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**NAVAL
POSTGRADUATE
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MONTEREY, CALIFORNIA

THESIS

**STEPS TOWARDS DETERMINING THE RIGHT NUMBER
OF DENTAL RECRUITS THE NAVY SHOULD ACCESS
TO MEET THE PROJECTED TARGETS FOR NAVY
DENTAL CORPS OFFICERS**

by

Richard Gilliard Jr.

March 2007

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**STEPS TOWARDS DETERMINING THE RIGHT NUMBER OF DENTAL
RECRUITS THE NAVY SHOULD ACCESS TO MEET THE PROJECTED
TARGETS FOR NAVY DENTAL CORPS OFFICERS**

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Submitted in partial fulfillment of the
requirements for the degree of

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from the

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ABSTRACT

This thesis took steps towards determining the right number of dentists the Navy should recruit to meet projected targets. Dental Corps data were provided from the Dental Corps Manpower office covering fiscal years 1984 through 2005. The accession sources for Dental Corps officers were a concern at the onset of this study. One goal of the research was to determine whether or not certain behaviors were associated with particular accession programs. The results showed that no particular accession source dominated any of the five specialties that were selected. To develop the loss rates, data from two Excel files, “DC Total Inventory” and “DC Losses” were merged. After merging the files, only one record per dentist remained from fiscal years 1988 through 2005. This evolution produced 3,643 records that portray each dentist’s career. The loss rate results suggest that once Dental Corps officers reach their tenth year they are less likely to leave the military than in earlier years. This would suggest that retention incentives should be focused during the fourth through sixth years of the Dental officer’s career. Oral Surgeons, however, are more likely than the other specialties to leave the military after their tenth year.

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I. INTRODUCTION AND BACKGROUND

A. INTRODUCTION

Currently, the United States Navy Dental Corps is experiencing difficulty recruiting and retaining junior and mid-grade Dental Corps Officers. The Navy Dental Corps is also experiencing difficulties with meeting targets for recruiting dental students into funded scholarship accession programs. Although the Navy Dental Corps has several excellent accession scholarship programs, it is still not accessing enough dental students to fill the funded dental school seats. This challenge of recruiting Dental and Medical Corps officers has also become the concern of high political officials. In May 2006, the Navy's Surgeon General, Admiral Donald C. Arthur, MC, USN, reported to the Senate Committee on Appropriations Subcommittee on Defense that the Navy was experiencing shortfalls in recruiting and retention of medical professionals in the military. More specifically, in FY 05 the Navy filled only 73 per cent of its Health Professions Scholarship Programs dental slots.¹ "I am worried when I hear that with the Health Professions Scholarship Program, the Army and Navy were unable to fill the slots allocated," said subcommittee chairman Sen. Ted Stevens (R., Ark.)."²

Navy Dental Corps officers are integral to the accomplishment of the overall mission of the Navy and Department of Defense. Therefore, it is essential that the correct number of dentists be recruited and retained in order to accomplish the Navy's war and peace time missions. Planning the correct number of dentists to be accessed into the Navy, as with other communities, requires focusing on the current inventory and the projected end strength. Accessing an adequate number of recruits into the dental training pipeline will mitigate future manning shortfalls. However, not accessing the correct number of dentists could cause long-term problems with manpower that could affect the community for several years.

¹ U.S. Medicine: <http://www.usmedicine.com/article.cfm?articleIK=1315&issueID=88> accessed 19 September 2006

² Ibid.

This thesis takes initial steps towards utilizing a Markov Model to produce a solution that will determine the correct number of dental recruits the Navy should access to meet the projected targets for the Navy Dental Corps Officer community.

B. BACKGROUND

1. Dental Corps History

The Navy commissions professional Dentists into a staff corps community; they are identified as Dental Corps Officers. Dental Corps officers are under the Navy Medicine umbrella. Navy Medicine is comprised of four officer staff corps and one enlisted corps: the officer corps consists of the Medical Corps, Dental Corps, Nurse Corps, and Medical Service Corps and the enlisted corps is the Hospital Corps. Dental Corps Officers in the United States Navy are naval officers who have obtained a Doctorate in either Dental Surgery (D.D.S.) or Dental Medicine (D.M.D.)

The United States Navy Dental Corps was established in 1912 by an act of Congress. However, the dawn of Navy dentistry can be traced back to 1873 when the dental needs of Sailors were assigned either to civilian dentists or Medical Corps officers on board ships.³ Several attempts were made by Bureau of Medicine and Surgery to formally establish a Navy dental community consisting of civilian and dental surgeons; however, Congress repeatedly rejected the Dental bill. Finally, in August 1912, a Dental bill was passed by Congress, when coincidentally, William Howard Taft, a man who had a passion for sweets, was serving as President of the United States. The newly established Dental Corps' impact was noticed quickly, although the community was only composed of 30 "acting assistant dental surgeons." Within one year of service, the Navy Surgeon General was able to report to the Secretary of the Navy that recruitment had directly

³ "Dental Corps History." Lkd. Dental Corps History at "Navy Medicine Online Homepage." <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&docid=10307> accessed on 22 Jan 2007.

improved due to the establishment of the Dental Corps. Navy dentists were able to treat dental conditions that only a year prior would have rendered a recruit unfit for active duty⁴.

Today, the Dental Corps headquarters is located in Washington, DC at the Bureau of Medicine and Surgery and operates under the supervision of U.S. Navy Medicine Surgeon General of the Navy. The Chief of the Dental Corps serves as the Assistant Chief for Dentistry for the Bureau of Medicine and Surgery (M09B-DC) and reports to the Deputy Chief, Bureau of Medicine and Surgery. From the original 30 “acting assistant dental surgeons”, the Navy Dental Corps has grown, as of June 30, 2006, to 1,088 dentists and over 16 specialties.⁵ Table 1 reflects distribution and manning level as of the Dental Corps ending 30 July 2006.

Table 1. Dental Corps Specialty Report ending July 2006⁶

SUPSPEC CODE #	SUBSPECIALTY DESCRIPTION	TOTAL INVENTORY ¹	TRAINING - # ASSIGNED	NET = INVENTORY	FY06	BA	DELTA	PERCENT MANNED ³
					BILLETS AUTH	FAIR SHARE ²		
1700 ⁴	Military Dentist	389	22	367	463	1	-96	79%
1710	Endodontist	62	15	47	47	3	0	94%
1724V ⁵	Military Dentist II	122	2	120	90	9	30	121%
1725	Comprehensive Dentist	120	15	105	113	9	-8	86%
1730	Maxillofacial Prosth	11	0	11	6	1	5	157%
1735	Orthodontist	26	6	20	16	1	4	118%
1740	Operative Dentist	21	3	18	22	2	-4	75%
1745	Oral Diagnostician	10	0	10	14	0	-4	71%
1749V	Exodontist	42	1	41	19	2	22	195%
1750	Oral Surgeon	108	30	78	80	3	-2	94%
1760	Periodontist	63	10	53	48	1	5	108%
1769	Prosthodontist	57	7	50	65	2	-15	75%
1775	Pub Hlth Dentistry	9	0	9	7	1	2	113%
1780	Oral Pathology	10	1	9	9	0	0	100%
1785	Oral Facial Pain	14	0	14	10	1	4	127%
1790	Dental Research	3	1	2	6	1	-4	29%
1795	Pediatric Dentist	21	3	18	14	2	4	113%
	Subtotal DC Officers	1088	116	972	1029	39	-57	91%

⁴“Dental Corps History.” Lkd. Dental Corps History at “Navy Medicine Online Homepage.” <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&dodid=10307> accessed on 22 Jan 2007.

⁵ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook

⁶ Ibid.

2. Dental Corps – War Time

Dental services are important in time of war. The Navy Dental Corps immediately validated its importance in wartime during World War I. When the U.S. entered World War I on 6 April 1917 there were 35 dental officers on active duty, but the number grew to 500 by the war's end.⁷ Dental Corps officers were assigned to warships, overseas, and with the Marines. Two Dental Corps officers also received exceptional distinction by being awarded the Medal of Honor for their bravery. LTJG Alexander G. Lyle was awarded the distinguished medal for serving with the 5th Regiment, U.S. Marine Corps unit. The second honored dental officer, LTJG Weeden Osborne, was the first Navy officer to die overseas during the war while serving with the 6th Regiment, U.S. Marines. The torpedo boat destroyer, USS OSBORNE (DD-295) was later launched in his honor on December 1919.⁸

In 1941, the Dental Corps community consisted of 759 active duty dental officers at 347 dental facilities, when two Dental Corps officers were killed during the attack on Pearl Harbor. World War II began and due to manpower shortages, dental requirements were lowered for potential recruits. The Dental Corps community responded by implementing a massive rehabilitation program that would focus on getting Navy and Marine Corps personnel eligible for overseas duty. Also, as in the previous World War, the Dental Corps proudly served in various capacities during the war. For their heroic efforts 93 dental officers received personal awards, including the Silver Star, Legion of Merit, Navy and Marine Corps Medal, and the Bronze Star.⁹ By the end of World War II, there were 7,026 dental officers serving on active duty and 1,545 dental facilities.

World War II produced some major milestones for the Dental Corps community. First, the dental technician community had grown to over 11,000. The community integrated females in the corps. LT Sara G. Krout, DC, USNR, was the first female dental corps officer in the Armed Forces. The Navy Dental School was commissioned as part of the Naval National Medical Center, Bethesda, MD. Lastly, on 18 December

⁷Dental Corps History." Lkd. Dental Corps History at "Navy Medicine Online Homepage." <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&dodid=10307> accessed on 22 Jan 2007.

⁸Ibid.

⁹Ibid.

1942, President Roosevelt approved the rank of rear admiral for Dental Corps officers. The Medal of Honor recipient of WWI, CAPT Alexander G. Lyle, became the first Dental Corps rear admiral of the United States Navy.

During the Vietnam War, MG Chandler summarized a philosophy that highlighted the importance of dentistry during wartime. He stated:

Dental and oral disease is universal and is the most common disease of man. Whereas, in civilian life poor oral health may only cause discomfort and pain, in the military environment a simple toothache can incapacitate a combat soldier as effectively as a combat wound. During the height of the Vietnam conflict, it was reported that one out of eight soldiers had to be withdrawn from duty to receive emergency dental treatment. While this problem to the soldier may only be that of various degrees of discomfort from his dental disease, the effects on the soldiers' organization are more serious. A soldier lost to duty for whatever reason decreases the fighting ability of the organization. When large numbers of soldiers are lost to duty for any reason, the problem must be corrected or a significant reduction in overall force effectiveness will result.¹⁰

The current goal within DoD to maximize our effectiveness with joint operations against GWOT warrants that wartime dental support is still an essential part of the mission. Today, the Dental Corps continues to maintain high operational readiness for operations in Afghanistan and worldwide, while it trains for all contingencies.¹¹ Dental Corps Officers serve with Marine Expeditionary Units and aboard 120 ships. They are often required to go beyond their call to duty as they sometimes provide triage and surgical support at Marine Battalion aid stations and battle dressing stations. Dental personnel continue to play a significant role in peace keeping and nation building through humanitarian assistance and disaster relief missions in third world countries.¹²

C. HEALTH PROFESSIONAL ACCESSION PROGRAMS

There are a number of possible reasons why, in the current atmosphere, it is difficult for the military to recruit individuals into the U.S. Armed Forces. Military pay

¹⁰ Richard D. Shipley, Colonel, USA. "Dental Corps Structure: Past, Present, and Future" Study Project, U.S. Army War College, 1993.

¹¹ "Dental Corps History." Lkd. Dental Corps History at "Navy Medicine Online Homepage." <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&docid=10307> accessed 22 Jan 2007

¹² Ibid.

in comparison to that in the civilian sector is often mentioned. A major factor today may be the Global War on Terrorism (GWOT) and the expectancy of long and continuous deployments overseas. Navy Medicine and the Dental Corps community in particular are having difficulties reaching their targeted recruitment numbers. Navy Medicine attempts to combat this problem by offering scholarship programs that will entice potential candidates to become dentists in the Navy Dental Corps. These programs are specified by the Office of the Chief of Naval Operations (N132). The current programs and definitions are discussed in OPNAV instruction (OPNAVINST 1110.1) and are listed below:

- Direct Commission: Recruiting a Dentist directly from a civilian environment.
- Recall to Active Duty: The voluntary return of a Commissioned Officer from reserve status to active duty.
- Inter-Service Transfer: The transfer of a Commissioned Officer serving on active duty, between uniformed services, or the transfer of Commissioned Officers not on active duty, between reserve components of the uniformed services.
- Health Service Collegiate Program (HSCP): Two-year scholarship program in designated health professions to complete degree/certification requirements and obtain reserve officer commission in the active duty component of the Dental Corps upon graduation.
- Armed Forces Health Professions Scholarship Program (AFHPSP) System:
 - Health Profession Scholarship Program (HPSP): An Inactive Ready Reserve (IRR) program for students accepted to, or enrolled in an accredited training program leading to a health profession degree. A sub-element is the Navy Active Duty Delay for Specialists (NADDS) program. This program also allows HPSP graduates to obtain graduate professional education at accredited civilian institutions.
 - Financial Assistance Program (FAP): An Inactive Ready Reserve (IRR) Program for Dentists currently accepted to, or enrolled in an accredited residency or fellowship program progressing toward a specialty, which has been designated as critical to the Department of Defense (DoD).
 - Health Professions Loan Repayment Program (HPLRP): An active duty and Reserve program used to recruit qualified health

professional in specified specialties. Under the HPLRP, the Navy repays all or a portion of the participants' incurred educational loan obligations.¹³

Department of Defense (DoD) offers these accession scholarship programs along with bonuses and financial incentives to entice potential dental students to select the military as a career. FAP provides payment of at least \$27,841, plus a monthly allowance of at least \$1,319, for dentists in certain specialties who are currently in or planning on going into residency programs. DoD also has HPSP for students who are currently in dental school. HPSP provides tuition assistance including all required fees, expenses, books and equipment for up to four years. HPSP also pays a monthly allowance of at least \$1,319. The HSCP is a major recruiting tool. HSCP offers dental students potentially over \$120,000 to cover college costs and living expenses incurred for up to 48 months of dental school. The dental student must maintain a 3.0 GPA or higher to qualify for HSCP. Candidates who participate in a Navy dental scholarship program are commissioned as Ensigns in the Naval Reserve while attending a dental school. These individuals retain this rank and salary corresponding to their pay grade while functioning as "prospective Dental Corps Officers."¹⁴ The prospective Dental Corps Officer who elects to participate in any of the above scholarship programs is obligated to complete three years of active military service.

