

A DESCRIPTION OF THE PRACTICE PATTERN CHARACTERISTICS OF  
ANESTHESIA CARE IN SMALL, MEDIUM AND LARGE TEACHING AND  
NON-TEACHING MEDICAL TREATMENT FACILITIES IN THE AIR FORCE

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## **ABSTRACT**

The purpose of this study was to investigate the practice pattern characteristics of anesthesia care in small, medium, and large teaching and non-teaching Medical Treatment Facilities (MTFs) in the Air Force. Data about anesthesia provider type, techniques and agents utilized, specialty services available, and military taskings affecting anesthesia providers (i.e. mobility exercises) were collected. The research was conducted utilizing a data collection tool distributed to the chief Certified Registered Nurse Anesthetists (CRNAs) at every Air Force MTF where anesthesia services were provided. A 73% return rate was obtained. Data demonstrated that 36% of the MTFs are staffed solely by CRNAs and the anesthesiologist to CRNA ratio is higher in large facilities. The most utilized technique in medium and large MTFs is general anesthesia with monitored anesthesia care (MAC) being the most used in small facilities. Fifty three percent of all MTFs provide obstetrical services with small MTFs administering twice as many intrathecal narcotics as labor epidurals. Most USAF MTFs provide pain management services with 50% of small facilities, staffed solely by CRNAs, having this service. The anesthetic agents most utilized include Fentanyl, Propofol, Versed, Desflurane, Isoflurane, Lidocaine and Rocuronium; others, Bupivacaine, Cisatracurium and

Remifentanyl are rarely used. Subarachnoid block is the technique most utilized by all MTFs on a weekly and daily basis and Bier blocks are the most utilized upper extremity block. Most MTFs report having a mobility tasking with small facilities having more CRNAs than anesthesiologists assigned. Almost all facilities reported not performing cases with field anesthesia equipment. The information from this study can assist Air Force leaders in tailoring educational/residency programs, determine operational readiness, and to assess practice variations among various Air Force MTFs and civilian institutions.

Key Words: Air Force Anesthesia Practice Patterns Medical Treatment Facilities  
Military

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IN THE AIR FORCE

by

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### **PREFACE**

This research was conducted to provide information pertaining to anesthesia practice patterns in the various types and sizes of Air Force Medical Treatment Facilities. The data obtained will be provided to the Nurse Anesthesia Consultant to the Air Force Surgeon General.

## **DEDICATION**

To Marcy, Jenny, Jamie and Julie thank you for helping me keep my perspective as to what is really important and supporting me in other endeavors such as this project. I love you all.

I would like to thank the members of my thesis committee for their guidance and efforts in seeing this study reach completion. In particular, my sincere appreciation and gratitude to my thesis chair, Dr. Maura McAuliffe, for her time and dedication throughout this endeavor.



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## CHAPTER 1 - INTRODUCTION

### Background

According to the Department of Defense (DOD, 1996) there are currently 1,028,150 active duty and dependent personnel in the United States Air Force (USAF) who are eligible to receive medical care, which includes anesthesia care when required, in USAF Medical Treatment Facilities (MTFs). It is difficult to estimate, however, the potential population that could require USAF anesthesia services since nearly all eight million active duty, retired and dependent military personnel are also eligible for medical care at USAF facilities.

Anesthesia is administered in 54 USAF MTFs worldwide (C. Gray, Col., USAF, NC, Nurse Anesthesia Consultant to the USAF Surgeon General, personal communication, March 19, 1997). The various services provided are dependent upon the individual facility's capabilities and staff. These MTFs vary in size, inpatient capacities, and anesthesia services as do hospitals in the civilian sector. Military anesthesia practice, however, is unique in that the scope of practice for USAF anesthesia providers must include proficiency with mobilization types of anesthesia equipment (AANA, 1994), and they must be trained for practice in remote field conditions. These skills are not required of civilian practitioners. All USAF Certified Registered Nurse Anesthetists (CRNAs) must possess critical thinking skills, which will allow them to function autonomously in remote locations utilizing all types of anesthesia, including regional anesthesia. Of the 54 MTFs, CRNAs provide anesthesia services at each and are the sole anesthesia providers



in 25 (45%) of these facilities (C. Gray, personal communication, March 19, 1997). Although many civilian CRNAs work with anesthesiologists, “about 20-25% of the American public are served solely by CRNAs, many who reside in rural areas” (Gunn, 1996, p. 49). Even though the military environment necessitates unique requirements for anesthesia practice, USAF anesthesia practice pattern characteristics probably share many more similarities than differences with civilian counterparts.

Data are available on the number, distribution, and projected needs of anesthesia providers in civilian and military anesthesia services (Levine, 1994; Rosenbach & Cromwell, 1988; Zaglaniczny, 1993; Zaglaniczny & Healey, 1998). Published information about practice patterns, patient mix, staffing mix, ancillary duties, and management patterns, although readily available for civilian anesthesia practice, is not readily available for USAF anesthesia services.

Information relating to anesthesia practice patterns is very much in demand, not only for individual facilities and federal health agencies concerned with medical restructuring, but also for anesthesia providers. As Conn, Davis, and Occena (1996) state, “redesign (reengineering or restructuring) is proceeding at unprecedented rates in health care delivery systems” (p. 145). For anesthesia providers to move the practice of anesthesia in an effective and efficient direction, changes should be based on accurately obtained and analyzed data. It is in this area of practice characteristics of anesthesia care delivery in the USAF that sufficient information for future planning is lacking.

## **Rational Significance of the Problem**

Like the civilian health care sector, the entire military environment is undergoing restructuring which directly impacts health care delivery in the USAF. Each MTF is facing the need to maximize efficiency as well as confront the immense health care changes affecting all military services. Currently the military is implementing a health care service entitled Tricare, which is similar in design to civilian managed care facilities such as Health Maintenance Organizations (HMOs). Once Tricare is realized, “there will be a substantial increase for active duty medical and nursing personnel to meet the need for primary care” (Levine, 1994, p. 652).

Policies aimed at restructuring health care systems have frequently taken the form of regulatory actions, at the individual facility, and at local, state, and national levels. These policies, however, “have too often resulted in cost shifting, increasing case volumes or service reductions rather than increases in efficiency or decreases in overall costs” (Fassett, 1995, p. 118). If proposed changes within a system are to be effective, then policy or system redesign must be based upon valid information.

In addition to the overall health care system restructuring in the USAF, anesthesia practice patterns are undergoing many changes both in practice policies as well as delivery of care. A literature review reveals much data pertaining to civilian anesthesia practice. The data are being utilized to investigate a variety of topics including: CRNA/anesthesiologist practice ratios, CRNA autonomy issues, provider need projections, scope of practice issues, cost effectiveness of Anesthesia Care Team (ACT) practices, and educational preparation of new providers. Attempts to resolve many of these issues have been made possible by studies of the civilian arena of anesthesia

practice (Fassett & Calmes, 1995; Gunn, 1996; Rosenbach & Cromwell, 1988; Zaglaniczny & Healey, 1998). Although USAF and civilian anesthesia workload characteristics share many similarities, attempting to utilize data obtained exclusively from the civilian sector in addressing USAF anesthesia issues may result in poor decision making.

As previously stated, several anesthesia workload studies provide excellent information and background data that could be utilized in developing necessary strategies in USAF anesthesia care (Rosenbach & Cromwell, 1988; Zaglaniczny 1993; Zaglaniczny & Healey, 1998). These studies, however, do not supply service specific data. If the anesthesia practice concerns being addressed by civilian providers are to be similarly addressed in the USAF environment, data must be obtained from the USAF anesthesia setting.

Currently, individual USAF MTFs follow anesthesia policies and practice procedures as outlined in operational regulations and instructions (Surgeon General USAF, 1995). Although individual facility demographics are available, no systematic data are available as to varying practice pattern characteristics of anesthesia care among different sizes of facilities (C. Gray, personal communication, May 19, 1997).

Data that could be useful in determining practice patterns include: utilization of regional and general anesthesia taking into account differing sizes and locations of the MTFs, class of providers (CRNA/Anesthesiologist) administering anesthetics, most commonly utilized anesthetics and techniques, any specialty services (pain clinics, epidural narcotics) provided, and anesthesia mobility taskings.

The data generated could be useful to tailor education/residency programs, determine operational readiness, assess practice variations, evaluate staffing variations, and characterize workload of small, medium, and large teaching and non-teaching USAF MTFs. Many of these issues are being addressed in the civilian anesthesia arena but the uniqueness of USAF anesthesia services mandates that data be obtained from USAF facilities.

Civilian anesthesia practice has many commonalities with that of USAF anesthesia practice such as a variety of practice settings, from small, rural facilities, to large medical centers. Yet, unlike civilian providers who may choose a work setting from a multitude of private or publicly governed profit or non-profit organizations, USAF anesthesia providers practice in MTFs based on the needs of the USAF. In many instances an individual USAF anesthesia provider may find himself or herself practicing in all types of settings from small to large inpatient facilities to outdoor mobile field locations.

Because of the diversity of settings USAF anesthesia providers must be ready and able to function in many environments. What is lacking, however, is information on the practice pattern differences among varying sizes and types of MTFs. These practice variations, if they exist, may determine what type of educational training new anesthesia graduates need in order to function efficiently in various practice settings. This information will allow educational institutions to tailor their training efforts to meet the needs of the USAF anesthesia practice environment and allow assignments to be based on anesthesia skill levels. In addition, the data may shed light on the unique mobility training requirements of USAF anesthesia providers.

The impact of accurate and timely USAF anesthesia practice pattern data cannot be overemphasized when it comes to the educational and mobility environments. In 1996, the Council on Certification of Nurse Anesthetists (CCNA) compiled data entitled *Professional Practice Analysis* (Zaglaniczny & Healey, 1998). The data consist of a variety of information from specific demographic data to distinct information relating to frequency and types of anesthesia techniques and agents used nationwide. This information, especially when compared to the previous two surveys conducted by the same organization in 1987 and 1992, provides the civilian nurse anesthesia educators valid data on the real world practices of our nation's anesthesia providers. Educators can then utilize this information to design didactic and clinical instruction that support current practice making student registered nurse anesthetists better prepared to provide real world care upon graduation.

The uniqueness of USAF anesthesia practice requires that information be specific to the Air Force environment so that data can be used in academic programs that train USAF anesthesia providers. Because 20-25% of the USAF MTFs are staffed solely by CRNAs (C. Gray, personal communication, May 19, 1997), it becomes apparent that military nurse anesthesia students should receive training that focuses on those practice characteristics found in the USAF MTF settings.

An additional, unique characteristic of military anesthesia practice is that of conflict or contingency readiness. The dramatic worldwide political and military changes over the past several years has led to new strategic considerations for medical operations in the United States military forces. These changes affect all aspects of USAF medical

contingency operations including anesthesia care. Within the last two years the USAF has established small medical teams that include anesthesia providers who are capable of rendering care at near front-line locations during conflict.

With change in operational tactics comes change in equipment and training. USAF anesthesia providers may now find themselves stationed at MTFs with a mobility tasking unlike any they have previously encountered. Currently, data are not available on types of mobility training anesthesia providers need or are receiving at individual MTFs. The need may exist for anesthesia providers to receive contingency training as part of their basic nurse anesthesia educational program to become familiar with field equipment and environmental factors during conflict. Issues such as these can only be addressed after adequate data are obtained about the current readiness requirements of anesthesia providers.

### **Statement of the Problem**

In the USAF, anesthesia services are provided in a variety of facilities differing in geographical, physical, and staffing characteristics. Similar to the civilian anesthesia arena where “data has demonstrated marked regional variations in anesthesia costs, practice patterns and use of non-physician providers” (Fassett & Calmes, 1995, p. 119), USAF anesthesia departments have many unanswered practice workload issues. In order to adequately plan for educational, manpower, and mobility requirements, data concerning the current practice patterns of anesthesia care delivery in small, medium, and large teaching and non-teaching USAF MTFs should be obtained.

### **Major Research Questions**

The following research questions have been identified:

1. What are the distribution and the types of anesthesia services being provided in small, medium, and large teaching and non-teaching MTFs in the USAF?
2. What type(s) of obstetrical services, if any, are being provided in small, medium, and large teaching and non-teaching MTFs in the USAF?
3. What types of anesthetic agents and techniques are anesthesia providers utilizing in small, medium, and large teaching and non-teaching USAF MTFs?
4. What class of anesthesia provider administers the anesthetics provided in small, medium, and large teaching and non-teaching USAF MTFs?
5. Do anesthesia providers have responsibilities outside the operating environment (i.e. pain clinic, OB epidural service, mobility tasking)?

### **Conceptual Framework**

The conceptual framework used in this study is the general system theory developed by von Bertalanffy (von Bertalanffy, 1968). The general system theory “mandates analysis of all the system’s parts, the relationship between and among those parts, as well as the system’s purposes, beliefs and tasks” (LaMonica, 1990, p. 24).

