POSITION PAPER
NATIONAL ASSOCIATION OF EMS PHYSICIANS

RECOMMENDED GUIDELINES FOR UNIFORM REPORTING OF DATA FROM OUT-OF-HOSPITAL AIRWAY MANAGEMENT:

POSITION STATEMENT OF THE NATIONAL ASSOCIATION OF EMS PHYSICIANS

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POSITION STATEMENT

Airway management is the most important procedure performed by prehospital rescuers.[1] Because of its importance in out-of-hospital care, National Association of EMS Physicians (NAEMSP) recommends that all emergency medical services (EMS) systems monitor the quality of invasive out-of-hospital airway management procedures (specifically, endotracheal intubation [ETI]) performed on patients.

To ensure uniformity in reporting outcome measures and to facilitate comparisons across multiple systems, the NAEMSP recommends that EMS systems adopt the following standards for collecting and reporting data from out-of-hospital airway management.

The following data elements should be monitored: (1) indications for invasive airway management; (2) whether ETI was attempted; (3) relevant clinical and physiologic parameters; (4) methods and techniques used for each ETI attempt, with the standard definition of oral ETI "attempt" as insertion of the laryngoscope blade; (5) outcomes (success) for each ETI attempt; (6) outcome (success) for the overall ETI effort, with indication of who determined the final tube location; (7) methods used for confirming endotracheal tube placement; (8) physiologic changes in patient condition after ETI attempts; (9) critical complications encountered during ETI efforts; (10) reasons for failed ETI; and (11) contingency "rescue" (secondary) airway management methods used in the event of ETI failure.

System airway management performance should be reported using standard formats, on a patient-encounter basis and using appropriate patient subsets.

Airway management performance quality data should be used to address systemwide issues, not the competence of individual rescuers.

Recommendations for specific data elements, standard definitions and terminology, and data reporting formats are detailed more extensively subsequently.

INTRODUCTION

Invasive airway management (in the form of ETI) is regarded as the most important procedure performed by EMS rescuers in the prehospital setting.[1] ETI is also recognized as a difficult procedure that can result in significant morbidity and mortality if not performed properly.[2] Although it is reasonable to expect that the highest quality of care be provided for the most important prehospital procedure, it is also clear that both measuring and achieving quality can be difficult given the challenging nature of the procedure.

Improving the quality of airway management cannot be accomplished unless performance is examined in detail. Anecdotal reports suggest that many EMS systems do not regularly examine the quality of airway management provided to patients. In describing a cohort with a 25% unrecognized endotracheal tube misplacement rate, Katz and Falk demonstrated that under borderline monitoring, the quality of airway management can be unacceptable.[3] Although ETI has been performed

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in the prehospital setting for over 20 years, recent reports suggest that ETI success rates have not improved.[4–6]

A further hindrance to evaluating prehospital ETI is the lack of uniform definitions, terminology, and reporting formats. Thus, even the most attentive EMS system cannot place its ETI performance in proper perspective because there are no established benchmarks for comparison.

The development and implementation of standard definitions and reporting elements can help to facilitate comparison of data from multiple sources; for example, the "Utstein" criteria for reporting data from cardiopulmonary resuscitation has enabled comparisons between multiple studies of cardiac arrest.[7] This paper proposes standard guidelines for monitoring and reporting data from out-of-hospital ETI as well as a framework for reporting airway management performance. It also proposes methods for collecting quality improvement data. The goal is to provide a framework to facilitate the accurate comparison of out-of-hospital airway management across diverse clinical and geographic settings.

RECOMMENDED PREHOSPITAL AIRWAY MANAGEMENT DATA ELEMENTS AND DEFINITIONS

The following data elements should be tracked for all patients who undergo attempts at invasive airway management. For each data element, definitions, variables (possible values), and rationale are provided. Invasive airway management refers primarily to ETI, but also includes situations in which active airway or ventilatory support is attempted (for example, Combitube, laryngeal mask airway, or bag–valve–mask ventilation).

Although the data elements are structured in a manner amenable to entry on a computer database, this document does not specify a particular database structure or format. Individual services, programmers, and vendors may choose to incorporate the elements in a different sequence or context. Many of the recommended data elements have potential overlap with other portions of a typical prehospital patient chart. Data elements marked with an asterisk (*) indicate parameters that are unique and specific to airway management and probably are not reported in other portions of the patient chart. A sample data reporting template is provided in the Appendix.

DATA ELEMENTS

1. Indications for invasive airway management*

a. *Definition*: This data element documents the clinical indication for performing invasive airway management.

b. *Variables (possible values)*
1. Apnea or agonal respirations
2. Airway reflexes compromised (ventilatory effort adequate, e.g., unconscious without a gag reflex)
3. Ventilatory effort compromised (airway reflexes adequate, e.g., pulmonary edema)
4. Injury or medical condition directly involving the airway
5. Adequate airway reflexes and ventilatory effort, but potential for future airway or ventilatory compromise as a result of course of illness, injury (head or other), or medical treatment
6. Other

c. *Rationale*: ETI can result in morbidity if injudiciously applied.[2] There are currently no validated indications for the decision to intubate. The recommended values reflect generally accepted criteria for performing ETI. The possible values "airway reflexes compromised (ventilatory effort adequate)" and "ventilatory effort compromised (airway reflexes adequate)'' represent commonly encountered clinical scenarios that merit distinct classification.[8,9]

2. Endotracheal intubation attempted

a. *Definition*: This data element documents if ETI was attempted.

b. *Variables (possible values)*
1. Yes
2. No

c. *Rationale*: Although the primary goal of these standards is to evaluate ETI, there may be instances in which ETI is not (or cannot be) attempted and when invasive airway management is performed using another method. Future developments in technology and clinical protocols may increase the use of non-ETI methods as the primary means of airway management.

3. Endotracheal intubation not attempted; alternate method of airway support*

a. *Definition*: This data element documents the primary airway management method utilized if ETI was not attempted. This does not pertain to secondary (rescue, contingency, or salvage) airway management in the event of failed ETI attempts.

b. *Variables (possible values)*
1. Bag–valve–mask (BVM) ventilation (with or without oral or nasal airway)
2. Combitube
3. Needle jet ventilation
4. Open cricothyroidotomy
5. Other cricothyroidotomy
6. Continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP)
7. Laryngeal mask airway (LMA)
8. Other
9. Not applicable; ETI attempted

c. *Rationale*: The possible values reflect alternative airway and ventilatory management approaches that may be implemented as an alternative to ETI. CPAP, BiPAP, and LMAs are currently not part of standard paramedic scope of practice in the United States, but their application in the prehospital setting have been explored and/or demonstrated in pilot studies.[10–13]

4. Patient in cardiopulmonary arrest on intubation

a. *Definition*: This data element documents if the patient was in cardiopulmonary arrest during efforts at ETI.

b. *Variables (possible values)*
1. Yes (cardiopulmonary arrest)

2. No (nonarrest)
3. Unknown

c. *Rationale*: It is generally accepted that ETI success rates for nonarrest patients (patients with a pulse) are lower than for patients in cardiac arrest.[4–6,14–18] This data element facilitates identification of the cardiac arrest ETI subset.

