Reaching Special Populations in Dentistry with General Anesthesia

Thesis

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By

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Abstract

Significant barriers to care impact special populations in dentistry. Patients in this population requiring general anesthesia for dental treatment often face long hospital wait lists and providers unable to treat them. Office-based anesthesia provided by dentist-anesthesiologists offers as a safe solution to help address the access to care issues faced by these patients. Because the regulatory landscape has been shaped by a mix of safety and external non-safety related factors, much variation exists between states for the regulation of office-based anesthesia in dentistry. These variations may affect the availability of dentist-anesthesiologists to help treat special populations in the office-based environment.

The purpose of this study is to describe the perceptions of North American Dentist-Anesthesiologists regarding specific regulations on access to care and safety as well as the influence of the regulatory environment when providing general anesthesia services to dentists in an office-based environment. It was also sought to identify and analyze the differences in perceptions and practice characteristics of mobile and fixed-facility dentist-anesthesiologists. Lastly, it was desired to gain insight regarding the effect of regulations on the distribution of dentist-anesthesiologists across the country.

An online questionnaire-based survey was distributed to active members of the American Society of Dentist Anesthesiologists at its 2019 annual conference. The results of valid surveys (n=46) were summarized with descriptive statistics. Fisher's Exact Tests were also used to

describe mobile (n=30) and fixed-facility (n=16) Dentist-Anesthesiologist differences. Dentist-Anesthesiologist demographic data from the survey sample closely approximated that of previous studies.

Generally, the opinions of dentist-anesthesiologists regarding the regulations were homogenous. An inverse relationship was generally seen between the perception of regulations' effect on safety and access to care with some exceptions. This relationship generally held for laws pertaining to educational requirements. It was also evident that mobile and fixed-facility dentist-anesthesiologists differed in their perceptions of specific laws as they pertained to affecting safety, however when there was no significant difference in perception of the regulation, their opinions were in concordance. Minor variations were seen on treatment demographics between groups. Additionally, the influence of state regulations on the selection of type of dental practitioner with which they provide anesthesia services was not significant.

The findings of this study may serve to provide a reference point from a representative group of experts in dental anesthesiology regarding the effect of different regulations on safety and access to care to safely improve special population reach in dentistry.

Dedication

This document is dedicated to by wife and children, Elizabeth, Theodore, and Samuel. Elizabeth, thank you for your endless love and support. It has been a crazy and beautiful journey together as we uprooted to trek across the country in search of my dreams. Theodore and Samuel, just like daddy, may your intellectual curiosity drive your wonderful future adventures and be limited only by your imaginations.

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Chapter 1: Introduction

The Center for Disease Control reports that oral health gaps are profound in the United States.[1] "Distinct oral health disparities and inequities continue to exist among low-income racial/ethnic minority groups, those residing in medically and dentally underserved rural and urban areas, and those with developmental or acquired disabilities, including frail and functionally dependent older adults."[2]

Literature reports that there is an insufficient supply of dentists providing care to special populations, including those general dentists that have undertaken additional postgraduate training. "Many dentists who have completed hospital-based, general practice residency programs do not use all of the skills they have learned in their subsequent private practice careers."[3] "The most difficult barrier to oral healthcare that adult patients with special needs encounter is finding a dentist willing to treat these complex patients."[4] The major barrier to treating patients in the community with special health care needs was the availability of general dentists and specialists.[5]

Dentist-Anesthesiologists are uniquely trained to safely provide comprehensive anesthesia services for dental treatment in office-based settings.[6] "There is strong clinical outcomes data to support the safety of office based anesthesia as performed by dentist anesthesiologists."[7] The availability of this type of practitioner in the office setting and their services increases the

availability of treatment for those patients who would otherwise face significant barriers to receiving treatment, including the possibility of not receiving treatment at all.

While general dental practitioners in North America are positioned to treat the needs of special populations due to numbers and distribution, they continue to know little about the use and availability of Dentist-Anesthesiologists' services. Pediatric dentists account for the largest percentage of dental general anesthesia cases rendered by Dentist- Anesthesiologists.[8] It has been noted that among pediatric dentists that use general anesthesia in their practices, the second largest rationale for not selecting a Dentist-Anesthesiologist to provide the service was no access to them.[9,30]

An unequal distribution of Dentist-Anesthesiologists across the country hints at an external force limiting access to these providers.[10] In many states, the regulatory environment restricts a Dentist-Anesthesiologist from practicing to the full extent of their training with regulations affecting mobility among office-based environments, including to those facilities of general dentists. Studies have found significant regional differences in the use of general anesthesia by dentists.[9] Differences in types of cases and practice settings vary substantially across the country and "may be attributed to distinct laws regulating sedation and general anesthesia within each state."[8]

"Quality and safety in anesthesia is usually monitored by analysis of perioperative mortality–morbidity and incidents."[11] However, standardized reporting systems to collect information about adverse anesthesia events are limited in dentistry. Moreover, given the fragmented regulatory environment and constant change of rules and laws, meaningful information

would be difficult to extract when analyzed as a whole across the country. While little is known regarding the effect of specific regulations in dentistry on safety, Dentist-Anesthesiologists, as experts in perioperative dental patient safety and anesthesiology, may provide insight to the functionality of existing laws by opining in regards to safety and access to care of selected regulations.

Chapter 2: Access to Care

Oral health related illnesses have been reported to result in approximately 6.1 million days of bed disability, 12.7 million days of restricted activity, and 20.5 million lost workdays each year according to the U.S. Department of Health and Human Services.[13] "Dental diseases, despite being largely preventable, remain a major public health problem across the world." [14] Vulnerable special populations are disparately affected as significant barriers to care exist within dentistry for these special populations. Vulnerable or Special populations include not only those patients with developmental or acquired disabilities, but also those with low-income, racial/ethnic minority groups, those residing in medically and dentally underserved rural and urban areas, children, and frail and functionally dependent older adults."[2] Patients with disability often face many difficulties in everyday life including architectural, transport, information as well as medical, psychological, legal, economic and social barriers.[15] The United States is not immune to oral health gaps according to the Center for Disease Control.[1] Not only are these marginalized groups experiencing barriers to gaining safe and timely access to oral healthcare, but they are also disproportionally affected by dental diseases.[16] An example of this includes that levels of dental caries in special populations are greater than in the general populations.[16]

"The Health Care Access Barriers Model (HCAB), provides a taxonomy and practical framework for the classification, analysis and reporting of those health care access barriers frequently faced by populations that exhibit adverse health disparities."[17] This model includes 3 main factors affecting healthcare access to care: "Financial—cost of care and health insurance status barriers; Cognitive—knowledge and communication barriers. Structural—including institutional and organizational barriers." [17]

Financial factors are often the focus of access to care discussions and study.[18] However, studies have recognized that "nonfinancial barriers were more common reasons for unmet need or delayed care than affordability barriers and most adults who experienced affordability barriers that led to unmet need or delayed care also experienced nonfinancial barriers."[19] Cognitive barriers are also well recognized in dentistry as a nonfinancial factor. The Academy of General Dentistry reports that "increased oral health literacy provides a first step toward enabling patients to see value and ask for services, and will inspire communities to consider positive oral health a priority they should work toward achieving."[20] However, structural issues relate to the availability of the provider (existence) but also the reach (ability to grow/expand in efforts to affect patient care) of the provider effects the treatment of patients that depend on that that type of provider. It is becoming more recognized that "the three categories of barriers are reciprocally reinforcing and affect health care access individually and in concert."[17] Thus, minor changes in the regulatory environment impacting structural changes can have some meaningful impact on the accessibility of care.

Chapter 3: Special Populations Dental Needs

The American Academy of Pediatric Dentistry defines special health care needs as "any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs."[21] People in the U.S. with a long-standing condition or disability represent "19.3% of 257.2 million people who were aged 5 and older in the civilian noninstitutionalized population—or nearly one person in five."[22] Studies have shown a growth of patients that can be identified as special needs. One pertinent example states that, "the prevalence of autism rose by 70% from 2002 to 2007 in California and has shown similar trends in others states."[23] It is important to note that special care populations include not only children, the intellectually disabled, the physically disabled, the psychological afflicted, those of age extremes, and the medically complex, but also minorities, the economically disadvantaged, and rural populations. The growing population of individuals identified with special health care needs requires not only providers but also certain additional services for successful treatment. It is paramount to note that "sedative medications and GA are necessities" for treatment many special patient populations. [22]

The literature supports that special care populations are underserved in dentistry. Indeed, the CDC reports that oral health disparities are profound in the United States. "Distinct oral health disparities and inequities continue to exist among low-income racial/ethnic minority groups, those residing in medically and dentally underserved rural and urban areas, and those with developmental or acquired disabilities, including frail and functionally dependent older adults."[24] These populations are growing. Their dental care supply is falling.

The US population in 2017 was 325,719,178 and the supply of dentists according to the 2018 ADA Health Policy Institute and the ASDA states that there were 198,517 total active dentists in the US with the following distribution: 158,992 General Dentists; 427 Dentist-Anesthesiologists; 7,546 Oral Surgeons; 7,778 Pediatric Dentists; 10,658 Orthodontists; 5,790 Periodontists; 3,708 Prosthodontists; 5,664 Endodontists; 827 Public Health; 426 Oral Pathologists; and 144 Oral Radiologists. This equates to roughly 60 dentists (any specialty) per 100,000 in US. However, the range per state was exceedingly variable ranging from as low as 40 dentists per 100,000 in Alabama to 83 dentists per 100,000 in Massachusetts. [25]

With respect to structural barriers, "of the factors that contribute to persistent oral health disparities in the United States, an insufficient oral health workforce figures prominently."[26] In a study that surveyed parents of children with disability, a large percentage of parents stated they did not know where to look for dental treatment of child which led to structural access to dental care barriers including long waiting times in spite of being conducted in an urban center, therefore "in the case of small communities (towns and villages) access to dental treatment of these patients is even more difficult."[15]

It has been suggested that there is an insufficient supply of dentists providing care to the special health care needs population and not necessarily a nominal supply of dentists. "The AGD recognizes that the distribution of dentists is a consideration to access to care in certain geographic locations. However, the AGD disagrees with Americans being labeled as "underserved" strictly by the ratio of dentists to number of persons in their localities, without regards to practice capacity, volunteer programs, and other important factors."[20] It is known, nonetheless, that the major barrier to treating patients in the community with special health care needs was the availability of general

dentists and specialists.[5] This disparity extends to and includes those general dentists that have undertaken additional postgraduate training for the treatment of these patients. “Many dentists who have completed hospital-based, general practice residency programs do not use all of the skills they have learned in their subsequent private practice careers. There is a tremendous need for dental treatment of patients with special needs in every community, especially with the aging population and increased longevity.”[3] “The most difficult barrier to oral healthcare that adult patients with special needs encounter is finding a dentist willing to treat these complex patients.”[4] It is important to understand that “poorer overall dental health and greater unmet needs were related to greater medical complexity.”[27]

Chapter 4: Reaching Special Populations through Dentist-Anesthesiologists

Dental Anesthesiologists are highly trained independent anesthesia providers that are qualified to provide anesthesia and perioperative medical services for the full scope of dental medicine. Dental Anesthesiologists are uniquely trained in both hospital operating rooms and ambulatory settings. They most often provide anesthesia services, including monitored anesthesia care, IV sedation, and general anesthesia for dental treatment in office-based settings and ambulatory care centers. The availability of this type of practitioner and services increases the availability of treatment for those patients who would otherwise face significant barriers to receiving treatment, including the possibility of not receiving treatment at all. According to Oral health in America: A report of the Surgeon General, "Barriers that can limit a person's use of preventive interventions and treatments include: Limited access to and availability of dental services, Lack of awareness of the need for care, Cost, and Fear of dental procedures."[13]

While financial factors are beyond the scope of this analysis, it important to recognize that studies have demonstrated that office-based General anesthesia provided by Dentist-anesthesiologists provides a viable "time- and cost-effective alternative that is associated with average adjusted cost savings of more than $5000."[28] The costly hospital Operating Room or facility fee is eliminated with the use of dentist-anesthesiologists in the dental office setting.[29] Thus, the availability of the Dentist anesthesiologists, as examined earlier, can address financial barriers in concert with structural barriers.

The Academy of General Dentistry believes that the role of the general dentist, in conjunction with the dental team, is of paramount importance to improving both access to and utilization of oral health care services.[20] The dental anesthesiologist is uniquely positioned to

assist general dental practitioners in providing needed care to special and underserved populations. However, general dental practitioners in the U.S. often know little about the use and availability of dental anesthesiologists' services likely due to barriers that have restricted their distribution. Pediatric dentists account for the largest percentage of dental General Anesthesia cases rendered by Dentist-Anesthesiologists.[8] Pham et al. noted that among pediatric dentists who use general anesthesia in their practices, the second largest rationale for not selecting a Dental anesthesiologist to provide the service was no access to them.[30] Grouping and adding other access-related rationales including state law prohibition of Dentist-Anesthesiologists, unfamiliarity of Dentist-Anesthesiologists, and complete unawareness of Dentist-Anesthesiologists would make accessibility-related barriers the primary reason for foregoing a Dental Anesthesiologist's services. Barriers can be attributed to significant regional differences in the use of General Anesthesia by dentists.[9,30] In many states, the regulatory environment restricts a dentist-anesthesiologist from practicing to the full extent of their training with regulations affecting mobility among office-based environments. The unequal distribution of dentist-anesthesiologists across the country hint at an external force limiting access to these providers.[10] "The types of cases and settings of practice may vary substantially. "This difference may be attributed to distinct laws regulating sedation and general anesthesia within each state."[8]

Research is required to further describe the practice environment of dentist-anesthesiologists and gain further perspective regarding the legal and regulatory requirements that dictate whether a general dentist is able to employ a dental anesthesiologist's service for the delivery of office-based anesthesia and their function as barriers to care for special needs populations.