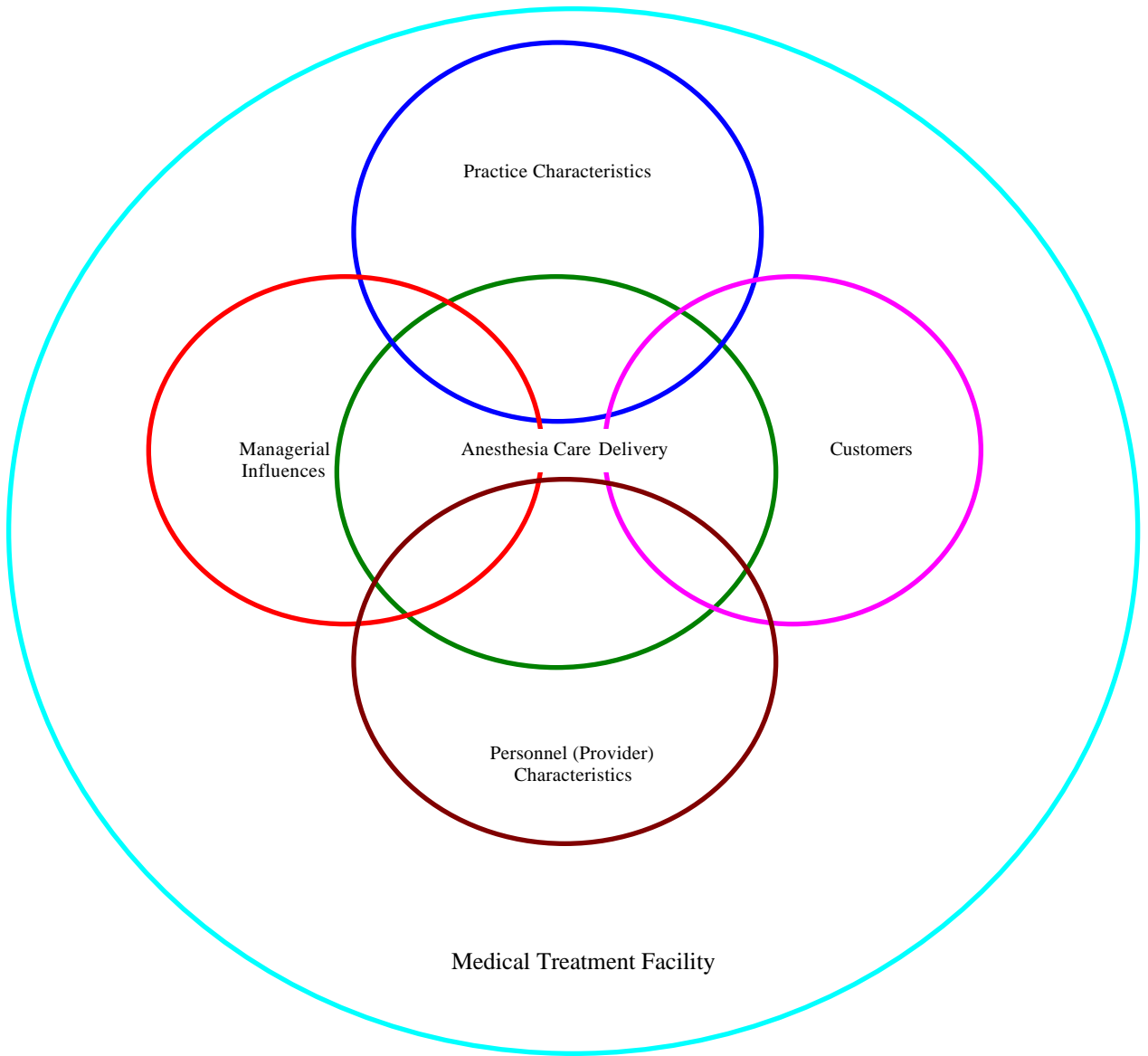
Systems can be defined as a set of relationships between objects and their properties or attributes. According to Putt (1978), bonds or relationships tie the system together making it a functional unit: “Surrounding every system is an environment that is either open or closed to influences. The surrounding environment contains sets of objects that affect both the system and the changes that may occur within it” (p. 3). A study of

systems is beneficial because of the broad applicability of the principles of systems theory to a variety of practices including the practice of anesthesia care delivery.

Any system can be divided into logical subsystems for the purpose of analysis (Putt, 1978). As in the analysis of USAF anesthesia care delivery, the subsystems may be viewed as relating to or part of the anesthesia care delivery system. Each identified subsystem having a direct impact on anesthesia care delivery may be analyzed for the specific contributions and effects it has upon the delivery of anesthesia care. Figure 1 illustrates that anesthesia care delivery is but one sub-system impacting the MTF. Additional sub-systems specific to anesthesia services such as practice characteristics, customers, managerial influences, and personnel characteristics directly influence anesthesia care delivery and, ultimately, impact the MTF. As LaMonica (1990) states, “a system has boundaries that are defined by the system’s purpose...one system is always related to or is part of a larger whole” (p. 26).

Each sub-system that influences anesthesia care delivery may be analyzed to determine what effect it has on the anesthesia care system as a whole (Figure 1). The environment that encompasses the anesthesia care sub-systems may be an individual medical facility or a much larger system such as USAF anesthesia care delivery as a totality. The effects on anesthesia care delivery (e.g., at an individual facility or group of facilities) by a particular sub-system may be determined by analysis of that sub-system, and, analysis requires information and data. The purpose of this study will be to obtain and present data specific to the practice characteristics sub-system as identified in Figure 1.





**Figure 1. Systems Impacting Anesthesia Care Delivery**

### **Definitions**

Operational definitions:

Distribution: relates to that particular type(s) of USAF MTFs (small, medium, or large teaching or non-teaching) where the surveyed anesthesia practice patterns are located.

Anesthetic agents and techniques: are those listed in the data tool (Appendix B) items # 30-44.

Class of anesthesia provider: is either a Certified Registered Nurse Anesthetists or anesthesiologist. The terms anesthesia provider and provider is used interchangeably.

Mobility tasking: is a tasking that requires the facility to maintain a percentage of medical personnel who are readily available for deployment to virtually any geographical location in support of contingency or humanitarian operations. These deployable teams consist of many medical specialties including anesthesia providers.

Types of surgical and anesthesia services provided: in addition to the administrative, military, teaching, and managerial duties performed by USAF anesthesia providers that contribute to differences in the practice patterns of anesthesia providers at various MTFs.

In this study, types of anesthesia services are those services listed under practice patterns in the data collection tool (Appendix B) that include general or monitored anesthesia care, regional (other than labor epidurals), obstetrical services (including labor or non-labor epidurals), and pain management.

MTFs: refers to USAF medical treatment facilities that provide anesthesia services as part of the medical services available. MTFs range from those providing only outpatient services to medical centers capable of the most modern treatment techniques.

The population served by an individual MTF varies dependent upon the number of active duty personnel, dependents and retirees who utilize the facility. Currently the USAF has 54 MTFs worldwide who provide anesthesia services. The individual MTFs will be designated small, medium, or large once data have been obtained based upon inpatient bed occupancy.

Distribution and types of anesthesia services: shall be defined as those types of anesthesia services included in the data collection tool (Appendix B) with the distribution being all Air Force MTFs surveyed that provide anesthesia services.

Small, medium, and large MTFs: refer to categorization of the various MTFs based upon reported number of inpatient beds (0-20= small, 21-79= medium, 80-350= large).

Teaching and non-teaching MTFs: differentiates between facilities providing formalized clinical training either to nurse anesthesia students or medical anesthesia residents or both.

Types of obstetrical services, anesthetic agents and anesthetic techniques: is defined as those anesthesia related obstetrical services, agents, and techniques included in the data collection tool (Appendix B).

Responsibilities outside the operating environment: include those duties performed by anesthesia providers other than services provided in the operative setting specifically staffing pain clinics, providing epidural services, and mobility requirements.

## **Assumptions**

1. Practice patterns of anesthesia delivery will vary among small, medium, and large teaching and non-teaching USAF MTFs.

### **Limitations**

1. This study was potentially limited by the willingness of the respondents to accurately complete the data collection tool in a timely manner.
2. Possible source of bias is that data was obtained from the chief/senior nurse anesthetists at each facility.
3. This study included only USAF MTFs, therefore, the results cannot be generalized to the other military services or to the civilian population.

### **Summary**

The current health care system in the United States is undergoing change in an attempt to provide cost effective services to those in need. The effects of health care reorganization are not only realized by the civilian community but by the military health care delivery systems as well. Virtually all health care providers will feel the effects of change be it in technological updates or cost cutting stratagems.

Anesthesia care delivery continues to undergo changes internally as well as those brought about by external pressures. Effective change requires data specific to areas being considered for reorganization. The civilian anesthesia community has state, regional, and nationwide data available that can be utilized to address reorganization strategies. To effectively meet reorganization challenges in anesthesia delivery in the USAF, data needs to be available specific to the USAF anesthesia care environment.

## **CHAPTER 2 - REVIEW OF LITERATURE**

### **Introduction**

This review is based on the available literature relating to published anesthesia practice patterns that include provider relations, work patterns, practice arrangements, patient case loads, and provider demographics. The majority of current information is limited to studies relating to the civilian anesthesia community. However, many comparisons to USAF anesthesia practice exist. Historical information regarding the development and practice of anesthesia is included as supportive data.

### **Historical Review of Anesthesia Practice**

After the discovery of aseptic techniques and moderately safe and effective anesthesia agents, the practice of surgery blossomed. As the demands of surgical intervention grew, so did the need for personnel to administer anesthesia. During that era delivering anesthesia was looked upon as a non-medical function. Moreover, “economics made anesthesia unattractive to physician specialists” (Bankert, 1993, p. 35). Therefore,

those who were already providing care were sought to provide anesthesia care, and they were nurses.

Over the ensuing decades physician interest in the field of anesthesia began to grow, and the medical specialty that developed was patterned after the nursing specialty. According to Gunn (1996), the newly developed “American Society of Anesthesiologists (ASA) was not long in stating that it’s goal was the establishment of an all physician specialty” (p. 48). Even though the ASA’s goal has never been achieved, the debate over the role of the two providers roles remains central to many practice issues today.

### **Provider Relations**

Currently, CRNAs and anesthesiologists provide an estimated 25 million anesthetics annually (Fassett & Calmes, 1995). It has been well documented that CRNAs and Anesthesiologists share overlapping functions (Eskreis, 1985; Tobin, 1994). Even though “there is little uniformity concerning how states regulate nurse anesthetists scope of practice, every state permits nurse anesthetists to administer local, regional and general anesthesia” (Tobin, 1994, p. 66). According to Rosenbach, Cromwell, Pope, Butrica, and Pitcher (1991), anesthesiologists practice alone in about 29% of the cases. In the remaining 71% of cases CRNAs provide anesthesia either with an anesthesiologist or independently. One of the most debated issues affecting the practice of anesthesia relates to supervision of CRNAs by anesthesiologists. Currently, many states require that a licensed physician supervise CRNAs. However, *no state* requires that the supervising physician be an anesthesiologist (AANA, 1994). Eskreis (1985) noted that CRNAs,

often “supervised” by physicians with no experience in anesthesia, do make independent critical life and death decisions for patients.

The effectiveness of CRNAs working alone or without anesthesiologists’ supervision has long been established in rural settings and in many community hospitals even when CRNAs are competing with anesthesiologists for cases (Gunn, 1996). According to Martino (1990), it is not unusual for CRNAs in small facilities to find themselves practicing alone for weeks at a time and, indeed, may be the only anesthesia providers available. However, most anesthesiologists “continue to espouse medical and/or anesthesiologist supervision of CRNAs for administration of all anesthetics” (Martino, 1990, p. 50).

### **Practice Arrangements**

A variety of political, legal, economic, and professional forces have encouraged the growth of combined (CRNA and anesthesiologist) provider practices. According to Fassett and Calmes (1995), the Anesthesia Care Team (ACT) is one type of group practice that has become quite prevalent. ACTs, which usually consist of CRNAs who administer anesthetics with medical direction from an anesthesiologist, are predominant in hospitals with large surgical volumes, academic or teaching hospitals, public hospitals, health maintenance organizations, and geographic areas with adequate CRNA manpower.

ACTs currently administer the majority of anesthetics in America. However, this collaborative practice has not provided the economic savings expected by utilizing the more cost effective non-physician CRNA providers. As Fassett and Calmes (1995) state, ACT administered anesthetics “are 30% more expensive than those administered by

CRNAs or anesthesiologists who practice in other settings” (p. 118). The reason for increased cost for ACTs is apparently related to excessive medical direction and duplication of services.

The anesthesiologist member of an ACT provides medical direction, which implies a consultation between providers with the anesthesiologist determining (in whole or part) the actions of the CRNA. In actual practice, however, medical direction may be “more collaborative in nature and heavily dependent on the experience, knowledge and skills of both team members” (Fassett & Calmes, 1995, p. 121). Gunn (1996) states that the intent to utilize medical consultation is for those patients having significant medical problems or complications, not for every individual receiving anesthesia care.