D. NAVY DENTAL ADVANCED PROGRAMS

The Navy also has advanced dentistry programs that allow dental corps officers to specialize. The advanced programs are geared to allow the Dental Corps to retain officers who are fully qualified to practice, teach, and conduct research in dentistry. The advanced general dentistry program is an accelerated program that offers dentists specialty training and clinical experience in the areas of orthodontics, restorative dentistry, oral and maxillofacial surgery, and oral pathology. Naval Postgraduate Dental School also offers advanced dental training under the command and support of the National Naval Medical Center, Bethesda. The Naval Postgraduate Dental School

¹³ Navy Department, Administration of Health Professional Accession Programs (HPAP), OPNAVINST 1110.1 CH-1 (Washington, DC: 2001), 2-3.

¹⁴ Navy Department, Appointment of Regular and Reserve Officers in the Dental Corps of the U.S. Navy, SECNAVINST 1120.13A Enclosure 1 (Washington, DC: 1988)1.

provides opportunities for dentists to apply to a three-year residency program specializing in oral and maxillofacial pathology, periodontics, and prosthodontics. In addition, Dental Corps Officers can apply to a two-year residency program specializing in comprehensive dentistry, endodontics, oral medicine, and orofacial pain. Lastly, the Naval Postgraduate Dental School offers a one-year fellowship in maxillofacial prosthetics. The Dental Corps Officer incurs additional obligated service time if he or she is accepted into one of the advanced education programs. Table 2 shows the additional time that is required.

Table 2. Dental Advance Education Program Obligated Service Time

Specialty	Obligated Service (Years)	Specialty	Obligated Service (Years)
Endodontist	3	Comprehensive Dentistry	2
Maxillofacial Prosthodontist	1	Orthodontist	3
Operative Dentist	3-4*	Oral Diagnostician	2
Oral Surgeon	4	Periodontist	3
Prosthodontist	3	Public Health Dentistry	4
Oral Pathology	3	Oral-Facial Pain	2
Dental Research	4	Pediatric Dentist	2-3*
*Depends on the length of the program.			

E. NAVY DENTAL CORPS SPECIALTIES

The Navy Dental Corps specialists are comprised mostly of previous Dental Corps generalists. Upon serving as a general dentist, Dental Corps officers may, with the approval of the Navy, decide to specialize in a dental field. The Dental Corps community is comprised of 16 major specialties.

Table 3 displays 16 different specialties in which dentists are distributed throughout the Navy Dental Corps community. An additional goal of the Dental Corps planners is to ensure that the right number of dentists is in each specialty. Reaching the correct number of specialists will allow the Dental Corps to provide the best dental care to the patient community.

Table 3. Dental Officer Subspecialty codes

<u>Name</u>	<u>Code</u>	<u>Name</u>	<u>Code</u>
General Dentistry	1700	Exodontist	1750V
Endodontist	1710	Periodontist	1760
Comprehensive Dentist	1725	Prosthodontist	1769
Maxillofacial Prosthodontist	1730	Public Health Dentist	1775
Orthodontist	1735	Oral and Maxillofacial Pathologist	1780
Operative Dentist	1740	Oral Facial Pain Dentist	1785
Oral Diagnostician	1745	Research Dentist	1790
Oral and Maxillofacial Surgeons	1750	Pediatric Dentist	1795

F. ORGANIZATION

The following chapters evaluate the current situation of the Navy Dental Corps and attempt to produce a solution that will determine the right number of dentist recruits the Navy should access to meet their projected targets. Chapter II provides a literature review of research about the Dental community. Chapter III introduces the reader to the data sources and methodology. It also provides a preliminary data analysis. Chapter IV reports the model that is chosen for this thesis and the results. Finally, Chapter V concludes with recommendations and ideas for further research.

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II. LITERATURE REVIEW

A. MILITARY HEALTH SYSTEM

The health care professionals who are serving in the U.S. Armed Forces fall under the jurisdiction of the Military Health System (MHS). MHS, one of the largest and oldest health care delivery systems in the United States, must execute twin missions.¹⁵ They are responsible for the governance and execution of health care policies and delivery of the three Service medical departments. The primary mission of the MHS and the three Service medical departments is *force health protection*.¹⁶ Force health protection involves providing medical support for the war-fighters on the battlefield, and providing preventive and everyday health care for approximately 1.8 million servicemen and women who serve in the Army, Navy, Air Force and Marines. The second mission is to provide a health care benefit to nearly 6.6 million other people who are eligible to use the MHS.¹⁷ The manpower requirements for accomplishing the second mission have increased because of the provision of Tricare for Life for military retirees.

In order to be successful in meeting its mission, MHS must recruit and retain health care professionals who are willing to serve their country while experiencing government bureaucracy and less compensation than their civilian counterparts. A 2002 CNA study states:

Because the Department of Defense (DoD) relies on a single force to meet these sometimes disparate missions, it must cultivate a workforce that is dedicated to caring for patients, committed to continuous improvement in performance and productivity, and competent in both wartime and peacetime. This challenge is particularly difficult because uniformed health care professionals are costly to access and train, and they have skills that are in demand in the private sector.¹⁸

¹⁵ Shayne Brannman, et al., Center for Naval Analyses, Health Professions' Retention-Accession Incentives Study Report to Congress: Phase II & III: Adequacy of Special Pays and Bonuses for Medical Officers and Selected Other Health Care Professionals, CRM D0004460.A5, (Alexandria, Virginia: 2002), 1

¹⁶ Ibid.

¹⁷ Ibid.

¹⁸ Ibid.

In response to this challenge of recruiting health care professionals, MHS has several accession programs and special pay bonuses in place to maintain a health care force capable of accomplishing the twin missions.

B. DENTAL CORPS COSTS

1. Recruiting and Accession Costs

The Dental Corps community, as discussed above, is an important community within MHS. Although the Dental Corps is important, the accession costs for the dental corps can be very high. Therefore it is imperative that MHS and DoD have manpower policies for health care professionals that are cost-effective. There are a number of costs that are associated with recruiting, training, and retaining military personnel. The six major life-cycle costs that the Center for Naval Analysis (CNA) discusses in its April 2003 report are:

- Accession costs;
- Education costs;
- Compensation;
- Temporary duty;
- Moving; and
- Internship and residency.

Accession costs consist of recruiting costs and accession bonuses. Recruiting costs include military and civilian personnel costs, advertising, communications, training, computer support, travel, supplies, equipment, and leased facilities used to recruit health professionals into the military directly or into one of its subsidized accession programs.¹⁹

According to CNA, the initial investment to recruit healthcare professionals across the three services is substantial. Average recruiting costs per health care professional were \$34,492 for the Army, \$25,738 for the Navy, and \$26,745 for the Air

¹⁹ Shayne Brannman, et al., Center for Naval Analyses, Life-Cycle Costs of Uniform Health Professions: Phase II: The Impact of Constraints and Policies on the Optimal-Mix-of-Accession Model, CRM D0007887.A2/Final, (Alexandria, Virginia: 2003), 8.

Force.²⁰ The health care accessions programs offer scholarships that pay tuition, stipends, and benefits which also cause DoD's total cost to escalate. The scholarship programs offer prospective dental corps officers funding to complete their degrees while they in turn are obligated to serve in the military for a designated time period. In today's environment, with the costs of higher education rising, this tool mitigates the factors of military life that may not be attractive to the civilian population. DoD's total costs, including education costs, stipend, benefits, and temporary duty costs (but not recruiting costs) for its Armed Health Professions Scholarship Program (AFHPSP) students, range between \$40,000 and \$47,000, depending on the health profession. Because most AFHPSP scholarships are for 2 to 4 years, this represents a substantial investment by the Services.²¹

2. Dental Corps Retention Costs

DoD's investment in recruiting and educating its health care professionals is substantial. This reflects the cost of each individual health care professional. With this initial investment it is essential to incorporate incentives to retain the prospective dentists who have decided to enter into the military. The cost of training a new dentist is greater than the cost of retaining one who has already completed the education and training that is required to become a Dental Corps officer. DoD has quality of life programs, health care benefits, and retirement programs that are tools meant to entice military members to stay in the military so that DoD can capitalize on its investment and retain the experience that the health care professional has gained. DoD's benefit package is quite rich for all military personnel. Current benefits (those received while on active duty) cost \$11,784 for O-1s and increases to \$18,356 for O-6s.²² In addition, retirement benefits—pension, retiree health care, and TRICARE For Life—are substantial.²³ Specifically, each year DoD must set aside 48.1 percent of the basic pay of every officer to pay for the retirement

²⁰ Shayne Brannman, et al., Center for Naval Analyses, Life-Cycle Costs of Uniform Health Professions: Phase II: The Impact of Constraints and Policies on the Optimal-Mix-of-Accession Model, CRM D0007887.A2/Final, (Alexandria, Virginia: 2003), 10

²¹ Ibid, 11.

²² Ibid, 11.

²³ Ibid, 11.

(pension and health care) benefits for those who reach retirement.²⁴ This is the average percentage across all communities. A community's actual costs depend on its continuation profile.²⁵

Pay parity is always a concern in the military to ensure the proper number of personnel are retained to accomplish the mission. Statutory compensation for MHS dentists consists of variable special pay (VSP), additional special pay (ASP), and board certification pay (BCP). The amount of these entitlement pays depends largely on years of service. ASP is given to those who agree to remain on active duty for at least one year. Generally, BCP is available only to those who are board certified in a specialty; however, general dentists who complete the Advanced Education in General Dentistry (AEGD) program may receive BCP.²⁶ The various special pays and compensation amounts offered to a dentist vary mainly depending on the longevity of the service-member.

a. Variable Special Pay (VSP)

To be eligible for VSP, one must be an officer of the Dental Corps of the Navy, and be on active duty under a call or order to active duty for a period of not less than one year.²⁷ VSP is an annual entitlement that is paid monthly to eligible officers; the amounts are shown in Table 4.

²⁴ Shayne Brannman, et al., Center for Naval Analyses, Life-Cycle Costs of Uniform Health Professions: Phase II: The Impact of Constraints and Policies on the Optimal-Mix-of-Accession Model, CRM D0007887.A2/Final, (Alexandria, Virginia: 2003), 11

²⁵ Ibid, 11.

²⁶ Shayne Brannman, et al., Center for Naval Analyses, Health Professions' Retention-Accession Incentives Study Report to Congress: Phases II & III: Adequacy of Special Pays and Bonuses for Medical Officers and Selected Other Health Care Professional, CRM D0004460.A5 (Alexandria, Virginia: 2002), 130

²⁷ Navy Department, "Fiscal Year 2007 Dental Officer Special Pay Plan," Bureau of Medicine and Surgery Special Pay Page, 2007, <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&docid=10766> accessed 16 January 2007.

Table 4. Variable Special Pay²⁸

VARIABLE SPECIAL PAY	
YEARS OF CREDITABLE SERVICE	SPECIAL PAY AMOUNT (\$ / YEAR)
Less than 3*	3,000
At least 3 but less than 6**	7,000
At least 6 but less than 8	7,000
At least 8 but less than 12	12,000
At least 12 but less than 14	10,000
At least 14 but less than 18	9,000
At least 18 or more	8,000
Above O-6	7,000

*If undergoing training

**Not undergoing internship training

b. Additional Special Pay (ASP)

An officer entitled to VSP, not undergoing dental internship, fellowship or initial dental residency training, and who possesses a current, valid, unrestricted license or approved waiver, is entitled to ASP at the following rates for any 12 month period during which the officer executes a written agreement to remain on active duty for a period of not less than one year beginning on the date the officer accepts the award of ASP.²⁹ ASP shall be paid annually at the beginning of the 12-month period for which the officer is entitled to such payment.³⁰ The rates are displayed in Table 5.

Table 5. Additional Special Pay³¹

ADDITIONAL SPECIAL PAY	
YEARS OF CREDITABLE SERVICE	SPECIAL PAY AMOUNT (\$ / YEAR)
Less than 3	4,000
At least 3 but less than 10	6,000
At least 10 or more	15,000

²⁸ Navy Department, "Fiscal Year 2007 Dental Officer Special Pay Plan," Bureau of Medicine and Surgery Special Pay Page, 2007, <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&docid=10766> accessed 16 January 2007.

²⁹ Ibid.

³⁰ Ibid.

³¹ Ibid.

c. Board Certification Pay (BCP)

An officer entitled to VSP who possesses a current, valid, unrestricted license or approved waiver and is board certified, by a Navy recognized board, is entitled to BCP, paid monthly, at the annual rates listed below (Table 6).³²

Table 6. Dental Corps Board Certification Pay³³

BOARD CERTIFICATION PAY (BCP)	
YEARS OF CREDITABLE SERVICE	SPECIAL PAY AMOUNT (\$ / YEAR)
Less than 10	2,500
10 but less than 12	3,500
12 but less than 14	4,000
14 but less than 18	5,000
18 & Greater	6,000

d. Dental Officer Multiyear Retention Bonus (DOMRB)

To qualify for DOMRB, Dental Corps officers must be below the grade of O-7, have a current, valid, unrestricted license or approved waiver, and have at least eight years of creditable service, or have completed any active duty service commitment incurred for dental education and training.³⁴ Also, they must have completed initial residency training, or be scheduled to complete residency training and have executed a written agreement to remain on active duty for two, three, or four years that is accepted by BUMED.³⁵ The entitlements are paid at the rates indicated for their specialty designated in the table below (Table 7). The amounts are paid annually on the anniversary date of the signed agreement.

³²Navy Department, "Fiscal Year 2007 Dental Officer Special Pay Plan," Bureau of Medicine and Surgery Special Pay Page, 2007, <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&docid=10766> accessed 16 January 2007].

³³ Ibid.

³⁴ Ibid.

³⁵ Ibid.

Table 7. FY-07 Dental Officers Multiyear Retention Bonus³⁶

Dental Officer Multiyear Retention Bonus (DOMRB) Rates			
Specialty	2 Year Agreement (\$)	3 Year Agreement (\$)	4 Year Agreement (\$)
Oral Maxillofacial Surgeons	25,000	38,000	50,000
Comprehensive/Operative Dentistry	20,000	30,000	40,000
Endodontics	20,000	30,000	40,000
Prosthodontics	20,000	30,000	40,000
Orthodontics	18,000	27,000	35,000
Oral Pathology/Oral Diagnosis/Oral Medicine	18,000	27,000	35,000
Pediatric Dentistry	18,000	27,000	35,000
Public Health Dentistry	18,000	27,000	35,000
Temporomandibular Dysfunction (TMD)	18,000	27,000	35,000
Dental Research	18,000	27,000	35,000
Exodontia (Advanced Clinical Practice)	13,000	19,000	25,000
Endodontics (Advanced Clinical Practice)	13,000	19,000	25,000
General Dentistry [Comprehensive Dentistry] (Advanced Clinical Practice)	13,000	19,000	25,000
Periodontics (Advanced Clinical Practice)	13,000	19,000	25,000
Prosthodontics (Advanced Clinical Practice)	13,000	19,000	25,000

e. Critical Skills Retention Bonus (CSRB)

In Fiscal Year 2002, the DoD initiated the CSRB as an incentive to retain military healthcare officers possessing certain identified critical skills that are undermanned or essential to meeting the Navy’s medical mission.³⁷ However, due to lack of funding the CSRB was not awarded in FY02. In FY03 a one-time bonus was paid to those who qualified and executed an agreement.