Nonetheless, some studies have continued to report considerable difficulties and obstacles for special populations in the access to medical and dental care despite attempts at legal regulation.[15] While it is generally agreed regulations exist in and of themselves to promote patient safety, the special conditions under which regulations arise as well as the arbitrary use of regulations in healthcare can have significantly detrimental effects on the availability of care. If the regulatory environment creates a low supply among an environment where demand is growing, scarcity will ensue.

Chapter 5: Dental Regulation

It is well known that the legal scope of practice of a licensed healthcare profession is statutorily defined in each state's laws in the form of a practice act. The practice of dentistry is regulated primarily at the state level through dental practice acts--by a state board of dentistry or a larger state agency regulating multiple health professions, such as a department of health.[31] Dental practice acts are the purview of the state legislature. These practice acts define the practice of dentistry in state statute. However, standards of practice are typically delegated to an administrative state agency. In many cases these state agencies take the form of boards of dentistry. Often these boards of dentistry are under the jurisdiction of the state department of health. The board of dentistry serves to create, adopt, and enforce rules relating to the minimum standard of care. If practice standards are not specifically stated by the legislature in statute or by the board in rule, dentists may be held to the minimum standards of practice and conduct recognized by the dental profession as a whole.[31]

The purpose of dental regulation, as it is in all healthcare, is to "ensure that only licensed practitioners perform the defined tasks of a particular profession, to protect the public from unprofessional, improper, unlawful, fraudulent, or incompetent practice" and boards are typically "charged with licensing, regulating, and disciplining professionals within the scope of the applicable practice act."[32] The regulatory process is that of developing and adopting standards to help form expectations for safety among providers and consumers. [33]

Yet, the advancement and development of any discipline within healthcare occurs with significant overlap, often engaging in similar procedures and utilizing similar skills. The most detailed study comparing competencies for medicine, nursing, and dentistry conducted in 2005,

found that the three disciplines developed basic competencies and learning objectives that exhibit great similarities although they developed independently of one another.[34] Nonetheless, the method and application of those skills and procedures may differ based on other factors within the discipline, albeit continuing to maintain strict adherence to safety and the public good. Whereby it is just as unreasonable for dentistry to regulate medicine, as it is for medicine to regulate dentistry. Thus, inherent difficulties are evident in the regulation of healthcare professions, including their scope of practice.

"The current US approach to health professions regulation limits the best use of the health workforce due to problems including mismatches between professional competence and state-specific legal scopes of practice for some health professions, lack of uniformity in legal scopes of practice across states for some health professions, limited flexibility to support overlapping scopes of practice across health professions, and the slow and often adversarial process for changing state specific scopes of practice."[35] But modification of practice acts and regulations can formalize the changes occurring in education and practice of a profession due to research or advances in technology.[36] With an understanding of the practice environment, State legislatures adopt or modify practice acts and therefore adopt or modify a scope of practice of a healthcare profession. In line with the practice acts, state boards govern the qualifications for and practice of dentistry within the state.[31] They may additionally impose other restrictions.

Differing bodies are influential in the development of practice acts and rules. "In addition to governmental bodies at both the state and federal levels, private professional organizations such as the American Dental Association and state dental associations historically have had an impact on the regulation of the dental profession."[31] These private bodies represent their respective

members, paid by membership fees, in efforts to support their area of practice as being most in tune with patient safety. However, rather than engaging in collaborative efforts with other professional organizations to promote public safety, economically incentivized turf wars often ensue. While interprofessional turf wars are clear, the existence of intra-professional turf wars where more than one specialty overlaps in service offering can have similar confounding issues. "It is common for the membership of state licensing boards to be dominated by members of professional associations--often under the mandate of state law.[31.] As referenced by Troolin with the case point of Minnesota:

> "The Minnesota Dental Association, Minnesota Dental Assistants Association, or the Minnesota Dental Hygienists' Association shall recommend to the governor for each term expiring not less than two dentists, two licensed dental assistants, or two dental hygienists, respectively, who are qualified to serve on the board."[124]

These turf battles are often costly and time consuming for the regulatory bodies, the professions and the legislators involved. "Incumbent professions with more resources for advocacy can overpower emerging professions with more modest means."[35]

Chapter 6: Development of Dental Anesthesiology's Regulatory Environment

As noted above, a state's dental practice act and professional board rules have a rich source of influencing bodies. When studying the current scope of practice in any profession, the history and organizational development are important to consider.

Formal dental education was established in 1827 by Dr. John Harris, a medical doctor, in Bainbridge Ohio. Dr. Chapin Harris, a student of Dr. John Harris, recognized the need for professional oversight in dentistry. The formal establishment of Dentistry as a profession separate from Medicine came about from unsuccessful negotiations in 1837 and 1938 after Chapin Harris's proposal to include dental studies in its medical curriculum was rejected by the University of Maryland Medical College.[37] This led Dr. Horace Hayden to establish Baltimore College of Dental Surgery in 1840, the first dental college, awarding the Doctor of Dental Surgery Degree.[38] Without the creation of the Baltimore College of Dental Surgery, "dentists today would likely be physician odontologists or stomatologists and the need to distinguish the evolution of anesthesiology training between physicians and dentists would not be necessary."[37]

Subsequently, the United States began to see the establishment of dental practice acts to regulate the profession with the first occurring in 1841 in Alabama. The Jacksonian Democracy concept of "every man his own doctor" led many healthcare regulations during that time to be repealed, thus "with some limited exceptions, formal regulation of the healthcare professions occurred mainly after the Civil War."[39]

While the first American M.D. degree was awarded In New York, at Kings College in 1770, it was not until 1847 when 250 delegates representing more than 40 medical societies and 28 colleges met in Philadelphia to found the American Medical Association and represent the

interests of their members.[40] Similarly, although much smaller group, 26 dentists met in Niagra, New York to represent and promote the interests of dentists, to subsequently establish organized dentistry with the founding of the American Dental Association in 1859.[41]

It is important to recognize, the use general anesthesia services in dentistry spans its entire history. From the inception of the use of Nitrous Oxide to accomplish dental procedures by the dentist Horace Wells in the 1840s, through the successful demonstration of general anesthesia with ether by the dentist William Morton for the removal of a neck tumor by physician surgeon John Collins Warren in 1846. For the next century, physicians and dentists together advanced the practice of anesthesiology in collaboration, commencing with inception of the term "Anesthesia" November 21, 1846 by Oliver Wendell Holmes, MD in a private letter to William Morton.[42,43]

It should be further noted that distinctions in the environment of practicing anesthesia by dentists and physicians only led to further advancement of the whole specialty of anesthesiology. In fact, during the era at the turn of the 20th century and into the 1950s, Dentistry was recognized as the qualitative and quantitative leader in the provision of anesthesia.[44] Dentists had gained significant experience with General Anesthesia using ambulatory and office-based anesthetics as many dentists administered thousands of anesthetics annually in their own offices, while there were only a few hundred medical anesthesia providers in the country practicing in hospital environments.[37] Given their experience with general anesthesia, dentists were often part of hospital staff and even headed general anesthesia departments such as Chief of General Anesthesia Harry M. Seldin, DDS at New York University between 1926-1931.[45] There was reciprocal education, where physicians often taught the art and science of anesthesiology to dentists, and dentists, likewise taught it to many physicians.[42]

Nonetheless, anticipating the growing tension between the disciplines and the role of organizations in the shaping of the regulatory environment of healthcare, Charles Tetor, DDS reported before the Northeastern Dental Association in October, 1910 "There will come a time in this country soon, when there will be laws passed to restrict the administration of anesthetics and it behooves the dental profession to see that anesthetics arc given a prominent place in the curriculum of our colleges ... Each one (of our dental students) should have not only a theoretical knowledge, but a practical one, for confidence and skill only come by practical experience."[46]

Despite the apparent collegiality, political motivations and differences developed and became ever more apparent through the movements of organized societies. The first professional anesthesia society, Long Island Society of Anesthetists, that was formed in 1905 with a membership body of 9 physicians; it would later grow to physician representation of 1,977 and become the American Society of Anesthesiologists (ASA) in 1945.[47]

Following the formation of the ASA, more than 100 years of collaboration between dentistry and medicine in Anesthesiology was all but destroyed. As the ASA became a more powerful advocate for physician anesthesiologists in the 1950s, unrestricted membership for dentists was rescinded. Subsequently, several dentists and former members of the ASA, including William Kinney DDS, Daniel Lynch DDS, and Leonard Monheim DDS, realized that dentistry needed a platform from which to address anesthesia issues.[37] In 1953 the American Dental Society of Anesthesiology (ADSA) was formed in Pittsburgh. Once again, a warning was given to Dentists, this time by Dr. Sterling Mead president of the ADSA in 1956. "It was pointed out at that time that unless dental schools and the profession awoke from their lethargic state, that dentists would find themselves deprived of the right to administer general anesthesia."[55]

Lobbying efforts by the ASA rapidly led to regulatory change that not only limited the ability for dentists to acquire anesthesiology training but also practice anesthesiology as had been developed for dentistry and in the method most applicable to the discipline. By the late 1980s, many residency positions in the that were once held by non–oral surgery resident dentists were no longer made available to dentists.[48]

In recognition of medicine's attack on the practice of anesthesiology by dentists, as well as intra-professional conflict regarding the best strategy to maintain anesthesia in dentistry, efforts were made by dentists to establish a better a positional stronghold for a specialty of anesthesia in dentistry based on the principles of education, safety and training. The formation of The American Society of Dentist Anesthesiologists (ASDA) founded on February 16, 1980, by dentist anesthesiologists James Chancellor DDS, Ralph Epstein DDS, James Snyder DDS, John Leyman DDS, and Lois Jacobs DDS, with all 17 initial members having completed the required minimum of 2 years of dedicated hospital anesthesiology residency training.[42]

Intra-professional discord and failed strategies to maintain control of the scope of practice of "anesthesia" in dentistry by the American Association of Oral and Maxillofacial Surgeons (AAOMS) further confounded the scope of practice and regulatory purview of anesthesia in dentistry. As noted by ADSA president Peter Jacobsohn, DDS "even within the profession of dentistry there have been roadblocks to the growth and progress of dental anesthesiology."[56] AAOMS passed resolutions in 1988 and 1989 strongly opposing the establishment of the specialty of dental anesthesiology.[42] For the next 30 years ASDA and the AAMOS would relentlessly debate regarding the "need" for a dental specialty of anesthesiology. AAOMS continued to vigorously

oppose the creation of an anesthesiology specialty with votes against it when brought before the commission of dental accreditation in 1993, 1997, 1999 and 2012.[49]

All the while, making use of this internal strife, the ASA continued to advance their projected role as the de facto experts in all matters anesthesiology, influencing both state and federal regulatory bodies from state boards to federal payment agencies such as the centers for Medicaid and Medicare services. Today, the ASA has more than 46,000 members.[50] The ASA has lobby efforts of $29,984,000 since 1998 and additional contributions of $23,782,468 Since 1990, according to Opensecrets.org the center for responsive politics.[51] This figure dwarfs AAMOS's (the largest dental specialty group with nearly 10,000 members) political efforts and lobbying amounts of $2,783,200 since 1998 and $4,903,380 in contributions since 1990.[52] Likely due to its minute size with less than 270 members, the ADSA numbers are not available.

On March 11, 2019, Dental Anesthesiology was ratified by the American Dental Association associated National Commission on Recognition of Dental Specialties and Certifying Boards as the 10th specialty of dentistry.[42]

Chapter 7: Safety and Dental Anesthesiology

Anesthesiologists have been addressing safety since the beginning of anesthesia care. This commenced with the often-cited death of Hannah Greener, a fifteen-year-old girl, who died during a toenail removal under anesthesia in 1848. The case has been studied at length with various authors contributing to determine the cause of death in efforts to improve anesthetic care. John snow wrote, "Two minutes from the commencement of the operation she was quite dead."[53] Most important to the modern safe practice of anesthesia relates to the lack of monitors, knowledge, training, and access to help.[54]

Even early on, recognizing the integral relationship between safety and anesthesia, dentists were instrumental in the development of modern anesthesia techniques and safety standards. Charles Tetor, DDS and Jay Heidbrink, DDS pioneered many of the modern anesthesia techniques and safety standards employed today. In fact, it was Dr. Tetor that in 1902 introduced the first anesthesia machine. This machine enabled the delivery of N2O/O2, ether, and chloroform in efforts to avoid hypoxic mixtures, regulate and titrate anesthetic dosages, and mind attention to other physiological processes such as humidity and positive pressure ventilation and included improvements in the form of additional "monitors" with the use of mercury columns to observe the flow of inhalational agents.[37] Furthermore, it was Dr. Heidbrink that set out the first color code for anesthesia gas tanks and invented the pin index safety system.[37] All these modalities are still in use today to improve the delivery of safe anesthetic care.

The anesthesia safety movement was formalized in the literature with the establishment of the Anesthesia Study Commissions in the 1940s intended to review fatality cases to determine whether the deaths were preventable. It was noted at the time via these studies that "anesthesia

accounts for a large number of preventable deaths, often in good risk patients undergoing minor surgery," and that "the anesthesia study commissions are beginning to close a serious gap in medical sciences."[57] It should be emphasized that this analysis was based on "operating room" fatalities in hospitals.