With proper utilization a collaborative practice approach may prove beneficial “because of the sophisticated level of practice of both CRNAs and anesthesiologists. Both of these groups bring highly specialized skills to manage the anesthetic process and enhance each others capabilities” (Katz& Waugaman, 1991, p. 116).

The American Society of Anesthesiologists (ASA) has advocated medical direction of all non-physician anesthetists at a 1:2 anesthesiologist to CRNA ratio. However, based on the lobbying by the American Association of Nurse Anesthetists (AANA) with support from its members as well as many anesthesiologists, a 1:4 ratio was established as the maximum number of concurrent cases for which an anesthesiologist could gain reimbursement for medical direction of CRNAs (Gunn, 1996). This ratio



serves no other purpose than to define reimbursement requirements and is not for qualitative or standard of care determinations.

A study by Fassett and Calmes (1995) found that in three quarters of all anesthesia cases a CRNA could administer the anesthesia independently without supervision or the assistance from another anesthesia provider (CRNA or Anesthesiologist). According to Gunn (1996), this finding is characteristic of many suburban hospitals. Beutler (1988) reports that about 75% of physician providers supervise and bill for CRNA services under the team approach. If only one quarter of the anesthesia cases require supervision or assistance from another provider, but three quarters are being billed for such services, then any potential savings by utilizing the team concept is forfeited. As Foster and Jordon (1991) argue, “the public cannot afford layered care involving multi-professionals who do not have a credible and justifiable reason for receiving payment for services rendered” (p. 114).

Currently the USAF regulation regarding anesthesia care (Surgeon General USAF, 1995) states that CRNAs may routinely administer anesthesia to children two years of age or older and those “ASA classification II or lower risk” (p. 6). The exception is that a CRNA may provide care to those younger than two years of age or higher risk than ASA classification of II after verbal consultation with “the individual’s anesthesia consultant” (p. 6). Because CRNAs are sole providers in 45% of all USAF MTFs, it is not known if medical direction or supervision is over-utilized in the remaining 55% where both CRNAs and anesthesiologists practice.

In terms of ACT practices Fassett and Calmes (1995) conclude that professional, philosophical, and political agendas may affect a department's policy on medical direction. "Continuing disagreements between anesthesiologists and CRNAs regarding scope of practice, reimbursement, professional autonomy, liability, education, prescriptive authority and access to clinical privileges have obstructed efforts to produce efficient, cost effective and collaborative ACT practices" (p. 122).

### **Provider Demographics, Case Load and Work Patterns**

Data have shown marked regional variations in use of non-physician providers, anesthesia costs, and practice patterns. These variations exist not only across states, but also across hospital or facility types. It is most often the individual medical facility that determines how anesthesia providers will be utilized, thus, determining in part the practice patterns at that facility.

Rosenbach and Cromwell (1988) conducted a survey of 500 CRNAs and anesthesiologists nationwide to gather primary data on work effort, practice arrangements, and patient load. This study provided significant information relating to the practice of anesthesia in several different areas. In addition, the CCNA studies in 1992 and in 1996 surveyed 1,313 and 2,586 CRNAs respectively obtaining data specific to nurse anesthetists in areas such as practice settings, procedures requiring high and low levels of expertise, the most and least frequently utilized agents, techniques, and monitoring devices (Zaglaniczny, 1993; Zaglaniczny & Healey 1998). Information furnished by these studies provides valuable insights into CRNA practice patterns.

According to the Rosenbach and Cromwell (1988) study, case mix distribution was identical for an anesthesiologist working alone or in a team with CRNAs. This may be due in part to the surgical facilities at hospitals with only CRNAs as well as the need for more than one anesthetist in very complex cases. In general, the hospital profile for anesthesiologists does not vary according to whether they work alone or with CRNAs except that the team approach is found in hospitals with more beds and more operations per week. From their study, Rosenbach and Cromwell, found that staffing patterns did not appear to be a function of case mix as the tertiary care facility had a three to one CRNA to anesthesiologist ratio. Instead, program differences (i.e., presence of obstetrics, epidural program), historical precedent, future expansion plans, and the philosophy of the chief anesthesiologist seem to account for the differences.

It was noted that most CRNAs who work alone are located in rural areas in hospitals averaging fewer than 100 beds with occupancy rates barely above 50% and with fewer than four operations per day. In 1992, the CCNA study found that in 63% of CRNAs who practiced in a hospital setting, however, the percentage dropped to 39% by 1996 (Zaglaniczny, 1993; Zaglaniczny & Healey, 1998). Additionally, CRNAs practicing in a physician group rose from 22% to 43% during the same period. The information provided did not specify the type of practice (independent, team, supervised) typically found in the physician group.

On average CRNAs working alone performed significantly less complex procedures (Rosenbach & Cromwell, 1988). These case mix differences were found across both obstetric and nonobstetric cases. The CRNA participation rate in obstetrical

services varies with unit size ranging from about 50% of the hospitals with fewer than 500 births to nearly 60% with 500 or more (Rosenbach et al., 1991).

Of the many tasks that may be performed by an anesthesia provider, the majority were reported to be more often accomplished by CRNAs when working alone than by CRNAs who work in a team. “Simply stated, a CRNA who works alone, there is no other anesthetist to perform the task. But when a MDA is involved, less delegation occurs” (Rosenbach et al., 1991, p. 125). Few CRNAs perform invasive tasks such as inserting central lines or Swan-Ganz catheters, anesthesiologists assume the major responsibility of invasive procedures. However, according to Gunn (1996), CRNAs working alone do more emergency cases on a percentage basis than do anesthesiologists or teams.

Historically, two thirds of the CRNAs rarely or never performed regional anesthesia. According to Rosenbach and Cromwell (1988), about two thirds of the anesthesiologists, but fewer than one third of CRNAs regularly administer regional blocks. Specific to CRNA practice patterns, Zaglaniczny and Healey (1998) reported that the 1996 CCNA study found that the most frequently used anesthesia techniques include oral endotracheal intubation, monitored anesthesia care, mask inhalation, and spinal or epidural blocks. Peripheral extremity blocks, eye blocks, and infiltration nerve blocks were among the least frequently used techniques, which coincides with the findings by Rosenbach and Cromwell.

In a recent article Abenstein and Warner (1996) asserted, without substantiating evidence, that CRNAs working alone are involved with less complex and do more shorter

procedures on healthier patients. However, Martin-Sheridan and Wing (1996) found that Abenstein and Warner's claim lacked any factual substantiation.

According to Martin-Sheridan and Wing (1996), a 1990 Office of Technology Assessment publication demonstrates that "despite lower mortality rates, except with regard to accidents, the rural population has a higher percentage of elderly patients and a higher incidence of such chronic diseases as cardiac, pulmonary and renal failure and diabetes" (p. 529). In addition, the demands on anesthesia providers in rural hospitals can, in many ways, be much greater than those in tertiary care facilities located in urban areas. Therefore, smaller does not necessarily equate to less demanding when it comes to anesthesia practice in the rural setting.

Many of the USAF MTFs are similar to civilian rural medical facilities not only in size but also in case mix and provider type. Even though similarities exist between USAF MTFs and civilian medical facilities, research to date has only considered the civilian anesthesia community and information specific to USAF anesthesia practice patterns is not available.

## **Summary**

In review, current literature referring to anesthesia care practice patterns reveals interesting data regarding such issues as: autonomy, provider ratios, distribution of providers, workload characteristics, team practice, and supervisory issues. Although demographic data are included in some of the published studies, information exclusive to military anesthesia practice characteristics is lacking. In particular, systematic data pertaining to USAF anesthesia practice patterns are nonexistent. As published studies

show there are a variety of anesthesia care delivery concerns in the civilian community that are being addressed utilizing data relating to current practice pattern characteristics. One may conclude that, because of the similarities between USAF and civilian anesthesia practice, the USAF may indeed benefit from such published data. However, the many inherent differences in Air Force anesthesia practice patterns require that information and data be obtained to address issues specific to USAF anesthesia care.

## **CHAPTER 3 - METHODOLOGY**

## **Introduction**

This chapter describes the methodology utilized in obtaining the data collected for this research. Specifically, the research design, sample population, method of measurement, protection of human rights, and data analysis are explained.

## **Research Design**

This was a descriptive study. Data pertaining specifically to practice patterns of anesthesia care delivery in USAF MTFs were obtained by mailed surveys and results tabulated for inclusion in this study. As per USAF Instruction 36-2601, approval to utilize the survey was obtained from Headquarters Air Force Personnel Center (USAFPC), Randolph Air Force Base, TX and from the Uniformed Services University Investigational Review Board (Appendix A). Approval was also obtained from the Nurse Anesthesia Consultant to the USAF Surgeon General, Col. G. Chris Gray.

## **Sample**

Participants in this study consisted of all USAF MTFs who offer anesthesia care. At the beginning of this study there were 54 MTFs reported as providing anesthesia care in the USAF worldwide.

## **Measurement**

A packet containing a letter requesting participation in the study (Appendix C), a cover letter from the Nurse Anesthesia Consultant to the USAF Surgeon General requesting participation in the study (Appendix D), the survey (Appendix B), and a stamped return mail envelope was mailed to the Chief CRNA at all USAF MTFs having anesthesia services available. A current listing of these MTFs was obtained from Col.

Gray. A follow up reminder was sent to those facilities' Chief CRNAs who had not returned the survey 6 to 8 weeks after the packet was initially mailed (Appendix E).

The survey, designed by the author in collaboration with several other researchers, consisted of 45 questions divided into three categories: management, personnel characteristics, and practice patterns. Data obtained specifically from the practice pattern category were tabulated for inclusion in this study. The categories relating to management and personnel characteristics, although not included in this study, will be analyzed by the thesis chairperson, Dr. Maura McAuliffe, CRNA, LtCol., USAF, NC, and forwarded to the Nurse Anesthesia Consultant to the USAF Surgeon General at his request. Several questions from the management and personnel characteristic categories provided relevant statistical background information relating to practice pattern characteristics and were included.

### **Protection of Human Rights**

Confidentiality was maintained in that each facility's return envelope was numerically coded for tracking purposes only; the individual surveys had no facility specific identification. Once registered as being returned, the envelope was separated from the survey and destroyed. In addition, all surveys were destroyed after the information had been tabulated.

### **Data Analysis**

Information from the 15 questions in the practice pattern portion of the survey was utilized along with several questions from the management and personnel characteristic categories. Data are summarized in terms of frequency, distributions,



means, and percentages, and classified according to the following categories: small, medium, and large training or non-training USAF MTFs. Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS).

### **Summary**

The design of this study was descriptive utilizing surveys designed by the author and other researchers approved by the appropriate university and military agencies. Data obtained from the sample population of all Air Force MTFs providing anesthesia services were summarized in terms of frequencies, distributions, means, and percentages utilizing SPSS. Confidentiality was maintained during all aspects of data collection, analysis, and presentation.

## CHAPTER 4 – ANALYSIS OF DATA

### Introduction

Analysis and interpretation of data obtained will be presented in relation to the major research questions outlined in Chapter 1. The first section provides demographic and background data necessary in determining many practice pattern relationships between the varying types of MTFs. Subsequent sections deal with the major research questions.

### Demographic & Background Data

Of the 54 surveys mailed to USAF MTFs providing anesthesia services, 40 were returned (73%). Because anesthesia services were no longer provided at one MTF, that survey was not completed. It was learned that another facility had stopped anesthesia services after the surveys had been sent. Therefore, 74% of the MTFs providing anesthesia services returned the survey (39 of 53). Natural breaks in the data provided for a distribution between small, medium, and large facilities based upon number of inpatient beds (Table 1).

**Table 1.**

#### **Size of MTFs According to Number of In-patient Beds**

Facility	N	Range	Mean
Small	23	0*-20	11
Medium	14	21-79	38

Large	2	80-350	232
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\*these facilities reported as Surgical Centers (N=4)

Attention needs to be given to the low N for large facilities (N=2). In many instances data was insufficient to draw any meaningful conclusions for this category and caution should be exercised when interpreting results from this category.

Additional demographic data included number of operating rooms per facility (Table 2), number and types of anesthesia providers per type of facility (Table 3) and average cases per month and year per facility (Table 4).

**Table 2.**

**Number of Operating Rooms for Small, Medium and Large MTFs**

Facility	N	Range	Mean
Small	23	2-3	2
Medium	14	3-6	4
Large	2	5-19	12

**Table 3.**

**Number of Anesthesia Providers per Small, Medium and Large MTFs**

Facility	N	CRNAs		Anesthesiologists	
		Range	Mean	Range	Mean
Small	23	2-4	2.5	0*-3	0.6
Medium	14	3-6	3.8	1-4	2.7
Large	2	5-20	12.5	4-26	15.0

\*14 small facilities report 0 Anesthesiologists

**Table 4.**

**Average Number of Anesthesia Cases per Month and Year for Small, Medium and Large MTFs**

Facility	N	Cases per Month		Cases per Year	
		Range	Mean	Range	Mean
Small	22	16-90	53	200-1300	646
Medium	14	50-300	164	600-3600	1828
Large	2	190-2300	1245	2300-16782	9541

The average number of CRNAs per number of operating rooms is similar in each category: nearly one to one for small (1.1), medium (0.9) and large (1.04) MTFs. The average number of anesthesiologists per operating room is 0.3 and 0.6 respectively for small and medium MTFs, and for large facilities the number of anesthesiologists per operating rooms is higher than that of CRNAs, averaging 1.25 per room.