5. Intubation for trauma

a. *Definition*: This data element documents if intubation was attempted because the patient's need for airway intervention was the result an underlying traumatic (vs. medical) condition.

b. *Variables (possible values)*
1. Yes (trauma)
2. No (medical)
3. Unknown

c. *Rationale*: It is generally accepted that ETI of trauma patients is more difficult than medical patients.[19] This data element facilitates identification of the trauma ETI subset.

6. Pediatric intubation

a. *Definition*: This data element documents if intubation was attempted on a patient less than 18 years of age.

b. *Variables (possible values)*
1. Yes (pediatric)
2. No (adult)
3. Unknown

c. *Rationale*: There are data suggesting that success rates for the ETI of pediatric patients are considerably lower than that for adults.[20–23] This data element facilitates identification of the pediatric ETI subset. This data element is necessary because reported age information (in the patient chart) may not be available or accurate.

There are currently no data suggesting that prehospital ETI success rates vary for differing pediatric age groups. Individual services may consider further stratifying this subset by different age groups. However, there are no data supporting the use of specific age ranges.

7. Heart rate before intubation

a. *Definition*: This data element documents heart rate obtained within 5 minutes before initial ETI attempts determined by pulse check or electrocardiographic (ECG) monitoring.

b. *Variables (possible values)*
1. Heart rate (beats/min)
2. Not obtained

c. *Rationale*: Attempted ETI can be physiologically stressful to the patient. Assessment of baseline and postprocedure physiologic parameters provide one method for evaluating the effects of the procedure and concurrent therapy (such as facilitating drugs) on the patient.

Given the time-dependent nature of resuscitation, vital signs probably cannot be obtained sooner than five minutes before ETI attempts. However, there may be instances when obtaining vital signs may need to be deferred; rescuers should recognize the obvious priority for executing airway interventions and not delay airway management interventions solely to obtain formal vital signs.

8. Systolic blood pressure before intubation

a. *Definition*: This data element documents systolic blood pressure obtained within 5 minutes before initial ETI attempts, determined by auscultation, palpation, or automated blood pressure cuff.

b. *Variables (possible values)*
1. Systolic blood pressure (mm Hg)
2. Not obtained

c. *Rationale*: See rationale for data element "heart rate before intubation."

9. Diastolic blood pressure before intubation

a. *Definition*: This data element documents diastolic blood pressure obtained within 5 minutes before initial ETI attempts. Determined by auscultation or automated blood pressure cuff.

b. *Variables (possible values)*
1. Diastolic blood pressure (mm Hg)
2. Not obtained

c. *Rationale*: See rationale for data element "heart rate before intubation." Diastolic blood pressure will not be available if blood pressure is measure by palpation.

10. Spontaneous respiratory rate before intubation

a. *Definition*: This data element documents spontaneous (unsupported) respiratory rate obtained within 5 minutes before initial ETI attempts, determined by observation without ventilatory assistance.

b. *Variables (possible values)*
1. Spontaneous respiratory rate (breaths/min)
2. Not obtained

c. *Rationale*: See rationale for data element "heart rate before intubation."

11. Oxygen saturation before intubation

a. *Definition*: This data element documents oxygen saturation obtained within 5 minutes before initial ETI attempts as determined by pulseoximetry.

b. *Variables (possible values)*
1. Oxygen saturation (SaO_2%)
2. Not measurable (device applied but measurement not obtainable)
3. Not obtained (device not applied)

c. *Rationale*: This data element is recommended because of the emergence of oxygen saturation as an accepted vital sign for both emergency medicine and EMS practice, particularly in instances of potential airway compromise. Many in-hospital and out-of-hospital providers routinely monitor oxygen saturation during ETI efforts. Oxygen

saturation is also often used to guide the intubation procedure. For example, decreasing oxygen saturation may indicate the need to discontinue ETI attempts and to provide more basic ventilation procedures to improve oxygenation before subsequent attempts. Oxygen saturation may also be used as an important factor in the decision to provide a definitive airway.

12. Eye Glasgow Coma Scale (GCS) before intubation

a. *Definition*: This data element documents the eye portion of the GCS obtained within 5 minutes before initial ETI attempts

b. *Variables (possible values)*
1. 1—no eye opening
2. 2—eye opening to pain
3. 3—eye opening to verbal command
4. 4—eyes open spontaneously
5. Not obtained

c. *Rationale*: Glasgow Coma Scale is used by some systems as an indication for definitive airway management in selected patient subsets.[24] There are currently no other accepted or validated scales for quantifying level of consciousness. The rationale for separating the components of the GCS is that certain GCS elements may have stronger predictive value for selected aspects of airway management.[25]

13. Verbal Glasgow Coma Scale before intubation

a. *Definition*: This data element documents the verbal portion of the GCS obtained within 5 minutes before initial ETI attempts.

b. *Variables (possible values)*
1. 1—no verbal response
2. 2—incomprehensible sounds
3. 3—inappropriate words
4. 4—confused
5. 5—oriented
6. Not obtained

c. *Rationale*: See rationale for data element "eye Glasgow Coma Scale before intubation."

14. Motor Glasgow Coma Scale before intubation

a. *Definition*: This data element documents the motor portion of the GCS obtained within 5 minutes before initial ETI attempts.

b. *Variables (possible values)*
1. 1—no motor response
2. 2—extension to pain
3. 3—flexion to pain
4. 4—withdraws from pain
5. 5—localizing pain
6. 6—obeys Commands
7. Not obtained

c. *Rationale*: See rationale for data element "eye Glasgow Coma Scale before intubation."

15. Monitoring and treatment adjuncts concurrent with intubation*

a. *Definition*: This data element documents if selected monitoring and treatment adjuncts were implemented during ETI attempts (Multiple choices possible).

b. *Variables (possible values)*
1. electrocardiogram (ECG) monitoring
2. Pulseoximetry
3. Cervical spine immobilization
4. Cardiopulmonary resuscitation (chest compressions)
5. Intravenous access
6. Gum elastic bougie
7. Beck airway-airflow monitor (BAAM; Great Plains Ballistics, Inc., Lubbock, TX)
8. Endotrol endotracheal tube

c. *Rationale*: This data element provides information regarding monitoring and treatment adjuncts that may be implemented during ETI. These elements represent either important safeguards or potential barriers to successful ETI. Continuous ECG and pulse oximetry monitoring are important safeguards when intubating nonarrest patients.[8,9] Intravenous access is also desirable safeguard before ETI attempts in nonarrest patients. Cervical spine immobilization is required for trauma patients and may make ETI more difficult.[8,9] Likewise, concurrent chest compressions may make ETI more difficult.