3. Graduate Dental Education (GDE)

The dental corps does not have an accession source (comparable to AFHPSP deferred and FAP for physicians) that it can use to consistently access fully trained specialists.³⁸ The dental corps must grow all of its dental specialists from its pool of

³⁶ Navy Department, “Fiscal Year 2007 Dental Officer Special Pay Plan,” Bureau of Medicine and Surgery Special Pay Page, 2007, <http://navymedicine.med.navy.mil/default.cfm?seltab=bumed&ecmid=93E9008D-802E-D019-ABBA0925B2764081&docid=10766> accessed 16 January 2007.

³⁷ Alan B. Christian, Influences on the Retention of Residency-Trained and Non-Residency Trained Navy Dental Corps Officers, Master’s Thesis, Naval Postgraduate School. Monterey, California, 2004.

³⁸ Shayne Brannman, et al., Center for Naval Analyses, Life-Cycle Costs of Uniform Health Professions: Phase II: The Impact of Constraints and Policies on the Optimal-Mix-of-Accession Model, CRM D0007887.A2/Final, (Alexandria, Virginia: 2003), 30

general dentists by providing GDE opportunities.³⁹ Providing GDE opportunities also works as a retention tool to encourage general dentists to make the decision to stay in the military for the chance of receiving advanced education and specializing. With dentists, the military uses AFHPSP to put people through dental school and afterwards, brings them on active duty as general dentists. After a few years of practice as general dentists, the military selects some to go through a dental residency program to become dental specialists.⁴⁰ The issue here is one of cost – can the requirements for dental specialists be met in a more cost-effective manner?⁴¹

The 2005 CNA study calculated the total GDE cost by adding the direct and indirect costs and resident's compensation, less the value of the resident's productivity. CNA estimated in-house GDE costs based on a 1997 study at Wilford Hall Medical Center at Lackland AFB. Although the medical center is not a Navy medical center, it was assumed that costs are approximately the same across the services. CNA referred to the case again in 2005; however, they converted the numbers to 2005 dollars using 2005 composite rates, 2005 general schedule salaries, and inflation since 1997 as measured by the CPI. On this basis, GDE estimated costs to be \$145,743 per resident per year. CNA calculated the dental specialties training costs and presented them in three categories. Table 8 presents the costs for specialties in which the residency program is two years, three year programs, and oral maxillofacial surgery (a four year program). The costs range from \$565,000 to \$857,000.

³⁹ Shayne Brannman, et al., Center for Naval Analyses, Life-Cycle Costs of Uniform Health Professions: Phase II: The Impact of Constraints and Policies on the Optimal-Mix-of-Accession Model, CRM D0007887.A2/Final, (Alexandria, Virginia: 2003), 31

⁴⁰ Robert A. Levy, et al, Center for Naval Analyses, Raising the Bonus and the Prospects for DoD's Attracting Fully Trained Medical Personnel, CRM D00131237.A1/SR1, (Alexandria, Virginia: 2005), 48

⁴¹ Ibid, 48

Table 8. Dental Training Costs, by Specialty⁴²

DENTAL TRAINING COSTS, TOTAL BY SPECIALTY	
Specialty	Training costs (\$K)
Specialties with 2-year residency ^a	565
Specialties with 3-year residency ^b	711
Oral maxillofacial surgery (4 year program)	857
a. These include orthodontics, comprehensive dentistry, endodontics, and periodontics.	
b. These include oral pathology, periodontics, and prosthodontics.	

CNA evaluated the cost of GDE and the possible effects of manning if bonuses were raised to attract fully trained specialists. CNA concluded that training is expensive because both the costs of GDE and the support that is provided to the student as pay drive up the cost of training. Of course there is no guarantee that the Services will, when the training is over, get the specialists they require, at least for those with relatively long training periods, i.e., physicians and dentists.⁴³ Because of the unpredictability of meeting the specialist manning requirements, the 2005 CNA study recommends increasing the current FAP bonus and or targeting specific specialties to acquire the required number of specialists.

C. MANPOWER PLANNING

Manpower planning is the process of obtaining the correct number of people with the proper skills at the appropriate time in order to fulfill organizational human resource needs.⁴⁴ Manpower analysts determine the number of people required, authorized, and available to operate, maintain, support, and provide training for the system. Manpower requirements are based on the range of operations during peacetime, low intensity conflict, and wartime. They should consider continuous, sustained operations and

⁴²Robert. A. Levy, et al, Center for Naval Analyses, Raising the Bonus and the Prospects for DoD's Attracting Fully Trained Medical Personnel, CRM D00131237.A1/SR1, (Alexandria, Virginia: 2005), 34

⁴³Ibid, 77

⁴⁴ Van Q. Nguyen, Analysis of the U.S. Marine Corps' Steady State Markov Model for Forecasting Annual First-Term Enlisted Classification Requirements, Master's Thesis, Naval Postgraduate School, Monterey, California, 1997.

required surge capability.⁴⁵ Two components are basic parts of the manpower planning activity: forecasting and programming. Forecasting involves generating the numbers, types, and qualities of personnel needed by an organization at some time in the future. Programming is the process and activities by which the forecast is implemented with much emphasis on development.⁴⁶

Bartholomew *et al* states;

It is almost a quarter of a century since the term “manpower planning” came into general use but the statistical treatment of manpower systems must be as old as the planning of the military and the building exploits of the ancient world.⁴⁷

Although human resources are not often considered to entail much mathematical theory, manpower planning utilizes the Markov Model to generate solutions to manpower scenarios. Bartholomew again adds that:

There are two features of most manpower planning problems which render them suitable for statistical treatment. The first is the concern with aggregates. Manpower planning, unlike individual career planning, is concerned with numbers, that is, with having the right numbers in the right places at the right time. The second feature of manpower planning which calls for statistical expertise is the fact of uncertainty. This arises both from the uncertainty inherent in the social and economic environment in which the organization operates and from the unpredictability of human behavior.⁴⁸

D. MARKOV MODEL

1. Introduction

In mathematics, a Markov chain, named after Andrei Markov, is a discrete-time stochastic process with the Markov property.⁴⁹ A Markov chain is a system, made up of states, that has the Markov property. At each time the system may have changed from

⁴⁵ Manpower Planning Chapter 6.2.1.3. http://akss.dau.mil/dag/GuideBook%5CIG_c6.2.1.3.asp accessed 31 January 2007

⁴⁶ Elmer H. Burack, E.H. and Nicholas J. Mathys. Human Resource Planning: A Pragmatic Approach to Manpower Staffing and Development, Lake Forest, IL, Brace-Park Press, 1980.

⁴⁷ David J. Bartholomew, et al., Statistical Techniques for Manpower Planning, Chichester, England, John Wiley & Sons, 1991, 9.

⁴⁸ Ibid, 1.

⁴⁹ Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/Markov_chain:accessed 30 January 2007.

the state it was in the moment before, or it may have stayed in the same state. The changes of state are called transitions. A series with the Markov property is such that the conditional probability distribution across the states in the future, given the state of the process currently and in the past, is the same distribution as one given only the current state. In other words, the past states carry no information about future states.⁵⁰ Steady-state analysis in the Markov model determines the number of personnel that must be accessed to meet the projected end strength, assuming the model continues to hold.

2. Navy Nurse Corps Markov Models

Two prior Naval Postgraduate School theses have utilized the Markov model to determine manpower requirements. Buni and Deen developed a deterministic Markov model for the flow of Navy Nurse Corps officers from the rank of O-1 through O-3.⁵¹ Deen and Buni developed a steady state analysis for these three ranks using data from fiscal years 1990 through 2003. The data included characteristics such as rank, date of rank, age, gender and accession source. In one scenario, Deen and Buni evaluate the effects of a force reduction in which accessions were cut by fifty percent. The model created critical shortages for Lieutenants Junior Grade and Lieutenants. They recognize that the shortage of junior officers should be expected since the number of accessions is decreased and the input into the system is reduced. This also has an effect on the overall force shaping plan. It creates a shortage of mid-grade officers and results in a more senior force.⁵²

Kinstler and Johnson developed a Markov Model to predict how many nurses the Navy should gain each year to maintain end strength and to indicate which Nurse Corps accession programs they should enter through. They merged data from the Bureau of Medicine and Surgery Manpower Information System (BUMIS) and Defense Manpower Data Center (DMDC) Master File and created a “Combined Data Base” that contained data for the years 1990 through 2001. Kinstler and Johnson’s Markov Model demonstrated a pre-existing overage of LTs and an underage of LTJGs and LCDRs.

⁵⁰ Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/Markov_chain:accessed 30 January 2007.

⁵¹ Dan P. Kinstler, and Ray W. Johnson. Developing a Markov Model to be used as a Force Shaping Tool for the Navy Nurse Corps, Master’s Thesis, Naval Postgraduate School. Monterey, California, 2005.

⁵² Gary T. Deen , and Glenn G. Buni. Development of a Steady State Model for Forecasting U.S. Navy Nurse Corps Personnel, Master’s Thesis, Naval Postgraduate School. Monterey, California, 2004.

They report that the overage of LTs and the underages of LTJGs and LCDRs could result from accelerated promotions rates from LTJG to LT, and the slow promotion rates from LT to LCDR. Kinstler and Johnson explained that promotion policies should be examined to compensate for this occurrence.⁵³

⁵³ Dan P. Kinstler, and Ray W. Johnson. Developing a Markov Model to be used as a Force Shaping Tool for the Navy Nurse Corps, Master's Thesis, Naval Postgraduate School. Monterey, California, 2005.

III. DATA SOURCES, GENERAL METHODOLOGY, PRELIMINARY DATA ANALYSIS

A. DATA SOURCES

The data set used in the modeling process was obtained from the Bureau of Medicine Management Information System (BUMIS) courtesy of the Dental Corps' Community Manager's office. Upon graduating from dental school, dentists are commissioned into the Navy Dental Corps as Lieutenants (O-3). Therefore, the data included dentists with the ranks of Lieutenant through Rear Admiral (O-3 to O-7). The Dental Corps data was received as Excel files from LCDR R. Woolfolk, Manpower Planner/Dental Corps Personnel Plans Analyst currently assigned to the Navy Medical Manpower Personnel Training and Education Command.

The data provided included the Dental Corps Worldbook updated as of 30 June 2006. The Dental Corps Worldbook is an Excel file that records the number of Dental Corps officers in separate categories. Some of the categories are date of rank, specialty, accession source, and active duty commissioning date. The data consist of the numerical history of the dental corps from 1990 and predicts the number of dentists out to 2015. The total inventory of dentists is shown in the file and is divided by dental specialty. Each year's beginning strength and the total number of gains and losses are provided, as well as loss rates. The data also include the year's end strength and compares that number with the target for that year. The manning percentage is also computed and included in the data. In the gain category, the number of dentists brought in each year by each accession source is recorded. Also, the number of losses each year is recorded and whether the losses were released, resigned, retired, or lost due to other circumstances is recorded.

Two additional Excel files were provided that contained Dental Corps Officers who served in the U.S. Navy from fiscal years 1984 through 2005. The two files were titled "DC Total Inventory" and "DC Losses". The DC Total Inventory file contained dental corps officers who remained on active duty for each fiscal year. Each officer had one record for each fiscal year that highlighted information specific to the individual service member. The data included the member's rank, specialty, source of entry (SOE),

and active commission base date (ACBD). The DC loss file contained the records of officers who were a loss to the Navy in that particular year. The loss file mirrored the information in the inventory file; however, the loss file included the estimated loss date, which is the date that the member was an actual loss to the Navy Dental Corps.

B. GENERAL METHODOLOGY

The Navy Dental Corps “grows” the majority of its specialists from within the dental community. This requires the Navy to groom the dentist through the ranks after he or she enters the Navy. The entering dentist becomes efficient at practicing dentistry and is promoted through the ranks while successfully completing Dental Corps tours of duty with increasing levels of responsibility. Upon graduating from dental school, Navy Dentists are commissioned as Lieutenants (O-3). A few dental direct accessions enter the Navy already possessing a specialty. However, the majority of Dental Corps officers serve their initial obligation as General Dentists. Typically, at year three or four, depending on his or her active duty obligation (ADO) (which is associated with the accession program), the Dental Corps officer arrives at a decision point. At the stay/leave decision point the officer can choose to leave active duty, apply for one of the dental specialties, or remain a general dentist. This thesis follows the path of dental officers through the various flow points. It focuses on five specialties in addition to general dentistry as a continuation path. The five dental officer specialties chosen were endodontist, comprehensive dentist, oral and maxillofacial surgeon, periodontist, and prosthodontist. These five specialties were selected due to the number of personnel in their inventories. Also, studies conducted by CNA focused on eight dental specialties, and the five selected for this thesis were among the eight selected by CNA.

C. ANALYSIS OF SPECIALTY CHOICE AND ACCESSION SOURCE

1. Accession Programs

The first step was to determine if accession program and dental specialty are related. The accession programs that the Dental Corps community utilizes include Direct Commission, Dental Student, Armed Forces Health Professions Scholarship Program (AFHPSP), Health Service Collegiate Program (HSCP), and Financial Assistance

Program (FAP). Direct Commission, Dental Student, and the AFHPSP access the highest percentages of dentists for the Dental Corps. The percentage of each accession source is shown below in Table 9.

Table 9. Accession Source

Accession Source		
Source	Number	Percent
Direct Commission	419	43
Dental Student	247	26
AFHPSP	234	24
HSCP	47	5
FAP	17	2
Total	964	100

The numbers represented in the above table are from the five specialties chosen for this research.

Figures 1 through 5 report the distribution of specialties for each accession source.