A much larger proportion of anesthesiologists is also seen in large facilities when comparing CRNA to anesthesiologist ratios. The ratio of CRNAs to anesthesiologists is approximately 4:1 in small MTFs decreasing to 1.5:1 in medium facilities and completely reversing in large facilities at a ratio of 1:1.2 (CRNA to anesthesiologist). As stated earlier, some authors support a 4 to 6 CRNA to MDA ratio, and even with anesthesiologists' greater involvement in anesthesia related services (preparation of

critically ill patients, management of pain services, and intensive services), a 3 to 4 CRNA to MDA ratio has been reported as sufficient (Gunn, 1996).

One possible reason for the large USAF MTFs reporting large numbers of anesthesiologists is that these facilities included anesthesia physician-residents in their data. However, the large facilities responding reported their anesthesiologists as “staff”, having passed oral and, in most cases, written boards. As previously stated, it is estimated that only one fourth of all anesthesia cases actually require supervision or additional assistance; however the number of anesthesiologists in large facilities appears far beyond even the ASA recommended 2:1 CRNA to anesthesiologist ratio.

About 20-25% of the American public is served solely by CRNAs (Gunn, 1996) and about 45% of the AF MTFs are staffed solely by CRNAs. The data obtained from this study is that 14 of the 39 respondents (36%) report staffing by CRNAs alone, all of which are small MTFs.

### **Distribution and Types of Anesthesia Services Being Provided**

Types of anesthesia services being provided at various types of AF MTFs can be established by determining types of anesthetics and services delivered at each facility.

In Figure 2 the types of anesthetics delivered as a percentage of total cases in small, medium, and large facilities in the month of September 1997 is depicted. Figure 3 illustrates the same for teaching and non-teaching MTFs. All facilities, where data was provided, utilize a variety of major categorical anesthetic techniques for their prospective patient populations. Consideration for the small N for large facilities as well as teaching facilities needs to be made when examining the data presented.

The most frequently utilized technique in all facilities, except for small, was general anesthesia with monitored anesthesia care (MAC) being the next most utilized technique. Overall types and duration of cases in addition to higher percentage of outpatient procedures may, in part, be responsible for the higher percentage of MAC cases at smaller facilities. A more specific breakdown of anesthetic techniques and utilization will follow.

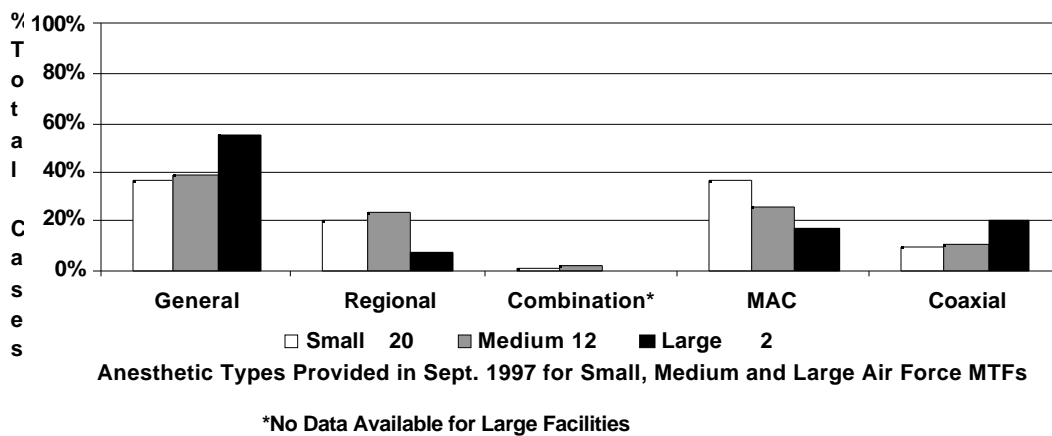


Figure 2.

Type of Anesthetics Provided by Size of Facility



### **Figure 3.**

#### **Type of Anesthetics Provided by Type of Facility**

Although the various MTFs are similar in types of anesthetics delivered, a variation does exist when looking at specific anesthesia services such as obstetrical and pain management. Of all MTFs responding, 53% (n=20) reported providing obstetrical services at their facility. Table 5 depicts a large variation exists between small and other size facilities in providing obstetrical services. Fifty percent of small facilities reporting do not provide obstetrical services. Several factors may be responsible for this large percent including Air Force Policy, cost effectiveness, and staffing requirements. These will be discussed below.

The Assistant Secretary of Defense (1992) has mandated that every military facility offering obstetrical services must provide labor epidurals as an option to expecting mothers (Assistant Secretary of Defense, 1992). If the facility cannot provide this service, then provisions must be made for patients to have this service available at other military or civilian facilities if they so choose. In order to provide this service, anesthesia personnel must be immediately available whenever labor epidurals are being utilized.

With a mean of three anesthesia providers in small facilities, the ability to support round the clock labor epidural services is questionable. Data specific to labor epidural procedures will be provided in the next section. Inability to support this type of service due to inadequate anesthesia staffing may, in some instances, determine the non-availability of obstetrical services at a small facility. Moreover, with resizing of many

military MTFs, cost effectiveness of maintaining such services may be the determining factor in the nonavailability those services. Many small MTFs not providing obstetric services are, however, providing a variety of gynecological procedures as evidenced by anesthesia case descriptions returned with several surveys by small facilities.

**Table 5.**

**Percentage of Air Force MTFs Providing Obstetrical Services**

Facility	N	PERCENT YES
Small	22	50
Medium	14	93
Large	2	100
Teaching	5	80
Non-teaching	33	64

Data provided regarding pain management also demonstrated considerable variation. Table 6 shows that more than half of small facilities do not provide pain management services as compared to 86% and 100% of medium and large facilities respectively. The reason for lower percentages of small facilities providing pain management services may be similar to that found with obstetrical services, i.e., anesthesia staffing may not provide the personnel to adequately allow for an ancillary pain management service. In addition, patient population types requiring acute or chronic



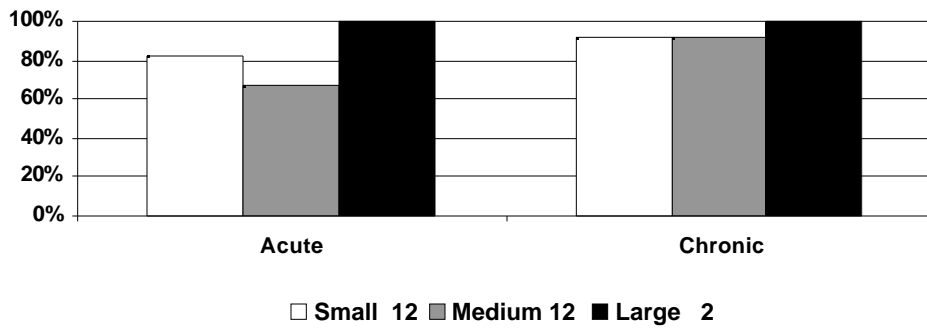
pain management may not be large enough at smaller facilities to effectively justify such a service.

**Table 6**

**Percentage of Air Force MTFs Providing Pain Management Services**

Facility	N	PERCENT YES
Small	21	57
Medium	14	86
Large	2	100
Teaching	5	100
Non-teaching	32	66

Those facilities providing pain management, data was collected about the percentage of MTFs providing acute post-operative and chronic pain management services (Figure 4). Acute post-operative pain management may include oral, intravenous, intrathecal, or epidural administration of pain medications in addition to a variety of peripheral nerve blocks or transcutaneous electrical nerve stimulation. Chronic pain management usually involves outpatient visits outside the operative setting in an attempt to control pain by a variety of measures including nerve blocks, steroid injections and oral medications. Data demonstrate that of facilities providing pain management services, the majority offers both acute and chronic services.



**Figure 4.**

**Percent of Air Force MTFs Providing Acute & Chronic Pain Management Services**

**Types of Obstetrical Services Provided at Various MTFs**

A large portion of responding MTFs provide obstetrical services (Table 5). Of these, various types of obstetrical procedures were examined and percentages determined based on total number of deliveries during a one month period (Table 7).

**Table 7**

**Labor Analgesic Techniques Performed in Sept. '97 by Size of Facility**

Facility	N	Deliveries	Intrathecal Narcotics		Labor Epidurals	
			# Cases	% of Deliveries	# Cases	% of Deliveries
Small	8	214	79	37	33	15
Medium*	11	493	122	23	143	29
Large	1	188	NR		NR	

\*2 Medium facilities reported “combined” spinal/epidural technique totaling 31 cases. NR= no response

Although there were no data available from large facilities, a distinct variation is noted between small and medium MTFs. Although both small and medium sized MTFs report the same percentage of caesarian sections per total deliveries (15% each) small facilities do twice as many intrathecal narcotic procedures as labor epidurals. Medium facilities, on the other hand, report a higher percentage of labor epidurals compared to intrathecal narcotics. The anesthesia staffing requirements necessary to adequately provide labor epidurals as an option may be too great for small facilities to cover as evidenced by the minimal labor epidural percentages for small facilities. Data for teaching and non-teaching facilities was not considered for obstetrical procedures due to insufficient data from teaching facilities.

### **Types of Anesthetic Agents and Techniques Being Utilized by Air Force**

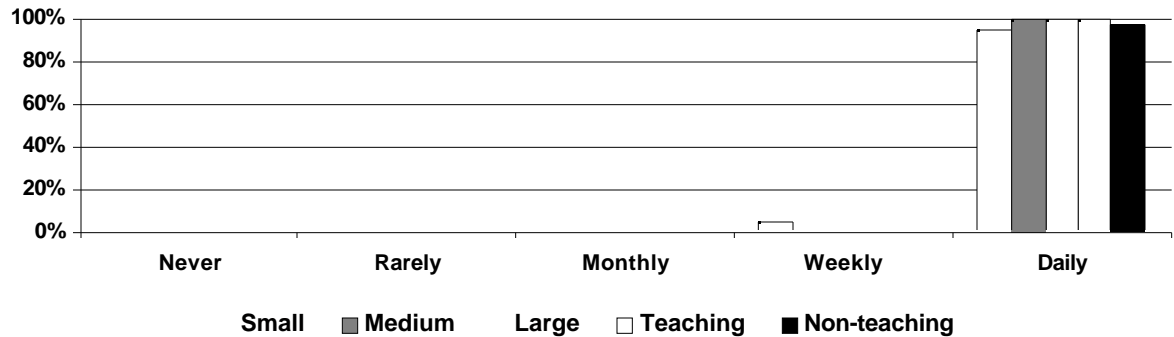
#### **Anesthesia Providers**

All facilities were surveyed as to types and frequency of use of several anesthetic agents and techniques. For the anesthetic agents, an effort was made to determine use of older “mainstay” agents in relation to some of the newer agents. The categories of agents included: narcotics, induction agents, volatile agents, anti-emetics, local anesthetics, and neuromuscular blocking agents.

Figure 5 shows that the narcotic Fentanyl is clearly the mainstay agent utilized daily at facilities. This data coincides with the CCNA study that ranks Fentanyl as the most frequently used anesthetic agent overall in 1996 (Zaglaniczny & Healey, 1998). At the other extreme, the newest narcotic, Remifentanyl, is not used at all on a daily basis, and the majority of MTFs report never using it. This finding also coincides with the

1996 CCNA study, which found Remifentanyl one of the least frequently used agents.

So, with respect to narcotic selection, Air Force and civilian practice appears to be similar.



**Figure 5.**

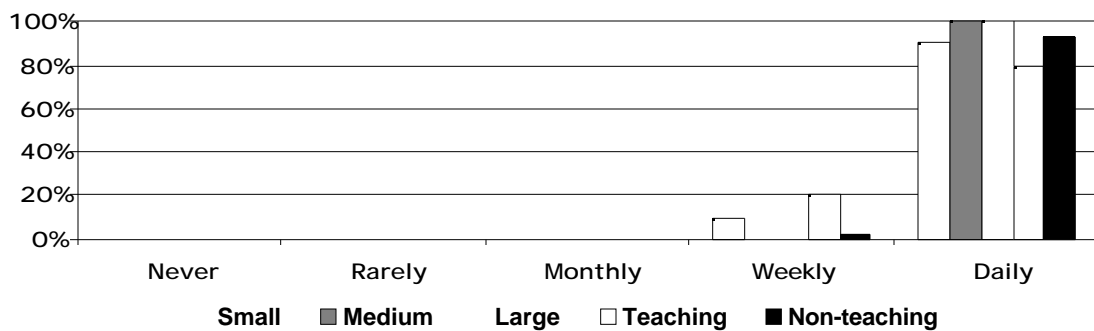
### **Use of Fentanyl by Air Force Anesthesia Providers**

Although Propofol is no longer considered a new agent, compared to older induction agents such as Thiopental, it is the newest in this class. Propofol, like Fentanyl, is the anesthetic induction agent used virtually everyday in all MTFs (Figure 6). Thiopental, although used by the majority of MTFs, is not utilized on a daily basis, but instead is relegated to weekly, monthly or in some places rarely used. These findings coincide with the CCNA studies which found that Propofol moved from a ranking of 13 in 1992 to the third most utilized anesthetic agent in 1996 (Zaglaniczny, 1993; Zaglaniczny & Healey, 1998). Thiopental was listed as the 4th most used agent in 1996.