Since that first systematic review, many examinations of anesthesia morbidity and mortality have been published. Nonetheless, these reviews, with limited exception, focused on hospitalized patients. As noted by Beecher and Todd when deciding over community anesthesiologists in 1954, "In choosing university hospitals we wanted to get as much uniformity in the material of the participating hospitals as possible."[58] Even in light of the uniform environments of these studies, "substantial differences in methodology make it very difficult to compare anesthesia-related mortality rates among studies."[59]

Nonetheless, this data can be used to help identify factors involved in the perioperative anesthesia environment in efforts to improve safety. In 1978 Cooper et al sought to identify the characteristics of human factors and equipment failure that contributed to critical anesthetic incidents in the teaching hospital environment.[60] This study served as the foundation for modern safety practices in anesthesia with a basis borrowed from the aviation industry. The study was conducted via interviews of involved anesthesia practitioners in efforts to discover, list and classify for pattern analysis. This study identified both human error categories as well as equipment failures that would serve as the basis to develop strategies of prevention. Human errors included ventilation/breathing/circulation; drug administration; anesthesia machine use; airway management; IV apparatus use; monitoring; fluid management and other. Equipment failures included monitor, breathing circuit, airway components, laryngoscope, anesthesia machine, and

other. The study further detailed the most frequent incidents that included in descending order: Breathing circuit disconnection, inadvertent gas flow change, syringe swap, gas supply problem, intravenous apparatus disconnection, laryngoscope malfunction, premature extubation, breathing circuit connection error, hypovolemia, and tracheal airway device position changes.

Thereafter, mostly through hospital-based studies, human errors and/or the failure to recognize error and events continued to be revealed as the main culprits of anesthesia morbidity and mortality. Thus, an emphasis on monitoring standards in anesthesia proceeded to develop. Following a review of 1,001,000 ASA Physical Status I and II patients from 1976 through mid-1988 in component hospitals of the Harvard Department of Anesthesia, John Eichhorn supported "that nearly all the inevitable mishaps (technical or from errors in judgement) that occur during anesthesia can be identified through safety monitoring early enough to prevent most major patient injuries."[61]

Ultimately, Eichhorn's study set the standard at Harvard that would officially become the 1986 ASA's standards for basic anesthesia monitoring and serve as mandatory guidelines for minimal safety monitoring. The goals for the standards were to (1) To improve patient care, thereby reducing the number of adverse outcomes arising from anesthesia accidents., (2) enhance detection of relatively low-frequency events, using principles derived from a large collective experience (3) To provide a means for objective evaluation (4) To establish a precedent for anesthesia risk management.[62] To date, these standards included and continue to include (last amended 2015) both the required the presence of "qualified anesthesia personnel" and continual evaluation of oxygenation, ventilation, circulation, and body temperature.[63]

The Institute of Medicine report, "To Err is Human: Building a Safer Health System" reports that an estimated 44,000 to 98,000 people die each year in the United States as a result of preventable medical errors.[33] However, steps designed for the practice of anesthesiology have been instrumental to addressing human errors. The profession of anesthesiology as a whole as been noted as "the only system in health care that begins to approach the vaunted 'six sigma' level of perfection."[64] "The application of this concept over the past 20 years has dramatically improved the safety of anesthesia and provided an excellent model for the rest of medicine."[65]

A question arises with regard to what exactly is a qualified anesthesia personnel that may be the model for excellent care. Given the literature, timing, study methodology, and settings that gave rise to safe anesthetic care, the assumption proposed that anesthesia safety can only be achieved in a hospital setting under the direction of a physician anesthesiologist. In fact the statement regarding the anesthesia care team put out by the ASA in 2019 dictates that a physician anesthesiologist is one that serves as "Director of the Anesthesia Care Team" and is "a physician licensed to practice medicine who has successfully completed a training program in anesthesiology accredited by the ACGME, the American Osteopathic Association, or equivalent organizations." The same statement includes reports on care rendered by Oral and Maxillofacial Surgeons (albeit neglects to mention that provided by Dentist-Anesthesiologists), as that anesthesia care that is administered by "Non-Anesthesiologist Physicians."[66]

Furthermore, incorrect and sensational extrapolations from the official ASA statements have been used to the detriment of both dentists and dental patients that may receive the anesthetic care from an anesthesiology trained dentist. It is important to recognize "that the use of mass media reports as a source of information and influence in health utilization for the general public

and medical professionals has been well described."[67] In the web post "Why are kids dying at the dentist" Marjorie Stiegler MD questions what a dentist's anesthesia training is and reports that there is significant confusion among the general public.[68] A prevailing bias against dentist-anesthesiologists rendering safe anesthetic care is denoted by the ASA statement juxtaposed statements such as "it seems ludicrous that the same standard of care is not used for sedation and anesthesia in all situations anywhere it is administered. There is nothing inherently different about "dental" sedation/anesthesia versus any other sedation or anesthesia."[69]

Indeed, the ASDA has published and continually updated it's a parameters of care which "include standards, guidelines, and management strategies to assist dentist anesthesiologists in maximizing the safety and comfort of patients while minimizing risk and discomfort."[70] Within these guidelines specific recommendations are given regarding the Monitoring and Intraoperative Management, Patient Evaluation and Preparation, Recovery and Discharge, and Emergency Management are delineated that are and have been in line with the ASA statements and guidelines for the corresponding subjects.[71] Additionally, other described parameters by the ASDA regarding personnel and venues of anesthetic care not inconsistent with the ASA.

Thereby, if the clinical standard of care, including but not limited to monitors, has always been a part of dental anesthesiology, a comparison regarding quality of care with respect to the setting should be addressed. While dentists had been routinely using anesthesia out of the OR since inception, physicians have only recently begun to report on its use in those settings. A 2018 study comparing office-based for Dental/Oral Surgery by Office-based Dentist Anesthesiologists versus operating Room-based Physician Anesthesiologists found that anesthesia rendered by dentist anesthesiologists is clearly a unique mode of anesthesia care carefully crafted for

dentistry.[72] However, it has been reported that there is a "lack of oversight and regulation" that compromises a fundamental difference between an Office based surgical facility and a hospital or ambulatory surgery center (ASC) and that the environment is akin to the "wild wild west of healthcare."[73,74] It is also noted that "many [physician] anesthesiologists who embark on office-based practices have no training or prior experience in that type of environment."[73] While Office based anesthesia (OBA) has been the dentist's main arena of performing anesthesia, physicians are now advocating that "the ability to deliver OBA must be in the repertoire of current and future anesthesiologists."[75] "Performing procedures outside of the OR creates a new set of challenges for anesthesiologists."[76] In fact it is recognized that "the ability to perform surgery in an office strongly correlates with improvement in delivering safe and effective office-based anesthesia (OBA)."[75] Regarding the safety of the mobile anesthesia provider, they report that the mobile anesthesiologist is one "who brings all necessary equipment and medications to safely anesthetize patients."[75] It is well recognized that physician "anesthesiologists must be taught how to evaluate the safety of an office-based practice and must have knowledge regarding the regulatory and accreditation requirements of particular states; the rules that apply to the physical design, equipment, and supplies; and the protocols for emergencies and quality improvement."[73]

One special consideration to compare hospital care and the office based environment with respect to patient safety is its relation to medical errors and nosocomial infections. Health-acquired infections are prevalent and a tremendous burden to patients, including a 6% mortality rate, as well as a burden on the health care system and the nation's scarce resources.[77] "The Centers for Disease Control found that 4% of patients in acute-care hospitals had at least one health care-associated infection, more than half of which were not associated with devices or operative procedures."[78]

"Pneumonia currently has the highest morbidity and mortality rates of all nosocomial infections, is hypothesized to account for 15% of all hospital-acquired illnesses"[79] It is also known that the incidence of hospital acquired pneumonia and pulmonary complications increases substantially with mechanical ventilation in the hospital settings.[80] It is additionally important to address the issue of non-anesthetic medical errors. Medical errors during hospitalization have been described to be the 3rd leading cause of death in the United States and represents over 400,000 deaths a year.[81] "In stressed and high-throughput systems, periodic overcrowding (high bed occupancy) and understaffing (low nurse:patient ratio) are widely described risk factors for nosocomial infections."[82] Many of those reasons are also implicated in non-anesthetic medical errors. However, while not unreasonable, "very few studies have been able to confirm that a nosocomial transmission occurs in dental settings."[83] Given its high risk of exposure to blood, body fluids, excretions, and/or secretion, dentistry is well attuned to infection control and employs "Standard Precautions" combined and expanded the elements of Universal Precautions and body substance isolation into its standard of care to protect clinicians and patients from pathogens.[84] "Transmissions of blood-borne pathogens (BBPs) in a dental health care setting have rarely been reported, particularly since routine hepatitis B virus (HBV) vaccination of dental health care personnel (DHCP) and universal precautions were recommended (1982 and 1987, respectively)."[85]

"An additional complexity to safely providing OBA is the appropriate selection of patients."[75] "The most complex variable is the patient, whose comorbidities determine whether a procedure may be performed in an ambulatory facility."[86] Although the ASA classification was not created originally as a predictive index of perioperative risk, it has been used as a proxy for risk in several studies.[86] "The ASA recommends that patients who are American Society for

Anesthesiologists Physical Status (ASAPS) I and II are suitable candidates for OBA and that patients who are ASAPS III have a face-to-face consultation with the anesthesiologist before the day of the procedure to determine suitability."[73] It is important to note that in a study comparing the assessments made by physicians with those done by Dentist-Anesthesiologists prior to general anesthesia for pediatric dental care, no significant difference was noted between the physicians' and dentist anesthesiologists' ratings of ASA physical status. The same study further demonstrated "there was a statistically significant difference with respect to 10 of 17 sections examined, with the community-based physicians' H&Ps tending to be incomplete more often," as well as, "over 20% of community-based physicians made no mention of the history of present illness and 1/3 all physician H&Ps were missing vital sign recordings."[87] Moreover, the training in order to assess and perform anesthesia by dentists is part of the core curriculum components that exist for of both the Oral and Maxillofacial Surgery and Dental Anesthesiology residency programs; this provides an educational pathway for establishing clinical competence.[88]

Because limited data exists further comparing the anesthetic care of physician and dentist-anesthesiologists, given that the OBA setting is different from the hospital (used to create the standards employed by the ASA), outcomes evidence can be used as a proxy to assess the safety of dental anesthesia as provided by dentists. Alia El-Mowafy writes "Although the studies on mortality for deep sedation and GA in the dental office have their limitations, the published rates are low. The evidence in the literature supports that the practice of anesthesia within the dental setting is safe."[89] In a review of 20 studies from 1955 to 2012 focusing on death related to dental anesthesia, only 218 deaths in 71,435,282 patients (3 deaths per 1,000,000 persons) were found with the mortality rate being 1:327,684.[90] This figure in line with anesthesia deaths altogether,

with roughly 4 deaths per 1,000,000.[91] A complication rate of 0.4%–1.5% for all types of anesthesia administered in the office based setting by Oral and Maxillofacial surgeons has been reported.[92] It is also important to note that Dentist-Anesthesiologist's patient pool includes treatment of populations with special needs which could theoretically create complications that do not necessarily compare with preestablished models for anesthetic risk; however a study by Boynes et al. determined that the types of complications and rates were similar to data from general population studies.[93] The most comprehensive study to examine clinical outcomes of OBA performed by dentist anesthesiologists on dental patients aged 0-21, concluded "strong clinical outcomes data to support the safety of OBA as performed by dentist anesthesiologists."[7]

Chapter 8: Training Differences Among Dental Anesthesia Providers

Training differences between Physician Anesthesiologists, Dentist-Anesthesiologists, and Oral and Maxillofacial may reflect the practice environment of the different anesthesia providers. As mentioned earlier, each field developed in response to the demand of its own operating environment, however a comparison may be possible via procedural training requirements. Given the wide scope of experiences during residency training, specific procedural requirements of each discipline can be used to roughly address the adequacy of anesthesiology training specifically necessary to the dental field which includes: emergency medical management, airway skills, pediatric anesthesia management, and special needs patient anesthesia management.

According the 2019 the Accreditation Council for Graduate Medical Education (ACGME) physician anesthesiology training requirements includes 36 months of residency training in clinical anesthesiology in addition to an initial 12 months of "fundamental clinical skills of medicine" training after completion of an accredited medical school. The 36 month of clinical anesthesiology includes a minimum of 2 months of critical care, research months, and an unannounced number of elective rotations It unclear exactly how many of those months are dedicated to strict anesthesia clinical care and often depends on the institution of training. During the physician anesthesiology training program, residents must demonstrate competence in pediatric anesthetic management of 100 patients younger than 12 years of age with 20 of those children being younger than 3 and five less than 3 month of age. They are required to be involved in the care for 20 patients presenting for initial evaluation of pain. Physician anesthesiology trainees are also required to be involved in the obstetric anesthetic care of 40 patients undergoing vaginal delivery and 20 patients undergoing c-sections. Training requirements for Cardiac anesthesia include 20 patients undergoing cardiac

surgery with 10 of these patients involving the use of cardiopulmonary bypass. Anesthesia training in vascular surgery requires 20 patients undergoing open or endovascular procedures on major vessels. Non-cardiac intrathoracic surgery requirements for physician anesthesiologists requires care of 20 patients undergoing, including pulmonary surgery and surgery of the great vessels, esophagus, and the mediastinum and its structures. There is a neuro-anesthesia requirement that includes care of 20 patients with intracerebral procedures. Anesthetic care of 20 patients undergoing procedures for complex, immediate life-threatening pathology is required. There is a neuraxial and regional anesthetic care requirement that includes epidural anesthetic care of 40 patients, spinal anesthetic care of 40 patients, and peripheral nerve blocks in 40 patients. Although no specific procedural quantity requirement is listed, physician anesthesiology training must include specialized techniques and a broad spectrum of airway management techniques, to include laryngeal masks, fiberoptic intubation, lung isolation techniques, central vein and pulmonary artery catheter placement, transesophageal echocardiography, evoked potentials, use of electroencephalography (EEG) or processed EEG monitoring, surface ultrasound, and transthoracic echocardiography. Training must additionally include patients with acute post-operative pain and patients undergoing a variety of diagnostic or therapeutic procedures outside the surgical suite.[94]

While, it is assumed that actual training procedure numbers listed above for physician anesthesiologists often exceed the minimums, it is also important to note that this minimum is a sum of 400 anesthetic procedures with no differentiation between levels of anesthesia, i.e. general anesthesia, deep sedation, moderate sedation or mild sedation. Moreover, it is evident that there is no quantifiable out of OR or office-based anesthesia training requirement. It important to note

that the dental environment does not routinely employ obstetric, cardio-thoracic surgery, or neuraxial/regional anesthesia below the neck.

