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13. ABSTRACT (Maximum 200 words) Osteoporosis is a serious health issue for women. This study was designed to identify the risk factors for osteoporosis that may be more common in service women and to compare with a matched military dependent control group the treatment for and frequency of osteoporosis in service women. Nulliparity was the most consistent risk factor for osteoporosis seen in service woman but not in the dependent (control) group. Stress fractures were also more frequently observed in service women. Treatment for or prevention of osteoporosis was identical for both service women and military dependents. The diagnosis of osteoporosis caused emotional problems for the service women in this study and many felt that osteoporosis impaired their physical performance. More research to understand this problem as well as better patient education is needed. In the military health care system, the diagnosis of osteoporosis is often made inappropriately. This finding highlights a subject for additional research and possible education for health care professionals. No significant differences in bone mass of the two groups was identified at any bone site. The frequency of service women with osteoporosis was identical to that of a large cohort of military dependent subjects.
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INTRODUCTION

Osteoporosis is a serious health issue for women. Roughly 25 million Americans have osteoporosis. Four out of five are women. Osteoporosis causes 1.5 million fractures a year at a cost of 10-13 billion dollars a year. Because of the lifestyle within the military, servicewomen are more physically active and exercise more regularly than non-military women. Since physical activity decreases the risk of osteoporosis, service women may have less bone loss than the general population. This, however, has never been studied. On the other hand, military regulations require servicemembers to meet defined weight standards. Since a thin body habitus (ideal body weight) is associated with an increased risk of osteoporosis, the beneficial effect of exercise on osteoporosis may be mitigated. This pilot study will attempt to identify risk factors that may contribute to or protect the servicewoman from osteoporosis and determine the frequency of osteoporosis in service women referred for bone mineral densitometry (BMD). If osteoporosis is found more frequently in our study subjects, this important finding would serve as the basis for a more rigorously controlled study, the results of which could have a profound effect on the medical management of women in the military.

This project consists of two parts. The first part (Objectives 1-3) is a retrospective pilot study describing the demographics, risk factors for osteoporosis and therapy of service women with osteoporosis. The second part (Objective 4) is a prospective study

of the demographics, risk factors, and bone mineral densities (BMD) of service women sustaining a fracture. Specific objectives of this proposal are:

Objective 1. To describe the demographics, the risk factors for osteoporosis, the factor(s) that resulted in the request for measurement of BMD, and the BMD of active duty women referred to the bone density laboratory at Walter Reed Army Medical Center. To compare these data to that of age and race matched dependents also referred to this laboratory.

Objective 2. To determine the prevalence of osteoporosis in servicewomen referred for measurement of BMD.

Objective 3. To describe the therapies used for the treatment of osteoporosis. To determine if the diagnosis of osteoporosis has any impact on the servicewoman.

Objective 4. To prospectively determine the demographics, the risk factors for osteoporosis, and the BMD of active duty women referred to orthopedic clinics because of a fracture. To compare this information to that of age- and race-matched dependents with a fracture.

EXPERIMENTAL METHODS

The study design is outlined in Figure 1. The study variables of the service women and control groups were compared using the two sample T test for continuous variables and the Yate's corrected Chi-square test or Fisher exact test as indicated in the results tables for the discrete variables. A p value <0.05 was considered significant and a p value between 0.10 and 0.05, as a trend. A subgroup analysis was conducted to compare the study variables of the osteoporotic women in the two study groups in the retrospective analysis (Objectives 1-3).

Data about the study subjects were collected from the following sources: the bone mineral density chart, the endocrine clinic convenience chart when available, the outpatient record room at WRAMC and CHCS (composite health care system). These sources were reviewed for the following information (study variables: demographics and military status, bone mineral density results, risk factors for osteoporosis, treatments for osteoporosis).

Information used to contact service members was obtained from CHCS, the BMD chart, or next of kin information listed in CHCS.

Patients were recruited for the prospective (fracture) portion of this study (objective 4) from the WRAMC orthopedics clinic, emergency room, and orthopedics wards, and the orthopedics service at Kimbrough Army Medical Center, Ft Meade, the medical clinic at

Ft Belvoir, and the orthopedics clinic and family practice clinic at MGMC, Andrews Air Force Base. The orthopedics service at the National Naval Medical Center, Bethesda MD, declined to participate. The Naval Academy Clinic, Annapolis MD also declined to participate in this study.

RESULTS

From the BMD lab database containing over 1600 bone mineral densitometry subjects, 227 active duty women subjects were identified. Excluded from this study were 49 active duty women: 39 because they had only whole body scans (previous research study), 8 mislabeled (e.g. not service women), and 2 were objective 4 (fracture) subjects. The resulting 178 service women served as the experimental group for objectives 1-3 of this study. 178 control women subjects (dependents) were identified by matching in order: race, age at time of the BMD study, and type of BMD study (spine, hip, forearm).

To assess the impact of osteoporosis, 104 of the 178 (58.4%) service women were successfully contacted by either phone or by mailed questionnaire. No information about 74 women in this group was available because: the address was not current (N=27), 4 had died since their last bone mass measurement, 4 had no address or phone number available, and 39 did not respond to the mailed questionnaire.

The service members were well matched with the dependent control subjects with respect to age, height, race, service

affiliation, menopausal status, and hospital status (Table 1). The service member group weighed on average 6 lbs less than the control group ($p=0.045$) and were less likely to be referred from the Endocrinology clinic for measurement of bone mass. Both groups had identical risk factors for osteoporosis except that the service members were more frequently nulliparous (14.0 vs 2.2%, $p<0.0001$) and were more likely not to have clinical information available (39.3 vs 27.0%, $p=0.0009$). Service members were referred more frequently for bone densitometry because of stress fractures (3.4 vs 0%, $p<0.039$) and were less likely to have bone mass measurements done as a result of participation in a research project (7.3% vs 15.7%, $p=0.02$). Preventative therapy or treatment for osteoporosis was identical in both groups.

