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HEALTH CARE STUDIES
AND CLINICAL INVESTIGATION

THE IMPACT OF RECENT FEDERAL ADMINISTRATIVE RULES ON ARMY DENTAL CARE
VOLUME I:
A COST ANALYSIS OF BLOODBORNE PATHOGENS: A REPORT OF CONSULTATION

Jay D. Shulman, COL, DC
James A. Lalumandier, LTC, DC
Richard D. Amstutz, LTC, DC
Timothy R. Williams, SFC, USA
Paula Truesdell, SPC, USA

DENTAL STUDIES DIVISION

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The Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard was analyzed and the initial and annual costs of compliance by the Directorate of Dental Services were estimated using FY91 data. In addition to the costs of supplies and equipment, the cost of personnel time required to perform required tasks was also determined.

The estimated **annual cost** of the Directorate of Dental Services' Infection Control Program, which includes the cost of complying with Bloodborne Pathogens Standard, ranges from $7,330,108 when amortized costs, personnel and dental treatment room (DTR) opportunity costs are excluded, to $27,371,080 when those costs are included. Cost per patient visit ranges from $2.14 when amortized costs, personnel and DTR opportunity costs are excluded, to $3.00 when amortized costs are included, to $8.00 when all costs are included.

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The estimated **initial cost** of complying with the Bloodborne Pathogens Standard is $9,245,371. The **annual cost** of complying with the Bloodborne Pathogens Standard, per patient visit, ranges from $.22, when amortized costs, personnel and DTR opportunity costs are excluded, to $1.08 when amortized costs are included, to $3.14, when all costs are included. Our mid-range per patient visit estimate of $1.08 is close to those reported by the Navy ($1.11) and the Indian Health Service ($1.15), even though all three studies used different methods. In contrast, our study did not include the cost of sterilizers and ultrasonic cleaners. Including those costs would have made our estimate even closer. Our range of estimates of the cost of complying with the Bloodborne Standard fell far below those of Clinical Research Associates and Pollack in AGD Impact ($8.61 and $17.56 per patient visit, respectively) because they estimated the cost of a dental practice's entire Infection Control Program. Our upper-bound estimate of the Directorate's Infection Control Program ($8.00) is reasonably close to the $8.61 reported by Clinical Research Associates.

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Executive Summary

The Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard was analyzed and the initial and annual costs of compliance by the Directorate of Dental Services were estimated using FY91 data. In addition to the costs of supplies and equipment, the cost of personnel time required to perform required tasks was also determined.

The estimated **annual cost** of the Directorate of Dental Services' Infection Control Program, which includes the cost of complying with Bloodborne Pathogens Standard, ranges from $7,330,108 when amortized costs, personnel and dental treatment room (DTR) opportunity costs are excluded, to $27,371,080 when those costs are included. Cost per patient visit ranges from $2.14 when amortized costs, personnel and DTR opportunity costs are excluded, to $3.00 when amortized costs are included, to $8.00 when all costs are included.

The estimated **initial cost** of complying with the Bloodborne Pathogens Standard is $9,245,371. The **annual cost** of complying with the Bloodborne Pathogens Standard, per patient visit, ranges from $.22, when amortized costs, personnel and DTR opportunity costs are excluded, to $1.08 when amortized costs are included, to $3.14, when all costs are included. Our mid-range per patient visit estimate of $1.08 is close to those reported by the Navy ($1.11) and the Indian Health Service ($1.15), even though all three studies used different methods. In contrast, our study did not include the cost of sterilizers and ultrasonic cleaners. Including those costs would have made our estimate even closer. Our range of estimates of the cost of complying with the Bloodborne Standard fell far below those of Clinical Research Associates and Pollack in AGD Impact ($8.61 and $17.56 per patient visit, respectively) because they estimated the cost of a dental practice's entire Infection Control Program. Our upper-bound estimate of the Directorate's Infection Control Program ($8.00) is reasonably close to the $8.61 reported by Clinical Research Associates.

Organization of Report

This report is in two volumes. Volume I discusses the impact of the Bloodborne Pathogens Standard on the Army Dental Care System. It analyzes the Standard, estimates the costs of compliance, and relates then to the costs of the Dental Care System's overall Infection Control Program. In addition, it reviews several published estimates of the impact of the Standard on other dental practice environments. Volume II discusses the impact of the Hazard Communications Standard on the Army Dental Care System. It analyzes the standard and estimates the cost of compliance.

Introduction

Purpose

The purpose of this report is to estimate the costs of implementing the Occupational Health and Safety Administration (OSHA) Bloodborne Pathogens Standard. It reviews the recent history of infection control in the Army Dental Care System and identifies the additional requirements imposed by the OSHA standards. The costs to Health Services Command (HSC) associated with these requirements as well as those of the overall infection control program will be estimated.

Background

Interest in infection control has grown substantially in the past few years. This increased attention has resulted primarily from recent information regarding the transmission of hepatitis B virus (HBV) and other infectious diseases, as well as the emergence of human immunodeficiency virus (HIV) infection and acquired immune deficiency syndrome (AIDS). The impact of standards from governmental agencies have also added to this increased interest.

Although patient protection is an obvious priority, health care workers (HCW) are also vulnerable to cross-infections in the dental environment. Initially, HBV generated the early concerns about cross-infections. The documented exposure of dentists, auxiliaries, and patients to HBV led to an awareness among HCW of the dangers of other infectious diseases. It also led to the development of guidelines for infection control protocols issued by the American Dental Association (ADA), the Centers for Disease Control (CDC), and most recently by OSHA. OSHA, a part of the Department of Labor, was created by Congress in 1970 to protect workers from hazards in the work place.