Like Physician Anesthesiology training, Dentist-Anesthesiology training approved by the Commission of Dental Accreditation (CODA) requires completion of a 36 month Clinical Anesthesiology training program. At a minimum, a total of 24 months over a 36 month period must be devoted exclusively to clinical training in anesthesiology, of which a minimum of 6 months are devoted to dental anesthesiology. Additionally, residents must be assigned full-time for a minimum of 12 months over a 36 month period to a hospital anesthesia service that provides trauma and/or emergency surgical care. With respect to minimum procedure counts, Dentist-Anesthesiologists are required to complete the following: a 800 total cases of deep sedation/general anesthesia. Of these cases, 300 are required to be intubated General Anesthetics with 50 included as Nasal intubations and 25 incorporating advanced airway management techniques. Advanced airway management techniques include but are not limited to the following devices and techniques: blind nasal intubation, bougie, fiberoptic intubation, intubating laryngeal mask airway (LMA), light wand, and video laryngoscopes. Of the 25 advanced airway techniques, no more than 10 can be blind nasal intubations. Furthermore, Dentist-Anesthesiologists are required to anesthetically manage 125 children of age 7 and under. Additionally, there is a requirement to treat 75 special needs patients. While no numerical requirements are listed, the case distribution should include ambulatory patients, geriatric patients, patients with physical status ASA III or greater, patients requiring moderate sedation, and patients with chronic orofacial pain.[95]

It is also important to discuss the differences between anesthesia providers in dentistry. Within dentistry "dentist-anesthesiologists are unique anesthesia providers." "The anesthesia care

provided by dentist anesthesiologists is separate and distinct from anesthesia provided by oral and maxillofacial surgeons primarily because dentist-anesthesiologists do not use the operator-anesthetist model as their primary method of delivering anesthesia care," and care rendered by Dentist-anesthesiologists is significantly longer in duration with patients that are much younger.[70,72] OBA provided by Oral and Maxillofacial surgeons is usually of short duration for minor dentoalveolar surgery. Oral Surgeons performing OBA procedures that are more involved and/or longer often work in conjunction with another anesthesia trained provider or at the hospital. As such, there are training differences in the requirements for the two main dental specialty anesthesia providers.

Oral and Maxillofacial Surgery training programs approved by the Commission of Dental Accreditation (CODA) require an anesthesia rotation assignment for a minimum of 5 continuous months, including one of these dedicated to pediatric anesthesia, in addition to the administration of anesthesia during oral and maxillofacial surgery procedures throughout the program's total 48 month Oral and Maxillofacial Surgery residency requirement. The administration of general anesthesia/deep sedation is required for a minimum of 300 cases. This experience must involve care for 50 patients younger than 13. A minimum of 150 of the 300 cases must be ambulatory anesthetics for oral and maxillofacial surgery outside of the operating room.[96]

Chapter 9: Regulation of Dental Anesthesia

Given the dental environment's specificity of anesthesia training for the oral and maxillofacial surgeon and dentist-anesthesiologist, all other things being equal, it is these providers that may best be suited to perform anesthesia in the dental environment under their appropriate conditions. However, as noted above, a variety of professional environment circumstances as well as safety considerations are uniquely applicable to the regulation of anesthesia care in dentistry. The evolution of a particular's state regulation of dental anesthesia care is a product of lobbying influence professional organizations, other federal or state laws and rules, an understanding of anesthesia provider training, an understanding of the practice environment, and reactions to adverse events including attempts to mitigate such events in the future.

In efforts to organize a regulatory framework for analysis, the author performed an exhaustive review of state regulations and dental practice acts as they pertain to the delivery of general anesthesia services in dentistry.[102-151] During this review, four categories where anesthetic care was regulated emerged that could roughly allocate the vast variety of state regulations in existence today. Disciplinary action was excluded from analysis. It is important to understand, that given the evolving nature of these laws, regulations, and rules it is difficult to express that any one law used as an example is active at the time of this writing. A state by state approach of listing laws in each category or categorizing states on a scale would be inappropriate. It is important to review the verbiage of each law class in context, as difference in use may redirect its interpretation. Nonetheless, taken in and of itself, at any given specific point, a "law" of dental anesthesia regulation may fit into one of the following categories: Mobility factors, Facility factors, Treatment Requirements, and Competition factors.

Mobility Factors:

This category contains rules and regulations that would affect the mobility of anesthesia personnel between various facilities and/or dental providers. These laws are further subdivided into Provider-related regulations and Permanence of equipment and supplies.

Provider-related regulations are those that relate to requirements placed on the clinical provider before engaging in the anesthetic care of dental patients. It is important to note a dichotomy in the provision of anesthetic care in dental patients. Providers of can either be the anesthesiologist or the treating dentist. In the case of the operator-anesthetist, the treating dentist is also the anesthesiologist. These regulations are generally composed of an educational/training accomplishment component which serves to define the allowable sedation permit level for which that provider may apply, as well as additional continuing education requirements.

Some states such a Florida have clearly stated regulations for the treating dentist versus the anesthesiologist. In Florida, for instance, treating dentists can only engage in the anesthetic care of dental patients in their own facility if permitted to a level of sedation themselves before using a physician anesthesiologist or additional permitted dentist. The physician anesthesiologist or GA permitted dentist can sedate to any level needed regardless of the level of permitted treating dentist. If the permitted treating dentist choses a qualified anesthetist (e.g. CRNA), anesthesia may only be delivered to the level of the permitted treating dentist. Alternatively, the treating dentist may treat sedated patients without any level of sedation permitting only at the facility of a permitted dentist and only if and ascribed number of continuing education hours in sedation and airway management have been completed by the treating dentist.[110]

Rules and regulations regarding the mobility or permanence (not existence) of anesthesia equipment and supplies is found in several states. For instance, states such as North Carolina, account for "Itinerant providers" whose equipment and supplies are able to be mobile and transported to the office of another provider.[134] Other states, such as Georgia, specifically require "all of the aforementioned equipment, drugs, and supplies must be stationary and not subject to transfer from one facility to another."[111]

Facility Factors:

Facility factors are those factors inherently linked to the existence or operation of the facility. This category includes four subcategories: Staffing, Permitting, Examinations, and Structural requirements.

During the development of safety standards in anesthesia, the availability of sufficient and properly trained staff was significant. Under normal circumstances, the hospital environment has an army of readily available and well-trained nurses and personnel, as well as additional anesthesiologists, to be used in an emergency situation. However, in the office-based environment this factor can be quite variable given that, theoretically, an operator-anesthetist only requires two people: the patient and the doctor. Thus, rules and regulations regarding staff is common across states. Staff laws can be further subcategorized into those that specify minimum numbers and those that specify staff's training requirements. An example of a law regarding staff numbers and training can be found in Maine where "during the administration of deep sedation or general anesthesia, the operating dentist and at least two other individuals, one of whom is experienced in patient monitoring and documentation, and trained to handle emergency situations, must be present."[120] Specific training requirements are also found in some states such as Indiana, where

the administration of general anesthesia requires "at least two (2) persons who are employed in the dental office" or who are licensed dental hygienists and states that "all such persons who are members of the anesthetic team shall be trained and currently competent in basic life support."[115]

Another subcategory relates to giving notification to the board with or without the requirement of an issuance of a permit by the board to use anesthesia at a particular location is often used in dental anesthesia regulations. These laws are seen in a variety of formats. For instance in Ohio, no facility permit is required however, an itinerant dental anesthesia provider is requested to give "written notification within ten days to the Ohio state dental board if anesthesia services are provided at any new facility(s) other than those already listed with the Ohio state dental board." Moreover, in the case that a physician anesthesiologist is used, then the "operating dentist shall provide advanced written notice to the Ohio state dental board that general anesthesia/deep sedation services are provided at his or her facility by a physician anesthesiologist."[136] Other states such as Massachusetts require that "prior to the administration of general anesthesia or deep sedation in a dental office, a Facility Permit D-A must be obtained by the qualified dentist for each office site where general anesthesia or deep sedation is to be administered, including the offices of dentists who work with a qualified medical or dental anesthesiologist."[122]

Facility inspection with and without examinations and/or general anesthesia procedure observation are also commonly found. In states such as Tennessee "an on-site inspection to determine if a dental facility is equipped to support the provision of anesthesia/sedation services."[143] Some states such as Oklahoma require a more comprehensive evaluation inspecting

and examining "the knowledge, techniques, procedures, facilities, drugs, equipment and personnel utilization of every dentist who administers general anesthesia (including deep sedation)."[137]

Last of the facility factors, some states detail structural requirements for a dental facility in order to administer general anesthesia. For instance, Kentucky requires and inspects the facility for specific details including:

> "an oxygen and gas delivery system with a backup system fail-safe; a gas storage facility; a safety indexed gas system; suction and backup system; an auxiliary lighting system; suitability of operating room to include: a. size, which shall be at a minimum ten (10) feet by eight (8) feet or eighty (80) square feet; b. Operating primary light source and secondary portable back-up source, unless back-up generator is available; and c. accessibility by emergency medical staff; as well as a Recovery area that includes oxygen, suction, and visual and electronic monitoring, which may be in the operating room itself."[118]

Treatment Requirements:

Regulation of treatment requirements relates to actual factors affecting tha actual practice of General Anesthesia care. This category incorporates 4 subsections including: a listing of equipment and supplies, pre-operative care requirement, perioperative care and monitoring guidelines, and some form a recovery/discharge criterion.

It is not uncommon that state regulations may require the availability of specific equipment and supplies. Please note the availability does not necessarily require the permeance of said equipment and supplies. Some states such as North Carolina create a detailed inventory including:

> "a CPR board or dental chair without enhancements, suitable for providing emergency treatment; lighting as necessary for specific procedures and back-up lighting; suction

equipment as necessary for specific procedures, including non-electrical back-up suction; positive pressure oxygen delivery system, including full face masks for small, medium, and large patients, and back-up E-cylinder portable oxygen tank apart from the central system; small, medium, and large oral and nasal airways; blood pressure monitoring device; EKG monitor; electrocardiograph; pulse oximeter; defibrillator; precordial stethoscope or capnograph; thermometer; vascular access as necessary for specific procedures, including hardware and fluids; laryngoscope with working batteries; intubation forceps and advanced airway devices; tonsillar suction with back-up suction; syringes as necessary for specific procedures; and tourniquet and tape" and "the following unexpired drugs shall be maintained in the facility and with access from the operatory and recovery rooms: (A) Epinephrine; (B) Atropine; (C) antiarrhythmic; (D) antihistamine; (E) antihypertensive; (F) bronchodilator; (G) antihypoglycemic agent; (H) vasopressor; (I) corticosteroid; (J) anticonvulsant; (K) muscle relaxant; (L) appropriate reversal agents; (M) nitroglycerine; and (N) antiemetic."[134]

A limited number of states have specific requirement regarding preoperative care and/or monitoring. While some states have a general requirement regarding the practice at the standard of care, other states such as New York clearly list practice requirements. For that state, these preoperative requirements include:

"a written and oral medical history, consultation with the patient's physician, as appropriate, for patients ASA III (a patient with severe systemic disease, according to the American Society of Anesthesiologists [ASA] patient physical status classification system) or greater; preoperative instructions shall be given to the patient, parent, escort, guardian

or caregiver; preoperative dietary restrictions shall be considered based on the anesthetic/ sedative technique planned; the patient, parent, guardian or care giver shall be advised regarding the procedure associated with the delivery of any sedative or anesthetic agents and informed consent for the proposed anesthesia/sedation shall be obtained; a focused physical evaluation shall be performed as deemed appropriate; baseline vital signs shall be obtained unless the patient's behavior prohibits such determination and in any such case, this fact shall be noted in the time-oriented anesthesia record; determination of adequate oxygen supply and equipment necessary to deliver oxygen under positive pressure shall be completed; and an intravenous line, which is secured throughout the procedure, shall be established. If, due to lack of patient cooperation, the intravenous line cannot be maintained throughout the procedure, the inability to maintain such shall be documented in the anesthesia record."[133]

Intraopertive or monitoring requirements for New York include:

"oxygenation: color of mucosa, skin or blood shall be continually evaluated; and oxygen saturation shall be evaluated continuously by pulse oximetry; Ventilation: intubated patient: end-tidal CO2 shall be continuously monitored and evaluated, non-intubated patient: breath sounds via auscultation and/or end-tidal CO2 shall be continuously monitored and evaluated; respiration rate shall be continually monitored and evaluated; and when agents implicated in precipitating malignant hyperthermia are utilized, end-tidal CO2 shall be continuously monitored and evaluated; Circulation: the dentist shall continuously evaluate heart rate and rhythm via ECG throughout the procedure, as well as pulse rate via pulse oximetry; and the dentist shall continually evaluate blood pressure;

Temperature: a device capable of measuring body temperature shall be readily available during the administration of deep sedation or general anesthesia; and when agents implicated in precipitating malignant hyperthermia are utilized, continuous monitoring of body temperature shall be performed."[133]

Recovery and Discharge criteria is not uniformly found throughout states. In fact, many states do not address the issue. New York, however, is also one of the states that lists specific Recovery/Discharge criteria. The regulation states:

"the recovery and discharge of the patient is the responsibility of any of the following: the licensed dentist providing the anesthesia/sedation management for that patient, another licensed dentist with a anesthesia/sedation certificate permitting him or her to provide the same level of anesthesia/sedation administered to the patient treated or a licensed physician with the appropriate anesthesia training. Prior to discharge, the patient shall meet the following discharge criteria, which shall be documented in the patient's chart: alert and responsive; patient can maintain and support his or her airway without intervention; vital signs, including oxygenation on room air, are within acceptable limits; patient is ambulatory with assistance; responsible adult escort is present to escort the patient from the office; written and verbal instructions are given to patient and responsible adult escort. These instructions shall include a way for the patient/guardian to communicate with the anesthesia provider or provider of dental care in case of an emergency or adverse reaction; and prior to discharge, evaluation of the patient's pain and post-operative nausea and vomiting (PONV) shall be done. The results of these assessments and management shall be documented in the patient's chart."[133]

Competition Factors:

There are regulations and differences regarding competition factors for dental anesthesia. These competition factors are regulations that impose a financial or competitive disadvantage to the practice of dental anesthesiology without directly affecting the safety of patient care. Competitive factors in the regulation of dental anesthesiology include: Fees, Advertising requirements, and non-dental anesthesia provider provisions.