In retrospect, because of the potential necessity of Air Force providers to deliver anesthesia to wartime casualties, a survey of the use of induction agents such as Ketamine may have been appropriate to determine if providers are indeed utilizing such agents.

Propofol, although a very useful and popular induction agent, is not the usual agent of choice for induction of the shock or hypovolemic patient.

Although the anxiolytic/amnestic agent Versed is generally used as a pre-operative medication and not considered an anesthesia induction agent, it was included to determine if this drug was as popular among providers in Air Force MTFs as civilian practice where it was ranked third and second most used agent in 1992 and 1996 respectively. Versed is used virtually as much as Fentanyl or Propofol on a daily basis by Air Force anesthesia providers.



**Figure 6.**

**Use of Propofol by Air Force Anesthesia Providers**

Droperidol has for many years been used as an anti-emetic agent by anesthesia providers both for prophylaxis and to treat post anesthesia nausea and vomiting. One of the newest anti-emetic agents, Ondansetron, is unusual in that its pharmacokinetic profile results in fewer side effects when compared to Droperidol. Used largely as an anti-emetic

for cancer patients, Ondansetron has quickly found a place in anesthesia care however, the comparatively high cost of this agent may be a limiting factor in its overall acceptance.

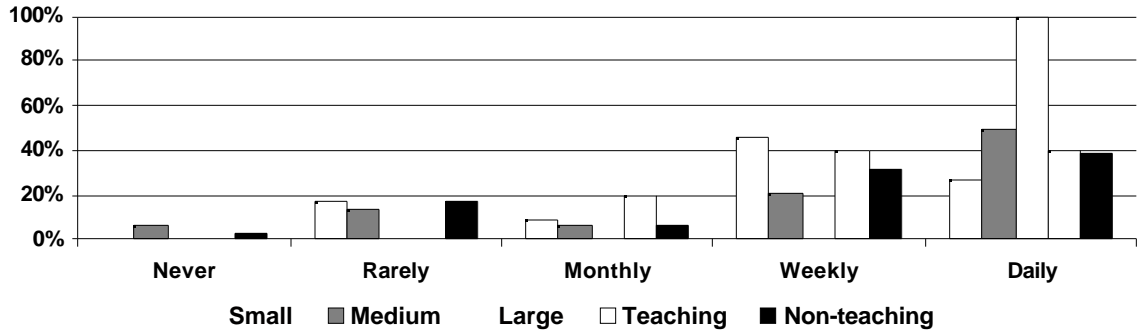
Ondansetron is utilized more on a daily basis by providers in medium and teaching MTFs when compared to Droperidol, although a higher percentage of small, medium, and non-teaching MTFs report never using the newer agent. Overall, a higher percentage of all MTFs appear to be using anti-emetics on a weekly to daily basis with the greatest daily usage being in medium, large, and teaching facilities. Surgical case types associated with high incidences of postoperative nausea and vomiting such as middle ear surgery as well as less-experienced resident providers at teaching facilities may partially account for the higher percentage of anti-emetic agents used in these facilities.

Similar to the 1996 CCNA study, five volatile agents were examined. Figures 7 and 8 show that Desflurane has the highest percentage of daily use in all facilities. Interestingly, a higher percentage of facilities reporting that the agent is rarely or never used when compared to Isoflurane. Combined percentage use on a monthly, weekly, and daily basis shows that Isoflurane is utilized more than other agents surveyed. Zaglaniczny and Healey (1998) reported that the CCNA survey likewise found that Isoflurane was the most frequently used volatile agent with Desflurane following second. Enflurane, oldest of the agents surveyed, was found in this and the CCNA study to be by far the least utilized agent.

The large daily percentage of Desflurane use, a much newer agent than Isoflurane, may be related to its properties of quick onset as well as fast emergence approximately half that of Isoflurane. Rapid “on and off” properties make Desflurane ideal in many

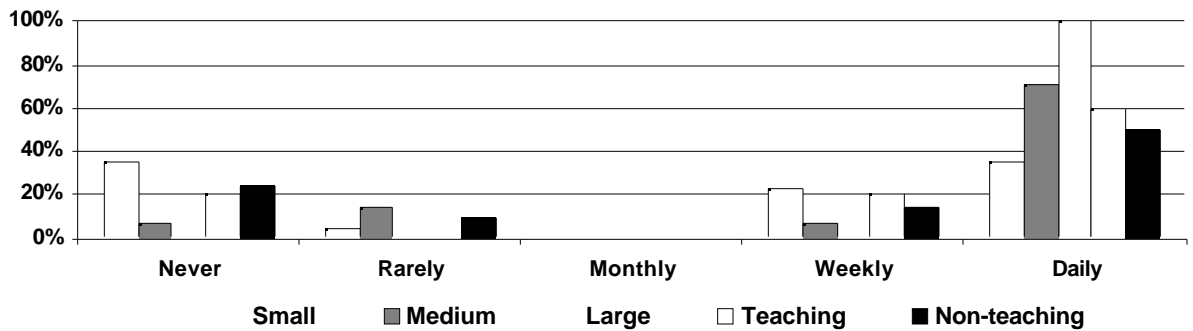
outpatient settings or short duration procedures where expeditious case turnarounds are desirable. In addition, because of its high vapor pressure, Desflurane requires a special vaporizer that in many instances is provided free by the company as part of an incentive package to use the product. The current high cost of Desflurane when compared to Isoflurane as well as lack of availability may be contributing factors in small and non-teaching facilities reporting never utilizing the drug.

Halothane and Sevoflurane are two agents that can be used for anesthesia induction because their nonpungent properties make mask induction tolerable for the patient. The newest of the two agents, Sevoflurane, shows a higher combined daily and weekly use rate in all facilities surveyed when compared to Halothane; however, half of non-teaching and nearly 64% of small facilities report never using this agent. In addition, a large combined percentage report never or rarely utilizing Halothane. Although it appears that Sevoflurane is being use more on a daily and weekly basis by all facilities when compared to Halothane, a large percentage of small and non-teaching MTFs report never or rarely using either agent. The low utilization rate among these types of facilities may be largely related to the small patient population types requiring mask induction anesthesia, namely pediatric patients, and the high reported use of other agents, mainly Isoflurane. The CCNA 1996 survey reported similar results in that Sevoflurane was the third most utilized volatile agent followed very closely by Halothane.



**Figure 7.**

**Use of Isoflurane by Air Force Anesthesia Providers**



**Figure 8.**

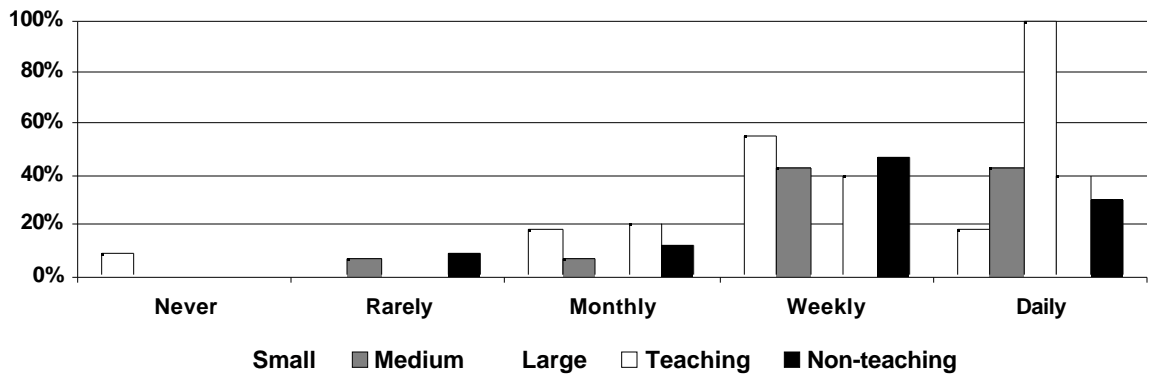
**Use of Desflurane by Air Force Anesthesia Providers**

In assessing neuromuscular blocking agents (NMB), three agents were selected to represent differing spectrums of these types of agents. Succinylcholine, oldest of the NMB surveyed, remains the only routinely used depolarizing agent in the United States. Many non-depolarizing NMB agents have been developed attempting to replicate Succinylcholine’s quick onset and short duration of action, the newest of which is Rocuronium. Although Rocuronium approaches Succinylcholine in quick onset its



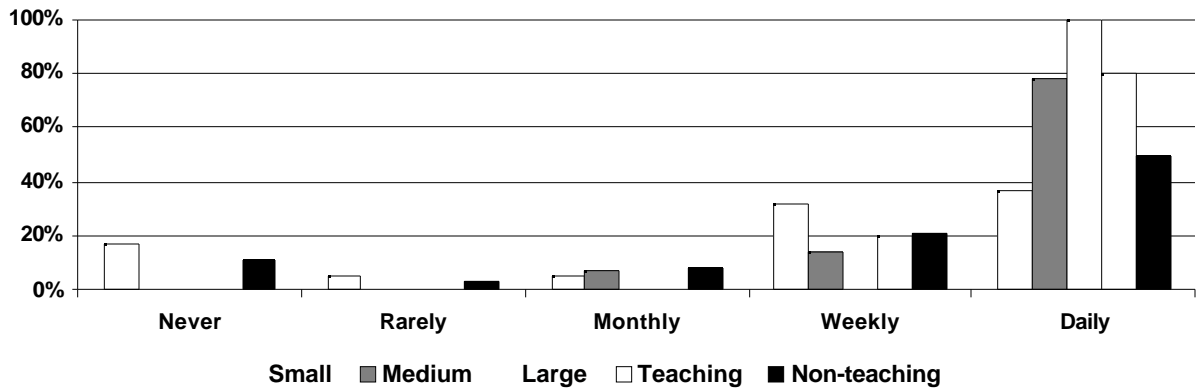
duration of action is many times longer when administered in higher induction doses. Tables 9 and 10 show that Succinylcholine is utilized by a large percentage of all facilities on a weekly or daily basis, although Rocuronium has a higher percentage of daily use among all facilities surveyed. Lack of potential side effects specific to Succinylcholine, the fairly quick onset, and pharmaceutical company incentives may be partially responsible for the high utilization of Rocuronium. The CCNA study of 1996 demonstrated that Succinylcholine was the most overall utilized NMB agent followed by Rocuronium, then Vecuronium. In retrospect, it would have been interesting to have included the popular NMB agent, Vecuronium, in this study to compare its utilization to Rocuronium by Air Force anesthesia providers.

The newest nondepolarizing NMB, Cisatracurium, was also included to determine the utilization of this newest agent by Air Force providers. Cisatracurium is marketed as a replacement to the older Atracurium, essentially because it is void of the histamine producing side effects found in the older agent. Addition of Atracurium would have provided a useful comparison of these two types of agents.



**Figure 9.**

**Use of Succinylcholine by Air Force Anesthesia Providers**



**Figure 10.**

**Use of Rocuronium by Air Force Anesthesia Providers**

According to Zaglaniczny and Healey (1998), the CCNA study listed Lidocaine as the most frequently used local anesthetic followed closely by Bupivacaine with the least frequently used local agent being the new agent Ropivacaine. Lidocaine (for regional anesthetic use) is utilized weekly or daily by virtually all Air Force facilities responding. Unfortunately, Bupivacaine was not included in this survey. Information on Bupivacaine

would have revealed if this agent was a close second to Lidocaine as in the CCNA study or, perhaps, has become the most utilized local agent in the USAF. This information would be interesting in light of the recent renewed interest in Lidocaine- induced Transient Radicular Irritation (TRI).

The syndrome of TRI has been reported as far back as 1992 and has become a topic in the Anesthesia Patient Safety Foundation Newsletter in 1995-1996 (deJong, 1997). The discussion arises over the reported incidence of this syndrome caused by intrathecal injection of Lidocaine, which is not reported with other local anesthetics. An interesting determination would have been to survey the utilization of Lidocaine and Bupivacaine solely as an intrathecal anesthetic. This information may have revealed if another local anesthetic such as Bupivacaine is used more than Lidocaine for intrathecal anesthesia.

The newest local anesthetic to be introduced is Ropivacaine, marketed as an agent similar in action to Bupivacaine, but devoid of the potential cardiac complications associated with accidental intravascular injection. This agent has apparently failed to make inroads in USAF facilities. The seemingly nonuse of this agent may be in part due to cost, marketing, or non-acceptance by providers who do not appreciate its benefits over currently available agents. This finding is also consistent with civilian practice in that the CCNA study similarly demonstrated Ropivacaine as the least utilized local agent.