Selected ETI adjuncts are incorporated into this section (rather than as separate ETI techniques in data element 16) because they are rarely used and are considered adjuncts to standard ETI approaches. Although they do not represent distinctly different ETI strategies, they may improve the likelihood of success for these standard ETI methods. For example, many EMS services have indicated that they routinely use the gum elastic bougie to facilitate oral intubation.[26,27] Similarly, the BAAM has been widely used to facilitate blind nasotracheal intubation.[28–31] Improved nasotracheal intubation success rates have been reported with the use of trigger-tipped Endotrol endotracheal tubes (Mallinckrodt, Inc., Hazelwood, MO).[32]

16. Endotracheal intubation method*

a. *Definition*: This data element documents the method used to accomplish ETI for each "attempt." This data element is repeated for each ETI "attempt." "Attempt" is defined as:
1. Insertion of laryngoscope blade into mouth (for orotracheal methods)
2. Insertion of tube through nares of nose (for nasotracheal methods)
3. Insertion of rescue airway device into mouth (for Combitube, LMA, and other oral rescue airway devices)
4. Insertion of rescue airway device through neck (for cricothyroidotomy, needle jet ventilation, retrograde ETI, and other "surgical" methods of airway management)

b. *Variables (possible values)*
1. Orotracheal intubation, no medications given (conventional orotracheal intubation): ETI via the oral route using a laryngoscope without the use of facilitating sedative or paralytic agents.

2. Nasotracheal intubation, no medications given (conventional nasotracheal intubation): ETI via the nasal route without the use of facilitating sedative or paralytic agents; includes both blind and visualized techniques
3. Sedation-facilitated intubation: The use of intravenous or intramuscular sedative and/or analgesic agents to facilitate ETI; includes benzodiazepines (midazolam, valium, etc.), narcotics (fentanyl, morphine, etc.), and induction agents (etomidate, pentathol, etc.); does not include the use of neuromuscular-blocking agents
4. Rapid-sequence intubation (RSI): The use of a neuromuscular-blocking agent (with or without the use of adjunct drugs) to facilitate ETI
5. Other intubation, includes all other nonsurgical methods of orotracheal and nasotracheal intubation (digital, lighted stylet, etc.)

c. *Rationale*: There are many different techniques for accomplishing ETI. The majority of ETI performed in the prehospital setting occur in patients in cardiac arrest; patients in cardiac arrest are generally flaccid and can usually be intubated using conventional orotracheal methods.[6] In patients with a perfusing rhythm (nonarrest), however, inadequate jaw relaxation can complicate ETI efforts.[14,15,33] Although some of these patients can be intubated by conventional orotracheal methods, alternative intubating methods may be used, such as nasotracheal intubation, sedation-facilitated intubation, and rapid-sequence intubation.

The success rates for different ETI methods are distinctly different because of different patient conditions and the effects of different drugs.[4–6,14,15,24,32,34–45] Because of this variability, it is important to stratify ETI success rates according to the method of ETI that is used.

The definition of ETI attempt varies widely according to medical specialty and clinical convention. Many EMS services define "attempt" as insertion of the endotracheal tube. However, anesthesiologists and emergency physicians typically define "attempt" as insertion of the laryngoscope blade.[46]

The intention in tracking the number of "attempts" is to provide an estimate of the magnitude of effort needed to intubate a patient. The "insertion of blade" definition for attempt is preferred because each attempt to enter the oropharynx and visualize the vocal cords potentially results in deprivation of ventilation and oxygenation. A definition of "attempt" that is limited to tube insertion biases the clinical picture. For example, a patient that underwent four laryngoscopies but no attempts at tube insertion would be inappropriately described as having had "zero" attempts at ETI.

The use of the "insertion of blade" definition also facilitates comparison between prehospital providers and emergency physicians and anesthesiologists, an important analysis that has not been possible to make as a result of the inconsistent definition of "attempt." Therefore, the definition of "attempt" as "insertion of laryngoscope blade" is recommended.

For nasotracheal intubation, "attempt" should be defined as insertion of the endotracheal tube through the nares of the nose.

The ETI method should be reported for each "attempt"; this approach is recommended because different methods may be used during the course of a patient encounter. For example, a patient may fail sedation-facilitated intubation on the first two attempts, prompting the use of rapid-sequence intubation for the third attempt.

The selection of specific pharmacologic agents is likely to be documented in other sections of the typical patient care report. Therefore, facilitating drugs and their respective dosages are not recommended as standard components of this data set.

17. Level of provider attempting endotracheal intubation*

a. *Definition*: This data element documents the level of training of the individual attempting ETI for each ETI attempt. This data element is repeated for each ETI attempt.

b. *Variables (possible values)*
1. Emergency medical technician–paramedic (EMT-P)
2. Emergency medical technician–intermediate (EMT-I)
3. Emergency medical technician–basic (EMT-B)
4. Paramedic student
5. Prehospital nurse
6. Physician assistant
7. Physician (resident level)
8. Physician (attending or fellow level)
9. Other

c. *Rationale*: Many different levels of providers perform ETI in the out-of-hospital setting. This data element facilitates identification of the level of rescuer that attempted ETI. EMT-B is included in the possible values because ETI is currently listed on the national EMT-B curriculum as an optional module and is currently being performed by EMT-Bs in some systems.[47]

18. Intubation success for each attempt*

a. *Definition*: This data element documents success of ETI for each ETI "attempt," defined as intratracheal tube placement as determined by the rescuer using clinical examination and conventional endotracheal tube placement verification methods. This data element is repeated for each ETI attempt.

b. *Variables (possible values)*
1. Yes (successful)
2. No (unsuccessful)

c. *Rationale*: The success for each ETI attempt is recommended as a measured intermediate outcome because the uncontrolled nature of the field environment

can result in tube dislodgement and reintubation may be necessary.[6] In addition, the number of laryngoscopies needed to facilitate ETI is considered by many clinicians to provide an important measure of ETI performance; the success of each attempt provides additional insight for this measure. If the rescuer inserted the laryngoscope blade but did not attempt to pass the tube, this situation should be recorded as an *unsuccessful* attempt.

19. Endotracheal tube placement verification by auscultation*

a. *Definition*: This data element documents the findings when auscultation of lung fields and epigastrium are performed to verify the location of endotracheal tube after the final ETI attempt.

b. *Variables (possible values)*
1. Breath sounds present in both lung fields and absent from epigastrium; suggests tube correctly placed (tracheal placement)
2. Breath sounds absent from both lung fields and/or present over epigastrium; suggests tube incorrectly placed (esophageal placement)
3. Indeterminate; lung fields and epigastrium auscultated but tube position could not be determined
4. Not applicable; tube placed but breath sounds not assessed
5. Not applicable; unable to place tube

c. *Rationale*: Identification and confirmation of correct endotracheal tube placement is difficult in the uncontrolled field environment. Existing standards call for the use of multiple techniques or devices to confirm correct tube placement.[48] The current recommendation is to report only the outcome of the final ETI attempt in order to reduce data collection requirements. Data elements 19–25 reflect the techniques most commonly used in clinical prehospital practice.

The purpose of data elements 19–25 is to reinforce the need for redundant ET tube confirmation, to emphasize the use of adjunct technology to verify ET tube placement, and to document how these different techniques are generally applied. Although there are other potential methods for confirming ET tube placement, those approaches are generally used on only rare instances or are not supported by scientific evidence or widespread clinical practice. For example, direct visualization and revisualization of the endotracheal tube have been recommended in response to the Katz and Falk report of misplaced prehospital ET tubes.[3] However, these methods of tube confirmation have not been standardized, formally validated, or widely implemented in clinical protocols.

