So... Pediatric Patients are not just smaller versions of the Adults we treat everyday!

There are really important differences...

Important ‘Kid’ Anatomy

- Small Nares & Large Tongue
- Adenoids & Tonsils largest – age 4-10
- Narrower Airway
- Diaphragmatic Breathing
- Poorly Developed Accessory Breathing Muscles
- Decreased Functional Residual Capacity (FRC) – Lung Size Increases Rapidly Until Age 6, Then More Slowly

Airway Matures to that of an Adult by age 10-12
The Pediatric Patient - Cardiovascular

- Heart has less muscle mass
- Lower strength of contraction
- Decreased sympathetic tone
- Increased parasympathetic tone
- Cardiac Output 2x an adult
  - Increased oxygen consumption
- Heart can maintain output over a wide range rates without failing
The Pediatric Patient

Cardiac Arrest (Morray, Anesthesia 93:6, 2000)

- Most common causative factor was respiratory
- Laryngospasm or Obstruction causing Respiratory event causing Cardiac Arrest
- Airway, Airway, Airway!!!

<table>
<thead>
<tr>
<th>Age</th>
<th>Resp Rate</th>
<th>Heart Rate</th>
<th>Sys BP</th>
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<tr>
<td>0</td>
<td>30-60</td>
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<td>21</td>
<td>12-20</td>
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Preoperative Evaluation

- Family History of Muscular Dystrophy, Malignant Hyperthermia or Sickle Cell Disease?
- Recent History of Upper Respiratory Infections (URI)?
- Large Tonsils, Loose Teeth?
- Most haven’t had anesthesia before...
- Ear Abnormalities — Associated with Cardiac/Airway Abnormalities
- Evaluate and Listen to Heart and Lungs

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</tbody>
</table>
The Pediatric Patient – Recent URI

What’s the Problem??
• URI increases bronchial hyperreactivity for up to 7 weeks leading to...
  – More rapid desaturation
  – Increased laryngospasm
  – Bronchospasm
  – Atelectasis, Pneumonia
• Average child 6-8 colds per year
  – When to perform elective surgery?
• Existing asthma, etc. worsens risk!

Able to Proceed
• Afebrile
• Clear Secretions
• Appear Healthy
• Noninfectous

“...mild URI may be safely anesthetized since problems encountered are generally easily treated...”
Rolf, Cote J Clin Anesth 1992

Postpone Case
• Fever > 38 degrees C
• Mucopurulent Secretions
• Lethargy
• Productive Cough
• Pulmonary Symptoms

“...if bacterial infection, place on antibiotics, postpone surgery > 4 weeks.”
Tait, Malviya Anesth Analg 2005

Pediatric Dental Anxiety

• 6%-15% of the US population avoids regular dental care because of dental anxiety
• 5-10% of US adults have dental phobia – so fearful, they avoid dental care at all costs
• In most cases, the condition begins in childhood
  ▪ Females>Males
  ▪ Younger>Older
  ▪ Oral Surgery>Dental Procedures>Prophylaxis

Causes...
Direct experiences
Vicarious Learning
Stimulus Generalization
Helplessness & Lack of Control
Mass Media
A prospective study of dental anxiety in a cohort of children followed from 5 to 9 years of age

- 1404 children underwent exams at 5 yrs & 9yrs.
- Parents completed questionnaires at the evaluations
- 8.8% displayed anxiety at age 5
- Half of those were free of anxiety at age 9
- Those that remained anxious had become even more anxious + added newly anxious 9 yr olds
- Dental anxiety increased from 8.8% at age 5 to 14.6% at age 9

Characteristics indicating a greater likelihood of dental anxiety at age 9...
- Female gender
- Parents who were anxious
- History of extraction
- Visits to the dentist that were irregular & for symptoms of a disorder
- History of dental anxiety at age 5
- No relationship between restorative care and dental anxiety

Techniques to Reduce Anxiety

- Positive Reinforcement
- Non-threatening Language
- Tell-Show-Do Techniques
- Understanding & Listening to Patient Concerns
- Patient Put in Control by the Dentist
- Relaxation Techniques
- Systematic Desensitization
- Cognitive Restructuring
- Pharmacologic Techniques

What can we do to improve the quality of pediatric anesthesia?

- Pre-Screen Patients Thoroughly
- Tailor the Anesthesia to the Situation
‘When all you have is a hammer, everything tends to look like a nail’

What can we do better?

• Remember the Parent is Part of the Treatment Equation
• Safety, Safety, Safety!
• Have the Right Equipment
• Know ‘When to Say When’ to Parents

Parental Presence during Induction?

Did the parent make the MD’s job easier?
Parents: 68% said yes
MD’s: 31% said yes

Was the parent’s presence helpful to the child?
Parents: 80% said yes
MD’s: 12% said yes


Parental Presence during Induction?

88 Children age 2-8 randomized to…

• Oral Midazolam, no parent
• Parent in OR – no midazolam
• No parent & no midazolam

“Oral midazolam more effective in reducing child anxiety than parental presence”

“Oral midazolam more effective in reducing parental anxiety than parental presence”

Anesthetic Options...
“The benefit of the sedation may be minimized if the administration of the sedative agent is associated with pain or adverse memories”

Routes of Administration
- Oral
- Intranasal
- Transmucosal
- Transdermal
- Inhalation
- Intramuscular
- Intravenous
- Rectal

5 year old Male presents with Mom Localizes Pain to the Maxillary Incisors Child in Pain and Extremely Anxious

Case Assessment
- Negative Medical History
  - Normal birth and birth weight
  - No family anesthetic complications
  - No recent cough, runny nose
  - No medications
- He would only allow a quick exam while being in his mother’s lap
- #D, E, F, G with large caries

What sedation regimen would your office choose?
Options for treatment...

