



THE UNIVERSITY OF
SYDNEY

COPYRIGHT AND USE OF THIS THESIS

This thesis must be used in accordance with the provisions of the Copyright Act 1968.

Reproduction of material protected by copyright may be an infringement of copyright and copyright owners may be entitled to take legal action against persons who infringe their copyright.

Section 51 (2) of the Copyright Act permits an authorized officer of a university library or archives to provide a copy (by communication or otherwise) of an unpublished thesis kept in the library or archives, to a person who satisfies the authorized officer that he or she requires the reproduction for the purposes of research or study.

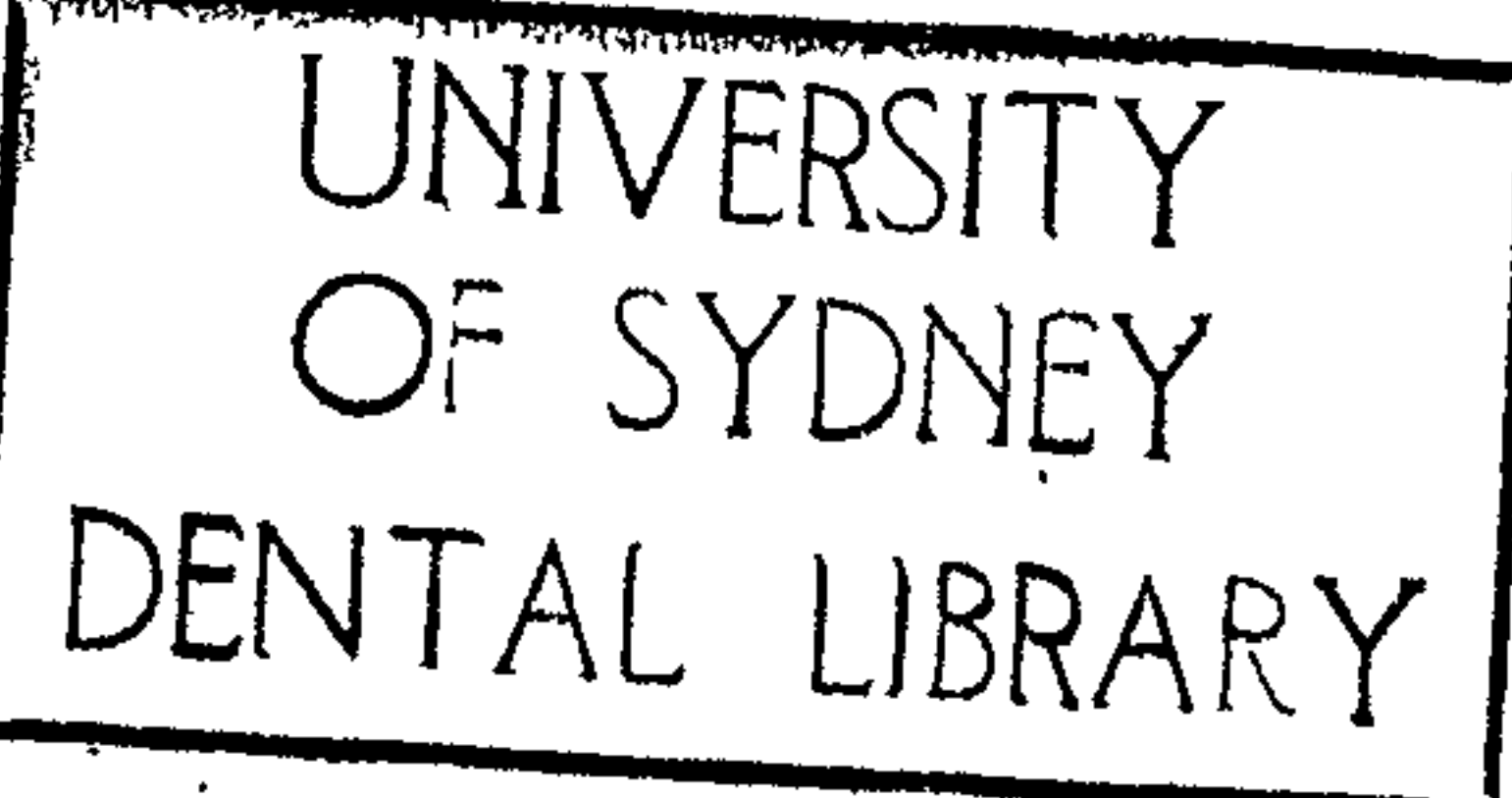
The Copyright Act grants the creator of a work a number of moral rights, specifically the right of attribution, the right against false attribution and the right of integrity.

You may infringe the author's moral rights if you:

- fail to acknowledge the author of this thesis if you quote sections from the work
- attribute this thesis to another author
- subject this thesis to derogatory treatment which may prejudice the author's reputation

For further information contact the University's Copyright Service.

sydney.edu.au/copyright



EVALUATION OF THE DENTAL CARE REQUIREMENTS

OF THE

AUSTRALIAN REGULAR ARMY

BY:

MAJOR P. THALER

LDS RCS Eng.

ROYAL AUSTRALIAN ARMY DENTAL CORPS

A Thesis submitted in partial requirement

for the degree of

Master of Dental Science

Department of Preventive Dentistry,

Faculty of Dentistry,

University of Sydney,

1980.

ACKNOWLEDGEMENTS

I am indebted to the following, without whose support and assistance this study would have been impossible:

Professor P.D. Barnard,
MPH, MDS, FRSH, FRACDS, FICD, FAPHA

Captain M.T. Junaidi, BDS (Malaya)

The officers and other ranks of the
Royal Australian Army Dental Corps.

3. TABLE OF CONTENTS

	PAGE
5.1 INTRODUCTION	1
5.1.1 Background	1
5.1.2 Statement of Problem	1
5.1.3 Reasons for Investigation	3
5.1.4 Other Evaluations	3
5.1.5 Outline Research Method	4
5.2 BACKGROUND	6
5.2.1 Organisation of the ARA Dental Services	6
5.2.2 Methods used to monitor Dental Care	8
5.3 STATEMENT OF HYPOTHESIS	9
5.3.1 Dental Officer/Troops Ratios	9
5.3.2 Auxiliaries	10
5.3.3 Dental Fitness	11
5.3.4 Demand versus Need	11
5.3.5 Deployment of ARA Dental Manpower	12
5.3.6 Overall Dental Establishments	12
5.3.7 Special Groups	12
5.3.8 Contingency Expansion Planning	13
5.4 OUTLINE RESEARCH DESIGN	14
5.4.1 Evaluation Systems - General	14
5.4.2 Concepts and Strategies of Evaluation	15
5.4.3 Basic Oral Health Surveys - WHO Format	18
5.4.4 Modifications to WHO Format	20
5.4.5 Sample	23

5.4.6	Data Collection and Analysis	25
5.4.7	Administration and Logistics	25
5.5	IMPLEMENTATION	27
5.5.1	Survey Team	27
5.5.2	Hardware	30
5.5.3	Software	31
5.5.4	Pilot Survey	50
5.5.5	Main Survey	51
5.5.6	Method of Data Collection	51
5.5.7	Statistical Method	65
5.5.8	Man-Hour Statistics	68
5.6	RESULTS	70
5.6.1	Sample Characteristics	70
5.6.2	Distribution Characteristics	76
5.6.3	Reliability of Data	78
5.6.4	Demographic Analysis	78
5.6.5	Service Utilisation	79
5.6.6	Disorders of Mucosa, Teeth and Bone	86
5.6.7	Prosthetic Status	89
5.6.8	Prosthetic Requirement	91
5.6.9	Periodontal Status	93
5.6.10	Dentofacial Anomalies	95
5.6.11	Immediate Attention	96
5.6.12	Endodontic Care	97
5.6.13	Missing Teeth	98
5.6.14	Restorations	99
5.6.15	Teeth for Extraction	100
5.6.16	DMFT and related Findings	101

5.6.17	Effect of Restorative Care	112
5.6.18	Dental Fitness	115
5.6.19	Dental Care Requirement Components	116
5.6.20	Dental Care Requirement (weighted)	117
5.7	DISCUSSION	119
5.7.1	Research Design	119
5.7.2	Implementation	123
5.7.3	Discussion of Findings (vide Hypothesis)	127
5.7.4	Discussion of Findings (other studies)	146
5.8	SUMMARY	148
5.8.1	Methods	148
5.8.2	Findings	148
5.9	CONCLUSIONS	150
5.9.1	Dental Officer/Troops Ratios	150
5.9.2	Auxiliaries	150
5.9.3	Dental Fitness	151
5.9.4	Demand versus Need	151
5.9.5	Deployment of ARA Dental Manpower	152
5.9.6	Overall Dental Establishments	152
5.9.7	Special Groups	153
5.9.8	Contingency Expansion Planning	153
5.9.9	Research and Development	156
6.	REFERENCES	157
	APPENDICES	
	Appendix A - Weighted Tr.Time Factors	159
	Appendix B - Dental Treatment Record	160
	Appendix C - Report Printout	161
	Appendix D - WHO Oral Health Assessment	162

4. LIST OF TABLES

TABLE	PAGE
1 Sample Size	24
2 Sample Size by Years of Service Group	72
3 Sample Size by Age Group	72
4 Sample Size by Percentage of Field Force Service	73
5 Age Distribution of Other Ranks/Officers	74
6 Age Distribution of Sex in Sample	74
7a Age Distribution of Sample by States of Origin	75
7b ditto	75
8 Last Access to Dental Care of Sample by Age	79
9 Response to Question 1 by Age	80
10a Response to Question 1a by Age	81
10b ditto	81
11 Response to Question 1b by Age	82
12a Response to Question 1c by Age	82
12b ditto	83
13a Response to Question 2 by Age	83
13b ditto	84
14 Response to Question 2a by Age	84
15a Response to Question 2b by Age	85
15b ditto	85
16 Distribution of Oral Mucosal Disease in Sample by Age	86
17 Distribution of Defects of Teeth in Sample by Age	87
18 Distribution of Disorders involving Bone in Sample by Age	87

19	Distribution of Other Conditions in Sample by Age	88
19a	Prosthetic Status of Sample by Age	89
19b	ditto	90
20a	Full Denture Requirement of Sample by Age	91
20b	Partial Denture and Bridge Requirement of Sample by Age	92
21	Subjects in Sample Affected by Periodontal Conds. by Age	94
22	Periodontal Treatment Requirement in Sample by Age	94
23	Dentofacial Anomalies/Treatment Reqt. in Sample by Age	95
24	Immediate Attention Requirement of Sample by Age	96
25	Endodontic Care Requirement of Sample by Age	97
26	No. of Standing Teeth Categs. for Subjects in Sample by Age	98
27	Nn. of Teeth req. Restorations in Sample by Subject Age	99
28	Categs. of Teeth for Extraction in Sample by Subject Age	100
29a	Mean DMFT for Whole Sample by Age	101
29b	Mean DMFT for Sample by Years of Service	102
29c	Mean DMFT of Sample by Percentage of Service/Field Force	103
30	Mean DMFT of Recruit Sub-Group by Age	106
31	Mean DMFT for Staff Cadet Sub-Group by Age	107
32	Mean DMFT of Officer Sub-Group by Age	108
33	Mean DMFT of Field Force Sub-Group by Age	109
34	Mean DMFT of Base Troops Sub-Group by Age	110
35	Mean DMFT of Army Apprentice Sub-Group by Age	111
36a	Mean No. of Tooth Surfaces in Sample Req. Treatment, by DMFT	113
36b	Mean No. of Tooth Surfaces in Sample Req. Treatment, by FT	114
37	Group Distribution of Dental Fitness	115
38	Percent requiring Components of Dental Care by Groups	116
39	Mean Dental Man-Hours per Types of Care by Groups	118
40	No. / % of Groups req. Care, with Time Commitment in Hours	118

4.2 LIST OF ABBREVIATIONS USED *

AAS	Army Apprentices School
ACT	Australian Capital Territory
ADV.	advanced
APP	Army Apprentice(s)
ARA	Australian Regular Army
CARO	Central Army Records Office
D.	disease
DDS-A	Director of Dental Services - Army
DEP.	deposits
DGAHS	Director General of Army Health Services
D/O	Dental Officer
EM/IM	emergency/immediate
F.	full
FF	Field Force
F/F	full over full(dentures)
FS	service in Field Force
GING.	gingivitis
HQ	Headquarters
INF.	infection
INFCEN	Infantry Centre
INT.	intense
MD	Military District
MDSc	Master of Dental Science
MPA	Manual of Personnel Administration
NCO	non-commissioned officer
NSW	New South Wales
NT	Northern Territory
OCS	Officer Cadet School (Portsea, Vic)
OFFR	officer(s)
OH/PV	oral hygiene/preventive
O/R	other rank
P.	partial(denture)
PAT.	patient
PER.	periodontal
P/P	part over part(dentures)
PREV.	preventive
PROS.	prosthetic
QLD	Queensland
RAADC	Royal Australian Army Dental Corps

* - most abbreviations used because of table format requirements.

LIST OF ABBREVIATIONS USED *

RAM	random access memory
REC	recruit(s)
req	requiring
REST.	restorative
RMC	Royal Military College
ROM	read - only memory
RTB	Recruit Training Battalion
SA	South Australia
SAS	Special Air Services
S.DEV.	standard deviation
S.ERR.	standard error
SO1	staff officer grade 1
SPEC	specialist
TAS	Tasmania
TF	Task Force
TR.	treatment
Trg Comd	Training Command
US	United States(of America)
U/L	upper and lower(dentures)
VIC	Victoria
WA	Western Australia
WHO	World Health Organisation
WRAAC	Womens'Royal Australian Army Corps
YOS	years of service
YR	year
YRS	years
#	number
%	percent

* - most abbreviations used because of table format.

5.1 Introduction

5.1.1 Background

This study of the Dental Care Requirements of the Australian Regular Army was requested by DDS-A in Dec.1978.

The author, Maj P. Thaler, RAADC, was tasked to undertake the study project in conjunction with and as part of thesis work for MDSc (Sydney).

Research was to be carried out under the supervision of the Department of Preventive Dentistry, University of Sydney, with Professor P.D. Barnard as supervisor.

ARA Dental Units were to provide support for the survey phases of the study.

5.1.2 Statement of Problem

The broad problem areas in the provision of Dental Services to the ARA leading to DDS-A sponsorship of the study were considered to be:

5.1.2.1 lack of recent or current research data specific to the dental epidemiology or demand/need analysis of dental care of the ARA population;

5.1.2.2 uncertainty as to the adequacy of dental manpower, as currently established for the provision of dental care;

5.1.2.3 the need for rationalisation, based on up-to-date scientific evaluation of need for dental care, of deployment of dental manpower;

5.1.2.4 the need for identification of the real clinical component of dental officers' assumed work value, to enable DDS-A to quantify dental officer time commitments.

5.1.2.5 scientific evaluation of composition of ARA dental care requirements, to provide a rationale for auxiliary/trade ratios in manning of dental units;

5.1.2.6 the need for determination of valid dental officer to troops ratios for dental manning and deployment, encompassing adequate consideration of possible differences in types of Army patient and special sub-groups of population by age or length or type of service.

5.1.2.7 To make allowances for the inevitable difference in dental disease characteristics of Army manpower called up for

contingency service(e.g. mobilisation)in planning of dental manpower establishments,their deployment and general strategy.

5.1.3 Reasons for Investigation.

5.1.3.1 the primary purpose of this study was to obtain a current reliable estimate of the dental care requirements of the ARA by numbers and types of care;by hours of treatment time required for the entire population;and for subgroups stratified by type of service,showing significant variation in care requirement from the population mean.

5.1.3.2 the study will serve as base line data for future evaluations,investigations and comparisons.

5.1.3.3 the information will be useful to DDS-A in evaluating effectiveness of the Army dental care delivery system,determining appropriate future dental care objectives and organisation,and validating present dental establishment/organisation parameters.

5.1.4 Other Evaluations

The most recent study conducted in this field,and similar in aims

and population characteristics, was reported on in "Dental Care Requirements of Active Duty Army Personnel" by the US Army, in 1976. (see reference 11.)

Treatment plans were developed for 13182 active duty Army personnel. The data obtained were reliable at the 95% confidence level. The study provided distributions for its entire sample for each of 17 treatment variables, two missing teeth variables, and estimates of the treatment time requirement for each dental care variable.

Its findings provide some data for comparative purposes. (see Discussion of Findings).

5.1.5 Outline research method

Research data was obtained through conduct of a pilot survey (to determine appropriate sample sizes) and a major clinical survey of ARA soldiers/officers.

5.1.5.1 sample selection was based on the author's hypotheses as presented in this thesis and methodology recommended for international use by WHO, as well as the anticipated variation of findings in groups specified in the study objectives;

5.1.5.2 sample size was based on measures of variance and

central tendency observed in the pilot survey; with desired level of confidence of the study findings being used to calculate numbers required for the major survey;

5.1.5.3 stratification of sample was based on January 80 Army manning to obtain appropriate mix by age, sex, years of service and significant special populations as per hypothesis;

5.1.5.4 methodology of survey included the use of man-portable microcomputers in the field for data collection; and for interim validation and subsequent analysis of findings. The use of hard copy was restricted to provision of reports and examination result printout inserts into individual soldiers' treatment records (where requested).

5.2 Background

5.2.1 Organisation of the Dental Services of the ARA

The Health Services Branch under the Director General Army Health Services (DGAHS) is responsible for the organisation, administration and implementation of medical, dental and nursing services and the coordination of joint health matters within Army Office.

The Director of Dental Services-Army (DDS-A) is responsible to the Chief of Personnel, and to the DGAHS, for the provision of Dental Services to the ARA.

DDS-A formulates policy on military dentistry matters, recommends dental manpower levels to the Staff, deploys available dental manpower, recommends types and levels of dental materiel and equipment, and is responsible for the training of dental officers and other ranks.

5.2.1.1 Manpower Characteristics.

The Royal Australian Army Dental Corps (RAADC) operates on the basis of provision of single or multiple "dental teams" at locations of concentration of Army manpower.

Current manning consists of 51 Dental Officers and 145 Other

Ranks.

The basic "dental team" or its multiples are incorporated within the local Army administration and command/control structure and organised on a unit/section basis.