When the bone mass of the forearm, spine, lateral spine, and hip (3 sites), young normal Z scores or the age matched Z scores were compared, no significant differences were observed between the service member or dependent (control) groups at any bone site except for the BMD of the Trochanter (Table 2A). The frequency of osteoporotic bone mass measurements or low age matched Z scores did not differ at any bone site (Table 2B). Too few subjects had repeated measurements of bone mass. Therefore, the rate of change of bone mass over time could not be reliably analyzed as proposed in the project proposal.

To investigate any possible differences between osteoporotic servicewomen and dependent controls, we performed a subgroup comparison. Subjects were considered osteoporotic if the young

normal Z score of the spine, femoral neck, trochanter or forearm was <-2.0 . There were 81 osteoporotic servicewomen (46%) and 76 osteoporotic control subjects (43%) in our original groups. Both osteoporotic groups were well matched with regard to physical characteristics and demographics. The osteoporotic service women had lower calcium intake (12.3% vs 1.3%, $p=0.016$) and were nulliparous more frequently (18.5% vs 2.6%, $p=0.003$) than osteoporotic dependents. The reason for bone mass measurement and the preventative therapy or treatment for osteoporosis did not differ between the two groups (Table 3).

When the bone mass, young normal Z scores or the age matched Z scores of the two osteoporotic groups were compared, no significant differences were observed at the forearm, spine, lateral spine, femoral neck, trochanter or Ward's triangle (Table 4A). The frequency of osteoporotic bone mass determinations was not significantly different at any site (Table 4B).

We attempted to contact each service woman in this study. Of the 104 respondents, 27.9% were still on active duty. Difficulty with the military physical training requirements was experienced by 32.7% of the service women, 18.3% had a history of stress fractures, and 37.5% had been told that they had osteoporosis. Of those that had been told that they had osteoporosis, this diagnosis had caused problems for 48.7%: physical problems for 63.2%, emotional problems for 26.3%, and both physical and emotional problems for 10.5% (Table 5A).

We then investigated differences between osteoporotic service women respondents and those with normal bone mass. Interestingly, the osteoporotic respondents had less difficulty with military physical training (19.3 vs 48.9%, $p=0.0027$). There was no difference between the two groups of subjects with respect to the frequency of stress fractures or type of problem (physical or emotional) caused by the diagnosis of osteoporosis. Of interest is that only 45.6% of the osteoporotic service women were told that they had osteoporosis, and 27.7% of the women with normal bone mass were told that they had osteoporosis (Table 5B).

Fifty nonpregnant women over 18 years of age were enrolled in the prospective portion of this study: 17 servicewomen and 33 dependents. The ages of the service women and dependents were not equivalent (43.0 vs 60.9 years old, $p<0.0003$). It was not possible to match these 17 service women by age and race using subjects from among the 33 dependents with new fractures for two reasons: 1) while there were 5 Hispanic women in the service women group, there were none in the dependent group. 2) pairing 17 dependents with the closest ages to the servicewoman group, the paired dependent group was still significantly older than the servicewoman group (54.7 vs 43.0 years old, $p=0.0134$). Thus the differences between the service woman and total dependent group were analyzed (Table 6).

Service women were more frequently nulliparous (64.7 vs 18.2%, $p=0.0029$), less likely to have menses (35.3 vs 90.9%, $p=0.0001$), and tended to exercise more frequently than the dependent control group ($p=0.073$). These findings may have resulted from the age

difference between these two groups. Both fracture groups were well matched with respect to the frequency of other osteoporosis risk factors (Table 6).

Significant differences between the bone mass and young normal Z scores of the two fracture groups at all bone sites except for the trochanter (Table 7). These differences were related to the differences in ages of these two groups since there was no difference in age matched Z scores at the forearm, total hip or three subregions of the hip, the spine and lateral spine.

CONCLUSIONS

1. Nulliparity is the most consistent risk factor for osteoporosis seen in the service woman group but not the dependent (control) group. Stress fractures were also more frequently observed in the service member group than in the dependent group.
2. Treatment for or prevention of osteoporosis was identical for both service women and dependents.
3. The diagnosis of osteoporosis caused emotional problems for women. Many women with this diagnosis felt that it impaired their physical abilities. More research is needed to understand this problem and better patient education is needed.
4. In the health care system, the diagnosis of osteoporosis is often incorrectly made. This finding highlights a subject for additional research and an area for possible educational intervention.
5. No significant differences in bone mass of the two groups was

identified at any site. The frequency of service women with osteoporosis was identical to that of dependent control subjects.