- Local Anesthesia Only
- Oral Premedication +/- N₂O
- Intramuscular Ketamine/Versed
- Intravenous Moderate Sedation
- Intravenous Deep Sedation/General Anesthesia
- Inhalational General Anesthesia
- Combination of These
  - Other?

Factors to Consider...

Preanesthetic Assessment
  - Anxiety Level
Intended Depth of Anesthesia
  - Length of Procedure
Potential Airway Insult
  - Need for Postanesthetic Care

How do we correctly choose a sedation regimen?

Oral Midazolam
  - Patient Familiarity – Ease of Use
  - Minimal Side Effects
  - Useful Premedicant
  - Requires Patient Cooperation
  - Dose .5mg/kg, Maximum 20mg

Minimal Sedation
Pediatric Dental Anxiety

“Practitioners should recognize that ‘conscious sedation’ is an oxymoron for many children less than 6 years old.”

“Deep pharmacologic restraint is usually required to gain cooperation...(which) increases the risk of an adverse respiratory event.”

Cote, Pediatrics 105:805, 2000

‘We either sedate them deeply or make them super heroes!’

Ketamine

Phencyclidine derivative producing ‘dissociative’ anesthesia

Cataleptic state
- Eyes open
- Slow nystagmic gaze
- Noncommunicative
- Amnesia present
- Analgesia
Ketamine

Respiratory Effects
- Intact Reflexes
- Maintenance FRC
- Bronchodilator

Cardiovascular Effects
- Increased HR
- Increased BP

Onset of Sedation: 3-10 Minutes
Duration of Sedation: 15-30 Minutes
Time to Discharge: 30-120 Minutes

IM ketamine, midazolam & glycopyrrolate for pediatric sedation in the emergency room

- 37 patients (1-7 years)
- NPO for 3 hours
- No supplemental O2
- Ketamine 3 mg/kg, midazolam 0.05 mg/kg, glycopyrrolate 0.005mg/kg

Pruit et al, JOMFS 1995

Intramuscular Sedation Video

- Sleeping / Cooperative 70% (avg 4.8 min)
- Intermittant Crying 16%
- Inadequate Sedation 14%
- O2 Sat > 96%
- Resp Rate / Pulse Increase 13%, 18%
- Hypersalivation 11%
- Working Time: 30 minutes
- Recovery Time (injection-discharge): 50-120 minutes

Pruitt et al, JOMFS 1995
Sevoflurane as the ‘Ideal’ Agent

- ‘Needleless’
- Nonpungent
- Sufficient Potency
- Rapid Onset
- Bronchodilator

- Greater Control of Precision & Depth
- No Adverse Cardiac Complications
- No Postemergence Side Effects

Adding Safety...

End-Tidal CO\textsubscript{2} Monitor

- Monitoring of the concentration of expired carbon dioxide (CO\textsubscript{2})
- Presented as a graph of expiratory CO\textsubscript{2} plotted against time
- Continuous Sampling of Expired Gases
- Monitors adequacy of ventilation

Infrared Absorption

<table>
<thead>
<tr>
<th>Source</th>
<th>Chamber</th>
<th>Detector</th>
</tr>
</thead>
</table>

CO\textsubscript{2} maximally absorbs waves @ a wavelength of 4.25 micrometers

High CO\textsubscript{2} = Less infrared reaching detector = High CO\textsubscript{2} reading

Display of the Capnography Waveform is more Informative than the Value Readout
Qualitative Capnography Information

➢ Apnea
➢ Hypoventilation
➢ Hyperventilation
➢ Expiratory Obstruction
➢ System disconnect / leak
➢ Malignant hyperthermia
➢ Exhausted CO₂ absorber
➢ Esophageal intubation

EtCO₂ Waveform

Bronchospasm/COPD

- Phase II is prolonged
- Slope of phase III is increased

Adding Safety...

'Blue Tooth' or Cordless Pretracheal Stethoscope
Drug Calculator

Excel spreadsheet
Available On-Line at the ADSA Website
www.adsahome.org

Anesthesia Morbidity & Mortality in the Dental Office

What is Crisis Resource Management

- Training that prepares us for the ‘human factors’ that enter into the causation, propagation, and management of critical incidents
- De-emphasis of medical knowledge and isolated skills
- Emphasis on practice and simulation

Basis for CRM

Errors will always occur...
- Prevent as many as possible
- Recognize as quickly as possible
- Correct as many as possible
- Minimize the rest...
Basis for CRM

• Human mind ‘wants everything to be fine…’
• Don’t Assume all is going well
• Constantly prove to oneself that the patient is doing well
• ‘Not to Decide is to Decide’

Elements of CRM

• Effective ‘Closed Loop’ Communication
• Permission to Challenge Authority
• Situational Awareness
• Management of Resources
• Use of Checklists to Minimize Errors
• Task Prioritization
• Time Management
• Team Practice/Repetition is Critical
• Effective Leadership

Effective Leaders

• Avoid Hazardous Attitudes
• Stay in Focus
• Closed Loop Communication
• Seek Input From Those Around Them
• Address Specific Requests
• Accept Constructive Criticism
• Encourage Challenge to Authority
• Delegate Tasks
CRM in Action...
- Expect complications during patient treatment
- Have a practiced plan of action in place in the treatment area
- Equipment organized and easily accessible
- Medication and dosing readily available
- Task-Oriented preparation has already occurred with Staff

Task-Oriented Office Preparation
- How far away is the Bag-Valve-Mask from the patient?
- How far away is the Emergency Cart from the patient?
- Who can help with the Airway?
- Who can place the IV?
- What is the dose of the emergency drug for this patient?
- How quickly can it be drawn up?
Anesthetic Management of the Geriatric Patient

Michael K Rollert DDS
Nelson & Rollert OMS
Denver CO

The US Elderly Population is Increasing...