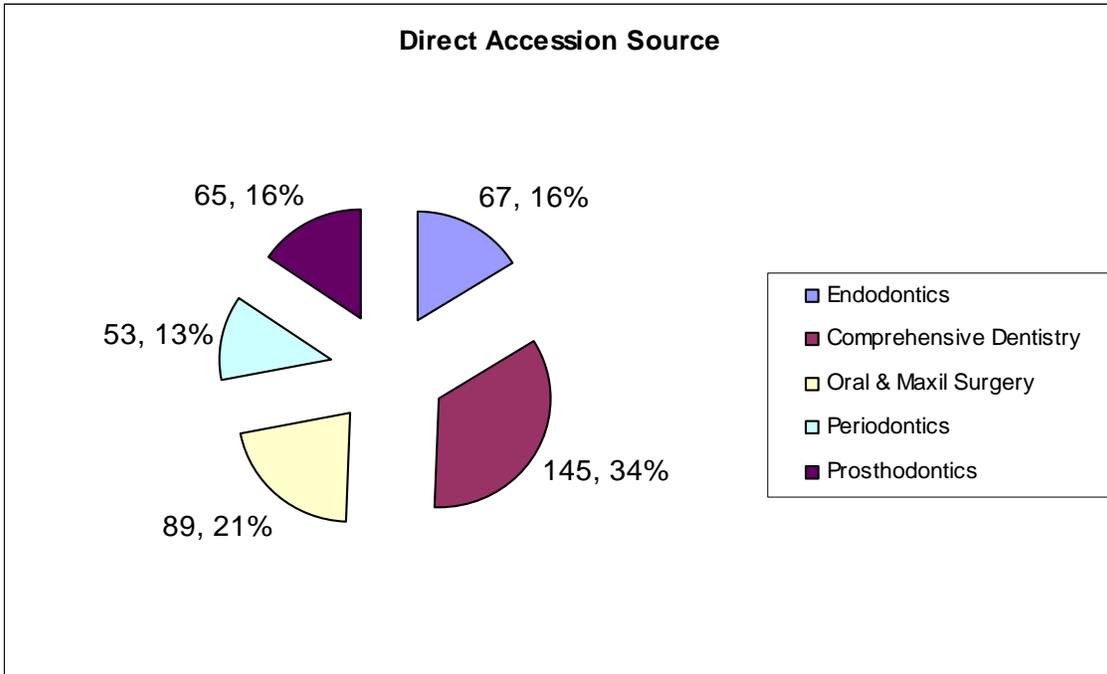


Figure 1 Specialty by Direct Commission: FYs 1988 – 2005⁵⁴

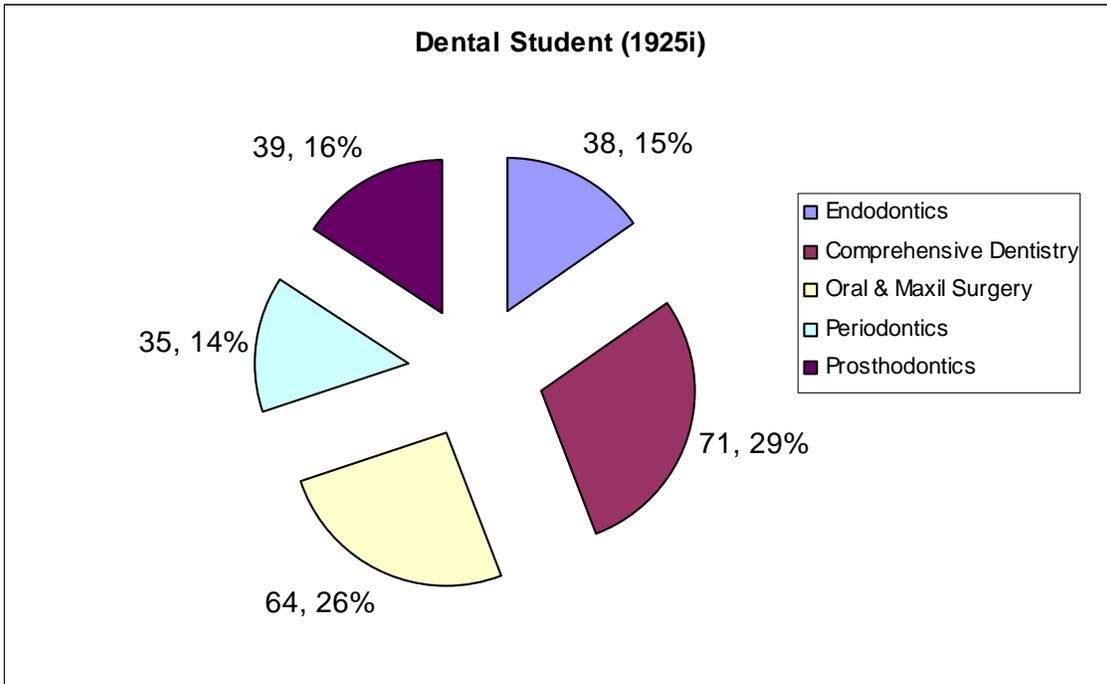


Figure 2 Specialty by Dental Student: FYs 1988 – 2005⁵⁵

⁵⁴Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

⁵⁵ Ibid.

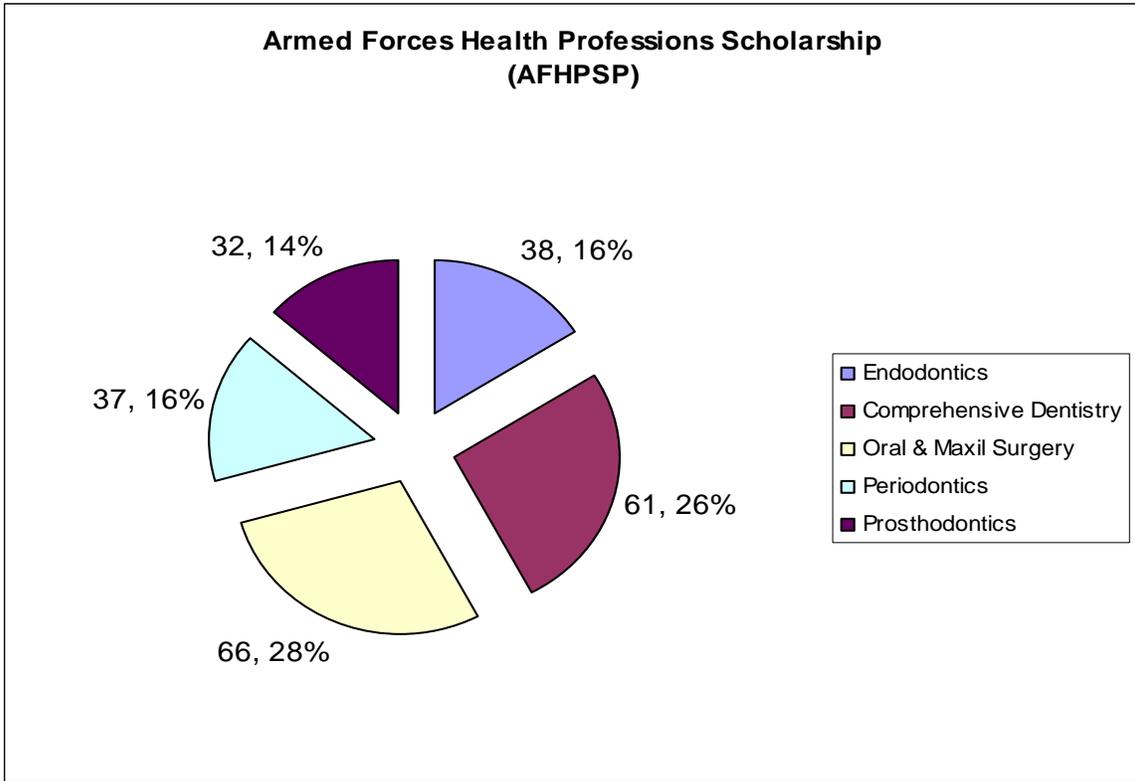


Figure 3 Specialty by Armed Forces Health Professions Scholarship⁵⁶

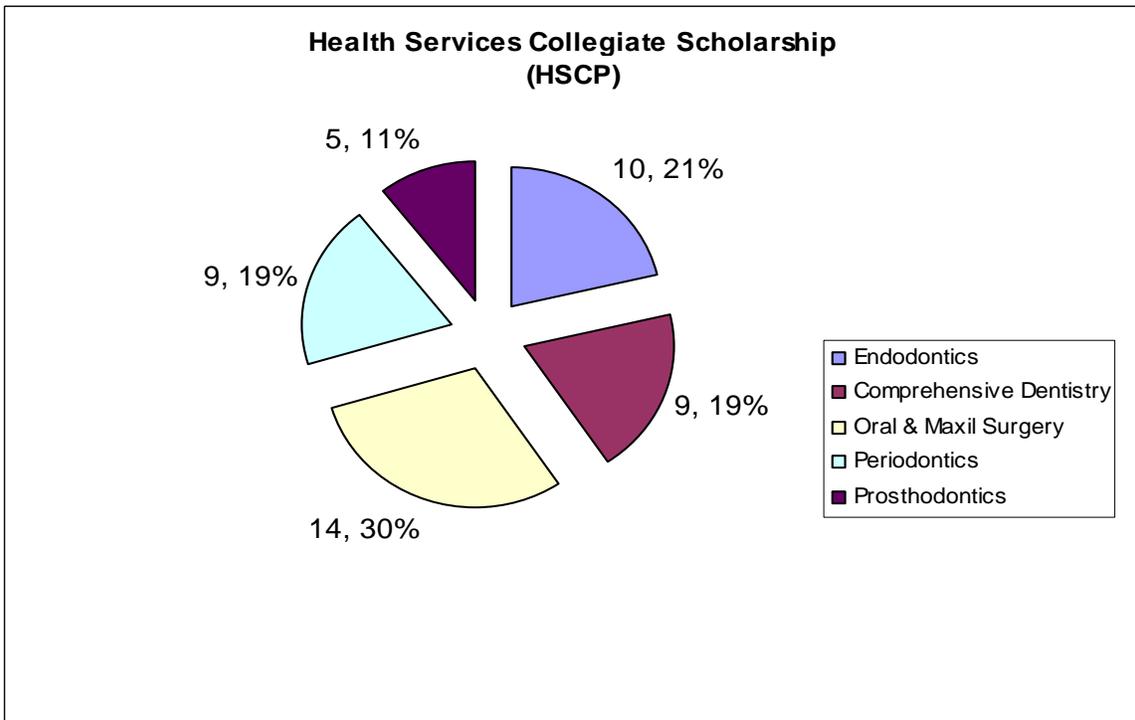


Figure 4 Specialty by Health Services Collegiate Scholarship⁵⁷

⁵⁶ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

⁵⁷ Ibid.

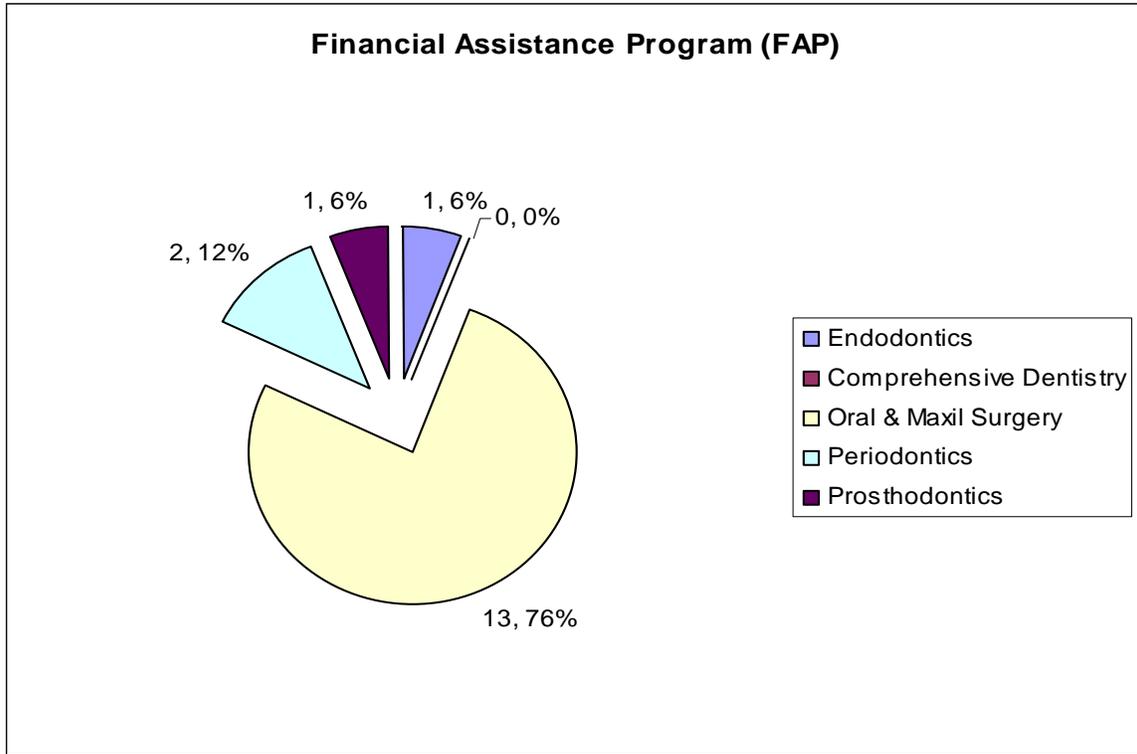


Figure 5 Specialty by Financial Assistance Program⁵⁸

The data reflects that dentists who are entering through the primary Dental Corps accession programs are evenly distributed throughout the selected dental specialties except for FAP. FAP is a direct commissioning program that is used to access dentists currently accepted to, or enrolled in an accredited residency for fellowship program progressing to a specialty, which has been designated as critical to the Department of Defense (DoD). Therefore, judging from the data, Oral Surgery apparently was designated as a critical specialty, which explains why 76% of FAP accessions were Oral Surgeons.

2. Specialties

Endodontology, Comprehensive Dentistry, Oral and Maxillofacial Surgery, Periodontist, and Prosthodontist are the five specialties selected for evaluation in this thesis. Table 10 shows the number of dentists within each of the five specialties.

⁵⁸ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

Table 10. Specialties⁵⁹

Specialties		
Specialty	Number	Percent
Comprehensive Dentistry	352	30
Oral Surgery	290	25
Endodontics	192	16
Prosthodontics	174	15
Periodontics	172	15
Total	1180	100

Dental Corps officers initially complete their first tour of duty as general dentists and afterwards they may choose to specialize. If an officer is accepted into one of the advanced education programs he or she incurs additional obligated service time for the training received.

In order to verify that accession sources are not an important influence on behavior in regards to the selection of a particular specialty, specialties by accession source are shown in Figures 6 through 10.

