED, ICU, Hospitalist, and Anesthesiology Physician Leader.
  - ED, ICU Nursing Leaders.
  - Respiratory Therapy Leaders.
  - QA/Safety Leadership (VP or higher level).

- ☐ Establish the need for improvement by examining current vulnerabilities, using known and simulated complications and difficult cases, along with key statistics.

- ☐ Create the vision of institution-wide reliability for airway management safety through standardization of best practices, policies and procedures.

- ☐ Under the leadership of a physician anesthesiologist, develop a comprehensive airway toolkit method (e.g., the Safer Airway Bundle)[1]. Start implementation in the ED and ICUs, and then move to floor units and other departments. Include the following Key Components: Failed Airway Path, Airway Cart, Airway Checklist, Quality Assurance, and Team Training.
  - Implement Safer Airway Essential Components, as described in **Appendix A**.

- ☐ Require tracking and reporting of "near misses" and complications of airway management. Identify adverse outcomes that are iatrogenic and preventable (eg. multiple attempts, esophageal intubation, SpO2 <90% or decline of >10%, dental or soft tissue injury). Use these case data in medical staff educational sessions to prevent recurrences, as a part of Continuous Quality Improvement (CQI).

- ☐ Provide periodic airway management education for all care providers. This will include: identification of airway problems, selection and use of appropriate intervention, and understanding when and how to call for expert assistance (e.g. from Anesthesiology).

[1] Safer Airway. Team-Based Airway Safety High Reliability for Airway Management. Retrieved from: www.SaferAirway.org

The Performance Gap

This set of Actionable Patient Safety Solutions (APSS) promotes airway safety and gives broad recommendations for urgent and emergent airway management in settings both inside and outside of the operating room including pre-hospital emergency medical services (EMS), emergency departments (ED), intensive care units (ICU), general medical/surgical units, procedural areas and outpatient settings.

Centers for Medicare and Medicaid Services (CMS) has identified Airway Safety as a priority area for Round 2 of the Hospital Engagement Networks (HENs) due to the high risk and significant impact of airway related injuries and deaths. Several United States and European organizations have provided focused evidence based clinical recommendations to their specialty membership and general audiences. There have been few calls for specific standards outside of the operating room (OR). We strongly promote that this needs to change.

This Airway Safety APSS serves to highlight key need areas for best practice development and implementation, as well as promote evolving programs that introduce a new level of practice and comprehensive airway safety engagement.

Finally, this Airway Safety APPS serves as a launching point calling for a multi-disciplinary Global Airway Safety (GAS) Collaborative to support further development, assessment, implementation, and promotion of clear actionable solutions for strengthening airway safety awareness, education, management, research and policy.

Threats and Vulnerability

Delayed, missed or lost airways can result in death or catastrophic injuries that are almost always preventable. In particular, endotracheal intubation via direct laryngoscopy is a skill intensive, physically challenging, single operator technique, which has an unacceptable rate of failure, even in the hands of airway specialists. Unrecognized esophageal intubation, multiple failed attempts at securing the airway, aspiration of gastric contents, airway injury, dental trauma, hypoxemia and brain injury are tragically all too common.

The wide variation of techniques and technology for airway management is a key contributing factor to patient outcomes. Although the goals of airway management are essentially uniform, clinical approaches depend heavily on provider specialty and physical locale in healthcare settings, without standardization of best practices. For example, video laryngoscopy (VL) equipment is not reliably available in all areas, despite a wealth of scientific evidence that demonstrate its clinical superiority over direct laryngoscopy in a variety of clinical settings. The incidence of failed airways can be as high as 1 in 50 in the ED and ICU settings and the occurrence of death or brain damage have been reported to be 38 fold (ED) to 58 fold (ICU) higher than in OR settings.[2] Adverse events from airway management failure may be even higher in non ED/ICU hospital settings. Incidences of inadvertent airway extubation are also serious threats that can lead to death or severe disability.