A variety of general and regional techniques were included in this study attempting to determine at what frequency these types of techniques were being utilized by the differing MTF facilities. Figures 11-15 show data by each facility type pertaining

to general anesthesia techniques and Monitored Anesthesia Care (MAC). General techniques surveyed include: Laryngeal Mask Airway (LMA), mask inhalation, mask maintenance (not including LMA), and fiberoptic intubations.

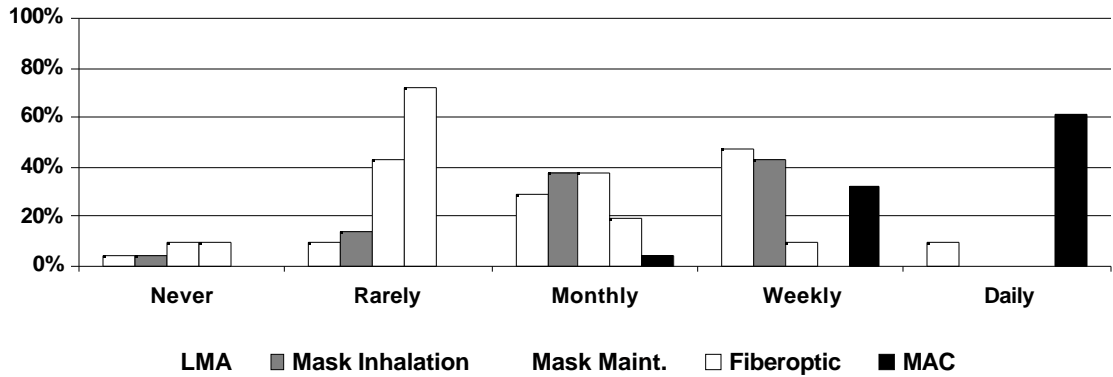


Figure 11.

**Frequency of Use of Anesthesia Techniques in Small Air Force MTFs**

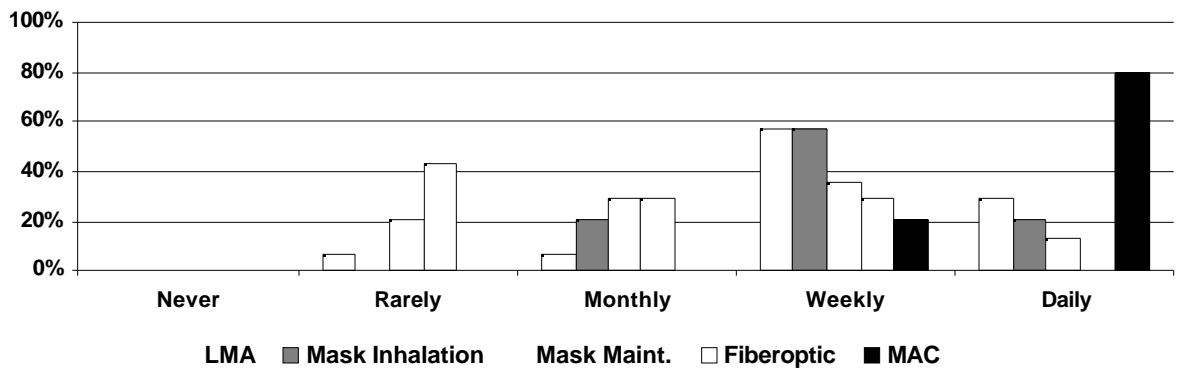


Figure 12.

**Frequency of Use of Anesthetic Techniques in Medium Air Force MTFs**

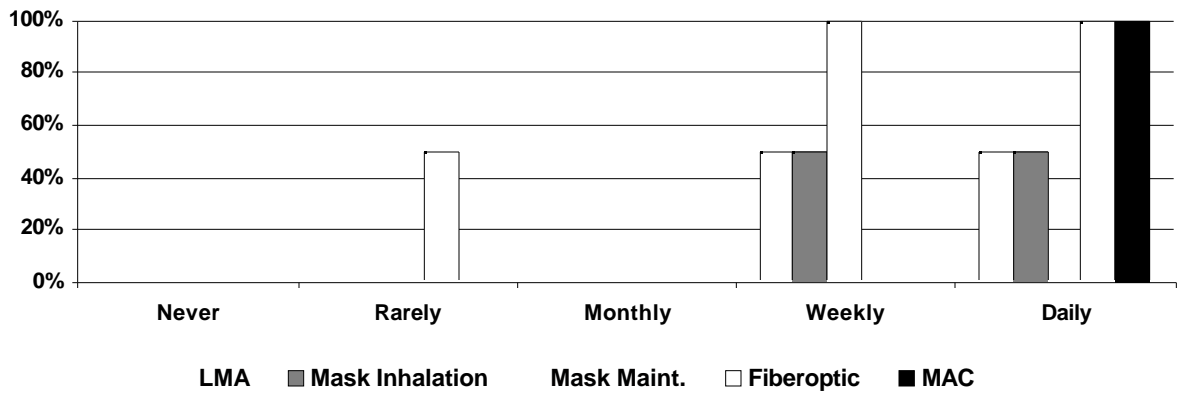


Figure 13.

**Frequency of Use of Anesthetic Techniques in Large Air Force MTFs**

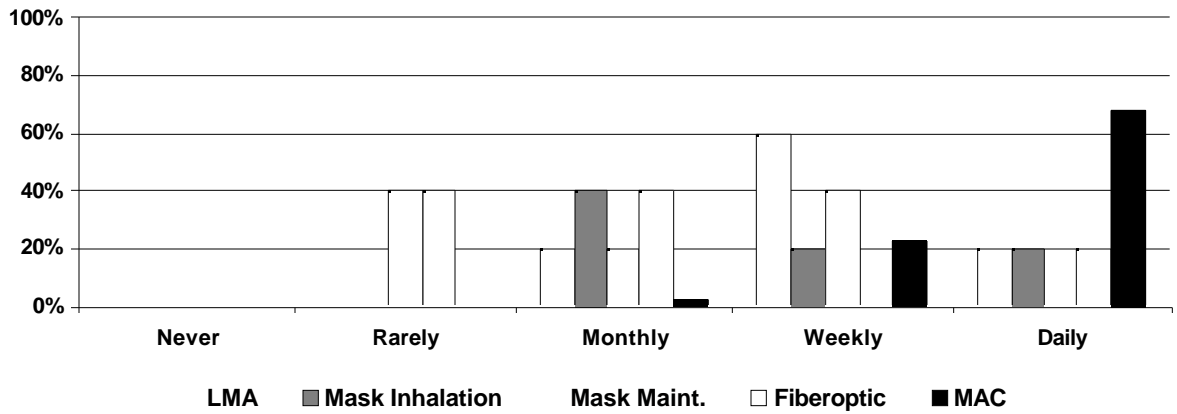
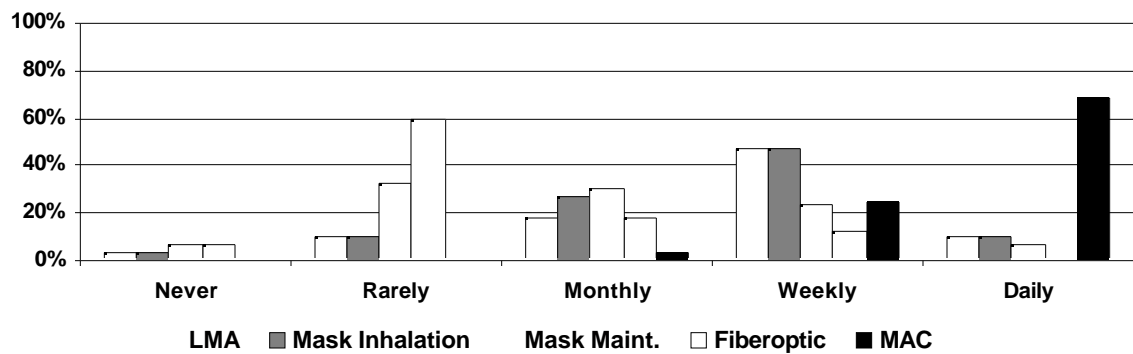


Figure 14.

**Frequency of Use of Anesthetic Techniques in Teaching Air Force MTFs**



**Figure 15.**

**Frequency of Use of Anesthetic Techniques in Non-teaching Air Force MTFs**

As figures 11-15 show, Monitored Anesthesia Care (MAC) enjoys the highest percentage of daily use by all MTFs surveyed. Because all types of facilities practice MAC frequently, the need for educational programs to provide adequate didactic and clinical instruction for this technique should solidify. This technique was found to be the second most utilized technique in the 1996 CCNA study behind oral endotracheal (Zaglaniczny & Healey, 1998). LMA appears to be utilized more generally by facilities on a weekly basis, although there are some small and non-teaching MTFs reporting that they never utilize LMAs. Eventhough LMAs do not protect the anesthetized patient’s airway and are not indicated in certain populations (obese, diabetic), they are included as an option in the Difficult Airway Algorithm by the American Society of Anesthesiologists (ASA). The addition of LMAs to the ASA algorithm has made this technique a standard in difficult airway management and requires anesthesia providers to maintain proficiency in their use.

Medium to large facilities report more frequent use of mask inhalation technique, possibly related to larger population of pediatric patients requiring this method of anesthesia induction. Although mask inhalation appears to be utilized fairly frequently, mask maintenance (not including LMAs) is not utilized as often. This finding suggests that many mask inductions are followed by endotracheal intubations or use of LMAs and maintenance of anesthesia by mask alone is not continued. More mask maintenance techniques are being used in medium to large teaching MTFs, possibly due to teaching efforts in these facilities. Fiberoptic intubations are by far the least utilized technique surveyed. This finding coincides with the 1996 CCNA results that list fiberoptic as the second least utilized technique behind cricothyrotomy. Because fiberoptic intubations are usually reserved for acute difficult airway management or as preemptive management of the suspected difficult airway, they are not routinely utilized at most facilities. The infrequent use of this ASA standard of care technique in managing the difficult airway necessitates that anesthesia providers maintain proficiency by other than clinical means if necessary.

In comparison, the CCNA study found that MAC was the most frequently used technique after endotracheal intubations followed by mask inhalations. LMA use was reported as less than that of fiberoptics.

Figures 16-20 refers to the regional anesthetic techniques included in this study. These techniques included a variety of regional block methods including subarachnoid and nonlabor epidural blocks (labor epidural blocks covered previously).

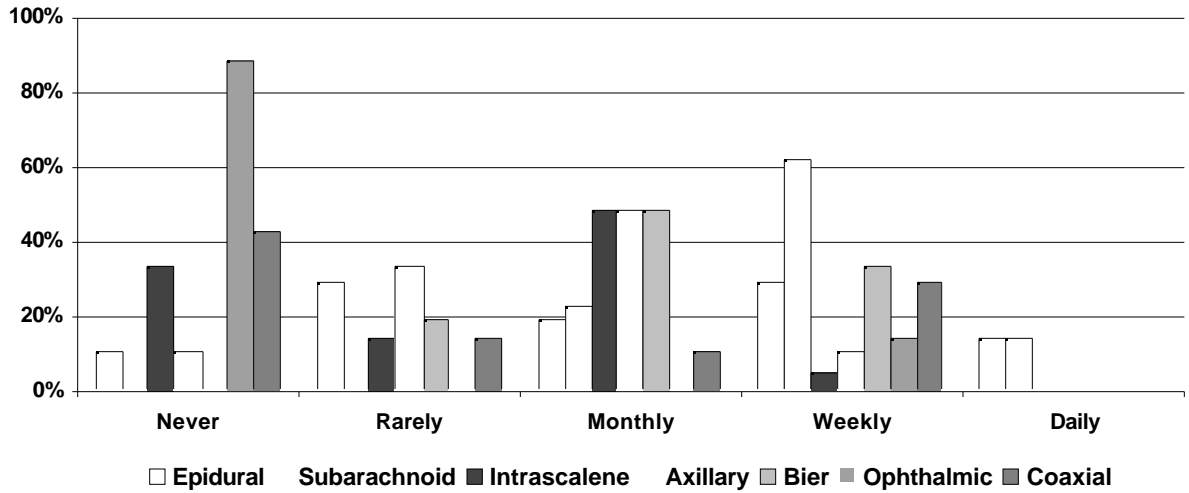


Figure 16.