⁵⁹ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

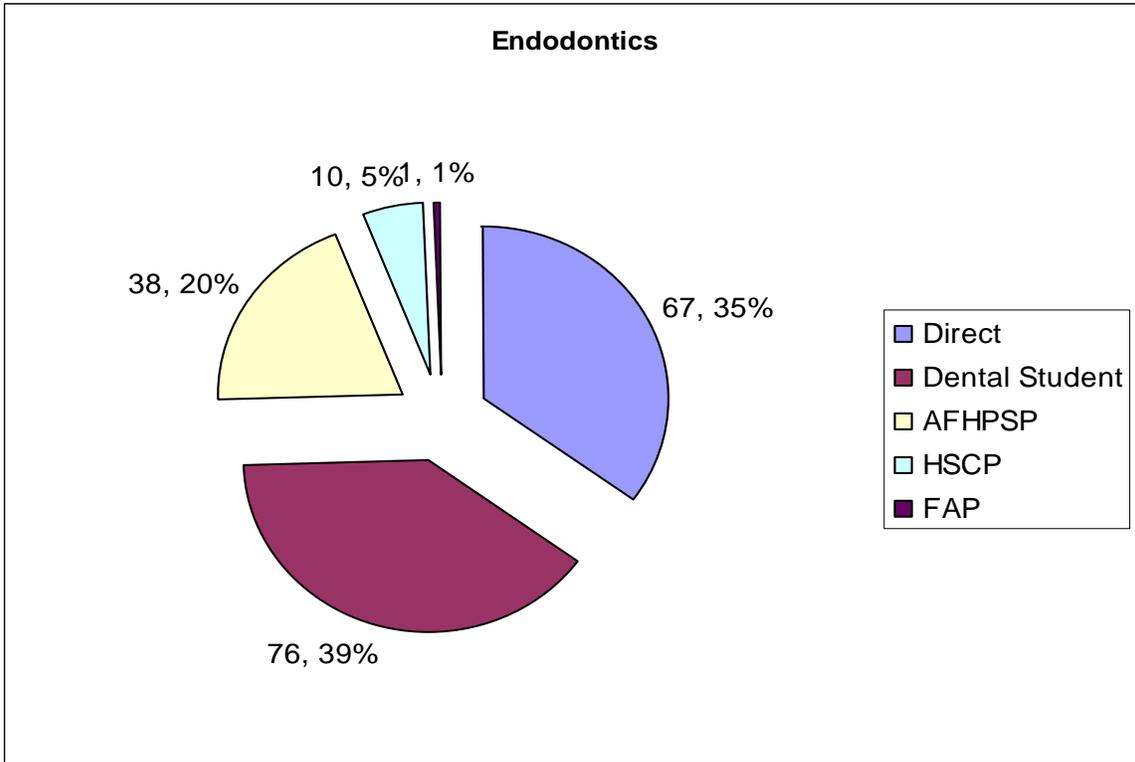


Figure 6 Accession Sources by Endodontist: FYs 1988 – 2005⁶⁰

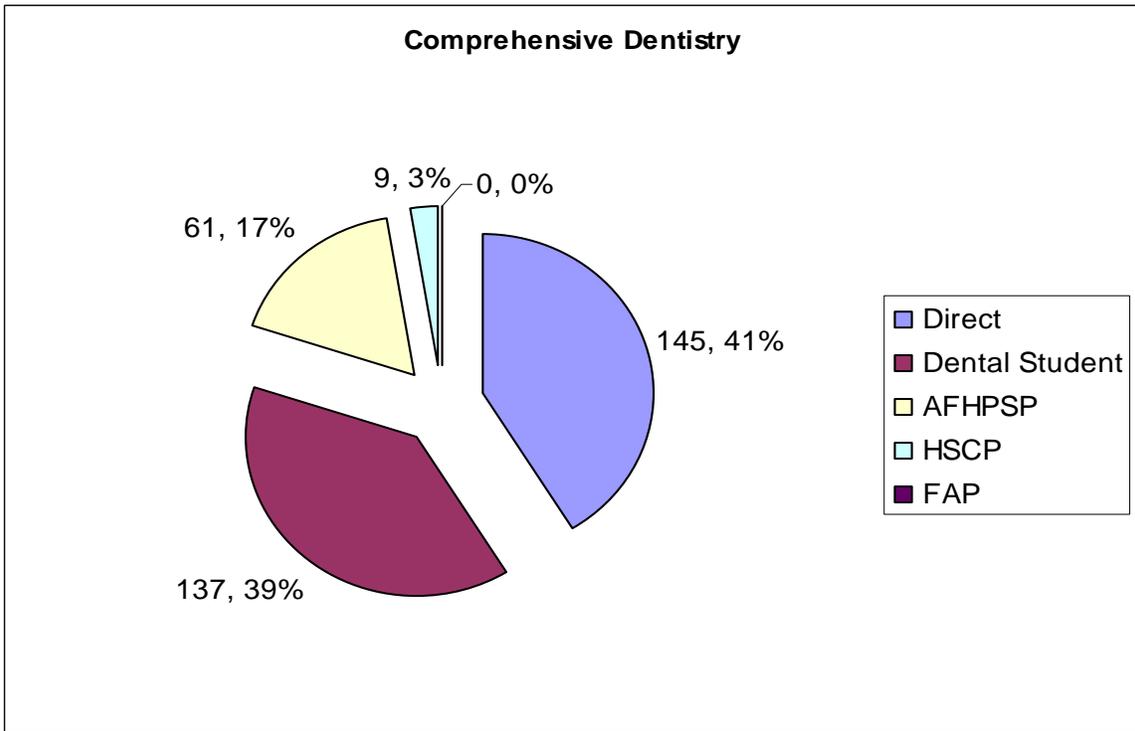


Figure 7 Accession Sources by Comprehensive Dentistry⁶¹

⁶⁰ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

⁶¹ Ibid.

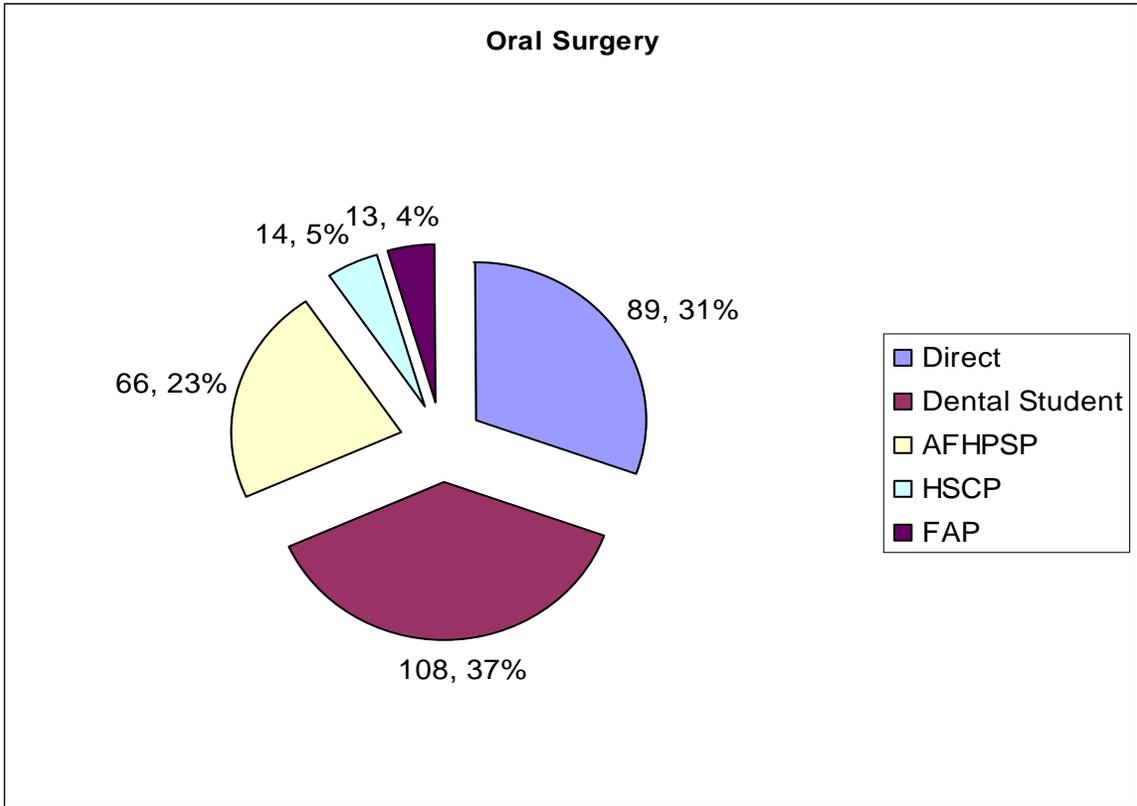


Figure 8 Accession Sources by Oral Surgeon⁶²

⁶² Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

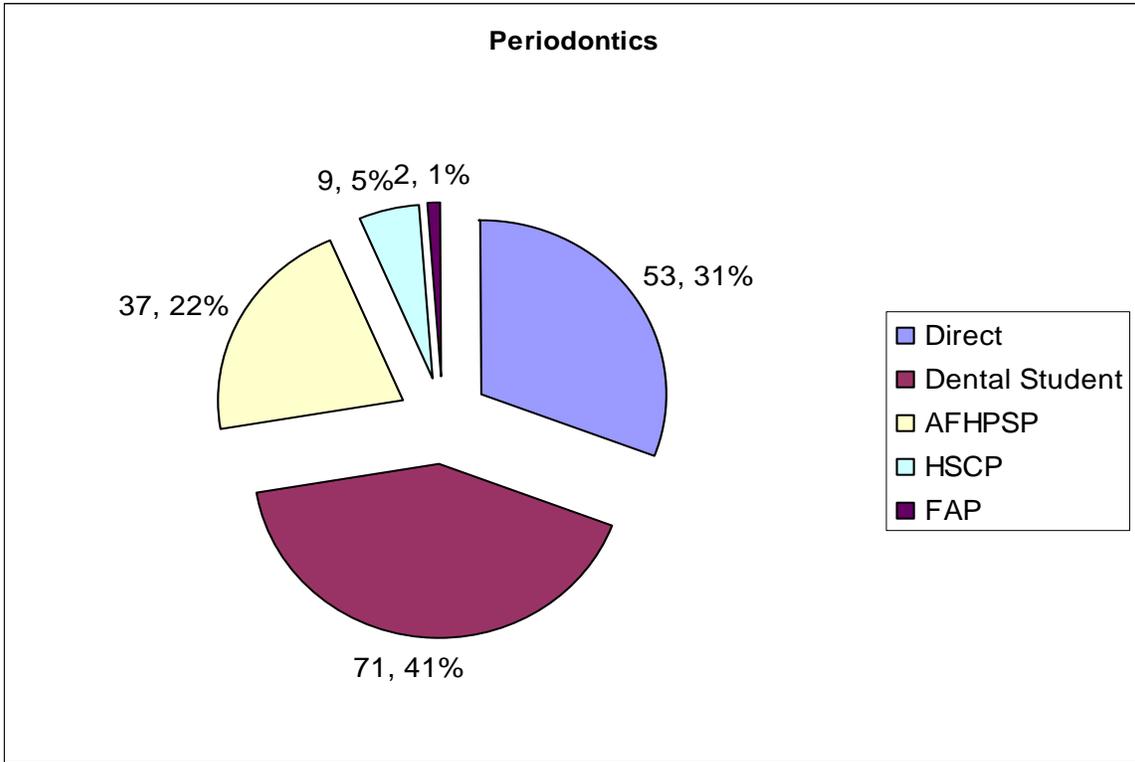


Figure 9 Accession Source by Periodontist⁶³

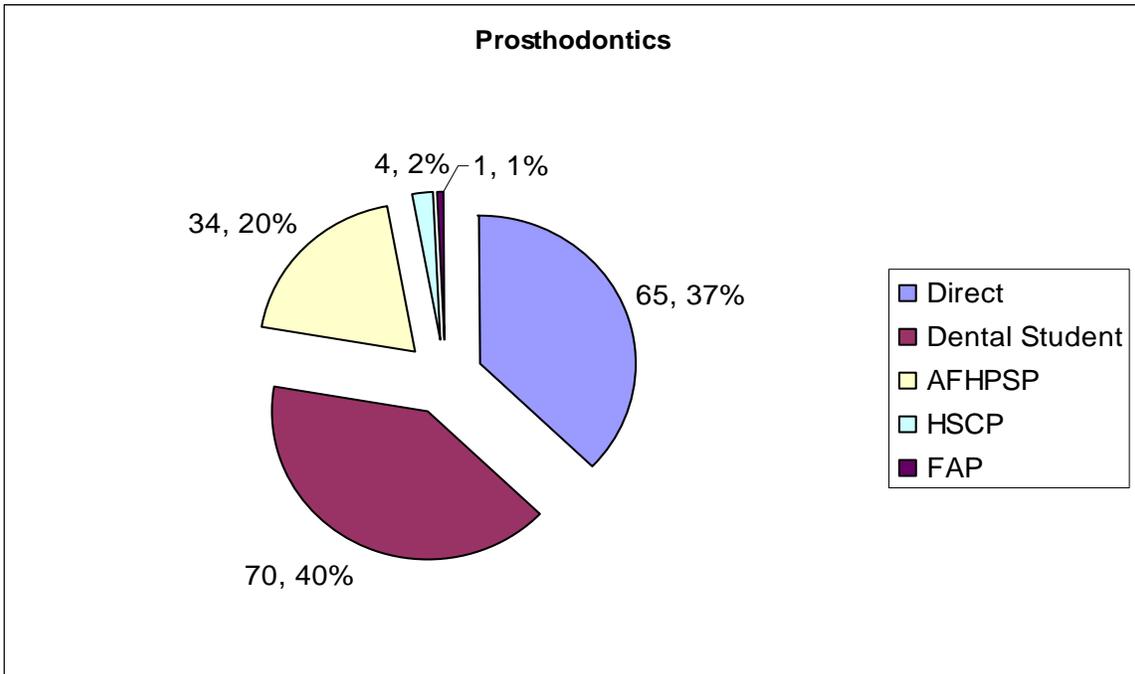


Figure 10 Accession Source by Prosthodontist⁶⁴

⁶³ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

⁶⁴ Ibid.

As reflected by the tables the specialties are manned in about the same proportion by dentists who enter through the various accession sources. The tables indicate that Dental Student accessions make up the highest percentage of the accession for all the specialties except for Comprehensive Dentistry. For Comprehensive dentistry, the Direct Commission percentage is slightly higher at 41% compared to 39% for the Dental Student accession group. In fact, Dental Student and Direct accessions are close in the percentages that they contribute for all of the five specialties. AFHPSP numbers reflect that it is the third highest accession source, with HSCP and FAP provides the lowest percentage of accessions.