The team consists of:

1. the Dental Officer, who is a registered/registrable general dental practitioner, with officer rank (minimum Captain);
2. the Dental Assistant, who is the equivalent of a civilian chairside assistant, with basic military training and additional Corps (i.e. dental) training provided in-service;
3. the Dental Technician, who is a dental assistant, with additional in-service training as a dental technician.

5.2.1.2 Deployment Characteristics

RAADC (ARA) personnel are deployed at:

1. DDS-A, Canberra, performing staff functions only;
2. At Military District Headquarters, performing staff functions only;
3. As a treatment section at the Royal Military College;
4. On detachment to the Papua New Guinea Defence

Forces(dental officers only);

5. As cadre staff to Army Reserve Dental Units(other ranks for administrative duties only);

6. As the Divisional Dental Unit,serving the three(geographically widely dispersed)Task Forces in Field Force;

7. As Dental Units in Military Districts.

5.2.2 Methods used by DDS-A to monitor Dental Care

These rely,in the main,on scrutiny of regular treatment returns by Dental Units,compiled on a monthly basis and forwarded via the Staff Officers(Dental Services)on superior Formation Headquarters. The returns contain quantitative information on numbers of patients treated,individual dental officer output,laboratory output,and item of service analyses (of a basic kind). They offer a measure of information on unit productivity,but little data on prevalence of dental disease or service utilisation in the absence of regular demographic updating of individual dental units' treatment responsibility statistics.

5.3 Statement of Hypothesis

The following hypotheses were considered in mounting the study:

5.3.1 Dental officer/troops ratios

Current ratios (1:250 recruits; 1:350 trainees; 1:650 base troops; 1:1000 divisional troops) appear to be traditional, or based on outdated work value and epidemiological data, rather than related to the requirements and needs of today's Army.

In the light of recent advances in preventive care (e.g. systemic and topical use of fluorides) and their effect on certain age groups predominant in the ARA, the current system of allocation of dental officers based on ratios stratified by type of soldier alone, appears irrational.

For example, the current extent of delivery of service at the recruit interface (i.e., where members with civilian dental disease characteristics are merged with the ARA population), is limited to emergency/immediate care and examination/documentation only.

This group's backlog of untreated dental conditions is superimposed, on reposting, on the main population's backlog of care, to a fluctuating degree.

Military manning administration, as practised throughout the ARA (and other Forces), makes it totally impracticable for dental units delivering care in widely dispersed locations, to monitor

these changes or to make accurate predictions in respect of changing treatment needs of their serviced population at times of significant "peaks" or "troughs" in posting activity.

Furthermore, it is to be anticipated that groups at the interface between civilian and Army dental care will differ in prevalence of dental disease, and consequently in type and amount of dental care required, from groups with prolonged benefit of service care (which places no financial constraints on treatment).

Thus it can be postulated that dental officer/troops ratios should not be applied rigidly to populations or groups which display wide fluctuations in treatment need; also that ratios should be flexible and determined by periodic assessment of prevalence of dental disease in a given group, or mix of groups.

5.3.2 Auxiliaries

Current ratios of auxiliaries to dental officers (2:5 dental hygienist; approx. 4:5 dental technician; 1:1 dental assistant) appear not to have been scientifically validated in recent times.

Cost and manpower effective institutional dental care has to be planned identifying the components of dental care in quantitative terms for the population to which care is delivered.

Thus it can be postulated that the mean component care requirements of the ARA soldier necessitate a revision of auxiliary manpower ratios.

5.3.3 Dental fitness

As a result of the subjective nature of current classification of dental fitness in the ARA, it can be postulated that dental fitness of subgroups within the population, or indeed the entire population, is not as required by the service.

5.3.4 Demand versus Need

The demand element in the Army Dental Services may be considered as a compound of DDS-A policy-determined recall system(s), fitness entitlements and requirements (statutory) on induction and discharge, and patient initiated demand (for advice or treatment). The need element may be concomitant to demand, but is absolute. It depends on the incidence and prevalence of dental disease, the effect of preventive measures at all levels, and the effectiveness of therapeutic measures. Because of the intangible character of some of the components of need, it can only be gauged with reasonable accuracy where patient access is regular and examination techniques are thorough.

It can thus be postulated that the present recall system may not be effective; that special need (i.e. emergency care requirement) may be underestimated; and that patient initiated demand may be more complex in character than currently assumed.

5.3.5 Deployment of ARA Dental Manpower

Currently, ARA dental manpower is deployed mainly in areas of troop concentration.

It can be postulated that maximisation of manpower in areas with a large requirement for clinical backlog care, would lead to a more effective dental service.

5.3.6 Overall Dental Establishments

Subject to requirement for additional consideration of consequent auxiliary establishments, it can be postulated that current peace/war dental officer establishments are inadequate to meet the dental care requirements of the ARA.

5.3.7 Special Groups

It can be postulated that special groups within the ARA (e.g. SAS, cadets, apprentices, recruits, divisional troops) may show treatment requirements significantly different from the mean ARA population.

5.3.8 Contingency Expansion Planning

It can be postulated that mean dental care requirements derived from a study of the peace-time ARA may dictate a revision of contingency health plans for the Army.

5.4 Outline Research Design

5.4.1 Evaluation Systems-General

Dental care research is concerned with the provision of dental services to defined populations. Since such services are provided by groups with specialised skills to larger groups with needs which vary with such factors as age and social condition, it is clear that workers in this field must be familiar with the sources of demographic information and the methods of handling statistics derived from them. (see reference 14., cp. 2, 8, 15).

Estimates of population are normally needed in dental care research for assessing the demand for dental services in different areas and for the calculation of rates used as indicators of dental health.

In this study, current manning figures of the ARA will be substituted for estimates of population. Population projection is based on current manning policies; i.e. an Army of 32000 members. The ARA population model from the point of view of dental health may be considered to be divided into "states" or "compartments", each ascribed a degree of dental fitness. Movements can take place between compartments and into and out of the system. The transitions can be treated as deterministic or stochastic.

Cost benefit analysis of dental care relies heavily on assessing

the effect on a population of alterations in dental health. As such, it is considered to be beyond the scope of this study.

5.4.2 Concepts and Strategies of Evaluation

There are three main reasons why the evaluation of a health care system or program is a complex operation:

Firstly, instruments of evaluation are still in a rudimentary state and are not as precise, exact or reliable as they should be.

Secondly, the facts to be observed and assessed are themselves often so abstract and multi-dimensional that it is not easy to express them in operational terms that permit direct evaluation.

Finally, because of the multi-dimensional nature of health, the number and variety of factors that can influence the results of health care make any attempt to obtain satisfactory control over all the variables quite out of the question.

5.4.2.1 Technical evaluation

Means the precise or approximate assessment of value, quantity and cost.

Its two main goals are regulation and control. The first seeks to prevent or correct errors and deficiencies in order to maintain the general level of quality or raise it to a minimum acceptable standard. The second goal is to control the

quality of acts performed or processes used in the execution of certain functions.

Technical evaluation can only give a global opinion whether a program is "acceptable" or "unacceptable".

5.4.2.2 Research evaluation

May be described as the definition of the relationship between the results observed and the methods used to obtain them.

This study is therefore obviously more suited to be part of a larger research evaluation of the ARA Dental Services, and has been designed to provide data for both deductive and inductive application of research evaluation.

5.4.2.3 Systems Approach

Unlike experimental design of evaluation, this starts with a series of objectives considered as an integral part of a multifunctional social unit, organised to achieve the objectives of a system.

5.4.2.4 Summary

The design of this study should enable its findings to be

used as part of a broader evaluation of the ARA Dental Services.

Using research evaluation coupled with a systems approach to such an evaluation, the findings of this study will assist in defining and analysing the population component of a larger evaluation project.

Other components such as objectives, organisation, operation and staff activities would require additional research.

5.4.3 Basic Oral Health Surveys-WHO Format

Basic oral health surveys, which enable the present status and future needs of a population to be estimated on a sound basis, supply reliable data for providing effective oral health care.

WHO, since 1961, has formulated and revised/updated standard methods for reporting dental diseases and conditions to achieve international conformity and comparability in oral health statistics. (see reference 10, pp. 7/8, 29)

This latter aim must be shared by Armed Forces research; therefore this format was considered in essence to be the basis for the survey methodology of this study.

The aims of the format are:

1. to provide a systematic approach to the collection and reporting of data on oral diseases and conditions;
2. to ensure that, as far as possible, data collected in a wide range of environments are comparable;
3. to encourage dental health personnel in all countries to make standard measurements in oral conditions and diseases as a basis for planning and evaluating oral health programs;
4. to describe a systematic method for estimating the requirements for the application of preventive measures, including health education, and for curative, restorative, or palliative treatment; and

5. to encourage the recognition and utilisation of valuable opportunities for conducting epidemiological research.

The combined oral health and treatment assessment form (see Appendix D) is designed to enable health administrators to obtain data for comprehensive estimates for preventive, curative, and restorative action and for manpower requirements.

The service utilisation part of the form provides research information in the area of demand and need.

In this study the following variables are measured (if quantitative) or coded (if qualitative):

- study number, date, registration number, examination number;
- personal and demographic information (x6)
- service utilisation (x7)
- disorders of mucosa, teeth, bone and other conditions
- prosthetic status and denture requirements
- periodontal status (x4)
- periodontal treatment requirements
- dentofacial anomalies (x4)
- conditions needing immediate attention (x4)
- dental caries status and treatment of teeth.

5.4.4 Modifications to WHO Format

The WHO charting method precludes distinction between number of tooth surfaces requiring restoration (for any reason, incl. caries) and configuration of restorations; similarly no geomorphic information of filled teeth can be extrapolated. The decision to tolerate this shortcoming in charting was based on consideration of computer software graphics available at the time of design of the study.

Appropriate software was developed by research carried out during this study, but its advent was too late for modification of survey software, i.e. some time after commencement of the main surveys. The only significant effect of this absence of geomorphic charting data is seen in terms of weighting of treatment variables for time taken to effect treatment.

The basic WHO format allows for variation required to meet the specific requirements of this study:

5.4.4.1 personal/demographic

Variables for File Number (to enable computer search through subdivided data), Army Number, Rank, Unit, time in Field Force, time in Military District and time since last visit to dentist were added.

WHO Variables for Study Number, Date, Registration

Number, Examination Number, Ethnic Group, Occupation, Geographic Location and Examiner were not used.

5.4.4.2 service utilisation

Coding criteria in this section were modified to provide information as to leave and duty factors peculiar to the ARA, and the socio-economic criteria were discarded.

5.4.4.3 denture requirements

Coding criteria in this section were expanded to show bridge requirements.

5.4.4.4 dentofacial anomalies

Additional variables to show present orthodontic status and orthodontic treatment required were introduced.

5.4.4.5 dental caries status and treatment of teeth

Status was determined using bitewing radiographs.

Quantitative variables were added to show number of teeth requiring anterior and/or posterior endodontic care.

Additional coding criteria were introduced to show existing bridge pontics and to show pontics of required bridges.

5.4.4.6 Weighting for time of surface treatment requirements

It was decided, in the absence of Australian Armed Forces research data, to utilise weightings derived from recent studies carried out on US Army and US Navy personnel by Cassidy et al. (See Appendix A)

These weightings make a (not very significant) distinction between time taken to complete one or several single surface restoration(s) and completing multi-surface or multi/single surface combined restorations with a common surface total.

It was decided to multiply the data number of tooth surfaces requiring restoration by Cassidy's single surface time value.

Computer tests carried out ARA on survey data show the weighting error produced to be within acceptable (5%) limits when compared to a Cassidy sample.

5.4.5 Sample

The sampled population consisted of ARA personnel posted to units in the ACT, NSW and Victoria.

CARO and Army Office manning figures were used to obtain group sizes within the total ARA population. Total ARA manning figure for the purposes of survey calculations was determined as 31696.

Groups to be considered within this total population were determined as:

Base/Military District personnel (i.e. exclusive of 1 Div troops, but inclusive of Trg Comd troops);

Field Force personnel

Recruits (male at 1RTB and female at WRAAC School);

Officers (in all groups);

Cadets (at OCS and RMC);

Army Apprentices.

A pilot survey was incorporated into this study to provide information on expected values and variations of indices for determination of sample size for the main survey; this sample size to provide data to be reliable at a 95% level of confidence.

Accordingly, Army units chosen for pilot survey were

AAS, OCS, RMC, 1RTB, 1TF and HQ2MD.

Sample size for main survey derived from pilot survey data was as shown in Table 1:

Table 1

<u>GROUP</u>	<u>MANNING</u>	<u>WEIGHTING</u>	<u># SELECTED</u>	<u>WEIGHTED SAMPLE</u>
APP	00994	0.031	142	046
OCS	00122	0.004	000	006
RMC	00415	0.013	138	020
REC	03200	0.100	151	150
FF	11621	0.367	553	545
BASE	10948	0.345	519	519
OFFR	04396	0.138	211	207
TOTAL	31696	1.000	1713	1493

The weighted sample of the whole ARA population constituted 4.8% of total ARA manning.

5.4.6 Data Collection and Analysis

Consideration was given to data collection by means of the modified Oral Health and Treatment Assessment Form.

It was decided, however, that use of man-portable microcomputers for data collection would provide a saving in stationery costs, minimise the risk of loss of voluminous hard-copy survey data, and enable the setting of strict operator (recorder) error parameters to maximise accuracy.

Data analysis, in turn, could be carried out by the same machines, providing a considerable saving in cost of use of time-sharing mainframe computer facilities for statistical analysis.

This method would provide the further advantage of enabling interim analysis to be carried out (if required, on survey site) to monitor and report on survey data and progress.

In addition, through design of interactive software, it would be possible to store data and reports in word-processor compatible format, for publication of study findings and use in future studies.

5.4.7 Administration and Logistics

It was decided that Army administrative action for the project would be initiated by HQ7 Dental Unit, Sydney, and supported by

S01(Den)HQ2MD and DDS-A.

Adequate liaison with dental units supporting the survey was considered to be of paramount importance to the success of the project.

5.5 Implementation

Research and development pertaining to the computer application software used in the survey(s) was commenced in February 1979, and continued throughout 1979/80.

The Pilot Survey of 140 patients was conducted in the period October-November 1979.

The main clinical of 1713 patients was commenced in June 1980, and completed August 1980.

Each examiner, on average, examined 40 patients per day, in two 20-patient sessions. Average time taken to process a single patient, including radiography, was 20 minutes; of which 10 minutes was taken up by the actual Oral Health Assessment and related data recording.

5.5.1 Survey Team

The team was structured to collect and record survey data using microcomputers.

It consisted of two clinical examiners (dental officers) and two recorders (auxiliaries).

In each location visited, the team used local dental unit support for patient and patient documentation management and, in some instances, radiography.

5.5.1.1 Examiners

These were responsible for the conduct of assessment of oral health status and treatment needs and, in some instances, the taking of bitewing radiographs for the survey.

Calibration of examiners was performed under University supervision.

The examiners were:

1. Maj P. Thaler, RAADC; officer in charge of survey;
2. Capt M. Junaidi, Medical/Dental Corps, Malaysian Armed Forces.

5.5.1.2 Calibration of examiners

As recommended by most authorities (see references 2., pp. 336; also 10., pp. 18-20) calibration of examiners was undertaken, using duplicate examinations of a group of 100 soldiers in the early part of the main survey.

The pilot survey was conducted by a single examiner; the second examiners' services did not become available early enough to use the pilot survey for duplicate examinations, which would have been desirable for optimum assurance of accuracy of examinations.

Minimal standardisation was found to be necessary as a result

of calibration. This was probably due to the close similarity of clinical diagnostics prevailing in military dentists with considerable mass-examination experience in training units. Both examiners had spent long periods in practice at such establishments.

5.5.1.3 Recorders

These were responsible for the conduct of the demographic and service utilisation components of the survey (under dental officer supervision) and for patient management. They were also responsible for data entry onto computer and for administration and maintenance of the computer filing systems. In addition, they assisted the officer in charge in software development and management of data on-line.

The recorders were:

1. Ssgt K. Mitchell, RAADC;
2. Pte L. Tocock, RAADC.

5.5.1.4 Team Training

A major area of difficulty in implementation of this survey arose from the requirement of research design to use microcomputers for collection and analysis of data, and for the processing of reports.

Neither the second examiner nor the two recorders had had any previous training or experience in the computer field.

The second officer was a dental officer (general duty) of the Malaysian Armed Forces, undertaking postgraduate study at the University of Sydney.

The senior team NCO was normally employed as an Administrative Assistant in RAADC.

The other recorder was a Dental Assistant by trade.

The required formal introductory training in microcomputer operation and programming was given to team members through two 5-day courses designed and conducted by the author both at the United Dental Hospital of Sydney and at the Regional Defence Training Centre, Sydney.

On-the-job training for all members was continued throughout the design and implementation stages of the study.

5.5.2 Hardware

1. At the outset of the study, the Management Advisory Services of the Dept. of Defence were appraised of the outline requirements for computer hardware.

Departmental evaluation of the (then) current state of the art led to selection of hardware and peripherals suited to the purposes of this study.

Concomitantly, the Dept. of Preventive Dentistry of the University

of Sydney selected the same hardware for departmental use, thus making a second identical computer system available to the research team.

The systems ultimately used were type 6502 8-bit microprocessor, 32 kilobyte (net) user memory microcomputers with visual display units (intelligent peripherals), dual disk drives of 340 kilobyte storage, and tractor feed (graphics-supporting) printers.

2. This equipment is manufactured and serviced by Commodore Business Machines (USA) and distributed in Australia by Commodore Information Centre.

5.5.3 Software

5.5.3.1 General

The process of writing and running a program is one of defining a problem or process from the very general level of thought used by the human mind to the very precise sequence of instructions used by the computer. (see reference 7, pp. 1/2) The lowest, and therefore the most precise level, is the binary code used by the microprocessor; this is the level used in machine code (machine language) programs.

At a higher level are the commands of a BASIC interpreter. These allow instructions to be given to the

processor in easily understood English language statements. The execution of one instruction statement in BASIC may require several hundred steps of machine code program.

The next level above the BASIC interpreter is the subroutine. This is a block of code written in BASIC to perform a specific function. Subroutines give the programmer higher level functions than those available in BASIC. Thus, a subroutine to sort an array (of data) into alphanumeric order gives the programmer a new command, summarised as: SORT ARRAY X. Just as the BASIC command represented several hundred machine code commands, so a subroutine may consist of a hundred BASIC commands.