20. Endotracheal tube placement verification by bulb aspiration device*

a. *Definition*: This data element documents the findings when a bulb aspiration device is used after final ETI attempt to verify the location of endotracheal tube.

b. *Variables (possible values)*
1. Bulb inflated immediately; suggests tube is correctly placed (tracheal placement)
2. Delayed bulb inflation; suggests tube is incorrectly placed (esophageal placement)
3. Indeterminate; used bulb aspiration device but tube position could not be determined
4. Not applicable; tube placed but bulb aspiration device not used
5. Not applicable; unable to place tube

c. *Rationale*: See rationale for "endotracheal tube placement verification by auscultation."

21. Endotracheal tube placement verification by syringe aspiration device

a. *Definition*: This data element documents the findings when a syringe aspiration device is used after final ETI attempt to verify the location of endotracheal tube.

b. *Variables (possible values)*
1. Easy syringe aspiration; suggests tube correctly placed (tracheal placement)
2. Difficult syringe aspiration; suggests tube incorrectly placed (esophageal placement)
3. Indeterminate; used syringe aspiration device but tube position could not be determined
4. Not applicable; tube placed but syringe aspiration device not used
5. Not applicable; unable to place tube

c. *Rationale*: See rationale for "Endotracheal tube placement verification auscultation."

22. Endotracheal tube placement verification by colorimetric end-tidal carbon dioxide detector device*

a. *Definition*: This data element documents the findings when a colorimetric end-tidal carbon dioxide detection device is used after final ETI attempt to verify the location of endotracheal tube.

b. *Variables (possible values)*
1. Color change present; suggests tube correctly placed (tracheal placement)
2. No color change present; suggests tube incorrectly placed (esophageal placement)
3. Indeterminate; used colorimetric end-tidal carbon dioxide detector device but tube position could not be determined
4. Not applicable; tube placed but colorimetric end-tidal carbon dioxide detector device not used
5. Not applicable; unable to place tube

c. *Rationale*: See rationale for "Endotracheal tube placement verification by auscultation."

23. Endotracheal tube placement verification by digital end-tidal carbon dioxide detector device*

a. *Definition*: This data element documents the findings when a digital end-tidal carbon dioxide detector device is used after final ETI attempt to verify the location of endotracheal tube

b. *Variables (possible values)*
1. Elevated end-tidal values present; suggests tube correctly placed (tracheal placement)
2. Elevated end-tidal values not present; suggests tube incorrectly placed (esophageal placement)
3. Indeterminate; used digital end-tidal carbon dioxide detector device but tube position could not be determined
4. Not applicable; tube placed but digital end-tidal carbon dioxide detector device not used
5. Not applicable; unable to place tube

c. *Rationale*: See rationale for "endotracheal tube placement verification by auscultation."

24. Endotracheal tube placement verification by waveform end-tidal carbon dioxide detector device*

a. *Definition*: This data element documents the findings when a waveform end-tidal carbon dioxide detector device is used after final ETI attempt to verify the location of endotracheal tube.

b. *Variables (possible values)*
1. End-tidal waveform present; suggests tube correctly placed (tracheal placement)
2. End-tidal waveform not present; suggests tube incorrectly placed (esophageal placement)
3. Indeterminate; used waveform end-tidal carbon dioxide detector device but tube position could not be determined
4. Not applicable; tube placed but waveform end-tidal carbon dioxide detector device not used
5. Not applicable; unable to place tube

c. *Rationale*: See rationale for "endotracheal tube placement verification by auscultation."

25. Peak end-tidal carbon dioxide value*

a. *Definition*: This data element documents the peak end-tidal carbon dioxide value indicated by digital or waveform end-tidal carbon dioxide detector device; reflects peak value within first minute after tube placement; does not apply to colorimetric devices.

b. *Variables (possible values)*
1. End-tidal carbon dioxide ($ETCO_2$, mm Hg)
2. Indeterminate (used end-tidal carbon dioxide detector device but could not determine peak value)

c. *Rationale*: There are no current data to indicate the minimum end-tidal carbon dioxide levels that should be used to define intratracheal placement. This data element permits more precise identification of the endpoints of end-tidal capnometry when used for ET tube confirmation.

26. Intubation success for overall patient encounter*

a. *Definition*: This data element documents if the endotracheal tube was properly placed on transfer to receiving facility or healthcare team; Determined by the receiving provider when possible.

b. *Variables (possible values)*
1. Yes (successful)
2. No (unsuccessful)

c. *Rationale*: This data element documents ETI success for the overall patient encounter and is defined as ET tube location on transfer to receiving facility or health care team. Although the result of the last ETI attempt may be used to identify overall ETI success, there are data suggesting that patients often arrive at the receiving medical facility with an incorrectly placed endotracheal tube.[3] From the perspective of the patient's overall course, ET tube misplacement or dislodgement should be considered unsuccessful airway management because it necessitates initiation of ETI efforts by the receiving facility or team.

From a medical quality point of view, the overall outcome of the patient at the end of the prehospital course is more pertinent than provisional outcomes measured at intermediate points in the course of patient care. Furthermore, successful out-of-hospital airway management involves not just proper tube placement, but also *maintenance* of proper tube placement. More so than in the in-hospital setting, endotracheal tubes in the field setting are prone to dislodgement, and the frequent reconfirmation of tube placement is a mandatory task in the prehospital management of patients.[6]

There are currently no data regarding methods that should be used by the receiving provider to verify ET tube placement.

27. Person determining intubation success for overall patient encounter*

a. *Definition*: This data element documents the individual(s) determining overall ETI success for the patient encounter.

b. *Variables (possible values)*
1. Rescuer who performed intubation; failed intubation
2. Rescuer who performed intubation; no transfer of patient care
3. Rescuer who performed intubation; patient pronounced dead in field
4. Rescuer who performed intubation; receiving team or facility did not verify correct placement
5. Rescuer who assisted intubation
6. Receiving hospital team
7. Receiving ground EMS team
8. Receiving air medical team

9. Other
10. Unknown

c. *Rationale*: This data element is an important component in better defining overall ETI outcome and identifying how that outcome was determined. Many clinicians believe that identification of the final ET tube location should be performed by a person other than the rescuer performing ETI. Although it is expected that the receiving hospital team will make the final determination of tube location in most cases, multiple possible values are listed because the provider receiving an intubated patient may not necessarily be in a receiving medical facility (for example, when care of a patient is transferred from a ground EMS unit to an air medical team).

28. Heart rate after intubation

a. *Definition*: This data element documents heart rate obtained within 5 minutes after final ETI attempt (successful or unsuccessful).

b. *Variables (possible values)*
1. Heart rate (beats/min)
2. Not obtained

c. *Rationale*: See rationale for data element "heart rate before intubation." Postintubation vital signs are important because they facilitate measurement of the physiological effect of ETI and medications administered to facilitate ETI.