REFERENCES

None

FIGURE 1: STUDY DESIGN and RESULTS: OVERVIEW

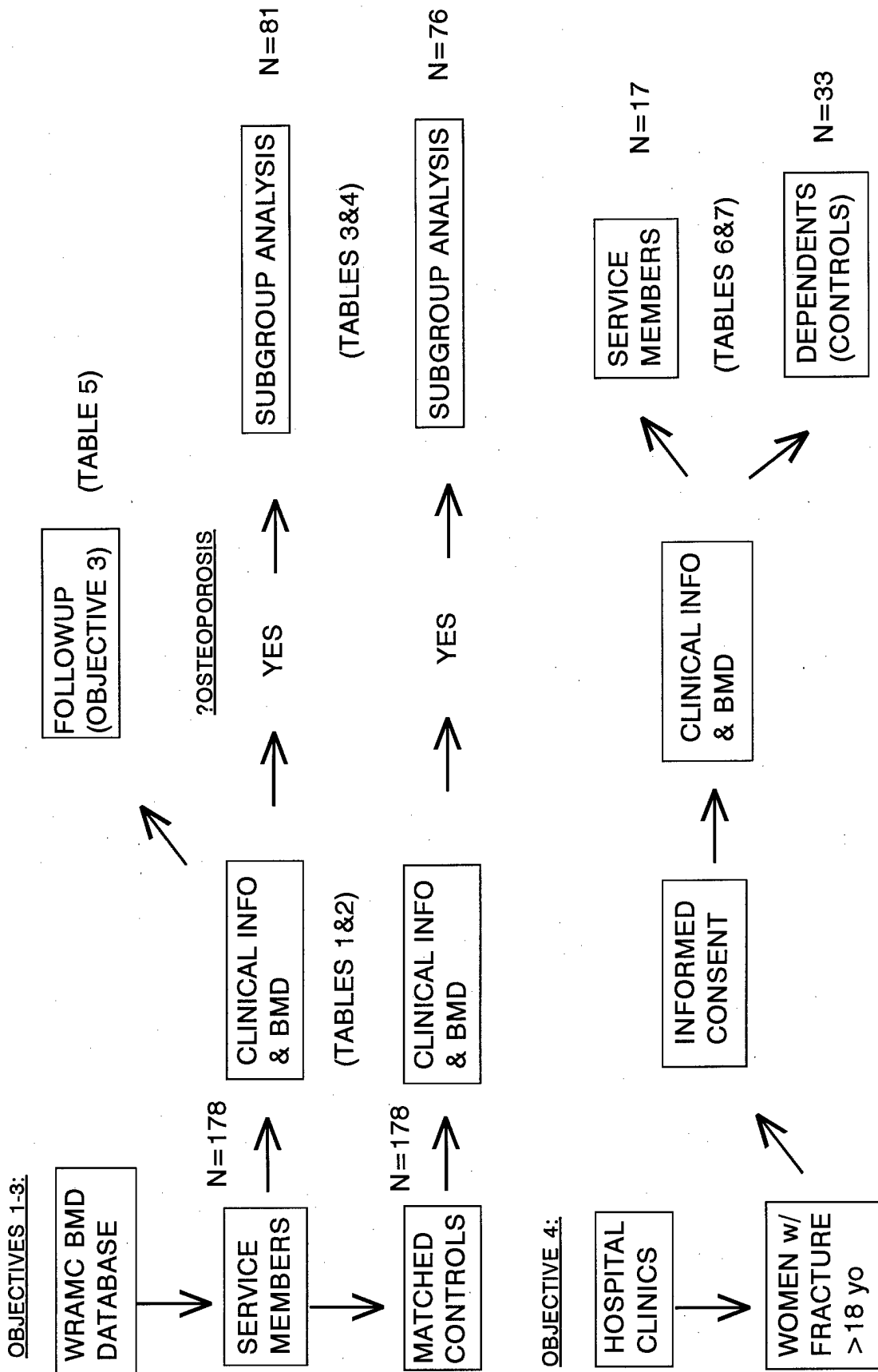


TABLE 1: CLINICAL CHARACTERISTICS, OSTEOPOROSIS RISK FACTORS and THERAPY (OBJECTIVES 1 and 3)

A. CLINICAL CHARACTERISTICS

	GROUP 1 (SERVICE MEMBER)	GROUP 2 (CONTROLS)	p*
N	178	178	--
AGE (YRS)	46.4 ± 15.5	46.4 ± 15.4	NS
HT (IN)	63.9 ± 3.7	64.0 ± 3.0	NS
WT (LBS)	144.0 ± 25.7	150.0 ± 29.7	0.045

Data given as the mean ± 1SD *Two sample T test

B. DEMOGRAPHIC, RISK FACTOR AND TREATMENT VARIABLES

VARIABLE	GROUP 1 SERVICEWOMEN	GROUP 2 CONTROLS	p*
<u>RACE</u>			
Caucasian	146 (82.0%)	148 (83.1%)	NS
Black	31 (17.4%)	29 (16.3%)	NS
Hispanic	1 (0.6%)	0	NS
Asian	0	1 (0.6%)	NS
<u>MILITARY STATUS</u>			
Active Duty	110 (61.8%)	0	--
Retired	68 (38.2%)	0	--
Dependent	0	178 (100%)	--
<u>SERVICE</u>			
Army	130 (73.0%)	122 (68.5%)	NS
Navy	13 (7.3%)	15 (8.4%)	NS
Air Force	26 (14.6%)	31 (17.4%)	NS
Marine	2 (1.1%)	7 (3.9%)	NS
Public Health Service	5 (2.8%)	1 (0.6%)	NS
Other	1 (0.6%)	1 (0.6%)	NS
Unknown	1 (0.6%)	1 (0.6%)	NS
<u>MENOPAUSAL STATUS</u>			
Postmenopausal	74 (41.6%)	71 (39.9%)	NS
Premenopausal	57 (32.0%)	62 (34.8%)	NS
Premature menopause	23 (12.9%)	22 (12.4%)	NS
Unknown	24 (13.5%)	23 (12.9%)	NS
<u>HOSPITAL STATUS</u>			
Outpatient	161 (90.4%)	160 (89.9%)	NS
Inpatient	17 (9.6%)	18 (10.1%)	NS