The first level of command generalisation above the subroutine is the program, consisting of a collection of subroutines.

Above the program is the highest level in the hierarchy of programming, the suite of programs. This is a collection of several programs which are united by a common data base and collectively perform an application, e.g. dental survey data collection/analysis.

The existence of a hierarchy of conceptual generalisations is very useful, since it allows the process of program writing to be split into a series of easily defined (and identifiable) stages. This firstly gives the programmer a logical sequence

of operations and secondly allows much of the work associated with the lowest levels to be automated. This is done by using a high level language like BASIC, which removes the necessity of writing in the lowest or machine code level.

The first stage in writing a large applications program (or suite) is to define its exact function. Flow-charting of the desired function is a preferred way of translating concepts into specifications of program design. A (highly) simplified version of the trunk element of the flow chart of the software system designed by the author might thus be:

DATA COLLECTION - DATA ANALYSIS - REPORTS.

5.3.3.2 Design Criteria

The author developed software, utilising the following criteria:

1. the hardware selected;
2. the need for interaction capability in terms of collection, storage, monitoring, modification, analysis, reporting and word processing of data;
3. the requirement for ease of operation by Army personnel with little formal computer training; and
4. the need for flexibility of software developed during this study so that it might be usable for similar future projects.

This necessitated a conceptual structuring of software design, with considerable emphasis given to skeletal functions which have recurring usefulness in the type of analysis tasks required of the dental researcher and administrator.

5.5.3.3 Languages

Commodore BASIC(Level3) was used in conjunction with machine code. The proportion of BASIC to machine code in most parts of the software averaged at 60:40.

5.5.3.4 Software System Specifications

1. Main program, with functions of survey conduct, patient record display, record modification; chaining to:
2. record extraction, using criteria of infinite number;
3. record indexing by variable;
4. radiology based modification with automatic indexing by Army Number and available for all variables;
5. variable count, on criteria-selected sample;
6. function to produce hard copy of oral health/treatment assessment compatible with the Defence Dental Treatment Record (Form PM342) format;
7. Stand-alone program to produce hard copy of report to unit commanders; this function entails analysis of variables

and classification of individuals in sample into dental fitness classes as per Manual of Personnel Administration (see reference 4.) of the ARA.

8. Stand-alone program to perform global statistical analysis of sample, with hard copy option.

5.5.3.5 Main Program

1. The entire suite of programs utilises data disks (on drive 1) ,which store survey data (i.e.individual patient records) in random access blocks/fields(see reference 8). Each disk is capable of storing 650 patient records.The file structure is controlled by a key file system.

2. Key files are sequential, and stored on the program disk (on drive 0). This system enables the user to employ a large number of different data disks, thus allowing for a large data base. The total number of data disks tolerated by the software design is limited to Key File Identity Codes consisting of all letters of the alphabet and single-digit numbers from 0 to 9.

The key file stores binary information as to whether a given data block (and its fields, or sub-records) has been allocated to valid data. By using record numbers from 1 to 650, the

system calculates using a specific algorithm (see reference 7) the track and sector numbers, and thereby the location, on disk, of any given patient record.

3. Writing and reading of data in its appropriate locations is speeded up by the machine code instructions used by the disk-operating-system. Maximum time taken to read or write a record to/from disk, regardless of amount of data already stored on the disk, is 3 seconds.

4. Upon initialisation of the program, the given identity of the desired disk is entered by the operator. Thereupon the relevant key file is read into high (protected) memory of the computer, where it stays until either exchanged for another key file (e.g. when several disks are being used) or erased as a result of power-down of the machine.

Initialisation also adjusts the storage capabilities of random access memory (user memory) to provide for the storage of arrays and subroutines used by the program, particularly for the complex data entry system employed.

5. Data entry is controlled to enable cursor (the position indicator in the computer screen environment, pointing to the current data entry) control for cancellation or repeat of entry, to restrict entries as to field size and (alpha)numeric

value, and to allow for speedy null entries.

Thus parameters are set for each variable in terms of valid or "acceptable" entries, minimising operator error. For example, where a yes/no answer is required, the computer will not accept any alternate, non-binary, answers.

The user is advised by the screen display, through special enhanced "banners", of the status of entry (e.g. Demographic Detail) as well as of the options, or codes, demanded as an entry.

6. Complete error monitoring is built into the system as a subroutine which is enabled whenever an operator function (e.g. data entry) or a disk access function (e.g. write data) is enabled. Should an operator, hardware or software error occur and danger of corruption of data exist, the system passes an appropriate error message to the screen and halts operation until the error is successfully recovered. The disk operating system of the computer is capable of considerable automatic error recovery, and will only advise of irrecoverable errors; i.e. errors that cannot be recovered within 180 milliseconds of program execution.

7. To guard against loss of data in the event of a power failure (where, of course, all computer means of protection against corruption or loss of data become inoperative), all

data is "logged" continuously by a printer. The resulting hard copy can be used to re-enter data which may have been lost as a result of power failure.

8. Conduct Survey Function. This function provides for running of the complete Oral Health and Treatment Assessment on a patient (see reference 10; also Appendix D) including such modifications as imposed vide 5.4.4.

The demographic, service utilisation and clinical components of the assessment are run in the WHO order. An option is built into the system to allow the operator to skip (exclude) the service utilisation component of the assessment.

All valid data entered is immediately written onto disk by the system, to minimise possible loss of data through system failure. Thus power failure halfway through the clinical examination of a patient would result in loss only of the data in respect of the current survey question/variable. The remainder of the patient's record would remain intact. Logged hard copy would enable complete recovery of lost data.

9. Patient Record Display. This function enables screen display of the complete record of a survey patient. As the number of variables involved is too large to fit the (40 column) screen, two "pages" of display are available. The display includes the WHO format tooth chart.

10. Record Modification. The system allows for modification/alteration of any variable used in the assessment (within the set parameters of the assessment). Variables are accessed by variable name. Modifications are written directly onto disk, after valid data entry.

11. Other functions included in the main program are:

information on number of free records available on disk; key file update function, to enable the user to include changes in number of patient records stored in the key file; and delete/recover function. This enables the user to delete records from the key file, or to recover them (i.e. re-enter them). This is useful if one wishes not to have certain records considered by, say, analysis.

5.5.3.6 Record Extraction

All variables used by the system are stored on disk as strings (alpha characters) of defined length. Thus, each variable used becomes a field, or sub-record, within the main data block, or patient record. This record characteristic makes

it possible to perform search, sort and extract functions. A record, or records, may be extracted and displayed depending on set criteria. These are whether or not the record contains a variable, or variables, of specific value or alpha-nature. The variable value, or alpha-nature, may be defined using the available (through the record structure as described above) displacement value (starting point in field), field/data string length, in addition to qualifiers such as "equal to", "greater than", "lesser than" and "not equal to" of the search string.

For example, records will be extracted provided that:
patient age is greater than 20 yrs;
rank is equal to Private;
state of origin is Victoria;
patient has not been examined within last 12 months; and
displayed soft deposits of less than 3 sextants.

5.5.3.7 Record Indexing

This function allows for the indexing of the data base (i.e. all records from a given disk or disks) by a given variable, and its subsequent scan or search for records with a set value or alpha-nature of the variable.

The system loads values or strings of the variable for the complete data base on a given disk (i.e. all records) into an

array in user memory. Once the search string has been defined, it will search the array for "matches", and display the records which are matches.

For example, if the data base is indexed for Army Number, and the search string defined as "3", displacement 1, the system will search for records of patients whose Army Number starts with a "3", i.e. Victorians.

5.5.3.8 Radiology Function

This function automatically indexes the data base by Army Number and upon entry of such a number, asks for the field/variable which it is desired to modify as a result of radiology. It subsequently displays the current variable value(s), allows modification, and writes the modification directly onto the patient's record on disk.

This allows for speedy modification of records, where radiographs are marked with the patient's Army Number.

5.5.3.9 Variable Count

This function enables the user to define a variable in terms of value or alpha-nature, and to have the occurrences of the defined variable counted in the data base.

For example, a count might be obtained of the number of unerupted third molars.

5.5.3.10 Hard Copy of Patient Record

This function produces a printout of one or several survey records of individual patients.

The printout is modified to be compatible with the Dental Treatment Record used by the Australian Armed Forces, and is

illustrated in Appendix B.

The tooth chart shows features such as caries or prescribed exodontia, but is not geomorphic as a result of the charting limitations imposed on the data base by the WHO method. (see 5.4.4).

5.5.3.11 Report Function

Appendix C shows the type of report produced by this function.

Its main purpose is to describe, in lay terms, the dental state of troops surveyed, including dental fitness classification, man-hours required for dental treatment and types of treatment required.

This type of software can, of course, easily be modified to produce reports based on descriptive statistics for academic or Public Health purposes.

5.5.3.12 Analysis of Rates

This program globally extracts from the data base qualitative, or coded, information/variables. Rates and percentages are derived, and standard errors calculated. Results of analysis are presented as hard copy. The program is interactive with the word processor used in

this study, and can thus be used to present statistics in tabular, or bar chart form.

5.5.3.13 Quantitative Analysis

Several programs were developed to meet the study requirements of analysis of quantitative data. The design principles on which these programs were based can be used to support similar requirements in other studies.

The programs designed as part of this study enable production of hard copy results of analysis, and are interactive with word processing software for the automatic production of tables and/or bar charts.

They perform analysis of the relevant sections of the data base for extrapolation of DMFT, surfaces requiring treatment, or any quantitative variable; and allow for plotting of these indices/variables against subject age, years of service, DMFT or FT.

Means, standard deviations/errors are calculated. (see references 2 and 5). Derived indices such as D/DMFT, F/DMFT and M/DMFT are calculated and presented for comparative purposes.

5.5.3.14 Geomorphic Charting Software

1. Parallel with software development directly related to the requirements of this study, research was undertaken in the field of memory-economic geomorphic charting functions for microcomputers. This research was not successfully completed until after commencement of the main survey, and its results could therefore not be applied to the computer methodology of this study. The software developed will, however, prove useful in future research.

2. The main problems confronting the programmer in development of geomorphic charting functions are twofold:

a. the need to store complex data economically on disk, in order to maximise the number of patient records which may be accommodated on a single disk (this problem has been alleviated by the current state-of-the-art megabyte floppy and fixed (hard) disk technology).

b. the enabling of rapid execution of screen displays, or hard copies, of chartings.

3. The graphics symbols of the Commodore microcomputer proved more than adequate in range to accommodate normal charting requirements. However, to meet the criteria as above, tooth information had to be condensable, or codeable, into a minimum number of bytes.

As the type of microprocessor used in the computer in question operates on 2-bit bytes (see reference 8.), the maximum number of codes storeable as one byte is 255 (the highest decimal number expressable as a 2-digit hexadecimal). The (FDI pattern) charting method used for geomorphic charting required each tooth to have 5 surface options (occlusal, mesial, distal, buccal and lingual) as well as 2 additional options used for endodontic and periodontal records (or for optional, other, use), making a total of 7 required options.

The number of possible variables for each option, to enable normal charting had to be a minimum of 20, including such variables as filled/amalgam, porcelain crown, temporary dressing, for surgical extraction, etc.

From this it can be readily seen that the possible permutations of options and variables vastly exceed the one byte storage possibility of 255 codes.

The problem was resolved by the author through development of a 2 kilobyte ROM chip, which was "burnt" to combine data display (by machine code) with coding storeage in its microcircuitry.

Disc space used was also minimised through the use of machine coded bytes.

5.5.3.15 Utilities

A utility program may be defined as one which facilitates the writing of application programs, or assists in their management.

Several such utilities were developed as part of this study, as follows:

1. Screen-Dump. Enables production of hard copy by the printer of any screen display.
2. File-Conversion. Enables the conversion of sequential survey data (as used in earlier parts of the survey - see 5.7.2.3) to random access data.
3. Disk Utility. Enables the display/printout of contents of disks by track, sector and block. It further enables the "patching" or modifying of data stored on disk, thus permitting the user to restore and recover corrupted data on disk.
4. Diskprint. Enables the printout of a data disk directory in terms of file (as defined by survey design - see 5.5) content. This is invaluable for management of restricted, as opposed to global, analysis of the data base.

5. Key File Creator. This utility, used in conjunction with 4., enables the creation of "dedicated" key files (see 5.5.3.5), which speed up restricted analysis by skipping unwanted records.

Two commercial utilities were used extensively in the development of the suite of programmes used in this study and in the preparation of this thesis. They were:

6. The BASIC Programmer's Toolkit. This is a machine code utility provided in a 2 Kilobyte ROM chip, and developed by Palo Alto ICs, Palo Alto, California, and available through Commodore Information Centre, Sydney and the Commodore dealer network worldwide.

It enables the automatic numbering of program lines, the renumbering of BASIC programs, the deletion of BASIC program lines, the location and display of BASIC program lines that contain a specified string, the appending of one program module to another, the dumping (displaying) of the names and values of all the variables used by a program (excluding arrays) at any dynamic point in execution, dynamic error detection, tracing of program execution by line number (dynamic monitoring of BASIC), step-monitoring of program execution.

7. Commodore Word Processor 3. This is a machine code word processing and text editing utility of great power. Its capabilities proved more than adequate for the requirements of this thesis.

5.5.4 Pilot Survey

A sample size of 20 was used for each of the groups examined in the pilot survey.

Individuals of the various groups were examined as follows:

1. Base soldiers at HQ2MD;
2. Field Force soldiers at 1TF;
3. Officers at all locations;
4. Army Apprentices at AAS;
5. Cadets at OCS;
6. Staff cadets at RMC;
7. Recruits at 1RTB.

All clinical findings were modified through radiology, where necessary.

Analysis of pilot survey findings showed the small (OCS) cadet population to be so closely related to the cadet population at the Royal Military College to make consideration of this (OCS) group as a separate entity statistically unnecessary. It was therefore excluded from the main survey.

5.5.5 Main Survey

Sample size was determined for each group surveyed, using pilot survey analysis to obtain target figures.

Individuals of the various groups were examined as follows:

1. Base soldiers at all locations, including INFCEN and Randwick;
2. Field Force soldiers at 1TF;
3. Officers at all locations;
4. Army Apprentices at AAS;
5. Staff cadets at RMC;
6. Recruits at 1RTB and WRAAC School.

5.5.6 Method of Data Collection

(see reference 10, pp. 21-55; also 5., ch. 14)

5.5.6.1 Instruments and Supplies

Care was taken to ensure a ready and constant supply of instruments, using batches and cold sterilisation.

The standard Army dental surgery supplied adequate space and seating for patients and survey personnel, as well as excellent lighting (overhead and focussed).

The teams used:

1. sickle shaped explorers;
2. plain mouth mirrors;
3. plain spectacles for protection of examiners from debris;
4. disposable gauze masks;
5. gauze pads and cotton wool rolls for removal of debris;
6. periodontal probe.

5.5.6.2 Demographic Detail

Patients were allocated to a File, according to location/venue of survey.

Service Number, Rank, Name and Unit were recorded for each patient. Patients whose Service Number showed affiliation to allied Armies or other Arms were excluded from the survey. Sex and Age were recorded. Age was recorded as age last birthday.

5.5.6.3 Disorders of Mucosa, Teeth, and Bone and Other Conditions

A screening examination of the oral mucosa and the hard and soft tissues around the mouth was performed for all subjects included in the survey, before the teeth and periodontal tissues were examined.

Lips, buccal mucosa (including the upper and lower sulcus and retromolar area), palatal mucosa, surface and margins of the tongue, and the inferior surface of the tongue and the floor of the mouth were inspected. Mobility of the tongue was checked.

The entire dentition was screened for tooth defects and for evidence of trauma.

Tissues appearing abnormal, as well as the submandibular, sublingual and cervical lymph nodes were palpated digitally.

Results were coded 0 for absent and 1 for present; where disorders were present, they were specified in a separate field.

5.5.6.4 Dentofacial Anomalies

These were judged present if, in the judgement of the examiner, one or more of the following criteria were met:

1. it had a significant and unacceptable effect on facial appearance;
2. it caused a significant reduction in masticatory function or resulted in significant impairment of speech;
3. there was a gross defect, such as cleft lip, cleft palate, or pathological or surgical injury that unquestionably had high priority for treatment;

4. it constituted an occlusion predisposing to tissue destruction in the form of periodontal disease or caries. Anomalies were coded (according to criteria in reference 10., pp. 49/50)

5.5.6.5 Prosthetic Status

Subjects examined were classified as follows: (see Appendix D)

1. not wearing denture(s);
2. wearing upper denture(s);
3. wearing lower denture(s);
4. wearing upper and lower dentures.

5.5.6.6 Denture Requirement

(see also 5.4.4.3 and 5.4.4.5)

Subjects examined were classified as follows: (see Appendix D)

1. not requiring denture(s) or bridge(s);
2. requiring upper denture(s) or bridge(s);
3. requiring lower denture(s) or bridge(s);
4. requiring upper and lower dentures or bridges;
5. requiring denture repairs or relines.

5.5.6.7 Periodontal Status

In applying the scoring methods for soft deposits, calculus, intense gingivitis, and advanced periodontal involvement the mouth was divided into six segments:
anterior, from canine to canine;
left and right posterior, from first premolar to the last tooth in the arch;
for mandible and maxilla.

Each assessment was made separately, i.e. soft deposits were noted before recording other features, etc.

The lingual and vestibular aspect of each segment was inspected for each assessment. All assessments in a particular segment ceased when a periodontal condition was detected on any aspect of any tooth in that segment.

Conditions were scored 0 for absent, 1 for present.

1. Soft deposits were scored using a mouth mirror only, when they were clearly visible to the unaided eye at the gingival margin of one or more (not dried) teeth within a segment.

2. Calculus was scored when it was obviously present in contact with the gingival margin of one or more teeth in the segment, as determined by direct inspection or with the aid of a mouth mirror, and confirmed calcified with a periodontal

probe.

3. The presence of intense or acute gingivitis was recorded for segments in which one or more areas of the papillary or marginal gingivae surrounding fully erupted teeth showed marked changes in colour, or if firm digital palpation caused bleeding. Intense gingivitis that had extended beyond the papillae into the area of the attached gingivae, indicated by loss of stippling and tone, was included in this category. Changes in colour were determined in relation to the colour of adjacent gingival tissue that was not inflamed.