29. Systolic blood pressure after intubation

a. *Definition*: This data element documents systolic blood pressure obtained within 5 minutes after final ETI attempt (successful or unsuccessful); determined by auscultation, palpation, or automated blood pressure device.

b. *Variables (possible values)*
1. Systolic blood pressure (mm Hg)
2. Not obtained

c. *Rationale*: See rationale for data element "systolic blood pressure before intubation."

30. Diastolic blood pressure after intubation

a. *Definition*: This data element documents diastolic blood pressure obtained within 5 minutes after final ETI attempt (successful or unsuccessful); determined by auscultation or automated blood pressure device.

b. *Variables (possible values)*
1. Diastolic blood pressure (mm Hg)
2. Not obtained.

c. *Rationale*: See rationale for data element "diastolic blood pressure before intubation."

31. Spontaneous respiratory rate after intubation

a. *Definition*: This data element documents spontaneous respiratory rate obtained within 5 minutes after final ETI attempts; determined by observation without ventilatory assistance.

b. *Variables (possible values)*
1. Spontaneous respiratory rate (breaths/min)
2. Not applicable; patient successfully intubated
3. Not applicable; Secondary airway inserted
4. Not obtained

c. *Rationale*: See rationale for data element "spontaneous respiratory rate before intubation." This data element is most meaningful in cases of unsuccessful ETI. This data element provides a measure of the effect of ETI efforts and facilitating medications on spontaneous respiratory drive. This data element is less useful when ventilation is provided by ETI or rescue airway device.

32. Oxygen saturation after intubation

a. *Definition*: This data element documents oxygen saturation obtained within 5 minutes after final ETI attempt (successful or unsuccessful), as determined by pulseoximetry.

b. *Variables (possible values)*
1. Oxygen saturation (SaO_2%)
2. Not measurable (device applied but measurement not obtainable)
3. Not obtained (device not applied)

c. *Rationale*: See rationale for data element "oxygen saturation before intubation."

33. Critical complications encountered during airway management*

a. *Definition*: This data element documents airway management complications that have strong potential to result in adverse patient outcomes Multiple choices possible.

b. *Variables (possible values)*
1. Failure to successfully perform ETI
2. Injury or trauma to patient from airway management
3. Adverse event from drugs administered to facilitate airway management (for example, hypotension or cardiac arrest)
4. Esophageal intubation, delayed detection (detected after securing of tube)
5. Esophageal intubation, unrecognized (detected by receiving health care facility or team)
6. Tube dislodgement during transport or care
7. Other
8. No critical complications resulting from airway management

c. *Rationale*: Ensuring patient safety is an important element of quality medical care. Managing the airway of critical patients generally should not result in adverse effects. Tracking and reporting critical complications are important elements of ensuring quality airway management.

Of the many potential complications and difficulties associated with airway management, the recommended values primarily reflect complications that

(1) can adversely affect the patient, and (2) are direct results of care delivered by the prehospital team. There are currently data not validating or quantifying the magnitude of effect of any of these complications, and no data suggesting that these are the only complications with potential to cause adverse outcome.

34. Suspected reasons for failed intubation*

a. *Definition*: If all attempts at ETI are unsuccessful, this data element documents the reasons for ETI failure (multiple choices possible).

b. *Variables (possible values)*
1. Inadequate patient relaxation
2. Inability to expose vocal cords during laryngoscopy
3. Patient anatomy
4. Orofacial trauma
5. Blood, vomitus, or secretions obscuring view of vocal cords
6. Inability to access patient to perform intubation
7. ETI attempts initiated, but arrived at destination facility before successful intubation
8. Equipment failure
9. Other
10. Not applicable (successful intubation)

c. *Rationale*: There are only limited data describing the factors associated with ETI failure.[14,15,33] Identification of the factors underlying failed ETI is an important component of monitoring airway management quality. These factors may reflect the clinical condition and the anatomy of the patient, theskill of the rescuer, or logistic barriers. Only a limited set of options has been provided; individual services may track additional elements.

35. Secondary airway management method*

a. *Definition*: This data element documents the secondary ("contingency," "rescue," or "salvage") method used for airway management (multiple choices possible).

b. *Variables (possible values)*
1. Bag–valve–mask ventilation with or without oral or nasal airway
2. Combitube
3. Laryngeal mask airway
4. Needle jet ventilation
5. Open cricothyroidotomy
6. Other cricothyroidotomy (for example, Mellker cricothyroidotomy kit)
7. Other (retrograde intubation, etc.)
8. Not applicable (successful intubation)

c. *Rationale*: Loss of airway control can result in morbidity or mortality. All services should have contingency or rescue airway measures available in the event of inability to perform ETI. There are only limited data regarding the frequency of rescue airway use.[24,49–51] The recommended data elements only reflect commonly used rescue airway methods; other methods of rescue airway management are available.

36. Secondary airway management resulted in satisfactory ventilation*

a. *Definition*: This data element documents if secondary (contingency, rescue, or salvage) airway management method resulted in satisfactory ventilation.

b. *Variables (possible values)*
1. Yes
2. No
3. Not applicable (successful intubation)

c. *Rationale*: Only limited data exists regarding the actual effectiveness of rescue airway devices in clinical application.[24,50–52] This data element helps to evaluate whether the rescue airway was effectively applied. There are currently no data or standards for "satisfactory ventilation" using rescue airways; the assumption is that providers will attempt to ventilate to the same standards used for intubated patients.

37. Time of decision to intubate*

a. *Definition*: This data element documents the time of decision to attempt ETI.

b. *Variables (possible values)*
1. Time of decision to intubate (24-hour format)
2. Unknown

c. *Rationale*: Elapsed time frames are of extensive interest in resuscitation and prehospital care.[7,53–56] The magnitude of the effort needed to manage the airway may be partly quantified by the elapsed time needed to intubate. Elapsed time-to-intubation can only be obtained by identifying: (1) the time of decision to intubate a patient, (2) the time of successful intubation (if ETI is successful), and (3) the time ETI efforts are abandoned (if ETI attempts fail). The use of "on-scene time" or "time of arrival at patient side" as surrogates for "time of decision to intubate" are biased because providers may face logistic barriers or may need to implement other procedures before deciding to initiate ETI.[5,57]

38. Time of successful intubation*

a. *Definition*: This data element documents the time of the first successful ETI attempt.

b. *Variables (possible values)*
1. Time of successful intubation (24-hour format)
2. Unknown
3. Not applicable; unsuccessful intubation

c. *Rationale*: See rationale for data element, "time of decision to intubate."

39. Time intubation attempts abandoned*

a. *Definition*: This data element documents the time that ETI attempts were abandoned.

b. *Variables (possible values)*

1. Time ETI attempts abandoned (24-hour format)
2. Unknown
3. Not applicable; successful intubation

c. *Rationale*: See rationale for data element "time of decision to intubate." Arrival at receiving facility should not be used as a surrogate marker for this data element because ETI efforts often do not continue while en route to the receiving facility.