- In Last 90 Years, the US Population has Tripled, while the elderly population has Increased 10-Fold.
- In 40 years, the Elderly are projected to represent 21% of the population, yet generate 45% of Health Care Expenses.
After the age of 65, over half the population will require a surgical intervention.

Is the incidence for dentists and oral/maxillofacial surgeons even higher?

How are the elderly different?
What modifications should be made regarding their anesthesia?

Aging requires special considerations for monitoring and drug therapy

Skin/Musculoskeletal
Cardiovascular
Pulmonary
Neurologic
Renal
Hepatic
Gastrointestinal
Endocrine

The Physiology of Aging

Skin & Musculoskeletal Systems
- Fat content to body mass increases
- Larger depot for fat-soluble drugs
- Skin damage more likely
  - Atrophy of the epidermis
  - Loss of skin elasticity
  - Actinic changes increases pigmentation
- Increased arthritis and osteoporosis
  - Loss of dentition
  - Can be more difficult to ventilate
The Physiology of Aging

**Cardiac System**
- Heart is stiff & does not pump well
  - Less compliant atrium & ventricles
  - Hardening of arterial walls
  - Often hypertrophy of left ventricle
- Rhythm of heart can be abnormal
  - Dyshytemias
  - Atrial Fibrillation
- Heart rate is slow & has to pump harder
  - Rate decreases 1%/yr from mid-fifties
  - Systolic blood pressure increases
- Assume cardiovascular disease!
  - Plaques cause calcifications in the vessels
  - Decreasing artery size
- Heart attack possible
  - Coronary circulation affected by plaques
  - Myocardial ischemia & infarction possible
- Hardening of heart valves
  - Valvular stenosis
  - Valvular regurgitation

**Pulmonary System**
- Stiffer and less compliant lungs
  - Less lung expansion & elasticity
  - Less muscle strength of chest wall and diaphragm
  - Decreased 35% by age 80
- Decreased breathing efficiency
  - Hypoventilation
  - Decreased gas exchange surface area
  - Oxygen not as readily absorbed in the blood
- Increased breathing problems
  - Increased chance of hypoventilation, apnea!
  - Less oxygen reserve (FRC)
Pulmonary System
- Lung not able to adjust to changes
  - Blunted response to hypoxia (low oxygen)
  - Blunted response to hypercarbia (increased carbon dioxide)
- Collapse of lungs more likely
  - Increased atelectasis

Pulmonary System
- Impaired cough reflex
  - Cough is less intense & less effective
  - Slow clearing of airways
- Gag reflex lost
  - Loss of protective laryngeal reflexes
- Material more likely to enter the lungs
  - Increased risk of aspiration
- Increased chance of postoperative lung infections

Neurologic System
- Can't stay warm
  - Lowered sensitivity to skin receptors
  - Shivering at a lower temperature
- Blood pressure receptors less reliable
  - Orthostatic Hypotension more common
  - Syncope 3% of ER Admissions
  - 80% of those are patients > 65 years old

Neurologic System
- Brain speed slows, less awareness
  - More forgetful
  - Slow with less coordination
Central Nervous System
- Parkinson’s Disease
  - General Population 1:1000
    - Over 60 1:75
- 10-15% patients display some form of perioperative confusion
  - Preoperative dementia is the most significant risk factor for postoperative delirium

Postoperative Delirium
- Disorientation of time, place, and person
- Risk factors include… dementia, age, functionality, psychoactive medications
- Usually subsides within 48 hours of surgery

Renal System
- Filtration process impaired
  - Kidney function declines 1%/yr after 50
- Imbalances difficult to correct
  - Acid-base imbalances more likely
  - Decreased urine concentrating ability
- Total body water decreases significantly

Interval delirium can occur after a lucid interval of 1 or more days
- Increases in periods of darkness
- Can have long term effects, such as poor recovery, need for hospitalization, & greater likelihood of placement in assisted living
The Physiology of Aging

Hepatic System
- Liver getting smaller
  - Liver mass decreased (40% by age 80)
  - Hepatic blood flow is decreased
- Decreased ability to process and eliminate drugs
  - Decreased Albumin production
  - Decreased plasma protein drug binding

Geriatric Drug Clearance
Drugs subject to hepatic metabolism or renal excretion are metabolized at 1/2 to 1/3 the rate of younger adults
- Fentanyl = 50% less for 85 yr old
- Midazolam = 30% less for 60yr old
  - 60% less for 80 yr old
- Diazepam = 66% less for the geriatric patient
- Propofol = 15% less for 65 yr old
- More pronounced hypotension

The Physiology of Aging

Gastrointestinal System
- More reflux symptoms
  - Decreased esophageal sphincter tone
- Decreased Esophageal and Intestinal Motility
  - Gastric emptying time increased
  - Nausea/Vomiting more likely
  - Aspiration more likely

Endocrine System
- Increased risk of diabetes
  - Incidence peaks at 60-70 years old
  - Insulin receptor sensitivity
  - Risk increased with obesity
- Increased Hypothyroidism
  - Incidence increases in females
**Anesthesia History**
- Thorough medical history...
- Be prepared to ask followup questions
- Multiple medications and dosages...
- Medical consultation with physician needed?
- History of anesthetic complications?
  - Reactions to medications?
  - Nausea/Vomiting?
  - Prolonged Recovery?

**Preanesthesia Considerations**
- Try to avoid routine use of preoperative sedative medications
- Keep comfortable – avoid pressure points with pillows, chair adjustment
- Keep warm – maintain core temperature
- Monitoring is vital
- Keep oxygenated!