4. Advanced periodontal involvement is the term used to describe periodontal disease at the stage where the pathological process has definitely extended to involve the periodontal membrane and alveolar bone. For the purposes of this survey, the major diagnostic signs were taken to be: either, definite tooth mobility; or, a periodontal pocket greater than 3mm in depth, accompanied by one or more of the following conditions:

- a. intense gingivitis;
- b. marked change in gingival contour;
- c. suppuration;
- d. advanced gingival recession with exposure of cementum.

5.5.6.8 Dental Caries

The examination for caries was conducted with a plane mouth mirror and a sharp sickle-shaped explorer.

The entire dentition was examined in each patient.

Radiography, using bitewing x-rays, was used to supplement the findings of this clinical examination (see 5.5.6.9).

The coding system used was as shown in Appendix D.

The M component (missing teeth) of patients' DMFT as extrapolated in later analysis of findings, scored teeth missing for reasons of caries in patients up to age 30 yrs. In older patients, this component became a tooth mortality score through inclusion of teeth missing "for any reason".

The criteria used for diagnosis and coding were as follows:

Code 0 = Sound tooth. Recorded as such if it showed no evidence of treated or untreated clinical caries;

Code 1 = Decayed tooth. Caries was recorded as present when a lesion in a pit or fissure or on a free smooth tooth surface has a detectably softened floor, undermined enamel, or a softened wall, or the tooth has a temporary filling. On approximal surfaces the explorer point had to be able to enter a lesion with certainty. The stages of caries that precede cavitation as well as other conditions similar to the

early stages of caries were deliberately excluded because they cannot be diagnosed positively and reliably. Thus, in the absence of other positive criteria, defects such as white or chalky spots, discoloured or rough spots and stained fissures were not counted as caries.

Code 2 = Filled tooth with no decay. Teeth were considered as such whenever one or more permanent restorations were present and there was no secondary (recurrent) caries or other area of the tooth with primary caries.

As distinct from the criteria used by WHO (see reference 10., pp. 39) teeth restored for whatever reason were not recorded as EXCLUDED, but as filled. This was decided so as not to introduce difficulties in obtaining accurate information on tooth history from patients during a survey operating under pressure of time in terms of rapid patient flow.

Code 3 = Filled tooth with primary decay. A tooth was scored as such when it contained one or more permanent restorations and also one or more areas that were decayed but had no obvious physical association with the restoration(s).

Code 4 = Filled tooth with secondary decay. A tooth was scored as such when it contained one or more permanent restorations and there was secondary decay (in physical contact with the

restoration(s)). Filled teeth containing both primary and secondary decay were scored in this category.

Code 5 = Permanent tooth missing due to caries. This score was used only for subjects under 30 years of age.

Code 6 = Permanent tooth missing for reasons other than caries. This score was used for permanent teeth judged to be absent congenitally or extracted for orthodontic reasons.

Code 7 = Permanent tooth missing for any reason (30 years or older).

Code 8 = Unerrupted tooth. This classification was restricted to permanent teeth and used only for a tooth space with an unerupted permanent tooth, but no primary tooth, present. Such teeth were excluded from all calculations concerning dental caries.

Code 9 = Excluded tooth. (see also 5.5.6.8, c.)

This classification was used when a tooth was restored as a result of reasons other than caries. Because of difficulties encountered by examiners in eliciting reliable information from patients in respect of this classification, the analysis software was adjusted to consider these teeth to be

filled, and to include them in the F. component of DMFT index.

5.5.6.9 Radiographs

(see also 5.7.1.3)

Bitewing radiography was used to supplement diagnosis of caries and presence of teeth in all non-edentulous patients surveyed, as follows:

1. new bitewing radiographs were taken if the patient had not been x-rayed within the six months preceding the survey (to minimise exposure to radiation).
2. in the remainder of patients, bitewings taken at their last dental check-up were used for survey purposes.

5.5.6.10 Treatment requirements of teeth

Code 0 = None. This was recorded if a tooth was sound, or if it was decided that a tooth cannot or should not receive restorative treatment. Moreover, this code was used only if the tooth was not indicated for extraction, for any reason.

Codes 1, 2, 3, 4 = Restorations. Depending on how many surfaces were involved for restoration, one of these numeric codes was used to designate the treatment required to remove primary or secondary caries, to repair damage due to trauma, or to replace

unsatisfactory fillings.

Unacceptable discolouration of a tooth resulting from trauma, a pulpal condition, or a developmental defect was also considered to be a reason for restoration.

Replacement need of a filling or crown was recorded in the absence of caries when there were one or more signs of the following:

- a. a deficient margin to an existing restoration;
- b. an overhanging margin of an existing restoration, causing local irritation, which could not be re-contoured;
- c. fracture of an existing restoration.

Code 5 = Extraction for caries. A tooth was thus recorded when:

- a. caries had so destroyed the crown that it could not be repaired;
- b. caries had progressed to an extent that there was an obvious and open exposure of the pulp; or
- c. only the roots remained.

Code 6 = Extraction for periodontal disease. A tooth was thus recorded when the disease had progressed so far that the tooth was loose or functionless and, in the clinical judgement of the examiner, could not be restored to a firm and

functional state by periodontal therapy.

Code 7 = Extraction for prosthetic reasons. A tooth was thus recorded when extraction was not specifically required because of caries or periodontal disease but, rather, because a full denture was planned.

Code 8 = Extraction for other reasons. A tooth was thus recorded when extraction was required for orthodontic or cosmetic reasons, on account of a developmental defect, or because of impaction.

Code 9 = Other. This category was used to indicate any other treatment not specifically covered by previous codes, e.g. removal of occlusal interferences on restorations.

5.5.6.11 Periodontal Treatment Requirements

Since the periodontal status of each subject was determined by a rapid visual examination it was possible to define the preventive or curative action required only in general terms. Numeric codes were used, as follows:

Code 0 = No treatment necessary. There are no obvious signs of soft deposits, calculus, intense gingivitis or advanced

periodontal involvement.

Code 1 = Oral hygiene instruction. Soft deposits are present in one or more segments but there are no obvious signs of either intense gingivitis or advanced periodontal involvement.

Code 2 = Prophylaxis and oral hygiene instruction. Soft deposits and calculus are present. Intense gingivitis may be recorded in one or more segments, but there is no advanced periodontal involvement.

Code 3 = Periodontal therapy without the extraction of any teeth for periodontal reasons.

Code 4 = Treatment, which includes the extraction of one or more, but not all, teeth for periodontal reasons.

Code 5 = Full extraction.

5.5.6.12 Conditions needing Immediate Attention

"Immediate attention" was taken to mean that, in the judgement of the examiner, pain, infection or serious illness will result unless treatment is provided within the period of time

specified by the examiner.

Criteria used are illustrated in Appendix D; and reference 10.

5.5.6.13 Endodontic Treatment Requirement

(see also 5.4.4.5)

This was recorded separately for anterior and posterior teeth; the number entered signifying the number of teeth requiring treatment in each case.

Pulp treatment not involving devitalisation of the pulp was not scored in this category, but scored vide 5.5.6.12, under pulp treatment. (see also 5.6.12).

5.5.7 Statistical Method.

Methodology was based on principles detailed in references 2., 5., 13. and 15. Its incorporation into microcomputer utilisation for analysis was based on principles and hardware and software characteristics detailed in references 7. and 8..

5.5.7.1 Determination of sample size

A level of confidence of 95% was set as required in survey design. It was therefore necessary to sample the ARA population using sample sizes in the main survey which would:

- a. ensure this reliability for results pertinent to the stratified sample of the whole population;
- b. ensure this reliability for sub-groups of the population deemed significant in terms of the hypotheses.

Stratification (see reference 15., pp. 242; also 5., pp. 64) required that the population be divided into strata such that the mean of the measures investigated, or the proportion having the particular characteristic, differed widely from one stratum to another; and, that the number of members of the population in each stratum was known.

Further, consideration was given to the fact that the

reduction in the standard error of an estimate from a stratified random sample is dependant on the allocation of the total number of units in the sample to the separate simple random samples.

If the allocation is such that the simple random sample size for a stratum is proportional to the number of elementary units in the stratum and their standard deviation, the standard error of the estimate is the minimum possible for the given total sample size. This is optimum allocation. Accordingly, the sample had to be stratified by sub-groups as defined in the hypotheses.

Observations derived from the Pilot Survey of the major factors related to dental care requirements, i.e. surfaces requiring treatment and DMFT, were used to obtain an estimate of their variance.

Using the formula:

$$N = 4 \times \text{SD squared} / E \text{ squared}$$

where N = sample size necessary;

SD = standard deviation of pertinent mean;

E = standard error for desired level of confidence (95%).

it was possible to calculate sample size(s) as required by

the criteria detailed in 5.5.7.1 a. and 5.5.7.1 b..

5.5.7.2, Significance Testing

(see reference 5., pp.81-85)

One of the prime reasons for estimating the standard error of the mean of an observation is to find out whether the difference between this mean and another mean (say, differences in surfaces requiring treatment between sub-groups of the ARA) could have arisen by chance or, instead, is likely to be a reliable finding indicating that the two samples were actually drawn from two different universes (namely, that one or several factors of an environmental or other nature have acted and affected the two groups of soldiers' dental condition differently). Differences were tested using computation of the t value (t-Test).

The formula

$t = \text{difference between means} / \text{standard error of the difference}$

was used in conjunction with a Table of t values, and number of degrees of freedom operating, to calculate the probability of chance occurrence of the difference, and thereby its significance.

This calculation was incorporated into the relevant specification of the computer software designed to carry out analysis of survey findings.

5.5.8 Man-Hour Statistics

(see reference 1.; also 11., pp. 4/9)

Treatment time weighting factors were applied to the raw care needs to obtain the hours of care required for each treatment variable (see Appendix A).

The time factors found at Appendix A were incorporated into the computer program which was used for data tabulation and analysis. The factors were applied to the appropriate treatment need variables in order to provide times that could be used to generate a variety of descriptive statistics.

By converting the number of requirements to a time base (hours), a meaningful estimate of the impact of the need for care on dental resource utilisation can be made.

Provided an accurate estimate of work value of providers of care (e.g. dental officers) is available, in terms of per diem and per annum clinical man-hours, these statistics can be used to determine manning need.

In the case of the ARA dental officer, clinical work value has been

reliably estimated at 6.4 hours per diem, or 1442 hours per annum. (see reference 3.)

For any given component of mean treatment need (variable TN), it was thus possible to calculate annual operator time required for this treatment (variable OT), by:

$$OT = TN \times \text{number of posted troops (N)}$$

The number of dental officers required to complete these treatments (variable DO) can be derived by:

$$DO = OT/1442$$

This number can, of course, be expressed in terms of lesser time available through juxtaposition of the daily work value factor.

Desirable Dental Officer: Troops ratios were derived by:

$$\text{Ratio} = (OT/1442)/DO$$

The above methods of calculation were also used to determine adequate dental officer establishment levels for both the overall ARA, and for relevant sub-groups.

5.6 Results

5.6.1 Sample Characteristics

The distribution of sample sub-groups is shown in Table 1.

Table 1

<u>GROUP</u>	<u>MANNING</u>	<u>WEIGHTING</u>	<u># SELECTED</u>	<u>WEIGHTED SAMPLE</u>
APP	00994	0.031	142	046
OCS	00122	0.004	000	006
RMC	00415	0.013	138	020
REC	03200	0.100	151	150
FF	11621	0.367	553	545
BASE	10948	0.345	519	519
OFFR	04396	0.138	211	207
TOTAL	31696	1.000	1713	1493

1. A total of 1713 patients' completed modified Oral Health and Treatment Assessment Forms(in computer files)comprise the data base for this study.
2. A total of 1487 patients' completed modified Oral Health and Treatment Assessment Forms(in computer files)constitute the stratified sample representing the total ARA population.

3. The distribution of the sample among the years of service (YOS) groups is found in Table 2.

The 3-6 YOS group had the largest input (385 persons), while the groups comprising the 9-12 and >12 YOS were the smallest (comprising 152 and 120 persons respectively).

Table 2

SAMPLE SIZE BY YEARS OF SERVICE GROUP

YEARS OF SERVICE	NUMBER PER GROUP	PERCENT OF TOTAL SAMPLE
0-1	219	014
1-3	327	025
3-6	385	025
6-9	239	016
9-12	152	010
12 or more	120	008
TOTAL	1487	100

4. . Table 3 presents the age distribution of the sample. The over 45 years of age group was the smallest of the age stratification groups.

Table 3

SAMPLE SIZE BY AGE GROUP

YEARS OF AGE	NUMBER PER GROUP	PERCENT OF TOTAL SAMPLE
0-19	347	023
20-24	163	031
25-29	317	021
30-34	207	013
35-44	130	008
45 or older	23	001
TOTAL	1487	100

5. The distribution of the sample by percentage of time served in Field Force (FS) is found in Table 4.

The >74% FS group had the largest input (417 persons), while the groups comprising the 15%-29% and 60%-74% FS were the smallest (comprising 163 and 181 persons respectively).

Table 4

SAMPLE SIZE BY PERCENTAGE OF FIELD FORCE SERVICE

SERVICE IN FF	NUMBER PER GROUP	PERCENT OF TOTAL SAMPLE
15% or less	314	021
15%-29%	163	010
30%-44%	204	013
45%-59%	208	013
60%-74%	181	012
74% or more	417	028
TOTAL	1487	100

6. The officer/other rank distribution by age is found in Table 5.

7. The male/female distribution of the sample by age is found in Table 6.

Table 5

AGE DISTRIBUTION OF OTHER RANKS/OFFICERS

STATUS	MILITARY				YEARS OF AGE			TOTAL
	0-19	20-24	25-29	30-34	35-44	>=45		
O/R #	325	410	241	162	100	16	1254	
O/R %	93.6	88.5	76.0	78.2	76.9	69.5	84.3	
OFFICER #	19	53	76	45	30	7	230	
OFFICER %	5.1	11.4	23.9	21.7	23.0	30.4	15.1	

Table 6

AGE DISTRIBUTION OF SEX IN SAMPLE

AGE	N	MALES		FEMALES	
		#	%	#	%
0-19 YRS	317	329	94.8	15	4.3
20-24 YRS	463	422	91.1	41	8.8
25-29 YRS	317	313	98.7	4	1.2
30-34 YRS	207	205	99.0	2	.9
35-44 YRS	130	128	98.1	2	1.5
>=45 YRS	23	23	100.0	0	.0
TOTAL	1487	1420	95.4	64	4.3

8. The distribution of the sample by state of origin is found in Tables 7a and 7b.

Table 7a

AGE DISTRIBUTION OF SAMPLE BY STATES OF ORIGIN

AGE	N	QLD		NSW		VIC		SA	
		#	%	#	%	#	%	#	%
0-19 YRS	347	22	6.3	137	39.1	76	21.9	49	14.1
20-24 YRS	163	43	9.2	214	46.2	88	19.0	47	10.1
25-29 YRS	317	47	14.0	140	44.1	55	17.3	38	11.9
30-34 YRS	207	33	15.9	110	53.1	30	14.4	16	7.7
35-44 YRS	130	25	19.2	64	49.2	16	12.3	5	3.8
>=45 YRS	23	1	4.3	10	43.4	3	13.0	4	17.3
TOTAL	1487	171	11.4	675	45.3	268	18.0	159	10.6

Table 7b

AGE DISTRIBUTION OF SAMPLE BY STATES OF ORIGIN

AGE	N	WA		TAS		NT	
		#	%	#	%	#	%
0-19 YRS	347	26	7.4	18	5.1	2	.5
20-24 YRS	463	25	5.3	5	1.0	0	.0
25-29 YRS	317	23	7.2	9	2.8	0	.0
30-34 YRS	207	10	4.8	6	2.8	0	.0
35-44 YRS	130	9	6.9	9	6.9	0	.0
>=45 YRS	23	0	.0	5	21.7	0	.0
TOTAL	1487	93	6.2	52	3.4	2	.1

5.6.2 Distribution Characteristics

1. The distribution of missing teeth, other than third molars, and the variables for the number and hours required for restorations, extractions and endodontics are all positively skewed, and have a mode of zero. Positive skewness refers to the graphic interpretation of the distributions described, and indicates that the high point on the vertical axis is located to the left side of the horizontal axis. In cases where the mode is zero, and negative values do not exist, a very positively skewed distribution is described.

Conversely, the preventive care variables were negatively skewed. Such distributions do not fit the normal curve, and mean, median and standard deviation values are therefore not necessarily the most appropriate description of central tendency. However, these measures are in common use in the presentation of dental research findings; therefore they were used in the presentation of the findings of this study.

2. Percentage distributions and cumulative percentages provide meaningful statistics in respect of treatment variables.

3. Examples of the usefulness of sample distributions are:
86.3% of teeth present required no restorations;
only 1.4% of teeth present required restorations of 3 or more

surfaces.

4. The mean, in skewed populations as described, is strongest in interpreting time or cost-related concerns. When a treatment time conversion factor (see Appendix A) is applied, the mean is of particular significance in predicting the treatment time requirements for specific population groups such as man hours required per single member, or units.

Cost factors can also be applied to the means in order to predict population treatment costs.

5. Distribution percentages of binary (yes/no) variables completely describe the population in terms of practical significance. The use of mean values for such data, when used to facilitate computation of projected time considerations, is an appropriate method for estimating man-hour requirements.

5.6.3 Reliability of Data

Data reliability was determined by using the standard error of the mean to calculate the 95% confidence intervals for variable means and rates.

5.6.4 Demographic Analysis

1. Means and standard deviations/errors are included in descriptive statistics of the stratified population sample and in descriptive statistics of the sub-groups described in terms of the hypotheses.

2. Differences between groups were tested for significance (see 5.5.7), where appropriate. These findings are described in the Discussion of Findings.

3. The stratified sample of the whole population was used to draw conclusions and to make projections in respect of the ARA as a whole. This allows for ease of overall planning for the Dental Services, based on survey findings.

These findings also act as base line data for comparison with sub-group findings.

4. Sub-group findings were used to detect significant

differences relevant to the hypotheses. These findings will allow for detailed and regional planning of the Dental Services, with particular emphasis on establishment/manning needs, and projections in terms of anticipated incidence and prevalence of dental disease in these groups.