RECOMMENDED FORMAT FOR REPORTING SYSTEM-WIDE PERFORMANCE OF AIRWAY MANAGEMENT

Prehospital services should use the following guidelines for summarizing systemwide performance of airway management:

1. ETI success rate (percentage and relative frequency) for all ETI (pooled [based on overall outcome of patient encounter], not per attempt)
2. ETI success rate (percentage and relative frequency) for subset of patients in cardiac arrest
3. ETI success rate (percentage and relative frequency) for subset of patients with a pulse (nonarrest)
4. For patients with a pulse (nonarrest), ETI success rates (percentage and relative frequency) stratified by overall ETI method:
   a. Orotracheal
   b. Nasotracheal
   c. Sedation-facilitated intubation
   d. Rapid-sequence intubation
5. ETI success rates (percentage and relative frequency) for subset of pediatric patients (<18 years of age) (Individual services may choose to further stratify this group by specific age ranges.)
6. ETI success rates (percentage and relative frequency) for subset of trauma patients
7. *Cumulative* success rates for consecutive ETI attempts
8. Frequencies of critical complications
9. Frequencies of rescue airway use
10. Patients receiving no ETI attempts but in whom airway or ventilatory support is required

"Relative frequency" denotes reporting the frequency of an event, for example, "7 of 10." Percentage denotes reporting the frequency on a percentage basis.

Selected services that perform very small numbers of ETI annually may have percentage figures that are not meaningful either overall or for selected subsets. Furthermore, the numbers for individual procedures or subsets may be small, even for larger EMS systems. Therefore, data from clusters of services or systems should be combined to obtain regionwide success rates for each of the recommended reporting formats. This approach is imperative for establishing meaningful baseline benchmarks for comparison.

With regard to reporting format 5, there is consensus that there may be wide variation in intubation difficulty among different age groups, but there are currently no data to support the use of specific age ranges.

With regard to reporting format 7, consecutive ETI attempts should be pooled together to provide cumulative ETI success rates. For example, success rates should be calculated separately for: (1) First attempt only; (2) First and second attempts; and (3) First, second, and third attempts.

AIRWAY MANAGEMENT QUALITY IMPROVEMENT

Methods for Collecting Airway Management Data

These data elements are only meaningful if a system for complete data collection is established. With little literature available on the quality improvement (QI) of EMS airway management programs, other sources must be used to explore the techniques available. One of the most widely available sources is the methodology used in published studies of EMS airway intervention techniques. Examining the methods used and the problems encountered in these studies provides insight into the issues faced when attempting to perform QI on an airway management program.

One of the most common methods used in airway management studies is the retrospective review of EMS patient records. For example, to analyze airway management by paramedics, Krisanda et al. used a retrospective review of three years of EMS patient records to capture nearly 300 patients in which ETI were performed.[14] Dickinson et al. used a monthly review of patient records in a study of the use of midazolam to facilitate ETI. He captured 154 ETI and identified 20 patients in whom midazolam was used over a 22-month period out of over 13,000 emergency responses.[37]

Slater et al. used a retrospective review of patient records in a study comparing RSI performed preflight versus en route in an air medical service.[45] Sing et al. used a combination of EMS and hospital patient records in a retrospective review of RSI by an air medical team.[44] In a study comparing trigger versus conventional ET tubes for nasal intubation, O'Connor et al. used a review of patient records with data abstraction performed by QI officers working for the ambulance services involved to gather data on 224 nasal intubation attempts.[32]

The review of the EMS patient record as a data collection technique provides one method for describing the actual activity within the system. However, the quality of the review depends on the training and persistence of the reviewers as well as the completeness of documentation on the EMS record. In addition, the design of the EMS patient record influences the data available for abstraction. Currently used EMS patient care reports typically contain only limited information on the clinical course of the patient encounter.

To overcome limitations in data completeness as a result of patient record design, some authors have used standardized data collection sheets. However, individual voluntary reporting, whether using data forms or logs, have problems related to compliance. In a comparison of various airway techniques, Rumball and MacDonald used a data form completed by the EMS personnel for each intervention.[50] They did not report on the compliance with data form completion or the method used to ensure complete data collection.

Wang et al. reported rates of capture for ETI information varying from 39% to 100% for 45 advanced life support ambulance services using data reporting.[6] The median return rate was 75%. Although 16 services captured over 90% of ETIs, nine services returned

data forms on fewer than 50% of attempted ETI. However, data form completion in this study was voluntary, not mandatory. Domeier et al. used a standardized data collection form in their study of EMS spinal clearance criteria.[58] Even with persistent QI feedback on compliance with completion of forms, the highest capture rate of data forms was only 70%. Although the data sheet provides more information than most patient care reports, not all encounters meeting reporting criteria will be captured by a voluntary reporting mechanism.

Because using the data form as the sole technique has significant problems with noncompliance resulting in incomplete data, some authors have combined the data sheet with surveillance techniques to obtain better compliance with data collection. For example, O'Brien et al. used a data form to describe the course of each patient receiving endotracheal intubation.[35] Because paramedics were required to report the physical disposition of every endotracheal tube, they used this technique to identify study patients. The data form had to be completed for each patient before endotracheal ETI equipment could be exchanged. They noted a low compliance with previous voluntary prospective data sheet completion.

In their study of ET tube placement, Katz and Falk used a data form completed by the emergency department physician in conjunction with EMS logs to capture patients for whom a form was not initially completed.[3] In these initially missed cases, physicians were reported to have completed the form within 48 hours. In a study describing current paramedic trauma ETI practice, Domeier et al. required paramedics to complete a data sheet on eligible patients.[18] To ensure complete compliance, the ambulance service QI coordinator and the principal investigator reviewed all EMS patient records; and for patients without completed data sheets, patient records were returned to the provider for data sheet completion.

Another technique used by some authors is the structured interview. Doran et al. used a structured interview with paramedics to determine factors influencing successful ETI.[15] The paramedics to be interviewed were identified using reviews of EMS patient records. In arguably the largest and best funded EMS airway intervention study to date, one involving pediatric patients requiring airway management, Gausche et al. required both the treating paramedics and emergency physicians to complete a study data form.[21] Structured interviews of paramedics were performed after each patient enrollment, and reviews of EMS and other patient records were used to complete their data collection. The authors reported that only one patient was possibly missed in this process.

The introduction of electronic EMS patient records, along with both ambulance service and regional EMS system databases have greatly improved the ability to gather information on large numbers of patients. In a study analyzing prehospital intubation performance, Wang et al. used a statewide EMS patient record database.[5] Manual review of selected charts to verify accuracy was a standard practice in this statewide system. Many services have used electronic records to facilitate pooling of records from very large regions. For example, the Commonwealth of Pennsylvania maintains a database containing information on every EMS patient encounter in the state.

Other combinations of techniques can improve the quality of data and compliance with data collection. In a study of paramedic RSI performance, Ochs et al. used a combination of standardized data sheet, computerized EMS patient record collection, and structured interview after each RSI.[24] In a study of an EMS spinal clearance protocol, Domeier et al. added data elements from a previously used standardized data form to the EMS patient record, which was entered into a system database.[59]

In summary, data sources for airway management quality improvement may include one or more of the following:

1. Systematic reviews of EMS patient records
2. QI data forms completed for each airway intervention
3. QI data logs maintained by system ambulance services or hospitals
4. Individual reporting for each intervention to a QI coordinator or medical director
5. Computerized patient care report data collection

The best method to ensure that complete information is obtained entails the completion of either QI data forms or a specially modified patient record combined with a systematic review of all patient care reports (either through manual review or computerized record reviews) to capture pertinent encounters that have been missed by the initial screening. Information is best gathered by individual EMS services and requires a person trained and diligent in making certain that data collection is complete. Using EMS services as a source of information, in combination with regular reporting of information to the system medical oversight body or medical director, will ensure as reasonably complete a data set as can be obtained.