**Geriatric Anesthesia Management**
- Age alone is not a significant anesthesia risk factor
- Use less drug, expect increased time to eliminate medications
- “start low and go slow”
- Give preference to reversible anesthetic agents

**Postoperative Delirium**
- Johns Hopkins Medical Institute Study
  - 114 patients > age 65 undergoing hip fracture repair
  - Randomly assigned to light or deep sedation
- Number of days with ‘delirium’ was **significantly less** in the ‘light’ sedation group
  - Risk factors included preoperative dementia, blood transfusion, & level of sedation
Geriatric Anesthesia Management

- Minimize narcotics = better ventilation
- Watch for hypotension
- If hypertension – check for full bladder
- Increased surgical time = increased anesthetic complications
- Discharge with a reliable adult!

Use Caution – Geriatric Patients

- Diazepam – Prolonged sedation - Increased falls
- Benadryl – Prolonged sedation, BPH
- Meperidine – Decreased renal clearance of the metabolite normeperidine – causing tremor, seizures
- NSAIDS – Ulcers, gastritis, further renal decline
- Steroids – Worsens diabetes control

Use lots of TLC!

Let’s take a break…
Simulation Training for the Office-Based Anesthesia Team

Richard M. Ritt, EMT-P, MAa,*, Jeffrey D. Bennett, DMDb, David W. Todd, DMD, MD, FACDc

INTRODUCTION

An OMS office is a complex environment. Within such an environment, a diverse scope of complex surgical procedures is performed with different levels of anesthesia, ranging from local anesthesia to general anesthesia, on patients with varying comorbidities. Optimal patient outcomes require a functional surgical and anesthetic team, who are familiar with both standard operational principles and emergency recognition and management. Offices with high volume and time pressure add further stress and potential risk to the office environment. Creating and maintaining a functional surgical and anesthetic team that is competent with a culture of patient safety and risk reduction is a significant challenge that requires time, commitment, planning, and dedication. This article focuses on the role of simulation training in office training and preparation.

WHAT IS SIMULATION?

Medical simulation is an artificial representation or imitation of a real event or process. It provides a safe environment, often immersive in nature, for both doctor and staff to have unlimited exposure to various experiences, both routine treatment and infrequent emergencies, without adverse consequences to any patient (Box 1). It is beneficial in providing education and assessment of both individual and team performance and of system operation and functionality. Both the educational and assessment components of simulation training are essential to simulation training. The simulation experience is actually incomplete without the

Disclosures: None.

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1042-3699/17/© 2017 Elsevier Inc. All rights reserved.
assessment or debriefing session. The debriefing provides an opportunity for the team to reflect on their performance in which strengths, weaknesses, and gaps are identified, which allows for an office to optimize operations, enhance dental team performance, and ultimately improve patient outcomes.

Simulation training develops both the individual and the team. Individual development focuses on knowledge, task acquisition, and equipment and drug familiarity. Team development emphasizes leadership, role delegation, workload distribution, closed loop communication, staff member empowerment, documentation, and stress reduction.

THE NEED FOR OFFICE-BASED SIMULATION TRAINING

In the hospital, there is a team of internal medical doctors, anesthesiologists, medical specialists, nurses, respiratory therapists, and pharmacists, who can respond to a medical challenge or medical emergency. By the simple nature of the hospital environment, this team is regularly exposed to complex medical situations. Even though medical emergency intervention is routine for this team of highly trained medical staff, many hospitals have regularly scheduled simulated drills throughout the hospital for certain scenarios.

In an OMS office, the minimal staffing may consist of 1 doctor, 1 anesthetic assistant, 1 surgical assistant, and possibly 1 front office staff member. Although many states require Advanced Cardiac Life Support (ACLS) and Pediatric Advanced Life Support (PALS) for anesthesia certificates and the Office Anesthesia Evaluation program recommends regular emergency drills, there may be no mandatory training for anesthetic and surgical assistants other than Basic Life Support (BLS). This environment necessitates a different team model. Additionally, an OMS office is not a critical care center and the office may never or infrequently have been involved in the management of a medical challenge or medical emergency.

TYPES OF SIMULATORS

There are a variety of simulators that can be used to improve methods/processes (Box 2) and skills (Box 3) for managing both routine care and office emergencies. Simple task trainers have been shown to teach skills that transfer well to clinical care. Simple airway manikins allow bag-valve-mask (BVM) ventilation, nasopharyngeal and oral airway placement, supraglottic airway placement, and endotracheal intubation. By definition, most of the task simulators used in BLS and ACLS are simple simulators that do not expose a trainee to complex and difficult airway management tasks and scenarios. Cardiopulmonary resuscitation (CPR) manikins can be low fidelity with compression practice or high fidelity with recording of tidal volume, respiratory rate, compression depth, and compression rate. Simulation can be software based, where participants respond to a vital signs monitor display and manipulate tasks and drugs according to options in the menu. These programs can be used