Missed airways in the EMS setting have been reported to be as high as 52%.[3] Although airway management can be successfully performed by paramedics in the field (success rates as high as 97.7%), variations in training, techniques, and technology result in many systems with less than optimal provider competence and inadequate intubation success rates (47.6%). The approach to airway management in the EMS setting has undergone a dramatic

[2] Cook, T. M., & MacDougall-Davis, S. R. (2012). Complications and failure of airway management. British Journal of Anaesthesia, 109(suppl 1), i68-i85.
[3] Hubble, M. W., Wilfong, D. A., Brown, L. H., Hertelendy, A., & Benner, R. W. (2010). A meta-analysis of prehospital airway control techniques part II: Alternative airway devices and cricothyrotomy success rates. Prehospital Emergency Care, 14(4), 515-530.

transformation since the advent of video laryngoscopy.[4] Video laryngoscopy improves laryngeal view and results in high rates of endotracheal intubation (ETI) success, both during first pass attempts and after difficult or failed direct laryngoscopy in the hospital setting.[5,6] However, due to the high cost of video laryngoscope equipment, EMS has not widely adopted VL and therefore the ETI success rates in the field remain low.

Studies indicate that unrecognized esophageal intubation in prehospital settings is as high as 25%.[7] With the outcome of an unrecognized esophageal intubation frequently being death, and with the availability of capnography which allows for easy recognition of malpositioned placement of the endotracheal tube, any unrecognized episode of esophageal intubation is avoidable. Yet some EMS agencies have not adopted waveform capnography and unrecognized esophageal intubations still occur.

Unplanned extubation, both in the field and in the hospital, is an avoidable, costly problem. Unplanned extubation occurs in over 7% of patients undergoing mechanical ventilation in the Intensive Care Unit and the complications of unplanned extubations result in over $4 Billion in healthcare costs.[8] Although the incidence is likely higher in EMS settings due to the difficulties of transporting critically ill patients in a chaotic environment, unplanned extubation is not tracked in most EMS data systems. Similarly, most hospitals do not track unplanned extubations and therefore the 7% incidence may be an underestimate.

Because of underreporting, the true incidence of airway management related injuries is unknown. What is clear, however, is that the healthcare industry must transition away from viewing airway management related injuries as the inevitable "cost of doing business" and redefine these complications as preventable iatrogenic harm.

Gaps

The overwhelming majority of hospitals currently lack standardization of airway management among individual providers, teams, units or institutions. In addition, they have significant vulnerabilities due to inadequate or absent essential safety components such as:

- Operational Failed Airway Protocols/Pathways
- Essential Equipment
- Systematic Team Training
- Competency Assessment and Credentialing
- Best Practices (hardwired into clinical care)
- Integrated Safety/QA Tools
- Systems for adequately tracking and registering difficult airways, failed airways and unplanned extubations

[4] Chesmian, R. V., Bhananker, S., Ramaiah, R. (2014). Videolaryngoscopy. International Journal of Critical Illness and Injury Science, 4(1): 35-41.
[5] Silverberg, M. J., Li, N., Acquah, S. O., & Kory, P. D. (2015). Comparison of video laryngoscopy versus direct laryngoscopy during urgent endotracheal intubation: A randomized controlled trial. Critical Care Medicine, 43(3), 636-641.
[6] Aziz, M. F., Healy, D., Kheterpal, S., Fu, R. F., Dillman, D., & Brambrink, A. M. (2011). Routine Clinical Practice Effectiveness of the Glidescope in Difficult Airway Management: An Analysis of 2,004 Glidescope Intubations, Complications, and Failures from Two Institutions. The Journal of the American Society of Anesthesiologists, 114(1), 34-41.
[7] Katz, S. H., & Falk, J. L. (2001). Misplaced endotracheal tubes by paramedics in an urban emergency medical services system. Annals of Emergency Medicine, 37(1), 32-37.
[8] da Silva, P. S. L., & Fonseca, M. C. M. (2012). Unplanned endotracheal extubations in the intensive care unit: Systematic review, critical appraisal, and evidence-based recommendations. Anesthesia & Analgesia, 114(5), 1003-1014.