Many systems are beginning to use computerized patient records that could be adapted to collect important airway quality improvement information. Although computerized patient care information would be expected to be an excellent source of complete information, oversight is still required to ensure accurate and complete reporting, given that the quality of the information retrieved is only be as good as that which is entered. Continuing advances in computer technology may improve the ability to capture highly detailed data, particularly in instances of critical patient encounters (for example, when ETI is attempted, as proposed in this article). Flexibility in computer interfaces may facilitate data capture in these important instances without presenting an undue documentation burden on all patient encounters.

Data Maintenance

All of the studies previously discussed used either a database or spreadsheet to manage airway data. The use of a medically trained individual to review and enter this data allows for a continuous review of the data being generated. The database should be maintained by the ambulance service, the system medical oversight body, or the system medical director. In any case, feedback regarding system performance should be provided to the service and its personnel. Data accuracy and data form completion should be monitored regularly

to capture missing or incomplete information.

Outcome Information

In the context of medical care, "outcome" typically refers to the results of a procedure, intervention, or episode.[60] Outcome data are important because they help to describe the results (positive or negative) of the procedure, intervention, or episode. Outcomes for EMS care, including out-of-hospital airway management, may be measured at several time points for example, after the prehospital, emergency department, or inpatient phases.[61] Although outcome information is perhaps the most important information to collect, it is also the most difficult information to obtain.

Domeier et al. used systematic reviews of medical records to determine the hospital outcomes in trauma patients after EMS spine injury assessments.[58,59] In their study of ET tube placement, Katz and Falk used a data form completed by the emergency department physician and EMS log reviews to capture patients for whom a form was not initially completed.[3] Gausche et al. used review of hospital records to ascertain mortality and neurologic outcome of intubated pediatric patients.[21]

Determination of key outcomes during the course of intubation can also be challenging. EMS systems should implement some method to verify that "successful ETIs" are in fact correctly placed. Katz and Falk demonstrated that independent confirmation by the receiving emergency physician frequently reveals ET tube misplacement.[3] The cooperation of hospitals within an EMS system to provide outcome information to the EMS system is an important but rarely achieved component of airway management quality improvement. Because of the absence of a defined hospital mechanism for reporting both correctly and incorrectly placed tubes, the EMS provider remains the only source for tube placement confirmation.

Information on ET tube misplacement is often collected on an inconsistent, case-by-case basis. Rarely is there an established reporting mechanism that provides for the reliable collection of outcome information. Although requiring documentation of emergency department (ED) confirmation of tube placement by EMS providers on their patient care report helps in obtaining complete outcome information, not all patients are transported to an ED. There are many systems that perform field termination of medical and traumatic cardiac arrests in certain circumstances. In these patients, there may not be a mechanism to have a non-EMS provider confirm correct tube placement. In this article, we have proposed a data element to identify "who" determined the final tube outcome. This not only helps to clarify this outcome measure, but also will encourage additional investigation and protocol development in this area.

Reporting

The single feature common to most of the studies cited is that the information was not collected as part of an ongoing QI program, but rather to answer only specific study questions. Because of the critical importance of airway intervention as a part of modern EMS, systems must monitor these parameters on an ongoing basis and have a mechanism for regular reporting of the information. At minimum, results of the QI process should be reported to those involved with the airway program, to the EMS services, and to any provider for whom reporting would benefit. Compiling this information and reporting it outside of the system will help to provide benchmarks for other EMS systems to achieve.

DISCOVERABILITY AND PRIVACY

Discoverability is the extent to which healthcare information may be subject to use in litigation. Statutory law generally protects from discovery data that are generated for quality assurance purposes.[62] Although there are exceptions based on case law to rules limiting discovery, they are narrow and usually involve information contained in peer review records and incident reports.[63,64] Although there remains the threat of discovery of information contained in any record, it is important that medical directors and services not be limited in data collection efforts by fears that are unwarranted.

For its part, the protection of privacy of health care-related information is governed by the Health Insurance Portability and Accountability Act of 1996 (HIPAA). HIPAA requires that safeguards be provided by health care entities to limit unnecessary or inappropriate access to, and disclosure of, protected health information (PHI). Safeguards in the collection, compilation, analysis, and dissemination of quality assurance information require compliance with HIPAA's minimum necessary standards.[65] This may entail purging records of PHI ("de-identification") and limiting access by individuals on a "need-to-know" basis.

Laws and regulations vary by locality, change over time, and are subject to interpretation by courts and government agencies, so it is important to address specific questions regarding discoverability and privacy to persons knowledgeable about these topics in relation to local jurisdictions. Finally, despite any legal exposure that may come with using health care data as a quality assurance tool, and despite the requirements to safeguard the privacy of the data, information generated has important value not only as a means to measure and improve the quality of a health care system, but as a learning tool for individual providers.

CONCLUSION

Airway management, including endotracheal intubation, is the most important procedure performed in the prehospital setting. EMS services should closely monitor the performance of ETI to ensure that the highest level of care is provided. EMS services should adhere to the recommended standards for defining, collecting, and reporting airway management data. Although there are many methods for collecting airway management data, systems should use methods that result in the most accurate reports of treatment courses and outcomes.

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APPENDIX

SAMPLE AIRWAY MANAGEMENT REPORTING TEMPLATE

This sample data form illustrates one method for collecting and documenting the recommended data elements. *This is a sample template only.* Individual users may choose to integrate these data elements into their own paper or electronic data collection platforms. (A Microsoft PowerPoint version is available for download at http://www.naemsp.org.)

(The Appendix appears on the next page.)