The ADA issued the first infection control recommendations for dentistry in 1978 (1). As additional information became available, the ADA revised its infection control recommendations in 1985 and again in 1988 (2,3). These 1988 revisions followed the 1986 infection control recommendations for dentistry and the 1987 universal precautions guidelines both issued by the CDC (4,5). OSHA's first involvement with infection control came in 1983 when it issued voluntary HBV guidelines (6). In 1986, unions representing HCWs petitioned OSHA for an emergency rule to protect their members from work place exposure to HIV and HBV (6). OSHA denied this petition but agreed to adopt a permanent rule on exposure to bloodborne pathogens. Five years later, OSHA issued the draft occupational exposure to bloodborne pathogens standard which, after much debate and revision, has become the Bloodborne Pathogens Standard with an effective date of 6 March 1992 (7). This comprehensive rule sets forth the specific requirements OSHA believed would minimize the possibility of transmission of bloodborne diseases to HCW.

In response to the voluntary guidelines issued over the past decade by the ADA and the CDC, and in compliance with Department of the Army regulations (i.e., AR 40-5), the Dental Corps leadership has periodically established policies regarding infection control in Army dental treatment facilities and dental laboratories. In general, these policies have been consistent with available scientific knowledge and have preceded many of the requirements detailed in OSHA's 1991 Bloodborne Pathogens Standard.

Prior to 1986, as ADA and CDC recommendations for infection control were made available, the Assistant Surgeon General for Dental Services distributed these guidelines to DENTAC commanders for "review and information". There was no direct infection control policy. DENTAC commanders frequently, through the appointment of an infection-control officer, translated these guidelines into Standard Operating Procedures (SOP) for the dental facilities within their command. These SOPs were often divided into the following areas:

1. Patient assessment. Consists mainly of the need to obtain a thorough medical history.

2. Personnel protection. SOPs covering this area recommended that HCW use gloves when touching blood, saliva, mucous membranes, blood-soiled items, body fluids, or secretions, as well as surfaces contaminated with them. Repeated use of a single pair of gloves was discouraged. Wearing surgical masks and protective eyewear or plastic face shields were encouraged. Wearing reusable or disposable gowns, laboratory coats, or uniforms was recommended for when clothing was likely to be soiled with blood or body fluids. It was suggested that surfaces such as light handles or x-ray unit heads be wrapped with

impervious-backed paper, aluminum foil, or clear plastic wrap between patients. HCW were also encouraged to wash hands between patient treatment contacts. Instructions were also included in SOPs to safeguard HCW from injury from potentially infective sharp instruments and needles.

3. Sterilization and chemical disinfection. SOPs suggested that metal and heat-stable dental instruments should be sterilized between use either through autoclaving, dry heat, or chemical vapor. The adequacy of sterilization cycles was to be verified weekly by the use of spore-testing devices or heat and steam-sensitive chemical indicators. Heat-sensitive instruments (e.g., handpieces) were to be disinfected with liquid chemical germicides. Recommendations extended to the flushing of the handpieces after use for 20 to 30 seconds.

4. Environmental surface and equipment disinfection. Sodium hypochlorite, prepared daily, was the recommended chemical germicide for decontaminating surfaces within the dental operatory at the completion of work activities. This area extended to the decontamination of supplies and materials (e.g., impressions and intra-oral appliances) prior to sending them to a dental laboratory. The same recommendations applied to the laboratory.

5. Aseptic technique. This area covered the overall infection control in the dental clinic to include the handling of biopsy specimens and the disposal of waste materials (AR 40-5).

In June of 1987, the Chief of the Army Dental Corps issued the first official infection control policies for Army dental treatment facilities (8). The first policy established guidelines regarding the dental management of HIV-infected patients. This was in response to an Army-wide screening of the active duty force for the presence of HIV infection. The second policy outlined guidelines regarding infection control in dental treatment facilities as well as dental laboratories (9). This second policy essentially mirrored the guidelines issued to DENTAC commanders previously which were based on recommendations established by the ADA in 1985 and the CDC in 1986.

In addition to amplifying already existing recommendations for infection control, these newly established policy guidelines incorporated new requirements. First, the policy <u>recommended</u> that all dental HCW be immunized against HBV.[1] Second, DENTAC commanders were directed to establish SOPs "to protect the patient, and the staff from infection transmission" using the ADA infection control recommendations to develop the SOPs. Third, DENTACs were responsible for providing semi-annual infection

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[1]HBV immunization became mandatory 17 April 1989.

control training to their entire staff as well as maintaining records of training. Finally, DENTACs became responsible for monitoring compliance of their staff with infection control SOPs. Along with these policy modifications, a clinic checklist of guidelines for infection control, relating to issues of high priority to the Inspector General, was issued.

A March, 1988 directive from the Directorate of Dental Services, HSC, followed the latest ADA and CDC infection control guidelines, which recommended that handpieces be sterilized between patients (10). A recent change in ADA policy withdrew disinfection of handpieces between patients as an option. DENTACs were instructed to ensure that handpieces were sterilized between patients (11). Sterilization of handpieces was mandated immediately (12).

The most recent infection control policies issued by the Chief, Army Dental Corps were established in June 1991 (13). These policies utilized the 1987 policies with some modifications and additions, mostly in response to new OSHA guidelines and pending OSHA regulations. The most noticeable addition called for the classification of personnel and tasks in the dental practice according to levels of risk of exposure to infectious diseases as defined in OSHA guidelines. The other addition regarded the management of HCW who receive a parenteral or mucous membrane exposure to blood or other body fluids. Finally, an infection control protocol was distributed to be used as an aid in implementing the infection control guidance.

In the past eleven years, the discovery and spread of AIDS, as well as increased knowledge regarding other infectious diseases, has forced the entire dental community to make a permanent change to incorporate accepted infection control techniques. The health and safety of the profession, as well as the dental patient, are the impetus behind these changes. The Army Dental Care System has consistently demonstrated a willingness to respond to these changes.