Leadership Plan

Models currently exist for comprehensive airway safety improvement with high leverage interventions. The Veteran's Health Administration (VHA) recently initiated the Out of OR Airway Management (OOORAM) directive and the multidisciplinary Safer Airway Program is currently under development.

The Safer Airway Program is a comprehensive, team-based system solution that hardwires evidence-based best practices in clinical settings and safety science. It provides broad recommendations and customizable tools for multiple healthcare settings including emergency departments, intensive care units and general medical/surgical units, procedural areas and calls for implementation of proven solutions such as Failed Airway Protocols (FAP), comprehensive equipment cart/systems, essential clinical practices, checklist utilization and team training.

The Safer Airway Program is being developed via a collaboration of Emergency Medicine Associates, (Germantown, MD), the Emergency Medicine Patient Safety Foundation (EMPSF), and national advisors. The American College of Emergency Physicians' Quality Improvement and Patient Safety Section (QIPS), the Patient Safety Movement Foundation and other medical specialty organizations are leading the advancement of the Safer Airway Program.

Practice Plan

1. Emergency Medical Services (EMS) Recommendations for Basic Life Support (BLS) Units
    - Supraglottic Airway (SGA) for use in cardiac arrest
    - Training and recurring competency assessment for specific airway safety scenarios. Enrollment in regional and national systems for reporting adverse events and near miss events (e.g. EMS based Emergency Medical Error Reduction Group – www.emerg.org).
2. Emergency Medical Services (EMS) Recommendations for Advanced Life Support (ALS) Units
    - Supraglottic Airway for initial use in cardiac arrest and as a rescue device for failed intubation
    - Primary use of Video Laryngoscopy for endotracheal intubation
    - Continuous Waveform Capnography on the following patient groups:
        - **i.** All SGA or intubated patients
        - **ii.** Select conditions with potential threat to airway safety or adequacy of ventilation (overdose, respiratory distress, severe CHF)
    - Training and recurring competency assessment for specific airway safety scenarios
    - Enrollment in regional or national system for reporting adverse events and near miss events (e.g. EMS based Emergency Medical Error Reduction Group – www.emerg.org).
3. Hospital Recommendations
    - Establish high-reliability as the driving principle for airway safety in all clinical areas
    - Proactively embrace airway safety best practices prior to regulatory or accrediting body adoption
    - Form standing leadership group for airway management safety including key stakeholders in C-suite Safety/Quality Administration, Emergency Medicine, Critical Care, Anesthesiology, Hospital Medicine, Respiratory Care and Nursing
    - Implement system for anesthesia specialist to assist with difficult airways in non-OR settings
    - Develop standardized, site-specific systems for airway management in areas including ED, ICU, general units and procedural areas, which incorporate the following key components (**Appendix A: Safer Airway Essential Components**):
        - **i.** **Hospital-wide Failed Airway Protocol/Pathway** (FAP)
            1. Assure FAP is "operational", simple, known and utilized by all staff managing airways
            2. Include provision for Awake Fiberoptic/Video Intubation (ED, ICU), and ensure the availability of both technical and professional resources
        - **ii.** **Comprehensive, Standardized Airway Cart/Equipment System** to ensure all needed equipment is present for all intubations and airway emergencies in the ED, ICU, OR, Post Anesthesia Care Unit (PACU) and general unit settings. Avoid separate basic and

"difficult" airway cart/stocking systems as this may decrease the chances that all needed equipment will be at hand should an urgent airway situation arise. Stock essential items on each cart appropriate to the clinical setting which may include:

1. Oral and Nasal Airways
2. Face Masks
3. Video Laryngoscopy on all carts and ready for all intubations
4. Tracheal Tube Introducer Catheters (Bougies)
5. Supraglottic Airways appropriately sized to meet needs of patient population and with intubating and gastric access capability
6. Cricothyrotomy Kits (simple)
7. Needle jet ventilation capability for pediatrics (ED / ICU) after VL,DL, SGA and BVM failure
8. Flexible Fiberoptic Scope (Video preferred) (Located In the ED and ICU)
9. Waveform Capnography
    a. On all intubated patients in all settings including ED, ICU, PACU and during transport
    b. Patients vulnerable to airway/ventilation deficiency
    c. Integrated into main and transport monitors
10. Optimal Endotracheal Tube Fixation Systems or Devices

iii. Hardwire Best/Critical Practices

1. Utilization of a checklist/QA tool to hardwire and assess critical practices
2. Airway assessment and planning
3. Team communication and collaboration with plan/ performance
4. Optimal 1 and 2 person Bag -Mask ventilation with appropriate oral and nasal pharyngeal airways
5. Optimal patient positioning (e.g. Ear to Sternal Notch, Head Elevated Laryngoscopy Position (HELP),[9] RAMP for Obesity
6. Apneic Oxygenation ("No DeSat") for pre-oxygenation
7. Prompt SGA use in failed VL/DL and primary placement in cardiac arrest codes
8. Prompt emergency cricothyrotomy after VL, DL, SGA and BVM failure
9. Waveform Capnography – Immediately and maintained on all intubations for continuous monitoring of ventilation and airway competency
10. Use of non paralyzed or "Awake" techniques in appropriate clinical setting
11. Use of flexible fiberoptic or video scope when converting SGA to endotracheal tube (ETT) and for Awake Fiberoptic Intubation (AFOI)
12. Formalize system for appropriate sedation and patient restraints to decrease risk of unplanned extubation (UE)
13. Formalize system for optimally securing ETT to avoid UE
14. Implement best practice guidelines for weaning & planned extubation
15. Implement system for recording and alerting clinicians (similar to allergies) for patients with known difficult airways (DA)
16. Utilize a robust system for tracking and analyzing QA, adverse, and near miss events for airway management (airway registry beyond hospital safety reporting system) for all difficult and failed airways and unplanned extubations

iv. Team Training

1. Implement a system where all physicians and staff receive initial and recurring team based training for protocol, equipment and critical practices, as well as utilization of critical clinical and teamwork best practices.
2. Ensure all intubating clinicians are appropriately trained and credentialed.

[9] Levitan, R. M., Mechem, C. C., Ochroch, E. A., Shofer, F. S., & Hollander, J. E. (2003). Head-elevated laryngoscopy position: Improving laryngeal exposure during laryngoscopy by increasing head elevation. Annals of Emergency Medicine, 41(3), 322-330.

4. Outpatient Procedure Centers Utilizing Moderate or Deep Sedation
    - Ensure staff administering sedation are trained to monitor and manage airways appropriate to the setting
    - Utilize proper monitoring equipment and tools including pulse oximetry and waveform capnography
    - Equip with needed airway management equipment and skills for use including: oxygen therapy, bag-valve mask ventilation, BLS level use of supraglottic airway devices
5. Professional/Healthcare/Stakeholder Organizations
   Seek national collaboration with other professional, safety and healthcare organizations in an Airway Safety Collaborative with the aim to help the industry:
    - Learn more about airway management practices in a broad representation of hospitals and clinical environments
    - Develop and/or promote high impact best practices to be implemented in specified clinical units (pre-hospital, ED, ICU, medical/surgical floor, procedural areas, outpatient settings)
    - Establish and maintain a national airway registry tool
    - Research system solutions to improve airway safety
    - Develop education programs and materials for trainees and practicing clinicians
6. Industry Recommendations
    - Collaborate with ongoing and future safety initiatives to develop or modify products or solutions to best address airway safety threats by:
        - **i.** Optimizing human factors and device usability
        - **ii.** Label products to be clearly and easily identified for size and use (with human factors consideration in high stress events)
        - **iii.** Seek and respond to clinical and safety requests for modification
    - Establish a mechanism for industry collaboration for rapid identification and response to vulnerabilities and to seek the rapid dissemination and adoption of high reliability components to products or services
    - Package products for high reliability and ease of access
    - Package essential supplies to accommodate portable airway cart systems
    - Support the development of airway safety research
    - Support the development of national airway safety policy
    - Support unbiased educational forums for airway safety
    - Participate in the Global Airway Safety (GAS) Collaborative
7. Accrediting Agencies
    - Work with professional clinical/safety organizations to establish process, performance and measurement standards for airway safety
    - Highlight and assess airway standards during site visits as a high priority focus
    - Elevate airway safety as a national patient safety goal
8. Government (Funders/Regulators/Service Providers)
    - Work with professional clinical/safety organizations to establish process, performance and measurement standards for airway safety
    - Fund research for improving airway management safety through the spectrum hospital and healthcare settings
    - Utilize financial incentives to help drive adoption of established highly reliable airway safety practices
9. Safety Organizations (Global, National, Regional, State level)
    - Assist, support and participate the development of a Global Airway Safety Collaborative
    - Elevate airway safety as a national safety goal
    - Support and promote the development and implementation of actionable airway safety solutions
    - Network potential funders to empower solution development and research
    - Support the development of airway safety training programs and tools
10. Risk Management/Insurance Industry
    - Elevate airway safety as a national safety goal
    - Fund and support the development and implementation actionable airway safety solutions
    - Establish financial incentives for groups that demonstrate implementation, tracking, assessments and training in airway safety practices, tools and procedures