VARIABLE	GROUP 1 SERVICEWOMEN	GROUP 2 CONTROLS	p*
<u>ORIGIN OF BMD REFERRAL</u>			
Endocrine Clinic	118 (66.3%)	136 (76.4%)	0.046
Endocrine Inpatient	8 (4.5%)	9 (5.1%)	NS
Orthopedic clinic	4 (2.2%)	1 (0.6%)	NS
Rheumatology clinic	5 (2.8%)	1 (0.6%)	NS
Internal medicine clinic	2 (1.1%)	3 (1.7%)	NS
General medicine clinic	2 (1.1%)	0	NS
Other	39 (21.9%)	28 (15.7%)	NS
<u>RISK FACTORS FOR OSTEOPOROSIS</u>			
Hyperparathyroidism	15 (8.4%)	12 (6.7%)	NS
Hyperthyroidism	12 (6.7%)	11 (6.2%)	NS
Low calcium intake	12 (6.7%)	4 (2.2%)	NS
Glucocorticoid use	21 (11.8%)	30 (16.9%)	NS
Anticonvulsant use	0	2 (1.1%)	NS
Smoking	32 (18.0%)	27 (15.2%)	NS
Excessive alcohol	3 (1.7%)	5 (2.8%)	NS
Sedentary lifestyle	2 (1.1%)	2 (1.1%)	NS
Nulliparity	25 (14.0%)	4 (2.2%)	<0.0001
Gastric/Small bowel surgery	3 (1.7%)	1 (0.6%)	NS
Family History-	15 (8.4%)	9 (5.1%)	NS
osteoporosis Rx- thyroid	36 (20.2%)	50 (28.1%)	NS
hormone Kidney	5 (2.8%)	13 (7.3%)	NS
failure	4 (2.2%)	6 (3.4%)	NS
Diabetes mellitus	4 (2.2%)	10 (5.6%)	NS
Rheumatoid arthritis	1 (0.6%)	2 (1.1%)	NS
Liver Disease	3 (1.7%)	1 (0.6%)	NS
Sarcoidosis or TB	1 (0.6%)	1 (0.6%)	NS
Malabsorption	10 (5.6%)	11 (6.2%)	NS
Cancer	1 (0.6%)	5 (2.8%)	NS
Other bone disease	8 (4.5%)	13 (7.3%)	NS
High serum calcium	70 (39.3%)	48 (27.0)	0.0009
No History			
<u>REASON FOR BMD</u>			
History of complete fracture	31 (17.4%)	21 (11.8%)	NS
History of stress fracture	6 (3.4%)	0	0.0395
Osteopenia on Xray	24 (13.5%)	23 (12.9%)	NS
Family hx of osteoporosis	13 (7.3%)	5 (2.8%)	NS
Treatment with steroids	9 (5.1%)	12 (6.7%)	NS
Hypercalcemia	10 (5.6%)	7 (3.9%)	NS
Renal Failure	4 (2.2%)	10 (5.6%)	NS
Normal controls	1 (0.6%)	0	NS
Thyroid hormone treatment	10 (5.6%)	12 (6.7%)	NS
Calcitonin treatment	2 (1.1%)	0	NS
Didronil treatment	2 (1.1%)	5 (2.8%)	NS
Research protocol	13 (7.3%)	28 (15.7%)	0.02
Other	82 (46.1%)	63 (35.4%)	NS
No reason given	12 (6.7%)	24 (13.5%)	NS

VARIABLE	GROUP 1 SERVICEWOMEN	GROUP 2 CONTROLS	p*
<u>TREATMENT</u>			
Exercise	10 (5.6%)	11 (6.2%)	NS
Calcium	59 (33.1%)	52 (29.2%)	NS
Estrogens	42 (23.6%)	30 (16.9%)	NS
Calcitonin	2 (1.1%)	1 (0.6%)	NS
Etidronate	2 (1.1%)	8 (4.5%)	NS
Other	6 (3.4%)	9 (5.1%)	NS
No history available	59 (33.1%)	43 (24.2%)	NS

* Yates corrected Chi-square

TABLE 2A: BONE MINERAL DENSITOMETRY (OBJECTIVE 2)

BMD SITE	GROUP 1 (SERVICE MEMBER)	GROUP 2 (CONTROLS)	p*
SPINE: N/TOTAL	173/178	175/178	
Bone mineral density	0.96 ± 0.18	0.96 ± 0.18	NS
Young normal z score	-1.26 ± 1.51	-1.23 ± 1.42	NS
Age matched z score	-0.68 ± 1.24	-0.66 ± 1.24	NS
LATERAL SPINE: N/TOTAL	65/178	29/178	
Bone mineral density	0.67 ± 0.13	0.67 ± 0.13	NS
Young normal z score	-1.88 ± 1.53	-1.77 ± 1.59	NS
Age matched z score	-0.26 ± 1.09	-0.48 ± 1.48	NS
HIP- FEMORAL NECK: N/TOTAL	103/178	115/178	
Bone mineral density	0.720 ± 0.155	0.708 ± 0.131	NS
Young normal z score	-1.73 ± 1.62	-1.77 ± 1.42	NS
Age matched z score	-0.79 ± 1.26	-0.68 ± 1.05	NS
HIP- TROCHANTER: N/TOTAL	103/178	115/178	
Bone mineral density	0.592 ± 0.155	0.554 ± 0.109	0.0365
Young normal z score	-1.23 ± 1.73	-1.44 ± 1.38	NS
Age matched z score	-0.56 ± 1.30	-0.68 ± 1.10	NS
HIP- WARD'S TRIANGLE: N/TOTAL	103/178	115/178	
Bone mineral density	0.618 ± 0.188	0.597 ± 0.162	NS
Young normal z score	-2.03 ± 1.99	-2.24 ± 1.77	NS
Age matched z score	-0.56 ± 1.40	-0.67 ± 1.16	NS
FOREARM: N/TOTAL	70/178	96/178	
Bone mineral density	0.590 ± 0.092	0.574 ± 0.079	NS
Young normal z score	-0.542 ± 1.01	-0.801 ± 0.918	NS
Age matched z score	-0.235 ± 0.850	-0.445 ± 0.724	NS

* Two sample T test

TABLE 2B: FREQUENCY OF LOW Z SCORES (OBJECTIVE 2)