In the past four years there have been several articles addressing the cost of infection control measures. Most, however have been anecdotal, and have focused on private practice. Broderick, analyzing supply expenditures for the Indian Health Service in Kansas and Oklahoma 1985-1988 found that the proportion of the supply budget used for infection control supplies rose from 9.18 percent in 1985 to 34.26 percent in 1988 (14). Simecek and Schutt, surveying Navy and Marine Corps dental clinics, estimated the cost of supplies and services associated with the Navy's infection control program to cost $1.11 per patient sitting, required 181 full-time personnel to provide central sterilization services, and took an average of 12 minutes to disinfect dental treatment rooms between patients. While Simecek and Schutt identified personnel associated with the

infection control program they did not cost them out (15). In addition, neither of these studies isolated the cost of complying with the Bloodborne Pathogens Standard, which is only a portion of the total infection cost. The supply and equipment costs of infection control in the private dental office were addressed by Clinical Research Associates (16). The cost per patient was estimated to be $8.61. An estimate cited by Scarbeck (17) put the annual cost of infection control in a private practice at $17.56 per patient.

Bloodborne Pathogens Standard

On 6 December, 1991, OSHA issued the Standard for Occupational Exposure to Bloodborne Pathogens with an implementation date of 6 March, 1992. The Standard will be phased-in over a four month period beginning 6 March 1992. Table 1 shows the implementation schedule for the Standard.

Two sources were used to analyze the Standard. The actual Standard published in the Federal Register (18) was the primary source, and a pamphlet produced by OSHA entitled "Controlling Occupational Exposure to Bloodborne Pathogens in Dentistry" (19) was used to clarify the Standard.

The first step in complying with the Standard is the development of a written Exposure Control Plan (ECP). The ECP must be accessible to all employees and be made available to the Assistant Secretary of Labor for Occupational Safety and Health or the Director of the National Institute for Occupational Safety and Health upon request. It must be reviewed and updated at least annually, and whenever necessary to reflect changes. The first step in the development of the ECP is the association of a level of risk (risk classification) with every job classification.

Table 2 presents the risk classification associated with major tasks and procedures for each job classification in the Army Dental Care System. While the list of procedures in not exhaustive, it is generally representative of those performed by members of the Dental Care System. Risk classification ranged from high (procedures that have a high likelihood to put an employee in contact with contaminated fluids), to potential (procedures with a low to moderate likelihood of putting an employee in contact with contaminated fluids), to none (no likelihood of contact with contaminated fluids).

Table 3 identifies those portions of the Standard that are relevant to dental clinic/laboratory operations. It lists actions that employers must take to comply with the Bloodborne Pathogens Standard for each job classification in the Dental Care System. The actions are a condensation of the relevant section

of the Standard. The location of section is given in the "source" column. The letters (A - H) refer to the job classifications in Table 2.

Estimated Costs of Bloodborne Pathogens Standard

Methods

This analysis compares our estimates of the costs associated with the infection and chemical hazard control programs in 1987 (the baseline year) to those associated with complying with the OSHA Bloodborne Pathogens and Hazard Communications standards. In addition it will estimate the overall costs of the HSC Infection Control Program. The analysis will break the Standard down into the "actions for employers" identified in Table 2.

Unlike the Navy study (15) that asked clinic chiefs to itemize infection control expenditures, or the Indian Health Service study (14) that obtained expenditure data from a central supply department, this study estimates expenditures by associating them with productivity. For example, total expenditures on rubber dams is estimated from the number of rubber dam placements (procedure code 2960)[2] and the unit cost to the Fort Sam Houston DENTAC ($.12). Similarly, expenditures on examination gloves is estimated by the number of twice[3] the number of patient treatment visits (procedure codes 9973 and 9974), and the unit cost to the Fort Sam Houston DENTAC ($.79). Expenditures on dental handpieces were estimated using the guidance HSC provided to the DENTACs and the cost to the government of a representative handpiece. Appendix A shows the basis for supply and equipment cost determination. The time it takes personnel to perform activities in compliance with the Standards is the opportunity cost of the Standard. Appendix B presents the methods of determining personnel costs.

The method of cost determination is based on that of Clinical Research Associates (CRA)(16). Disposable and durable supply and cost estimates were obtained from the Fort Sam Houston DENTAC. The cost per patient for supply items is calculated in Appendix B. The costs of major pieces of equipment (sterilizers, dental units, and radiology) are not included.

Every piece of equipment has an expected life span after which it is due for replacement. The effects of steam sterilization on dental handpieces decreases their life span substantially

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[2]Department of the Army Pamphlet 40-16, Dental Statistical Reporting, 30 September 1987.

[3]One pair for the dentist and one pair for the assistant.

(reducing it from 5 to 3 years).[4] This amortization is included in the analysis. Although 2 high speed and 2 low speed handpieces are already in the operatories, most of them have been sterilized since 1988 and are due for replacement.

The initial cost of the Standard is $9,245,371 (Table 4), of which $548,971 is personnel opportunity cost. Table 5 presents the elements of the Infection Control Program and its Bloodborne Pathogens Standard compliance component. The upper-bound annual cost of the overall Infection Control Program is $27,371,080, or $8.01 patient visit.[5] The upper-bound annual cost of the Bloodborne Pathogens Standard compliance component is $10,719,721, or $3.14 per patient visit. The upper-bound cost of the Bloodborne Pathogens compliance component is 39 percent of that of the overall Infection Control Program. Since many of the requirements of the Standard had already been met by the Dental Care System, the cost of complying with Standard is substantially lower than it would otherwise have been.