11. Consumer Groups
    - Support and help fund the development of a Global Airway Safety Collaborative with the aim to elevate the standard of care for airway safety
    - Support and help fund safety organizations and programs that will help protect constituent members with regard to airway safety (key focus areas in geriatric, pediatric and bariatric patient groups)
    - Demand specific and demonstrable highly reliable airway safety from healthcare organizations and institutions. Help establish and promote public awareness campaigns for airway safety engagement, practices and performance

Technology Plan

Suggested technologies are limited to those proven to show benefit or are the only known technologies with a particular capability. As other technology options may exist, please send information on any additional technologies, along with appropriate evidence, to info@patientsafetymovement.org.

Airway management devices that improve safety and drive better patient outcomes should be adopted, including:

Video Laryngoscopes: The video laryngoscopy market is growing and essential features to maximize efficacy include:

- Portable
- Easy to use
- Clear and reliable airway visualization without fogging
- Permit ETT delivery with minimal operator fine motor skills
- Large video screen to allow multiple operators to act as a team. Devices with small video screens may be preferred when space is limited (i.e. helicopters, etc.)
- Image storage capability
- Low risk for cross contamination
    - Examples of Video Laryngoscopes include the GlideScope (Verathon), C-MAC (Storz), McGrath (Medtronic), and King Vision (Ambu).

Flexible Fiberscopes: Although video laryngoscopes have reduced the need for flexible fiberoptic intubation, flexible fiberscopes remain the device of choice in certain critical airway conditions (angioedema, oropharyngeal neoplasm, head and neck radiation, congenital deformity, etc.).

- Examples include reusable Olympus, Storz and Pentax flexible fiberscopes. Low cost single-use flexible fiberscopes with reusable video monitoring such as the Ambu aScope are now available as an alternative to high-priced reusable flexible fiberscope systems.

Supraglottic Airways: Second-generation supraglottic airways are now available and provide safety advantages over first generation devices. Advances in SGA allow for easier placement, higher ventilation pressures, gastric decompression and intubation through the device. These technological advances have furthered the importance of having the latest generation of SGAs available when needed as rescue or primary airway devices.

- Examples of newer generation supraglottic devices that permit intubation and gastric decompression include LMA Supreme (LMA), AuraGain (Ambu), iGel (Intersurgical) and AirQ (Cookgas). The Aintree Intubation Catheter (Cook Medical) allows for exchange of supraglottic airway to endotracheal tube using a flexible fiberscope.