BMD SITE	GROUP 1 (SVC MEMBER)	GROUP 2 (CONTROLS)	p*
SPINE: N/TOTAL	173/178	175/178	
Young normal z score <-2.0	50 (28.9%)	50 (28.6%)	NS
Age matched z score <-2.0	24 (13.9%)	18 (10.3%)	NS
LATERAL SPINE: N/TOTAL	65/178	29/178	
Young normal z score <-2.0	28 (43.1%)	11 (37.9%)	NS
Age matched z score <-2.0	6 (9.2%)	4 (13.8%)	NS
HIP- FEMORAL NECK: N/TOTAL	103/178	115/178	
Young normal z score <-2.0	45 (43.7%)	50 (43.5%)	NS
Age matched z score <-2.0	17 (16.5%)	11 (9.6%)	NS
HIP- TROCHANTER: N/TOTAL	103/178	115/178	
Young normal z score <-2.0	29 (28.2%)	38 (33.0%)	NS
Age matched z score <-2.0	8 (7.8%)	14 (12.2%)	NS
HIP- WARD'S TRIANGLE: N/TOTAL	103/178	115/178	
Young normal z score <-2.0	54 (52.4%)	62 (53.9%)	NS
Age matched z score <-2.0	14 (13.6%)	11 (9.6%)	NS
FOREARM: N/TOTAL	70/178	96/178	
Young normal z score <-2.0	7 (10.0%)	11 (11.5%)	NS
Age matched z score <-2.0	1 (1.4%)	4 (4.2%)	NS

* Yates corrected Chi-square

**TABLE 3: CLINICAL CHARACTERISTICS, OSTEOPOROSIS RISK FACTORS
and THERAPY (OSTEOPOROTIC SUBJECTS)**

	SERVICE WOMEN	DEPENDENTS	p*
N	81	76	NS
AGE (YRS)	53.58 ± 16.48	54.46 ± 14.47	NS
HT (IN)	63.26 ± 3.73	63.08 ± 3.25	NS
WT (LBS)	134.8 ± 25.4	140.0 ± 24.0	NS

Data given as the mean ± 1SD; * Two sample T test

VARIABLE	SERVICE WOMEN	DEPENDENTS	p*
<u>RACE</u>			
Caucasian	73 (90.1%)	67 (88.2%)	NS
Black	7 (8.6%)	8 (10.5%)	NS
Hispanic	1 (1.2%)	0	NS
Asian	0	1 (1.3%)	NS
<u>MILITARY STATUS</u>			
Active Duty	38 (46.9%)	0	----
Retired	43 (53.1%)	0	----
Dependent	0	76 (100%)	----
<u>SERVICE</u>			
Army	54 (66.7%)	47 (61.8%)	NS
Navy	6 (7.4%)	9 (11.8%)	NS
Air Force	16 (19.8%)	19 (25.0%)	NS
Marine	1 (1.2%)	0	NS
Public Health Service	3 (3.7%)	1 (1.3%)	NS
Unknown	1 (1.2%)	0	NS
<u>MENOPAUSAL STATUS</u>			
Postmenopausal	46 (56.8)	48 (63.2%)	NS
Premenopausal	17 (21.0%)	14 (18.4%)	NS
Premature menopause	9 (11.1%)	10 (13.2%)	NS
Unknown	9 (11.1%)	4 (5.3%)	NS
<u>HOSPITAL STATUS</u>			
Outpatient	74 (91.4%)	73 (96.1%)	NS
Inpatient	7 (8.6%)	3 (3.9%)	NS

<u>ORIGIN OF BMD REFERRAL</u>			
Endocrine Clinic	59 (72.8%)	57 (75.0%)	NS
Endocrine Inpatient	1 (1.2%)	4 (5.3%)	NS
Orthopedic clinic	0	1 (1.3%)	NS
Rheumatology clinic	2 (2.5%)	0	NS
Internal medicine clinic	1 (1.2%)	2 (2.6%)	NS
General medicine clinic	1 (1.2%)	0	NS
Other	17 (21.0%)	12 (15.8%)	NS
<u>RISK FACTORS FOR OSTEOPOROSIS</u>			
Hyperparathyroidism	12 (14.8%)	5 (6.6%)	NS
Hyperthyroidism	6 (7.4%)	5 (6.6%)	NS
Low calcium intake	10 (12.3%)	1 (1.3%)	0.0167
Glucocorticoid use	17 (21.0%)	13 (17.1%)	NS
Anticonvulsant use	0	2 (2.6%)	NS
Smoking	21 (25.9%)	18 (23.7%)	NS
Excessive alcohol consumption	2 (2.5%)	3 (3.9%)	NS
Sedentary lifestyle	2 (2.5%)	0	NS
Nulliparity	15 (18.5%)	2 (2.6%)	0.0032
Gastric/Small bowel surgery	2 (2.5%)	1 (1.3%)	NS
Family History- osteoporosis	9 (11.1%)	6 (7.9%)	NS
Rx- thyroid hormone	15 (15.5%)	19 (25.0%)	NS
Kidney failure	2 (2.5%)	3 (3.9%)	NS
Diabetes mellitus	3 (3.7%)	3 (3.9%)	NS
Rheumatoid arthritis	3 (3.7%)	5 (6.6%)	NS
Liver Disease	1 (1.2%)	2 (2.6%)	NS
Sarcoidosis or TB	0	1 (1.3%)	NS
Malabsorption	1 (1.2%)	1 (1.3%)	NS
Cancer	5 (6.2%)	5 (6.6%)	NS
Other bone disease	0	4 (5.3%)	NS
High serum calcium	6 (7.4%)	7 (9.2%)	NS
No History	25 (30.9%)	14 (18.4%)	NS
<u>REASON FOR BMD (REASON)</u>			
History of complete fracture	19 (23.5%)	11 (14.5%)	NS
History of stress fracture	2 (2.5%)	0	NS
Osteopenia on X-ray	17 (21.0%)	17 (22.4%)	NS
Family Hx of osteoporosis	5 (6.2%)	5 (6.6%)	NS
Treatment with steroids	2 (2.5%)	3 (3.9%)	NS
Hypercalcemia	6 (7.4%)	2 (2.6%)	NS
Renal Failure	2 (2.5%)	3 (3.9%)	NS
Thyroid hormone treatment	3 (3.7%)	6 (7.9%)	NS
Calcitonin treatment	2 (2.5%)	0	NS
Etidronate treatment	1 (1.2%)	3 (3.9%)	NS
Research protocol	3 (3.7%)	9 (11.8%)	NS
Other	35 (43.2%)	25 (32.9%)	NS
No reason given	4 (4.9%)	10 (13.2%)	NS
<u>TREATMENT (RX)</u>			
Exercise	8 (9.9%)	6 (7.9%)	NS
Calcium	38 (46.9%)	34 (44.7%)	NS
Estrogens	21 (25.9%)	21 (27.6%)	NS
Calcitonin	1 (1.2%)	1 (1.3%)	NS
Etidronate	1 (1.2%)	6 (7.9%)	NS
Other	6 (7.4%)	5 (6.6%)	NS
No history available	22 (27.2%)	11 (14.5%)	NS