Discussion

Table 6 shows the effect of removing selected costs from the analysis on both the Infection Control Program and its Bloodborne Pathogens compliance components. Removing dental treatment room (DTR) opportunity costs, dental assistant opportunity costs associated with DTR preparation, and training costs yields lower-bound estimates of $10,259,665 for the Infection Control Program and $3,693,582 for its Bloodborne Pathogens compliance component; $3.00 and $1.08 per patient visit, respectively. Further removing the amortized costs of handpieces and cloth clinic gowns reduces the lower-bound estimates from $7,330,108 for the Infection Control Program and $733,979 for the Bloodborne Pathogens Component; $2.14 and $.22 per patient, respectively.

Table 7 presents our cost data and those of the Navy, IHS, and the two private practice studies. Since each study used different data collection and costing methods only the crudest comparisons can be made. The other studies estimated the cost of the overall Infection Control Programs rather than that of the Bloodborne Pathogens Standard compliance component.

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[4]Broderick used five years and CRA used two years.

[5]Patient visits were estimated by adding patient handling procedure codes 9972, 9973, and 9974 (3,417,985). Of that, 1,796,176 were related to treatment (9973, 9974).

When the estimated annual cost of the 118 full-time personnel providing central sterilization services (15)[6], per patient cost of the Navy's overall infection control program increases from $1.11 to $2.72. Simecek and Schutt reported 12 minutes downtime for disinfecting the Navy's 1,856 DTRs between patients.

Table 7 shows that our estimate range of $.22 to $3.14 per patient visit is not too far from those of the Navy ($1.11-$2.72) and Indian Health Service ($1.15), but is substantially lower than the private practice studies (CRA, $8.61; Pollack, $17.56). The $.22 per patient estimate is our most conservative estimate of the cost of Bloodborne Pathogens Standard compliance. It includes no amortized costs.

While our upper-bound estimate is higher than those of the other Federal Services it is substantially lower than those relating to private practice. One reason for this difference is the inclusion of all costs even remotely related to infection control in the private practice estimates. For example, of Pollack's $17.56 per patient cost, $9.75 (56%) was the "average downtime for doctor or hygienist treatment room" and $3.63 (21%) was the "cost of the time it takes to clean and turn around a treatment room (17)." In contrast, our estimates of DTR downtime and DTR cleaning costs contribute $1.50 (49%) and $0.46 (15%), respectively, of our per patient cost. When personnel and DTR opportunity costs are removed, Pollack's per patient cost is $4.18. As discussed previously, the difference between our upper-bound Infection Control Program cost estimate ($27,371,080) and Bloodborne Pathogens component ($10,719,721) estimates is due to the fact that the Army had already incorporated many of the practices mandated by OSHA, while many private practices had not.

Conclusion

The cost of HSC's Infection Control Program is substantial. While the cost of compliance with the Bloodborne Pathogens Standard is only a small portion of that cost it still represents a significant unfunded requirement.

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[6]At $23,250 per year (E-4) this is $2,743,453 per year.

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TABLES

Table 1

Implementation Schedule for Bloodborne Pathogens Standard

Items	Effective Date	60 Days	90 Days	120 Days
OSHA Standard	3/6/92			
Exposure Control Plan		5/5/92		
Training			6/4/92	
Record Keeping			6/4/92	
Engineering/Work Practices				7/6/92
Personal Protective Equipment				7/6/92
Housekeeping				7/6/92
HBV Vaccination/ Postexposure Procedures				7/6/92
Labeling				7/6/92

Table 2

Risk Rating for Exposure Determination

Job Classification	Task/ Procedure	Risk Classification
Chairside Assistants (A)	Tissue Retraction	High
	Suction Oral Fluids	High
	Pass Instruments	High
	Take Impressions	High
	Handle Sharps	High
	Handle Waste	Potential
	Clean Rooms	High
	Sterilize Instruments	High
	Clean Traps	High
	Greet/Seat Patients	None
Hygienists (B)	Scaling	High
	Rubber Cup Polish	High
	Fluoride Application	High
	Sealant Application	High
	Home Care Instruction	Potential
	Clean Rooms	High
	Sterilize Instruments	High
	Tongueblade Exams	None
	Dental Health Education	None
Dentists (C)	Clinical Procedures	High
	Tongue blade Exams	None
	Dental Health Education	None
	Administration	None

Table 2 - Continued

Job Classification	Task/ Procedure	Risk Classification
Lab Technicians (D)	Pour Models	Potential
	Fabricate Appliances	None
	Repair Prostheses	Potential
Supply Personnel (G)	Order/Distribute/ Stock Supplies	None
Equipment Repair Technicians (F)	Repair Dental Equipment	Potential
	Other Duties	None
X-Ray Technician (E)	Take X-rays	High
	Develop X-rays	Potential
Receptionist (H)	Make Appointments	None
	Answer Telephone	None

Table 3

Methods of Compliance with Bloodborne Pathogens Standard

Item	Source in Standard	Job Classification	Action for Employers
I. Training & Recording			Train employees during working hours using knowledgable trainers at no cost to the employee.
A. Initial Training	(g)(2)	A - F	Train employees by 4 Jun 92.
B. New Employees	(g)(2)(ii)	A - F	Train employees prior to occupational exposure.
C. Annual Training	(g)(2)(iv)	A - F	Train employees annually.
D. Exposure Incident	(f)(3-5)	A - F	Direct exposed employee to a health care professional. Provide health care professional with a copy of the Bloodborne Pathogens Standard [sic], description of the employee's job duties, accident report, results of blood tests, and medical records.

Table 3 - Continued

Item	Source in Standard	Job Classification	Action for Employers
E. Records	(h)(1)	A - F	Establish a confidential medical record for each employee with occupational exposure. Record may be retained on-site or by the health care professional who provides services to the employees. The medical record must be maintained for 30 years past the last date of employment. Training records must be kept by the employer for 3 years.

Table 3 - Continued

Item	Source In Standard	Job Classification	Action for Employers
II Preventive Measures			
A. Hepatitis B Immunization	(f)(1)	A - F	Make the immunization available without cost within 10 working days of initial assignment of personnel whose job classification or tasks result in occupational exposure.
B. Universal Precautions	(d)(1)	A - F	Since blood and saliva from all dental patients are considered to be potentially infectious materials, all employees shall use universal precautions.