Waveform Capnography: This important technology has become the standard of care for intubated patients in the UK and parts of Europe. United States Intensive Care Units, Emergency Departments and Emergency Medical Services are beginning to adopt this technology but significant gaps exist. Continuous Waveform Capnography should become a mandated safety practice for all SGA or intubated patients. This technology should have the capability to integrate into the facilities monitoring systems.

- Systems for in hospital and transport use are manufactured by Masimo, Medtronic (Oridion/Covidien), Nonin, Philips (Respironics) and Welch Allyn.

Endotracheal Tube Stabilizers: The current systems for stabilizing endotracheal tubes include adhesive tape, cotton twill ties and multiple commercial devices. Although the current literature does not clearly identify any particular device or technique that is superior, numerous devices on the market are clearly inferior in their ability to restrain against extubation forces. The most current cited unplanned extubation rate of 6.4%, with a range of studies showing rates as high as 18.9%, suggest that current stabilization techniques and devices are inadequate and therefore further research into developing a better stabilization system should be supported.[8] (Note: A study completed at the University of Colorado, Department of Biomedical Engineering, compared seven methods of endotracheal tube restraint systems and found one device to restrain against significantly higher forces compared to all of the other systems tested.[10] However, this restraint system is currently undergoing final stages of research and development and the manufacturer does not expect market clearance by the U.S Food and Drug Administration until late in 2016.)

[10] Wagner, J. L., Shandas, R., & Lanning, C. J. (2014). Extubation force depends upon angle of force application and fixation technique: A study of 7 methods. BMC Anesthesiology, 14(1), 1.

Metrics

Topic:

Unplanned Extubation in Mechanically Ventilated Patients

Rate of unplanned extubation for patients undergoing mechanical ventilation via endotracheal tube

Outcome Measure Formula:

Numerator: Number of incidences of unplanned extubations in patients mechanically ventilated via an endotracheal tube

Denominator: Total number of mechanical ventilation days

*Rate of unplanned extubation is expressed in terms of:

Number of patients experiencing an unplanned extubation per 100 mechanical ventilation days

Metric Recommendations:

Direct Impact:

All patients undergoing mechanical ventilation via endotracheal tube

Lives Spared Harm:

Lives = (Unplanned Extubation $Rate_{baseline}$ – Unplanned Extubation $Rate_{measurement}$) x *Vent $Days_{baseline}$

*Vent Days is the Outcome Measure Formula Denominator: (Total Number of Mechanical Ventilation Days)

Notes:

Extubation may occur as a planned or unplanned event. A planned extubation occurs when a physician orders the removal of the endotracheal tube. An unplanned extubation is defined as removal of a patient's endotracheal tube without a physician's order. Unplanned extubation may occur either due to patient self extubation or accidental extubation by an external force.

Risk factors for unplanned extubation should be measured including patient sedation and patient restraint.

Rate of complications and mortality related to incidences of unplanned extubation are important to determine the extent of adverse effects of unplanned extubation:

- Rate of pneumonia in mechanically ventilated patients with an incident of unplanned extubation compared to rate of pneumonia in mechanically ventilated patients without an incident of unplanned extubation
- Rate of severe brain injury in mechanically ventilated patients with an incident of unplanned extubation compared to the rate of brain injury in mechanically ventilated patients without an incident of unplanned extubation
- Mortality rate in mechanically ventilated patients with an incident of unplanned extubation compared to the rate of mortality in mechanically ventilated patients without an incident of unplanned extubation.

Data Collection:

Data is collected through manual review of written patient care reports or electronic capture of data fields from electronic patient care reports. Electronic capture from electronic billing data is typically very inaccurate.

Many hospitals patient care reports do not currently have unplanned extubation and related components (self extubation, accidental extubation, and requirement for reintubation) as data fields.