3. Gains and Losses

Utilizing the DC Worldbook, the Dental Corps from FY 90 through FY 06 gained an average of 115 dentists per year while losing an average of 151. The Department of Defense went through a downsizing period during most of these years, which may have contributed to the higher number of losses than gains. Direct Commission, Dental Student, AFHPSP, and HSCP were the primary contributors to the gain category. Retirement, Resignations, and Release from Active Duty contributed to the majority of the losses. During this time the end-strength for Dental Corps Officers dropped from 1,697 in 1990 to 1,088 in 2006. The loss rate during this period was fairly stable, between 8.0% and 12.9% per year. The highest loss rate of 12.9% occurred in 2005 while the lowest loss rate of 8% occurred in 1997. Table 11 shows gains, losses, and loss rate for FY 90 through FY 06.

Table 11. Dental Corps gains, losses, and loss rates⁶⁵

Beginning strength, gains, losses, loss rate by FY				
FY	Beginning strength	Gains	Losses	Loss Rates
90	1697	157	157	9.3
91	1697	115	146	8.6
92	1666	102	192	11.5
93	1576	96	183	11.6
94	1489	109	153	10.3
95	1445	122	163	11.3
96	1404	109	180	12.8
97	1333	107	107	8
98	1333	138	139	10.4
99	1332	152	125	9.4
00	1359	140	136	10
01	1363	120	141	10.3
02	1342	118	164	12.2
03	1296	103	152	11.7
04	1247	101	143	11.5
05	1205	81	156	12.9
06	1130	81	123	10.9

⁶⁵ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

IV. MODEL AND RESULTS

A. MODEL

In order to develop the model the data from two Excel files, “DC Total Inventory” and “DC Losses” were merged. After merging the files, only one record per service member remained. The data were from FY 1988 through FY 2005. The record indicated the fiscal year the member was lost or if the member remained in the service through at least FY 06. This evolution produced a succession of 3,643 records that portray each dentist’s career. The accession sources of the dentists were identified, however, there were some missing entries that did not allow all of the data to be included in the research.

The succession of the dentist’s specialty code was also tracked through his or her career. There were years where the member’s specialty codes were not recorded; therefore, to adjust for this a rule was applied to the model. If a dentist’s first appearance was after year 1 and there was a specialty recorded in the that year, “general” was filled in for years one through seven, then the specialty was recorded for the remaining years. The eighth year was chosen because the data showed that the rate of moving from “General” to specialty was higher during year seven and eight than between any other two years.

B. GENERAL DENTIST

The manning percentage of General Dentists as of the end of July 2006 was 79%. This presents a manning problem for the Dental Corps Community managers. Most dentists entering into the Navy Dental Corps community serve as General Dentists at the beginning of their careers. Once they have completed their initial active duty obligation they may remain a generalist or choose to specialize. If a general dentist decides to remain a generalist there are opportunities for advanced education. The Dental Corps community offers general dentists the opportunity to complete a one year program called the Advanced Education Graduate Degree (AEGD) program. Also, a General Dentist may choose to become a Comprehensive Dentist. Table 11 illustrates the percentage of General Dentists in comparison of the other specialties used in this research.

Table 12. General Dentist and 5 Selected Specialties

Specialties	Number	Percent
General Dentist	2028	60
Endodontist	216	6
Comprehensive Dentist	399	12
Oral Surgery	345	10
Periodontist	189	6
Prosthodontist	204	6
Total	3381	100

C. LOSS RATES

The following sections provide loss rates for the overall Dental Corps community and the five selected specialties. Data taken from FY 1988 through FY 2005 were used to calculate years out to 31 years. After merging the data from the Dental Corps Inventory and Loss excel file, a total of 3,643 records were created. Dentists are required to have a graduate degree in dentistry before they are commissioned as Dental Corps officers. Therefore, the dentist’s time in dental school did not count towards the loss rates. The loss rates were calculated from the date that they began serving as Dental Corps officers. The reporting date in the data was designated as the starting point for the member’s career.⁶⁶

The loss rates were first calculated for the entire Dental Corps community; this combined general dentists and all of the specialists. Then the individual loss rates were calculated for general dentists and four of the specialty areas. The loss rates of General Dentists and Comprehensive Dentists were combined for this study because while examining the data, it was discovered that several Comprehensive Dentists later converted back to general dentistry. This initially skewed the results, and therefore, it

⁶⁶ BUMIS data dictionary states the RPD (reporting date) is a six digit date which is the officer’s “on-board” date for his career.

was decided that, for this thesis, the two occupations would be combined. While conducting research it was discovered that the Comprehensive Dentist is a highly trained general dentist with the knowledge and experience necessary to serve in smaller and remote clinics independent of direct specialty support.⁶⁷ So it was determined that it would be reasonable to combine General and Comprehensive Dentistry. Loss rates were also calculated for the remaining four specialties: Endodontics, Periodontics, Oral Surgery, and Prosthodontics.

1. Overall Dental Corps

The data included for the overall loss rate for the Dental Corps included the total inventory. This included the generalists and the five specialties that were selected for this thesis. Determining the overall loss rates of the Dental Corps would allow the research to obtain a “big picture” and analyze the behavior of the overall Dental Corps community. The loss rates for the Dental Corps community are shown in Figure 10 which track out to year 31.

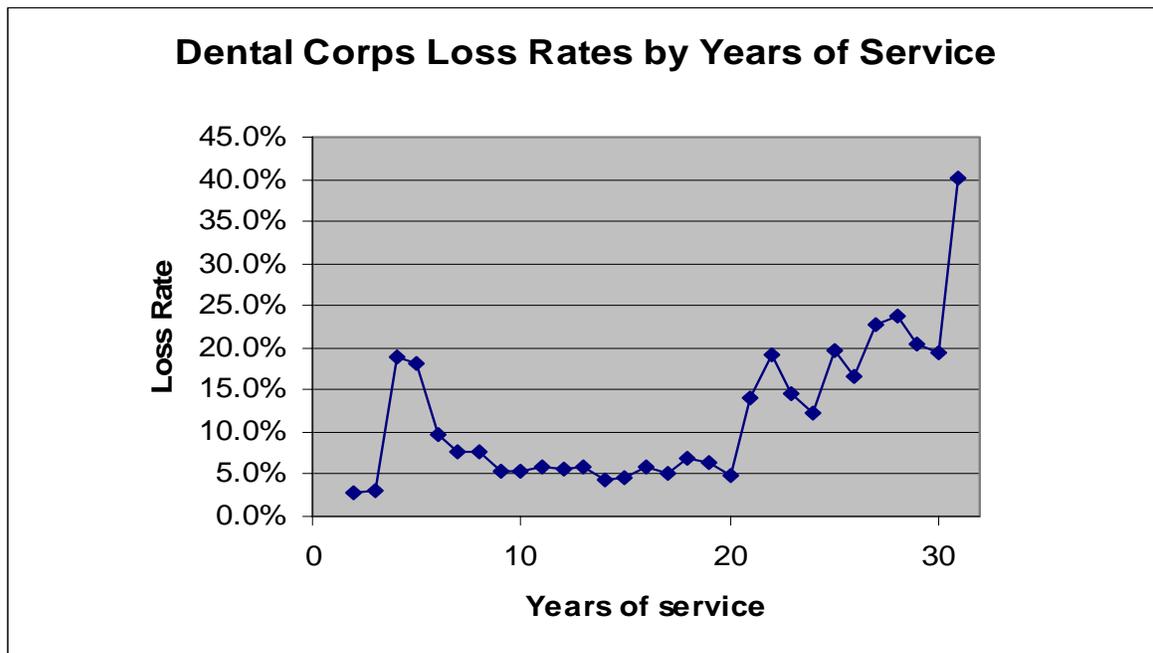


Figure 10 Dental Corps Loss Rates⁶⁸

⁶⁷ Naval Postgraduate Dental School website
<http://www.bethesda.med.navy.mil/Careers/Postgraduate%5FDental%5FSchool/Comprehensive%5FDentistry/> accessed 12 March 2007.

⁶⁸ Author.

Dental Corps officers must serve an initial active duty commitment of a minimum of three years. Some dentists are required to serve four years due to receiving additional funding from their particular accession source. The data illustrates a low attrition rate through year three. Years four and five show a substantial increase. This is the first stay/leave decision point for Dental Corps officers. The attrition rate jumps up from 3 percent in year 3 to 19 and 18 percent in years 4 and 5, respectively. The sixth year also reports attrition at nearly 10 percent; however, attrition begins to stabilize between 4 and 5 percent starting with year 8 through year 20. As with the behavior of most military professionals, once the member has invested eight or more years, he or she is more inclined to remain on active duty until at least year 20. Remaining to year 20 will allow him or her to receive military retirement pay. The retirement pay could equal to as much as 50 percent of basic pay. The attrition rates for year 20 and beyond are higher than those in years 8 through 19. Attrition rates for years 20 and 29 range from 14 to 24 percent. At this time dentists will determine their opportunity cost and decide whether they should stay in the Navy longer or take the retirement option and start another career in the civilian sector. The attrition rates increase again after year 30. At year 31 the attrition rate jumps up to an overall high of 40 percent. Unless an officer is promoted to the rank of Rear Admiral (O-7), he or she must retire after 30 years of active duty commissioned service. The percentage of retirement pay for the military increases by 2.5 percent each year past 20, but the percentage increase reaches a maximum out at 75 percent at year 30. Therefore, the opportunity cost is greater past year 30 because there is no retirement pay incentive to stay past the 30 year point. This explains the large spike in the attrition rate for year 31.

2. General Dental Corps

As discussed earlier, the data for General and Comprehensive Dentists were combined to obtain loss rate results. Comprehensive Dentists are highly trained general dentists which validated the decision to merge the data for these two groups. The results for the loss rates for General Dentist are shown in Figure 3, which tracks them out to year 31.

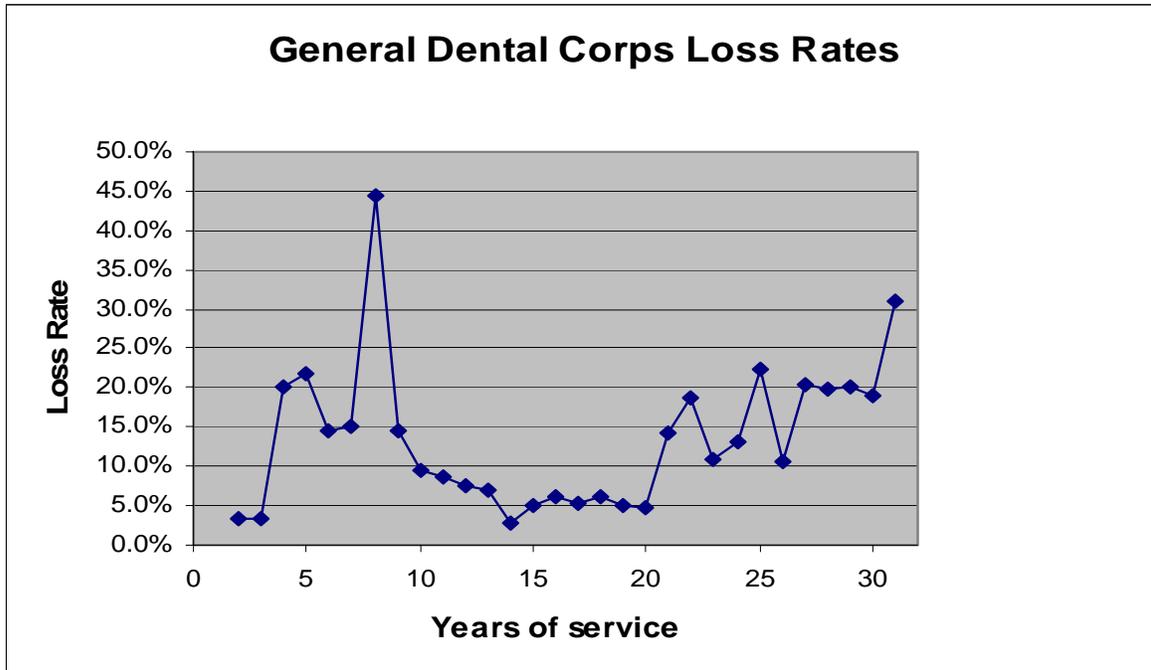


Figure 11 General Dental Corps Loss Rates⁶⁹

The attrition rate for general dentists increases to 20 and 21 percent in years 4 and 5, respectively. This represents the dentists that elect either to specialize or leave the active duty military. The attrition rate increases once again at year 8 to 45 percent. The eighth year is when generalists are more likely to choose a specialty. Between years 10 and 20 the attrition rate begins to decrease and stabilize around five and six percent. This trend can be attributed to dentists who take into account the years they have invested and decide to remain on active duty in hopes of retiring after 20 years. This assumption can be validated by looking at years 21 and 22. The attrition rate increases to 15 percent in year 21 and 18 percent at year 22. In the 25th year the attrition rate is 22 percent. In the years 27 through 30 the attrition rate for the general dentists are steady at around 20 percent. Afterwards, in year 31, the attrition rate jumps up to 31 percent. This is the result of dentists who complete their active duty officer career of 30 years and retire.

3. Endodontist

Endodontists are dentists who specialize in endodontics which requires an additional 2 – 3 years of training beyond dental school. They specialize and limit their

⁶⁹ Author.

practice to root canal therapy and root canal surgery⁷⁰ Navy Dental Corps officers have the opportunity to specialize in Endodontics once they complete their initial tour as a general dentist. National Naval Medical Center (NNMC), Naval Postgraduate Dental School commands and supports a two year residency advanced program for endodontics. Endodontists were authorized 48 billets for FY 06.⁷¹ The Endodontists were 94 percent manned as of 30 Jun 2006. Figures 12 and 13 show the loss rates for Endodontists.