**Frequency of Use of Regional Anesthetic Techniques in Small Air Force MTFs**

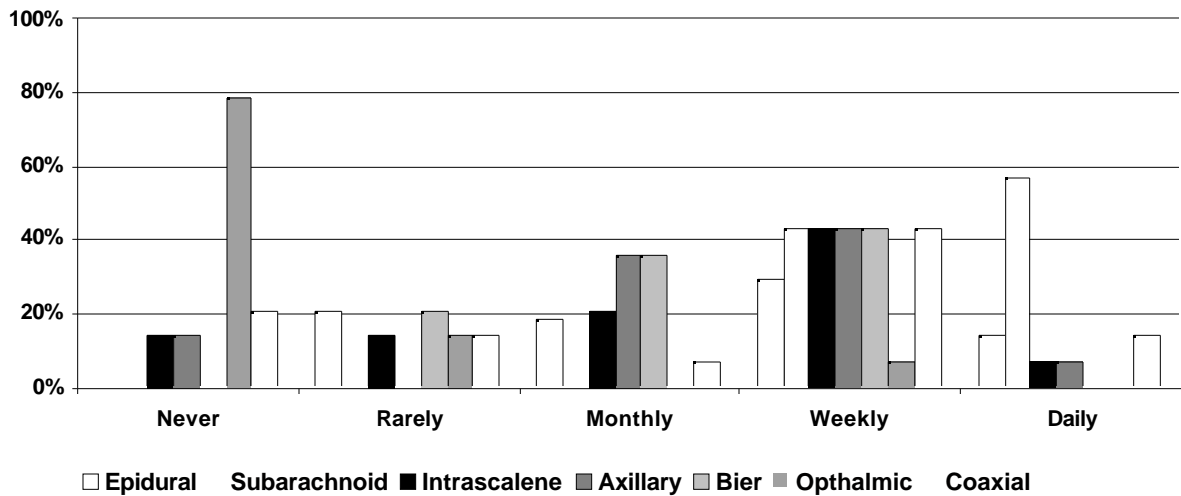


Figure 17.

**Frequency of Use of Regional Anesthetic Techniques in Medium Air Force MTFs**



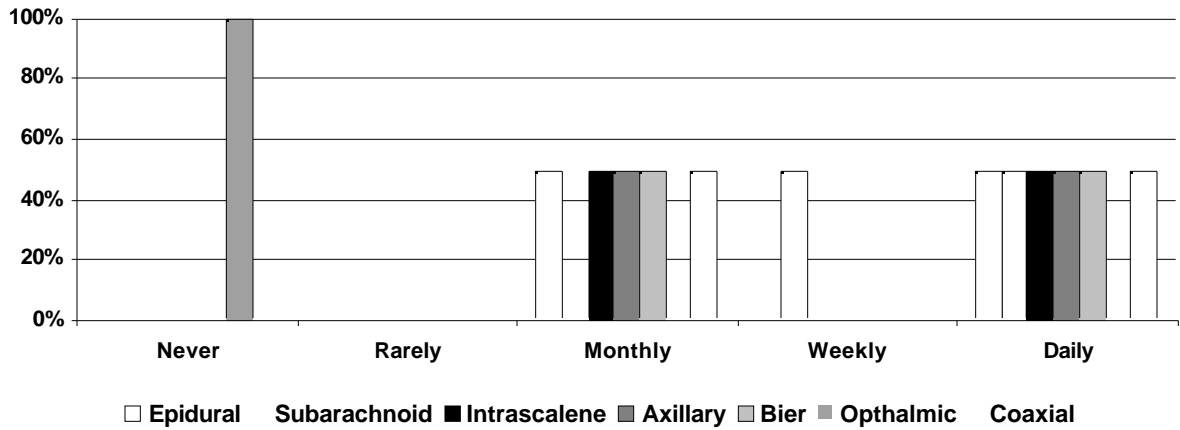


Figure 18.

**Frequency of Use of Regional Anesthetic Techniques in Large Air Force MTFs**

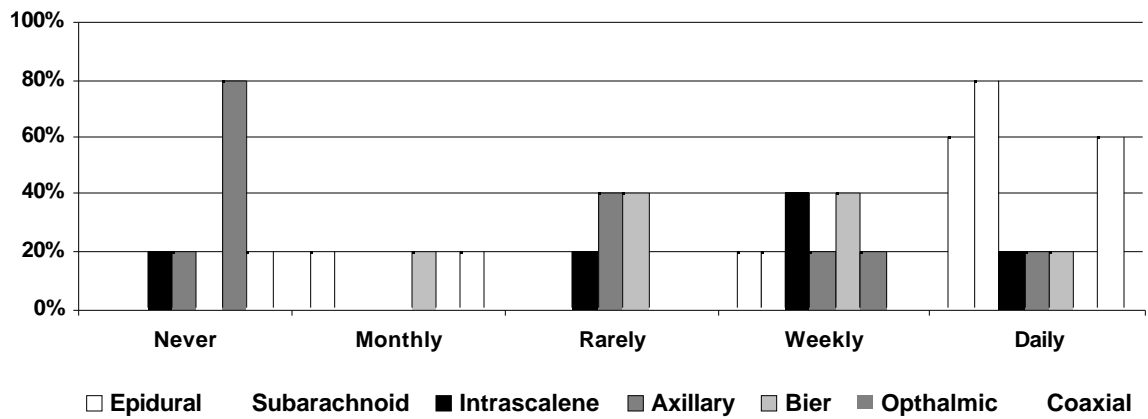
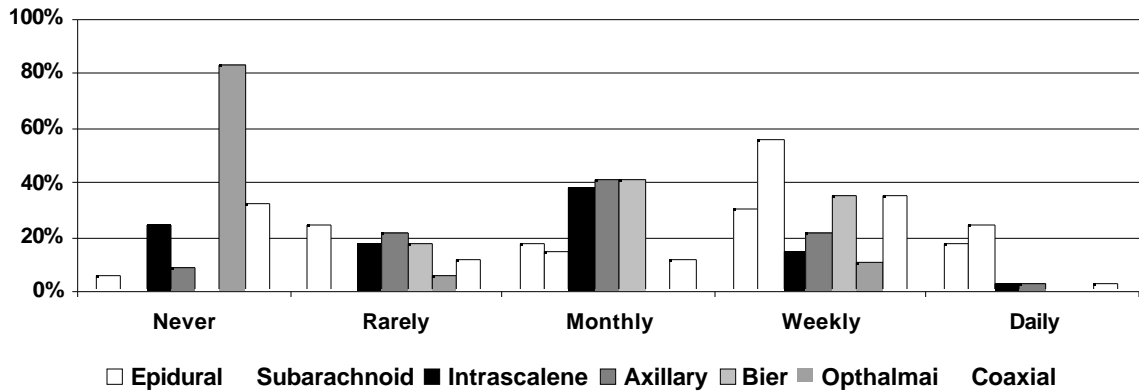


Figure 19.

**Frequency of Use of Regional Anesthetic Techniques in Teaching Air Force MTFs**



**Figure 20.**

**Frequency of Use of Regional Anesthetic Techniques in Non-teaching Air Force MTFs**

As figures 16-20 illustrate, subarachnoid blocks are used more frequently by all facilities on a weekly and daily basis. Whereas small and non-teaching facilities utilize subarachnoid blocks more on a weekly basis than any other technique surveyed while the highest percentage of daily use is in medium and teaching MTFs. Non-labor epidural blocks are fairly evenly distributed from rarely to daily use in small and non-teaching facilities while nearly 80% of medium and teaching facilities use non-labor epidurals on a combined weekly and daily basis. This finding may be related to surgical case types requiring peri-operative epidural analgesia, increased use due to instruction and/or anesthesia personnel available to maintain epidurals.

Of the upper extremity blocks surveyed (interscalene, axillary, Bier), Bier blocks have the highest percentage of combined monthly and weekly use among all facilities,

although this technique is used daily only by large MTFs. Nearly half of the small facilities use all of these techniques on a monthly basis, and 43% of medium MTFs use them weekly. Large MTFs are the only facilities reporting significant daily use of these regional blocks, but definite consideration needs to be given, once again, to the low number of large facilities reporting (N=2).

Coaxial narcotic injections (excluding labor epidurals) are used by at least 50% of medium, large, and teaching facilities on a weekly or daily basis with a large percentage of small and non-teaching MTFs never or rarely using this technique. Although a large percentage of MTFs provide subarachnoid blocks (as previously discussed), it was not established from this survey if coaxial narcotic use was reported as a stand-alone technique or included as part of subarachnoid blocks. An overwhelming finding was that at virtually all facilities anesthesia providers do not provide ophthalmic blocks.

The CCNA study (Zaglaniczny & Healey, 1998) reported the most frequently used regional blocks were subarachnoid, infiltration, and epidural. Bier block was also listed as the most utilized upper extremity block with brachial plexus second (interscalene was not included). Intrathecal narcotics were listed between Bier and brachial plexus blocks on their frequency scale. As with this study, the CCNA study found that ophthalmic blocks were not frequently administered by anesthesia providers. In addition, Rosenbach and Cromwell (1988) found that peripheral extremity, eye and infiltration blocks were among the least frequently used techniques by anesthesia providers.

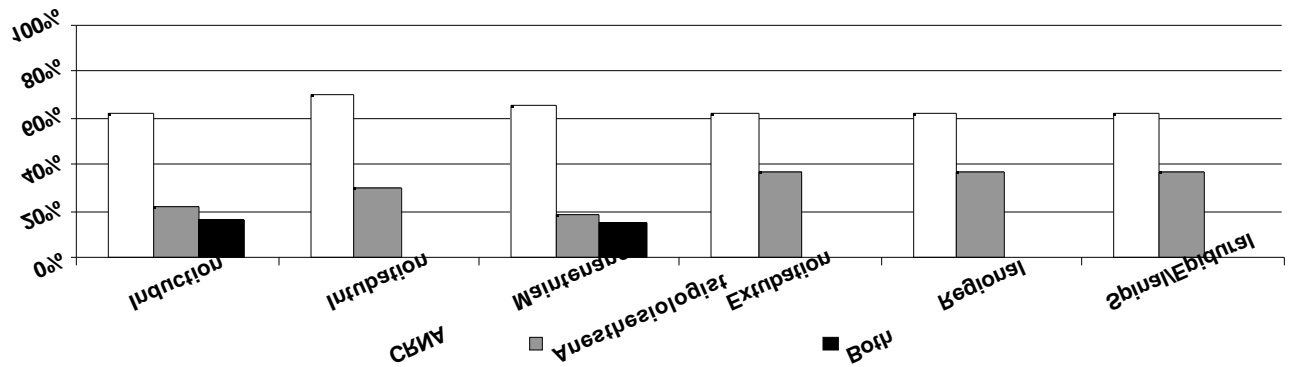
#### **Class of Anesthesia Provider Performing Anesthesia Tasks in Air Force MTFs**

Another objective of this survey was to determine which type of anesthesia

provider (CRNA, Anesthesiologist, or both) performed anesthesia-related tasks such as induction, intubation, anesthesia maintenance, extubation, regional anesthesia, and spinal/epidurals. The intent of the question was to determine which provider, on a frequency basis, typically accomplishes these tasks, not who performs these tasks for one individual case. Apparently, judging by the statements of many respondents, the question was not understood.

Written comments by respondents such as “the question is confusing...we all do our own cases”, “docs are not present unless we ask for help”, “CRNAs do their own cases and the Anesthesiologists do theirs...that is why the split is 50/50”, “each provider plans and administers the anesthetic for their own cases”, “each provider is independent” and “all CRNAs and MDAs do all of these things...who does it depends on who is available” make it apparent the question was not understood as intended.

Because the intent of establishing which provider accomplishes the anesthetic tasks for all cases was confusing, the data will not be utilized. However, some facilities apparently understood the intent of the question and included data specific to provider types who performed certain anesthesia tasks, and that data are presented in Figure 21 as a mean percent of all data collected.



**Figure 21.**

**Percentage of Anesthesia Tasks Accomplished by Provider Type**

By the comments provided with this question, it is apparent that CRNAs and anesthesiologists in these facilities frequently practice with equal autonomy and that 71% of CRNAs practice independently or in collaboration with anesthesiologists. Written responses confirm that CRNAs in the MTFs either practice independently or consult with anesthesiologists when necessary.

**Do Anesthesia Providers Have Responsibilities Outside the Operating Environment?**

Many anesthesia providers in the USAF have additional duties outside the operating room directly related to hospital or military responsibilities or both. Specifically, in this survey, involvement in pain management services and mobility taskings were ascertained.

As reported, 57% of small, 86% of medium, and 100% of large MTFs provide pain management service. Historically, pain services have been provided and managed by anesthesiologists as this service usually involves regional blocks or initiating pharmacological interventions or both. In addition to establishing pain management services in MTFs, the study attempted to determine CRNA involvement in pain management clinics. Table 8 shows that at least 50% of small, medium and large MTFs have CRNAs working in pain management clinics. Of those MTFs where CRNAs are the sole anesthesia providers (N=14), 50% report providing pain management services.

**Table 8.**

**Percent of Air Force MTFs With CRNAs Working in Pain Management Clinics**

Facility	N	PERCENT YES
Small	12	58
Medium	12	50
Large	2	50

Mobility requirements are an essential part of military medicine. Many facilities have specific mobility assignments required of hospital personnel including anesthesia personnel. Tables 9-13 show what percentages of MTFs report have mobility taskings, personnel affected, time required, and specific mobility equipment issues.