Fees are direct financial responsibilities of a given sum to the state agency or federal agency to be able to practice anesthesiology in dentistry. The fees may take the form of general anesthesia permit or a facility permit. These fees may additionally include a cost in order to obtain inspection/evaluation of the facility prior to permitting. Fees are commonly requested on a repetitive time basis, i.e one a year, every 2 years, etc. Often multiple fees are requested for each location where general anesthesia is practiced by dentists. Moreover, with regards to federal DEA registration "separate registration is required for each principal place of business or professional practice at one general physical location where controlled substances are manufactured, distributed, imported, exported, or dispensed by a person." This includes administration of many anesthetic agents with the following definition, "the term "dispense" means "to deliver a controlled substance to an ultimate user or research subject by, or pursuant to the lawful order of, a practitioner, including the prescribing and administering of a controlled substance . . ."[97] These fees maybe quite sizable in it and of themselves or as a cumulative factor. In efforts to provide a clear definition and allow the itinerant or mobile application of anesthesiology some states have enacted additional state based narcotic handling and transporting requirements. While the purpose of these laws is likely to prevent the unlawful diversion of controlled substances, there is

significant ambiguity to application and may serve to further augment access to care concerns with limited application to the safety of anesthetic care by dentists.

It is important to note that most states dental practice acts and board rules that regulate the performance of General Anesthesia by permitted dentists have also encoded exceptions and/or definitions for the performance of general anesthesia by physician anesthesiologists or other providers. Sometimes the performance of office-based anesthesia by a physician anesthesiologist or nurse anesthetist does not require that provider to hold a permit, pay a fee, nor review credentialing. While dentists with accredited general anesthesia training including Oral and Maxillofacial Surgeons and Dentist-Anesthesiologists submit additional fees, permits, inspections, and examinations, often physicians need not provide an equal level of effort. In fact, most states accept "qualification" of a physician provider based on providing services in a hospital environment as enough to do so in the dental arena without registration or additional training requirements. This has been argued to be because physicians operating in hospitals (private or public organizations) have significant documentation requirements to verify training, certification, or proficiency in the procedures.[98] Nonetheless, sometimes the definition of physician anesthesiologist, such as used by that Alabama, may be exceedingly vague in addressing the qualifications of these physicians such that it reads working in conjunction with a "qualified medical doctor who is a member of the anesthesiology staff in an accredited hospital."

The advertising of dental specialty services is often regulated under differing conditions across the country by dental practice acts and board rules. This has served as a point of competitive restriction in legal arena and endured various challenges. Currently many laws regarding the

restriction of advertising as a dentist-anesthesiologist are being rewritten or amended consideration of its acceptance as the 10th specialty of dentistry by CODA.

Chapter 10: Study Purpose

The purpose of the study was to describe the opinions of Dentist-Anesthesiologists as they pertain to effect of the specific regulations on safety and access to care and analyze their influence on their practice characteristics. This description and analysis may help provide insight regarding the availability of dental care for special populations as a function of certain regulatory barriers that impede Dentist-Anesthesiologists from reaching General Dentists without improving patient safety. Additionally, we aimed to identify regulations that have a positive influence on safety with minimal effect on access.

Chapter 11: Methods

This Ohio State University IRB exempt cross sectional study was designed to gather a snapshot of the practice characteristics and opinions of Dentist-Anesthesiologists in North America. The study included an online anonymous voluntary survey for Dentist-Anesthesiologists that was distributed electronically via a projected link osuanesthesia.com at the April 2019 American Society of Dentist Anesthesiologist meeting in Chicago. Expected attendance of participants was approximately 100-200 active dentist-anesthesiologist members of the American Society of Dentist Anesthesiologists. The link could be accessed by any device with a web browser connected to the internet. No personal identifiable information was requested or collected. Privacy was aided by using their personal device. Participation was voluntary. All participants were over 18 years of age. Non-Dentist-Anesthesiologists and those that have completed the survey previously were excluded. No personal identifiable information was requested for login. Anonymous conference hall wifi was available and additionally IPs were not traced.

Within the survey there were seven sections including consent and exclusions that were located in the initial sections. Subsequent sections gathered participant demographics including age, gender, time in practice, state of practice, and type of practice of the participant. Practice characteristics were collected in the fourth section including frequencies of treatment. The participant was asked to state the frequency with which they treat subsets of patient ages, ASA categories, special patient categories, and location, as well as payment received, and types of dentists to whom general anesthesia is provided. The fifth section included three specific questions regarding state regulations' effect on type of clinical practice, type of dentist where services are provided, and their decision to practice in that state. The survey concluded with the last two

sections where the participant was asked to rate the level of barrier and the level of safety for specific office-based anesthesia related regulations on a modified Likert scale.

Exclusionary criteria as stated above, was used to remove invalid responses. Data from the valid surveys were entered onto Excel spreadsheet and imported into JMP statistical software for analysis. Quantitative evaluation included descriptive statistics, one-tailed hypothesis testing and probability analysis, and Fischer's Exact Testing.

Rationale for Regulation Selection:

Efforts were made to avoid regulatory questions regarding competitive factors and to select regulations that were constrained in scope to facility and mobility factors. Competitive factor questions were also avoided because the financial implications of barriers and safety are beyond the scope of this analysis. One exception to this within the competitive factor category is that of additional controlled substance handling requirements by a state; these types of regulations may be concurrently considered as mobility factor. Additionally, treatment requirement related regulations were avoided as they are seen beyond the scope of this analysis due to confounding patient and setting variables with implications that are best derived from outcomes research and the standard of care.

Generally, the regulations for the survey were also selected in part because of the variability and stance noted between states. Rules intended to improve or maintain anesthesia safety may conversely have the unintended consequences of not achieving that goal and additionally pose a significant barrier to the delivery of safe care by affecting the reach of populations. As such, these laws may pose substantial barriers on the mobility of appropriately trained anesthesiologists and reach of dental patients.

Mobility Related Regulations:

1. The treating General Dentist is required to have a General Anesthesia Permit in order for a Dentist-Anesthesiologist to deliver General Anesthesia at the treating dentist's facility.
2. The treating General Dentist is required to have a sedation Permit of any level in order for a Dentist-Anesthesiologist to deliver General Anesthesia at the treating dentist's facility.
3. The treating General Dentist is required to have airway or sedation continuing education in order to treat patients under General Anesthesia.
4. General Anesthesia equipment and supplies must remain at the treating General Dentist's facility permanently.
5. There are State narcotic handling and transporting regulations in addition to federal requirements.

Facility Related Regulations:

1. A facility permit is required for the treating General Dentist's treatment facility before a Dentist-Anesthesiologist can deliver General Anesthesia.
2. Specific structural requirements are dictated regarding the treatment facility where General Anesthesia will be delivered.
3. An inspection of the treatment facility where General Anesthesia will be delivered is required
4. Observation of a General Anesthesia procedure at the treatment facility is required.
5. The treating General Dentist's staff must comply with specific educational and training requirements in order for General Anesthesia to be rendered at that facility.

6. The delivery of General Anesthesia must include a specified number of additional staff plus the Dentist-Anesthesiologist and treating general dentist.

Chapter 12: Results

A total of 48 surveys were completed. Two surveys were eliminated from data analysis due to meeting exclusionary criteria (completed a previous survey and not an active dentist-anesthesiologist) for a total n=46.

Respondents were generally from across North America were Dentist-Anesthesiologists are found with most respondents from California, followed by Canada, Arizona, Ohio, Colorado, Pennsylvania, and Virginia. There was also representation from Washington, Idaho, Nevada, Oklahoma, Texas, Missouri, Illinois, Wisconsin, Michigan, Tennessee, North Carolina, Maryland, and Massachusetts. Notable exceptions (states with 5 or more registered ASDA dentist-anesthesiologists) from our survey sample without any respondents included the tri-state area of New York, New Jersey, and Connecticut. (Figure 1)

The demographics of the respondents was composed of 61% (n=28) and 35% female (n=16). The ranges years in practice was distributed as 26% having less than 5 years in practice, 39% between 5-15 years, 13% between 16-25 years, and 22% over 25 years. Most of the respondents (48%) were between 36 and 50 years of age, followed by 26% under 35, 22% between 51-65 with 4% over 65 years of age. Regarding the type of practice, 65% (n=30) were in mobile practice, while 35%(n=16) were in a fixed practice setting. Of those in a fixed practice setting, most were associated with a private dental practice (56%, n=9), followed by academic/dental school setting (31%, n=5), ambulatory surgical center (6%, n=1), and Hospital (6%, n=1). 80% (n=37) of our respondents were not operator anesthetists with none (0%, n=0) of the mobile providers practicing as operator-anesthetists. Of the fixed facility providers 56% (n=9) practiced as operator-anesthetists.(Table 1)

Using a modified and defined 3 level Likert frequency scale of Often (approximately at least once per week), Sometimes (approximately at least once per month, but less than once per week), and Rarely (approximately less than once per month, and may include never) results were recorded for frequency of working with "types of dentists", "patient payment", "patient location", patient "ASA category", "patient age", and "special populations" types.

Dentist-Anesthesiologist respondents in this study often worked with Pediatric dentists (83%, n=38) followed by Oral Surgeons (35%, n=16), other dentists (30%, n=14), and general dentists (28%, n=13). Additionally, dentist-anesthesiologists most rarely worked with general dentists (37%, n=17). This distribution generally held for mobile practitioners, where they most often worked with pediatric dentists (90%, n= 27) and least often with general dentists (23%, n=7) as well as least rarely with pediatric dentists (3%, n=1), and most rarely with general dentists (40%, n=12). Similarly, fixed practice dentist-anesthesiologists most often worked with pediatric dentists (69%, n=11). However, fixed practice dentist-anesthesiologists were both least often (19%, n=3) and most rarely (44%, n=7) working with oral surgeons. (Table 2)

Patient payment was most often fee for service (72%, n=33), followed by Medicaid/medicare (48%, n=22) and Private insurance (20%, n=9). Likewise, 67% (n=31) reported that they most rarely receive no payment of work based on donation. Some differences were seen between mobile and fixed facility dentist-anesthesiologists in that those in mobile accepted fee for service most often (80%, n=24), followed by medicaid/medicare (47%, n=14), and private insurance (13%, n=4) where fixed practitioners were less likely to accept fee for service and more likely to accept private insurance, albeit with relative frequencies of 56% (n=9) fee for service, 50% (n=8) medicaid/medicare, and 31% (n=5) private insurance. (Table 3)

Patient location was most suburban (72%, n=33) and urban (67%, n=31). Rural patient location was most rarely (48%, n=22) indicated. This distribution generally held for both mobile and fixed dental anesthesiologists. (Table 4)

Our sample most often treated children of ages 2-12 (89%, n=41) and least often (9%, n=4) and most rarely (72%, n=33) infants under age 2. This trend was consistent regardless of type of practitioner. (Table 5)

Regarding physical status, dentist-anesthesiologists indicated that ASA 1 (96%, n=44)) and ASA 2 (93%, n=43) patients are most often treated, while 0% indicated that they often treat ASA 4 patients. Similarly, 89% (n=41) indicated they most rarely treat ASA 4 patients. (Table 6)

Special populations in this survey included physical disability, intellectual disability, psychiatric illness, fear/anxiety, failed local anesthesia, those requiring extensive procedures, and medically complex. The special population indicated as most often treated by dentist-anesthesiologists was those with fear/anxiety (91%, n=42), followed closely by intellectual disability (80%, n=37) and those requiring extensive procedures (76%, n=35). It is important to note that very limited number of providers indicated that they rarely treat any of the special populations. In fact, it was indicated that the most rarely treated special population was those with failed local anesthesia (17%, n=8). While the trend was generally consistent between mobile and fixed dentist-anesthesiologists as well as their response as a whole, some interesting differences can be noted. Comparing the frequency of treating special populations that has physical disability 81%(n=13) of fixed anesthesiologists and 37%(n=11) of mobile anesthesiologists indicated they treated they patients often; in the same category, practitioners treated these patients sometimes 19%(n=3) and 60%(n=18) respectively. Additionally, regarding medical complexity, fixed

practitioners were slightly more likely to indicate they treat this special population often (56%, n=9) compared to mobile (33%, n=10), with a sometimes response of 31% (n=5) and 53% (n=16) respectively. (Table 7)

One tailed hypothesis testing with an alpha of 0.1 indicated that state rules and regulations were not a factor to establishing clinical practice in that state over another state p= 0.0588. There was no significant difference (p= 0.3971) if state rules and regulations were a factor in selecting the type of clinical practice (i.e. mobile, private dental practice, ASC, etc) that the dentist-anesthesiologist chose. However, with p=.000000009, the type of dentist(specialist) with which a dentist anesthesiologist worked was not a factor of state rules and regulations. (Table 8)

Using a different set of modified and defined 3 level Likert scales the selected rules and regulations were rated by the sample for barrier to care (Not a Barrier, Uncertain, Yes, Barrier) and then again for safety (Does not improve safety, Uncertain, Improves safety). Ignoring uncertain responses, statistically significant barriers were found among the perception of additional state narcotic handling /transporting regulations (p= 0.008) and equipment permanence (Alpha= 0.1 level with p = 0.0614). Additionally, it was found that the requirement of airway/sedation continuing education for general dentists (p= 0.019), educational and training requirements for facility's staff (p= 0.003), and specified number of staff for general anesthesia (p= 0.001) were statistically significant not barriers. Statistically significant Laws that were perceived to improve safety included the requirement of airway/sedation continuing education for general dentists(p= 0.0003), structural requirements for the facility(p= 0.047) educational and training requirements for facility's staff (p= 0.000001), and specified number of staff for general anesthesia (p=0.0000002). Conversely, rules and regulations that statistically significantly did not

improve safety included equipment permanence and being required to stay at facility (p= 0.0013) as well as additional state narcotic handling /transporting regulations (p=0.000003). (Table 9)

Of further note, Fisher Exact testing was run to discover differences in perceptions between the mobile and fixed groups. There was no statistically significant result for the difference with which the groups agreed to barriers. However, there was statistically significant variation between the way the two groups perceived several laws with the fixed groups perceiving an improvement of safety on the following laws: equipment permanence(p= 0.0165), requirement of facility permit (p=0.0084), requirement of inspection(p=0.0369), and the requirement of additional staff (p= 0.0122).