<table>
<thead>
<tr>
<th>Box 1</th>
<th>Advantages of simulation training</th>
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<tbody>
<tr>
<td>1.</td>
<td>Provide education and assessment in clinical operation (both routine and emergent)</td>
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<td>2.</td>
<td>Repetitive practice to address performance gaps without putting patients at risk</td>
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<td>3.</td>
<td>Real time “deliberate” practice of infrequent medical emergencies</td>
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<td>4.</td>
<td>Standardized experience with most emergency scenarios</td>
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<td>5.</td>
<td>Safe environment for both the doctor and staff members</td>
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<td>6.</td>
<td>Team and crisis resource training that is specific to the environment and personnel</td>
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<td>7.</td>
<td>Unlimited exposure to high-risk, low-incident cases</td>
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<td>8.</td>
<td>Ability to organize and customize training opportunities</td>
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<td>9.</td>
<td>Ability to provide immediate feedback</td>
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<tr>
<td>10.</td>
<td>Opportunity for the entire office team to participate in training</td>
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<thead>
<tr>
<th>Box 2</th>
<th>Procedural processes</th>
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<tbody>
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<td>1.</td>
<td>Patient triage</td>
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<tr>
<td>a.</td>
<td>Taking and documenting vital signs</td>
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<td>b.</td>
<td>How to review medical history</td>
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<tr>
<td>c.</td>
<td>Recognizing subtle signs of medical conditions</td>
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<td>d.</td>
<td>Preanesthetic questions</td>
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<tr>
<td>2.</td>
<td>Checklist</td>
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<td>3.</td>
<td>Timeout</td>
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<tr>
<td>4.</td>
<td>Communication (closed loop)</td>
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<td>5.</td>
<td>Teamwork</td>
</tr>
<tr>
<td>6.</td>
<td>Equipment familiarity</td>
</tr>
<tr>
<td>7.</td>
<td>Drug familiarity</td>
</tr>
<tr>
<td>8.</td>
<td>Intraoperative monitoring</td>
</tr>
<tr>
<td>9.</td>
<td>Postoperative monitoring</td>
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<tr>
<td>10.</td>
<td>Discharge operation</td>
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</tbody>
</table>
by practitioners to refine clinical knowledge or by office staff to demonstrate basic concepts, role responsibility, and team function. The highest level of simulation provides an artificial replication of the clinical setting, which fully immerses a team into an experience that simulates both routine operation and emergency scenarios. This can involve human simulated patients (biological simulation) or high-fidelity simulation manikins. High-fidelity simulation manikins, such as the SimMan (Laerdal Medical Corporation, Wappingers Falls, NY), allow for airway interventions, intravenous (IV) fluid administration, CPR, defibrillation, and so forth.

This level of human simulation is unparalleled in that it provides an opportunity for practitioners to work with their own personnel, potentially within their own office environment, to address both routine operation and emergency scenarios.

**WHAT IS LEARNED FROM EMERGENCY DRILLS?**

**Procedural Familiarity, Task Acquisition, and Assessment**

Patient selection and anticipation and preparation for medical challenges and medical emergencies
are the responsibility of an office and can both reduce adverse events and optimize patient outcome. Although this article is not focused on patient selection, a well-trained, empowered office staff may have a critical role in patient selection. Patients or patient escorts may share information with office staff that they may not share with the doctor. Office staff who accompany a patient into the operatory may recognize subtleties as patients walk down a hallway and enter a room that may not be obvious to a doctor whose encounter with patients is while they are seated in a surgical chair. A trained office staff member may not necessarily make a diagnosis but may be more likely to identify an abnormality or a deviation from “normal.” A hierarchal environment that does not empower staff to fully contribute to patient care may miss this critical information.

Team empowerment is also critical and can optimize teamwork during an emergency. Every staff member should feel comfortable with communicating thoughts pertaining to patient assessment and intervention. An empowered staff who can inform a doctor of something that the doctor or more senior team member may not have recognized or may not be performing adequately may improve patient outcome. Alternatively, a lack of such communication can contribute to or worsen the outcome of an adverse outcome.

Current residents and practitioners who provide care in the hospital and The Joint Commission or comparably accredited offices are familiar with processes, such as checklists and timeout (see: Leon A. Assael, article “Preventing Wrong-Site Surgery in Oral and Maxillofacial Surgery,” in this issue). These procedural processes are important and reduce adverse events. It is time for these processes to be incorporated into all OMS offices. The introduction of these changes is intended to be beneficial for patient care. Incorporating change into an office alters workflow, however, which can be associated with mental and physical demand that may have an impact on performance and effort and result in frustration. Using simulation as a component of office training allows for a smoother transition in which resource assessment can be accomplished to minimize overwhelming the system. Simulation can also ensure optimal system operation. Simulation centers that replicate hospital wards have all levels of staff, from clerical to clinical, participate in simulated experiences that reproduce basic procedures. An OMS office can achieve the same with simulating concepts, such as patient triage, timeout, checklists, and so forth.

There are multiple tasks that are required for both routine care and emergency care (see Box 3). An area of focus is on airway management because many of the most common serious complications and emergencies experienced in office-based anesthetic practice are related to airway management. Approximately 90% of airway emergencies can be corrected with simple measures, such as airway repositioning, nasopharyngeal or oropharyngeal airway placement, and effective BVM ventilation. All OMS staff are required to successfully participate in BLS biannually. The airway emergency and the level of acquired skill provided by BLS, however, do not equate to the clinical environment during ambulatory anesthesia, especially a difficult and challenging patient airway. The first time taking a mannequin-acquired airway skill to a real clinical environment, even one in which conditions are optimal, may result in a less than 50% success. Furthermore, these skills can deteriorate over time without practice, and an exposure every 2 years does not amount to a well-trained office. All OMSs administering office-based anesthesia are required to successfully participate in ACLS biannually. Likewise neither does the airway challenge equate to the difficult airway nor is the time-limited recertification course sufficient to maintain skill and/or knowledge of emergency management without repeated re-exposure throughout the year. Some offices in which general anesthesia is performed have both surgeon and office staff perform BVM ventilation on patients during the procedure so that the process is not novel when required during an emergency. Task simulators attempt to replicate a real patient and enable staff to learn new skills and practice these skills.