TABLE 4A: BONE MINERAL DENSITOMETRY - OSTEOPOROTIC SUBJECTS
(SUBGROUP ANALYSIS)

BMD SITE	SERVICE MEMBER	DEPENDENTS	p*
SPINE: N/TOTAL	80/81 (98.8%)	76/76 (100%)	
Bone mineral density	0.813 ± 0.133	0.835 ± 0.142	NS
Young normal z score	-2.364 ± 1.249	-2.245 ± 1.202	NS
Age matched z score	-1.255 ± 1.178	-1.166 ± 1.278	NS
LATERAL SPINE: N/TOTAL	37/81 (45.7%)	15/76 (19.8%)	
Bone mineral density	0.587 ± 0.089	0.570 ± 0.090	NS
Young normal z score	-2.88 ± 1.12	-3.00 ± 1.09	NS
Age matched z score	-0.68 ± 1.01	-1.17 ± 1.64	NS
HIP-FEMORAL NECK: N/TOTAL	53/81 (65.4%)	60/76 (78.9%)	
Bone mineral density	0.608 ± 0.101	0.620 ± 0.099	NS
Young normal z score	-2.88 ± 1.14	-2.73 ± 1.07	NS
Age matched z score	-1.51 ± 1.08	-1.16 ± 0.98	0.08
HIP-TROCHANTER: N/TOTAL	53/81 (65.4%)	60/76 (78.9%)	
Bone mineral density	0.493 ± 0.114	0.487 ± 0.091	NS
Young normal z score	-2.40 ± 1.38	-2.32 ± 1.18	NS
Age matched z score	-1.28 ± 1.08	-1.14 ± 1.16	NS
HIP-WARD'S TRIANGLE:	53/81 (65.4%)	60/76 (78.9%)	
Bone mineral density	0.489 ± 0.132	0.485 ± 0.113	NS
Young normal z score	-3.34 ± 1.51	-3.42 ± 1.37	NS
Age matched z score	-1.30 ± 1.26	-1.24 ± 1.04	NS
FOREARM: N/TOTAL	35/81 (43.2%)	47/76 (61.8%)	
Bone mineral density	0.538 ± 0.096	0.544 ± 0.081	NS
Young normal z score	-1.16 ± 0.92	-1.20 ± 0.98	NS
Age matched z score	-0.58 ± 0.84	-0.60 ± 0.79	NS

Data given as mean ± 1SD; *Two sample T test

TABLE 4B. FREQUENCY OF LOW Z SCORES - OSTEOPOROTIC SUBJECTS

BMD SITE	SERVICE MEMBER	DEPENDENTS	p*
OP SPINE: N/TOTAL Age matched z score <-2.0	50/80 (62.5%) 24 (30%)	50/76 (65.8%) 17 (22.4%)	NS
OP LATERAL SPINE: N/TOTAL Age matched z score <-2.0	28/37 (75.7%) 6 (16.2%)	11/15 (73.3%) 4 (26.7%)	NS
OP HIP- FEMORAL NECK: N/TOTAL Age matched z score <-2.0	45/53 (84.9%) 17 (32.1%)	50/60 (83.3%) 11 (18.3%)	NS
OP HIP- TROCHANTER: N/TOTAL Age matched z score <-2.0	29/53 (54.7%) 8 (15.1%)	38/60 (63.3%) 14 (23.3%)	NS
OP HIP- WARD'S TRIANGLE: Age matched z score <-2.0	47/53 (88.7%) 14 (26.5%)	49/60 (81.7%) 10 (16.7%)	NS
OP FOREARM: N/TOTAL Age matched z score <-2.0	7/35 (20.0%) 1 (2.9%)	11/47 (23.4%) 4 (8.5%)	NS+

* Yates corrected Chi-square; + Fisher exact test

TABLE 5A: SERVICEMEMBER (N=104) FOLLOWUP QUESTIONNAIRE
(OBJECTIVE 3)

QUESTION	N (%)
# currently on active duty	29 (27.9%)
If not on active duty, why did you leave the service?	
.... retired @ 20+ yrs	56 (74.7%)
.... medically retired	19 (25.3%)
Time in service (yrs) - total group	19.5 ± 7.4* (1-33)
Did/do you have difficulties with the military PT/exercise requirements?	
.... yes	34 (32.7%)
.... no	63 (60.6%)
no PT requirement (PHS)	7 (6.7%)
Did/do you experience a problem with stress fractures?	
.... yes	19 (18.3%)
.... no	85 (81.7%)
Have you been told you had osteoporosis?	
.... yes	39 (37.5%)
.... no	65 (62.5%)
If you were told that you had osteoporosis, did this diagnosis cause problems?	
.... yes	19 (48.7%)
.... no	20 (51.3%)
What type of problem?	
emotional	5 (26.3%)
physical	12 (63.2%)
both	2 (10.5%)