Chapter 13: Discussion

The purpose of the present study was to explore and describe Dentist-Anesthesiologists' opinions regarding state laws influence on safety, access to care, and clinical practice patterns. Additionally, further data was sought regarding the differences in practice opinions and characteristics between two main types of Dentist-Anesthesiologists: those practicing mobile office-based anesthesia and those practicing in a fixed-facility setting. It was hypothesized that the opinions of those Dentist-Anesthesiologists practicing in fixed settings vs. mobile regarding those laws would be significantly different. The results of this study indicate that there are statistically significant differences, both as a group and as types of anesthesiologists, with regard to various regulations and their influence on safety and access to care. The representative sample also indicated the perceived existence of an inverse relationship between safety and access to care of several laws.

Mobility is paramount to reaching special populations. Nearly 65% of the respondents in our study were involved in mobile office-based anesthesia practice. This number correlates to previous studies that have indicated nearly 58% of Dentist-Anesthesiologists provide mobile anesthesia services.[8] Several mobility related laws had statistically significant results. Our study indicated that Dentist-Anesthesiologists perceived those state laws regarding the transportation and handling of narcotics as posing a significant barrier to access to care. (Figure 5) Likewise, those state laws that required the permanence and/or restricted the mobility of dental anesthesiology equipment and supplies were found statistically significant as a barrier and as not improving safety. (Figure 6)

Our study also indicated that Dentist-Anesthesiologists as a whole felt that certain educational laws improve safety while not posing a significant barrier to care. There was a statistically significant opinion on improving safety with laws requiring General Dentists to have additional airway or sedation continuing education and those that required their staff to also have additional education and training. Moreover, Dentist-Anesthesiologists also felt these educational and training laws for the treating dentist and staff did not significantly pose a barrier.(Figures 3,4) This opinion is not unexpected as anesthesiology in dentistry has been written about to require "maintaining current knowledge, preparation, and teamwork."[12] However, it was interesting to note that there was no statistically significant consensus on laws requiring of any level of formal permitting of General Dentists for the employment of anesthesia services.

Regarding the practice environment, Dentist-Anesthesiologists felt that the laws that required a specified number of staff present for general anesthesia improved safety and were not a barrier. Additionally, laws related to the structural requirements of a facility improved safety.(Figure 2) However, the opinions regarding the effect of structural requirement laws on access to care were not significant.

Nearly uniformly, Dentist-Anesthesiologists felt that state laws and regulations were not a factor in selecting which type of dentist or specialist to whom general anesthesia services are rendered.(Figure7) This provides support to the concept that General Anesthesia provided by Dentist-Anesthesiologists may be a tool to reach special populations through General Dentists.

It is important to note that there were statistically significant differences in how mobile anesthesiologists and fixed-facility anesthesiologists opined on the safety of various laws. Fixed-facility anesthesiologists believed that laws including the requirement of a facility permit,

inspection of the treatment facility, and permanence of the equipment and supplies at the facility, improved safety. Laws requiring a specified additional number of staff were also viewed by fixed-facility Dentist-Anesthesiologists as improving safety as opposed to mobile Dentist-Anesthesiologists.(Figure 8) This is likely a result fashioned from working in similar conditions as physician anesthesiologists.

The sample (n=46) indicated a representative group of approximately 15-20% practicing Dentist-Anesthesiologists. The number of clinically practicing Dentist-Anesthesiologists in North America is difficult to ascertain. It is important to point out that "uncertain" responses were excluded from statistical analysis. Additionally, the sample size included a subset of respondents from Canada. The practice environments and regulatory forces may be different for these practitioners. Also, given the small size, there may be meaningful impact and statistical changes were the population analyzed. Nonetheless, we believe the analysis is valid as a reference guide to gain a better understanding of prevailing values rather than strict statistical interpretation of the results.

During the recent specialty application with the Commission on Dental Accreditation in 2019, the representative body of Dentist-Anesthesiologists, the American Society of Dentist-Anesthesiologists (ASDA), estimated approximately 427 eligible clinicians as "Dentist-Anesthesiologists."[99] They report that their active membership body represents over 60% of the "eligible" body of dentists that are Dentist-Anesthesiologists, but included non-practicing, retired, emeritus, and other specialty qualified practitioners. For the purposes of this study, we defined practicing Dentist-Anesthesiologist clinicians in North America as those active members of the ASDA. As of October 2019 according to the ASDA website that number was approximately

270.[101] This number is assumed valid for the survey and corroborated by numbers reported by the American Board of Dentist-Anesthesiologists indicating 262 diplomates.[100] Given the relatively small number of clinicians and distribution across North America, statistical significance regarding the effect of specific laws on their clinical practice would be misleading. Additionally, following the 2007 and 2016 "Guidelines on the Use of Anesthesia and Sedation by Dentists" multiple changes to state laws have taken affect across the country. Deriving meaningful data through a jurisdiction-based analysis of the impact of a particular state's laws on the practice characteristics of Dentist-Anesthesiologists would at best be limited. However, the opinions expressed in this survey by the representative sample of practicing North American clinicians provides a source of value that can be used by state dental boards and other regulatory bodies in negotiating the interplay of the public welfare and access to care.

Chapter 14: Conclusion

The practice of anesthesiology in dentistry has a long history that includes an outstanding attention to the development and use of anesthesia safety standards. Dental anesthesia has a strong record of safety both before and after industry changes brought upon by regulatory changes. This strong record of safety is no doubt the result of dental anesthesiology's dental specific training and special attention to the comprehensive evaluation, monitoring, and care of the unique needs of its patient population. However, given the parallel development of powerful and influential interests by some larger groups, the regulatory environment where dental anesthesia is practiced may have been influenced in such a way to create structural barriers to care. The existence of these structural barriers has significant limitations the ability of special populations to access care, in particular, to acquire safe and timely care outside the constructs of physician-operated hospital walls or oral surgeon's fixed office. Policy makers should carefully evaluate the practice characteristics and opinions of practicing dentist-anesthesiologists when shaping rules and regulations that may have profound impacts in the care of marginalized groups.

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Appendix A. Tables

	Demographics of Respondents			
		All *% (n)*	Fixed *% (n)*	Mobile *% (n)*
Gender				
	Female	35% *(16)*	31% *(5)*	37% *(11)*
	Male	61% *(28)*	63% *(10)*	60% *(18)*
Years in practice				
	<5 years	26% *(12)*	31% *(5)*	23% *(7)*
	5 - 15 years	39% *(18)*	50% *(8)*	33% *(10)*
	16- 25 years	13% *(6)*	6% *(1)*	17% *(5)*
	>25 years	22% *(10)*	13% *(2)*	27% *(8)*
Age				
	<35 years of age	26% *(12)*	19% *(3)*	30% *(9)*
	36 - 50 years of age	48% *(22)*	63% *(10)*	40% *(12)*
	51 - 65 years of age	22% *(10)*	13% *(2)*	27% *(8)*
	>65 years of age	4% *(2)*	6% *(1)*	3% *(1)*
Type of Practice				
	Academic/Dental school	11% *(5)*	31% *(5)*	0% *(0)*
	Ambulatory Surgical Center (ASC)	2% *(1)*	6% *(1)*	0% *(0)*
	Hospital	2% *(1)*	6% *(1)*	0% *(0)*
	Mobile Anesthesia Practice	65% *(30)*	0% *(0)*	100% *(30)*
	Private Dental Practice	20% *(9)*	56% *(9)*	0% *(0)*
operator-anesthetist				
	no	80% *(37)*	44% *(7)*	100% *(30)*
	yes	20% *(9)*	56% *(9)*	0% *(0)*

Table 1 Sample Demographics

	Frequency of Working with Types of Dentists				
		General Dentist	Pediatric Dentist	Oral Surgeon	Other Dentists
ALL n=46	Often	28% *(13)*	83% *(38)*	35% *(16)*	30% *(14)*
	Sometimes	35% *(16)*	7% *(3)*	33% *(15)*	43% *(20)*
	Rarely	37% *(17)*	11% *(5)*	33% *(15)*	26% *(12)*
FIXED n=16	Often	38% *(6)*	69% *(11)*	19% *(3)*	31% *(5)*
	Sometimes	31% *(5)*	6% *(1)*	38% *(6)*	38% *(6)*
	Rarely	31% *(5)*	25% *(4)*	44% *(7)*	31% *(5)*
Mobile n=30	Often	23% *(7)*	90% *(27)*	43% *(13)*	30% *(9)*
	Sometimes	37% *(11)*	7% *(2)*	3% *(9)*	47% *(14)*
	Rarely	40% *(12)*	3% *(1)*	27% *(8)*	23% *(7)*

Table 2 Frequency of providing General Anesthesia for dentist/specialist types

	Patient Payment				
		Fee for service	Private insurance	Medicaid or medicare	none/donation
ALL n=46	Often	72% *(33)*	20% *(9)*	48% *(22)*	0% *(0)*
	Sometimes	24% *(11)*	28% *(13)*	22% *(10)*	33% *(15)*
	Rarely	4% *(2)*	52% *(24)*	30% *(14)*	67% *(31)*
FIXED n=16	Often	56% *(9)*	31% *(5)*	50% *(8)*	0% *(0)*
	Sometimes	31% *(5)*	56% *(9)*	25% *(4)*	13% *(2)*
	Rarely	13% *(2)*	13% *(2)*	25% *(4)*	88% *(14)*
MOBILE n=30	Often	80% *(24)*	13% *(4)*	47% *(14)*	0% *(0)*
	Sometimes	20% *(6)*	13% *(4)*	20% *(6)*	43% *(13)*
	Rarely	0% *(0)*	73% *(22)*	33% *(10)*	57% *(17)*

Table 3 Frequency of Patient payment types

	Patient Locations			
		Rural	suburban	urban
ALL n=46	Often	17% *(8)*	72% *(33)*	67% *(31)*
	Sometimes	35% *(16)*	17% *(8)*	20% *(9)*
	Rarely	48% *(22)*	11% *(5)*	13% *(6)*
FIXED n=16	Often	6% *(1)*	63% *(10)*	63% *(10)*
	Sometimes	25% *(4)*	6% *(1)*	6% *(1)*
	Rarely	69% *(11)*	31% *(5)*	31% *(5)*
MOBILE n=30	Often	23% *(7)*	77% *(23)*	70% *(21)*
	Sometimes	40% *(12)*	23% *(7)*	27% *(8)*
	Rarely	37% *(11)*	0% *(0)*	3% *(1)*

Table 4 Frequency of Patient locations

	Patient Ages					
		infants/toddlers < 2	Children (2-12)	Adolescent (13-20)	Adults (21-64)	Geriatric (65+)
ALL n=46	Often	9% *(4)*	89% *(41)*	46% *(21)*	57% *(26)*	37% *(17)*
	Sometimes	20% *(9)*	11% *(5)*	46% *(21)*	30% *(14)*	41% *(19)*
	Rarely	72% *(33)*	0% *(0)*	9% *(4)*	13% *(6)*	22% *(10)*
FIXED n=16	Often	13% *(2)*	81% *(13)*	44% *(7)*	69% *(11)*	38% *(6)*
	Sometimes	25% *(4)*	19% *(3)*	44% *(7)*	19% *(3)*	44% *(7)*
	Rarely	63% *(10)*	0% *(0)*	13% *(2)*	13% *(2)*	19% *(3)*
MOBILE n=30	Often	7% *(2)*	93% *(28)*	47% *(14)*	50% *(15)*	37% *(11)*
	Sometimes	17% *(5)*	7% *(2)*	47% *(14)*	37% *(11)*	40% *(12)*
	Rarely	77% *(23)*	0% (0)	7% *(2)*	13% *(4)*	23% *(7)*