Although most emergencies requiring ventilation can be managed with BVM ventilation, there are situations in which intubation may be advantageous or required. Direct laryngoscopy has traditionally been used to facilitate airway intubation but at times may be unsuccessful. Videolaryngoscopy, for most anesthesiologists, is becoming the most commonly used technique to rescue failed direct laryngoscopy and in some situations is replacing direct laryngoscopy as the instrument to initially achieve intubation. Practicing OMSs, except for those recently graduated, most likely have not been exposed to videolaryngoscopy, which has become integrated into anesthetic care as standard equipment. Task simulators, therefore, provide an environment in which a practicing OMS may achieve a level of familiarity with a device, which should probably be a component of the emergency instrumentation. Furthermore, studies have demonstrated OMSs removed from residency training to be able to demonstrate satisfactory clinical use of the videolaryngoscope with task simulators.
A new facility is an exciting time for a practice yet potentially hides unrecognized and latent threats to patient safety. These threats may be secondary to missing or inappropriately placed equipment, deficient system operation, disorganized office layout, unfamiliarity with the new office environment, or insufficient space. A simulated drill has the potential to identify the errors that may occur during a real-time event and allow for potential threats to be corrected. As important as it is to involve all office staff in the simulation exercise, there is also benefit to getting to know and inviting the local emergency response staff to participate in these exercises when opening a new facility, when a new doctor joins an office, or as the emergency response staff change. This orientation allows an OMS office staff to share the emergency plan with the emergency response staff, which may include how best the emergency response staff can enter and maneuver their stretcher in the facility. Alternatively, the emergency response staff may identify aspects of an emergency plan that are problematic and not recognized by office staff and offer alternate suggestions or improvements. Additionally, facilitating transfer of care can optimize patient care, and the emergency response staff can share with office staff what information they would appreciate being available on their arrival.

There are advances in knowledge and technology, and surgeons introduce new procedures into offices throughout their professional careers. The goal is to expand the services of an office and optimize patient care. Although these procedural changes are intended to improve office function and optimize patient care, there may be unrecognized and unanticipated consequences resulting in adverse outcomes. Having an office staff simulate the new methods or techniques prior to implementation on a patient may identify errors or problems with procedural modifications that allow for correction before an adverse patient occurrence.

**Team Function**

Knowledge maintenance and keeping abreast of current concepts, such as reading the literature or attending lectures at a medical conference, are common methods of continuing education, which are frequently done individually. Yet care is delivered is by a team. Optimal outcome depends on the functionality of a team.

A trained anesthetic assistant can improve quality of patient care and reduce both the quantity of errors and the severity of the errors for the potential harm they may cause. The American Association of Oral and Maxillofacial Surgeons has developed the Dental Anesthesia Assistant National Certification Examination program to develop trained anesthetic assistants. This course may provide a foundation on which to begin. It is limited, however, in exposing participants to difficult and challenging procedures and tasks, which are critical to patient outcome. Participation and completion of the course is mandated neither by most state laws nor by a professional association. There is no documentation as to the effect it has in optimizing the delivery of care or reducing adverse events. Additionally, if the certification program is mandated, office staff turnover, especially, in small offices, may present difficulty with an office’s ability to maintain compliance. The importance of a trained assistant, however, is especially critical in a small office with 1 practitioner, in which the doctor during an emergency finds himself or herself assessing a patient, being team lead, and performing many if not all major tasks and procedures because the staff is inadequately trained.

With a doctor being both team leader and the primary individual performing tasks, there is the potential to become fixated on a specific task. Crew resource management (CRM) principles for a hospital code recommend that the sole doctor, as team leader, position himself or herself in a position to observe and direct and allow the nursing, respiratory, and pharmacy staff to be relegated to performing the tasks. Most OMS offices do not employ professionals, such as nurses or pharmacists. This concept is, therefore, difficult to replicate, emphasizing the importance of having a trained staff and the importance of preparation through simulation. Training provides a better understanding of roles, sharing of information, fostering interprofessional communication and collaboration, and a comfort and familiarity with each other in addition to improved skills and task capabilities.

**CRITICAL CARE PATHWAYS AND EMERGENCY MANUALS**

Airway obstruction, hypoventilation, and oxygen desaturation are representations of potential problems that may occur during an anesthetic. Continuous observation and monitoring, airway positioning or repositioning, suctioning, and anesthetic drug titration are tasks routinely performed throughout the delivery of an anesthetic. For a well-trained individual and team, the subtleties in a patient’s physiologic status are unconsciously recognized, communicated, and addressed individually and collectively. The process is frequently mundane, consisting of the same repetitive steps;
but when the process is followed, patient care most frequently is uneventful.

Best practice is achieved through the establishment of structured protocol. Clinical care pathways optimize patient care and reduce negative outcome. They are important for both routine and emergency situations. Emergency and checklist manuals are used in many high-hazard industries. During a high-stress emergency situation, especially when such situations are rare, even the best of medical personal and teams may have an inability to retrieve knowledge from long-term memory that is rarely used. The high stress of the emergent and unanticipated event may also contribute to an increase in omitting known steps. 

Emergency manuals consisting of a context-relevant set of cognitive aids and checklists simplify and enable emergency medical intervention. An example of such a cognitive aid is the “Emergency Therapy for Malignant Hyperthermia” procedural poster that hangs in many hospital operating rooms.

ROLES AND RESPONSIBILITIES

Oral surgery facilities differ in size, type, number of staff, and overall organization of the office environment. Routinely, personnel included in providing sedation in the operatory consist of the doctor, surgical assistant, and anesthesia assistant; and in some offices there may be a fourth assistant. Depending on office size, there are a variety of front office staff and additional surgical staff. A multidocotor office may have more than 1 surgeon available. Regardless of office size, when an office crisis or emergency arises, there needs to be an organized and cohesive response that efficiently uses the staff who are present at that time, which may vary by day.

Preassigned roles and responsibilities of staff promote a more efficient and organized team approach to managing a medical emergency. Emergency tasks and responsibilities are identified in Box 5. A representation of task delineation in an office with 1 doctor and 3 staff (anesthesia assistant, surgical assistant, and front-desk clerk) is provided in Table 1. There is no evidence, however, to suggest that the assistant airway training that is currently accepted as standard of care is sufficient, such that most assistants should be independently capable of managing the emergent airway. Although there is a lack of literature pertaining to the OMS model, the emergency and simulation literature suggest that more training is required to achieve an acceptable degree of success. State law may further compound emergency management, which limits who can prepare and administer medication.