NAEMSP AIRWAY MANAGEMENT REPORTING TEMPLATE

Patient demographic information:

Date: ____/____/____ Dispatch Time: ____:____ am / pm

EMS Service Name/No.: _____

Pt age (yr): _____ Patient sex: ❑ M ❑ F

1. Indication for invasive airway management (check one):

- ❑ Apnea or agonal respirations
- ❑ Airway reflex compromised
- ❑ Ventilatory effort compromised
- ❑ Injury/illness involving airway
- ❑ Adequate airway reflexes/vent effort, but potential for compromise
- ❑ Other _____

2. Was endotracheal intubation (ETI) attempted?

❑ Yes ❑ No

3. If ETI not attempted – alternate method of airway support:

- ❑ Bag-Valve-Mask (BVM)
- ❑ Combitube
- ❑ Needle Jet Ventilation
- ❑ LMA
- ❑ Open Cricothyroidotomy
- ❑ Other Cricothyroidotomy
- ❑ CPAP/BiPAP
- ❑ Not Applicable (ETI Attempted)
- ❑ Other: _____

4-6. Patient subsets (Select Yes/No):

Is patient in cardiopulmonary arrest on intubation?	❑ Yes ❑ No
Is patient a victim of trauma?	❑ Yes ❑ No
Is patient *under* 18 years old?	❑ Yes ❑ No

7-11. Vital signs prior to ETI attempt (leave blank if not obtained):

Pulse: ____ beats/min Blood Pressure: ____ / ____ mmHg

Resp Rate: ____ breaths/min SaO_2: ____ %

12-14. Glasgow Coma Score (GCS) before intubation:

Eye: ❑ none (1) ❑ pain (2) ❑ verbal (3) ❑ spontaneous (4)

Verbal: ❑ none (1) ❑ incomprehensible (2) ❑ inappropriate words (3) ❑ disoriented (4) ❑ oriented (5)

Motor: ❑ no response (1) ❑ extends to pain (2) ❑ flexes to pain (3) ❑ withdraws from pain (4) ❑ localizes pain (5) ❑ obeys commands (6)

15. Monitoring and treatment modalities concurrent with intubation (check *all* that apply):

- ❑ ECG monitor
- ❑ Pulse-Oximetry
- ❑ IV access
- ❑ C-spine immobilization
- ❑ CPR (chest compressions)
- ❑ Gum Elastic Bougie
- ❑ BAAM
- ❑ Endotrol Tube
- ❑ Other: _____

17. Level of training of each rescuer attempting intubation:

Rescuer	Level of Training (check one)
A†	❑ EMT-P ❑ EMT-I ❑ EMT-B ❑ Medic Student ❑ Nurse/PHRN ❑ Phys Asst ❑ MD/DO (attend) ❑ MD/DO (res) ❑ Other: _____
B†	❑ EMT-P ❑ EMT-I ❑ EMT-B ❑ Medic Student ❑ Nurse/PHRN ❑ Phys Asst ❑ MD/DO (attend) ❑ MD/DO (res) ❑ Other: _____
C†	❑ EMT-P ❑ EMT-I ❑ EMT-B ❑ Medic Student ❑ Nurse/PHRN ❑ Phys Asst ❑ MD/DO (attend) ❑ MD/DO (res) ❑ Other: _____

16-18. Provide information for each laryngoscopy attempt.
FOR ORAL ROUTE, EACH INSERTION OF BLADE (LARYNGOSCOPY) IS ONE "ATTEMPT."
FOR NASAL ROUTE, EACH PASS OF TUBE PAST NARES IS ONE "ATTEMPT."

Attempt	16. ETI Method	17. Who attempted?†	18. Was attempt successful?
#1	❑ OTI ❑ NTI ❑ Sedation ❑ RSI	❑A ❑B ❑C	❑ Yes ❑ No
#2	❑ OTI ❑ NTI ❑ Sedation ❑ RSI	❑A ❑B ❑C	❑ Yes ❑ No
#3	❑ OTI ❑ NTI ❑ Sedation ❑ RSI	❑A ❑B ❑C	❑ Yes ❑ No
#4	❑ OTI ❑ NTI ❑ Sedation ❑ RSI	❑A ❑B ❑C	❑ Yes ❑ No

Indicate drugs given to facilitate intubation:

- ❑ Midazolam ____ mg
- ❑ Diazepam ____ mg
- ❑ Lidocaine ____ mg
- ❑ Morphine ____ mg
- ❑ Etomidate ____ mg
- ❑ Succinylcholine ____ mg
- ❑ Atropine ____ mg
- ❑ Topical Spray
- ❑ Other – Specify: _____ - ____ mg
- ❑ Other – Specify: _____ - ____ mg

19-24. Endotracheal tube confirmation.

19. Auscultation	❑ Tracheal Placement	❑ Esophageal Placement	❑ Indeterminate	❑ Not Assessed	❑ Tube not placed.
20. Bulb Aspiration	❑ Tracheal Placement	❑ Esophageal Placement	❑ Indeterminate	❑ Not Assessed	❑ Tube not placed.
21. Syringe Aspiration	❑ Tracheal Placement	❑ Esophageal Placement	❑ Indeterminate	❑ Not Assessed	❑ Tube not placed.
22. Colorimetric $ETCO_2$	❑ Tracheal Placement	❑ Esophageal Placement	❑ Indeterminate	❑ Not Assessed	❑ Tube not placed.
23. Digital $ETCO_2$	❑ Tracheal Placement	❑ Esophageal Placement	❑ Indeterminate	❑ Not Assessed	❑ Tube not placed.
24. Waveform $ETCO_2$	❑ Tracheal Placement	❑ Esophageal Placement	❑ Indeterminate	❑ Not Assessed	❑ Tube not placed.
Other: _____	❑ Tracheal Placement	❑ Esophageal Placement	❑ Indeterminate	❑ Not Assessed	❑ Tube not placed.

25. Peak ETCO2 value: _____ ❑ Indeterminate

26. Was ETI successful for the overall encounter (on transfer of care to ED or helicopter)?

❑ Yes ❑ No

27. Who determined the final placement (location) of ET tube?

- ❑ Rescuer performing intubation.
- ❑ Another rescuer on the same team.
- ❑ Receiving helicopter crew.
- ❑ Receiving hospital team.
- ❑ Other: _____

28-32. Vital signs after intubation attempt:

Pulse: ____ beats/min Blood Pressure: ____ / ____ mmHg

Resp Rate: ____ breaths/min SaO_2: ____ %

33. Critical complications encountered during airway management (Check *all* that apply):

- ❑ Failed intubation effort.
- ❑ Injury or trauma to patient from airway management effort.
- ❑ Adverse event from facilitating drugs.
- ❑ Esophageal intubation – delayed detection (after tube secured).
- ❑ Esophageal intubation – detected in ED.
- ❑ Tube dislodged during transport/patient care.
- ❑ Other: _____

34. If all intubation attempts FAILED, indicate suspected reasons for failed intubation (check all that apply):

- ❑ Inadequate patient relaxation
- ❑ Orofacial trauma.
- ❑ Inability to expose vocal cords.
- ❑ Secretions/blood/vomit.
- ❑ Difficult pt anatomy.
- ❑ Unable to access pt.
- ❑ ETI attempted, but arrived at destination facility before accomplished.
- ❑ Not applicable – Successful field ETI
- ❑ Other: _____

35. If all intubation attempts FAILED, indicate secondary (rescue) airway technique used (check all that apply):

- ❑ Bag-Valve-Mask (BVM) Ventilation
- ❑ Needle/Jet Ventilation
- ❑ Combitube
- ❑ Open Cricothyroidotomy
- ❑ Not applicable – Successful field ETI
- ❑ Other: _____

36. Did secondary (rescue) airway result in satisfactory ventilation?

❑ Yes ❑ No ❑ Not applicable

37-38. Airway Management Times

Time of decision to intubate: ____:____ am / pm
Time of successful intubation: ____:____ am / pm
Time intubation abandoned: ____:____ am / pm

Template Design by H. Wang, University of Pittsburgh, PA - May 23, 2003.