**Table 9.**

**Air Force MTFs Having Mobility Requirements**

Facility	N	PERCENT YES
Small	23	57
Medium	14	79
Large	2	100

**Table 10.**

**Anesthesia Personnel Assigned to a Mobility Billet**

SIZE	N	CRNA		ANESTHESIOLOGISTS	
		RANGE	PERCENT	RANGE	PERCENT
Small	23	1-4	51	0-2	43
Medium	14	1-5	62	0-4	65
Large	2	2-20	88	2-25	93

**Table 11.**

**Total Weeks All Anesthesia Personnel are Absent From Facility in Mobility**

**Assignments**

SIZE	N	CRNA		ANESTHESIOLOGISTS	
		RANGE	MEAN	RANGE	MEAN
Small	23	0-17	3	0-2	1
Medium	14	0-16	4	0-16	4
Large	2	0-60	30	0-100	50

**Table 12.**

**Does Your Facility Perform Surgical Cases with Field Anesthesia Equipment**

SIZE	N	PERCENT YES
Small	20	5
Medium	14	21
Large	2	50

Tables 9-12 show a large percentage of anesthesia personnel and MTFs are involved in mobility taskings. The majority of all MTFs report as having a mobility requirement with the lowest percentage being in small facilities (57%). Small MTFs have a larger percentage of CRNAs than anesthesiologists assigned to a mobility billet, most likely due to the number of small facilities having no anesthesiologists at all. Medium and large MTFs show a slightly higher percentage of providers assigned to mobility being anesthesiologists. Likewise, the total weeks that providers are absent due to mobility assignments are nearly three times greater for CRNAs in small facilities compared to anesthesiologists, but virtually equal in medium facilities. Again, the percentages for large MTFs are based only upon two facilities (with only one stating personnel absent for mobility).

Question 35 was not included in the data analysis due to the wording, which, in retrospect, did not provide relevant information. By answering the question as stated “Have any of the anesthesia providers at your facility had exposure to field anesthesia equipment” could result in a yes answer even if only one provider had exposure. The



question would have provided much more significant information if a percentage of all providers who had an exposure to field equipment could have been established.

Although a majority of MTFs report having a mobility tasking and more than half of the anesthesia providers are assigned to a mobility billet, nearly all of the small and medium facilities do not perform cases using field anesthesia equipment (only one of the two large facilities report using field equipment). Much like fiberoptic intubations discussed earlier, proficiency in using field anesthesia equipment in the military environment is essential, but its use is rare in actual practice. The 885A field anesthesia machine was reported as the most utilized field machine among providers exposed to this equipment; however, it was not determined if this exposure was in a clinical or training setting.

### **Summary**

The data collected provides a variety of information relating to the practice patterns of the varying sized USAF MTFs. As the graphs and tables illustrate, the anesthesia practice characteristics are very similar to those of the civilian sector as reported in the 1996 CCNA study. As mentioned, data relating to the practice patterns of the different provider types could not be utilized; however, written comments provided an insight as to the apparent independent practice employed by each provider type.

## **CHAPTER 5 – SUMMARY, CONCLUSIONS & RECOMMENDATIONS**

Data obtained specific to anesthesia practice patterns can be useful in a variety of ways from tailoring educational programs to determining staffing, workload, and practice variations among the various types and sizes of facilities providing anesthesia services. As previously stated by Fassett and Calmes (1995), data collected in the civilian arena has demonstrated marked regional variations in practice patterns and use of nonphysician providers. Although civilian anesthesia practice has many commonalities to USAF practice, the unique military requirements of the Air Force necessitates specific data collected from Air Force MTFs.

The purpose of this research is to provide data about specific anesthesia practice patterns in the Air Force. Data was collected from 39 of 53 USAF MTFs (74%) responding to a survey distributed to all Chief CRNAs at USAF facilities providing anesthesia services. The survey consisted of three main sections: personnel, management and practice patterns. Although this research focused on the practice patterns of USAF anesthesia services, some information from the personnel and management sections of the survey were also included when appropriate.

Fifty nine percent of responses were from small facilities, 36 from medium and only 5 from large MTFs. Although the majority of USAF MTFs are considered small or medium facilities, only one of the five USAF medical centers responded. A greater response from large facilities may have provided a more accurate presentation of comparison among types of MTFs. Additional demographic data reveals a much larger proportion of anesthesiologists to CRNAs in large facilities. In addition, large facilities reveal a much higher proportion of anesthesiologists per operating room than small and

medium MTFs. Although the ratios of provider types vary among the different sized MTFs, written comments provided by a large portion of facilities stated that CRNAs and anesthesiologists practice independently, each provider administering the anesthetic for the case to which they are assigned.

Of all respondents in this study, 36% were from facilities staffed solely by CRNAs, which is representative of the 45% reported for all USAF MTFs. By comparison, 20-25% of civilian facilities are served solely by CRNAs (Gunn, 1996). Overall, medium MTFs perform approximately three times more cases than small facilities and large MTFs perform five times more than that of medium sized MTFs, although cases per provider was not calculated.

Among the differing MTFs, small facilities report a larger percentage of CRNAs than anesthesiologists assigned to a mobility billet. In addition, the total number of weeks that providers are absent due to mobility duties is three times greater for CRNAs in small facilities, but equal to that of anesthesiologists in medium MTFs. Although a majority of USAF anesthesia personnel are assigned to a mobility tasking, the majority have not performed cases using field anesthesia equipment. Of providers having exposure to field anesthesia machines, the 885A were the most frequently used. Fifty three percent of all MTFs reported providing obstetrical services; however, small facilities have the highest percentage of those not providing this service (50%). Both small and medium sized MTFs report the same percentages of cesarean sections; however, small facilities do twice as many intrathecal narcotic procedures as labor epidurals. The majority of medium and all of the large MTFs report providing pain management services, but more than half

of the small facilities do not. However, small MTFs report with the highest ratio of CRNAs working in pain management clinics.

Overall, general anesthesia and MAC were the two most utilized techniques by all facilities for the month of September 1997. Data pertaining to anesthetic agents showed that Fentanyl is the mainstay narcotic in all MTFs and Propofol is the induction agent utilized virtually everyday in all MTFs. Versed, like Fentanyl and Propofol, is used on a daily basis by all MTFs. The newest narcotic agent, Remifentanyl, is never or rarely used.

Sevoflurane appears to be the volatile induction agent of choice on a daily basis when compared to Halothane. Desflurane has the highest percentage of daily use in all MTFs, although a high percentage of facilities report that this agent is rarely to never utilized when compared to Isoflurane. Isoflurane is used more than other volatile agents are on a combined monthly, weekly, and daily basis. The neuromuscular agent Rocuronium has a higher percentage of daily use among all MTFs over other neuromuscular agents including Succinylcholine. The newest neuromuscular agent, Cisatracurium, is rarely used. The majority of MTFs utilize Lidocaine on a weekly to daily basis for regional anesthesia, but the newer agent, Ropivacaine, is virtually never used.

As reported in the month of September 1997, MAC was also the most utilized anesthetic technique on a daily basis by all facilities. Mask maintenance was utilized the most by medium and large facilities while the ASA standard techniques for difficult airway management, fiberoptic, and LMAs, were shown to be infrequently used, if at all.

On a combined weekly and daily basis, subarachnoid blocks showed a high percentage of use by all facilities. Nonlabor epidurals were reported as highly used on a weekly or daily basis only among medium and large facilities (small and non-teaching MTFs report using nonlabor epidurals evenly from rarely to daily use). Half of the small MTFs utilize upper extremity blocks monthly. Medium and large MTFs report using these techniques on a weekly and daily basis respectively with Bier blocks being the most utilized.

In comparison to the data obtained in the CCNA Professional Practice Analysis, many similarities exist between USAF and civilian anesthesia practice in the comparable areas surveyed. It should be noted that the CCNA studies were conducted specifically to determine if the nurse anesthesia certification examination accurately reflects current practice patterns; therefore, the data obtained by this study can similarly be utilized because USAF CRNAs must successfully pass the same certification exam.

As discussed in chapter 1, the general systems theory provides an excellent conceptual framework to describe the potential impact of the data generated by this research. The Medical Treatment Facility has many potential subsystems, one being that of anesthesia care delivery (Figure 1). Each sub-system that influences anesthesia care delivery may be analyzed to determine potential effects on larger systems as a whole. In order to perform analysis of any system, data must be collected. The data collected by this study, although focusing on anesthesia practice patterns, can provide insights into how other sub-systems are effected. For example, if the anesthesia practice patterns are such that obstetrical services cannot be provided at a facility, the anesthesia care that can

be delivered impacts not only the customers but also the medical treatment facility as a whole.

Furthermore, if a facility is to support a mobility tasking, managerial influences must ensure that the anesthesia provider has the time and proper training, which, in turn, impacts all the subsystems associated with anesthesia care delivery. In addition, data pertaining to USAF anesthesia mobility can effect not only those systems specific to anesthesia care, but also individual Air Force medical facilities as well as Air Force mobility requirements service wide. Data demonstrating the most utilized anesthetic techniques and agents can provide USAF anesthesia educators information for tailoring anesthesia programs. This information when used by educators further impacts other anesthesia systems by delivering competent providers whose practice characteristics positively influences anesthesia care delivery thus customers and treatment facilities as a whole.

### **Conclusions**

The purpose of conducting this research was to determine anesthesia practice patterns in USAF medical treatment facilities. Although adequate data was not obtained from large MTFs, the information presented provides an insight into many anesthetic techniques, agents, and practice patterns utilized in USAF anesthesia practice. In contrast to the information obtained in the 1996 CCNA Professional Practice Analysis, which was obtained specifically to “define the scope of practice to determine entry level competence and to provide content validity for the certification examination” (Zaglaniczny & Healey, 1998, p. 43). , the data gathered in this study will be made

available to Air Force professionals in evaluating the current status and assist in determining the direction of USAF anesthesia.

In addition, since USAF anesthesia practice is continually undergoing change to meet the requirements of the changing military environment, the information obtained by this study can assist in providing data in assessing and determining educational, assignment, mobility, and other Air Force anesthesia related issues.

### **Recommendations**

The information provided by this research can be applicable in assessing and determining many aspects of USAF anesthesia practice. In order for data to be reliable it must be current. Annual assessment of USAF anesthetic practice patterns will provide necessary data in tailoring educational, mobility, or manning requirements.

The length of the survey may have prevented the return by several facilities. Future practice pattern assessments should be specific to this area, decreasing the number of questions and potentially increasing return, especially from large facilities. Data from future surveys should include those agents and techniques identified in the analysis chapter as necessitating inclusion. In addition, those agents and techniques found to be rarely or not used at all may potentially be deleted from future anesthesia surveys.

Possibility exists for a standardized anesthesia practice pattern questionnaire to be developed and completed on an annual basis by USAF MTFs providing data to the Nurse Anesthesia Consultant to the Air Force Surgeon General. This standardized informational survey could be updated as necessary to conform to changing patterns of anesthesia practice. In addition, survey information could inform leaders in Air Force anesthesia of

any variations that may exist between civilian and USAF anesthesia practice patterns as well as variations between the various MTFs.

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Appendix A

Letters of Approval to Conduct Research

## Appendix B

### Survey

## Appendix C

### Letter Requesting Participation in the Study

To: Chief/Senior CRNA,

I am currently a nurse anesthesia resident at the Uniformed Services University of the Health Sciences. For completion of a masters degree thesis I am conducting research on anesthesia department workload characteristics in small, medium and large, teaching and non teaching medical treatment facilities (MTF) in the Air Force. This survey will be distributed to every Air Force MTF providing anesthesia services. The information from this survey should assist not only in documenting the importance of the CRNA role and their value to the military but also may provide valuable data to educational institutions allowing them to tailor their training programs to meet the needs of the Air Force. The questions are designed to gather basic demographic information, practice patterns and provider responsibilities. As the research implies, it is imperative that information be obtained from all 55 MTFs providing anesthesia care in order that the workload characteristics between the varying facility types be identified for description.

All information and responses provided will be held under lock and key and in strict confidentiality. Returned surveys will be coded for tracking purposes and be known only to myself and my thesis chairperson. Once all of the data is collected and analyzed, individual surveys will be destroyed. Information provided will be analyzed as group data only, individual facilities will not be identified or singled out.

As the senior nurse anesthetists in your facility, I realize your time is extremely valuable. However, I hope you will take the time to complete the survey which should take approximately 30-45 minutes. If data is not readily available for any particular item, please provide your best estimate. Please return the survey and any supporting documents in the enclosed self addressed, stamped envelope by October 31, 1997.

If you have any questions about this survey you may contact myself at (301) 570-3597 or my advisor, Dr. Maura McAuliffe, CRNA, LTC, USAF, NC at (301) 295-6565, DSN 295-6565. Thank you very much for your assistance in this educational and informational endeavor.

Sincerely,

Maj. Rick L. Wade, CCRN, MSN, USAF, NC  
Nurse Anesthesia Resident  
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If you would like to be provided with the results of this study, please provide your name and address on the bottom portion of this letter and return it with the survey.

## Appendix D

Cover Letter from the Nurse Consultant to the USAF Surgeon General

## Appendix E

### Reminder Letter to Complete Survey