DOES SIMULATION MAKE A DIFFERENCE?

Participants favorably perceive simulation training as an education method. Task simulators have demonstrated effectiveness to achieve a level of skill for various procedures, which is transferable to clinical practice. Additionally, simulation-based

<table>
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<tr>
<th>Box 4</th>
<th>Goals of simulation</th>
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<tbody>
<tr>
<td>1.</td>
<td>Knowledge reinforcement</td>
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<tr>
<td>2.</td>
<td>Leadership</td>
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<td>3.</td>
<td>Team training</td>
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<td>4.</td>
<td>Staff member empowerment</td>
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<td>5.</td>
<td>Workload distribution</td>
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<td>6.</td>
<td>Role delegation</td>
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<td>7.</td>
<td>Closed loop communication</td>
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<td>8.</td>
<td>Skill acquisition</td>
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<td>9.</td>
<td>Equipment/drug familiarity</td>
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<tr>
<td>10.</td>
<td>Documentation</td>
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<tr>
<td>11.</td>
<td>Patient disposition</td>
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<td>12.</td>
<td>Stress inoculation training</td>
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<tr>
<th>Box 5</th>
<th>Emergency tasks and responsibilities</th>
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<tbody>
<tr>
<td>1.</td>
<td>Team leader</td>
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<tr>
<td>2.</td>
<td>Procure emergency cart/kit</td>
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<tr>
<td>3.</td>
<td>Read emergency manual — checklist</td>
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<tr>
<td>4.</td>
<td>Airway management</td>
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<tr>
<td>5.</td>
<td>Monitor — take vital signs</td>
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<td>6.</td>
<td>Interpret ECG</td>
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<td>7.</td>
<td>IV insertion</td>
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<tr>
<td>8.</td>
<td>Drug preparation</td>
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<tr>
<td>9.</td>
<td>Drug administration</td>
</tr>
<tr>
<td>10.</td>
<td>Chest compressions</td>
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<tr>
<td>11.</td>
<td>Defibrillator use</td>
</tr>
<tr>
<td>12.</td>
<td>Documentation</td>
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<td>13.</td>
<td>Call for emergency assistance</td>
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<td>14.</td>
<td>Meet and direct EMS</td>
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<tr>
<td>15.</td>
<td>Manage waiting room/interact with escort</td>
</tr>
<tr>
<td>16.</td>
<td>Prepare records for transfer to EMS</td>
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education can improve performance and adherence to emergency protocol and processes that are transferable to clinical practice. Simulation-based training compared with non–simulation-based training demonstrated better knowledge and skill retention. The evidence suggests, however, that the gain in knowledge and skills diminishes with time without reinforcement and repetitive training.

There are no studies to suggest the benefit of anesthesia and medical emergency simulation training in OMS practice. This is important because OMS practice differs from specialty practices, such as emergency medicine, anesthesiology, internal medicine, and others, that are hospital based. These practitioners are immersed into an environment in which they may frequently be challenged to use the knowledge and skill acquired in the simulation training. Experience is important, but simulation training has further benefit because, when comparing individuals with comparable experience, the individual who was provided simulation training demonstrated a higher level of performance.11

Whether high-fidelity simulations offer better educational outcomes versus more simple skills trainers or whether simulation offers better education compared with traditional lecture format depends on which outcomes are measured. Generally, in terms of knowledge transfer, simulation is equal to or slightly better than nonsimulation activities. In terms of skills transfer, simulation is more effective than nonsimulation activities. In terms of teaching nontechnical skills, such as CRM, simulation training is less well proved and harder to assess in terms of benefit. In terms of generalization to clinical care and improved outcomes, except for specific treatment protocols in the delivery room (shoulder dystocia) and the emergency room (CPR and local anesthetic systemic toxicity response), simulation training has yet to prove its benefit. In addition, more study is needed to reflect on simulation training on initial learning versus long-term skill retention and clinical outcomes.

The frequency of a significant morbidity or mortality in an individual office is low. This makes it difficult to assess the effectiveness of simulation training on modifying quality of care and outcomes. Additionally, the low occurrence of morbidity and mortality as reported by OMS National Insurance Company, which is further supported by the literature, suggests that practicing OMSs lack current real-life experience in managing anesthetic and medical emergencies. The effectiveness of simulation training and regular mock exercises can, therefore, only be assessed by performance on simulation exercises and less likely by changes in patient care or outcomes. This is generally true for simulation training in general where improved patient outcomes across hospital systems or patient care groups is hard to demonstrate.

The American Association of Oral and Maxillofacial Surgeons recommends that the doctors and staff in OMS offices partake in periodic scheduled emergency management practice sessions, with which the authors concur.12 The authors confer that simulation has the same benefit for OMS practice as is demonstrated in other realms. Additionally, because OMS practices are not routinely

<table>
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<th>Table 1</th>
<th>Task delineation for office staff</th>
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<tr>
<td><strong>Doctor</strong></td>
<td><strong>Anesthesia Assistant</strong></td>
</tr>
<tr>
<td>Team oversight</td>
<td>Airway management</td>
</tr>
<tr>
<td>Establishes diagnosis and activates emergency</td>
<td>Monitor</td>
</tr>
<tr>
<td>Requests emergency instrumentation</td>
<td>Interprets ECG</td>
</tr>
<tr>
<td>Airway management</td>
<td>Assesses vital signs</td>
</tr>
<tr>
<td>Interprets ECG</td>
<td>Alerts doctor to changes in vital signs</td>
</tr>
<tr>
<td>Drug preparation*</td>
<td>Obtains vital signs</td>
</tr>
<tr>
<td>Drug administration*</td>
<td></td>
</tr>
<tr>
<td>IV insertion*</td>
<td></td>
</tr>
<tr>
<td>Chest compressions</td>
<td></td>
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<tr>
<td>Defibrillator use</td>
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<tr>
<td>Decision to activate 911</td>
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</table>
challenged with medical and anesthetic emergencies, practitioner and staff lack the added effect of experience on simulation training. Although there is no supportive evidence, it could be anticipated that this has an impact on retention of knowledge and skill resulting in a more rapid deterioration of capabilities. This further emphasizes the importance of frequent periodic emergency management practice sessions.