Table 3 - Continued

Item	Source in Standard	Job Classification	Action for Employers
III Control Measures			
A. Engineering and Work Practice Controls	(d)(2)	A - F	Examine, maintain, or replace engineering controls on a regular, scheduled basis.
1. Sharps	(d)(2)(vii)	A - C	Ensure that employees do not recap, shear, or break contaminated needles. Discard contaminated sharps, or store reusable sharps in closable, puncture-resistant containers colored red or labeled with the biohazard symbol.

Table 3 - Continued

Item	Source in Standard	Job Classification	Action for Employers
2. Specimens	(d)(2)(xii)	A - C	Ensure that specimens or contaminated impressions are stored or shipped only in contaniers that are closed and leakproof, and colored red or are labeled with the biohazard symbol.
B. Personal Protection Equipment (PPE)			Provide, maintain, and replace PPE. Ensure accessibility in appropriate sizes. Provide hypoallergenic gloves if the employee has an allergy to the gloves that are usually provided. Launder and/or discard PPE. PPE must not allow blood or other potentially infectious materials to pass through to clothing, skin, or mucous membranes

Table 3 - Continued

Item	Source in Standard	Job Classification	Action for Employers
1. Face and Eye Protection	(d)(3)(x)	A - F	Furnish a mask with either: 1) goggles; 2) eyeglasses with solid shields; or 3) chin-length face shields.
2. Protective Body Clothing	(d)(3)(xi)	A - F	Furnish protective clothing that must be removed as soon as feasible when penetrated by blood or other infectious materials, and prior to leaving the work area. Furnish either: 1) clinic jackets; 2) aprons; 3) lab coats; or 4) lab gowns. Long-sleeved gowns are required only for surgical procedures involving large quantities of blood.

Table 3 - Continued

Item	Source in Standard	Job Classification	Action for Employer
3. Disposable Gloves	(d)(3)(ix)	A - F	Furnish gloves to employees when they are performing clinical dentistry or hygiene; or when handling instruments, materials, and surfaces that are contaminated. Disposable gloves must be replaced upon completion of a dental procedure, or if torn or punctured during a procedure. Gloves may not be reused.
4. Utility Gloves	(d)(3)(ix)	A - F	Furnish utility gloves for cleanup. Utility gloves may be reused after they are decontaminated, but must be discarded if they deteriorate or fail to function as a barrier.

Table 3 - Continued

Item	Source in Standard	Job Classification	Action for Employer
5. PPE Containers	(d)(3)(viii)	A - F	Have an appropriately designated area or container for storing, washing, decontaminating, or discarding contaminated PPE.
IV Housekeeping	(d)(4)	A - H	Ensure that the worksite is maintained in a clean and sanitary condition. Implement a written schedule for cleaning as well as the method of decontamination for all surfaces. All contaminated equipment and work surfaces must be cleaned and decontaminated after contact with blood or other potentially infectious materials with an approptiate disinfectant. Protective coverings may be used to cover dental equipment but must be replaced when contaminated or at the end of the work shift.
V Waste	(d)(4)(iii)	A - F	Special precautions are necessary when disposing of contaminated sharps and other regulated waste.

Table 3 - Continued

Item	Source in Standard	Job Classification	Action for Employer
VI Laundry	(d)(4)(iv)	A - F	Launder contaminated articles, including employee clinic jackets and lab coats used as PPE. This may be accomplished on-site or at a facility that processes contaminated laundry. Contaminated laundry must be placed in bags or containers that are red or marked with the biohazard symbol. Gloves and other appropriate PPE must be worn when handling contaminated laundry.

Table 4

Bloodborne Pathogens Standard
(Initial Costs)

Task	Cost	Cost Type
1. Develop exposure control plan & DENTAC / ADL SOPs	340,096	Opportunity
2a. Training the trainers	40,000	Direct (TDY)
Attendees' time	102,000	Opportunity
Course preparation	4,251	Opportunity
2b. Develop DENTAC training curriculum	102,624	Opportunity
3a. High speed handpieces	3,230,000	Supply
Low speed handpieces	5,426,400	Supply
Total	9,245,371	

Table 5

Annual Costs of Infection Control Program and Compliance with Bloodborne Standard

Task	Infection Control	Bloodborne Standard
Prepare DTR	3,954,580	1,581,832
DTR Opportunity Cost	12,846,985	5,134,457
Trainer Preparation	309,850	309,850
Record Keeping	9,176	9,176
Handpieces (HS)[7]	1,076,666	1,076,666
Handpieces (LS)[8]	1,790,712	1,790,712
Face Shields	86,685	86,685
Clinic smocks[9]	62,179	62,179
Laundry	377,190	377,190
Treatment Gloves	2,837,958	
Examination Gloves	324,361	
Face Masks	140,369	
Biohazard Bags	93,024	
Surface Disinfectant	898,088	
Hand wash (chlorhexadine)	888,676	
Lamp Handle Cover	136,719	136,719
Monitor (Steam Sterilizer)	121,448	
Paper Towels	377,197	
Patient Chair Cover	68,360	
Sterilization Bag (Medium)	191,579	
Rubber Dam	28,226	
Tray Cover (Foam)	136,719	

[7]Amortized over 3 years.

[8]Amortized over 3 years.

[9]Amortized over 2 years.