5.6.5 Service Utilisation

1. Utilisation of dental services, by age and in categories of within 1 year, 2 years, 3 years or more than 3 years of survey, is described in Table 8 for the whole stratified sample.

Table 8

LAST ACCESS TO DENTAL CARE OF SAMPLE BY AGE

AGE	N	< 1 YR		< 2 YRS		< 3 YRS		> 3 YRS	
		#	%	#	%	#	%	#	%
0-19 YRS	347	228	65.7	70	20.1	22	6.3	27	7.7
20-24 YRS	463	310	66.9	96	20.7	39	8.4	18	3.8
25-29 YRS	317	233	73.5	57	17.9	16	5.0	11	3.4
30-34 YRS	207	148	71.4	44	21.2	9	4.3	6	2.8
35-44 YRS	130	83	63.8	30	23.0	7	5.3	10	7.6
>=45 YRS	23	12	52.1	8	34.7	0	.0	3	13.0
TOTAL	1487	1014	68.1	305	20.5	93	6.2	75	5.0

2. Responses to the WHO Oral Health Assessment and Treatment Form service utilisation component for the whole stratified sample are summarised in Tables 9 to 15

These Tables are annotated for modification of WHO coding for Army purposes, as applicable.

Table 9

RESPONSE TO QUESTION 1 BY AGE

AGE	N	#	YES	#	NO
			%		%
0-19 YRS	347	241	69.4	106	30.5
20-24 YRS	463	348	75.1	113	24.4
25-29 YRS	317	261	83.2	53	16.7
30-34 YRS	207	161	77.7	46	22.2
35-44 YRS	130	94	72.3	36	27.6
>=45 YRS	23	15	65.2	6	26.0
TOTAL	1487	1123	75.5	360	24.2

NOTE: Question 1 is: " Did you obtain dental care in the last 12 months?"

Table 10a

RESPONSE TO QUESTION 1A BY AGE

AGE	N	1		2		3		4	
		#	%	#	%	#	%	#	%
0-19 YRS	241	7	2.9	27	11.2	64	26.5	101	41.9
20-24 YRS	348	19	5.4	32	9.1	133	38.2	123	35.3
25-29 YRS	264	22	8.3	17	6.4	50	18.9	144	54.5
30-34 YRS	161	16	9.9	23	14.2	31	19.2	64	39.7
35-44 YRS	94	13	13.8	5	5.3	22	23.4	43	45.7
>=45 YRS	15	0	.0	0	.0	7	46.6	6	40.0
TOTAL	1123	77	6.8	104	9.2	307	27.3	481	42.8

NOTE: Question 1a is: "For what reason?"
 Codes are: 1=to get teeth cleaned;
 2=something was hurting;
 3=to get something fixed;
 4=check-up

Table 10b

RESPONSE TO QUESTION 1A BY AGE

AGE	N	5		6		7	
		#	%	#	%	#	%
0-19 YRS	241	7	2.9	33	13.6	2	.8
20-24 YRS	348	10	2.8	32	9.1	1	.2
25-29 YRS	264	7	2.6	24	9.0	0	.0
30-34 YRS	161	2	1.2	24	14.9	1	.6
35-44 YRS	94	0	.0	11	11.7	0	.0
>=45 YRS	15	2	13.3	2	13.3	0	.0
TOTAL	1123	28	2.4	126	11.2	4	.3

NOTE: 5=was sent an appointment
 6=other
 7=don't know

Table 11

RESPONSE TO QUESTION 1B BY AGE

AGE	N	1 #	%	2 #	%	3 #	%	4 #	%	5 #	%
0-19	241	140	58.0	20	8.2	0	.0	26	10.7	49	20.3
20-24	348	244	70.1	32	9.1	2	.5	41	11.7	22	6.3
25-29	264	213	80.6	22	8.3	0	.0	21	7.9	7	2.6
30-34	161	114	70.8	20	12.4	0	.0	23	14.2	2	1.2
35-44	94	75	79.7	10	10.6	0	.0	9	9.5	0	.0
>=45	15	15	100	0	.0	0	.0	0	.0	0	.0
TOTAL	1123	803	71.5	104	9.2	2	.1	120	10.6	80	7.1

NOTE: Question 1b is: "Who treated you?"

Codes are: 1=Dental Officer;

2=Army Dental Hygienist;

3=civilian dentist employed by Army;

4=own civilian dentist;

5=other.

Table 12a

RESPONSE TO QUESTION 1C BY AGE

AGE	N	1 #	%	2 #	%	3 #	%	4 #	%	5 #	%
0-19	106	50	47.1	3	2.8	3	2.8	1	.9	8	7.5
20-24	113	52	46.0	6	5.3	10	8.8	0	.0	18	15.9
25-29	53	31	58.4	3	5.6	6	11.3	0	.0	2	3.7
30-34	46	23	50.0	2	4.3	4	8.6	0	.0	8	17.3
35-44	36	17	47.2	0	.0	2	5.5	2	5.5	4	11.1
>=45	6	6	100	0	.0	0	.0	0	.0	0	.0
TOTAL	360	179	49.7	14	3.8	25	6.9	3	.8	40	11.1

NOTE: Question 1c is: "Why not?"

Codes are: 1=nothing wrong;

2=afraid of dentists;

3=prevented by duty;

4=prevented by leave;

5=too busy.

Table 12b

RESPONSE TO QUESTION 1C BY AGE

AGE	N	#	6 %	#	7 %	#	8 %	#	9 %
0-19	106	8	7.5	0	.0	12	11.3	11	10.3
20-24	113	8	7.0	0	.0	8	7.0	8	7.0
25-29	53	0	.0	1	1.8	7	13.2	0	.0
30-34	46	1	2.1	4	8.6	0	.0	2	4.3
35-44	36	3	8.3	0	.0	2	5.5	2	5.5
>=45	6	0	.0	0	.0	0	.0	0	0
TOTAL	360	20	5.5	5	1.3	29	8.0	23	6.3

NOTE: Question 1c is: "Why not?"
 Codes are: 6=no service;
 7=full dentures;
 8=other;
 9=don't know.

Table 13a

RESPONSE TO QUESTION 2 BY AGE

AGE	N	#	0 %	#	1 %	#	2 %
0-19 YRS	347	221	63.6	96	27.6	3	.8
20-24 YRS	463	288	62.2	129	27.8	5	1.0
25-29 YRS	317	196	61.8	86	27.1	9	2.8
30-34 YRS	207	132	63.7	35	16.9	5	2.4
35-44 YRS	130	77	59.2	31	23.8	2	1.5
>=45 YRS	23	18	78.2	1	4.3	0	.0
TOTAL	1487	932	62.6	378	25.4	24	1.6

NOTE: Question 2 is: "Is anything wrong with your teeth, gums or mouth now?"
 Codes are: 0=No;
 1=yes, teeth only;
 2=yes, gums only.

Table 13b
RESPONSE TO QUESTION 2 BY AGE

AGE -	N	3		4		9	
		#	%	#	%	#	%
0-19 YRS	347	4	1.1	15	4.3	8	2.3
20-24 YRS	463	6	1.2	28	6.0	7	1.5
25-29 YRS	317	4	1.2	17	5.3	5	1.5
30-34 YRS	207	14	6.7	19	9.1	2	.9
35-44 YRS	130	2	1.5	14	10.7	4	3.0
> 45 YRS	23	0	.0	4	17.3	0	.0
TOTAL	1487	30	2.0	97	6.5	26	1.7

NOTE: Question 2 is: "Is anything wrong with your teeth, gums or mouth now?"

Codes are: 3=yes, teeth and gums

4=yes, other

9=don't know

Table 14
RESPONSE TO QUESTION 2A BY AGE

AGE	N	YES		NO	
		#	%	#	%
0-19 YRS	347	131	37.7	215	61.9
20-24 YRS	463	210	45.3	253	54.6
25-29 YRS	317	159	50.1	158	49.8
30-34 YRS	207	80	38.6	127	61.3
35-44 YRS	130	62	47.6	68	52.3
>=45 YRS	23	10	43.4	13	56.5
TOTAL	1487	652	43.8	834	56.0

NOTE: Question 2a is: "Do you want any dental advice or treatment?"

Table 15a
RESPONSE TO QUESTION 2B BY AGE

AGE	N	0		1		2		3		4	
		#	%	#	%	#	%	#	%	#	%
0-19	131	13	9.9	28	21.3	6	4.5	38	29.0	5	3.8
20-24	210	12	5.7	48	22.8	17	8.0	48	22.8	2	.9
25-29	159	8	5.0	26	16.3	26	16.3	31	19.4	0	.0
30-34	207	6	7.5	20	25.0	9	11.2	12	15.0	0	.0
35-44	130	6	9.6	9	14.5	10	16.1	13	20.9	0	.0
>=45	23	0	.0	0	.0	5	21.7	0	.0	0	.0
TOTAL	652	45	6.9	131	20.0	73	11.1	142	21.7	7	1.0

NOTE: Question 2b is: "What sort of advice or treatment do you want?"

Codes are: 0=preventive;
1=exam or cleaning;
2=scaling or periodontal care;
3=fillings, crowns or bridges;
4=extraction or other surgery.

Table 15b
RESPONSE TO QUESTION 2B BY AGE

AGE	N	5		6		7		8		9	
		#	%	#	%	#	%	#	%	#	%
0-19	131	5	3.8	3	2.2	12	9.1	13	9.9	9	6.8
20-24	210	9	4.2	5	2.3	32	15.2	21	10.0	16	7.6
25-29	159	13	8.1	4	2.5	35	22.0	12	7.5	4	2.5
30-34	207	7	8.7	0	.0	10	12.5	11	13.7	5	6.2
35-44	130	9	14.5	0	.0	11	17.7	1	1.6	3	4.8
>=45	23	0	.0	0	.0	3	13.0	2	8.7	0	.0
TOTAL	652	43	6.5	12	1.8	103	15.7	60	9.2	37	5.6

Codes are: 5=dentures;
6=orthodontic care;
7=more than one of the above categories;
8=other;
9=don't know.

5.6.6 Disorders of Mucosa, Teeth, and Bone and Other Conditions

Tables 16 to 19 give a binary description of the prevalence of these disorders in the stratified sample for the whole population. Disorders and Other Conditions where found were specified. The detail of these specifications is contained in the data base for this study, but not included in this text.

Table 16

DISTRIBUTION OF ORAL MUCOSAL DISEASE IN SAMPLE BY AGE

AGE	N	WITH		WITHOUT	
		#	%	#	%
0-19 YRS	347	23	6.6	322	92.7
20-24 YRS	463	15	3.2	448	96.7
25-29 YRS	317	21	6.6	296	93.3
30-34 YRS	207	23	11.1	134	88.8
35-44 YRS	130	10	7.6	120	92.3
>=45 YRS	23	0	.0	23	100.0
TOTAL	1487	92	6.1	1393	93.6

Table 17

DISTRIBUTION OF DEFECTS OF TEETH IN SAMPLE BY AGE

AGE	N	WITH		WITHOUT	
		#	%	#	%
0-19 YRS	347	19	5.4	328	94.5
20-24 YRS	463	34	7.3	429	92.6
25-29 YRS	317	40	12.6	277	87.3
30-34 YRS	207	24	11.5	183	88.4
35-44 YRS	130	11	8.4	119	91.5
>=45 YRS	23	0	.0	23	100.0
TOTAL	1487	128	8.6	1359	91.3

TABLE 18

DISTRIBUTION OF DISORDERS INVOLVING BONE IN SAMPLE BY AGE

AGE	N	WITH		WITHOUT	
		#	%	#	%
0-19 YRS	347	0	.0	347	100.0
20-24 YRS	463	0	.0	463	100.0
25-29 YRS	317	1	.3	316	99.6
30-34 YRS	207	0	.0	207	100.0
35-44 YRS	130	0	.0	130	100.0
>=45 YRS	23	0	.0	23	100.0
TOTAL	1487	1	.0	1486	99.9

Table 19

DISTRIBUTION OF OTHER CONDITIONS IN SAMPLE BY AGE

AGE	N	WITH		WITHOUT	
		#	%	#	%
0-19 YRS	347	7	2.0	340	97.9
20-24 YRS	463	12	2.5	451	97.4
25-29 YRS	317	6	1.8	311	98.1
30-34 YRS	207	15	7.2	192	92.7
35-44 YRS	130	10	7.6	120	92.3
>=45 YRS	23	2	8.6	21	91.3
TOTAL	1487	52	3.4	1435	96.5

5.6.7 Prosthetic Status

Tables 19a and 19b describe the prosthetic status of the stratified sample of the whole population.

The data base includes distinction between dentures worn/not worn; but the statistics in the Tables as presented do not make this distinction, and, instead, use the criterion of possession of dentures.

Table 19a

PROSTHETIC STATUS OF SAMPLE BY AGE

AGE	N	F. UPPER		F. LOWER		F/F	
		#	%	#	%	#	%
0-19 YRS	34	1	.2	0	.0	0	.0
20-24 YRS	463	12	2.5	5	1.0	5	1.0
25-29 YRS	317	27	8.5	6	1.8	6	1.8
30-34 YRS	207	28	13.5	5	2.4	5	2.4
35-44 YRS	130	40	30.7	18	13.8	18	13.8
>=45 YRS	23	10	43.4	4	17.3	4	17.3
TOTAL	1487	118	7.9	38	2.5	38	2.5

Table 19b

PROSTHETIC STATUS OF SAMPLE BY AGE

AGE	N	P.UPPER		P.LOWER		P/P	
		#	%	#	%	#	%
0-19 YRS	347	7	2.0	0	.0	0	.0
20-24 YRS	463	19	4.1	1	.2	0	.0
25-29 YRS	317	29	9.1	11	3.4	5	1.5
30-34 YRS	207	35	16.9	11	5.3	5	2.4
35-44 YRS	130	19	14.6	10	7.6	0	.0
>=45 YRS	23	8	34.7	10	43.4	5	21.7
TOTAL	1487	117	7.0	43	2.8	15	1.0

5.6.8 Prosthetic Requirement

This requirement is presented as the compound of requirement for both fixed and removable prostheses, excluding obdurators.

The data base distinguishes between requirements for new or replacement dentures, as well as showing requirements for relines or repairs.

The data base also quantifies bridgework required by numbers of units of pontics and abutment teeth.

These distinctions are not made in the data presented in this text, which therefore represents overall prosthetic requirements in Tables 20a and 20b.

Table 20a

FULL DENTURE REQUIREMENT OF SAMPLE BY AGE

AGE	N	F. UPPER		F. LOWER		F/F	
		#	%	#	%	#	%
0-19 YRS	347	0	.0	0	.0	0	.0
20-24 YRS	463	5	1.0	5	1.0	4	.8
25-29 YRS	317	6	1.8	6	1.8	2	.6
30-34 YRS	207	4	1.9	8	3.8	2	.9
35-44 YRS	130	8	6.1	9	6.9	3	2.3
>=45 YRS	23	2	8.6	0	.0	0	.0
TOTAL	1487	25	1.6	28	1.8	11	.7

Table 20b

PARTIAL DENTURE AND BRIDGE REQUIREMENT OF SAMPLE BY AGE

AGE	N	UPPER		LOWER		U/L	
		#	%	#	%	#	%
0-19 YRS	347	13	3.7	10	2.8	4	1.1
20-24 YRS	463	27	5.8	33	7.1	11	2.3
25-29 YRS	317	53	16.7	53	16.7	31	9.7
30-34 YRS	207	42	20.2	44	21.2	22	10.6
35-44 YRS	130	28	21.5	27	20.7	16	12.3
>=45 YRS	23	3	13.0	7	30.4	2	8.6
TOTAL	1487	166	11.1	174	11.7	86	5.7

5.6.9 Periodontal Status

1. Table 21 shows numbers and percent of subjects in sample age groups affected by periodontal conditions.

The data base includes quantitative values of tooth segments(6) affected;these are not presented in this Table.

2. Table 22 gives a binary description of the periodontal treatment requirements of the stratified sample of the whole population.

Categorisation of type of required therapy is included in the data base, but not presented in this Table.

Table 21

SUBJECTS IN SAMPLE AFFECTED BY PERIODONTAL CONDITIONS BY AGE

AGE	N	SOFT DEP.		CALCULUS		INT.GING.		ADV.PER.D.	
		#	%	#	%	#	%	#	%
0-19	347	232	66.8	215	61.9	29	8.3	0	.0
20-24	463	312	67.3	320	69.1	60	12.9	0	.0
25-29	317	227	71.6	222	70.0	30	9.4	0	.0
30-34	207	129	62.3	133	64.2	20	9.6	15	7.2
35-44	130	73	56.1	93	71.5	7	5.3	3	2.3
>=45	23	13	56.5	15	65.2	5	21.7	2	8.6
TOTAL	1487	986	66.3	998	67.1	151	10.1	20	1.3

Table 22

PERIODONTAL TREATMENT REQUIREMENT IN SAMPLE BY AGE

AGE	N	NIL		YES	
		#	%	#	%
0-19 YRS	347	129	37.1	218	62.8
20-24 YRS	463	140	30.2	323	69.7
25-29 YRS	317	98	30.9	219	69.0
30-34 YRS	207	80	38.6	127	61.3
35-44 YRS	130	47	36.1	83	63.8
>=45 YRS	23	12	52.1	11	47.0
TOTAL	1487	506	34.0	981	65.9

5.6.10 Dentofacial Anomalies

Table 23 describes the stratified sample of the whole population in terms of presence/absence of dentofacial anomalies, and in binary terms of treatment requirement.

The data base also includes additional information as to type of past condition and/or treatment, which is not included in this Table.

Table 23

DENTOFACIAL ANOMALIES AND TREATMENT REQUIREMENT IN SAMPLE BY AGE

AGE	WITHOUT			WITH		NO TR.		TREATMENT	
	N	#	%	#	%	#	%	#	%
0-19	347	322	92.7	25	7.2	330	95.1	17	4.8
20-24	463	438	94.6	25	5.3	453	97.8	10	2.1
25-29	317	308	97.1	9	2.8	313	98.7	4	1.2
30-34	207	202	97.5	5	2.4	205	99.0	2	.9
35-44	130	128	98.4	2	1.5	130	100.0	0	.0
>=45	23	23	100.0	0	.0	23	100.0	0	.0
TOTAL	1487	1421	95.5	66	4.4	1454	97.7	33	2.2

5.6.11 Immediate Attention

1. Table 24 describes the immediate attention or emergency care requirements of the stratified sample of the whole population. It contains binary information on requirement, as well as information on type of therapy required (i.e. for conditions causing pain and/or infection, conditions likely to cause pain and/or infection in the immediate future, and for pulp treatment).
2. It should be noted that, as a result of subjective decisions by examiners as to the immediacy of requirement for care, the binary statistics in the Table represent absolute emergency care requirement, whereas categories of care statistics include cases where immediacy was not considered absolute. This undesirable subjectivity in data collection was recognised too late in the study for effective remedial action.