SIMULATION TRAINING SCENARIOS AND RESOURCES

It is vital that an entire team participate in the emergency exercises. Emergency drills should simulate both the common and rare emergency (Box 6). Offices should not only anticipate the rare emergency (eg, malignant hyperthermia) but the unusual and potentially complicating scenario (eg, mother faints, falls to ground, and bangs her head during induction of a 6-year-old child, and the office must maintain care of a sedated 6-year-old child and an unconscious mother with potential head trauma; or, a disruptive family member becomes aggressive during the medical management of a family member). The broad use of patient simulation as an educational activity prepares providers to:

- Focus on patient safety
- Practice high-risk, low-frequency cases
- Prepare for the what if and the unexpected
- Allow for repeated and deliberate practice
- Assume that one does best what one does most often

Prior to a simulated case, it is helpful that an OMS team call a time-out in an effort to review and identify any potential precautions, complications, or concerns.

The most common errors observed in situ and in conference-sponsored simulations include a lack of closed-loop communication, missing or incomplete documentation, and inaccurate verification and administration of medications. There are several resources that are helpful when addressing communication issues, the need for continuous patient assessment, and maximizing personnel and other pertinent resources. Practicing the principles of CRM is another benefit of simulation training. Developed in response to airline disasters in the late 1980s, CRM principles allow for effective teamwork in times of emergency. The 6 goals of CRM are enhanced situational awareness, self-awareness, leadership, assertiveness, decision making, and communication. In 2011, the American Heart Association developed elements for team dynamics. These elements emphasize the importance of closed-loop communication, clear roles and responsibilities, knowledge sharing, constructive intervention, and re-evaluation within an environment that fosters mutual respect and collegiality. The Agency for Healthcare Research and Quality (2015) describes a TeamSTEPPS approach that focuses on leadership, situation monitoring, mutual support, and communication. This approach empowers OMSs teams to resolve conflicts, practice routine and ongoing dialogue during all phases of patient care, and

---

**Box 6**

**Office urgencies and emergencies**

1. Cardiovascular
   a. Angina
   b. Myocardial infarction
   c. Cardiac arrest
   d. Hypotension
   e. Hypertension
   f. Bradycardia
   g. Tachycardia
   h. Dysrhythmia

2. Respiratory distress
   a. Hypoventilation
   b. Apnea
   c. Hyperventilation
   d. Oxygen desaturation
   e. Laryngospasm
   f. Bronchospasm
   g. Aspiration
   h. Airway obstruction (eg, foreign body or anaphylaxis)

3. Metabolic
   a. Hypoglycemia
   b. Hyperglycemia

4. Neurologic
   a. Seizure
   b. Altered mental status
   c. Loss of consciousness
   d. Agitation
   e. Psychiatric event

5. Disruptive escort
6. Nausea and vomiting
7. Malignant hyperthermia
promote good teamwork. Last, the use of Plan-Do-Study-Act can also foster an overall commitment to continual examination and re-evaluation of each medical emergency or crisis for potential improvement opportunities.18

SHOULD THIS BE STANDARD OF CARE?

There is no substitute for periodic simulation training for medical emergencies and crisis in oral surgery offices. The opportunity to practice in an office with staff and equipment maximizes the hands-on learning experience. There are a variety of simulators and task trainers available that can be purchased or rented to conduct comprehensive and timely training in the dental practice. Staff members can engage in role play as the simulator and encourage discussion on a wide range of topics and scenarios. Other options include obtaining outside support that provides the simulation training and equipment. Many local organizations, hospitals, and emergency and fire rescue departments provide required semiannual certifications in BLS, ACLS, and PALS. It is important for a dental practice to recognize that skills taught semiannually may be quickly forgotten unless they are regularly practiced.19 Therefore, a regimen of more frequent drills in shorter duration is suggested as a means to maintain skills and retain knowledge.20 The development of a consistent in situ office training schedule that is strictly adhered to maximizes emergency preparedness of all staff members. For example, dedicating and scheduling 1 hour on the first Monday of each month with specific goals, objectives, and skills can be planned on an annual basis.

As an alternative to in situ training, many local, state, and national organizations and society-sponsored conferences offer hands-on simulation training typically open to all members of an OMS team. Another option is to contact a local hospital, college, and/or university simulation center that contracts to groups using their centers. Virtual online programs have become more common and accessible as a convenient way for dental practices to have their team members complete continuing education requirements. Insurance carriers, risk management groups, and national societies are also good resources to access for potential online continuing education opportunities. In conclusion, enhancing the emergency preparedness of an entire OMS team through simulation training sharpens skills, communication, and knowledge when responding to a medical emergency or crisis in the dental office.21

THE FUTURE OF SIMULATION

The future of simulation will likely involve a continued evolution from different driving forces. Health care organizations and professional societies seek to use simulation to improve learning, performance, and patient safety and assure maintenance of competency. There is no doubt that simulation will be a component in training and maintenance of skills for health care professionals. Funders of health care, liability insurers and the government seek to use simulation to reduce costs, reduce errors, and reduce claims. The future of simulation will involve 3 different models of simulation to address cost effectiveness and clinical applications. Those 3 models will be physical reality (patient mannequins), screen-based simulation, and virtual reality with either 2-D or 3-D with or without physical tools.22 Further research is needed to clarify the best roles and cost effectiveness of simulation training in professional schools, training programs, and maintenance of competency for trained professionals.

REFERENCES