Table 5 - Continued

Task	Infection Control	Bloodborne Standard
Hepatitis B Immunization	84,100	
Prophy Angle (Disposable)	154,255	154,255
Sponges (4x4)	375,978	
Total	**27,371,080**	**10,719,7-21**

Table 6

Sensitivity of Infection Control and Bloodborne Pathogens Costs to Removal of Cost Elements

Costs Removed	Infection Control Cost ($)		Bloodborne Pathogens Cost ($)	
	Annual	Per Visit	Annual	Per Visit
None	27,371,0-80	8.00	10,719,721	3.14
1. DTR opportunity cost	14,524,0-95	4.25	5,585,264	1.63
2. DTR preparation	23,416,50-0	6.85	9,137,889	2.67
3. Training	27,061,2-30	7.92	10,409,871	3.05
4. Amortized costs	24,441,5-23	7.15	7,790,164	2.28
1 - 3	10,259,665	3.00	3,693,582	1.08
All above	7,330,108	2.14	763,979	.22

Table 7

Comparison of Selected Infection Control Cost Estimates to HCSCIA Estimates

	Simecek	Broderick	CRA	AGD	HCSCIA
Environment	Navy	IHS	Private	Private	Army
Training (direct)	No	No	No	No	Yes
Training (opportunity)	No	No	No	No	Yes
Sterilizers	Yes	Yes	Yes	Yes	No
Ultrasonic cleaners	Yes	Yes	Yes	No	No
Handpieces- HS	Yes	Yes	Yes	No	Yes
Handpieces- LS	Yes	Yes	Yes	No	Yes
Amortization	No	All Equipment 5 year	Yes[10]	Yes	Handpieces 3 year
Supplies	Yes	Yes	Yes	Yes	Yes
Eye protection	Yes	Yes	Yes	Yes	Yes
Protective clothing	Cloth	Cloth	Cloth	Cloth	Cloth
Hepatitis vaccine	No	No	Yes	Yes	Yes
Administrative	No	No	No	No	Yes
Personnel costs (DTR clean-up)	No[11]	No	No	Yes	Yes
DTR downtime	No[12]	No	No	Yes	Yes
Construction	Yes	No	No	No	No
Annual patient visits	2,908 per DDS[13]	1,751 per DDS	3,600 per DDS	4,560 per DDS	3,158 per DDS
Cost per patient visit	$1.11 -$2.72	$1.15	$8.61	$4.18 [14]- $17.56	$ .22 - $3.14[15] $2.14 - $8.00[16]

[10]High speed handpieces - 1 year; low speed handpieces - 2 years; sterilizer - 10 years; ultrasonic cleaner - 3 years.

[11]Simecek reported that 118 full-time personnel were required to operate central sterilization areas. At the E-4 pay grade the cost is $2,743,453.

[12]Simecek reported 12 minutes of downtime related to disinfecting the DTR but did not estimate the opportunity cost.

[13]Annualized .

[14]Personnel and DTR opportunity costs excluded.

[15]Cost of complying with Bloodborne Pathogens Standard.

[16]Cost of overall Infection Control Program.

APPENDICES

APPENDIX A

Assumptions and Computations

Bloodborne Pathogens Standard

1. Develop Exposure Control Plan and DENTAC/ADL SOPs.[17]

   Estimated: Average grade LTC 4 weeks (160 hours) @ $53.14 per hour = $8,502.40. For all DENTACs/ADLs, total = $8,502.-40 x 40 = **$340,096.00.**

2. Training and Recording.

   a. Training the Trainers. Initial conference at Fort Sam Houston to orient DENTAC Infection Control Officers to Standard.

      - Direct Cost (centrally funded TDY) - **$40,000**

      - Opportunity cost.

        •• 2 attendees per DENTAC/ADL (average grade LTC) - 3 days (including travel time) conference days for 80 personnel. Opportunity cost = $53.14 per hour x 3 days (24 hours) = $1,275.36. For 80 attendees, total = $1,275 x 80 = **$102,000.**

        •• Course Preparation - 2 weeks (80 hours) @ $53.14 per hour = **$4,251.20**

   b. Developing Training Curriculum.

      - DENTAC Infection Control Officer (LTC) - 1 week (40 hours) @ $53.14 per hour = $2,125.60. For 40 DENTACs and ADLs: total = **$85,024.**

      - Training NCO (E-7) - 20 hours @ $22.00 per hour = $440.00. For 40 DENTACs/ADLs, total = **$17,600**

   c. Implementing Annual Training.

      - Trainer Preparation - Infection Control Officer - 10 hours @ $53.14 per hour = 541.40. For 40 DENTACs/ADLs, total = **$21,256.**

      - Training DENTAC Personnel - Three hours @ $96,198 per hour = **$288,594** (Appendix A).

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[17]Based on information from Fort Carson, Fort Sam Houston, and Fort Hood Infection Control Officers.

d. Record Keeping

- Maintaining Training Records

  - Secretary (GS 5) - 20 hours/year @ $11.47 per hour = $229.40. For 40 DENTACs/ADLs, total = **$9,176.00**

e. DTR Preparation

- DTR downtime - 10 minutes between patient treatment visits, of which 4 minutes is attributable to the Standard. At 1,796,176 patient visits (codes 9973 + 9974) = (10/60) x 1,796176 = 299,363 hours downtime per year, of which 119,745 (.4 x 1,796,176) hours is due to the Standard. Assuming all 2,584 DTRs are available 8 hours/day, 240 days/year, there are 4,961,280 (240 x 8 x 2,584) potential DTR hours available. At 10 minutes per patient, DTR downtime is 6.03 percent of available DTR time, while 4 minutes per patient DTR downtime is 2.41 percent of available DTR time. The cost of operating the HSC Dental Care System (excluding Panama) in FY91 was 71,263,000 of which approximately $57,048,000 represented fixed costs.[18] Estimated military pay cost is 156,000,000 (Appendix A).