Table 24

IMMEDIATE ATTENTION REQUIREMENT OF SAMPLE BY AGE

AGE	YES			NO			PAIN/INF.		LIKELY TO		PULP TR.	
	N	#	%	#	%	%	#	%	#	%	#	%
0-19	347	33	9.5	314	90.4		25	7.2	18	5.1	5	1.4
20-24	463	44	9.5	419	90.4		20	4.3	27	5.8	14	3.0
25-29	317	16	5.0	301	94.9		7	2.2	10	3.1	1	.3
30-34	207	13	6.2	194	93.7		5	2.4	5	2.4	3	1.4
35-44	130	7	5.3	123	94.6		4	3.0	4	3.0	0	.0
>=45	23	2	8.6	21	91.3		2	8.6	0	.0	0	.0
TOTAL	1487	115	7.7	1372	92.2		63	4.2	64	4.3	23	1.5

5.6.12 Endodontic Care

1. Table .25 describes the endodontic care requirements for the stratified sample of the whole population.
 2. The yes/no part of the Table excludes requirement for pulpotomies; thus expressing absolute requirement for root canal therapy only.
 3. The remainder of the Table divides requirement between anterior and posterior teeth, and includes pulpotomies and pulp dressings.
- It thus reflects the overall endodontic care requirement of the sample, by anterior and posterior teeth.

Table 25

ENDODONTIC CARE REQUIREMENT OF SAMPLE BY AGE

AGE	N	NO #	%	YES #	%	ANTERIOR #	%	POSTERIOR #	%
0-19	347	323	93.0	24	6.9	8	2.3	17	4.8
20-24	463	439	94.8	24	5.1	15	3.2	15	3.2
25-29	317	305	96.2	12	3.7	1	.3	11	3.4
30-34	207	197	95.1	10	4.8	3	1.4	7	3.3
35-44	130	128	98.4	2	1.5	2	1.5	1	.7
>=45	23	23	100.0	0	.0	0	.0	0	.0
TOTAL	1487	1415	95.1	72	4.8	29	1.9	51	3.4

5.6.13 Missing Teeth

Table 26 describes the stratified sample of the whole population in terms of subjects with less than 21 teeth standing, less than 15 teeth standing, and who are edentulous.

Table 26

NUMBER OF STANDING TEETH CATEGORIES FOR SUBJECTS IN SAMPLE BY AGE

AGE	N	WITH <21		WITH <15		EDENTULOUS	
		#	%	#	%	#	%
0-19 YRS	347	4	1.1	1	.2	0	.0
20-24 YRS	463	4	.8	7	1.5	3	.6
25-29 YRS	317	9	2.8	19	5.9	6	1.8
30-34 YRS	207	17	8.2	25	12.0	5	2.4
35-44 YRS	130	12	9.2	22	16.9	18	13.8
>=45 YRS	23	5	21.7	10	43.4	4	17.3
TOTAL	1487	51	3.4	84	5.6	36	2.4

5.6.14 Restorations

1. Table 27 describes the stratified sample of the whole population in terms of numbers and percentages of teeth requiring no restorations, one-to three-surface restorations, and three-or more surface restorations and crowns.
2. Abutment restorations for prescribed bridgework are included.
3. It should be noted that, using the charting format of the WHO Oral Health and Treatment Assessment Form, it was not possible to distinguish between, say, a tooth requiring two single-surface restorations, and one requiring a two-surface restoration. Both teeth would appear in the data base as requiring two-surface restorations.

Table 27

NUMBERS OF TEETH REQUIRING RESTORATIONS IN SAMPLE BY SUBJECT AGE

AGE	NIL			1-SURFACE		2-SURFACE		3-SURFACE		>3/CROWN	
	N	#	%	#	%	#	%	#	%	#	%
0-19	347	8180	86.2	880	9.2	221	2.3	64	.6	106	1.1
20-24	463	10958	86.4	1046	8.2	405	3.1	105	.8	130	1.0
25-29	317	7008	86.4	581	7.1	255	3.1	117	1.4	121	1.4
30-34	207	4179	85.8	326	6.6	142	2.9	89	1.8	107	2.1
35-44	130	2113	87.3	126	5.2	77	3.1	41	1.6	65	2.6
>=45	23	257	83.9	15	4.9	3	.9	0	.0	3	.9
TOTAL	1487	32695	86.3	2974	7.8	1103	2.9	416	1.0	532	1.4

5.6.15 Teeth for Extraction

Table 28 describes the stratified sample of the whole population in terms of numbers and percentages of teeth for extraction for caries, periodontal disease, full dentures and other reasons.

Table 28

CATEGORIES OF TEETH FOR EXTRACTION IN SAMPLE BY SUBJECT AGE

AGE	N	CARIES.		PERIO		DENTURES		OTHER	
		#	%	#	%	#	%	#	%
0-19	347	15	.1	0	.0	0	.0	48	.5
20-24	463	30	.2	1	.0	0	.0	58	.4
25-29	317	13	.1	18	.2	0	.0	39	.4
30-34	207	21	.4	17	.3	0	.0	19	.3
35-44	130	0	.0	13	.5	0	.0	1	.0
>=45	23	0	.0	22	7.1	6	1.9	0	.0
TOTAL	1487	79	.2	71	.1	6	.0	165	.4

5.6.16 DMFT and related Findings

1. Mean values for DMFT for age groups in the stratified sample of the whole population, together with their standard errors and deviations, are presented in Table 29a.

Table 29a

MEAN DMFT FOR WHOLE SAMPLE BY AGE

AGE	#	%	MEAN	S.DEV	S.ERR	D/DMF	F/DMF	M/DMF
0-19 YRS	347	23	10.14	5.27	.28	.344	.530	.125
20-24 YRS	463	31	13.62	5.95	.27	.249	.574	.175
25-29 YRS	317	21	17.64	5.79	.32	.171	.564	.263
30-34 YRS	207	13	20.08	5.73	.39	.132	.471	.395
35-44 YRS	130	8	22.68	6.47	.56	.086	.361	.552
>=45 YRS	23	1	23.56	6.14	1.28	.062	.154	.782

2. Mean values for DMFT grouped by years of service in the stratified sample of the whole population, are similarly presented in Table 29b.

Table 29b

MEAN DMFT FOR SAMPLE BY YEARS OF SERVICE

<u>SERVICE</u>	<u>#</u>	<u>%</u>	<u>MEAN</u>	<u>S.DEV</u>	<u>S.ERR</u>	<u>D/DMF</u>	<u>F/DMF</u>	<u>M/DMF</u>
<1 YR	219	14	11.54	5.91	.39	.399	.400	.200
1-3 YRS	372	25	12.75	6.69	.34	.242	.530	.227
3-6 YRS	385	25	15.84	6.62	.33	.171	.540	.288
6-9 YRS	239	16	10.39	6.66	.43	.137	.503	.358
9-12 YRS	152	10	17.82	6.29	.51	.137	.580	.282
>12 YRS	120	8	21.61	5.76	.52	.156	.443	.400

3. Mean values for DMFT grouped by percentage of service in Field Force out of total service, in the stratified sample of the whole population, are similarly presented in Table 29c.

Table 29c

MEAN DMFT OF SAMPLE BY PERCENTAGE OF SERVICE IN FIELD FORCE

<u>% TIME FF</u>	<u>#</u>	<u>% MEAN</u>	<u>S.DEV</u>	<u>S.ERR</u>	<u>D/DMF</u>	<u>F/DMF</u>	<u>M/DMF</u>
<15%	314	21 14.46	6.69	.37	.260	.482	.257
15%-29%	163	10 15.78	7.47	.58	.139	.518	.341
30%-44%	204	13 14.65	6.84	.47	.199	.581	.219
45%-59%	208	13 15.55	7.40	.51	.202	.494	.302
60%-74%	181	12 15.81	7.51	.55	.189	.509	.301
>74%	417	28 16.47	6.95	.34	.182	.500	.316

4. The Tables (29a,29b,29c) also present values for the related indices of D/DMFT,F/DMFT and M/DMFT.

Total values for Tables 29a,29b,29c:

Sample N = 1487

Sample mean DMFT = 15.52

Standard deviation DMFT = 7.12

Standard error DMFT = .18

D/DMFT = .199

F/DMFT = .510

M/DMFT = .291

Mean FT(decayed teeth not counted)= 7.91

Mean FT(decayed teeth counted)=9.02

Adjusted F/DMFT = .581

5. Note that, as recommended by Dunning et al., (see reference 5., pp. 331; also 15.) teeth with secondary decay are counted only once, as DT., in DMFT sum.

As also recommended by Dunning, two kinds of FT values are presented, including or not including teeth which are both filled and decayed. (see reference 5., pp. 331, 1.)

6. Note further that, similarly recommended by the literature, teeth for immediate extraction are counted as MT in the DMFT sum. (see reference 5., pp. 331, 1.)

7. Tables 30-35 present mean DMFT findings by age, in sub-groups of the ARA population considered considered to be of major relevance in this study.

Table 30

MEAN DMFT OF RECRUIT SUB-GROUP BY AGE

AGE	#	%	MEAN	S.DEV	S.ERR	D/DMF	F/DMF	M/DMF
0-19 YRS	107	70	11.54	5.28	.51	.482	.378	.138
20-24 YRS	34	22	13.08	6.26	1.07	.438	.352	.208
25-29 YRS	7	4	21.57	5.44	2.05	.165	.026	.807
30-34 YRS	2	1	23.00	1.00	.70	.500	.195	.304
35-44 YRS	1	0	19.00	0	0		.684	.315

Total values for Table:

Recruit N = 151

Mean DMFT = 12.56

Standard deviation of DMFT = 6.02

Standard error of DMFT = .49

D/DMFT = .442

F/DMFT = .343

M/DMFT = .214

Mean FT(decayed teeth not counted) = 4.31

Mean FT(decayed teeth counted) = 5.36

Adjusted F/DMFT = .427

Table 31

MEAN DMFT FOR STAFF CADET SUB-GROUP BY AGE

AGE	#	%	MEAN	S.DEV	S.ERR	D/DMF	F/DMF	M/DMF
0-19 YRS	112	81	9.15	5.78	.54	.272	.683	.043
20-24 YRS	26	18	11.50	6.13	1.20	.264	.675	.060

Total values for Table:

Staff Cadet N = 138

Mean DMFT = 9.59

Standard deviation DMFT = 5.93

Standard error DMFT = .505

D/DMFT = .270

F/DMFT = .682

M/DMFT = .047

Mean FT(decayed teeth not counted) = 6.54

Mean FT(decayed teeth counted) = 7.43

Adjusted F/DMFT = .774

Table 32

MEAN DMFT OF OFFICER SUB-GROUP BY AGE

AGE	#	%	MEAN	S.DEV	S.ERR	D/DMF	F/DMF	M/DMF
20-24 YRS	58	27	11.70	5.39	.70	.232	.723	.044
25-29 YRS	81	38	17.33	5.49	.61	.154	.667	.178
30-34 YRS	37	17	20.62	4.28	.70	.112	.744	.142
35-44 YRS	27	12	18.88	6.19	1.19	.190	.486	.323
>=45 YRS	8	3	20.62	5.02	1.77	.090	.351	.557

Total values for Table:

Officer N = 211

Mean DMFT = 16.69

Standard deviation DMFT = 6.29

Standard error DMFT = .433

D/DMFT = .163

F/DMFT = .654

M/DMFT = .183

Mean FT(decayed teeth not counted) = 10.91

Mean FT(decayed teeth counted) = 12.33

Adjusted F/DMFT = .739

Table 33

MEAN DMFT OF FIELD FORCE SUB-GROUP BY AGE

AGE	#	%	MEAN	S.DEV	S.ERR	D/DMF	F/DMF	M/DMF
0-19 YRS	125	22	9.79	5.20	.46	.308	.544	.147
20-24 YRS	222	40	13.15	5.69	.38	.283	.564	.152
25-29 YRS	103	18	17.37	5.27	.51	.199	.549	.251
30-34 YRS	70	12	18.98	5.91	.70	.172	.410	.417
35-44 YRS	31	5	23.32	5.94	1.06	.089	.302	.607
>=45 YRS	2	0	24.00	1.00	.70	.104	.375	.520

Total values for Table:

Field Force N = 553

Mean DMFT = 14.53

Standard deviation DMFT = 6.73

Standard error DMFT = .286

D/DMFT = .232

F/DMFT = .508

M/DMFT = .261

Mean FT(decayed teeth not counted) = 7.38

Mean FT(decayed teeth counted) = 8.53

Adjusted F/DMFT = .587

Table 34

MEAN DMFT OF BASE TROOPS SUB-GROUP BY AGE

AGE	#	%	MEAN	S.DEV	S.ERR	D/DMF	F/DMF	M/DMF
0-19 YRS	52	10	10.07	4.46	.61	.246	.641	.112
20-24 YRS	177	34	14.86	6.27	.47	.165	.594	.239
25-29 YRS	124	23	17.13	6.13	.55	.135	.571	.292
30-34 YRS	82	15	19.39	6.28	.69	.094	.418	.486
35-44 YRS	71	13	23.00	7.03	.83	.048	.336	.614
>=45 YRS	13	2	25.23	4.77	1.32	.060	.042	.896

Total values for Table:

Base Troop N = 519

Mean DMFT = 17.01

Standard deviation DMFT = 7.20

Standard error DMFT = .316

D/DMFT = .125

F/DMFT = .492

M/DMFT = .383

Mean FT(decayed teeth not counted) = 8.37

Mean FT(decayed teeth counted) = 9.22

Adjusted F/DMFT = .542

Table 35

MEAN DMFT OF ARMY APPRENTICE SUB-GROUP BY AGE

AGE	#	%	MEAN	S.DEV	S.ERR	D/DMF	F/DMF	M/DMF
0-19 YRS	141	100	8.80	5.23	.44	.257	.668	.074

Additional values for Table:

Mean FT(decayed teeth not counted)=5.89

Mean FT(decayed teeth counted)= 6.81

Adjusted F/DMFT = .773

5.6.17 Effect of Restorative Care

1. The data base contains information on tooth surfaces requiring treatment, distinguishing between this requirement arising through caries, or for other reasons.

2. Tables 36a and 36b describe the relationship of this total requirement for the stratified sample of the whole population, to the indices of DMFT and FT.

3. Standard errors and deviations are given for the age group and sample mean surface treatment requirement, as are sample mean FT values (adjusted, and unadjusted for decayed tooth count).

4. It should be noted that positive values for number of surfaces requiring treatment occur in Table 36a in the group with 0 DMFT.

This apparent anomaly is explained by the fact that the DT component of DMFT is arrived at by counting decayed teeth only. Thus, a dentition unaffected by decay and with no filled or missing teeth may still require restorative treatment of surfaces for cosmetic, or other, reasons.

Table 36a

MEAN NUMBER OF TOOTH SURFACES IN SAMPLE REQUIRING TREATMENT BY
DMFT

<u>DMFT</u>	<u>N</u>	<u>%</u>	<u>MEAN</u>	<u>S.DEV</u>	<u>S.ERR</u>
0	16	1	.25	0	0
1-5	97	6	2.12	3.32	.33
6-11	359	24	4.22	4.50	.23
12-17	436	29	5.85	5.84	.27
18-23	358	24	7.89	7.93	.41
> 24	221	14	6.57	8.95	.60

Table 36b

MEAN NUMBER OF TOOTH SURFACES IN SAMPLE REQUIRING TREATMENT BY FT

<u>FT</u>	<u>N</u>	<u>%</u>	<u>MEAN</u>	<u>S.DEV</u>	<u>S.ERR</u>
0	104	6	3.30	4.89	.48
1-5	337	22	5.79	6.84	.37
6-11	559	37	5.53	6.19	.26
12-17	368	24	5.77	5.98	.31
18-23	114	7	8.64	10.52	.98
> 24	5	0	10.00	11.45	5.12

Additional values for Tables 36a and 36b

Sample N = 1487

Mean number of surfaces requiring treatment = 5.75

Standard deviation surfaces = 8.87

Standard error surfaces = .23

D/DMFT = .199

F/DMFT = .510

M/Dmft = .292

Mean FT(decayed teeth not counted)=7.91

Mean FT(decayed teeth counted)=9.02

Adjusted F/DMFT = .581

5.6.18 Dental Fitness

1. The ARA Dental Fitness Classification for the stratified sample of the whole population, and for significant sub-groups, is presented in Table 37.

2. The classification criteria used were those specified in the Manual of Personnel Administration, Volume 3, Chapter 36. (see reference 4.)

Classes 1 and 2 are deemed dentally fit, and contain those patients whose dental condition is not likely to render them unfit for duty within the next 6 months of examination.

Classes 3 and 4 are deemed dentally unfit, i.e. in need of either immediate/emergency dental care, or whose dental condition could render them unfit for duty within the next 6 months of examination.

Table 37

GROUP DISTRIBUTION OF DENTAL FITNESS

GROUP	N	% CL.1 CL.2 CL.3 CL.4			
FF	553	13	59	23	3
BASE	519	31	54	9	5
RECRUITS	151	14	43	28	13
OFFICERS	211	30	52	15	1
CADETS	138	29	56	13	0
APPRENTICE	141	29	51	18	0
ARA	1487	22	54	19	4

5.6.19 Dental Care Requirement Components

1. Table 38 shows the requirements for components of dental care, for the stratified sample of the whole population and for significant sub-groups.

2. The components of dental care selected for analysis were:

Emergency/immediate care;

Oral Hygiene and Preventive Care;

Restorative care;

Prosthetic care; and

Specialist care (of the type not provided within the Service).