Table 5 Frequency of treating patient age ranges

	ASA categories				
		ASA 1	ASA 2	ASA 3	ASA 4
ALL n=46	Often	96% *(44)*	93% *(43)*	26% *(12)*	0% *(0)*
	Sometimes	4% *(2)*	7% *(3)*	48% *(22)*	11% *(5)*
	Rarely	0% *(0)*	0% *(0)*	26% *(12)*	89% *(41)*
FIXED n=16	Often	94% *(15)*	88% *(14)*	31% *(5)*	0% *(0)*
	Sometimes	6% *(1)*	13% *(2)*	44% *(7)*	19% *(3)*
	Rarely	0% *(0)*	0% *(0)*	25% *(4)*	81% *(13)*
MOBILE n=30	Often	97% *(29)*	97% *(29)*	23% *(7)*	0% *(0)*
	Sometimes	3% *(1)*	3% *(3)*	50% *(15)*	7% *(2)*
	Rarely	0% *(0)*	0% *(0)*	27% *(8)*	93% *(28)*

Table 6 Treatment frequency of ASA categories

	Special populations							
		physical disability	intellectual disability	psychiatric illness	fear/anxiety	failed LA	Extensive procedure	medical complexity
ALL n=46	Often	52% *(24)*	80% *(37)*	52% *(24)*	91% *(42)*	37% *(17)*	76% *(35)*	41% *(19)*
	Sometimes	46% *(21)*	20% *(9)*	39% *(18)*	7% *(3)*	46% *(21)*	24% *(11)*	46% *(21)*
	Rarely	2% *(1)*	0% *(0)*	9% *(4)*	2% *(1)*	17% *(8)*	0% *(0)*	13% *(6)*
FIXED n=16	Often	81% *(13)*	94% *(15)*	56% *(9)*	94% *(15)*	44% *(7)*	81% *(13)*	56% *(9)*
	Sometimes	19% (3)	6% *(1)*	44% *(7)*	6% *(1)*	44% *(7)*	19% *(3)*	31% *(5)*
	Rarely	0% *(0)*	0% *(0)*	0% *(0)*	0% *(0)*	13% *(2)*	0% *(0)*	13% *(2)*
MOBILE n=30	Often	37% *(11)*	73% *(22)*	50% *(15)*	90% *(27)*	33% *(10)*	73% *(22)*	33% *(10)*
	Sometimes	60% *(18)*	27% *(8)*	37% *(11)*	7% *(2)*	47% *(14)*	27% *(8)*	53% *(16)*
	Rarely	3% *(1)*	0% *(0)*	13% *(4)*	3% *(1)*	20% *(6)*	0% *(0)*	13% *(4)*

Table 7 Treatment frequency of special population categories

		Were state rules & regulations a factor to establishing your clinical practice in that state over another state?	Are/were state rules & regulations a factor in selecting your TYPE OF CLINICAL PRACTICE (i.e. mobile, private dental practice, ASC, etc)?	Are/were state rules & regulations a factor in selecting with which TYPE OF DENTIST (General Dentist, Oral Surgeon, Pediatric dentist, etc) you deliver general anesthesia services?
ALL *n=46*	No	63% *(29)*	52% *(24)*	93% *(43)*
	Yes	37% *(17)*	48% *(22)*	7% *(3)*
FIXED *n=16*	No	75% *(12)*	38% *(6)*	94% *(15)*
	Yes	25% *(4)*	63% *(10)*	6% *(6)*
MOBILE *n=30*	No	57% *(17)*	60% *(18)*	93% *(28)*
	Yes	43% *(13)*	40% *(12)*	7% *(2)*

Table 8 Regulatory factors influence of practice characteristics

		The treating General Dentist is required to have a GA Permit in order for a DA to deliver GA at the treating dentist's facility	The treating General Dentist is required to have a sedation Permit of any level in order for a DA to deliver GA at the treating dentist's facility	The treating General Dentist is required to have airway or sedation continuing education in order to treat patients under GA	GA equipment and supplies must remain at the treating General Dentist's facility permanently	There are State narcotic handling and transporting regulations in addition to federal requirements	A facility permit is required for the treating General Dentist's treatment facility before a DA can deliver GA	Specific structural requirements are dictated regarding the treatment facility where GA will be delivered	An inspection of the treatment facility where GA will be delivered is required	Observation of a GA procedure at the treatment facility is required	The treating General Dentist's staff must comply with specific educational and training requirements in order for GA to be rendered at that facility	The delivery of GA must include a specified number of additional staff plus the DA and treating general dentist
ALL *n=46*	Not a barrier	43% *(20)*	46% *(21)*	57% *(26)*	35% *(16)*	26% *(12)*	41% *(19)*	35% *(16)*	41% *(19)*	46% *(21)*	54% *(25)*	61% *(28)*
	Uncertain barrier	2% *(1)*	13% *(6)*	15% *(7)*	9% *(4)*	15% *(7)*	11% (5)	17% *(8)*	17% *(8)*	17% *(8)*	26% *(12)*	20% *(9)*
	Barrier	54% *(25)*	41% *(19)*	28% *(13)*	57% *(26)*	59% *(27)*	48% *(22)*	48% *(22)*	41% *(19)*	37% (17)	20% *(9)*	20% *(9)*
	Improves safety	35% *(16)*	35% *(16)*	54% *(25)*	20% *(9)*	9% *(4)*	37% *(17)*	41% *(19)*	48% *(22)*	30% *(14)*	65% *(30)*	67% *(31)*
	Uncertain safety	22% *(10)*	28% *(13)*	33% *(15)*	22% *(10)*	24% *(11)*	26% *(12)*	37% *(17)*	22% *(10)*	26% *(12)*	28% *(13)*	28% *(13)*
	Does not improve safety	43% *(20)*	37% *(17)*	13% *(6)*	59% *(27)*	67% *(31)*	37% *(17)*	22% *(10)*	30% *(14)*	43% *(20)*	7% *(3)*	4% *(2)*
FIXED *n=16*	Not a barrier	44% *(7)*	44% *(7)*	50% *(8)*	38% *(6)*	31% *(5)*	38% *(6)*	44% *(7)*	50% *(8)*	44% *(7)*	69% *(11)*	75% *(12)*
	Uncertain barrier	0% *(0)*	13% *(2)*	19% *(3)*	6% *(1)*	19% *(3)*	19% *(3)*	6% *(1)*	6% *(1)*	13% *(2)*	6% *(1)*	13% *(2)*
	Barrier	56% *(9)*	44% *(7)*	31% *(5)*	56% *(9)*	50% *(8)*	44% *(7)*	50% *(8)*	44% *(7)*	44% *(7)*	25% *(4)*	13% *(2)*
	Improves safety	44% *(7)*	50% *(8)*	63% *(10)*	38% *(6)*	19% *(3)*	69% *(11)*	63% *(10)*	75% *(12)*	38% *(6)*	81% *(13)*	94% *(15)*
	Uncertain safety	19% *(3)*	25% *(4)*	25% *(4)*	31% *(5)*	13% *(2)*	13% *(2)*	25% *(4)*	13% *(2)*	19% *(3)*	19% *(3)*	6% *(1)*
	Does not improve safety	38% *(6)*	25% *(4)*	13% *(2)*	31% *(5)*	69% *(11)*	19% *(3)*	13% *(2)*	13% *(2)*	44% *(7)*	0% *(0)*	0% *(0)*
MOBILE *n=30*	Not a barrier	43% *(13)*	47% *(14)*	60% *(18)*	33% *(10)*	23% *(7)*	43% *(13)*	30% *(9)*	37% *(11)*	47% *(14)*	47% *(14)*	53% *(16)*
	Uncertain barrier	3% *(1)*	13% *(4)*	13% *(4)*	10% *(3)*	13% *(4)*	7% *(2)*	23% *(7)*	23% *(7)*	20% *(6)*	37% *(11)*	23% *(7)*
	Barrier	53% *(16)*	40% *(12)*	27% *(8)*	57% *(17)*	63% *(19)*	50% *(15)*	47% *(14)*	40% *(12)*	33% *(10)*	17% *(5)*	23% *(7)*
	Improves safety	30% *(9)*	27% *(8)*	50% *(15)*	10% *(3)*	3% *(1)*	20% *(6)*	30% *(9)*	33% *(10)*	27% *(8)*	57% *(17)*	53% *(16)*
	Uncertain safety	23% *(7)*	30% *(9)*	37% *(11)*	17% *(5)*	30% *(9)*	33% *(10)*	43% *(13)*	27% *(8)*	30% *(9)*	33% *(10)*	40% *(12)*
	Does not improve safety	47% *(14)*	43% *(13)*	13% *(4)*	73% *(22)*	67% *(20)*	47% *(14)*	27% *(8)*	40% (12)	43% *(13)*	10% *(3)*	7% *(2)*

Table 9 Perception of Barriers and influence on Safety of listed rules/regulations

Appendix B. Figures

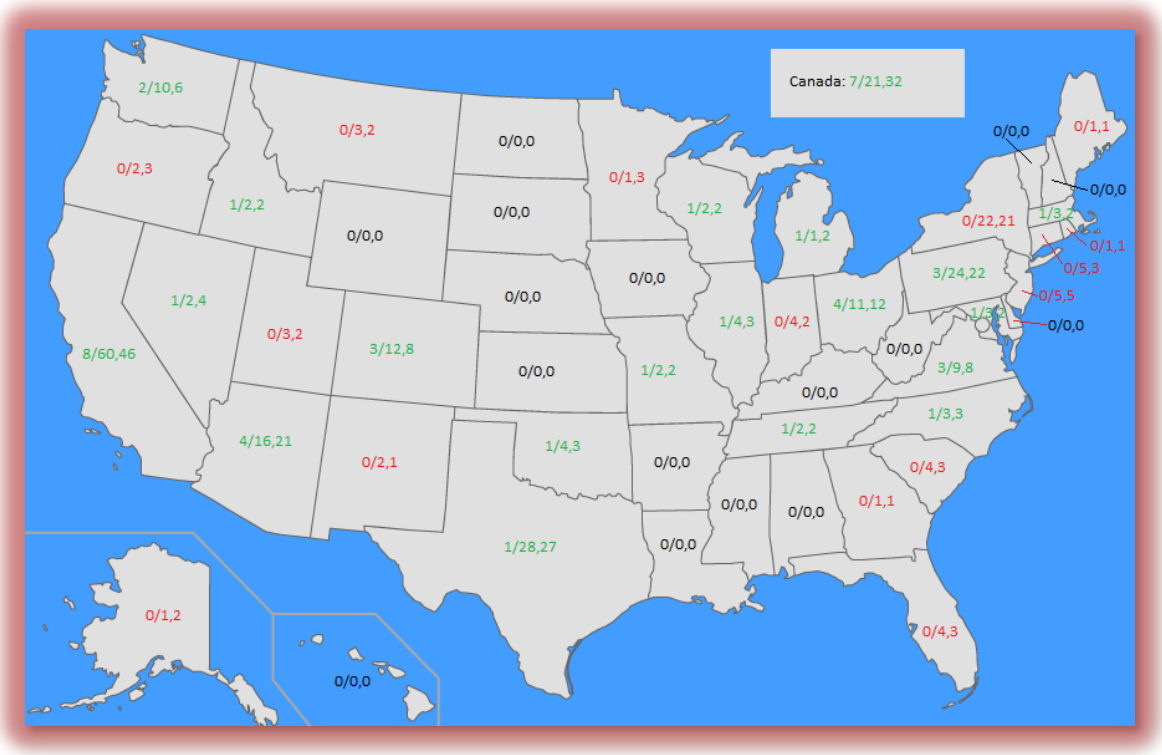

Figure 1: North American Distribution of Dentist Anesthesiologists

Survey / ASDA membership , ADBA Diplomates

Green states were surveyed and include ASDA or ADBA members
Red states were not sampled in survey but include ASDA or ADBA members
Black states were not sampled in survey nor include active ASDA or ADBA members

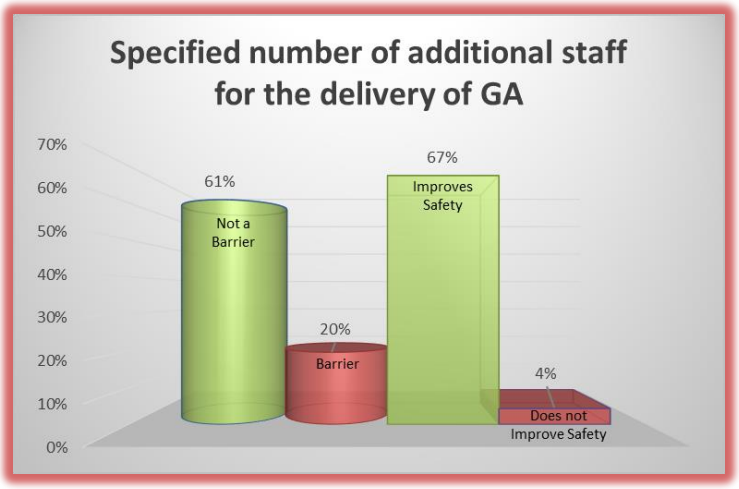

Figure 2: Specified number of additional staff improves safety without being a barrier