  Total operating cost (excluding BASOPS) = $213,048,000. The 2.41 percent downtime for the Standard represents a **$5,134,457 opportunity cost while 6.03 percent DTR downtime for the overall infection control program represents $12,846,794 opportunity cost.**

- Dental Assistant Downtime - prior to the Standard estimated downtime was 6 minutes. After the Standard the downtime is 10 minutes. At 10 minutes per treatment visit = (10/60) x 1,796,176 = 299,363 hours of dental assistant time; at $13.21 per hour (E-4 91E) = 299,363 x 13.21 = 3,954,580. At 4 minutes per treatment visit = (4/60) x 1,796176 = 119,745 hours of dental assistant time per year. Assuming E-4 91E assistant @ $13.21 per hour = 119,745 x 13.21 = **$1,581,832 per year.**

[18]Desert Shield/Storm and military pay costs excluded. Civilian pay - $43,727,000; contracts - $8,937,000; equipment - $4,384,000

3. Supply / Equipment Cost[19]

a. Start-up

- Autoclavable high speed handpieces (5 per DTR) - @ $500 ea. = $2,500 per DTR. For ½ of 2,584 DTRs[20]; **$3,230,000.**

- Autoclavable slow speed handpieces (4 per DTR) - @ 700 ea. = $2,800 per DTR. For of ¾ HSC's 2,584 DTRs;[21] **$5,426,400.**

- Perscription safety glasses with side shields (1 for ea. dentist/hygienist/DTA[22]) @ $100 ea. = **$155,800**

- Cloth clinic tunics @ 10.85 ea. Assuming 5 for every dentist, assistant, hygienist = 10.85 x 5 (2,286) = $124,016. Amortizing over 2 years = **$62,008 per year.**

b. Disposables

- Face shields (1 per dentist, assistant, hygienist per week) @ .79 ea. (48 per year) per year. For 1,126 assistants, = $42,697.92. For 260 hygienists = $9,859.20. For 900 dentists = $34,128. For all personnel = **$86,685 per year.**

- Disposable gloves (treatment) - @ .79 per pair. Two pair (dentist & assistant) per patient sitting (codes 9973 + 9974), or 2 x 1,796,176 = 3,592,352 pair x .79 = **$2,837,958 per year.**

- Disposable gloves (examination) - @ .20 per pair. One pair per patient sitting (code 9972), or .20 x 1,621,809 = **$324,361 per year.**

- Face masks - @ .13 ea. Two per dentist/assistant/hygienist per day; 2,454 x 2 = 4,908 masks per day; 4,908 x 220 days per year = 1,079,760 masks; 1,079,760 x .13 = **$140,369 per year.**

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[19] Although 2 high speed and 2 slow speed handpieces are already in the operatories since most of them have been sterilized since 1988, they are ready for replacement. Masks, gloves, and surface disinfectant cost not included because they were incorporated into Army dental practice before the introduction of the OSHA Bloodborne Pathogens Standard.

[20] This is an estimate of the number of operatories using high speed handpieces (excluding hygiene rooms, unused operatories, and overflow operatories.

[21] Excludes overflow or unused operatories.

[22] Per the Directorate of Dental Services, there are 1,068 dentists, 260 hygienists, 230 DTAs, and 896 dental assistants in HSC. Under the Standard and current OSHA interpretation of it, glasses with sideshields are sufficient protection. Therre is some question about whether future interpretations may mandate using disposable face shields to prevent saliva and blood from coming in contact with skin.

- Biohazard bags (large)- @ .15 ea. One per DTR per day; .15 x 2,584 DTRs x 240 days = **$93,024 per year.**

- Surface disinfectant - @ .02 per square foot x 25 square feet = $.50 per patient sitting (codes 9973 + 9974), or .50 x 1,796,176 = **$898,088 per year.**

- Handwash (chlorhexadine) - @ .26 per oz. At 2 washes (¼ oz per wash) per DDS and assistant = $.26 per patient sitting (codes 9972 + 9973 + 9974), or .26 x 3,417,985 = **$888,676 per year.**

- Lamp handle cover - @ .02 ea. At 2 per patient sitting (codes 9972 + 9973 + 9974, or .04 x 3,417,985 = **$136,719 per year.**

- Monitor (steam sterilizer) - @ $3.12 ea. At 2 per week per sterilizer,[23] = $7.24 per week, or 7.24 x 52 = $376 per year per sterilizer, or 376 x 323 = **$121,448 per year.**

- Paper towels - @ .03 per square. At 7 squares per patient sitting (codes 9773 + 9774), or .21 x 1,796,176 = **$377,197 per year.**

- Patient chair cover - @ .02 ea. At 1 per patient sitting (codes 9972 + 9973 + 9974) = .02 x 3,417,985 = **$68,360 per year.**

- Prophy angle (disposable) - @ .40 ea. At 1 per prophy (codes 1110 + 1120), or .40 x (385,637) = **$154,255 per year.**

- Sponges (4x4) - @ .11 ea. At 1 per patient sitting (codes 9972 + 9973 + 9974), = .11 x 3,417,985 = **$375,978 per year.**

- Sterilization bag (medium) - @ .11 ea. At 1 per patient sitting (codes 9973 + 9974) = .11 x 1,796,176 = **$197,579 per year.**

- Rubber dam - @ .12 ea. At 1 per code 2960, = .12 x 235,215 = **$28,226 per year.**

- Tray cover (foam) - @ .04 ea. At 1 per patient seating (codes 9772 + 9773 + 9774), or .04 x 3,417,985 = **$136,719 per year.**

[23] Assuming 1 sterilizer per 8 DTRs, or 323 sterilizers.