Mortality (will be calculated by the Patient Safety Movement Foundation):

The PSMF, when available, will use the mortality rates associated with Hospital Acquired Conditions targeted in the Partnership for Patient's (PfP) grant funded Hospital Engagement Networks (HEN). The program targeted 10 hospital acquired conditions to reduce medical harm and costs of care. "At the outset of the Partnership for Patients initiative, HHS agencies contributed their expertise to developing a measurement strategy by which to track national progress in patient safety—both in general and specifically related to the preventable HACs being addressed by the PfP. In conjunction with CMS's overall leadership of the PfP, AHRQ has helped coordinate development and use of the national measurement strategy. The results using this national measurement strategy have been referred to as the "AHRQ National Scorecard," which provides summary data on the national HAC rate[11]. Adverse events related to unplanned extubation was not included in the AHRQ National Scorecard document.

53% of patients experiencing unplanned extubation do not require reintubation and those patients have a low mortality rate (3%). 47% of patients experiencing unplanned extubation require reintubation and those patients have a high mortality rate (37%). The overall mortality rate for all incidences of unplanned extubation is 18%.[12]

[11] Agency for Healthcare Research and Quality. (2015). Efforts to improve patient safety result in 1.3 million fewer patient harms. Retrieved from http://www.ahrq.gov/professionals/quality-patient-safety/pfp/interimhacrate2013.html
[12] de Groot, R. I., Dekkers, O. M., Herold, I. H., de Jonge, E., & Arbous, M. S. (2011). Risk factors and outcomes after unplanned extubations on the ICU: A case-control study. Critical Care, 15(1), 1.

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Conflicts of Interest Disclosure:

*This Workgroup member has reported a financial interest in an organization that provides a medical product or technology recommended in the Technology Plan for this APSS.

Appendix A: Safer Airway Essential Components

(Source: www.saferairway.org)

	Solution		Level of Recommendation	Safety Rationale	Reference Source
1	**Failed Airway Protocol/Pathway (FAP)** (Operational) "Difficult Airway Pathway" (DAP) (*Alternative Term*)		Mandate	Standardized, actionable Team approach	
	A)	**Simple format** (3-4 Key Steps) Known & used by all team members	Mandate	Aligns teams to focus on major vulnerabilities and key actions	NAP4
	B)	**"Awake" - Non-Paralyzed Intubation** Integrated into Difficult Airway Pathway for ED/ICU	Highly Recommend	Essential practice not commonly performed in EM	ASA, DAS
	C)	Standardized throughout hospital	Highly Recommend	Validated safety practice	
2	**Airway Equipment**				
	A)	**Consolidated Airway Cart** (Standardized) Basic & "difficult" equipment unified	Mandate	Avoids critical delays, assures equipment availability & prompt access, Workspace w/ References	ASA
	A1)	Cart organized to support FAP Progression of need	Highly Recommend	Reinforces FAP Increases reliability	
	B)	**Video Laryngoscope** In room and ready for all intubations	Mandate	Higher 1st pass success Essential airway tool	ASA , NAP4
	C)	**Bougie** Type introducer catheters	Mandate	Critical Adjunct	ASA
	D)	**Supraglottic Airway Devices (SGD)**	Mandate		ASA
		i. **Laryngeal Mask Airways**	Mandate	Essential Rescue Device	ASA
		- LMA with Intubation capability	Highly Recommend	Allows conversion to ETT	ASA

		- LMA with Gastric Access capability	Recommend	Lowers aspiration risk	
		ii. **King Airway/Combitube** (alternative to LMA or rescue for LMA)	Highly Recommend	Key rescue device option	
	E)	**Cricothyrotomy Kits** (simple surgical)	Mandate	High reliability kits	ASA
	F)	**Needle Jet Ventilation kits**/Sets Pediatric patient under *10 y/o* and adults	Mandate		ASA
	G)	**Continuous Waveform Capnography** Maintained on all intubated patients including ED/ICU/Transports & with central monitoring enabled	Mandate	Monitoring ventilation effectiveness & continued placement w/ ETT and SGA. Standard of care in UK/Europe and US EMS but have significant gaps in US EDs, ICUs	AHA 2010 AARC (2003), ACEP, NAP4, AAGBI, ICS, EBA
	H)	**Flexible Fiberoptic Scope** In ED/ICU - 100% time	Mandate	Essential for Awake Intubation, SGA conversion	ASA
	I)	**LED blades/handles** for Direct Laryngoscopy (Replace bulb models - Single use models may be favorable)	Highly Recommend	10x brighter, higher reliability & better visibility	Anaesthesia
	J)	**Device for Securing Airway** (Avoiding Unplanned Extubation)	Highly Recommend	High rates of Unplanned Extubation (UE) in ED, ICU, Transport settings	
3	**Critical Practices** (Clinical and safety practices for preparation, performance and maintenance of artificial airways)				
	A)	**Utilization of Checklist QA Tool for hardwiring and assessing critical practices**	Mandate	Tool for practical preparation and critical practice assurance and QA monitoring	
	B)	**Assessment, planning and team communication for airway management** (as possible to the clinical setting)	Mandate	Know and accepted basic clinical and safety practice but often not utilized or hardwired into practice	