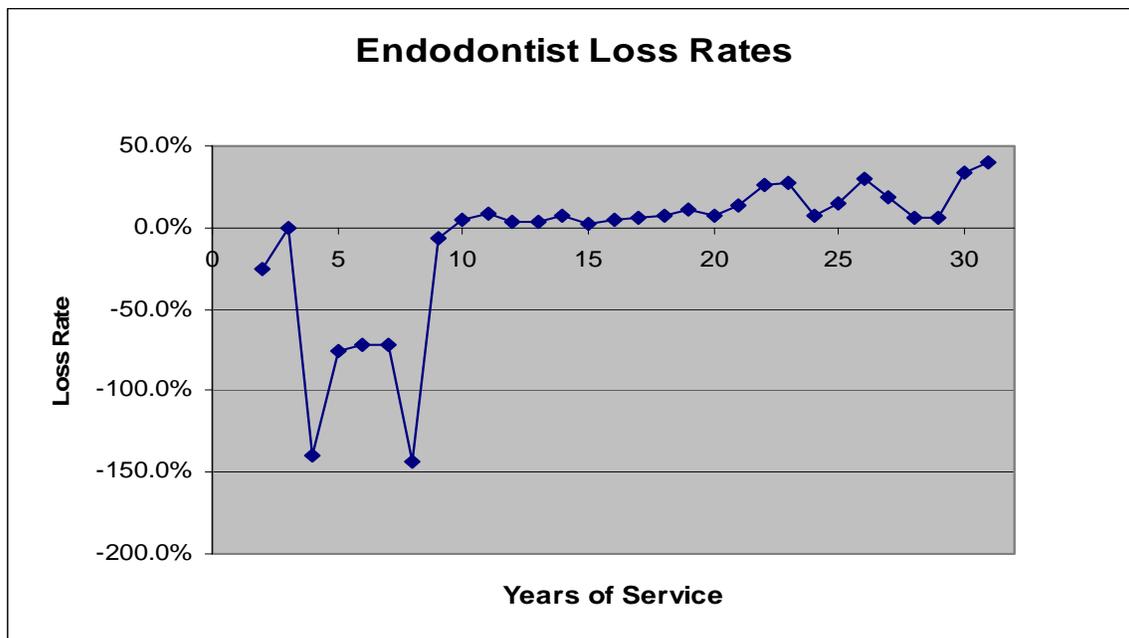


Figure 12 Endodontist Loss Rates⁷²

⁷⁰Wikipedia, the free encyclopedia. <http://en.wikipedia.org/wiki/Endodontist>:accessed 16 March 2007.

⁷¹ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

⁷² Ibid.

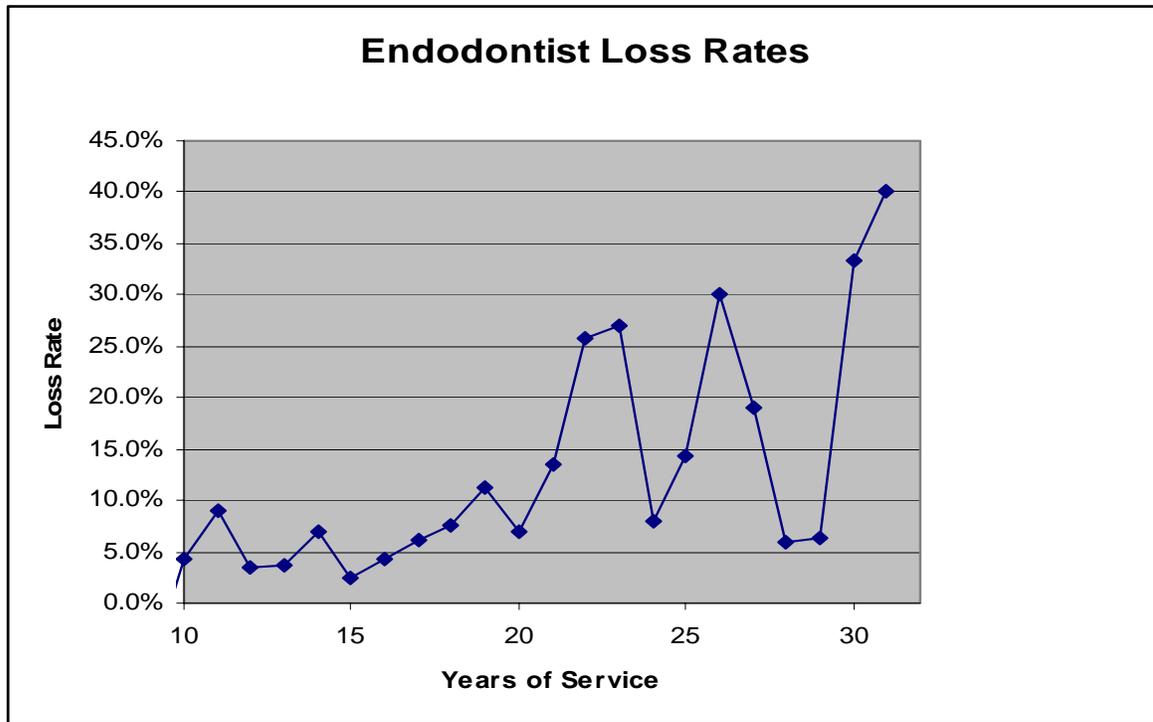


Figure 13 Endodontist Loss Rates (Year 10 through Year 31)

In the beginning years of the endodontist specialty, instead of decreasing numbers, the specialty is gaining dentists due to the fact that most Navy dentists enter the Navy as general dentists and then specialize later in their career. Because of this, instead of having positive attrition the numbers are extremely negative. This reflects general dentists who decide to specialize in endodontics between years 4 through 9. Starting at year 10 attrition rates begin to rise and provide results that are as expected. As displayed in the graph, the attrition rates are relatively steady from year 10 through year 20. Once a Dental Corps officer decides to specialize, typically he or she is also deciding to make the Navy a career. As discussed in Chapter 1, once he or she elects to specialize and is accepted he or she is required to serve additional obligated time. Table 2 in Chapter 1 shows the obligated time required for each specialty. So, by the time a dentist has completed his or her initial obligation and elected to specialize he or she could have already invested 10 – 15 years in the Navy. This explains the lower attrition rate for

Endodontics between years 10 to 20 compared to the General Dentists. Also, there are retention bonuses geared toward the specialist resulting in an additional decrease in attrition during those years.

After year 21, the attrition rates start to increase. At year 22 and 23, the attrition rate jumps to 26 and 27 percent. The attrition rate is at 30 percent during both the 26th and 28th year. The highest point for Endodontist's attrition is at year 31, which is expected due to the statutory retirement requirement and reaching the maximum of retirement pay level.

4. Oral Surgeon

An Oral Surgeon is also referred to as an Oral & Maxillofacial Surgeon (OMFS). An Oral Surgeon is responsible for treating the anatomical part of the mouth and jaws, as well as the face and the associated structures.⁷³ Navy Dental Corps officers have the opportunity to specialize in Oral Surgery. A four year obligation is required for the Oral Surgery advanced program. Eighty billets were authorized for the Oral Surgeon specialty for FY 06. In FY 06, the Oral Surgeon specialty was manned at 94 percent.⁷⁴ Figures 14 and 15 show the loss rates for Oral Surgeon.

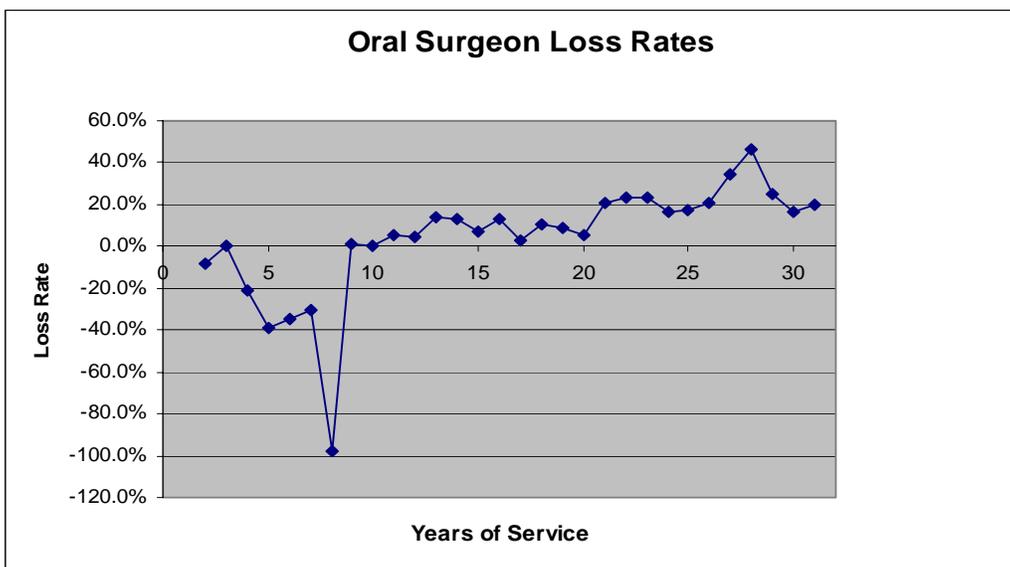


Figure 14 Oral Surgeon Loss Rates⁷⁵

⁷³Wikipedia, the free encyclopedia. <http://en.wikipedia.org/wiki/OralSurgeon>:accessed 16 March 2007.

⁷⁴ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

⁷⁵ Author.

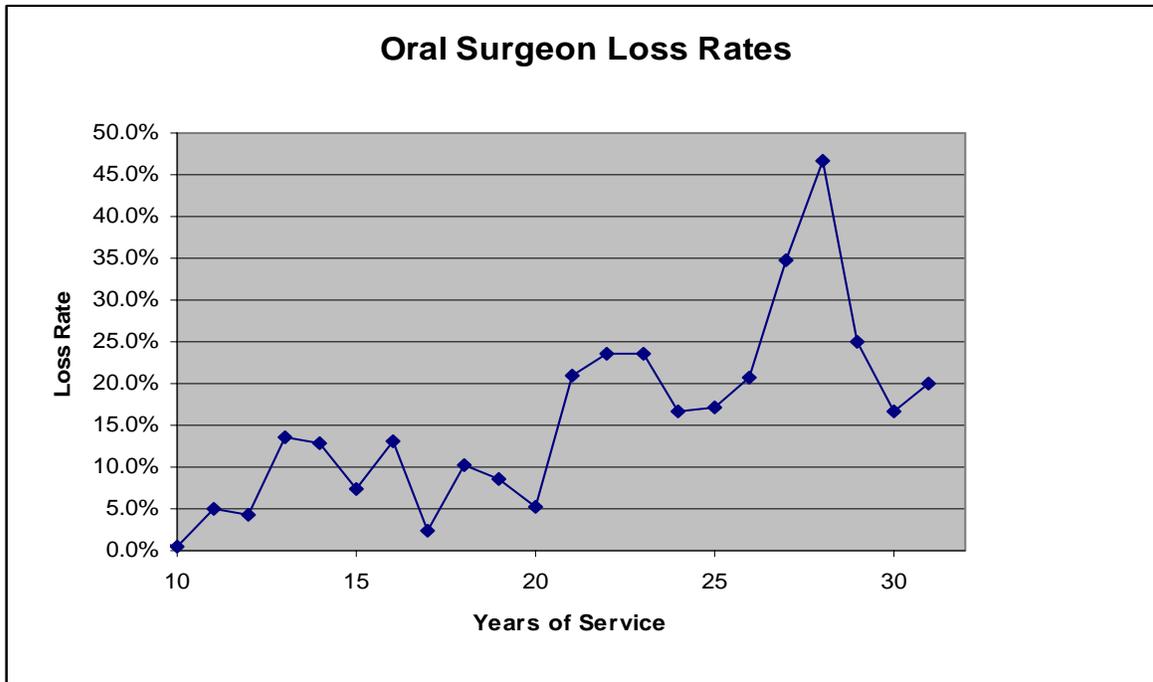


Figure 15 Oral Surgeon Loss Rates (Year 10 through Year 31)

Similar to Endodontists, the Oral Surgeon specialty receives an influx of dentists starting at year 4. A small percentage of Dental Corps officers enter the Navy already possessing a specialty. The majority of the Dental Corps specialists, however, choose to specialize after completing their initial tour as a General Dentist. From the fourth year through year 8, there is an influx of Dental Corps officers who specialize in Oral Surgery. This trend stops at year 9; at this time we begin to see a positive attrition rate. The attrition rate is higher in years 10 through 20 than for Endodontists. This may occur due to the pay disparity between military and civilian Oral Surgeons. The Dental Corps attempts to mitigate the loss of the Oral Surgeon specialists by offering them the largest retention bonus among the specialties. Table 1 in Chapter 1 shows the retention bonus amount for Oral and Maxillofacial Surgeons. Even so, in comparison to the other specialties, this group has the highest attrition rate between 10 and 20 years. Without the retention bonus, the attrition rate could be even higher.

The attrition rate climbs after the 20th year from 5 percent to 21 percent during the 21st year. The Oral Surgeon attrition rates are 24, 16, and 17 percent for years 23, 24, and 25, respectively. Then the percentage climbs to 35 percent in year 27 and skyrockets to

47 percent in year 28. After year 30, the attrition rate is 20 percent, which is lower than for the other specialties. The assumption could be made that there are very few Oral Surgeons on active duty at their 30 year point anyway. The almost 50 percent attrition rate at year 28 validates this assumption.

5. Periodontist

A Periodontist is a dental specialist who specializes in gum disease. Periodontics is another specialty that Dental Corps officers can decide to practice. NNMC, Naval Postgraduate Dental School offers a three year residency program for Periodontics. Upon completion of the advance education program there is a three year active duty commitment. There were 48 billets authorized for Navy periodontist in FY 06. The FY06 there were a total of 53 Periodontist. The Periodontist specialty was overmanned at 108 percent in FY 06.⁷⁶ Figures 16 and 17 show the attrition rates for Periodontists.

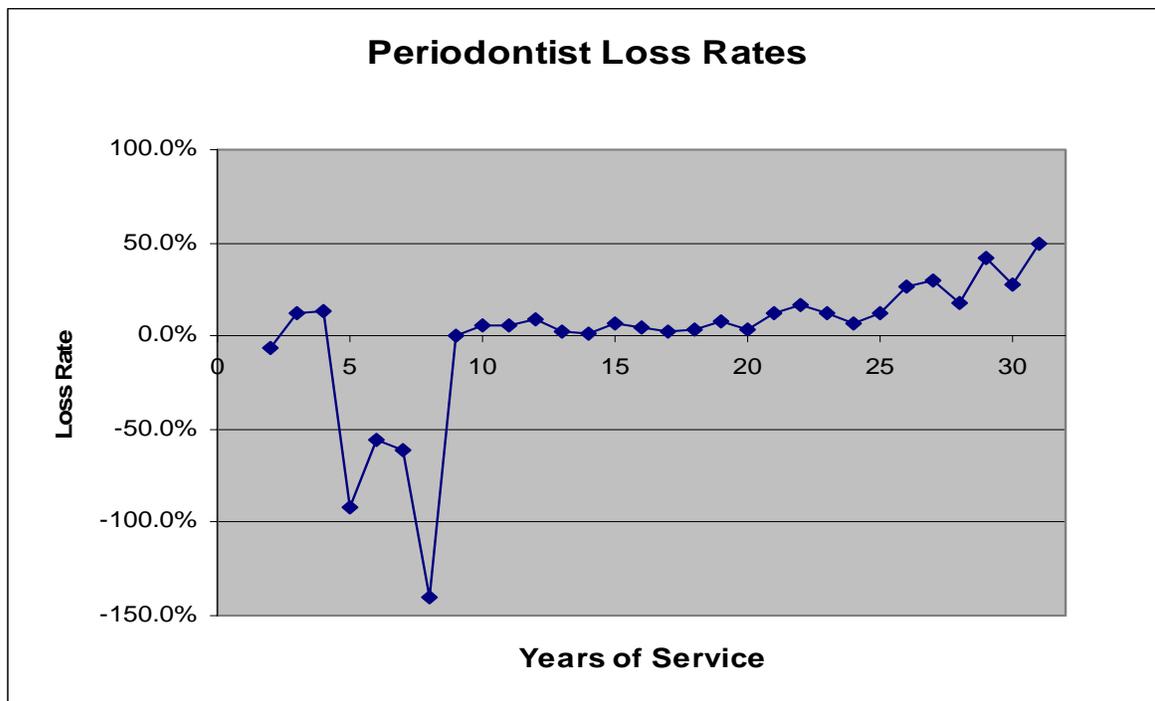


Figure 16 Periodontist Loss Rates⁷⁷

⁷⁶ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

⁷⁷ Author.