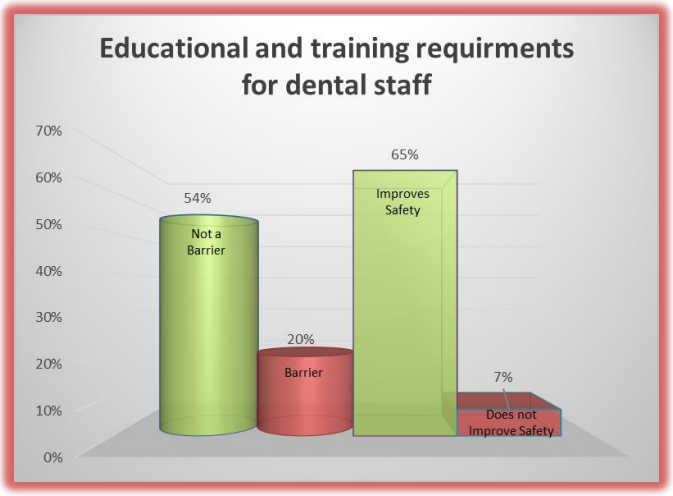

Figure 3: Education/Training of Staff as improves safety without being a barrier

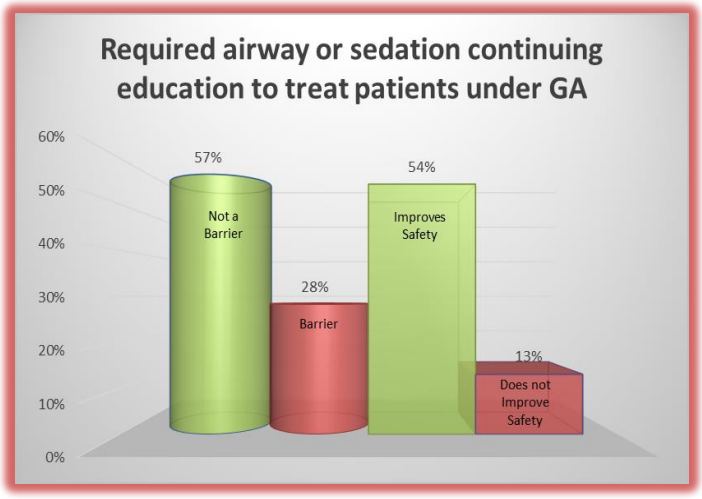

Figure 4: Treating dentist Airway/Sedation CE improves safety without being a barrier

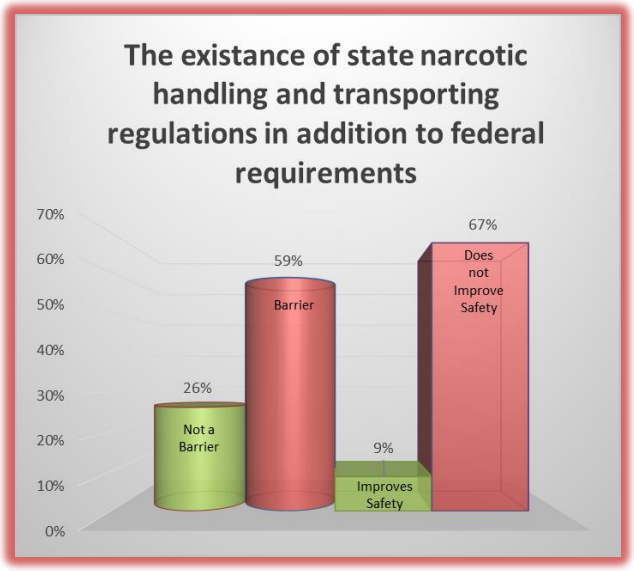

Figure 5: Additional narcotic regulations are barriers that do not improve safety

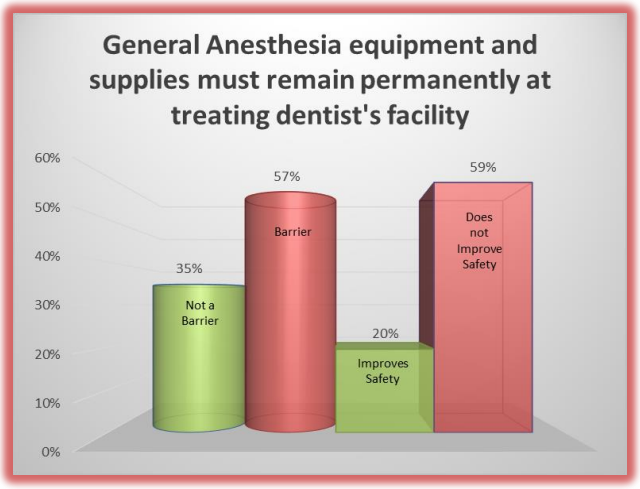

Figure 6: Facility permanence of GA equipment/supplies is barrier that does not improve safety

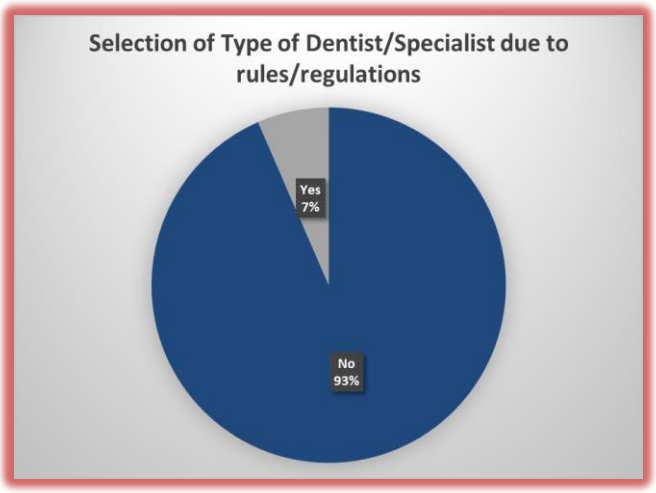

Figure 7: Selection of type of Dentist/Specialist with which DAs work were perceived not to be a factor of rules and regulation.

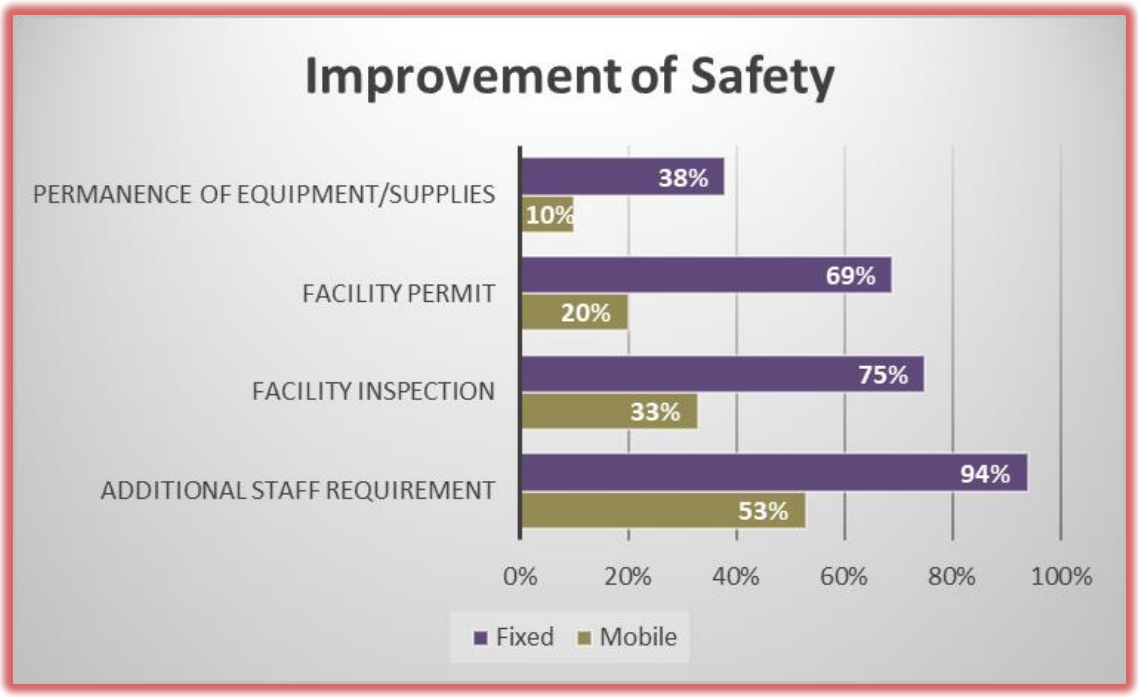

Figure 8: Significant Differences between Fixed and Mobile DAs in perception of improvement in safety

Dentist-Anesthesiologist Survey

You are invited to participate in a web-based online survey regarding the delivery of Office-based Anesthesia Services by Dentist-Anesthesiologists. Your responses may help us learn more about the use of General Anesthesia services by General Dentists across the country. This is a research project being conducted by Robert A. Busto, DMD, a Dental/Maxillofacial Anesthesiology resident at The Ohio State University. It should take less than 5 minutes to complete.

We want to assure you that your responses are completely anonymous. Responses to anonymous surveys cannot be traced back to the respondent. No personally identifiable information is captured. Your de-identified information may be used or shared with other researchers without your additional informed consent.

Your participation in this survey is voluntary. You will receive no direct benefits from participating in this research study. You may refuse to take part in the research or exit the survey at any time without penalty. While some fields maybe marked as required to ensure validity to the survey, please note you may choose not to respond, and exit the survey anonymously and without penalty.

If you have questions at any time about the study or the procedures, you may contact me via email at Busto.1@osu.edu.

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Office of Responsible Research Practices at 1-800-678-6251 or hsconcerns@osu.edu.

ELECTRONIC CONSENT: Please select your choice below. You may print a copy of this consent form for your records. Clicking on the "Agree" button indicates that

- You have read the above information
- You voluntarily agree to participate
- You are 18 years of age or older

* Required

ELECTRONIC CONSENT: Please select your choice below. You may print a copy of this consent form for your records. *

- ◯ Agree
- ◯ Disagree

I confirm that I am Dentist-Anesthesiologist with 2 or more years of Formal Anesthesia residency training.

- ○ Yes
- ○ No

Have you completed this survey previously? *

- ○ This is my FIRST TIME completing this survey
- ○ I have previously completed this survey

Demographics

Which AGE range best describes you? *

- < 35 years of age
- 36 - 50 years of age
- 51 - 65 years of age
- > 65 years of age

What is your GENDER? *

- Male
- Female
- Prefer not to say

How long have you been in the practice of Dental-anesthesiology? *

- < 5 years
- 5 - 15 years
- 16- 25 years
- >25 years

In what state do you practice most?

State list.

Which best describes your TYPE OF CLINICAL PRACTICE? *

- ○ Academic/Dental school
- ○ Mobile Anesthesia Practice
- ○ Private Dental Practice
- ○ Ambulatory Surgical Center (ASC)
- ○ Hospital

Do you practice as an operator-anesthetist? *

- ○ Yes
- ○ No

Practice characteristics

Please select the box that best describes the frequency with which you treat the following:

Ages: *

	Rarely	Sometimes	Often
Infants and Toddlers (<2 years)	○	○	○
Children (2-12)	○	○	○
Adolescent (13-20)	○	○	○
Adults (21-64)	○	○	○
Geriatric (65+)	○	○	○

ASA categories *

	Rarely	Sometimes	Often
ASA 1	○	○	○
ASA 2	○	○	○
ASA 3	○	○	○
ASA 4	○	○	○

Special patient categories

	Rarely	Sometimes	Often
Medical complexity	○	○	○
Physical disability	○	○	○
Intellectual disability	○	○	○
Psychiatric illness	○	○	○
Fear or anxiety	○	○	○
Previous Failed Local Anesthesia	○	○	○
Extensive Dental Procedures	○	○	○

Location *

	Rarely	Sometimes	Often
Rural	○	○	○
Suburban	○	○	○
Urban	○	○	○

Payment *

	Rarely	Sometimes	Often
Fee for service	○	○	○
Private insurance	○	○	○
Medicaid or medicare	○	○	○
None or donation	○	○	○

TYPES OF DENTISTS to whom you deliver Anesthesia services *

	Rarely	Sometimes	Often
General Dentists	○	○	○
Oral Surgeons	○	○	○
Pediatric Dentists	○	○	○
Other Dentists	○	○	○

Factors related to your practice of Dental Anesthesiology

For the state in which you are practicing most, were state rules & regulations a factor to establishing your clinical practice in that state over another state? *

- ◯ Yes
- ◯ No

For the state in which you are practicing most, were state rules & regulations a factor in selecting the TYPE OF CLINICAL PRACTICE? *

- ◯ Yes
- ◯ No

For the state in which you are practicing most, were state rules & regulations a factor regarding with which TYPE OF DENTIST you deliver services? *

- ◯ Yes
- ◯ No

State Rules/Regulations: Barriers

Please rate each of the following rules & regulations in regards to being a BARRIER to delivering Office-Based General Anesthesia to the patients of General Dentists by Dentist-Anesthesiologists. *

	Not a Barrier	Possible Barrier	Barrier
General Dentist requires General Anesthesia Permit	○	○	○
General Dentist requires Sedation permit of any type	○	○	○
General Dentist requires Airway or sedation continuing education	○	○	○
General Anesthesia equipment an d supplies can not be transported or must remain at General Dentist's facility	○	○	○
State Narcotic handling and transportation regulations in addition to federal	○	○	○
Facility permit required for General Dentist's Office or treatment facility	○	○	○
Specific Facility structural requirements	○	○	○
Inspection of Facility where Anesthesia will be delivered	○	○	○
Observation of Anesthesia procedure at Facility	○	○	○
Education and Training Requirements for General Dentist's staff	○	○	○
Number of staff required at General Dentist's Facility	○	○	○

State Rules/Regulations: Safety

Please rate each of the following rules & regulations in regards to the Improvement of SAFETY in delivering Office-Based General Anesthesia to the patients of General Dentists by Dentist-Anesthesiologists. *

	Does not Improve Safety	May improve Safety	Improves Safety
General Dentist requires General Anesthesia Permit	○	○	○
General Dentist requires Sedation permit of any type	○	○	○
General Dentist requires Airway or sedation continuing education	○	○	○
General Anesthesia equipment and supplies can not be transported or must remain at General Dentist's facility	○	○	○
State Narcotic handling and transportation regulations in addition to federal	○	○	○
Facility permit required for General Dentist's Office or Treatment Facility	○	○	○
Specific Facility structural requirements	○	○	○
Inspection of Facility where Anesthesia will be delivered	○	○	○
Observation of Anesthesia procedure at Facility	○	○	○
Education and Training Requirements for General Dentist's staff	○	○	○
Number of staff required at General Dentist's Facility	○	○	○