* N=92, data given as the mean ± 1SD

**TABLE 5B: SERVICEMEMBER FOLLOWUP QUESTIONNAIRE
(OBJECTIVE 3) - SUBGROUP ANALYSIS**

QUESTION	NORMAL BMD N=47	OSTEOPOROTIC GROUP N=57	p*
Currently on active duty	17 (36.2%)	12 (21.1%)	NS
If not on active duty, why did you leave the service?			
.... retired @ 20+ yrs	21 (70.0%)	35 (77.8%)	NS
.... medically retired	9 (30.0%)	10 (22.2%)	
Time in service (yrs)	16.3 ± 9.50 (0-30)	20 ± 8.53 (0-33)	NS**
Did/do you have difficulty with the military PT/exercise requirements?			0.0027
.... yes	23 (48.9%)	11 (19.3%)	
.... no	21 (44.7%)	42 (73.7%)	
no PT requirement (PHS)	3 (6.4%)	4 (7.0%)	
Did/do you experience a problem with stress fractures?			NS
.... yes	10 (21.3%)	9 (15.8%)	
.... no	37 (78.7%)	48 (84.2%)	
Have you been told you had osteoporosis?			NS (0.093)
.... yes	13 (27.7%)	26 (45.6%)	
.... no	34 (72.3%)	31 (54.4%)	
If you were told that you had osteoporosis, did this diagnosis cause problems?			NS
.... yes	6 (46.2%)	13 (50.0%)	
.... no	7 (53.8%)	13 (50.0%)	
What type of problem?			
emotional	1 (16.7%)	5 (38.5%)	NS+
physical	4 (66.7%)	7 (53.8%)	NS+
both	1 (16.7%)	1 (7.7%)	NS+

*Yates corrected Chi-square +Fisher exact test

** Two sample T test, data given as mean ± 1SD

TABLE 6: ALL FRACTURE PATIENTS - SUMMARY STATISTICS

	SERVICE MEMBERS	DEPENDENTS	p*
N	17	33	
Age	43.0 ± 15.6 (20-74)	60.9 ± 10.3 (39-79)	<0.0003
HT (IN)	64.71 ± 2.71	64.03 ± 2.49	NS
WT (LBS)	146.94 ± 30.14	152.91 ± 30.0	NS

Data given as mean ± 1SD * Two sample T test

	SERVICE MEMBERS	DEPENDENTS	p*
<u>MILITARY STATUS</u>			
Active Duty	15 (88.2%)		
Retired	2 (11.8%)		
Dependent		31 (100%)	
<u>RACE</u>			
Caucasian	11 (64.7%)	29 (87.9%)	NS
Black	1 (5.9%)	4 (12.1%)	NS
Hispanic	5 (29.4%)	0	0.0053
<u>SERVICE</u>			
Army	15 (88.2%)	17 (51.5%)	0.01
Navy	0	6 (18.2%)	NS
Air Force	1 (5.9%)	9 (27.2%)	NS
Marine	0	1 (3.0%)	NS
Public Health Svc	1 (5.9%)	0	NS
<u>HOSPITAL STATUS</u>			
Out-patient	14 (82.4%)	32 (97.0%)	NS
In-patient	3 (17.6%)	1 (3.0%)	
<u>RECENTLY BROKEN BONE</u>			
Hip	0	1	NS
Spine	1	6	NS
Forearm	0	2	NS
Elbow	1	1	NS
Wrist	2	4	NS
Hand	0	2	NS
Finger(s)	0	4	NS
Fibula	3	4	NS
Tibia	3	1	NS
Ankle	4	3	NS
Toe	1	2	NS
Foot	0	3	NS
Pelvis	1	1	NS
Tibia & Fibula	2	2	NS
Knee	0	1	NS
Humerus	0	1	NS
Radius	0	1	NS
Total	18	39	NS

	SERVICE MEMBERS	DEPENDENTS	p*
<u>NUMBER OF CHILDREN</u>			
None	11 (64.7%)	6 (18.2%)	0.0029
1	1 (5.9%)	3 (9.1%)	NS
2	4 (23.5%)	12 (36.4%)	NS
3	1 (5.9%)	0	NS
4	0	10 (30.3%)	0.0304
5	0	2 (6.1%)	NS
FAMILY HX of OP	3 (17.6%)	12 (36.4%)	NS
<u>DAIRY PRODUCTS</u>			
<1x/wk	3 (17.6%)	1 (3.0%)	NS
1-3x/wk	4 (23.5%)	6 (18.2%)	NS
4-6x/wk	4 (23.5%)	5 (15.2%)	NS
1x/d	4 (23.5%)	14 (42.4%)	NS
2-3x/d	2 (11.8%)	7 (21.2%)	NS
CONSUME ALCOHOL	13 (76.5%)	18 (54.5%)	NS
<u>NUMBER OF DRINKS EtOH</u>			
< 1/mo	2 (11.8%)	4 (12.1%)	NS
< 1/wk	3 (17.6%)	5 (15.2%)	NS
< 1/d	5 (29.4%)	5 (15.2%)	NS
1/d	2 (11.8%)	2 (6.1%)	NS
2/d	1 (5.9%)	2 (6.1%)	NS
<u>TYPE ETOH</u>			
None	5 (29.4%)	16 (50.0%)	NS
Beer	2 (11.8%)	2 (6.3%)	NS
Mixed Drinks	0	5 (15.6%)	NS
Wine	9 (52.9%)	9 (28.1%)	NS
All of the above	1 (5.9%)	0	NS
HX OF PREVIOUS FRACTURES	14 (82.4%)	19 (57.6%)	NS
CIGARETTE USE	6 (35.3%)	19 (57.6%)	NS
<u>MENSES</u>			
Regular	8 (47.1%)	3 (9.1%)	0.0067
None	6 (35.3%)	30 (90.9%)	0.0001
Irregular	3 (17.6%)	0	0.0628
<u>RISK FACTORS FOR OSTEOPOROSIS</u>			
Hyperparathyroidism	1 (5.9%)	1 (3.0%)	NS
Hyperthyroidism	0	1 (3.0%)	NS
Gastric/small bowel surgery	0	4 (12.1%)	NS
Gastric/small bowel surgery	0	2 (6.0%)	NS
Rx- thyroid hormone	3 (17.6%)	4 (12.1%)	NS
Renal failure	0	1 (3.0%)	NS
Diabetes mellitus	0	1 (3.0%)	NS
Rheumatoid arthritis	0	2 (6.0%)	NS
Hepatic disease	0	1 (3.0%)	NS
Sarcoidosis or TB	0	1 (3.0%)	NS
Malabsorption	1 (5.9%)	1 (3.0%)	NS
Cancer	3 (17.6%)	7 (21.2%)	NS
SEIZURE MEDICATIONS	1 (5.9%)	1 (3.0%)	NS
SMOKE (POST OR PRESENT)	6 (35.3%)	18 (54.5%)	NS
Rx STEROIDS	3 (17.6%)	3 (9.1%)	NS