Table 38

PERCENT REQUIRING COMPONENTS OF DENTAL CARE BY GROUPS

GROUP	% req EM/IM	% req OH/PV	% req REST.	% req PROS.	% req SPEC.
FF	50	79	84	20	2
BASE	33	57	66	21	3
RECRUITS	54	86	85	15	1
OFFICERS	17	81	69	13	1
CADETS	12	54	68	2	2
APPRENTICE	21	53	66	4	5
ARA	41	71	75	19	2

5.6.20 Dental Care Requirement weighted by Man-Hours

1. Dental man hour requirements, stratified into dental care components, are presented in Table 39, for the stratified sample of the whole population as well as for the significant sub-groups.
2. The weightings used were those developed by Cassidy et al. in studies of US Service personnel (see Appendix A).
3. The above information allows derivation of statistics on numbers and percentages of patients in the sample requiring dental care, as well as on commitment, in terms of man-hours and/or chairside time for patients, dental officers and dental hygienists. The data base also offers this information in respect of other auxiliaries (e.g. technicians), but this has not been tabulated in this text.
4. Table 40 presents these statistics and allows for extrapolation of values of time committed on dental care by the soldier in a given group, i.e. the interference factor with his other military duties; similarly it allows for extrapolation of dental man-hour figures for dental officers and dental hygienists, which, inter alia, enable calculation of necessary manning and establishments to provide effective care.

Table 39

MEAN DENTAL MAN HOURS PER TYPES OF CARE BY GROUPS

GROUP	for EM/IM	for OH/PV	for REST.	for PROS.	for SPEC.
FF	0.51	1.61	2.04	0.40	0.04
BASE	0.34	1.10	1.29	0.42	0.05
RECRUITS	0.55	1.73	2.78	0.31	0.03
OFFICERS	0.17	1.57	1.99	0.26	0.03
CADETS	0.12	1.01	1.18	0.04	0.04
APPRENTICE	0.22	0.98	1.45	0.08	0.11
ARA	0.41	1.41	1.88	0.39	0.04

Table 40

NUMBERS AND PERCENT OF GROUPS REQUIRING CARE, WITH TIME COMMITMENT
IN HOURS

GROUP	N	% req care	HRS. PAT.	HRS. D/O	HRS. PREV.
FF	553	86	4.86	3.20	1.62
BASE	519	68	3.38	2.21	1.10
RECRUITS	151	85	5.68	3.92	1.73
OFFICERS	211	69	4.11	2.50	1.57
CADETS	138	70	2.47	1.41	1.01
APPRENTICE	141	70	2.96	1.87	0.98
ARA	1487	77	4.35	2.89	1.41

5.7.1 Research Design

5.7.1.1 WHO format of Oral Health Survey

Use of this survey method, with minor modifications, provided a comprehensive data base adequate unto the needs of this study, and containing base line data for use in future studies.

The method provided an array of variables which were easily managed by the computer software designed, thus enabling a wide range of analytical capabilities for the research team. The only major criticisms of use of this method in this type of study would be:

1. the incompatibility of its charting method with those in use in Army documentation, leading to difficulty in matching hard copy printouts of individual patients' survey data with normal treatment records;
2. the absence of geomorphic data on existing and required restorations in the charting. This reduces (although not significantly) the accuracy of weighting for man-hours applied

to the restorative component of dental care, and leads to a data base which fails to provide information on the real extent and physical size of restorations found in the sample.

5.7.1.2 Sample Selection

It is considered that this, finance permitting, could have been improved in two ways, as follows:

1. by inclusion in the sample of Special Air Service/Commando soldiers, who constitute a numerically small, but probably significant, sub-group of the ARA population;
2. by the sampling of all three Task Forces, instead of one, to detect statistically significant differences in their care requirements.
3. by geographic stratification of the sample of the whole population.

Nevertheless, the sample selection as carried out appears to have resulted in "best estimates" of major findings in terms of the hypothesis.

This is borne out by the fact that the stratified sample of

the whole ARA population, as selected, tallied closely with population characteristics such as sex, years of service and age, which were not allowed for in stratification through research design.

According to CARO figures:

females constitute 12% of the 20-25 year age group in the ARA (c.f. 8.8% in same age group in sample);
the largest group by years of service is the 3-6 YOS group (c.f. Table 2);
the largest group by age is the 20-30 year group (c.f. Table 3).

5.7.1.3 Radiography

The decision to utilise bitewing radiography in the diagnosis of caries was based on the objective of the survey to determine treatment requirements of the sample as accurately as possible.

Although no records were kept of pre-radiography findings of caries in the data base of the main survey, such records were kept for data from the pilot survey.

This allowed comparison of treatment requirement statistics for restorative treatment (mean # of surfaces requiring treatment) before and after scrutiny of radiographs.

Results of this comparison are as follows: (pre-and

post-radiography)

GROUP	PRE- RADIOGRAPHY	POST- RADIOGRAPHY
FF	4.1	5.8
BASE	4.3	6.1
REC	5.4	5.6
OFFR	4.9	5.8
OCS	2.3	4.2
RMC	2.2	4.9
APP	1.2	2.2

It can be seen from this that the mean difference between findings before and after radiography is 1.4 surfaces.

It can further be seen that the difference is subject to considerable variance between groups.

5.7.2 Implementation

5.7.2.1 Survey Team

The study proved conclusively that team size was adequate and that little or no knowledge of computers is required in a team for a survey using microcomputers, provided that:

1. One member, preferably the officer-in-charge, of the team possesses such knowledge, and;
2. Provision is made in planning of the survey for the team to receive basic training in microcomputer application and operation;
3. Members are dental professionals, to exclude the need for tiresome training and familiarisation in oral health matters and glossary;
4. Support is available from local Dental Units, particularly in the scheduling and management of patient flow, and the performance of bitewing radiography;
5. Processing of radiographs is delayed to completion of field work, and undertaken using mass processing

equipment (e.g. Siemens Hospital size);

6. Promulgation of interim reports to Commanders of units visited, and Public Relations exercises, are minimised.

5.7.2.2 Hardware

This proved extremely reliable and suffered no breakdown despite its extensive use during the entire 2-year study period including repeated transportation by car and air to the field, and use and abuse by various operators.

5.7.2.3 Software

The development by the author of this software took up at least 50% of the total time spent on the study project. The fact that no similar application software existed at the outset of this development meant that considerable research, mainly by trial and error, had to be undertaken to reach the ultimate goal. The absence of useful literature in the field made plagiarism unfortunately impossible; a phenomenon not often encountered by researchers!

One of the many pitfalls encountered by the author was lack of guidance as to type of data filing to be used by the software. An early decision to use sequential filing, proved

disastrous, resulting in repeated corruption and loss of data. The use of Random Access, or Relative, filing is to be definitely recommended to any programmer involved in oral health applications, as it alone offers the required degree of reliability and sorting capability.

The management, from the beginning of a survey, of data diskettes for the separate sub-groups to be examined, is a vital prerequisite if delays in execution of analysis programs are to be avoided.

Careful selection of formulae, equations and algorithms which lend themselves to computer use, is essential to overcome the limitations of 32K of memory.

A typical example of this is the derivation of the standard deviation of means of large samples:

If the conventional formula of $SD = \text{square root}(\text{sum of squared deviations}/N-1)$ is used, storage of individual means in an array becomes necessary so that deviations may be determined once the sample mean becomes available.

This process will exhaust the user memory of 32K for, say DMFT, with about 2000 patients. Furthermore, garbage collection by the computer will unacceptably slow up the running of analysis.

If, however, the formula of $SD = \text{square root}(((\text{sum of squared means}) - (\text{square of sum of means}/N))/N-1)$ is used, no need for array storage of means arises.

The requirement for software to be interactive, particularly in terms of word processing is considered absolute by the author.

This text, and other reports and summaries have been entirely produced by CBM Text Editor 3 software interacting with the author's software and data base.

5.7.3 Discussion of Findings in Terms of Hypotheses

5.7.3.1 Dental Officer to Troop Ratios

Table 40

NUMBERS AND PERCENT OF GROUPS REQUIRING CARE, WITH TIME COMMITMENT IN HOURS

GROUP	N	% req care	HRS. PAT.	HRS. D/O	HRS. PREV.
FF	553	86	4.86	3.20	1.62
BASE	519	68	3.38	2.21	1.10
RECRUITS	151	85	5.68	3.92	1.73
OFFICERS	211	69	4.11	2.50	1.57
CADETS	138	70	2.47	1.41	1.01
APPRENTICE	141	70	2.96	1.87	0.98
ARA	1487	77	4.35	2.89	1.41

1. On the basis of the above results, the following ratios may be calculated (see 5.5.8) for the ARA, and significant subgroups, using the known ARA Dental Officer work value of 1442 man-hours of clinical productivity per annum, in conjunction with group manning statistics:

1. Field Force - 1:451 (current ratio 1:1000)
2. Base Troops - 1:652 (current ratio 1:650)
3. Recruits - 1:368 (current ratio 1:250)
4. Officers - 1:577 (no current ratio specified)
5. Cadets - 1:1023 (no current ratio specified)
6. Apprentices - 1:771 (current ratio 1:350)
7. ARA - 1:499 (no current ratio specified)

In comparing these to current ratios (see 5.3.1), it may be noted that Base Troops, Cadets, Apprentices and Recruits currently have a higher ratio of dental officers to troops than the ratio shown above. (NOTE that this is not necessarily reflected by current establishments!).

The remainder, including the sample representing the whole population, show lower ratios.

2. It can be clearly seen from mean DMFT values and related indices presented overleaf that the index of dental experience at the civilian interface is high at 12.56 DMFT. The difference between it and the value of 15.52 DMFT for the ARA is small, considering the average length of service of 6 years of the ARA soldier.

3. The index of dental treatment received, predominantly represented by the FT values, is substantially larger in the ARA sample compared to the Recruit sample. This indicates that substantial treatment is carried out, at least in terms of restorative care, on the soldier between time of enlistment and time of discharge. As stated before, none of this care is currently delivered at the Recruit Training Battalion.

4. The index of dental caries, represented by D/DMFT for the Recruits, is more than twice the value in the ARA sample.

DMFT and related indices for whole sample

Sample N = 1487
Sample mean DMFT = 15.52
Standard deviation DMFT = 7.12
Standard error DMFT = .18
D/DMFT = .199
F/DMFT = .510
M/DMFT = .291
Mean FT(decayed teeth not counted) = 7.91
Mean FT(decayed teeth counted) = 9.02
Adjusted F/DMFT = .581

DMFT and related indices for Recruit sub-group

Recruit N = 151
Mean DMFT = 12.56
Standard deviation of DMFT = 6.02
Standard error of DMFT = .49
D/DMFT = .442
F/DMFT = .343
M/DMFT = .214
Mean FT(decayed teeth not counted) = 4.31
Mean FT(decayed teeth counted) = 5.36
Adjusted F/DMFT = .427

5. Table 37 shows that subjects classified dentally fit (classes 1 and 2) in the Recruit sub-group are far fewer than in other sub-groups.

Table 37

<u>GROUP DISTRIBUTION OF DENTAL FITNESS</u>					
GROUP	N	%	%	%	%
		CL.1	CL.2	CL.3	CL.4
FF	553	13	59	23	3
BASE	519	31	54	9	5
RECRUITS	151	14	43	28	13
OFFICERS	211	30	52	15	1
CADETS	138	29	56	13	0
APPRENTICE	141	29	51	18	0
ARA	1487	22	54	19	4

6. The requirement for emergency/immediate care in the Recruit sub-group, as evidenced by the high proportion of subjects classified class 3 or 4 (see Table 37), and by the high percentage of subjects requiring this treatment component, as shown in Table 38.

Table 38

PERCENT REQUIRING COMPONENTS OF DENTAL CARE BY GROUPS

GROUP	% req EM/IM	% req OH/PV	% req REST.	% req PROS.	% req SPEC.
FF	50	79	84	20	2
BASE	33	57	66	21	3
RECRUITS	54	86	85	15	1
OFFICERS	17	81	69	13	1
CADETS	12	54	68	2	2
APPRENTICE	21	53	66	4	5
ARA	41	71	75	19	2

7. The mean dental man-hours required for both emergency and restorative care by Recruits, are the highest in the whole sample.

Table 39

MEAN DENTAL MAN HOURS PER TYPES OF CARE BY GROUPS

GROUP	for EM/IM	for OH/PV	for REST.	for PROS.	for SPEC.
FF	0.51	1.61	2.04	0.40	0.04
BASE	0.34	1.10	1.29	0.42	0.06
RECRUITS	0.55	1.73	2.78	0.31	0.03
OFFICERS	0.17	1.57	1.99	0.26	0.03
CADETS	0.12	1.01	1.18	0.04	0.04
APPRENTICE	0.22	0.98	1.45	0.08	0.11
ARA	0.41	1.41	1.88	0.39	0.04

It is therefore apparent, in support of the hypothesis, that need for dental care continuously "peaks" at the civilian interface, and that a substantial backlog of treatment requirement and commitment will be added by this group to any population it is mixed with through reposting.

5.7.3.2 Auxiliaries

Table 40

NUMBERS AND PERCENT OF GROUPS REQUIRING CARE, WITH TIME COMMITMENT
IN HOURS

GROUP	N	% req care	HRS. PAT.	HRS. D/O	HRS. PREV.
FF	553	86	4.86	3.20	1.62
BASE	519	68	3.38	2.21	1.10
RECRUITS	151	85	5.68	3.92	1.73
OFFICERS	211	69	4.11	2.50	1.57
CADETS	138	70	2.47	1.41	1.01
APPRENTICE	141	70	2.96	1.87	0.98
ARA	1487	77	4.35	2.89	1.41

1. The dental officer:hygienist ratio determinable from the above man-hour values for the whole sample and for sub-groups approximates closely to 2:1, as opposed to the currently established ratio of 2.5:1.

2. The data base does not allow for extrapolation of similar findings in respect of dental technicians or dental assistants.

3. Tables 36a and 36b show direct proportional increases of mean values for tooth surfaces requiring treatment, with both DMFT and FT. This clearly demonstrates that efforts in restorative care alone have little effect on the increment of dental caries.

Table 36a

MEAN NUMBER OF TOOTH SURFACES IN SAMPLE REQUIRING TREATMENT BY
DMFT

<u>DMFT</u>	<u>N</u>	<u>%</u>	<u>MEAN</u>	<u>S.DEV</u>	<u>S.ERR</u>
0	16	1	.25	0	0
1-5	97	6	2.12	3.32	.33
6-11	359	24	4.22	4.50	.23
12-17	436	29	5.85	5.84	.27
18-23	358	24	7.89	7.93	.41
> 24	221	14	6.57	8.95	.60

Table 36b

MEAN NUMBER OF TOOTH SURFACES IN SAMPLE REQUIRING TREATMENT BY FT

FT	N	%	MEAN	S.DEV	S.ERR
0	104	6	3.30	4.89	.48
1-5	337	22	5.79	6.84	.37
6-11	559	37	5.53	6.19	.26
12-17	368	24	5.77	5.98	.31
18-23	114	7	8.64	10.52	.98
> 24	5	0	10.00	11.45	5.12

Additional values for Tables 36a and 36b

Sample N = 1487

Mean number of surfaces requiring treatment = 5.75

Standard deviation surfaces = 8.87

Standard error surfaces = .23

D/DMFT = .199

F/DMFT = .510

M/Dmft = .292

Mean FT(decayed teeth not counted)=7.91

Mean FT(decayed teeth counted)=9.02

Adjusted F/DMFT = .581

This highlights the need for preventive care. As the employment specification of the Army Dental Hygienist includes authorisation for, and training in, the topical application of medicaments (e.g. fluorides), this trade, by expansion of its authorised manning, would achieve this goal.

5.7.3.3 Dental Fitness

Table 37

GROUP DISTRIBUTION OF DENTAL FITNESS

GROUP	N	%	%	%	%
		CL.1	CL.2	CL.3	CL.4
FF	553	13	59	23	3
BASE	519	31	54	9	5
RECRUITS	151	14	43	28	13
OFFICERS	211	30	52	15	1
CADETS	138	29	56	13	0
APPRENTICE	141	29	51	18	0
ARA	1487	22	54	19	4

The above Table shows that, of the representative sample for the whole ARA population, only 76% were dentally fit as defined by military authority.

It is particularly noteworthy that troops with a high draft priority (i.e. liable to be on operational duty at short notice), in Field Force, have 26% of their number dentally unfit.

5.7.3.4 Demand versus Need

1. The reponses to service utilisation Questions 1 to 2b of the Oral Health and Treatment Assessment Form, presented in Tables 8-15b, show that the demand for dental care in the sample is of a complex nature, i.e. that a wide range of answers were given.
2. The sample contained subjects who had not sought dental care for in excess of 3 years (5%).
3. 24.2% of the sample did not obtain dental care within 12 months of survey; and thus did not comply with Army dental recall regulations.
4. Tables 10a and 10b reflect demand in the sample. 27.3% of those who attended in the 12 months before the survey did so to get something fixed and 42.8% came for a check-up.
5. Tables 10a and 11 show low utilisation of hygienists.
6. Table 12a shows that, of the subjects who had not attended within 12 months of the survey, 49.7% felt there was nothing wrong with them, and used this as a reason for

for non-attendance.

6.9% said that they were prevented from attendance by duty, whilst 11.1% were "too busy".

7. Table 12b shows that 5.5% of subjects who had not attended within 12 months of the survey claimed no service as a reason for non-attendance.

8. Table 15a shows that, of subjects who stated they would seek advice and/or treatment:

20% (8.8% of whole sample) considered they required examination and/or cleaning.

6.9% of sample were treated by the Army Dental Hygienist, as extrapolated vide Table 11.

This contrasts sharply with established need for preventive care in 71% of the sample, vide Table 38.

11.1% solicited periodontal care.

21.7% considered they required fillings, crowns or bridges. This contrasts with the low figure of 6.9% seeking preventive care.

This (9.5% of sample) also contrasts significantly with

the established need of 75% of sample for restorative care(see Table 38).

Table 15b indicates that 6.5% (2.8% of sample) considered they required prosthetic care,whereas need for this care was defined professionally as 19% in Table 38.

9. Tables 13a and 13b show that 62.6% of sample considered themselves dentally fit.This contrasts with the 76% of sample established as dentally fit within the definition of Army authorities (see Table 37),indicating either:

that this definition is at fault;or

that a degree of dental hypochondria exists in the ARA population.