	C)	**Optimized patient positioning**	Mandate	Critical but commonly overlooked	ASA
	D)	**Apneic Oxygenation ("No Desat") Protocols**	Mandate	Significant potential to prevent or delay desaturation	Ann Emer Med
	E)	**2 Person BVM technique** (Appropriate seal, jaw thrust and prn bilateral NPA & OPA)	Mandate	Key basic airway skill for all healthcare personnel in all settings. Often not effectively performed	
	F)	**BIPAP/CPAP PreOxygenation if persistent hypoxia**	Highly Recommend	Useful with persistent hypoxia in obesity, CHF, other	Ann Emer Med
	G)	**Delayed Sequence Intubation w/ Ketamine** (Use for agitated patients with hypoxia)	Recommend	Important for allowing pre-oxygenation	Ann Emer Med
	H)	**Prompt Use of SGA if failed DL/VL**			
	I)	**SGA placement during codes** (Cardiac/respiratory arrest)	Highly Recommend	Assures open airway, prompt easy placement, Avoids resuscitation delay	
	J)	**Prompt use of surgical Cricothyrotomy if failed, VL/DL. SGA, BVM** (By qualified personal)			
	K)	**Flexible Fiberoptic Scope** to convert SGA to ETT	Highly Recommend	Blind techniques with only 65% 1st pass success rate	NAP4
	L)	**Awake Fiberoptic Intubation (AFOI)** or other non-Paralyzed Intubation Techniques (For predicted difficult/highly difficult intubations)	Highly Recommend	Essential practice not commonly performed in EM	ASA , DAS, NAP4
	M)	**Immediate utilization and maintenance of Continuous Waveform Capnography** (All intubated patients)	Mandate	SEE Equipment above	See references above
	N)	**Optimize Sedation & Restraint Protocols to minimize Unplanned Extubation (UE)**	Highly Recommend	Under sedation and agitation are risks for airway loss (UE)	AJCC
	O)	**Formalize system for optimally securing ETT**	Highly Recommend	High rates of fatality with unplanned expectation rates	

		(Tube holders for adults, C-Collar infants in transport)		reported as high as 7%. High risk in pediatric patients	
	P)	**Implement a System for flagging identified Difficult Airway patients in EHR**	Highly Recommend	Many EHR system have the capacity to implement DA ID and flagging but are not developed or utilized	
	Q)	**Utilize Extubation Guidelines**	Highly Recommend		
	R)	**Implement system for tracking and reviewing QA data from intubations or UE** (See Airway Registry)	Highly Recommend	Safety reporting systems have shown low yield for near miss events from fear of punishment	
	S)	**Strategies for Avoiding Peri-Intubation Hypotension**	Highly Recommend	Utilization of IVF, positioning and pressers iN high risk groups	
4	**Team Training**				
	A)	**Protocol, Equipment & Critical Practices** (Basic and advanced practices for preparation, performance, post-intubation management)	Mandate		
	B)	**Teamwork & Communication** (Plan sharing, open communication, debriefing)	Mandate		
	C	**System for ensuring that practitioners are trained and credentialed in airway management**	Mandate		