- Hepatitis B immunization - $100 per dentist, assistant, hygienist. = Assuming 725 new military dental assistants each year and an annual turnover of other personnel of 10 percent, the estimated annual cost is 100 x (725 + .10 (260 + 900)) = **$84,100 per year.**

- Handpieces (3 year amortization). For high speed handpieces: ⅓ x 3,230,000 = $1,076,666. For slow speed handpieces: ⅓ x 5,426,400 = $1,790,712. Total = **$2,867,378 per year.**

- Laundry for clinic tunics - @ .75 ea. Assuming daily laundering (220 laundering per provider per year) = .75 x (220 x 2286) = **$377,190.**

Cost of Some Commonly Used Disposable Items

Item	Cost at Initial Purchase	Amount Needed Per Health Provider	Cost Per Use Per Patient
Air/Water Syringe Tip	2.44/ea	1 tip	2.44
Biohazard Bags (large)	36.50/250 (.15)	1/day	.15
Environmental Surface Disinfectant	5.65/18oz (.31 oz)	25 square feet x 2¢/square foot	.50
Face Mask	6.48/50 (.13)	2	.26
Gloves (Operating)	18.00/50 (.72)	2	1.44
Gloves (Plastic)	4.95/100 (.10)	2	.20
Handwash (Chlorhexidine)	2.09/bt (.26 oz)	1/4 oz/wash x 4 washes	.26
Hose Cover	21.00/1200 foot (2¢)	4 foot length	.08
Lamp Handle Covers	8.28/500 (.02)	2 (2 handles/ light)	.04
Monitor (Chemiclave Sterilizer)		3 monitors + 3 media tubes/week	
Monitor (Glutaraldehyde)	1.73/250	1 monitor/day	.11
Monitor (Steam Sterilizer)	77.99/25 (3.12)	2 monitors/ week	.08
Paper Towels	47.25/ 1500 (.03)	7 squares	.21
Patient Bib (w/o Alligator Clips	12.37/500 (.02)	1	.02
Patient Chair & X-Ray Tube Cover	8.28/500 (.02)	2	.04
Prophy Angle, Disposable	79.99/200 (.40)	1 prophy angle	.40

Item	Cost at Initial Purchase	Amount Needed Per Health Provider	Cost Per Use Per Patient
Pumice	36.85/200 (.18)		
Rubber Dam	4.17/36 (.12)	1	.12
Saliva Ejector Tip	12.80/100 (.13)	1 tip	.13
Sponges for Scrubbing (4x4)	5.50/50 (.11)	2	.22
Sterilization (Bag, medium)	37.25/250 (.15)	2	.30
Suction, Tip	2.10/50 (.04)	1 tip	.04
Traps, High Velocity Suction	13.25/72 (.18)	1 trap replaced 2x/month	
Tray Cover (Foam)	17.95/500 (.04)	1	.04
Disinfectant Instruments	22.50/gallon (.08 per oz)		.01
Eye Protection (Shield)	.79 ea		3.58
Gloves (Utility)	19.75/12/bx (1.65)		.44
Incubator (Chemiclave)			
Incubator (Stat/M)			
Saliva Ejector Handle			
Sterilizer			
Disinfectant Instruments	247.50 ea		.02

Hourly Cost For HSC Dental Personnel[18]

Grade	Base Wage	Special Pays	HSC Census	Total Cost Per Hour
O - 6	56.27	7.69	277	17,716.92
O - 5	46.83	6.31	236	12,484.40
O - 4	39.49	5.29	348	15,583.44
O - 3	33.18	2.40	128	4,554.24
E - 9	30.35		10	303.50
E - 8	25.83		24	619.92
E - 7	22.00		128	2,816.00
E - 6	18.75		174	3,262.50
E - 5	16.08		420	6,753.60
E - 4	13.21		468	6,182.28
E - 3	11.29		438	4,945.02
GS 14	34.51		2	69.02
GS 13	29.21		4	116.84
GS 12	24.56		35	859.60
GS 11	20.49		4	81.96
GS 10	18.65		10	186.50
GS 9	16.34		6	98.04
GS 8	15.73		34	534.82
GS 7	14.08		109	1,534.72
GS 6	12.78		102	1,303.56
GS 5	11.47		397	4,553.59
GS 4	10.00		519	5,190.00
GS 3	8.90		635	5,651.50
GS 2	7.90		2	15.80
Contract DDS/ Hygienist	27.77		67	1,860.59
Total				**96,197.64**

Determining Hourly Personnel Costs

Military personnel costs will be estimated using Army Composite Standard Rates.(22) Dental Variable Specialty Pay (DVSP) was estimated for each pay grade by determining the annual DVSP for each year group within the rank group and taking a weighted average of the number of officers in each year group. Similarly, a weighted average of Dental Additional Specialty Pay (DASP) was taken for the year groups within each rank group. Board Certification Pay (BCP) for each rank group was estimated by multiplying the proportion of each rank group that is board certified by the average amount of board certification pay for the year groups within the rank group. To detemine the hourly cost, the annual DVSP and dividing it by 2080 (the standard number of available hours per year).

Grade	Average DVSP	Average DASP	Average BCP	Hourly Cost
O-6	3,000	10,000	3,000[a]	7.69[b]
O-5	4,000	7,500	1,125[c]	6.07[d]
O-4	5,000	6,000		5.29[e]
O-3	2,000	3,000		2.40[f]

The number of personnel in each (civilian and military) grade was determined from the number of HSC authorizations per TDA0192 as 20 May 92. This is not a census but is a basis for estimating the number of personnel. The E-1 and E-2 categories are not represented because there are no E-1 or E-2 authorizations. Medical Service Corps Officers are not included.

Civilian personnel costs are estimated by 116 percent of the pay at the fifth step of the 1992 General Schedule divided by 2080. Contract dentist/hygienist costs are based on the HSC's total costs for contract dentists/hygienists divided by the total hours contracted for.

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[a] 4,000 x .75 = 3,000.
[b] (3,000 + 10,000 + 3,000) ÷ 2080 = 7.69.
[c] 2,500 x .45 = 1,125.
[d] (4,000 + 7,500 + 1,125) ÷ 2080 = 6.07.
[e] (5,000 + 6,000) ÷ 2080 = 5.29.
[f] (2,000 + 3,000) ÷ 2080 = 2.40.