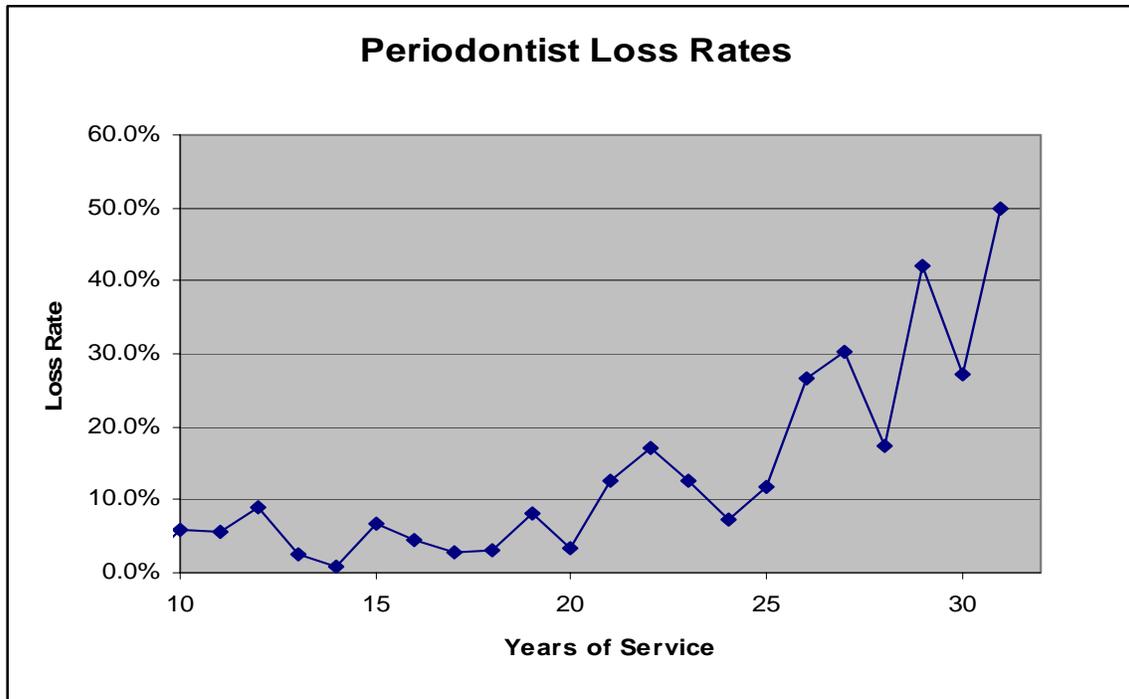


Figure 17 Periodontist Loss Rates (Year 10 through Year 31)

As in the previous specialties, there is an influx in the early years of dentists that decide to specialize in Periodontics. Apparently, in years 3 and 4 there was some attrition of the Periodontists who entered the Navy already with the Periodontics specialty. The tenth year begins with an attrition rate of 6 percent. The attrition rate remains stable as expected from years 10 through 20, ranging from 1 percent to its highest points at year 12 (9 percent) and year 15 (6 percent). When comparing the attrition rates of Periodontists to Oral Surgeons the number are a lot lower. This implies that once a dentist specializes in Periodontics he or she is less likely to leave the military before retirement than an Oral Surgeon. Periodontists with advanced clinical training are offered a retention bonus; however, the amount is among the lowest offered at this time. Their attrition rate increases to 13 percent in year 21 and then climbs to 17 percent in year 22. The trend dips to 7 percent at year 24 and then climbs once again to 27 and 30 percent at year 26 and 27. The attrition rate decreases in year 28 to 17 percent, and subsequently in years 29, 30 and 31 it increases to 42, 27, and 50 percent respectively.

6. Prosthodontist

Prosthodontists specialize in the restoration of oral function by creating prostheses and restorations (e.g. Complete dentures, crowns, implant retained/supported restorations).⁷⁸ The Dental Corps offers Navy Dentists the opportunity to specialize in prosthodontics. NNMC, Naval Postgraduate Dental School offers a three year residency program. If a Dental Corps officer chooses to specialize in prosthodontist he or she incurs a three year obligated service commitment. The prosthodontists are authorized 65 billets for FY 06, however, the inventory for them was only 49. Prosthodontists were only manned 74 percent in FY 06.⁷⁹ Figures 18 and 19 show the attrition rates for Prosthodontist.

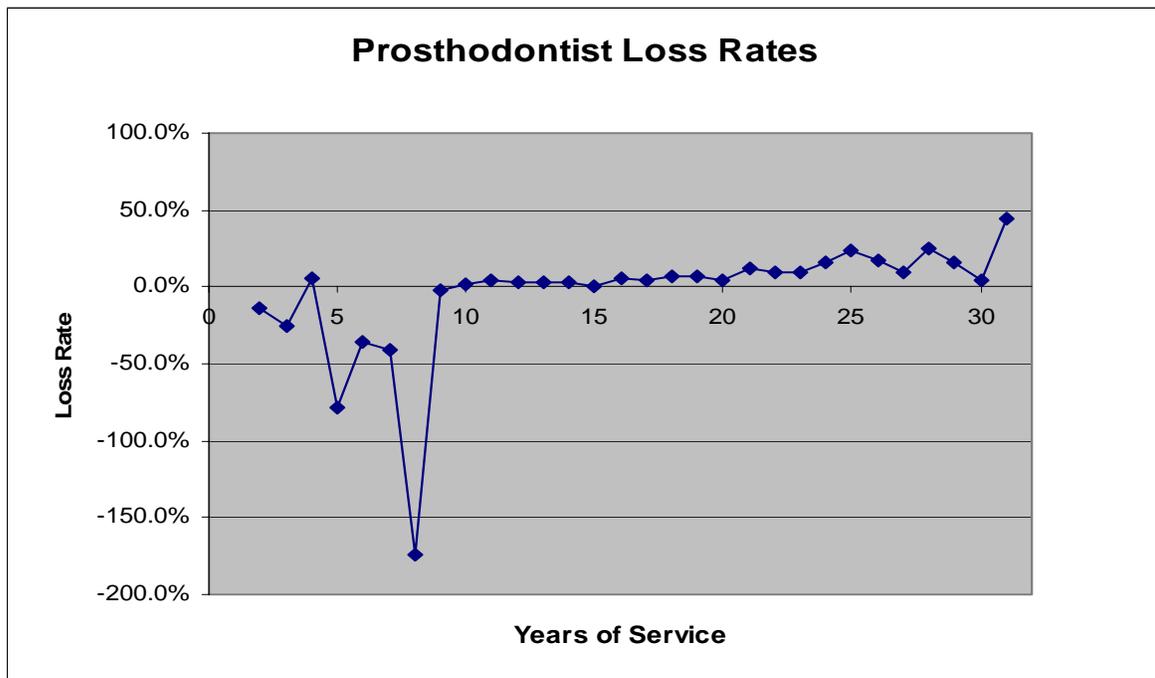


Figure 18 Prosthodontist Loss Rates

⁷⁸ Wikipedia, the free encyclopedia. <http://en.wikipedia.org/wiki/Prosthodontics> accessed 16 March 2007.

⁷⁹ Source: Roshard Woolfolk, LCDR, MSC, USN, Dental Corps July 2006 Worldbook.

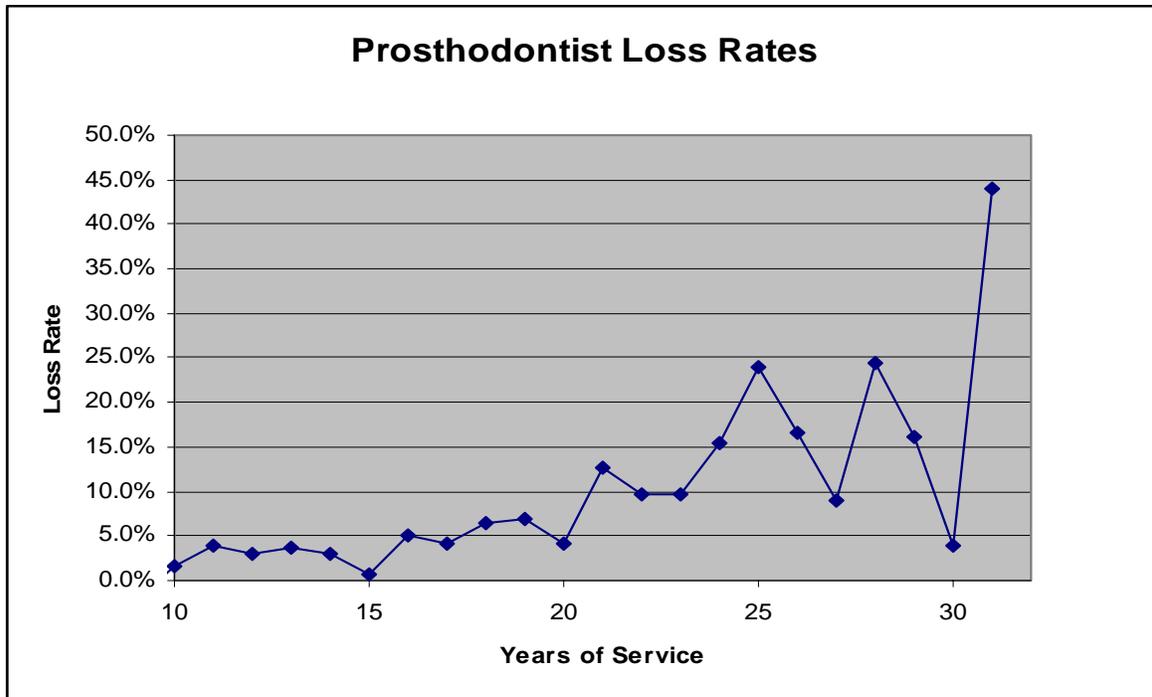


Figure 19 Prosthodontist Loss Rates (Year 10 through Year 31)

There is an influx of Navy dentists into the prosthodontist specialty from year 5 through year 9. Starting at year ten there is an attrition rate of close to 2 percent. From year 10 through year 20 the attrition rate ranges from 0.6% to 7 percent. Prothodontists has the lowest attrition rate between 10 to 20 years. Year 18 and 19 has the highest attrition rates during this period at 7 percent. This is most likely due to the fact that the accession programs credit dentists for time in school for pay purposes, which allows their clock to start before they are actually commissioned. So, for pay purposes they are able to retire in years 18 or 19 with 20 years of military service.

Once the prosthodontists reach the 21 year point the attrition rate jumps from 4 percent in year 20 to 13 percent in year 21. At year 25 and year 28 the attrition rate rises to 24 percent during both years and then at year 31 it climbs to 44 percent. As in the case with the other groups, after 30 years of service most officers are required to retire unless they are promoted to the rank of O-7. The data suggests that prosthodontists are also more likely to stay on active duty for a full 30 year career than other specialties.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS FROM THE RESEARCH

The accession sources for Dental Corps officers were a concern at the onset of this study. The goal of the research was to determine whether or not certain behaviors were associated with particular accession programs. The data for dentists were studied to see if there are particular accession sources that heavily populate particular dental specialties. If this occurred then it could be determined that a certain accession source was more influential within certain specialty groups. The specialties were first examined by the accession sources. Then the accession sources were examined by specialties. The results showed that no particular accession source dominated any of the five specialties that were selected for this thesis. Direct Commission, Dental Student and Armed Forces Health Professions Scholarship Program (AFHPSP) are the three top accession programs for Dental Officers. The dentists recruited from these accession programs are evenly distributed among the dental specialties. Therefore, there is no reason to favor one accession program over another based on requirements for dental specialists. A particular accession program, however, may be favored because of a greater cost savings.

A study of loss rates then provided a good overview of the attrition rates for the Dental Corps community over a military career. The results suggest that once a Dental Corps officer reaches his or her tenth year he or she is less likely to leave the military than in earlier years. This would suggest that retention incentives should be focused during the fourth through sixth year of the Dental officers career. Oral Surgeons, however, are more likely than the other specialties to leave the military after their tenth year. This maybe because Oral Surgeons are highly compensated for their services in the civilian sector. The Dental Corps community attempts to solve this dilemma by offering one of the highest retention bonuses to the Oral Surgeons. Although the attrition rates for Oral Surgeons are high that specialty was 94 percent manned. If the goal is to decrease the attrition rate of Oral Surgeons between years 10 through 20, the Dental Corps community may need to determine whether or not there is a cost benefit with increasing Oral Surgeons' retention bonus.

The results of the loss rate analysis also show that some specialties such as periodontics have very low attrition rates between the tenth and twentieth years. In FY 06, periodontists were overmanned at 108 percent. This may require the Dental Corps community to revisit their policies and determine if the current retention bonus levels are cost beneficial for certain specialties.

B. RECOMMENDATIONS AND CONSIDERATIONS FOR FUTURE STUDIES

The research suggests that accession source is not a significant factor in dentists deciding what fields to specialize in. Future studies should update this finding to determine that they are still valid before determining that accession source is not important in specialty choice.

The loss rates demonstrate that, once dentists reach their tenth year, they are more likely to remain on active duty until their 20th year or beyond. Future studies should update the loss rates and determine that they are still valid and utilize the attrition rate to predict the number of dentist loss per year. The attrition rate should also be used to produce a Markov Model that will predict the right number of dentist that should be accessed to meet Dental Corps targets.

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