25.4% of sample considered they had something wrong with their teeth only,and 30% considered they had problems with both teeth and gums.

1.6% considered they had something wrong with their gums only;this contrasts with the established distribution of oral mucosal disease of 6.1% of sample,vide Table 16;the established periodontal treatment need of 65.9% of sample,vide Table 22;and the 10.1% of sample affected by

intense gingivitis, vide Table 21.

It may therefore be stated that the results of the study demonstrate a considerable difference between patients' perceived need for gingival/periodontal care and established (professionally determined) need for such care.

5.7.3.5 Deployment of Dental Manpower

Table 40

NUMBERS AND PERCENT OF GROUPS REQUIRING CARE, WITH TIME
COMMITMENT IN HOURS

GROUP	N	% req care	HRS. PAT.	\HRS. D/O	HRS. PREV.
FF	553	86	4.86	3.20	1.62
BASE	519	68	3.38	2.21	1.10
RECRUITS	151	85	5.68	3.92	1.73
OFFICERS	211	69	4.11	2.50	1.57
CADETS	138	70	2.47	1.41	1.01
APPRENTICE	141	70	2.96	1.87	0.98
ARA	1487	77	4.35	2.89	1.41

Further to the preceding discussion of dental officer:troop ratios(see 5.7.3.1),deployment of dental manpower in the light of ratios determined,can be shown to be inadequate. The following numbers of dental officers are needed to supply effective dental care to the population sub-groups (manning figures as per CARO,see Table 1):

1. Field Force - 25.8 D/O for 11621 personnel
2. Base Troops - 16.8 D/O for 10948 personnel
3. Recruits - 8.7 D/O for 3200 personnel
4. Officers - 7.6 D/O for 4396 personnel
5. Cadets - 0.4 D/O for 537 personnel
6. Apprentices - 1.3 D/O for 994 personnel
7. ARA - 63.5 D/O for 31696 personnel

It must be noted that the above manning figures are in respect of full-time clinical duty by dental officers. Therefore consideration must be given to further increase of these figures to provide the necessary, and inevitably underrated, administrative responsibilities of dental officers.

It must also be considered that troop concentrations are frequently mixed populations of the above-mentioned sub-groups. Calculation of needed dental officer deployment in a given area must take this into account.

5.7.3.6 Special Groups

Table 40 shows that Recruits, Cadets and Apprentices have significantly different treatment requirements from those of the whole population.

Table 40

NUMBERS AND PERCENT OF GROUPS REQUIRING CARE, WITH TIME COMMITMENT IN HOURS

GROUP	N	% req care	HRS. PAT.	HRS. D/O	HRS. PREV.
FF	553	86	4.86	3.20	1.62
BASE	519	68	3.38	2.21	1.10
RECRUITS	151	85	5.68	3.92	1.73
OFFICERS	211	69	4.11	2.50	1.57
CADETS	138	70	2.47	1.41	1.01
APPRENTICE	141	70	2.96	1.87	0.98
ARA	1487	77	4.35	2.89	1.41

5.7.3.7 Contingency Expansion Planning

If the conservative assumption is made that Australia will raise up to three additional Divisions (39000-45000 troops) in the event of major conflict, dental manpower planning is confronted with a problem of immense magnitude.

It is reasonable to postulate that the type of draftee/called-up national serviceman would display similar population characteristics of oral health to the Recruit sub-group, as surveyed.

A small percentage of personnel called up will display characteristics more akin to those of the examined Officer/Cadet sub groups.

On this basis, using calculation methods as before, an estimate of numbers of dental officers required to produce Class 1 dental fitness in this draft, is as follows:

1. 106 officers to achieve the goal in the (improbably) available time of 1 year.
2. 1272 officers to achieve the goal in 4 weeks.
3. 5088 officers to achieve the goal in 1 week. (There were, in 1978, 7254 practitioners on the Australian Dental Registers, of whom 5776 are estimated to be active!). (see

reference 6.,pp.16,3.1)

4. Recent military history,including two major World Wars,has shown that 1 week of release from military duties for the purpose of dental care has never been given to a draft;even though unacceptable losses of operational manpower were suffered by all Armies as a result of untreated dental disease.

The lowering of dental fitness requirements by the recruiters has been an inevitable,illogical and undesirable consequence of the above-illustrated problem.

5.7.4 Discussion of Findings in Relation to Other Studies

The findings of this study may be compared to findings of a similar study carried out by Parker for the US Army (see reference 11.)

1. The disparity in size of the two Armies studied concomitantly dictated a larger sample size in the US study. It should be noted, however, that the US study did not achieve a 4.8% sampling of the US Army population, in contrast to this study where this figure was attained.

The exact percentage of population sampled is not published in Parker's report and unavailability of accurate census figures of US Army manning at the time of investigation makes its calculation impossible.

2. Distribution characteristics of Parker's sample appear closely related to those found in the Australian study (see 5.6.2).

3. Corrective dental care was required by 87.4% of the US sample (cf. 78% of ARA sample).

4. The relative frequency of need for restorations was:
0 restorations 72.9% (cf. 86.3% for ARA);

1 surface 15.1% (cf. 7.8%);
2 surfaces 6.1% (cf. 2.9%);
3 surfaces 3.4% (cf. 1.0%);
> 3 surfaces or crowns 1.3% (c.f. 1.4%).

5. The relative frequency of need for prosthetic care was:
upper partial dentures 8.4% (c.f. 11.1 for ARA);
lower partial dentures 11.7% (c.f. identical);
full upper dentures 3.4% (c.f. 1.6%);
full lower dentures 1.3% (c.f. 1.8%);

6. The relative frequency of need for endodontic care was:
anterior 4.3% (c.f. 1.9% for ARA);
posterior 5.2% (c.f. 3.4%).

7. Percentages of subjects affected by periodontal conditions were as follows:
soft deposits 89.4% (c.f. 66.3% for ARA);
calculus 81.7% (c.f. 67.1%).

8. An average of 8.5 total hours of treatment required was determined per active duty military person regardless of age, sex or time in service (c.f. 4.35 for ARA).

5.8 Summary

5.8.1 Methods

A survey, using the World Health Organisation Oral Health and Treatment Assessment Form (see reference 10.), was conducted on a stratified sample of 4.8% of the ARA population, and on sample sizes ensuring a 95% level of confidence for major components of dental care of significant sub-groups of this population.

Survey methodology included the use of microcomputers for data collection and analysis.

Computer application software was developed as part of the survey project.

Training of survey personnel in microcomputer operation and BASIC programming was also undertaken as part of the project.

5.8.2 Findings

1. The largest groups in terms of years of service (YOS) was found to be the 1-3 and 3-6 YOS groups, accounting for a total of 50% of the sample.

2. The largest group in terms of age was found to be the 20-24 yr group, accounting for 31% of the sample.

3. The largest group in terms of percent of time in Field Force service was found to be the 74% or more group, accounting for 28% of the sample.

4. Females formed 4.3% of the total sample.

5. The largest group in terms of state of origin was the group from NSW, accounting for 45.3% of the sample.

6. Mean DMFT for the sample was 15.5, with a standard deviation of 7.1, and standard error of 0.18.

7. Mean number of tooth surfaces requiring treatment in sample was 5.7, with a standard deviation of 8.9 and standard error of 0.23.

8. Mean man-hour requirement for dental care was 4.35 hours, of which the dental officer accounted for 2.89 hours.

5.9 Conclusions

5.9.1 Dental Officer to Troops Ratios

The results of this study show conclusively that rigid application of ratios for dental officers to troops cannot be supported. Currently applied ratios were found to be at some variance with ratios derivable from the study data.

The study also supports that element of the original hypothesis which postulated that these ratios should be regularly updated and reviewed, through prevalence and incidence studies in the various sub-groups of the ARA population.

These studies, using this data as base-line data, will also serve to detect groups with unmet needs and unexpected changes in demand.

5.9.2 Auxiliaries

The study proved the hypothesis for revision of Dental Hygienist:Dental Officer Ratios.

The study also determined a real need for Preventive Care, which would indicate the need for increased utilisation of hygienists. In view of the many, as yet unexplored, factors concerning periodontal status and preventive care in the sample data, further detailed analysis in this area must be recommended.

5.9.3 Dental Fitness

Findings of the study confirmed the hypothesis as to unacceptable levels of dental fitness in the sample.

At the time of publication of this thesis the author has as yet been unable to suggest preferable and acceptable alternatives to the, currently used, subjective method of dental fitness classification.

The author is, however, convinced that the topic merits further investigation and research, as a variety of more mathematical, and epidemiology-oriented indices seem plausible options.

5.9.4 Demand versus Need

1. The study confirms that there are deficiencies in the operation and effectiveness of the Army Dental Recall System.
2. The emergency care requirement as presented in the findings of this study is high, putting at risk the very soldiers (in Field Force) whose absolute dental fitness is a requirement for the conservation of manpower in war.
3. It is considered that the complexity of patient solicited demand is apparent, yet difficult to quantify exactly. There is

undoubted serious need for further, perhaps sociological and psychological, investigation of the variables involved.

As often stated by workers in the field, there is a need for determination of sociological/psychological indices related to (dental) health care utilisation.

Certainly the study confirms a need for more effective Dental Health Education, despite the redoubtable efforts already made by Army Dental Officers and their staff.

The gap between the individual's interpreted need and the professionally definable need for dental care might be partly bridged by intensification of educational effort.

5.9.5 Deployment of ARA Dental Manpower

As already discussed at length, the findings of the study confirm the hypothesis of needed deployment of dental manpower at areas of large clinical backlog care needs.

5.9.6 Overall Dental Establishments

The hypothesis of inadequacy of current peace/war establishments is considered proven.

To meet current needs alone, it must be strongly recommended that the number of established RAADC officers be increased by at least 40%. Concomitantly, increases in establishment of the other

essential members of the "Dental Team" must follow suit.

5.9.7 Special Groups

The study confirms the existence of sub-groups of the ARA population showing significant differences from the mean population care requirement.

Consideration of these differences in the allocation and delivery of dental care is strongly recommended.

5.9.8 Contingency Expansion Planning

As already discussed, the results of this study confirm the urgent need for formulation of manpower strategy to meet the massive needs of dental health care during mobilisation.

It is considered that planning for these needs cannot occur in isolation, i.e. by the Army or the Defence Forces alone.

Two major facts have emerged from the study to confirm this:

Firstly, that the resources available to the Army now, or as recommended, or as available through contingency mobilisation and call-up of civilian practitioners, will never suffice to achieve the desired degree of dental fitness of soldiers if prevalence of dental disease and treatment measures continue in their currently observed pattern;

Secondly, that restorative measures make no real inroads on dental disease but, on the contrary, allow for natural increases in the rate of caries to occur with advancing age and dental experience.

Therefore, in liaison and collaboration with other providers of dental care (e.g. Commonwealth and State Health Departments/Authorities) and with the Australian Dental Association, an effort has to be made to change the pattern of care provided to a more preventively oriented one throughout Australian dental practice.

Furthermore, if a genuine perception of the problem of dentally unfit troops in time of war can be brought about within the Ministry of Defence, and Government generally, then measures could be initiated now to upgrade the dental condition of the population groups likely to be called up in time of war.

Such measures should rely heavily on the services of the Army Reserve dental elements, as well as on policies to provide, at Government expense, free or cheap compulsory dental care and prevention to the groups likely to be called up.

Lastly, these groups should be made the beneficiaries of a massive Dental Health Education Effort, carried out by all Public Health Authorities, which should result in better utilisation of services and acceptance of regular preventive care.

Obviously, the auspices for such programmes are not good if, for example, the recommendations arising from this study were not even accepted for the peace-time ARA, whose soldiers should be models of dental fitness as demanded of an expanded Army or Defence Force.

5.9.9 Research and Development

As recommended in 5.9.1 and elsewhere in this text, the type of research and development carried out during this study is essential for rational planning of the delivery of dental care to the ARA.

The findings contained in the extensive and, as yet incompletely reported on, data base of this study should be further analysed and reported on.

The study should be used as base-line information in mounting further studies into, and performing regular surveys to monitor, the dental health of troops.

The development of computer applications to dental research and administration should continue, and those applications already developed should receive maximum utilisation by the RAADC. The cost, for instance, of installation of microcomputer terminals in each major Army Dental Centre, would be easily recouped in the advantages accruing to the Dental Services in terms of efficiency, conservation of manpower and quality of care.

6. REFERENCES

1. Cassidy, J.E.; Parker, W.A; and Hutchins, D.W.-Dental Care Requirements of Male Army Recruits. Military Medicine, 138:25, January 1973.
2. Chilton, N.W.-Design and Analysis in Dental and Oral Research, Philadelphia, J.B. Lippincott, 1967. 365pp.
3. Dept. of Defence-DDS-A Instructions, Canberra, DDS-A, 1974-1980. RESTRICTED.
4. Dept. of Defence-Manual of Personnel Administration, Canberra, DIOM, 1979. RESTRICTED.
5. Dunning, J.M.-Principles of Dental Public Health, London, Harvard University Press, 3rd edition, 1979. 655pp.
6. Facts & Figures, Sydney, Australian Dental Association, 1979.
7. Hampshire, N.-Library of PET Subroutines, Yeovil, Computabits Ltd, 1980. 137pp.

8. Hampshire, N.-The PET Revealed, Yeovil, Computabits Ltd, 2nd edition, 1980. 167pp.
9. Hollander, F., Dunning, J.M.-A study by age and sex of the incidence of dental caries in over 12000 persons. J.Dent.Res., 18, 43-60, 1939.
10. Oral Health Surveys Basic Methods, Geneva, WHO, 2nd edition, 1977. 68pp.
11. Parker, W.A.-Dental Care Requirements of Active Duty Army Personnel, Academy of Health Sciences US Army Report, April 1976.
12. Planning and Evaluating Dental Health Services, report on working group WHO EURO 5505, Copenhagen, 1972.
13. Reichmann, W.J.-Use and Abuse of Statistics, Harmondsworth Mdx, Penguin, 1964. 345pp.
14. Sackett, D.L., Baskin, M.S.-Methods of Health Care Evaluation, Hamilton Ont. McMaster University, 3rd edition, 1977. 19 chapters.
15. Slack, G.L.-Dental Public Health, Bristol, John Wright & Sons, 1974. 338pp.

Appendix A

Weighted Treatment Time Factors for Specific Dental Procedures

1. From Cassidy et al:

		Treatment Time
<u>Specialty Area</u>	<u>Clinical Procedure</u>	<u>required(hours)</u>
Restorative	1-surface restoration	0.35
	2-surface restoration	0.83
	3-surface restoration	0.83
Rem.prosth.	maxillary full denture	3.23
	mandibular full denture	3.23
	maxillary partial denture	1.97
	mandibular partial denture	1.97
Fixed prosth.	crowns	1.97
	abutment crowns	1.97
Exodontics	extractions	0.24
Oral Hygiene	prophylaxis	0.37
	calculus removal	0.19

2. Estimated Endodontic Treatment Time.

Anterior Tooth	2.00
Posterior Tooth	3.00

Mean Periodontal Treatment Time.

Moderate treatment(10 hrs or less)	5.00
Extensive treatment(>10 hrs)	15.00

Appendix B

Overleaf:

Dental Treatment Record Printout (based on Australian Defence Forces Form PM 342)

MEDICAL-IN-CONFIDENCE

SURVEY PRINTOUT: 16 OCT 80

RANK	NAME	NUMBER
rec	mulvaney	F512059

UNIT

WS

TOOTH#: 18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28

U	F	F	F	F	0	0	0	C	M	M	C	F	F	F	U
0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0

TOOTH#: 48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38

U	F	F	F	F	0	0	0	0	0	0	0	F	F	M	F
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PREVENTIVE

OTHER TREATMENT

SCALE/CLEAN:
O.H.I.:

PERIODONTAL:
PROSTH. STATUS: PU

DENT. REQ.: PU

OTHER:

S: 2

KEY TO CHARTING

TOP ROW EACH JAW=TOOTH CONDITION

BOTTOM ROW EACH JAW=TREATMENT REQD.

U=UNERUPTED

M=MISSING

0=SOUND

C=CARIOUS

F=FILLED

X=FOR EXD.

B=BRIDGE(PONTIC)

1-3=NO. OF SURFACES

4=4 SURF. OR CROWN

Appendix C

Overleaf:

Example of Printout of Report to Unit Commanders

OFF IN CONFIDENCE

DENTAL SURVEY SUMMARY FOR UNIT COMMANDERS

DATE COMPILED 12 NOV 88

OFFICERS EXAMINED: 238

OTHER RANKS EXAMINED: 0

TOTAL # OF (STATISTICALLY VALID) MEMBERS EXAMINED: 238

TEDED>> SAMPLE # IS WEIGHTED 1.8% OF LOCAL POPULATION

DENTAL FITNESS STATUS (VIDE NPA VOL3, CHAP36)

CLASS	#	% OF SAMPLE
69	30	
127	55	
31	13	
3	1	

TREATMENT REQUIREMENT:

TYPE	WREQ.	%REQ.	DENTAL MAN-HRS	MEAN MAN-HRS
EMERGENCY/IMMEDIATE	30	13	15	.130434783
ORAL HYGIENE/PREVENTIVE	149	64	286	1.24347826
RESTORATIVE	158	68	335.3	1.45782609
ORTHODONTIC	17	7	33.49	.145608696
SPECIALIST	1	1	8	.0347826087

SUMMARY:

OF SAMPLE WITH TREATMENT REQUIREMENT: 70

MAN DENTAL MAN-HOURS REQUIRED PER PATIENT IN SAMPLE: 3.07734783

MULTIPLY BY UNIT MANNING TO OBTAIN PATIENT TIME REQD.)

MAN DENTAL OFFICER TIME REQUIRED PER PATIENT IN SAMPLE: 1.79908696

MULTIPLY BY UNIT MANNING TO OBTAIN DENTAL OFFR TIME REQD.)

MAN PREVENTIVE MAN-HOURS REQUIRED PER PATIENT IN SAMPLE 1.24347826

MULTIPLY BY UNIT MANNING TO OBTAIN COMPOUND DENTAL OFFR AND DENTAL HYGIENIST TIME
REQUIRED FOR PREVENTION PER PATIENT IN SAMPLE)

CARD No. 3[illegible]

Appendix D

Overleaf:

WHO Oral Health and Treatment Assessment Form