	SERVICE MEMBERS	DEPENDENTS	p*
<u>EXERCISE</u>			
None	4 (23.5%)	18 (54.5%)	0.073
2x/wk	1 (5.9%)	4 (12.1%)	NS
3x/wk	4 (23.5%)	0	0.018
4x/wk	3 (17.6%)	1 (3.0%)	NS
≥5x/wk	5 (29.4%)	8 (24.2%)	NS
<u>TREATMENT</u>			
None	9 (52.9%)	12 (36.4%)	NS
Calcium	5 (29.4%)	17 (51.5%)	NS
Estrogen/ BCP	7 (41.2%)	12 (36.4%)	NS
Calcitonin	0	1 (3.0%)	NS
Etidronate	1 (5.9%)	1 (3.0%)	NS

* Yates corrected Chi-square

TABLE 7: BONE MINERAL DENSITY OF FRACTURE SUBJECTS

BONE SITE	SERVICE WOMEN	DEPENDENTS	p*
<u>FOREARM</u> BMD	0.661 ± 0.051#	0.594 ± 0.100##	0.0043
YOUNG NORMAL Z SCORE	-0.556 ± 0.854 (-2.12 - +0.88)	-1.66 ± 1.67 (-5.6 - +1.52)	0.0043
AGE MATCHED Z SCORE	-0.008 ± 0.89 (1.46 - +1.41)	-0.174 ± 1.36 (-3.71 - +2.39)	NS
<u>FEMORAL NECK</u> BMD	0.799 ± 0.126	0.711 ± 0.142	0.0365
YOUNG NORMAL Z SCORE	-0.959 ± 1.26 (3.21 - +1.16)	-1.83 ± 1.42 (-4.08 - +1.81)	0.0370
AGE MATCHED Z SCORE	-0.224 ± 1.04 (-2.23 - +1.62)	-0.158 ± 1.150 (-2.38 - +2.03)	NS
<u>TOTAL HIP</u> BMD	0.882 ± 0.141	0.760 ± 0.179	0.0183
YOUNG NORMAL Z SCORE	-0.737 ± 1.22 (-3.3 - +0.98)	-1.79 ± 1.49 (-6.58 - +1.30)	0.0153
AGE MATCHED Z SCORE	-0.405 ± 1.01 (-2.82 - +0.95)	-0.619 ± 1.39 (-5.21 - +2.03)	NS
<u>TROCHANTER</u> BMD	0.637 ± 0.107	0.565 ± 0.144	NS
YOUNG NORMAL Z SCORE	-0.948 ± 1.19 (-3.36 - +0.81)	-1.78 ± 1.55 (-7.26 - +1.50)	NS
AGE MATCHED Z SCORE	-0.511 ± 1.046 (-2.91 - +1.01)	-0.677 ± 1.495 (-5.94 - +2.20)	NS
<u>WARD'S TRIANGLE</u> BMD	0.668 ± 0.179	0.539 ± 0.163	0.0138
YOUNG NORMAL Z SCORE	-1.167 ± 1.632 (4.4 - +1.23)	-2.34 ± 1.48 (-4.39 - +1.72)	0.0135
AGE MATCHED Z SCORE	0.058 ± 1.236 (-1.87 - +2.19)	0.139 ± 1.24 (-2.19 - +3.66)	NS
<u>SPINE</u> BMD	0.978 ± 0.169	0.888 ± 0.153	NS
YOUNG NORMAL Z SCORE	-0.639 ± 1.575 (-4.27 - +1.25)	-1.51 ± 1.39 (-3.8 - +1.12)	0.0516
AGE MATCHED Z SCORE	-0.051 ± 1.396 (-3.35 - +2.07)	0.007 ± 1.24 (-1.87 - +2.29)	NS
<u>LATERAL SPINE</u> BMD	0.701 ± 0.125#	0.542 ± 0.249++	0.0074
YOUNG NORMAL Z SCORE	-1.46 ± 1.48 (-4.42 - +0.06)	-2.91 ± 1.55 (-6.33 - +0.29)	0.0042
AGE MATCHED Z SCORE	-0.242 ± 1.34 (-2.9 - +3.6)	-0.466 ± 1.39 (-3.49 - +2.09)	NS

*Two sample T test

Data given as the mean ± 1SD; #N = 16; ##N = 31; ++N=28